



5> All control cables shall be 2.5 Sq. mm. copper cable.

4.00.00 SPECIFIC REQUIREMENTS

4.01.00 H.V. Power Cables

The type and quantity shall be furnished as indicated in Annexure -A

4.02.00 L.V. Power Cables

The type and quantity shall be furnished as indicated in Annexure -B

4.03.00 Control Cables

The type and quantity shall be furnished as indicated in Annexure -C

4.04.00 Separate cables for each type of following services / functions as applicable shall be used for each feeder. Same multicore cable using different services and different voltage class/grade shall not be acceptable:

- a) Power.
- b) Control, interlock and indication.
- c) Metering and measuring.
- d) Alarm and annunciation.
- e) C.T. Cables.
- f) V.T. Cables.

4.05.00 Double/ multi run cable termination at motor end shall be avoided.

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4.11.00 Joints and Terminations

Materials of construction for a joint/termination shall perfectly match with the dielectric chemical and physical characteristics of the associated cables. The material and design concepts shall incorporate a high degree of operating compatibility between the cable and joints. The protective outer covering (jacket) used on the joints/terminations shall have the same qualities as that of the cable outer sheath in terms of ambient/operating temperature withstand capability and resistance to hazardous environments and corrosive elements.

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**H.V. POWER CABLE**

- 1.0 3300/3300V & 11000/11000V (i.e. un-earthed grade) 90°C continuous rating under normal condition and 250°C under short circuit condition, X LPE heavy duty power cable suitable for use in 3300V and 11000 V non effectively earthed system conforming to following requirement and in line with IS 7098, IS 8130 & IS 5831 and IS 3975.
- 1.1 Conductor : Stranded and compacted aluminium conductor of grade H2 and class 2 conforming to IS:8130.
- 1.2 Conductor Screen : Extruded semi-conducting compound.
- 1.3 Insulation : Extruded cross linked polyethylene (XLPE) conforming to IS-7098(Part-2)
- 1.4 Insulation Screen : Extruded semi-conducting compound with a layer of non-magnetic metallic tape. For single core armoured cables, the armouring shall constitute the metallic part of screening. The semi-conducting tape shall be easily strippable. (Applicable for cables above 3300V/3300V)
- 1.5 Core Identification : By coloured strips applied on cores or by numerals.
- 1.6 Inner Sheath : Extruded PVC compound conforming to type ST2 of IS:5831 for three core cables. Filler shall be of same material as of inner sheath i.e. ST2. Single core cables shall have no inner sheath.
- 1.7 Armour : Galvanised single round steel wire armour for twin and multicore cables.
- Non-magnetic hard drawn aluminum single round wire conforming to H4 grade for single core cables.
- 1.8 Overall Sheath : Extruded FRLS PVC compound conforming to type ST2 of IS:5831.
- Category Type
- C2 FRLSH (Fire Retardant Low smoke and halogen evolution)
- 1.9 Drum Conforming to IS-10418 (Steel Drum)



LV POWER CABLE

- 1.0 1100 V grade, 90° C continuous rating under normal condition and 250°C under short circuit condition rating, XLPE heavy duty, power cable conforming to following requirement and in line with IS 7098. IS 8130 & IS 5831 and IS 3975.
- 1.1 Conductor : Stranded and compacted plain aluminium of grade H2 for cable sizes above 2.5 mm² and class 2 stranded high conductivity annealed plain copper for cable sizes upto 2.5 mm² conforming to IS:8130.
- 1.2 Insulation : Extruded cross-linked polyethylene (XLPE) conforming to IS:7098(Part-3)
- 1.3 Core Identification : By color coding
- 1.4 Inner Sheath : Extruded PVC compound conforming to type ST2 of IS:5831 for multicore cable. Single core cables shall have no inner sheath.
- 1.5 Armour : Galvanised single round steel wire armour for twin and multicore cables.
- Non-magnetic hard drawn aluminium single round wire conforming to H4 grade for single core cables.
- 1.6 Overall Sheath : Extruded FRLS PVC compound conforming to type ST2 of IS:5831. having improved fire performance category and type as stated below.
- | Category | Type |
|----------|--|
| C2 | FRLSH (Fire Retardant Low smoke and halogen evolution) |
- 1.7 Drum Conforming to IS-10418(Wooden Drum)



CONTROL CABLES

- 1.0 1100 V grade 70°C continuous rating under normal condition and 160°C under short circuit condition rating PVC Control cable (YWWY) conforming to following requirement and in line with IS:1554, IS:8130, IS:5831 and IS:3975.
- 1.1 Conductor : Stranded non-compacted and circular, high conductivity annealed plain copper, generally conforming to IS:8130.
- 1.2 Insulation : Extruded PVC compound conforming to type A of IS : 5831.
- 1.3 Core Identification : By color coding and numbering at interval of 100mm or less
- 1.4 Inner Sheath : Extruded PVC compound conforming to type ST1 of IS:5831 for multi-core cables. Filler shall be of same material as of inner sheath i.e. ST1. Single core cables shall have no inner sheath.
- 1.5 Armour: : Galvanised single round steel wire for twin and Multi-core cables.
- 1.6 Overall Sheath : Extruded PVC compound conforming to type ST1 of IS 5831 having improved fire performance category and type as stated below.
- | Category | Type |
|----------|--|
| C2 FRLSH | (Fire Retardant Low smoke and halogen evolution) |
- 1.7 Drum : Conforming to IS-10418 (Wooden Drum)



Annexure-D

STANDARD CABLE SIZES

Sl. No.	Cable Size	Conductor	Insulation
1.0	H. T. CABLES		
1.1	1 core 630 Sq. mm. (3.3/3.3 KV & 11/11KV (UE))	AL X	LPE (FRLSH)
1.2	3 core 185 Sq. mm. (3.3/3.3 KV & 11/11KV (UE))	AL X	LPE (FRLSH)
1.3	3 core 240 Sq. mm. (3.3/3.3 KV & 11/11KV (UE))	AL X	LPE (FRLSH)
1.4	3 core 300 Sq. mm. (3.3/3.3 KV & 11/11KV (UE))	AL X	LPE (FRLSH)
1.6	1 core 70 Sq. mm. (3.3/3.3 KV & 11/11KV (UE))	AL X	LPE (FRLSH)
2.0	L. T. POWER CABLES		
2.1	3 core 2.5 Sq. mm.	Cu	XLPE (FRLSH)
2.2	3 core 6 Sq. mm.	Cu	XLPE (FRLSH)
2.3	2 core 16 Sq. mm.	Cu	XLPE (FRLSH)
2.4	2 core 16 Sq. mm.	AL	XLPE (FRLSH)
2.5	3 core 16 Sq. mm.	AL	XLPE (FRLSH)
2.6	4 core 16 Sq. mm.	AL	XLPE (FRLSH)
2.7	3 core 25 Sq. mm.	AL	XLPE (FRLSH)
2.8	2 core 35 Sq. mm.	AL	XLPE (FRLSH)
2.9	3 core 35 Sq. mm.	AL	XLPE (FRLSH)
2.10	4 core 35 Sq. mm.	AL	XLPE (FRLSH)
2.11	3 core 50 Sq. mm.	AL	XLPE (FRLSH)
2.12	4 core 70 Sq. mm.	AL	XLPE (FRLSH)
2.13	3 core 95 Sq. mm.	AL	XLPE (FRLSH)





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Sl. No.	Cable Size	Conductor	Insulation
2.14 3	1/2 core 95 Sq. mm.	AL	XLPE (FRLSH)
2.15	3 core 150 Sq. mm.	AL	XLPE (FRLSH)
2.16	3 core 185 Sq. mm.	AL	XLPE (FRLSH)
2.17 3	1/2 core 185 Sq. mm.	AL	XLPE (FRLSH)
2.18	3 core 240 Sq. mm.	AL	XLPE (FRLSH)
2.19 3	1/2 core 240 Sq. mm.	AL	XLPE (FRLSH)
2.20	3 core 300 Sq. mm.	AL	XLPE (FRLSH)
2.21 3	1/2 core 300 Sq. mm.	AL	XLPE (FRLSH)
2.22	1 core 630 Sq. mm.	AL	XLPE (FRLSH)
3.0 CONTROL CABLE			
3.1	2 core 2.5 Sq. mm.	Cu.	PVC (FRLSH)
3.2	3 core 2.5 Sq. mm.	Cu.	PVC (FRLSH)
3.3	5 core 2.5 Sq. mm.	Cu.	PVC (FRLSH)
3.4	7 core 2.5 Sq. mm.	Cu.	PVC (FRLSH)
3.5	9 core 2.5 Sq. mm.		PVC (FRLSH)
3.6	12 core 2.5 Sq. mm.	Cu.	PVC (FRLSH)
4.0 CABLES FOR ELECTRONIC EQUIPMENT GROUNDING			
4.1	1 core 35 Sq. mm.	Cu.	XLPE (FRLSH)
4.2	1 core 150 Sq. mm.	Cu.	XLPE (FRLSH)



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**TECHNICAL SPECIFICATION
FOR
415V PMCC/MCC, 415V ACDB, 220V DCDB &
NON-SEGREGATED PHASE BUSDUCT**





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SECTION - VII

415V PMCC/MCC, 415V ACDB AND 220V DCDB & NON-SEGREGATED PHASE DUCT

1.00.00 SCOPE OF SUPPLY

1.01.00 The following equipment shall be furnished complete with all accessories :

- a) 415V Power Control Centers
- b) 415V Motor Control Centers
- c) 415V Power-cum-Motor Control Centers
- d) 415V Distribution Boards and MCCB Boards
- e) DC Distribution Boards and MCCB Boards
- f) Solenoid valve boards
- g) DC starters
- h) 415V Non-segregated phase busduct

A list of various 415V boards that have been envisaged to be supplied under the main plant package of Sagardighi Thermal Power Project 1 x 660 MW Phase -III is given in Annexure - E. This list is only for general guidance of the Tenderers and the exact numbers shall be finalised by them.

1.02.00 Base channel frame of all boards along with necessary mounting hardware.

1.03.00 Set of accessories as listed below and shall be supplied for each PCC/PMCC/MCC:

- a) Breaker lifting and handling trolley
- b) Test cabinet with coupling cables for testing the breaker in drawout position
- c) Racking in/out handle for breakers
- d) Racking in/out handle for drawout MCC modules

1.04.00 Mandatory spares

1.05.00 All relevant drawings, data and instruction manuals.



2.00.00 GENERAL NOTES

In the context of the specification, the following definitions shall apply.

- 2.01.00 POWER CONTROL CENTER, hereinafter referred to as PCC, shall mean a continuous line-up of breaker panels, used to feed Motor Control Centers and motors rated above 90 KW up to and including 160 KW. All PCCs shall have duplicate incomers and a bus-section. Incomers, bus-section, and all outgoing feeders of a PCC shall be breaker controlled. Distribution of outgoing feeders shall be such as to ensure uniform loading on each section of the PCC.
- 2.02.00 MOTOR CONTROL CENTER, hereinafter referred to as MCC, shall mean a continuous line-up of vertical sections housing breaker panels, MCCB, contactor operated modules. All MCCs except emergency MCCs shall have duplicate incomers and a bus-section. Emergency MCCs shall have four incomers, two each from DG PCC and two each from T turbine PMCC. All incomers and Bus-sections shall be breaker controlled except few, which are castle key inter-locked. All outgoing feeders shall be breaker/ MCCB controlled, or contactor operated depending upon the rating and application. Distribution of outgoing feeders shall be such as to ensure uniform loading on each section of the MCC.
- 2.03.00 POWER-CUM-MOTOR CONTROL CENTER, hereinafter referred to as PMCC, shall mean a continuous line-up of vertical sections housing breaker panels, MCCB, and contactor-operated modules. All PMCCs shall have duplicate incomers and a bus-section. Incomers and bus-sections shall be breaker controlled. Depending upon the rating and application, outgoing feeders may be breaker controlled, MCCB controlled, or contactor operated. Distribution of outgoing feeders shall be such as to ensure uniform loading on each section of the PMCC.
- 2.04.00 DISTRIBUTION BOARD, hereinafter referred to as DB, shall mean a continuous line-up of vertical sections housing MCCB/switch-fuse modules only. All ACDB and DCDB shall have duplicate incomers and a bus-section. However Ventilation DB & Welding DB shall have single incomer. Wherever bus-sections are provided, distribution of outgoing feeders shall be such as to ensure uniform loading on each section of DB.
- ACDB Incomer shall be ACB or MCCB as per rating. DCDB Incomers shall be ACB or Switch fuse as per rating. All ACDB and DCDB outgoing feeders shall be MCCB and switch-fuse respectively.
- 2.05.00 SOLENOID VALVE BOARD, hereinafter referred to as SVB, shall mean a continuous line-up of vertical sections housing MCCB modules and contactor operated modules. SVBs may have one incomer, which shall be MCCB controlled. All outgoing feeders shall be contactor operated.
- 2.06.00 MCCB BOARD, hereinafter referred to as MCCB Board, shall mean a continuous line-up of vertical sections housing MCCB only. MCCB Boards may be fed from DBs and may have one incomer. MCCB Boards shall be of two types - one with 415V, 4-wire, triple pole-and-neutral (TPN) outgoing feeders and the other with 240V, 2-wire, single-pole-and-neutral outgoing feeders. The incomers in either case shall be 415V, 4-wire, TPN type. Incomers and





outgoing feeders of DC MCCB shall be 220V, 2-wire type and 24 V 2-wire type. DC MCCB shall have proper arrangement to suppress resting voltage/arc suppression.

3.00.00 **CODES AND STANDARDS**

3.01.00 All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) and IEC except where modified and/or supplemented by this specification.

3.02.00 Equipment and material conforming to any other standards, which ensure equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.

3.03.00 The electrical installation shall meet the requirements of Indian Electricity Rules as amended up to date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall be followed.

4.00.00 **SYSTEM CONCEPT AND DESIGN CRITERIA**

4.01.00 415V power distribution within the powerhouse shall be by means of PCCs, MCCs, DBs, SVBs and FBs. PMCCs shall not be used within the powerhouse.

In ESP control building, C.W. pump house; BOP and auxiliary buildings (like CHP, AHP, FGD etc.) use of PMCCs may be acceptable.

4.02.00 The PCCs/PMCCs shall be used to supply auxiliary power for normal and start up operation of generation units.

The MCCs/DBs/SVBs/FBs shall be used to provide power, control, and protection for A.C. and D.C. auxiliary services (motors and feeders) of generating units.

4.03.00 The equipment will be located in a hot, humid, and tropical atmosphere, heavily polluted at places with coal dust and/or fly ash.

4.04.00 Duty involves direct-on-line starting of large induction motors and also under certain emergency conditions, automatic transfer of loads from one source of supply to other. Motor starting current varies from 6 to 8 times of full load current.

4.05.00 Busbars of PCCs/PMCCs shall be sized to carry continuously the associated transformer secondary rated current plus a 20% margin.

Busbars of MCCs/DBs/SVBs/FBs shall be sized to carry continuously the total running load of the MCC, DB, SVB, FB (including anticipated future load, wherever applicable) plus a 20% margin.

Loads of outgoing feeders to Owner/other Packages wherever applicable shall also be considered while sizing the bus bars, equipment and components.



thereof coordinating with other package bidder. All busbars shall be capable of withstanding the mechanical forces and thermal stresses due to maximum short circuit current.

4.06.00 In-cubicle ratings of incoming and bus-section breakers/ switches shall be identical to the associated busbar rating.

4.07.00 Incomers rated up to and including 400 A, except for MCC and PMCCs, shall be MCCB/ switch controlled. Above 400A, all incomers and feeders shall be breaker controlled.

4.08.00 PCCs shall be used to feed MCCs and motors rated above 90 KW up to and including 160 KW. All motors rated above 90 KW up to and including 160 KW shall be breaker controlled. For motors rated higher than 90 KW, breaker shall be given with Numerical motor protection relay. The transformer rated above 90kVA shall be breaker controlled with numerical protection relay.

4.09.00 Motors rated up to and including 90 KW shall be contactor operated and shall be fed from MCCs. For all motors below 50 kW, MCCB shall be given. For motors between 50 kW to 90 KW, MCCB with E/F protection should be used.

4.10.00 For continuous operation at specified ratings, the temperature rise of various equipment/components shall be limited to the permissible values specified in relevant standards and/or this specification.

4.11.00 Circuit breakers shall not produce any harmful over voltage during switching off of induction motors. Surge protective devices (if required) shall be included to limit over voltages.

4.12.00 Incomer, Bus-sections, all outgoing motor feeders, transformer feeders of all MCC/PMCCs shall have provisions for remote operation from the respective control room through DCS and or PLC.

4.13.00 Each switchgear/PCC/PMCC/MCC/ACDB/DCDB/SVD/FB will have 20% spare outgoing feeder of each type & rating with a minimum one (1) no. of each type and rating. Additional two no active 160A feeders shall be provided in each switchgear/PCC/PMCC/MCC for customer future use.

5.00.00 **SPECIFIC REQUIREMENTS**

5.01.00 **Construction**

5.01.01 PCCs/PMCCs/MCCs/DBs/SVBs/FBs shall be indoor, air insulated, and metal-clad type.

The design construction shall be such as to permit extension at either end.

5.01.02 PCCs/PMCCs/MCCs/SVBs shall be drawout type.

DBs/FBs shall be fixed type.





5.01.03 PCCs/PMCCs/MCCs/DBS/SVBs shall be suitable for floor-mounting and FBs Boards shall be suitable for wall-mounting.

5.01.04 Generally, PCCs/DBs/SVBs shall be of single-front construction and PMCCs/MCCs shall be of single/double-front (if accepted by Owner) construction. Breaker panels of PMCCs shall be of single-front construction.

5.01.05 All frames and load bearing members shall be fabricated using mild steel structural sections or pressed and shaped cold rolled sheet steel of thickness not less than 2mm.

Frame shall be enclosed in cold rolled sheet steel of thickness not less than 2mm (CR). Doors and covers shall also be of cold rolled sheet steel of thickness not less than 1.6 mm. Stiffeners shall be provided wherever necessary. Removable gland plates of thickness 3mm (hot/cold rolled sheet steel) or 4 mm (non-magnetic material) shall be provided for all panels.

The design shall be such that the specified degree of protection is achieved even after a breaker control module has been taken out of the panel.

5.01.06 PCC/PMCC assemblies shall comprise of a continuous line-up of single/multi-tier cubicles. Installation of circuit breakers shall however be limited to the bottom two tiers only. Not more than two breakers shall be accommodated in one vertical section.

MCC/DB/SVB assemblies shall comprise of a continuous line-up of dead-front, free-standing vertical sections, housing the control modules in multi-tier formation.

All MCCs/DBs/SVBs shall be front-wired and front-connected.

5.01.07 PCCs/PMCCs/MCCs/SVBs/DBs shall be fully compartmentalised with metal/insulating partitions between compartments.

FBs Boards shall be non-compartmentalised.

Working height shall be limited between 450mm and 1800mm from floor level.

5.01.08 Each breaker/control module shall be housed in a separate cubicle, complete with an individual front access door having sufficient opening with concealed type hinges.

Each vertical section shall have a removable back cover.

All doors and covers shall be gasketed.

5.01.09 Breaker cubicles shall be so sized as to permit closing of the front access door when the breaker is pulled out to ISOLATED position. The breaker can be operated both in service & test position with the door closed.



- 5.01.10 For breaker panels, all switches, lamps, and indicating instruments shall be flush mounted on the respective compartment door whereas relays and other auxiliary devices shall be mounted in a separate compartment.
- For MCC/DB/SVB modules, all push-buttons, lamps, and indicating instruments shall be flush/semi-flush mounted on respective module compartment.
- 5.01.11 For single-front assemblies, a full-height vertical cable alley with cable supports shall be provided in each section to facilitate unit wiring.
- The alleys shall be liberally sized to accommodate all cables as per cable schedule and shall have removable cover at the front for access.
- 5.01.12 Wherever two breaker compartments are provided in the same vertical section, insulating barriers and shrouds shall be provided in the rear cable compartment to avoid accidental touch with the live parts of one circuit while working on the other.
- 5.01.13 A horizontal wire way extending the entire length of the assembly shall be provided at the top for inter-panel wiring.
- 5.01.14 Incomers shall be provided at the ends of an assembly and bus section, wherever required, shall be provided at the middle of the assembly.
- 5.01.15 Four (4) Nos. lifting lugs shall be for each section, two (2) nos. on either end of the section.
- 5.01.16 PCCs/PMCCs/MCCs/DBs/SVBs shall be supplied with base frames made out of structural steel sections along with all necessary mounting hardware required for bolting/ welding the base frames to the foundation. FBS Boards shall be supplied along with necessary hardware for mounting against wall.
- 5.01.17 After isolation of power and control circuit connections, it shall be possible safely carry out maintenance in a compartment with the busbar and adjacent circuit live. Necessary shrouding arrangement shall be provided for this purpose over the cable terminations located in cable alley.
- 5.01.18 The minimum clearance in air between phases and between phases and earth for the entire run of horizontal and vertical busbars shall be 25mm. For all other components, the clearance between two live parts, a live part and an earthed part, and isolating distance shall be at least 10mm throughout. Wherever it is not possible to maintain these clearances, insulation shall be provided by barriers. However, for horizontal and vertical busbars, the clearances mentioned above should be maintained even when these are sleeved or insulated. All connections from busbars shall be fully shrouded to minimize the risk of phase to phase and phase to earth shorts.

- 5.01.19 Unless otherwise stated, equipment rating and module size shall be as per Annexure - G. Module selection chart is specified for guidance of Bidder in respect to requirement of module space and component rating.
- 5.02.00 **Bus and Bus Taps**
- 5.02.01 All PCCs/PMCCs/MCCs/ACDBs/SVBs/ACFBs provided with three phase busbars and neutral busbar.
- All DCDBs and DCFBs shall be provided with two busbars.
- All busbar compartments shall be completely enclosed.
- 5.02.02 Horizontal and vertical busbars and bus connections shall be of high conductivity copper/aluminium/aluminium alloy.
- The maximum temperature of busbars and bus connections shall be limited to 55°C with silver plated joints and 40°C with all other types of joints over an ambient of 50°C.
- No diversity factor shall be allowed for temperature rise.
- 5.02.03 Vertical busbars shall be designed for a minimum current rating of 200 A.
- 5.02.04 All bus connections shall be provided with anti-oxide grease. Adequate contact pressure shall be ensured by means of two-bolt connection with plain and spring washers and locknuts.
- 5.02.05 Bimetallic connectors shall be provided for connections between dissimilar metals.
- 5.02.06 All busbars and bus connections shall be fully insulated for working voltage. Insulating heat shrinkable sleeves shall be provided for all busbars. All joints and tap-off points shall be shrouded.
- 5.02.07 Bus insulators shall be non-hygroscopic, flame retardant, track resistant, high strength, sheet moulded compound or equivalent polyester fibreglass moulded type. Separate supports shall be provided for each phase and neutral busbar.
- 5.02.08 Cross-section of the busbars shall be uniform throughout the length of the assembly. All busbars and bus connections shall be supported and braced to withstand the stresses due to maximum short circuit current and also to take care of any thermal expansion.
- 5.02.09 Busbars shall be colour coded for easy identification and so located that the sequence R-Y-B shall be from left-to-right, top-to-bottom, or front to rear when viewed from the front of the assembly.
- 5.02.10 Bolted disconnecting links shall be provided for all incoming and outgoing feeders for isolation of neutral, if necessary.

5.03.00 **MCC/SVB/DB Modules**

- 5.03.01 MCC/SVB modules shall have self-aligning power/control disconnects. All disconnects shall be silver-plated to ensure good contacts.
- 5.03.02 Modules of same size and type shall be physically and electrically interchangeable.
- 5.03.03 The design of drawout modules shall be such as to permit easy withdrawal/re-insertion of the unit with guide rails to ensure correct alignment.
- 5.03.04 Various module sizes should be multiples of one basic unit to facilitate modifications at site. Suitable provision for this purpose should also be incorporated in the vertical busbars.
- 5.03.05 Drawout modules shall have three distinct positions, namely, SERVICE, TEST and ISOLATED.

In the SERVICE position, both power and control circuits shall be engaged. It shall not be possible to open the module door when the module is in SERVICE position.

In the TEST position, the power circuits shall be disengaged but the control circuits shall be engaged. It shall be possible to close the module door when the module is in TEST position. Keeping the front access door of module in closed condition, the Breaker can be placed in ISOLATED, TEST or SERVICE position from outside.

In the ISOLATED position, both power and control circuits shall be disengaged.

- 5.03.06 Modules shall house the control components for a circuit such as switch, fuse, contactors, relays, push-buttons, lamps, meters, etc. Only the push-button actuators, lenses of indicating lamps, and transparent windows for meters shall be mounted on module door such that when the module is withdrawn, the cubicle door shall provide specified IP-54 degree of protection when the module door is closed.
- 5.03.07 Breaker operated incomers and bus sections shall be provided with one (1) LOCAL-REMOTE selector switch.
- Contactor operated motor feeder modules shall be provided with one (1) MCC-NORMAL-TRIAL selector switch.
- These selector switches shall be lockable type and shall be mounted on the panel.
- Ethernet switches (if mounted in the switchgear itself) shall be mounted in a separate compartment/compartments in all switchgears provided with numerical relays. Inter-panel wiring of Ethernet cable for connection of numerical relays to Ethernet switches and required power supply to Ethernet switches shall be arranged in the switchgear.

- 5.03.08 The equipment layout shall provide sufficient working space in between the components.
- 5.04.00 **Circuit Breaker**
- 5.04.01 Circuit Breakers shall be three pole, single throw, air break type with stored energy, trip free mechanism and shunt trip coil.
- 5.04.02 Circuit breakers shall be drawout type, having SERVICE, TEST & ISOLATED positions with positive indication for each position.
- 5.04.03 Circuit breakers of identical rating shall be physically and electrically interchangeable.
- 5.04.04 All incoming breakers, bus-section breakers, Outgoing and motor feeder breakers shall have motor wound spring charging mechanism.
- 5.04.05 Each breaker operated feeder shall be provided with protective devices as specified in Annexure-B.
- 5.04.06 All breakers with motor wound spring charging mechanism shall have facility of manual spring charging also.
- 5.04.07 For motor wound mechanism, spring charging shall take place automatically after each breaker closing operation. On open-close-open operation of the circuit breaker shall be possible after failure of power supply to the motor.
- 5.04.08 Mechanical safety interlock shall be provided to prevent the circuit breaker from being racked in or out of the service position when the breaker is closed.
- 5.04.09 Automatic safety shutters shall be provided to fully cover the female primary disconnects when the breaker is withdrawn.
- 5.04.10 Each breaker shall be provided with an emergency manual trip, mechanical ON-OFF indicator, an operation counter, mechanism charge/discharge indicator, and electrical anti-pumping feature.
- 5.04.11 In addition to the auxiliary contacts required for normal breaker operation and indication, each breaker shall be provided with the following for interlocking purpose :
- a) Position/cell switch with minimum 4NO + 4NC contacts.
 - b) Auxiliary switch, with minimum 6NO + 6NC contacts, mounted on the stationary portion of the breaker panel and operated mechanically by a sliding level from the breaker in SERVICE position.



Alternatively, electrically reset-latching relay may be used for the purpose. The exact requirement contact of the position/cells switch, limit switch, auxiliary switch and latching relays shall be decided by the Tenderers taking into account the scheme requirements. Limit/auxiliary switches shall be convertible type, that is, suitable for changing N.O. contact to N.C. and vice-versa.

5.04.12 Spring charge limit switch shall be provided for breakers with motor wound spring charging mechanism. These limit switches shall be provided with minimum 2NO + 2NC contact.

5.04.13 Limit/auxiliary switches shall be convertible type, that is, suitable for changing N.O. contact to N.C. and vice-versa.

5.05.00 **Switches**

5.05.01 Switches shall be triple/double pole, air break type and designed for duties as specified in Annexure-A. Motor duty switches shall be capable of safely making and breaking the locked rotor current of the associated motor circuit.

5.05.02 The switch shall have a quick-make, quick-break mechanism operated by a suitable external handle, complete with position indicator. This handle shall have provision for padlocking in ON and OFF position.

5.05.03 The compartment door shall be interlocked mechanically with the switch such that the door cannot be opened unless the switch is in OFF position. Means shall be provided for releasing this interlock at any time.

5.05.04 Switches shall be capable of withstanding the let-through fault current of back-up fuses or circuit breakers.

5.05.05 Wherever two incoming switches and one bus-section switch/breaker are provided for an assembly, these shall be mechanically/key interlocked to ensure that only two out of the three can be closed at time.

Wherever two incoming switches are provided for an assembly, these shall be mechanically/key interlocked to ensure that one of the two can be closed at time.

5.06.00 **Fuses**

5.06.01 Fuses shall be HRC, preferably link type, with a minimum interrupting capacity equal to the short circuit current of the LT system.

5.06.02 Fuses shall be furnished complete with fuse bases and fittings of such design as to permit easy and safe replacement of fuse element.

Visible indication shall be provided on blowing of the fuse.

5.06.03 Motor fuse characteristics and ratings shall be chosen to ride over starting period without blowing. The fuse on incoming feeder wherever provided, shall be chosen to provide discrimination with motor/feeder fuses.





5.07.00 **A.C. Starter**

5.07.01 Contactors

- a) The contactors shall be three pole, air break type with non-bouncing silver/silver alloy contacts. The contactor shall be designed for duty as per Annexure-A attached.
- b) Each contactor shall be provided with minimum (2) normally open and two (2) normally closed auxiliary contacts rated 10A at 240V A.C. The exact requirement of contacts shall be decided by the tenderer taking into account the scheme requirements and spares.
- c) Contactors for forward and reverse direction of reversible drives shall preferably be both electrically and mechanically interlocked.
- d) Delayed dropout contactors, if required and provided for some essential auxiliaries, shall not dropout on power failure if the voltage is restored within three seconds
- e) Contactor starters shall comply with the requirements of IEC 60947-4-1 or IS 13947(Part4/Sec.1) in respect of co-ordination of the characteristics of contactor, overload relay, and MCCB. The type of co-ordination shall be Type-2 as per IEC/ IS.

5.07.02 Thermal Overload

- a) Thermal overload relays shall be three elements, positive acting, ambient temperature compensated with adjustable settings.
- b) Single phasing preventor shall be provided as an inbuilt feature of the thermal overload relay.
- c) Relays shall be manual reset type with 1 NO and 1NC contacts;
Resetting of relays shall be possible with compartment door closed. Colour of the resetting button shall be BLACK.
- d) Relays may be direct acting or C. T. operated, depending on current rating. C.T.s shall be included in the scope of supply.
- e) Relays for fan motors having long starting time shall be saturable case C.T operated.

5.08.00 **D.C. Starters**

5.08.01 DC starters shall be complete with MCCB, contactors, resistors, relays, meters, push-buttons, lamps, etc.





5.08.02 Starters shall be furnished in totally enclosed floor-mounting, sheet steel cubicles complete with a hinged front access door. Minimum thickness of sheet steel shall be 2mm.

5.08.03 The cubicle enclosure shall provide dust and humidity protection, the degree of protection being not less than IP-54.

The resistor enclosure shall be provided with ventilating louvers and wire mesh guard and shall have a degree of protection IP-23.

5.08.04 Cubicle space heater shall be provided to maintain internal temperature above dew point. Heater shall be furnished with MCCB unit and thermostat control.

5.09.00 **Control and Indication**

5.09.01 Circuit breakers shall be wired up for local and remote operation. Each breaker cubicle shall be equipped with the following:

i) One(1) SW.GR.-REMOTE selector switch for In comer, O/G, Tie, B/C and Transformer feeders / One(1) SW.GR.-NORMAL-TRIAL selector switch for motor feeders. Selector switch shall be Lockable stay put type.

ii) Two (2) push buttons for TRIP and CLOSE

iii) For Incomer/ Bus -coupler/ Motor feeder / Transformer Feeder, Ten (10) indicating lamps on the front of the compartment : -

a.	Breaker Closed	:	Red
b.	Breaker Open	:	Green
c.	Spring Charged	:	Green
d.	Lock out Relay Operated	:	Amber
e.	Breaker in Service	:	Amber
f.	Breaker in Test	:	Amber
g.	Trip Circuit Healthy	:	White
h.	Control Supply Healthy	:	Blue
i.	Breaker Auto-trip	:	Amber
j.	Trip Relay Healthy	:	Blue

Other than above feeders Three (3) indicating lamps on the front of the compartment :

Breaker open & Spring charged	:	Green
Breaker closed	:	Red
Breaker tripped/trip circuit faulty	:	Amber

5.09.02 The general scheme of connections for control, interlock, and protection is shown in the enclosed drawings. Detailed requirements of individual circuits shall be developed by the Tenderers.

5.09.03 Push buttons shall be heavy duty, oil tight, push to actuate type with integral escutcheon plate marked with its function.





5.09.04 Each push-button shall have minimum two (2) NO and two (2) NC contacts rated 10A at 240 V A.C.

5.09.05 Selectors switches shall be stay-put; rotary type with escutcheon plates marked to indicate the function and positions, and shall be lockable in each position. Selector switch contacts shall be rated for 10A at 240 V A.C.

5.09.06 Selector switches shall be provided with minimum three (3) contact blocks of 1 NO + 1 NC each.

The exact requirements of contacts shall be decided by the Tenderers taking into account the scheme requirement and spares.

5.09.07 Lamps shall be LED type. LED lamp shall be made in accordance with I nP Technology (Aluminium Indium Gallium Phosphide Technology). The body shall be made of Poly Carbonate Unbreakable Lens. LED shall be protected by inbuilt fuse with surge suppressor or leakage voltage glow protection. LED circuit shall be PCB mounted. Intensity shall be greater than 200 mcd. All Push Button lamp shall be as per LED indicating lamp.

5.09.08 For control supply, two (2) nos. adequately rated 415/240V control transformers with necessary taps shall be provided. Auxiliary bus bars shall be used to distribute 240V AC control supply. The control supply of different modules shall be tapped individually from the auxiliary bus bars. Transformer ratings shall be so selected to facilitate 100% standby arrangement with 20% spare capacity. A four position selector switch (A-I-B-O) i.e. . Transformer A-Independent-Transformer B- Off shall be provided to feed power from the secondary side of control transformer to two independent control bus (namely Bus-A & Bus-B)

The operation of this selector switch shall be as follows:

Position -I: Both the control buses i.e. Bus -A & Bus-B will receive its control power supply from their dedicated control transformer.

Position -A / Position -B: In case of outage of any one of the control transformer, both the control buses i.e. Bus-A & Bus-B will receive its control power supply from other healthy control transformer.

Position -OFF: No supply to control transformer.

The above philosophy is required to ensure smooth changeover & manual control of the control supply so that the control supply shall remain healthy in case of outage of any one (1) control transformer. Necessary protection, alarm & indication shall be provided as required.

5.09.09 DCDBs shall be provided with indication to monitor healthiness of the incoming DC supplies.



5.10.00 **Meters and Meter Selector Switches**

- 5.10.01 All indicating instruments (96 x 96 mm) shall be switch board types, with 240 Deg. scale, anti-glare glass and accuracy class of $\pm 2\%$ full scale. Each meter shall have zero adjuster on the front.
- 5.10.02 Motor ammeters shall have an extended suppressed end-scale range to indicate starting current (6 to 8 times full-load current).
- 5.10.03 All breaker operated incomers and motor feeders above 30 KW up to 200 KW shall be provided with 3-phase electronic energy meter with pulse output for interfacing with EMS.
- 5.10.04 Meter selector switches shall be maintained contact, stay-put type, with knob handle. Ammeter and voltmeter selector switches shall be four position type. Ammeter selector switches shall have made before break contacts, to prevent open circuiting of CT secondary.
- 5.10.05 The energy meters shall be provided on LV side of each incoming transformer feeder of 415V buses as per the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006 and its amendments.

5.11.00 **Current Transformer**

- 5.11.01 Current Transformers shall be cast-resin type. All secondary connections shall be brought out to terminal blocks where wye or delta connection will be made.
- 5.11.02 Motor feeders rated 30 KW and above, up to and including 90 KW, shall be provided with CTs for metering. Above 90 KW, separate CTs shall be provided for metering and protection.
- 5.11.03 Accuracy class of the current transformers shall be :
- a) Class PS for differential and restricted earth fault
 - b) Class 5P20 for other relaying
 - c) Class 0.5 ISF < 5 for metering
- 5.11.04 Other CT particulars like ratio, burden knee-point voltage, excitation current and secondary resistance shall be decided by the Tenderers.
- 5.11.05 Feeders requiring remote metering and/or current monitoring shall be provided with current transducers with calibration for full-scale reading. The output shall be 4-20 mA DC of which 4-18 mA shall correspond to the normal range.
- 5.11.06 CT secondary shall be rated for 1 A for metering and either 5A or 1A for protection.



5.12.00 Voltage Transformer

- 5.12.01 Voltage transformers shall be cast -resin, drawout type and shall have an accuracy class of 0.5. Voltage transformer mounted on breaker carriage is not acceptable.
- 5.12.02 High voltage windings of voltage transformer shall be protected by current limiting fuses. The voltage transformer and fuses shall be completely disconnected and visibly grounded in fully drawout position.
- 5.12.03 Low voltage fuses, sized to prevent overload shall be installed in all ungrounded secondary leads. Fuses shall be suitably located to permit easy replacement while the switchgear is energised.

5.13.00 Relays

I. General- A

- a) All relays & timers in the protection circuit shall be flush mounted with connection from inside. They shall have transparent, dust tight covers, removable from the front. They shall have built-in testing facilities. Except small auxiliary relays and timers all relays shall be drawout type.
- b) Relays shall be rated for operation on 1A secondary current and 110V secondary voltage to be decided by the bidder. Number and rating of relay contacts shall suit the job requirements.
- c) The Bidder shall furnish, install & co-ordinate all relays to suit the requirements of protection, interlock and bus transfer schemes as broadly indicated in the annexures and drawings. Application check shall be made on all motor protection relay motor characteristics furnished by the Owner. The result of such check shall be furnished for approval.
- d) It shall be the responsibility of the Bidder to fully co-ordinate the overload and short circuit tripping of the circuit breakers with the upstream and downstream circuit breakers / motor starters to provide satisfactory discrimination.
- e) All setting devices shall be accessible after removing the front cover. No relay shall be mounted on the rear side of PCC / PMCC panel.
- f) All relay coils and their auxiliary contacts (including un-enabled relays in Composite Numerical Relays, if any), including spare contacts will be wired up to the terminal blocks of respective panels for wiring to DCS and for future use. All unused terminals of relays shall also be fitted with screws.
- g) Parameterization and loading and downloading of data shall be possible from local HMI as well as from DCS.





- h) All numerical relays shall have front communication port for parameterization, loading and downloading of data thru' Laptop.
- i) All numerical relays and multi-functional meters shall be hooked up and connected with HMI thru' Fiber Optic cable.

II.

General- B

- a) All protective relays shall be of numerical microprocessor based multifunctional type having communication facility as shown in enclosed Dwg. No. 12A05-DWG-E-3101 (Network Scheme of Numerical Relays).
- b) All relays shall conform to the requirements of IS: 3231 / IEC: 60255 standards. The Numerical relays shall have communication, Metering and monitoring facility.
- c) Vendor shall ensure availability of spare parts and maintenance support for the equipment for at least 15 years from the date of supply.
- d) Any foreign relay manufacturer through his Indian partner or subsidiary company in India shall provide application, testing, commissioning and other necessary support for minimum 15 years. They shall also maintain adequate inventory of each type of relay or spares to meet the requirement arising during project execution and plant operation.

III.

Technical Requirement

a)

Auxiliary Power Supply

Unless otherwise specified, relay shall be suitable to accept both AC / DC supplies with range 110V to 240V with tolerance of $\pm 20\%$. The auxiliary power supply shall preferably be site selectable requiring no additional hardware.

b) **Basic Requirement and Constructional Requirement**

- i) Relays shall be suitable for flush mounting on the front with connections from the rear. The enclosure shall be dust tight having degree of protection minimum as IP: 52.
- ii) Relay shall have draw out feature with plug in type PCB for easy replacement. In case of fixed type relay, the terminals shall be easily accessible for testing and commissioning.
- iii) Relay shall have self-diagnostic feature with indication of relay failure on relay front. However, while diagnostic circuit runs, it must not interfere in the main protective



relay circuit and allow working of main protective circuit continuously. Relay faults (self-diagnostic) shall be communicated and annunciated to HMI.

- iv) Design of the relay shall be such that it must operate selectively and with proper discrimination. It must be immune to any kind of electromagnetic interference. Vendor to submit all related type test reports for the offered model along with the offer.
 - v) Necessary auxiliary relays, timers, trip relays, etc. required for complete scheme, interlocking, alarm, logging, etc. shall be provided. No control relay, which shall trip the circuit breaker when relay is de-energized, shall be employed in the circuits.
 - vi) Numerical Relays shall have appropriate setting ranges, accuracy, resetting ratio, transient overreach and other characteristics to provide required sensitivity to the satisfaction of the Owner.
 - vii) Time clock synchronization feature shall be provided for synchronization of clocks of numerical relay and metering LAN with data concentrator time clock. Required hardware and software interface to receive GPS/Time signal to achieve time synchronization shall be supplied by the contractor. The resolution of time synchronization shall be ± 1.0 millisecond or better throughout the entire system.
- c) Display & Indication
- i) All numerical relays shall have keypad / keys to allow relay settings from relay front. In addition, relay shall have front port for downloading / uploading of relay settings from the PC / Laptop. All hand-reset relays shall have reset button on the relay front. Relay to be self or hand reset shall be software selectable.
 - ii) All relays shall have LED / LCD display for settings, status, faults and events. LCD display shall be backlit and temperature compensated up to 65°C for contrast and legibility.
 - iii) As a minimum, the relay shall have LED indicating lamps for fault trip, relay healthy / unhealthy and control supply on.
 - iv) The relay shall have at least 6 programmable LEDs on relay front.



d) Software Security

Relay shall be provided with password protection against unauthorized write access. However, viewing of metering data, settings, and status and event data as read only parameters should be without password protection. All software shall be user friendly and latest up to date version.

e) Disturbance, Event Recording & Data Storage

Status, disturbance data and events shall be stored in non-volatile memory or memory backed up by battery. It should be possible to store minimum 50 events with date and time stamp, last 5 fault records and last disturbance record. When auxiliary power fails, it should be possible to see the latest state of display when power is restored. Also, in case of power supply failure lock out status of the relay should be stored and kept in memory to allow the working of interlock logic properly on restoration of the supply.

f) Trip Circuit Supervision & Lock out function

i) Relay shall have built in lockout function. Lock out feature shall be self reset or hand reset and shall be software selectable.

ii) Relay shall have built in trip circuit supervision function.

g) Input / Output Interface, Filters and Galvanic Isolation

h) Relay shall have at least 4 NO contacts each shall separately be programmable for either hand reset or self-reset. The contact rating shall be minimum 5A at 250V AC / DC.

i) Relay shall be made immune to capacitance effect due to long length cables.

ii) All IOs shall have galvanic isolation. Analog inputs shall be protected against switching surges, harmonics etc.

i) Serial Communication

i) All numerical relay shall have communications on three ports; local front port communication to laptop and a dual port on IEC 61850 to communicate with the data concentrator through LAN and Ethernet switches.

ii) All relays should be able to communicate with DCS system. Data shall be available at the DCS on request.

iii) Protocol adapted for communication to DCS should facilitate easy interface with worldwide used open protocol like Modbus or IEC 103 protocols.



- iv) It shall be also possible for Relay Parameterization as well Downloading of Disturbance Records from PC /Laptop provided in Unit & Engineering Workstations located in Central Control Room of each unit. Necessary user friendly and latest software to be provided for this purpose. Communication protocol shall be selected from relay to PC to provide all information.
- v) One (1) set of Laptop by each Switchgear manufacturer, loaded with common support software and which will allow easy settings of relays in addition to uploading of event, fault, disturbance records, measurements from relay front communication port. The Switchgear supplier shall furnish CD's for the above relay parameterization as well as download of disturbance recorder for all relays of his supplied switchgear. Accessories like table/chair/desk/power socket etc. as required for all PC/Laptop should be supplied.

Refer Section-I of Vol.-II-F/1 for Relay and Energy Management System.

5.14.00 **Secondary Wiring**

- 5.14.01 All boards shall be fully wired at the factory to ensure proper functioning of control, protection, transfer and interlocking schemes.
- 5.14.02 Fuse and links shall be provided to permit individual circuit isolation from bus wires without disturbing other circuits. All spare contacts of relays, switches and other devices shall be wired up to terminal blocks.
- 5.14.03 Wiring shall be done with flexible, 1100 V grade, PVC insulated switchboard wires with stranded copper conductors of 2.5 mm² for control, current and voltage circuits.
- 5.14.04 Each wire shall be ferruled by plastic tube with indelible ink print at both end having terminal block no., terminal nos., destination no. as per approved Drawing.
- 5.14.05 Wire terminations shall be made with crimping type connectors with solder as insulating sleeves. Wires shall not be spliced between terminals.

5.15.00 **Terminal Blocks**

- 5.15.01 Terminal blocks shall be 1100V grade box-clamp type 10-mm² minimum with marking strips. Terminals for C.T. secondary leads shall have provision for shorting.
- 5.15.02 Terminal blocks used for interface with DCS via termination cabinet shall be suitably sized to facilitate proper termination of interconnecting cables.





- 5.15.03 Not more than two wires shall be connected to any terminal. Spare terminals equal in number to 20 % active terminals shall be furnished and these spare terminals shall be uniformly distributed on each terminal blocks. Minimum 150mm clearance shall be maintained between two rows of terminal blocks. The minimum clearance between the first row of terminal blocks and the associated cable gland plate shall be 250 mm.
- 5.15.04 Terminal blocks shall be located to allow easy access. Wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.
- 5.16.00 Cable Termination
- 5.16.01 Generally, all assemblies shall be designed for cable entry from the bottom. Sufficient space shall be provided for all the cables as per cable schedule, for ease of termination and connection.
- 5.16.02 All provisions and accessories shall be furnished for termination and connection of cables as per cable schedule, including removable gland plates, cable support, crimp type tinned copper/aluminium lugs, double compression brass glands with tapered washer (Power cable only) and terminal blocks.
- 5.16.03 Gland plates shall be minimum 4 mm thick. The gland plate and supporting arrangement for 1/C power cables shall be non-magnetic type to minimise the flow of eddy current.
- 5.17.00 Bus Duct Connection
- 5.17.01 Bus duct connection, wherever provided, shall be furnished along with transition panel, if required. Bus duct connections shall be from the top.
- 5.17.02 All connecting bus work shall have the same continuous rating as associated PCC/PMCC/MCC/DB bus and shall be fully braced for the LT system short circuit current.
- 5.17.03 All provisions such as matching flanges and other accessories required for proper connection to bus duct shall also be supplied.
- 5.17.04 Automatic reserve closure (ARC) cover shall be provided for 415V unit & emergency auxiliary switchgear.
- 5.18.00 Ground Bus
- 5.18.01 A ground bus, rated to carry maximum fault current, shall be provided which shall extend the full length of the assembly.
- 5.18.02 The ground bus shall be provided with two-bolt drilling with G.I. bolts and nuts at each end and shall be suitable to receive 50 x 6 mm G.S. flat.
- 5.18.03 All stationary units including non-current carrying metal work of boards/panels shall be directly connected to the ground bus for effective grounding.





The frames of all circuit breakers and drawout V.T. units shall be grounded through heavy multiple conductors at all times except when the primary disconnecting devices are separated by a safe distance.

The frames of all other drawout modules shall be grounded at all times except when the power disconnects are separated by a safe distance.

- 5.18.04 Wherever the schematic diagrams indicate a definite ground at the switchgear; a single wire for each circuit thus grounded shall be run independently to the ground bus and connected thereto.
- 5.18.05 C.T. & V.T. secondary neutrals shall be earthed through removable links so that earth of one circuit may be removed without disturbing others.
- 5.18.06 All hinged doors shall be earthed by flexible copper braid.
- 5.19.00 Nameplates
- 5.19.01 Nameplates of approved design shall be provided on each cubicle, at the top of the assembly and on each instrument & device mounted on or inside the cubicle.
- 5.19.02 The material shall be lamicoid or approved equal. 3 mm thick with white letters on black background.
- 5.19.03 The name plates shall be held by self-tapping screws. Nameplate size shall be minimum 20 x 75 mm for instrument/devices & 40 x 50 mm for panels.
- 5.19.04 Caution notice on suitable metal plate shall be affixed both at the front and back of each vertical panel.
- 5.20.00 Space Heaters and Plug Sockets
- 5.20.01 Panel and motor space heaters, Plug socket, panel illuminations shall be fed from separate AC auxiliary busbars running throughout the switchboard. All the panel and motor space heaters shall be fed from these busbars through single pole MCB and neutral link.

The AC auxiliary bus shall be charged thru' 2X100%, 415/240V Space heater supply transformers with a "TRANSFORMER-A /TRANSFORMER-B selector switch. The 415V incoming supply to these aux. transformers shall be tapped before the respective Incoming breakers, so that in the event of 415V panel is not energized, the 240V aux. bus remains ready for supplying power to motor / panel space heaters, panel illumination. Necessary protection, alarm & indication shall be provided as required.
- 5.20.02 Each vertical section shall be provided with thermostat controlled space heater and 5A, 3 pin plug socket.
- 5.20.03 In addition, motor feeders rated 30 KW and above shall be wired-up for feeding the motor space heater through suitably rated breaker auxiliary NC contact and/or contactor.





- 5.20.04 Cubicle heater. Motor heater, and Plug-socket circuits shall have individual MCCB units.
- 5.21.00 A.C./D.C. Power Supplies
- 5.21.01 Necessary AC and DC power supplies as required for control and service, shall be arranged by the Contractor. Duplicate feeder shall be arranged for both A.C & D.C. supply.
- 5.21.02 Isolating MCCB units shall be provided for the incoming supplies. These shall be 4-pole, single throw for 415V AC and 2-pole double throw with off position for 220V DC.
- 5.21.03 Bus-wires of adequate capacity shall be provided to distribute the incoming supplies for different cubicles. Isolating MCCB units shall be provided at each cubicle for A.C./D.C. supplies.
- 5.21.04 A.C. load shall be so distributed as to present a balanced loading on three-phase supply system.
- 5.22.00 Tropical Protection
- 5.22.01 All equipment, accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects & corrosion.
- 5.22.02 Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.
- 5.23.00 Painting
- 5.23.01 All assemblies shall be finished in light grey (IS shade * 631) with two coats of synthetic enamel paint. Painting process shall be of powder coating type.
- 5.24.00 Moulded Case Circuit Breaker
- 5.24.01 Moulded Case Circuit Breaker shall be three pole, single throw, air break type having trip free mechanism with quick make break contacts. Moulded Case Circuit Breaker for feeders of MCCs/MCCB Boards and for outgoing feeder from PCCs/PMCCs. MCCBs shall have door interlocks and padlocking facility.
- Moulded Case Circuit Breakers shall have current limiting design.
- Moulded Case Circuit Breakers of identical rating shall be physically and electrically interchangeable.
- Moulded Case Circuit Breakers shall be provided with 1 NO and 1 NO electrically separate auxiliary contacts.
- 5.24.02 MCCB for motor feeders shall have adjustable short ckt release. MCCB used for 50KW and above motor rating shall have additional E/F protection.
- For other feeders MCCB upto 100A rating shall be provided with built front adjustable releases (short ckt and overload). MCCB of rating above 100A shall





be provided with microprocessor based inbuilt front adjustable releases (short circuit and overload) and shall have adjustable earth fault protection unit also.

5.25.00 Miniature Circuit Breaker

5.25.01 MCB shall be suitable for manual closing and opening and also automatic trip on overload and short circuit.

6.00.00 TESTS

6.01.00 The switchgear shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standards.

6.02.00 Routine Tests

The tests shall include but not necessarily limited to the followings :

- a) Operation under simulated service condition to ensure accuracy of wiring, correctness of control scheme & proper functioning of the equipment.
- b) All wiring and current carrying parts shall be subjected to appropriate High Voltage Test.
- c) Primary current & voltage shall be applied to all instrument transformers.
- d) Routine test shall be carried out on all equipment such as circuit breakers, instrument transformers, relays, meters, contactors, MCCB, etc.

6.03.00 Type Tests

The following type tests shall be performed on a representative sample of the LV Switchgear assembly:

- a) Temperature rise Test
- b) Short time current test on main circuit and earth circuit.
- c) Verification of making and breaking capacity.

6.04.00 Type test certificates of any equipment shall be furnished if so desired by the Purchaser. Otherwise, the equipment shall have to be type tested, free of charge, to prove the design. Type tests performed before five (5) years are not acceptable.





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WBPDCCL

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

ANNEXURE-A

RATINGS & REQUIREMENTS

1.0 GENERAL

Type : Metal-clad, drawout (PCC/PMCC/MCC/SVB)
Metal-clad, fixed (DB)

Service : Indoor

Enclosure : As per Section – I of Volume.-II-F/1

1.1	System	AC	DC
	Voltage	: 415V \pm 10%	220V \pm 10%
	Phase	: 3-phase and neutral	-
	Frequency	: 50 Hz -3 to -5%	-
	Combined voltage and frequency variation	: 10% (absolute sum)	-
	System grounding	: Solidly grounded	Ungrounded

1.2 Rated Current at 50°C ambient

Busbar : To be decided by the Tenderers

Circuit breaker : - Do -

Switches : 16A to 630A

1.3	Short Circuit Rating	AC	DC
	Interrupting	: 50 KA	25* KA
	Short Time for	: 50 KA (3 second)	25* KA (1 second)
1.4	Hipot for 1 minute (min.)	: 2.5 KV	1.5 KV

* Minimum only ; actual value to be decided by the bidder and to be substantiated by calculation .



**WBPDC**

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

1.5 A.C./D.C. Power Supply

Control Voltage for : 220 V DC \pm 10%
 Circuit breaker

DC power supply :
 For C & I : 24 V DC \pm 10%

Control voltage for : 240 V AC \pm 10%, 1 Ph, 50 Hz \pm 5%
 MCC modules

Service voltage : 240 V AC \pm 10%, 1 Ph, 50 Hz \pm 5%

2.0 CIRCUIT BREAKER

2.1 Duty Cycle : 0-3'-CO-3'-CO

2.2 B reaking Current

A.C. Symmetrical : 50 KA

2.3 Making Current : 105 KA Peak

2.4 Auxiliary Voltage

Closing : 220 V D.C. (85 - 110%)

Tripping : 220 V D.C. (70 - 110%)

Spring Charging : 220 V D.C. (85 - 110%)

3.0 CONTACTOR DUTY

AC

DC

: Class III-Category
 AC3 for unidirectional
 drives and AC4 for
 bi-directional/inching
 duty drives

Class I -
 Category DC2

4.0 SWITCH DUTY

Motor feeders : AC23

DC22

Other feeders : AC22

DC22





ANNEXURE-B

PROTECTIONS

1.0 The minimum protections to be provided for circuit breaker controlled feeders are listed below :

- a) Incoming Feeders :
- a) 3-Inverse time O/C relays (51) for phase faults
 - b) 1-Inverse time O/C relay (51N) for Earth faults
 - c) IDMTL Over Current (51 SN) for standby earth fault (for incomer from transformer only) – This protection will be part of upstream feeder.
 - d) Restricted E/F (64) (for incomer from transformer only) – This protection will be part of upstream feeder.
 - e) Under Voltage with time delay (27).
 - f) VT Fuse failure.
 - g) Circuit Breaker failure.
 - h) Sensitive earth fault detectors shall be provided in DC system to annunciate earth faults

b) Motor Feeders : Microprocessor based Numerical Protection for LT Motor

Bidder shall quote suitable digital/microprocessor based numerical relay for motor protection with following minimum facility as indicated below :

- Thermal model with negative sequence current.
- Voltage compensated acceleration.
- Under voltage, over voltage protection.
- Overload protection.
- Short circuit & SC back-up.
- Current unbalance.
- Ground fault (through CBCT)
- Temperature monitoring (stator, bearing etc.).
- Phase reversal.



Apart from above suitable provision for metering and monitoring such as voltage, current, power factor, watt-hr, event record etc. shall be provided.

The relays shall have facility for user interface capability, character display, keypad, LED indicator and communication port along with licensed version software.

- c) Lighting/Welding Transformer : 3-inverse time O/C relays with feeders high set instantaneous unit (50/51) for phase faults

1-inverse time O/C relay (51N) for earth fault

- d) Outgoing Feeders : - 2-Inverse time O/C relay (51) for phase fault
- 1-Inverse time O/C relay (51N) for Earth fault

All inverse time O/C relay shall be 1.3 sec version.

- 2.0 Apart from protection relays, each electrically operated breaker shall be provided with separate anti-pumping (94), trip annunciation (30), lock out (86) and trip circuit supervision (74) relays. Lockout relay shall be hand reset type.
- 3.0 Fuse failure relay shall be provided on the secondary side of voltage transformer to monitor H.V. & L.V. fuses.



ANNEXURE-F

MODULE SELECTION

MOTOR FEEDER

Type	Motor Rating	MCCB Rating	Contactor	Cable size
AU/AR	0 - 5.5 KW	32A	16A	3/C – 6 Sq.mm - Cu
BU/BR	5.6 - 11 KW	63A	32A	3/C - 16 Sq.mm - Al
CU	11.1 - 22 KW	63A	63A	3/C - 35 Sq.mm - Al
DU	22.1 - 50 KW	100A	100A	3/C - 95 Sq.mm - Al
EU	50.1 - 75 KW	200A	160A	3/C - 185 Sq.mm - Al
FU	75.1 - 90 KW	400A	300A	2 x 3/C - 185 Sq.mm - Al

NOTE :

1. MCCB, thermal overload relay, Contactor are to be coordinated (Type-2) with motor rating by the Contractor.
2. "U" stands for Undirectional and "R" for Reversible drives.
3. MCCB with E/F protection to be considered for motors of rating 50 KW and above.
4. Following Indication Lamps shall be provided on Motor module-
ON : Red, OFF : Green, Trip : Amber, MCCB OFF : Blue.





OUTGOING FEEDER

Type	MCCB Rating	Cable Size
AF	32A	4/C – 16 Sq.mm - Cu
BF	63A	4/C – 35 Sq.mm - Al
CF	100A	3.1/2 – 95 Sq.mm - Al
DF	200A	3.1/2 – 300 Sq.mm - Al
EF	400A	4 x 1/C – 630 Sq.mm - Al

MODULE SELECTION (For DC SYSTEM)

Type	Switch Rating	Fuse Rating	Cable Size
DAU	16A	16A	2/C-2.5 Sq.mm. Cu.
DAF	32A	32A	2/C-2.5 Sq.mm. Cu.
DBF	63A	63A	2 x 2/C-16 Sq.mm - Al
DCF	100A	100A	4/C-35 Sq.mm - Al
DDF	200A	200A	2 x 4/C-35 Sq.mm - Al
DEF	400A	400A	2 x 1/C-630 Sq.mm - Al

NOTE :

- Following Indication Lamps shall be provided on MCCB module-
ON : Red, OFF : Green, Trip :Amber.
- ON indication Lamp shall be provided on DC module.



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SAGARDIGHI THERMAL POWER PROJECT,
1 X 660 MW UNIT NO 5, STAGE III.

MILL REJECT SYSTEM (PNEUMATIC TYPE)
&

COAL BUNKER DEBLOCKING DEVICES

SPECIFIC TECHNICAL REQUIREMENT

SPECIFICATION No: PE-TS-445-160-A001

VOLUME: II B

SECTION-I

SUB-SECTION-IC

REV 00

DATE 17.07.21

SUB SECTION-IC

(CONTROL AND INSTRUMENTATION)



**1X660MW SAGARDIGHI THERMAL POWER EXTENSION
PROJECT (UNIT #5)**

C&I TECHNICAL SPECIFICATION

FOR

MILL REJECT SYSTEM



**CONTROL AND INSTRUMENTATION DEPARTMENT
PROJECT ENGINEERING MANAGEMENT
BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
NOIDA**

PREPARED BY	CHECKED BY	APPROVED BY
ANJALI RAMAN	SC SHARMA	SC SHARMA
MNGR. (C&I)	DGM (SH-I02,C&I)	DGM (SH-I02,C&I)



**1X660MW SAGARDIGHI THERMAL POWER
EXTENSION PROJECT (UNIT #5)**


SECTION: C
SUB SECTION :
C&I

**C&I SPECIFICATION FOR
MILL REJECT SYSTEM**


INDEX

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6	MOTORISED VALVE ACTUATORS
7	FIELD & MEASURING INSTRUMENTS
8	SIGNAL EXCHANGE BETWEEN DRIVES & DCS
9	INSTRUMENT CABLE INTERCONNECTION AND TERMINATION PHILOSOPHY
10	ERECTION HARDWARE
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12	TYPE TEST REQUIREMENT
13	APPLICABLE CODES AND STANDARDS
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	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	


**GENERAL TECHNICAL
SPECIFICATION
CONTROL & INSTRUMENTATION**

	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	


GENERAL REQUIREMENT

- 1.0 Bidder shall provide complete and independent control & instrumentation system with all accessories, auxiliaries and associated equipments for the safe, efficient and reliable operation of auxiliary systems.
- 2.0. The quantity of instruments for auxiliary system shall be as per tender P & ID, wherever provided, for the respective system as a minimum for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any price and delivery implication to BHEL.
- 3.0 Measuring instruments/equipment and subsystems offered by the bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Further all the instruments shall be of proven reliability, accuracy, and acceptable international standards and shall be subject to employer's approval. All instrumentation equipment and accessories under this specification shall be furnished as per technical specification, ranges, makes/ numbers as approved by the employer' during detail engineering.
- 4.0 The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold and all the other accessories required for mounting/ erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg / Cm². The contacts of equipment mounted instruments; sensors, switches etc. for external connection including spare contacts shall be wired out to suitably located junction boxes.
- 5.0 In case of any contradiction most stringent clause/condition shall prevail.

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	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
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C&I SPECIFIC TECHNICAL REQUIREMENT


	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	


Specific Technical Requirements (C&I):

- 1) The control of Mill Reject system (MRS) shall be through DDCMIS based control system (in BHEL scope) of CPU system of Unit#5. The operation and control philosophy of MRS shall be as per design memorandum given elsewhere in the specification. The DDCMIS panel along with a dedicated OWS (in BHEL scope) shall be located in CPU regeneration control room.
- 2) Conveying air compressor's control & operation shall be from MRHS control system. Each compressor shall have its own microprocessor based control system also, which shall be further interfaced (Hardwired & redundant soft wired) with MRHS control system for overall control, operation & monitoring of compressors. Bidder shall include required hardware at MP end.
- 3) The Contractor shall provide complete Instrumentation for control, monitoring and operation of entire Mill Reject system. The requirements given are to be read in conjunction with detailed Technical specification enclosed in the specification. Further in case of any discrepancy in the requirement within the same section noted by the bidder in the specification, the same will be brought to the notice of BHEL in the form of pre- bid clarification. In absence of any pre-bid clarification, the more stringent requirement as per interpretation of Customer shall prevail without any commercial implication.
- 4) The instrumentation to be provided for MRS shall be as per the technical specification document / drawings wherever provided for the respective systems as a minimum requirement for bidding purpose. However, for completeness of the system and its associated equipment, Bidder shall also provide all the necessary instruments to the process requirement even if not indicated in the given technical Specification document /drawings. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any technical, commercial and delivery implication to BHEL.
- 5) The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial and delivery implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
- 6) Bidder to provide local pneumatic cum control panel for each conveying vessel/pyrite hopper. This local panel will act as interface between the DCS and the field devices for commands & feedbacks. This panel shall also consist of vessel high and low pressure switch.
- 7) Bidder to provide local control panel for Control of deblocking devices. Further compressor of deblocking devices shall have its own microprocessor based

	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	
<p>control system also, which shall be further interfaced (Hardwired & redundant soft wired) with DCS for overall control, operation & monitoring of compressors.</p> <ol style="list-style-type: none"> 8) Electrical Actuators with integral starter shall be provided for all on/off and inching type valves along with necessary interface units for linking to corresponding Control System as applicable, typical Hook-up diagram of drives is included for reference. Non-contact type electronic 2-wire position transmitters shall be provided for all inching type motorised valves. The detailed specification is attached elsewhere in the specification. 9) The solenoid operated valves/Dampers/Gate shall have a limit switch for open/close feedback. Control voltage of Solenoid Valve shall be 24V DC only. 10) 2 nos. RF type level switch and One no. temperature switch shall be provided for interlock & monitoring purpose per hopper. 11) RF Type level switches shall be provided for each storage bunker and DPS shall be provided across each bag filter for interlock & monitoring purpose. 12) Local control panel/station if any required for operation shall be in bidder scope. 13) Interface of MCC, HT SWGR, Actuators, solenoid drives, control valves etc. with DCS based control system shall be as per Drive Control Philosophy attached in the specification. 14) All the instruments/drives shall be terminated on JBs/Panels in field. JBs/Panels shall be in Bidder's scope. Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 12-15 mtrs) and trunk cable. 15) RTD's shall be of duplex type. Both the elements of duplex temperature sensors shall be terminated to junction boxes. Temperature measurement shall have up scale / down scale drive to protect from process upset in case of sensor failure. For RTDs ring - tong type lugs shall be used at Junction Boxes. 16) All local gauges, transmitters and switches shall be mounted on suitable enclosures, racks subject to owner's approval. All transmitters shall be HART compatible. 17) Bidder to terminate all instrumentation and control elements in junction boxes. Bidder to provide input/output list, drives list, junction box schedule and termination details, recommended control logics / write-up etc. the list of documents to be submitted after award of contract is to be referred by bidder. 18) All field instruments enclosure shall be IP65. Local panel/cabinet enclosure shall be IP 55, unless otherwise specified. Electronics located outside control room shall be tropicalized and enclosed in dust & weatherproof cabinets (IP-65/67) suitable for the environment. 		

	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	
<p>19) Components of instruments, control devices, accessories, piping etc. which contact steam, condensate or boiler feed water shall be manufactured from copper-free materials.</p> <p>20) Double root valve shall be provided for all pressure tapings where the line pressure is 40kg/cm² and above. Single root valve for below 40Kg /sq. cm.</p> <p>21) Primary sensor redundancy for Control/measurement shall be decided as per following general criteria:</p> <ol style="list-style-type: none"> Critical controls & respective measurements, measurements required for protection of auxiliaries & for major CLCS- Triple redundant. Non-critical but important control & measurements and measurements required for other CLCS- Dual redundant. <p>22) All the instruments/ sensors/transmitters/switches meant for redundant applications shall have completely separate and independent impulse pipes/ root valves etc. No redundant instrument shall share a single process tapping. There will be separate and independent tapping for every individual instrument.</p> <p>23) Bidder to comply with codes and standards as mentioned in the specification.</p> <p>24) Instrument installation shall be as per the attached "Standard Hook-up diagram of instrument." However, any instrument/ analyser installation not covered in the same shall be subject to Customer and BHEL approval during detailed engineering.</p> <p>25) Bidder shall provide erection hardware as per installation drawings.</p> <p>26) Bidder to provide mandatory spares as per mandatory spares list attached elsewhere in the specification.</p> <p>27) Bidder to perform tests of C&I items/instruments/systems as per Quality plans/type test attached in the specification. However, if any test not specified in the quality plan but specified in specification Tests for I&C equipment included elsewhere in specification will have to perform by Bidder without any cost implication. The make/model of various instruments/items/systems shall be as per Customer/BHEL approved vendor list. No commercial and delivery implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.</p> <p>28) Bidder must offer general tools and tackles and special calibration instruments required during start-up, trial run, operation and maintenance of the system.</p> <p>29) 230V UPS supply shall be made available for MRS package at below mentioned locations:</p>		

	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	
<p>i. One no. supply at compressor house which shall be used for controllers of MRS compressor skids.</p> <p>ii. One no. supply at each mill bay which shall be used for power supply required for level probes installed at pyrite hopper & on silo, level instrument installed on silo and power supply to timer card panel of bag filters installed at silo etc.</p> <p>iii. Distribution of 230V supply from a single source to various locations in compressor house & mill bay area shall be in bidder's scope.</p> <p>Further distribution to various instruments shall be in Bidder's scope. Bidder to include necessary power distribution board (ACDB) (as per details attached elsewhere in this specification) in his scope. Any power supply other than the above, if required by any instrument/device, has to be derived by the Bidder from the above supply and all necessary hardware for the same shall be in bidder's scope. Bidder to furnish UPS power requirement UPS / Electrical load data along with the bid.</p> <p>30) Bidder to furnish electrical load/UPS load data during detailed engineering.</p> <p>31) Scope of Instrumentation cables (Screened Control Cables), Fibre Optic cable & Control cables shall be as per Electrical Cable scope matrix in Electrical portion of specification. Any cable in Bidder's scope shall be as per specification.</p> <p>32) Number of pairs to be selected for Screen /Control cable (Size : 0.5 mm²)</p> <p>a) F-Type: 2P/4P/8P/12P</p> <p>b) G-Type: 2P/4P/8P/12P</p> <p>33) Number of cores to be selected for Control cable (Size: 2.5 mm²):</p> <p>a) 3 Core</p> <p>b) 5 Core</p> <p>c) 12 Core</p> <p>34) Instrument ranges 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.</p> <p>35) The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL.</p> <p>36) The bidders shall specifically mention any deviation they would like to take on the C&I specification. In absence of only deviation, a No deviation certificate is to be furnished.</p>		


	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	
<p>37) Contractor shall furnish Instrument Schedule, I/O list, Drive list, Cable Schedule, Cable interconnection (DCS end terminal details shall be provided to vendor during detail engineering to incorporate in cable interconnection), JB grouping, Annunciation list, SOE list, List of Instruments/devices for HART in BHEL approved format. Also reusable database format like MS Excel, MS Access etc. of these documents shall also be provided by Contractor in BHEL approved format. Soft copy of the formats shall be provided to the successful bidder.</p> <p>38) In addition to requirements specified here, all C&I systems/ sub-systems/ equipment/ devices shall also meet other requirements stipulated under other Sub-sections/ parts/ sections of specification.</p> <p>39) In case of any conflict and repetition of clauses in the specification, BHEL discretion will prevail.</p> <p>40) All the outdoor field instruments such as analysers/transmitters/meters etc. shall be provided with suitable Free standing cabinet(s)/panel/rack so that the equipments are protected against rain/ sunlight etc. Site fabricated racks are not accepted</p> <p>41) Control & Instrumentation equipment shall be guaranteed against manufacturing defect for at least two (2) years from the date of handing over to Owner.</p> <p>42) Any part/module of the C&I system which are not listed under recommended spares shall be deemed as having life expectancy not less than the expected life of the plant i.e. 30 years.</p> <p>43) Bidder to delegate /depute their persons/experts (21 man days for minimum 3 tours) as per owner/consultants' requirement without any additional cost at site during commissioning.</p> <p>44) Bidder's presence is required for 3 Man days (Excluding travel time) at EDN Bangalore during FAT of DDCMIS for certifying correctness & completeness of implementation of Control logic. Intimation to attained FAT shall be informed in 2 days advance. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.</p> <p>45) Bidder to ensure participation of their senior personnel and experts in discussions with Owners and other equipment bidders during various stages of contract implementation as required by the Owner.</p>		

**WBPDCL**

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

- 2.06.04 The conveying air compressor for Unit#5 shall have common stand by with Stage II conveying compressors and shall be controlled from the existing Stage II control system. Compressor control shall be envisaged through skid mounted proprietary local control panel with serial interface with existing MRHS PLC system.
- 2.06.06 Necessary and suitable instrumentation as required to achieve the operation philosophy as indicated in V.II/H2 of this specification and as illustrated in the relevant tender flow diagram shall be provided as minimum requirement of the system.
- 2.06.07 Bidder shall provide all control equipment, accessories, all instrumentation cables including laying and termination of cables, erection hardware for safe, efficient and reliable operation of the plant instruments (As per Technical Specification Volume IIE/Section -VI).



	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	

C&I DELIVERABLES LIST

**LIST OF VENDOR DELIVERABLES FOR C&I FOR MILL REJECT SYSTEM
(1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5))**


DOCUMENT NUMBER PE-GL-445-160-I001

SHEET 1 of 1


Sl.No.	DRAWING NO.	DRAWING/DOCUMENT TITLE	CATEGORY
1	PE-V0-445-145-I901	CONTROL & OPERATIONAL WRITE-UP FOR THE SYSTEM	A
2	PE-V0-445-145-I902	CONTROL SCHEME/LOGIC DIAGRAM (TO BE IMPLEMENTED IN DDCMIS)	A
3	PE-V0-445-145-I903	HMI PICTURES/PLANT SCHEMATICS	A
4	PE-V0-445-145-I904	INSTRUMENT SCHEDULE WITH SET POINTS	A
5	PE-V0-445-145-I905	I/O LIST (ANALOG & BINARY)	A
6	PE-V0-445-145-I906	DRIVE LIST/SOLENOID/ACTUATOR VALVE LIST WITH LOCATION DATA	A
7	PE-V0-445-145-I907	FIELD JB/LIE/LIR,DRIVES TERMINATIONS / GROUPING DOCUMENT	A
8	PE-V0-445-145-I908	DATASHEETS FOR INSTRUMENTS, JBs, etc.	A
9	PE-V0-445-145-I909	QUALITY PLANS (INSTRUMENTS, VMS, LCP etc.)	A
10	PE-V0-445-145-I910	INSTRUMENT INSTALLATION/ HOOK UP DRAWINGS	A
11	PE-V0-445-145-I911	THERMOWELL SIZING CALCULATION	A
12	PE-V0-445-145-I913	CABLE SCHEDULE & INTERCONNECTION	A
13	PE-V0-445-145-I914	ANNUNCIATION & SOE LIST	A
15	PE-V0-445-145-I916	LCP GA DRAWING	A


NOTES:

1. ANY OTHER DOCUMENT DECIDED DURING DETAILED ENGINEERING SHALL BE PROVIDED BY BIDDER WITHOUT ANY COMMERCIAL/TECHNICAL IMPLICATION.
2. CONTRACTOR TO SUBMIT REUSABLE DATABASE FORMATS IN BHEL/CUSTOMER APPROVED FORMATS LIKE MS EXCEL,MS ACCESS OF DOCUMENTS LIKE INSTRUMENT SCHEDULE, I/O LIST, DRIVE LIST,FIELD JB TERMINATIONS, CABLE SCHEDULE & INTERCONNECTION, etc. SOFT COPY OF FORMATS SHALL BE PROVIDED TO SUCCESSFUL BIDDERS.


	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	


SPECIFICATION FOR MOTORISED VALVE ACTUATOR

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		DOCUMENT NO.: PE-ID-445-145-I902	
			VOLUME II B	
			SECTION D	
			REV. NO. 01	DATE:27/03/2020
			SHEET 1	OF 5
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
GENERAL *	* PROJECT	1 X 660 MW SAGARDIGHI STPP		
	OFFER REFERENCE			
	* TAG NO. SERVICE			
	* DUTY	<input type="checkbox"/> ON / OFF <input type="checkbox"/> INCHING		
	* LINE SIZE (inlet/outlet): MATERIAL			
	* VALVE TYPE	<input type="checkbox"/> GLOBE <input type="checkbox"/> GATE <input type="checkbox"/> REG. GLOBE <input type="checkbox"/> BUTTERFLY		
	* OPENING / CLOSING TIME			
	* WORKING PRESSURE			
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF -20 to 70 DEG C AND RELATIVE HUMIDITY OF 0-95% IN HOT HUMID AND TROPICAL ATMOSPHERE AND HIGHLY POLLUTED AT PLACES OF COAL DUST AND FLY DUST		
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY		
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY		
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY		
	CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF, DUST TIGHT SUITABLE FOR OUTDOOR USE WITHOUT CANOPY, NEMA6/IP:68	
MECHANICAL POSITION INDICATOR		TO BE PROVIDED FOR 0-100% TRAVEL		
BEARINGS		DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.		
GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION		METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.		
SIZING		OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR INCHING SERVICE - 150 STARTS/HR MINIMUM & FOR REGULATING SERVICE - 600 STARTS/HR MINIMUM as per IEC60034-1		
HANDWHEEL as per standard EN 12570:2000	* REQUIRED	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		
	* ORIENTATION	<input type="checkbox"/> TOP MOUNTED <input type="checkbox"/> SIDE MOUNTED		
	*TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.			
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY		
	MOTOR MAKE / MODEL / TYPE / RATING (KW) (REFER NOTE NO. 6 & 7)	BIDDER TO SPECIFY		
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT-INCLUSIVE OF I.S. TOLERANCE		
	ACTUATOR APPLICABLE WIRING DIAGRAM	<input checked="" type="checkbox"/> ENCLOSED (BIDDER TO CONFIRM) A: <input checked="" type="checkbox"/> DRG. NO. 3-V-MISC-24227 R00 B: <input type="checkbox"/> DRG. NO. 3-V-MISC-24550 R00 C: <input type="checkbox"/> DRG. NO. 3-V-MISC-24283 R00 D: <input type="checkbox"/> DRG. NO. 4-V-MISC-90271 R11 E: <input type="checkbox"/> For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram		
	COLOUR SHADE	<input type="checkbox"/> BLUE (RAL 5012) <input type="checkbox"/> <input checked="" type="checkbox"/> TO BE DECIDED DURING DETAILED ENGINEERING		
	PAINT TYPE	<input type="checkbox"/> ENAMEL <input checked="" type="checkbox"/> EPOXY CONFIRMING TO CORROSION CATEGORY C5-I		
	SHAFT RPM	BIDDER TO SPECIFY		
	OLR SET VALUE	BIDDER TO SPECIFY		

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		DOCUMENT NO.: PE-ID-445-145-I902		
			VOLUME	II B	
			SECTION	D	
			REV. NO.	01	DATE:27/03/2020
			SHEET	2	OF 5
Data Sheet A & B					
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)		
INTEGRAL STARTER	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY			
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY			
	@ PWR SUPP TO MTR / STARTER	415V, 3PH, AC			
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER <input type="checkbox"/> 230 V <input type="checkbox"/> 110 V			
	@ ENCLOSURE CLASS OF MOTOR	<input type="checkbox"/> IP 67 <input checked="" type="checkbox"/> IP 68 <input type="checkbox"/> FLAME PROOF			
	@MOTOR BEARING WITH 2 EARTH TERMINALS	DOUBLE SHIELDED; GREASE LUBRICATED ANTI FRICTION			
	@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B			
	@ WINDING TEMP PROTECTION	<input checked="" type="checkbox"/> THERMOSTAT (3 Nos., 1 IN EACH PHASE)			
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED (THERMISTOR PTC)			
	INTEGRAL STARTER	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED			
	TYPE OF SWITCHING DEVICE	<input checked="" type="checkbox"/> CONTACTORS <input type="checkbox"/> THYRISTORS			
	TYPE	<input checked="" type="checkbox"/> CONVENTIONAL <input type="checkbox"/> SMART (NON-INTRUSIVE)			
	IF SMART (REFER BELOW POINT a – h)				
	a) SERIAL LINK INTERFACE	<input type="checkbox"/> INTEGRAL <input type="checkbox"/> FIELD MOUNTED			
	b) SERIAL LINK PROTOCOL	<input type="checkbox"/> FOUNDATION FIELD-BUS <input type="checkbox"/> PROFI-BUS <input type="checkbox"/> DEVICE NET <input type="checkbox"/>			
	c) SERIAL LINK MEDIA	<input type="checkbox"/> TWISTED PAIR Cu-CBL <input type="checkbox"/> CO-AXIAL Cu-CBL <input type="checkbox"/> OFC			
	d) HAND HELD PROGRAMMER	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED			
	e) TYPE OF HAND HELD PROGRAMMER	<input type="checkbox"/> BLUETOOTH <input type="checkbox"/> INFRARED <input type="checkbox"/>			
	f) MASTER STATION	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED			
	g) MASTER STN INTRFACE WITH DCS	<input type="checkbox"/> MODBUS <input type="checkbox"/> TCP/IP			
h) DETAILS OF SPECIAL CABLE	<input type="checkbox"/> ENCLOSED <input type="checkbox"/> NOT REQUIRED				
STEP DOWN CONT. TRANSFORMER	<input checked="" type="checkbox"/> REQUIRED				
OPEN / CLOSE PB	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED				
STOP PB	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED				
INDICATING LAMPS	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED				
LOCAL REMOTE S/S	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED				
STATUS CONTACTS FOR MONITORING	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED				
INTEGRAL STARTER DISTURBED SIGNAL(Refer Note 14)	REQUIRED MOTOR THERMOSTTTRIP O/L RELAY OPTD, CONT./POWER SUPPLY FAILED, S/S IN LOCAL/REMOTE/OFF MODE, TORQUE SWITCH OPEN/CLOSE CUT OFF/STOP PB OPTD, VALVE JAMMED ETC)				
ACTION ON LOSS OF EXTERNAL ELECTRIC POWER	<input checked="" type="checkbox"/> STAYPUT <input checked="" type="checkbox"/> FAIL SAFE TO BE DECIDED DURING DETAILED ENGINEERING				
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter) DATASHEET & WIRING DIAGRAM OF ISOLATION DEVICE TO BE PROVIDED	TYPE OF ISOLATING DEVICE	<input checked="" type="checkbox"/> INTERPOSING RELAY <input type="checkbox"/> OPTO COUPLER TO BE DECIDED DURING DETAILED ENGINEERING			
	QUANTITY	<input type="checkbox"/> 2 NOs. <input checked="" type="checkbox"/> 3 NOs.			
	DRIVING VOLTAGE	<input checked="" type="checkbox"/> 20.5 – 24V DC <input type="checkbox"/> _____ V DC			
	DRIVING CURRENT	<input checked="" type="checkbox"/> 125mA MAX <input type="checkbox"/> _____ mA MAX			
	LOAD RESISTANCE	<input checked="" type="checkbox"/> > 192 ohms - <25 k ohms <input type="checkbox"/> > _____ ohms - < _____ ohms			

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	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		DOCUMENT NO.: PE-ID-445-145-I902	
			VOLUME II B	
			SECTION D	
			REV. NO. 01	DATE:27/03/2020
			SHEET 3	OF 5
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
TORQUE SWITCH (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN / CLOSE	<input type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos. / <input type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos		
	CONTACT TYPE	2 NO + 2 NC		
	RATING	5A 240V AC AND 0.5A 220V DC		
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE		
	ACCURACY	+3% OF SET VALUE		
LIMIT SWITCH (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN : INT : CLOSE	<input type="checkbox"/> 1 No. <input type="checkbox"/> 2 Nos.	2 Nos. (ADJ.)	<input type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos.
	CONTACT TYPE	2 NO + 2 NC		
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC		
	ACCURACY	2% OF SET VALUE		
POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty & other specific applications**)	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	MFR & MODEL NO.	BIDDER TO SPECIFY		
	TYPE	<input type="checkbox"/> ELECTRONIC (2 WIRE) R/I CONVERTER <input type="checkbox"/> ELECTRONIC (2 WIRE) CONTACTLESS		
	SUPPLY	<input type="checkbox"/> 24V DC <input type="checkbox"/>		
	OUTPUT	<input type="checkbox"/> 4-20mA		
	ACCURACY	\pm 1% FS		
SPACE HEATER	@SPACE HEATER	REQUIRED		
	@ POWER SUPPLY (NON INTEGRAL)	230V AC, 1 PH., 50 Hz		
	@ POWER SUPPLY (INTEGRAL)	BIDDER TO SPECIFY		
	@ RATING			
TERMINAL BOX	ACTUATOR/MOTOR TERMINAL BOX	REQUIRED		
	ENCL CLASS ACTUATOR/MOTOR T.B.	<input type="checkbox"/> IP 68 <input type="checkbox"/>		
	@ EARTHING TERMINAL	REQUIRED		
	PLUG & SOCKET	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	NO. OF PINS REQUIRED(TO BE CHECKED AS PER SIGNALS IN DRIVE CONTROL PHILOSOPHY)			
	NOS. OF PLUG & SOCKET	<input type="checkbox"/> 1 Nos. for ON/OFF <input type="checkbox"/> 2 NOS. (for inching duty) <input type="checkbox"/> OTHER (TO BE SPECIFIED INLINE WITH DRIVE CONTROL PHILOSOPHY)		
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:-----		
	@ SPACE HEATER CABLE GLAND	SIZE:-----		
	CONTROL CABLE GLANDS-1	CABLE GLAND SUITABLE FOR INSTRUMENTATION CABLE SIZE OF 4P X 1.5 SQMM		
	CONTROL CABLE GLANDS-2	CABLE GLAND SUITABLE FOR INSTRUMENTATION CABLE SIZE OF 8P X 0.5 SQMM		
	CONTROL CABLE GLANDS-3 (Additional for inching duty)	CABLE GLAND SUITABLE FOR INSTRUMENTATION CABLE SIZE OF 2P X 0.5 SQMM		
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY		_____ Kg.

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		DOCUMENT NO.: PE-ID-445-145-I902	
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			SHEET 4	OF 5
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	

NOTES:

- SCOPE:** DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
- CODES & STANDARDS:** DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATIONAL STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH: IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691, IS-4722, IEC 60947-5-1 AND EN 15714-3 .2010 OR LATEST VERSION.
- TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
- CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED.
- THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION. THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.
- THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.
- THE MOTOR SHALL BE CAPABLE OF STARTING AT 85 PERCENT OF RATED VOLTAGE RUNNING AT 80 PERCENT OF RATED VOLTAGE AT RATED TORQUE AND 85 PERCENT RATED VOLTAGE AT 33 PERCENT EXCESS RATED TORQUE FOR A PERIOD OF 5 MINUTES EACH.
- IN ADDITION TO ABOVE REQUIREMENTS FOR LIMIT/TORQUE SWITCH, **MECHANICAL END STOP** WITH ACCURACY OF 2% SHALL BE SUPPLIED.
- IT SHOULD BE POSSIBLE TO OPERATE THE ACTUATOR LOCALLY. LOCKABLE LOCAL/REMOTE SELECTION SHALL BE PROVIDED ON THE ACTUATOR.
- LOCAL POSITION INDICATOR SHALL BE PROVIDED FOR 0 TO 100 % TRAVEL.
- CONTROL WIRING SHALL BE SUITABLE VOLTAGE GRADE COPPER WIRE 1.5 SQ. MM.
- ENDURANCE: RATED TORQUE RANGE SHOULD BE BASED ON ISO 5211, ISO5210.
- TAG PLATE SHALL BE CONFIRMING TO STANDARD BS-15714.
- THE ACTUATORS SHALL BE DESIGNED TO BE SELF-LOCKING UPON LOSS OF POWER. MOTOR SHALL BE DESIGNED TO CLOSE IN 30 SECS. FROM FULL OPEN POSITION AND SHALL HAVE ADEQUATE CAPACITY TO OPEN AND CLOSE UNDER FULL UNBALANCED DESIGN PRESSURE.
- AUTOMATIC PHASE CORRECTION FACILITY AND POTENTIAL FREE CONTACT FOR ANNUNCIATION OF POWER FAILURE SHALL BE PROVIDED.
- LIMIT SWITCHES SHALL BE SILVER PLATED WITH HIGH CONDUCTIVITY AND NON-CORROSIVE TYPE. CONTACT RATING SHALL BE SUFFICIENT TO MEET THE REQUIREMENT OF CONTROL SYSTEM SUBJECT TO A MINIMUM OF 60 V, 6 VA RATING. PROTECTION CLASS SHALL BE IP67.
- THE TERMINAL BOX SHALL BE WEATHER PROOF WITH REMOVABLE FRONT COVER & CABLE GLANDS FOR CABLE CONNECTION. IT SHALL BE SUITABLE FOR 2.5 SQ MM COPPER CONDUCTOR.
- ACTUATOR SHALL ATTAIN FULL SPEED OPERATIONS BEFORE VALVE LOAD IS ENCOUNTERED AND IMPART AN UNSEATING BLOW TO START THE VALVE IN MOTION (HAMMER BLOW EFFECT).
- ** VALVES WITH 10 DEGREE/20DEGREE FEEDBACK REQUIREMENT FOR APPLICATIONS SUCH AS CW/ACW/PLANT WATER SYSTEM SHALL BE CONSIDERED AS INCHING DUTY VALVES. ACCORDINGLY, POSITION FEED BACK TRANSMITTER, PLUG & SOCKET REQUIREMENT SHALL BE CONSIDERED.**


\$\$ TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE.

	PREPARED BY	CHECKED BY	APPROVED BY	VENDOR COMPANY SEAL
NAME	ANJALI RAMAN	VIPUL KUMAR VERMA	SURESH CHAND SHARMA	NAME
SIGNATURE				SIGNATURE
DATE	27.03.2020	27.03.2020	27.03.2020	DATE

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

@ BE FILLED BY ES

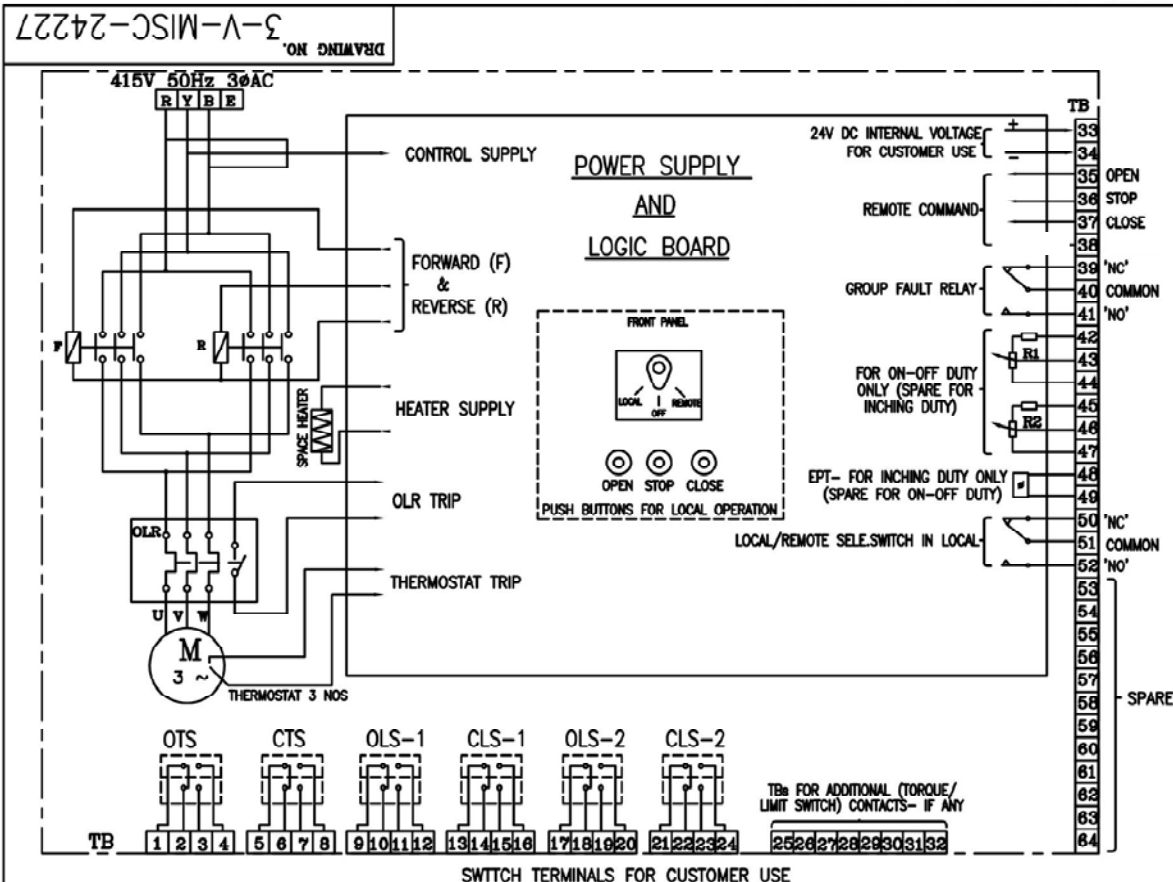
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	SPECIFICATION FOR MOTORISED VALVE ACTUATOR	DOCUMENT NO.: PE-ID-445-145-I902		
		VOLUME	II B	
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		SHEET	5	OF 5
Data Sheet A & B				
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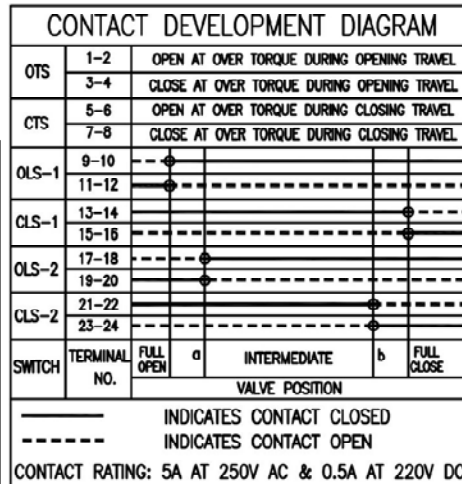
ADDITIONAL NOTES FOR SAGARDIGHI PROJECT:

- TEST WITNESS: TESTS SHALL BE PERFORMED IN THE PRESENCE OF OWNER/PURCHASER'S REPRESENTATIVE SO DESIRED BY THE OWNER/ PURCHASER. THE CONTRACTOR SHALL GIVE AT LEAST FIFTEEN (15) DAYS ADVANCE NOTICE OF THE DATE WHEN THE TESTS ARE TO BE CARRIED OUT.
- ADVANCE NOTICE SHALL BE GIVEN TO THE OWNER AS AGREED IN THE CONTRACT, PRIOR TO THE STAGE OF MANUFACTURE BEING REACHED, AND THE PIECE OF PLANT MUST BE HELD AT THIS STAGE UNTIL THE OWNER HAS INSPECTED THE PIECE, OR HAS ADVISED IN WRITING THAT INSPECTION IS WAIVED, IF HAVING CONSULTED THE OWNER AND GIVEN REASONABLE NOTICE IN WRITING OF THE DATE ON WHICH THE PIECE OF PLANT WILL BE AVAILABLE FOR INSPECTION, THE OWNER DOES NOT ATTEND, THE SUCCESSFUL BIDDER MAY PROCEED WITH MANUFACTURE HAVING FORWARDED TO THE OWNER DULY CERTIFIED COPIES OF HIS OWN INSPECTION AND TEST RESULTS.
- ACTUATOR SHALL ATTAIN FULL SPEED OPERATIONS BEFORE VALVE LOAD IS ENCOUNTERED AND IMPART AN UNSEATING BLOW TO START THE VALVE IN MOTION (HAMMER BLOW EFFECT).
- A SPACE HEATER SHALL BE INCLUDED IN THE LIMIT SWITCH COMPARTMENT SUITABLE FOR 240V, 1 PHASE, 50 HZ SUPPLY.

ALL DIMENSIONS ARE IN MILLIMETRES. FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER RELEVANT QCP / QP.



Separate wire (no common wire) to be used for signal exchange between DCS and actuator. Additionally, separate TBs are to be used at actuator end. Please refer attached dwg 12A05-DWG-I0021 for the same.



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

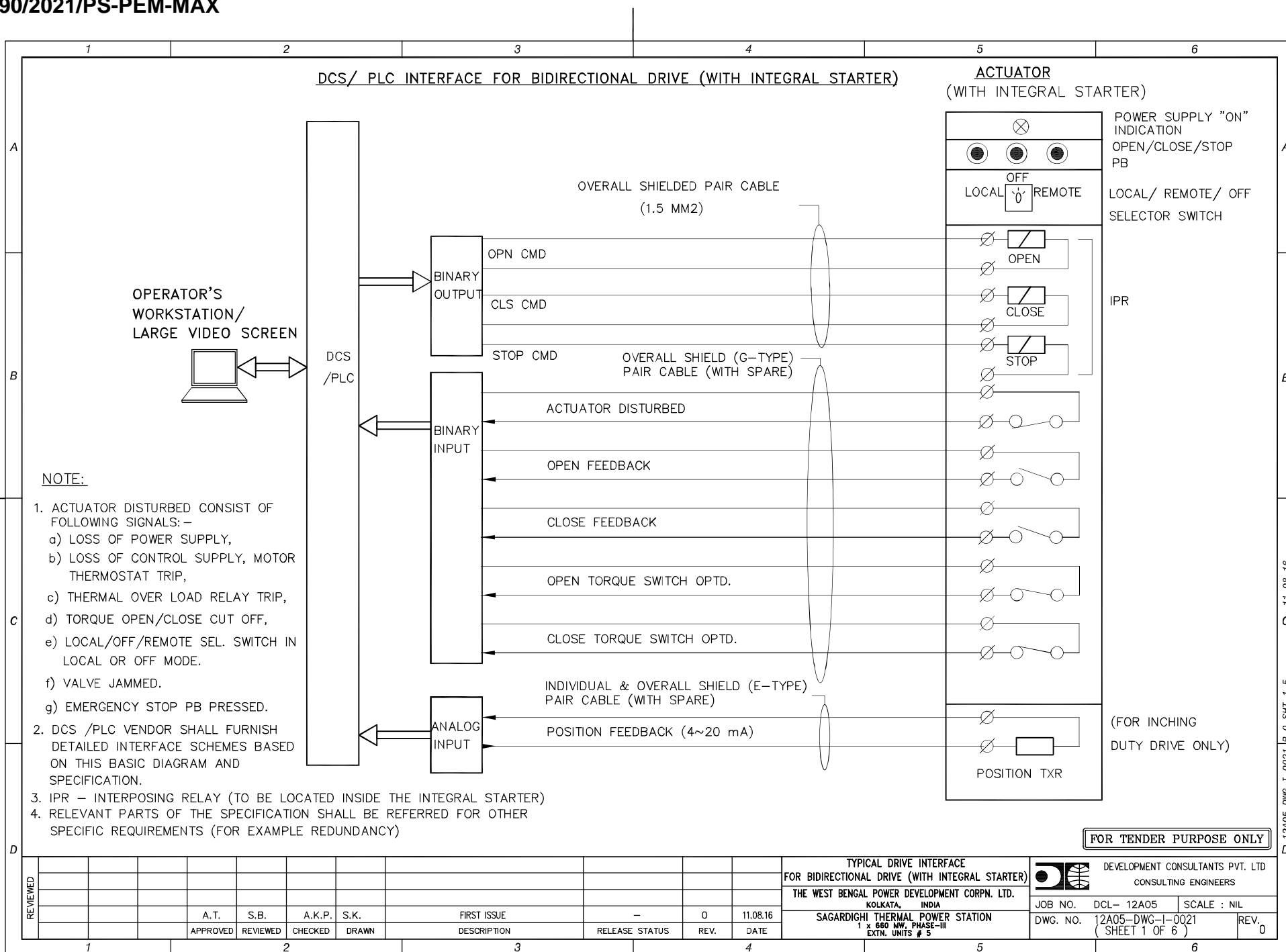
NOTE:-

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


REV	DATE	ALTERED
		CHD & APPD

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

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



389490/2021/PS-PEM-MAX

	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	
<div> <p style="text-align: center;">SPECIFICATION FOR FIELD & MEASURING INSTRUMENTS</p> </div> <div> <p> </p> </div>		



SECTION-VI

TECHNICAL SPECIFICATION

CONTROL AND INSTRUMENTATION SYSTEMS

1.00.00 FIELD INSTRUMENTS

This section provides general guidelines for field instruments and equipment to be supplied under this specification. All measuring instruments/equipment and subsystems offered by Bidder shall be from reputed experienced manufacturer of specified type and range of equipment, whose guaranteed and trouble free operation has been established. All instruments/equipment shall be of proven reliability, accuracy, repeatability requiring a minimum of maintenance and comply with the acceptable international standards. All instruments/equipment and accessories shall be supplied as per technical specifications, ranges, make as approved by Owner.

- i) HART management system shall be integral feature of the DDCMIS and shall be provided for centralised configuration, maintenance, diagnostics & record-keeping for all electronic transmitters.
- ii) Bidder shall provide following facilities as a minimum through software:
 - a) Constant scanning to monitor faults of changes to instrument configuration.
 - b) Owner-defined and standard calibration and configuration procedures for all transmitters.
 - c) Constant signal data collection facilities to maintain continuously updated records.
 - d) Automatic tracking of configuration changes made in the field, such as may be introduced by hand-held communicator. All configuration function associated with hand-held communicators shall be available in the system.
 - e) Event and log reports on screen as well as on printer.
 - f) Any addition/deletion of transmitter will be reported on printer and logged in hard disk.

1.01.00 PRESSURE TRANSMITTER

01. Type : Microprocessor based Smart, HART protocol compatible
02. Transmission : 2 - Wire





WBPDCCL

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

- | | | | |
|------|---------------------|---|--|
| 03. | Output Signal | : | Simultaneous transmission of digital and 4-20 mA DC signal. |
| 04. | Signal Processing | : | Silicon solid state electronic circuitry |
| 05. | Sensor type | : | Capsule / Diaphragm |
| 06. | Element material | : | AISI-316 or better |
| 07. | Static Pressure | : | 150 % of maximum span continuously, without affecting the calibration. |
| 08. | Turn-down ratio | : | 10 : 1 for vacuum/very low pressure application ; 30 : 1 minimum for other applications. |
| 09. | Span and Zero | : | Locally adjustable non-interacting. Facility for elevation and suppression by 100% of span |
| 10. | Enclosure Class | : | Weather proof as per IP-65 with durable corrosion resistant epoxy coating (Explosion proof for NEC Class-1, Division 1 area wherever required) |
| 11. | Output Indicator | : | Backlit LCD type |
| 12. | Nameplate | : | Tag number, service engraved in stainless steel tag plate |
| 13. | Body | : | Forged Carbon Steel (SS for DM Water & corrosive service). |
| 14. | Power supply | : | 16 - 48 Volts D.C. |
| 15. | Load | : | 500 Ohms (min.) at 24 Volts D.C. |
| 16. | Ambient Temperature | : | 0 - 50°C |
| 17. | Performance : | | |
| i) | Accuracy | : | ± 0.075% of Span or better |
| ii) | Repeatability | : | ± 0.05% of Span or better |
| iii) | Response time | : | 100 msec or better |
| iv) | Stability | : | ± 0.1% of Calibrated Span for 6 months up to 70 Kg/cm ² and ± 0.25% of Calibrated Span for more than 70 Kg/cm ² |
| v) | Zero and span drift | : | ± 0.015% per deg. C at max span and 0.11% per deg. C at min span |
| 18. | Sealing/Isolation | : | Extended diaphragm with 5 meters SS armored capillary for corrosive, viscous and dirty fluid applications. Material for separator |





diaphragm shall be as per application. Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application

- | | | | |
|-----|-------------|---|--|
| 19. | Diagnostics | : | Self indicating feature |
| 20. | Accessories | : | <ul style="list-style-type: none"> a) Universal mounting bracket suitable for 2" pipe mounting. b) High tensile carbon steel U- bolts. c) Installation accessories as per relevant installation drawing. d) Syphons for steam and hot water services. e) ½" NPT 2-valve stainless steel manifold for pressure transmitters constructed from SS316 bar stock. In case it becomes necessary to use a DP transmitter for gauge pressure measurement then a 2-valve manifold should be used in place of 5-valve manifold. f) Companion flange with nuts, bolts and gaskets. g) Hand held configurator kit for calibration of Smart Transmitter. |

1.02.00 Differential Pressure Transmitter

- | | | | |
|-----|------------------------|---|---|
| 01. | Type | : | Microprocessor based Smart, HART protocol compatible |
| 02. | Transmission | : | 2-Wire |
| 03. | Output signal | : | Simultaneous transmission of digital and 4-20 mA DC signal. |
| 04. | Signal Processing Unit | : | Silicon solid-state electronic circuitry |
| 05. | Sensor type | : | Capsule/Diaphragm |
| 06. | Element material | : | AISI-316 (Stainless Steel) or better |
| 07. | Static Pressure/ | | |





Overload Pressure	:	Maximum line (or static) pressure on either side without permanent deformation or loss of accuracy
08. Turn-down ratio	:	10 : 1 for vacuum/very low pressure application; 30 : 1 minimum for other applications.
09. Span and Zero	:	Locally adjustable, non-interacting
10. Enclosure class	:	Weather proof as per IP-65 with durable corrosion resistant epoxy coating (Explosion proof for NEC Class-1, Division 1 area wherever required))
11. Zero suppression / elevation	:	At least 100% of Span
12. Output Indicator	:	Backlit LCD type
13. Nameplate	:	Tag number and Service engraved in stainless steel tag plate
14. Body	:	Forged Carbon Steel (SS for DM Water)
15. Ambient temperature	:	0 - 50° C
16. Power supply	:	16 - 48 Volts DC
17. Load	:	500 Ohms (min.) at 24 Volts DC
18. Performance :-		
i) Accuracy	:	±0.2 % of span or better
ii) Repeatability	:	± 0.05 % of span or better
iii) Response time	:	100 msec or better
iv) Stability	:	± 0.1% of Calibrated Span for 6 months up to 70 Kg/cm ²
v) Zero and span drift	:	± 0.015% per deg. C at max span and 0.11% per deg. C at min span
19. Sealing/Isolation	:	Extended diaphragm with 5 meters. SS armored capillary for corrosive, viscous and dirty fluid applications. Material for separator diaphragm, depending on application.
20. Diagnostics	:	Self indicating feature
21. Accessories	:	a) Universal mounting bracket suitable for 2" pipe mounting.



- b) High tensile carbon steel U-bolts.
- c) Installation accessories as per relevant installation drawing.
- d) Syphons for steam and hot water services.
- e) ½" NPT 5-valve stainless steel manifold, constructed from SS316 bar stock.
- f) Companion flange with nuts, bolts and gaskets.
- g) Hand held configurator kit for calibration of Smart Transmitter.

1.02.00 DISPLACER TYPE LEVEL TRANSMITTERS

- | | | | |
|-----|--------------------------------------|---|---|
| 01. | Type | : | SMART |
| 02. | Stages of operation | : | Continuous |
| 03. | Material - | | |
| | i) Displacer | : | AISI 316 SS |
| | ii) Suspension wire | : | AISI 316 SS |
| | iii) Torque tube housing application | : | Carbon steel or SS as per application |
| | iv) Torque tube | : | Inconel |
| | v) Displacer chamber | : | Carbon steel or SS as per process application |
| | vi) Transmitter Housing | : | Die cast aluminium or better |
| 04. | Power supply | : | 16-48 Volts D.C. |
| 05. | Transmission | : | 2-wire |
| 06. | Output Signal | : | Simultaneous transmission of digital and 4-20 mA DC signal. Standard HART protocol. |
| 07. | Signal processing | : | Solid-state electronic circuitry |
| 08. | Static / overload pressure | : | Maximum static pressure without permanent deformation or loss of accuracy. |
| 09. | Turn-down ratio | : | 10 : 1 or better |





10. Zero & Span : Easily accessible (local zero & span adjustment and non-interactive type)
11. Enclosure Class : IP-65 (Explosion proof for NEC Class-1, Division 1 area)
12. Output Indicator : Yes, Backlit LCD type
13. Nameplate : Tag number and Service engraved in stainless steel tag plate
14. Ambient Temperature : 0 - 50°C
15. Load Impedance : 500 Ohms at 24 Volts (minimum)
16. Process Connection : 2" Companion flange with nuts, bolts and gaskets
17. Performance -
 - Accuracy : $\pm 0.2\%$ of span or better
18. Accessories :
 - a) Counter Flange, nuts, bolts, gaskets etc.
 - b) Weights for 5 point calibration of instruments.
 - c) Vent and drain plugs
 - d) Special calibration tool/configurator, if any.
19. Preferred Features :
 - a) Test plug connection and cutout terminals physically separated from other electronics.
 - b) Electronic Damping facility (adjustable).

1.03.00 MASS FLOW METER

A. Sensor

01. Measuring Principle : Coriolis Mass flow.
02. Primary Element : Flow Tube of 316SS or better
03. Temperature Control : To be provided for heavy fuel oil application. Heating arrangement shall be integral.
For Heating
04. Process Connection : Flanged and rating as per process requirement.
05. Drain : Self-draining facility





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1x660 MW Unit No. 5, Phase - III

1.06.00

Rotameter

- | | | | |
|-----|--------------------------|---|--|
| 01. | Type | : | Online upto 2" and Bypass above 2" line size" |
| 02. | Metering tube | : | Borosilicate glass |
| 03. | Float | : | AISI 316-SS unless the process fluid demands some other material. |
| 04. | Body MOC | : | SS as per fluid condition. |
| 05. | Scale | : | Aluminium Graduated - Engraved black on white background. |
| 06. | Process connection | : | Flanged to line size or threaded for connection size ½" or less. |
| 07. | Accuracy | : | ± 2% of full scale detection or better for on-line type and ±4% of full-scale detection or better for by-pass type. |
| 08. | Nameplate | : | Tag number, service engraved in stainless steel tag plate |
| 09. | Accessories | : | Slip-on orifice plate of 316-SS and taps of / SS as per application. Applicable SS Isolation valves and SS Range Orifice - for bypass type rotameters. |
| 10. | Housing protection class | : | IP- 65. |

1.07.00

Pressure Gauge and Differential Pressure Gauge

- | | | | |
|-----|----------------------|---|---------------------------|
| 01. | Type | : | Bourdon/Bellows/Diaphragm |
| 02. | MOC Sensing & Socket | : | AISI-316 SS |
| 03. | Movement Material | : | AISI-304 SS |
| 04. | Case Material | : | Stainless steel.. |
| 05. | Bezel Material | : | SS 304. |
| 06. | Socket Material | : | SS 316 |
| 07. | Enclosure | : | IP-65. |
| 08. | Dial Size | : | 150 mm |





- | | | | |
|-----|-------------------------------|---|--|
| 09. | Scale | : | Black lettering on white background in 270 Deg. arc. |
| 10. | Window | : | Shatterproof glass |
| 11. | Range Selection | : | Normal process pressure – 50 ~ 70 % of range (approximately). |
| 12. | Over-range Protection | : | 125% of maximum range by internal stop. External stop at zero |
| 13. | Adjustment | : | Micrometer screw for zero adjustment. Internal micrometer screw for range adjustment.

External zero adjustment for glycerine filled gauges. |
| 14. | Element Connection | : | Argon welding |
| 15. | Process Connection | : | 1/2" NPT(M) Bottom connection for local mounting, back connection for panel mounting. |
| 16. | Performance | : | Accuracy of ± 1.0 % of span or better. |
| 17. | Operating ambient temperature | : | 0 - 50°C |
| 18. | Safety Feature | : | Blow out disc./diaphragm at the back |
| 19. | Accessories | : | <p>a) Snubbers and Glycerin filled for pulsating fluid applications and at pump discharge.</p> <p>b) Stainless steel Diaphragm chemical seals for corrosive, viscous and solid-bearing or slurry type process fluids. diaphragm chemical seal shall be provided with the following:</p> <p style="margin-left: 40px;">1) Top chamber : SS 304</p> <p style="margin-left: 40px;">2) Bottom Chamber: SS 316</p> <p style="margin-left: 40px;">3) Sealing fluid: Silicon DC 200</p> <p style="margin-left: 40px;">4) Diaphragm: SS 316</p> <p>c) 3-way SS gauge cock/ 2-Valve SS-316 barstock manifold for pressure gauges with 1/2" NPT process connection..</p> |



- d) 5-valve SS316 manifold constructed from barstock for differential pressure gauge. Process connection ½" NPT.
- e) Union, nut & tail piece and other Installation accessories as required.
- f) Syphons for steam and hot water services.

20. Applicable standard : IS-3624 / 1996 , EN-837-1

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

1.08.00 Temperature Gauge

- 01. Type : Inert gas filled remote mounting system.
- 02. Sensing Element Material : Bourdon - AISI-316 SS
- 03. Capillary Armoring : Stainless steel flexible
- 04. Movement Material : AISI 304 SS
- 05. Bulb / Stem Diameter : 12 mm
- 06. Bulb / Stem Material : AISI 316
- 07. Capillary : Stainless Steel
- 08. Thermometer connection to well : ½" NPT
- 09. Case Material : Stainless steel
- 10. Dial Size : 150 mm in general (100 mm for SWAS gauges)
- 11. Scale : Black lettering on white background in 270 Deg. arc.
- 12. Mounting : Surface/Panel
- 13. Over range Protection : 125 % of range or more
- 14. Instrument connection : Bottom connection for local mounting and back connection for panel mounting.





- | | | | |
|-----|-----------------|---|---|
| 15. | Range | : | Normal temperature – 50 ~ 70% of range approximately. |
| 16. | Zero adjuster | : | Micrometer screw adjustable from front. |
| 17. | Window | : | Shatterproof glass. |
| 18. | Accuracy | : | $\pm 1\%$ or better |
| 19. | Enclosure Class | : | IP-65 |
| 20. | Capillary | : | 5 meters (local)/15.0 meters (local panel) - armoured stainless steel |
| 21. | Compensation | : | Capillary and Case Compensation |
| 22. | Accessories | : | a) Forged/barstock SS316 thermowell screwed as per ASME PTC code. Process connection M 33X2 (M). Material of construction of thermowell:
1) SS 316: in general
2) Inconel: For flue gas application
3) Tungsten carbide: For coal mill application

b) Installation accessories as required. |
| 23. | Nameplate | : | Tag number, service engraved in stainless steel tag plate |

1.09.00

Thermocouples

- | | | | |
|------|--------------------|---|--|
| 01. | Type | : | a) Type-K (Chromel Alumel) / Type-R (Pt.-Rhodium Pt.) / Type-E (Chromel Constantan) [As per application]

b) Duplex (Triplex incase of turbine/Generator/excitor bearing temperature may be used)

c) Ungrounded |
| 02. | Wire gauge | : | 16 AWG for Type-K, 24 AWG for Type-R |
| 03. | Standard | : | ANSI-MC 96.1. |
| 04. | Protecting Tube :- | | |
| i) | O.D. | : | 8 mm |
| ii) | Material | : | 316-SS Seamless |
| iii) | Filling | : | Magnesium Oxide (Purity above 99.4%) |





09. Nameplate : Tag number, service engraved in stainless steel tag plate
- 1.10.00 Passing condition of various drain valves shall be monitored by measuring drain pipe metal temperature at the downstream of the drain valves. Also Drum, SH, RH metal temperature measurement shall be provided. Necessary thermocouples shall be provided as per the following specification.
- 01. Measuring medium : Metal temperature
 - 02. Metal of thermocouple element : Chromel-Alumel Type-K
 - 03. Type of thermocouple : Duplex with separate hot junctions, ungrounded type.
 - 04. Insulation : Mineral insulation Magnesium Oxide
 - 05. Thermocouple wirer gauge : 16 AWG
 - 06. Protective Sheath : SS 321
 - 07. Protective Sheath Dia : 8 mm O.D.
 - 08. Characteristics of thermocouple : Special limits of error as in ANSI MC 96.01.1975
 - 09. Mounting Accessories : 1/2" BSP SS sliding end connector, weld pad, weld on clamps of heat resistant steel SS 310.
 - 10. Cold end sealing : SS pot seal with colour coded PTFE headed sleeve insulated flexible tails. Sealing compound - Epoxy resin
 - 11. Minimum Bending Radius : 30 mm
 - 12. Length of T/C : 30 mtrs. (minimum)

1.11.00 Resistance Temperature Detector

- 01. Type : Platinum (Duplex), Ungrounded
- 02. Resistance : 100 ohm at 0°C
- 03. Base : Wound on ceramic (anti-inductive)
- 04. Wiring : 3 /4 Wire





05. Protecting Tube :-
- i) O.D. : 8 mm
 - ii) Material : SS-316, Seamless
 - iii) Filling : Magnesium oxide (Purity above 99.4%).
06. Response time : a) < 20 seconds for measurement.
b) < 10 seconds for control.
07. Calibration : DIN 43760
08. Accuracy : $\pm 0.5\%$ of range
09. Head :
- i) Type : IP-65 universal screwed type. (Explosion proof for NEC Class-1, Division 1 area)
 - ii) Material : Die cast aluminum or better
 - iii) Terminal blocks : Nickel plated Brass-screw type / silver plated
 - iv) Cable connection : $\frac{1}{2}$ " NPT gland and grommet.
 - v) Others : Terminal head cover with SS chain and suitable gasket. All thermowells in the high velocity steam service shall be checked for Strouhal's frequency limit to arrive at a safe size and design of thermowells"
10. Accessories :
- a) Adjustable nipple-union-nipple [$\frac{1}{2}$ " Sch 80 X $\frac{1}{2}$ " NPT (M)] with thermowell connection
 - b) Compression fittings/unions
 - c) Flanges etc. (for flanged connections only)
 - d) Barstock thermowell of stepless tapered design as per ASME PTC19.3 code.
- Process connection M33x2 (M) in general or $1\frac{1}{2}$ " flanged for flue gas/Furnace/air etc. application.
- Material of construction of thermowell:
- 1) SS 316: in general
 - 2) Inconel: For flue gas application



3) Tungsten carbide: For coal mill application.

- | | | | |
|-----|-----------|---|---|
| 11. | Nameplate | : | Tag number, service engraved in stainless steel tag plate |
|-----|-----------|---|---|
- 1.12.00 Pressure Switch
- | | | | |
|-----|--------------------------|---|---|
| 01. | Type | : | i) Piston for high pressure application (above 40 bar)

ii) Bellow /Diaphragm for low pressure application (below 40 bar) |
| 02. | Sensing element material | : | AISI SS-316. All other wetted part SS316. |
| 03. | Case Material | : | Die-cast aluminum alloy with neoprene gasket. |
| 04. | Setter Scale | : | Black graduation on white linear scale. Graduation 0-100% with red pointer for set points. |
| 05. | Over range | : | 150 % of maximum pressure |
| 06. | Adjustments | : | a) Internal Set Point
b) Differential adjustment |
| 07. | End Connection | : | 1/2" NPT (M) bottom connected |
| 08. | Switch configuration | : | Two SPDT |
| 09. | Switch Rating | : | 240V, 5A AC/220V, 0.5A DC |
| 10. | Switch Type | : | Snap acting, shock & vibration proof |
| 11. | Terminal Block | : | Suitable for full ring lugs for cable connection. |
| 12. | Elect connection | : | Plug in socket |
| 13. | Enclosure Class | : | IP-65 weather and dust proof (Explosion proof for NEC Class-1, Division 1 area). |
| 14. | Performance | : | a) Repeatability $\pm 0.5\%$ of full range
b) Accuracy of Setting Indication of $\pm 1.5\%$ |
| 15. | Ambient temperature | : | 0 – 50°C |



- | | | | |
|-----|-------------|---|--|
| 16. | Nameplate | : | Tag number, service engraved in stainless steel tag plate |
| 17. | Accessories | : | <ul style="list-style-type: none"> a) Remote diaphragm seal with SS-316 capillary for viscous & corrosive application. MOC of seal material shall be as per process fluid requirement. b) Snubbers for pulsating fluid application. c) Syphons for steam and hot water services. d) Retention ring and screws for surface mounting. e) 1/2" NPT 2 Valve SS-316 manifold constructed from barstock f) Brass cable gland |

1.13.00 Differential Pressure Switch

- | | | | |
|-----|--------------------------|---|--|
| 01. | Type | : | Bellows / Diaphragm / Piston actuated |
| 02. | Sensing element material | : | AISI SS-316. For all other wetted part SS 316 |
| 03. | Case Material | : | Die-cast aluminum alloy with neoprene gasket. |
| 04. | Setter Scale | : | Black graduation on white scale with 0-100% graduation and provided with red pointer for set point adjustment |
| 05. | Over range | : | Static pressure on any one side, the other side being open to atmosphere. |
| 06. | Adjustments | : | <ul style="list-style-type: none"> a) Internal set point adjustment b) Differential adjustment |
| 07. | Process Connection | : | 1/2" NPT (M) bottom connected / back connected. |
| 08. | Switch configuration | : | Two SPDT |
| 09. | Switch rating | : | 240V, 5A AC/220V, 0.5A DC. |
| 10. | Switch type | : | Snap acting type contacts, shock and vibration proof. |



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11. Terminal Blocks : Suitable for full ring lugs for cable connection.
12. Elect connection : Plug in socket
13. Performance :
 - a) Repeatability $\pm 0.5\%$ of full range
 - b) Accuracy of set point Indication: $\pm 1.5\%$
14. Operating Ambient Temperature : $0 - 50^{\circ}\text{C}$
15. Enclosure : IP-65 (Explosion proof for NEC Class-1, Division 1 area).
16. Accessories :
 - a) Snubbers for pulsating fluid application.
 - b) Syphons for steam and hot water services.
 - c) Retention ring and screws for surface mounting.
 - d) $1/2"$ NPT 3-Valve SS-316 manifold constructed from barstock
17. Nameplate : Tag number, service engraved in stainless steel tag plate
18. Remote Seal type for special application :
 - a) Silicone oil / fluorolube filled remote diaphragm seal for dirty / viscous / corrosive fluid.
 - b) SS armoured capillary at least 3 meters each.
 - c) Adapter flanges with nuts, bolts and gaskets for instrument and process side.

1.14.00 Temperature Switch

01. Type : Inert gas filled-in
02. Sensing Element Material : Bellow / Bourdon AISI SS-316
03. Bulb Material : AISI SS-316
04. Capillary : Stainless steel armoured
05. Movement Material : AISI SS-304
06. Case material : Epoxy coated steel plate or die-cast aluminum alloy with neoprene gasket and





clear glass where applicable cover conforming to IP-65. (Explosion proof for NEC Class-1, Division 1 area).

07. Scale : Black lettering on white background
08. Over range Protection : 120 %
09. Instrument connection : Bottom
10. Switch configuration : Two SPDT
11. Switch rating : 240V, 5A AC/220V, 0.5A DC
12. Switch type : Snap acting, shock and vibration-proof.
13. Adjustability : Internal Set point adjustable over span range
14. Elect connection : Plug in socket
15. Compensation :
 - a) Capillary compensation with invar wire throughout the capillary length.
 - b) Case compensation
16. Performance :
 - i) Scale Accuracy : ± 1.0 % of full scale
 - ii) Repeatability : < 0.5 % of full range
 - iii) Response time : Less than 40 seconds with thermowell
17. Capillary length : 5 meters (minimum) for local mounting/15 meters for local panel mounting.
18. Nameplate : Tag number, service engraved in stainless steel tag plate
19. Accessories : Thermowell from SS barstock, Mounting accessories, $\frac{1}{2}$ " NPT cable gland.

1.15.00 Level Switch

01. Type : External cage float operated. Magnetically coupled.
02. Float Material : AISI-316 stainless steel or better
03. Other wetted parts : AISI-316 stainless steel or better
04. External Cage : Carbon steel / Stainless steel or better as per process requirements, welded type / flanged





construction. Cage pressure rating shall equal or exceed the rating of the main vessel.

- | | | | |
|-----|------------------------------|---|---|
| 05. | External cage mounting | : | Side-Side. |
| 06. | External cage connection | : | 25 NB socket welded. |
| 07. | Switch housing | : | Epoxy coated die-cast aluminum alloy with neoprene gasket conforming to IP-65. (Explosion proof for NEC Class-1, Division 1 area). |
| 08. | Type of switch configuration | : | 2 SPDT (two nos.) |
| 09. | Contact rating | : | 5A, 240V/AC, 0.25A, 220V DC |
| 10. | Accessories | : | a) Counter flange, nuts & bolts, suitable gasket etc.
b) Steel globe type drain valve.
c) ½"NPT cable gland
d) Stainless steel alpha-numeric engraved for service and tag.
e) Globe drain valve |
| 11. | Preferred feature | : | Switch operating point marked on cage |
| 12. | Mounting | : | On standpipe |

1.16.00 Conductivity Type Level Switch

- | | | | |
|-----|--------------|---|--|
| 01. | Type | : | Conductivity discrimination. |
| 02. | Application | : | Drain pots viz. on CRH line |
| 03. | Mounting | : | Flanged – on external cage. |
| 04. | Probe MOC | : | Stainless steel with high purity ceramic. |
| 05. | Probe rating | : | > Maximum design pressure of vessel. |
| 06. | Input | : | Four independent channel with selectable switching threshold for water conductivity. |
| 07. | Relay Output | : | Four isolated output relays for Hi, Lo, Hi-Hi, Lo-Lo. |





08. Contact type & rating : 2SPDT or 1 DPDT @ 5A 30V DC.
09. Local Display : Coloured LEDs for Hi, Lo, Hi-Hi, Lo-Lo, Power & fault.
10. Power supply : Dual 240V AC, 50 Hz, 1Ph UPS supply.
11. Enclosure : IP-65, corrosion resistant & wall mounting type (Explosion proof for NEC Class-1, Division-1 area).
12. Accessories :
 - a) PTFE cable from probe to electronics
 - b) Mounting accessories
 - c) External cage
 - d) Washer & gasket
13. Test pressure : Two times rated pressure
14. Elect connection : Plug in socket

1.17.00 Capacitance Type Level Switch

01. Type : Capacitance type
02. Probe :
 - a) Rod or suspended electrode
 - b) Rope type probes may be used only where required probe length is greater than 1.5 meters.
 - c) Reference rod for non grounded tank.
03. Probe Mounting : 1-1/2" Flanged
04. Material of construction : 316 SS and to suit fluid type
05. Insulation : PTFE/PP/Kynar Part/Full as required
06. Enclosure : Powder coated Die cast aluminium. with neoprene gasket conforming to IP-65. (Explosion proof for NEC Class-1, Division 1 area).
07. Ambient temperature : 0-60°C.
08. Mounting : Top Mounting
09. Supply voltage : 240V AC, 50 Hz, 1Ph UPS supply/ 24V DC





10. Relay output : 2 SPDT
11. Contact rating : 5A min. at 240V AC on resistive load
12. Response time : 100 msec or better
13. Elect connection : Plug in socket
14. Accessories : Counter flange, cable gland, prefab cable and stainless steel name plate engraved with alpha-numeric.

1.18.00 RF Type Level Switch

Sensing Probe :

01. Type : Rigid
02. Material : SS-316
03. Mounting : Threaded
04. Probe Head Housing : Cast Aluminium
05. Protection : IP-66

Electronic Controller :

01. Supply Voltage : 240V AC (UPS)
02. Relay Output : 2 nos. SPDT
03. Contact Rating : 240V AC, 5A/ 220V DC, 0.25A
04. Housing Material : Cast Aluminium
05. Protection : IP-65
06. Local LED Indication : Power On, Alarm Level, Probe Healthy
07. Switching Repeatability : $\pm 0.5\%$
08. Accessories : Coaxial cable probe connection to controller
1/2" NPT Cable Gland

1.19.00 Ultrasonic Level Switch

01. Principle of operation : Ultrasonic contact level technology
02. Input Power : 24V DC/ 240V AC





- | | | | |
|-----|--------------------|---|---|
| 03. | Output Contact | : | 2 SPDT (240V AC, 5A/ 220V DC, 0.25A) |
| 04. | Switch Mounting | : | Integral |
| 05. | Sensor Material | : | SS-316 |
| 06. | Enclosure | : | Cast Aluminium (IP-65) |
| 07. | Process Connection | : | 2" Flanged |
| 08. | Repeatability | : | 2 mm |
| 09. | Power supply | : | 240V AC, 50 Hz, 1Ph UPS supply/ 24V DC |
| 10. | Cable connection | : | ½" NPT with cable gland |
| 11. | Accessories | : | Cable gland, cable, companion flange, bolts & nuts, gaskets etc. along with all mounting hardware |

1.20.00 Ultrasonic Level Transmitter

- | | | | |
|-----|-----------------------------|---|---|
| 01. | Principle of operation | : | Detection of reflected ultrasonic pulse |
| 02. | Signal processing | : | Microprocessor Controlled Signal Processing |
| 03. | Type | : | Smart |
| 04. | Display | : | Large alpha-numeric back lit LCD/LED |
| 05. | Calibration & configuration | : | Accessible from front of panel |
| 06. | Diagnostic | : | On-line |
| 07. | Status | : | For power, Hi / Lo / V. Hi / V. Lo-level indication, fault etc. |
| 08. | Construction | : | Plug-on board |
| 09. | Power supply | : | 240V AC, 50 Hz, 1Ph UPS supply/ 24V DC |
| 10. | Signal Output | : | 4-20 mA DC (isolated) - 500 Ohm load with HART protocol. |
| 11. | Hysteresis | : | Fully adjustable preferred |
| 12. | Output contacts | : | 2SPDT Potential free changeover contacts @ 5A 230V AC. |



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13. Power supply : Dual 240V AC, 50 Hz, 1Ph UPS supply.
14. Enclosure : a) IP-65, corrosion resistant & wall mounting type for local electronics.
b) IP-42 for remote indicator
15. Accessories : a) PTFE cable from probe to electronics
b) Mounting accessories.
c) Standpipe
d) Washer & gaskets
e) Double isolation valves on each connection, double drain valves & double vent valves with mechanical lock.
f) ½" NPT cable gland
16. Test pressure : Two times design pressure

1.22.00

Air Filter Regulator

01. Filter Element : Sintered Bronze
02. Filter Size : 5 microns
03. Input Air : 10.0 Kg/Sq. cm (maximum)
04. Output : Adjustable from 0-2.0 Kg / Sq. cm or 0-7.0 Kg / Sq. cm (continuous) as applicable.
05. Effect of Supply : Maximum 0.02 Kg/Sq. cm for a change pressure variation in supply pressure of 4 Kg/Sq. cm
06. Bowl Material : Metallic.
07. Accessories : 2" dial size output pressure gauge
08. Feature : No perceptible drop of pressure on opening the drain port.

1.23.00

SOLENOID VALVE

01. Operating Principle : Electromagnetic (noiseless)
- Coil voltage rating : 24V DC (in general) other 220V DC /240V AC /110V AC as required

non UPS 240 V AC
supply is not acceptable
for solenoid





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- | | | | |
|-----|---------------------|---|---|
| 03. | Ways | : | 3 ways in general other depending on requirement |
| 04. | Port size | : | 1/4" NPT all ports |
| 05. | Body | : | SS Bar Stock |
| 06. | Trim | : | AISI SS-316 |
| 07. | Manual Operator | : | In built |
| 08. | Duty | : | Suitable for continuous energization |
| 09. | Sealing | : | Airtight and leak proofing with nitrile (NBR) and polyurethane (PUR) material |
| 10. | Ambient Temperature | : | 0 - 50 ^o C |
| 11. | Fluid Temperature | : | 0-150 ^o C (approx.) |
| 12. | Coil Enclosure | : | Stainless Steel |
| 13. | Insulation | : | Class-H |
| 14. | Coil Casing | : | IP-65 (Explosion proof for NEC Class-1, Division-1 area) |
| 15. | Response time | : | 4-7msec |
| 16. | Mounting | : | On pipe or on panel |
| 17. | Cable Connection | : | ½" NPT cable gland |
| 18. | Accessories | : | Mounting brackets, nuts and bolts |
| 19. | Special feature | : | (i) LED indication for power

(ii) Double coil type for open & close operation of valve / damper.

(iii) Solenoid valve directly integral to actuator body shall have NAMOOR interface for uniformity |

1.24.00 ORIFICE PLATE

- | | | | |
|-----|-------------------|---|---|
| 01. | Application | : | Low fluid velocity flow measurement |
| 02. | Design Standard | : | Concentric as per ASME PTC-19.5 (Part –II), ISA RP-3.2 or BS-1042, Part-I |
| 03. | Number of Tapings | : | As required plus one additional pair of taps |
| 04. | Diameter Ratio | : | Between 0.34 to 0.7 |





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|-----|----------------|---|---|
| 05. | Thickness | : | 3mm for main pipe of diameter upto 250mm, 6mm for main pipe of diameter above 250mm and 10mm for diameter above 500 mm |
| 06. | Document | : | Beta ratio calculation, assembly drawing and Flow vs. DP curve. |
| 07. | Meter run pipe | : | Same as pipe material |
| 08. | Accessories | : | <div style="border: 1px solid red; padding: 2px; display: inline-block;"> Flanges, gaskets, nuts & bolts, root valves
 (1" 316 SS globe) jack screw, meter run pipe,
 Drain & vent hole as per application etc. </div> |

1/2" SS316 globe

NOTE: One flow element of each type shall be calibrated in the test laboratory for validation of computed flow calculations.

1.25.00 FLOW NOZZLE

- | | | | |
|-----|-----------------|---|--|
| 01. | Application | : | High fluid velocity flow measurement |
| 02. | Design Standard | : | ASME PTC 19.5 |
| 03. | Tapings | : | D and D/2 (Numbers as required plus one additional pair of taps) |
| 04. | Diameter Ratio | : | Between 0.4 and 0.7 |
| 05. | Material | : | 316 SS |
| 05. | Document | : | Beta ratio calculation, assembly drawing and Flow vs. DP curve. |
| 06. | Meter run pipe | : | Same as pipe material |
| 07. | Accessories | : | Meter run pipe, nipples and root valves (1" 316 SS globe).(Inspection port assembly for nozzles used in plant performance purpose) |

NOTE: One flow element of each type shall be calibrated in the test laboratory for validation of computed flow calculations.

1.26.00 GAUGE GLASS

- | | | | |
|-----|-----------------|---|--|
| 01. | Type | : | Reflex |
| 02. | Glass | : | Toughened borosilicate. Resistant to mechanical and thermal shocks. |
| 03. | Body material | : | Carbon steel / stainless steel- As per process requirements (Flanged Connection) |
| 04. | Pressure rating | : | Twice the maximum working pressure |





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- 05. Temperature rating : 300° C
- 06. Bolts and nuts : Rust proof alloy steel
- 07. Accessories : Suitable ball check valves of SS-304/316 body, gaskets, companion flange etc.

1.27.00 LEVEL GAUGE (FLOAT & BOARD)

- 01. Type : Float and Board
- 02. Float & Tape MOC : AISI 316
- 03. Pulley and Pulley Housing material : SS 304
- 04. Guide wire : SS 316 Stainless steel
- 05. Accuracy : +/- 2 mm
- 06. Indication : Vertical dial
- 07. Rating : Twice the design pressure
- 08. Spring tension assembly : SS 304
- 09. Anchor plate : SS304
- 10. Calibrated scale board: Aluminium with black graduation

Note: The measuring rope/tape shall be passed through conduits

1.28.00 POWER CYLINDERS (PNEUMATIC)

- 01. Mounting Type : a) Fixed position mounting (End mounting).
: b) Trunnion mounting
- 02. Control Signal : 4-20 mA DC to smart positioner with HART protocol for modulating purposes. 24V/48VDC operated solenoid valve operating on pneumatic line for open & closing purpose of on & off drive.
- 03. Supply Air : 0-7 Kg / Cm².
- 04. Selection : Based upon thrust / torque, stroke length, angular movement, full-scale travel time, repeatability, space factor etc. Provision for air-to-open and air-to-close operation.
- 05. Casing : IP-65.





06. Accessories (as required) :
- a) Air lock relay
 - b) Hand wheel.
 - c) Air filter regulator with gauge.
 - d) Volume Booster.
 - e) Limit Switches.
 - f) Smart Positioner with integral I-P convertor, feedback position Transmitter (4-20 mA DC output), Input & Output pressure gauges, local keypad & display.
 - g) Solenoid Valve
 - h) Junction box with cable gland
07. Fail-safe operation : Stay put for regulating duty.
08. Repeatability : Better than 0.5% of full travel.
09. Hysterisis : Less than $\pm 1\%$ of full travel
10. Operating Temp. limit : 80°C (min.)

1.29.00

SIGHT GLASS

01. Type : Flap-type
02. End connection : Screwed / Flanged
03. Material :
- a) Body : SS-304
 - b) Cover Plate : SS-304
 - c) Indicator : SS-316
04. Sight Glass : Toughened Borosilicate
05. Gasket : Neoprene
06. Bolts & Nuts : High tensile steel
07. Hydraulic Test
- Pressure : 1.5 times maximum working pressure
08. Accessories : As required

1.30.00

SMOKE DENSITY ANALYZER

01. Type : Insitu dry visible light (through LED)
02. Principle of





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13. Enclosure Class : IP-65
14. Interchangeability : Fully Interchangeable Transmitters
15. Accessories : Sampling System, cables, sensor holder, dessicant chambers, souble compression fittings, ¾" cable gland, mounting fixture etc.

1.37.00

DENSITY METER

01. Operating Principle : Vibration Density measurement
02. Wetted Part Material : SS-316L
03. Case Material : Cast Aluminium
04. Output : 4~20 mA DC
05. Electrical connection : ½" NPT
06. Enclosure Class : IP-65
07. Local Display : Digital 5 digit, density display with temp. compensation
08. Accuracy : ±1.0 %
09. Power Supply : 240V AC (UPS)
10. Location : At the discharge of Gypsum bleed pump in FGD system.

1.38.00

RADAR TYPE LEVEL MEASUREMENT

01. Type : Radar based on Time Domain Reflectometry
02. Antena : Co axial / single rod type guided wave or Horn type as required for the application
03. Communication : Two wire 4-20mA DC, HART protocol
04. Environmental temperature : 0 – 50°C
05. Enclosure : Explosion proof /IP 65 as per application
06. Cable Entry : ½" NPT
07. Calibration : a) Self calibration with internal reference
b) Zero & Span calibration
08. Programming : Handheld programmer & Local key pad
09. Process Connection : Flanged /screwed





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- | | | |
|-----|--------------------|--|
| 10. | Transmitter Beam | |
| | Angle | : 10 degree or less |
| 11. | Blocking distance | : less than 300 mm |
| 12. | Electronic Housing | : Epoxy painted Die-Cast aluminium alloy |
| 13. | Antenna / Flange | |
| | assembly | : 316 SS or Hest alloy (as required) |
| 14. | Output Indicator | : Digital Integral Display (Backlit LCD/LED) |
| 15. | Accuracy | : 5 mm or 0.1% of probe length |
| 16. | Accessories | : a) Programming tool kit
b) Gasket |

1.39.00 CHLORINE LEAK DETECTOR

- | | | |
|-----|-----------------------|--------------------------------------|
| 01. | Type | : Electrochemical |
| 02. | Resolution | : 0.1 ppm |
| 03. | Display Type | : Digital Indicating Meter |
| 04. | Operating Temperature | : 0~45°C |
| 05. | Alarm Contacts | : Dual Alarm setpoints (240V AC, 5A) |
| 06. | Enclosure Class | : IP-65 |
| 07. | Mounting | : Wall mounting |
| 08. | Power Supply | : 240V AC |
| 09. | Output | : 4~20 mA DC (600 Ω load) |

1.40.00 RESIDUAL CHLORINE ANALYZER

- | | | |
|-----|--------------|--|
| 01. | Type | : Amperometric |
| 02. | Electrode | : Platinum/ Gold and copper electrode shall be provided with cell cleaning system |
| 03. | Display Type | : LCD in Analyzer Panel |
| 04. | Range | : 0 to 20.0 mg/L (ppm) |
| 05. | Accuracy | : 2% or better . The measurement accuracy shall not be affected by presence of treatment chemicals as chromates, |





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phosphates, de-former highly polluted water, change in temperature etc.

- | | | | |
|-----|-----------------|---|---|
| 06. | Sensitivity | : | 0.01 mg/L |
| 07. | Alarm Contacts | : | Dual Alarm setpoints (240V AC, 5A) |
| 08. | Enclosure Class | : | IP-65 |
| 09. | Power Supply | : | 240V AC |
| 10. | Output | : | 4~20 mA DC (600 Ω load) |
| 11. | Calibration | : | Zero & Span adjustment. Final calibration adjustments of the analyzer to be done at site and duly verified by titration. Temperature compensation range 0-50°C. |
| 12. | Mounting | : | Field mounting conform to IP-65 |
| 13. | Accessories | : | Chemical reagents, sample drain, pumping system (if required) etc. |

1.41.00 ELECTRIC TO PNEUMATIC (E/P) CONVERTERS

- | | | | |
|-----|----------------------|---|--|
| 01. | Air Supply | : | 1.5 kg/cm ² |
| 02. | Max. supply Pressure | : | 7 kg/cm ² |
| 03. | Input Signal | : | 4-20 mA DC (as required by the design of control system). |
| 04. | Output Signal | : | 0.2 to 1.0 kg/cm ² |
| 05. | Control Action | : | Air to Close, Air to Open and Fail freeze-field selectable |
| 06. | Response Time | : | 5 seconds for 0 to 90% output pressure |
| 07. | Repeatability | : | +/- 0.1% span typical |
| 08. | Accuracy | : | +/- 0.25% span typical |
| 09. | Linearity | : | 0.5% of span or better |
| 10. | Hysteresis | : | 0.1% of span or better |
| 11. | Ambient Temp. | : | |
| | effect | : | Less than 0.02% of span per °C between |





-20 °C to +60 °C

12. Supply pressure effect: less than 1%
13. Span and zero adjustment : screw
14. Mounting : Close to Actuator (but not on the actuator)
15. Output Capacity : To suit the actuator
16. Protection Class : IP 65
17. Allowable Drift Rate : $\pm 2\%$ of set point / hour maximum

On loss of control signal, the last set point pressure shall be maintained so that the associated control valve remains in stay put condition.

1.42.00

SMART POSITIONER

01. Type : Universal design (linear or rotary application)
02. Input Signal : 4-20mA DC , 2 wire loop with 24V DC.
03. Output Signal (position F/B) :
i) 4-20mA
ii) Configurable end position switch
04. Supply Pressure :
Single acting 1.2 to 7.0 bar
Double acting 1.2 to 10.5 bar
05. Air Delivery :
Single acting 10.0 SCFM at 2.1 bar supply
Double acting 7.2 SCFM at 2.1 bar supply
06. Housing : IP 65
07. Repeatability : $\pm 0.3\%$ of span or better
08. Accuracy : $\pm 0.1\%$ of span or better
09. Communication : Hart protocol
10. Power-up with position : < 150 ms or better control
11. Power interruption without reset : <100ms or better
12. Body Material : Aluminium
13. Response Time : Less than 10 sec





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
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
10. Accessories : Tee, counter flange





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- 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



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- 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





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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





- | | | | | |
|--|-----|-----------------|---|-------|
| | 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.
±0.5 Hz for frequency meter |
| | 05. | Input | : | 0-1/0-5A for current measurement, 0-240V for voltage measurement, 50 ± 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 |



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- | | | | |
|-----|-----------------|---|--|
| 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 |





- | | | | |
|-----|-----------------|---|--|
| 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 |

3.11.00 Push Button Station (Emergency Stop)

- | | | | |
|-----|---------------------|---|--|
| 01. | Function | : | Hardware communication between P/B Station & DCS |
| 02. | Type | : | Mechanical keys Shrouded |
| 03. | Size | : | 48 mm |
| 04. | Mounting | : | On Auxiliary Console |
| 05. | Signal Level | : | 24V DC Binary |
| 06. | Ambient temperature | : | 0-50 ° C |
| 07. | Ambient Humidity | : | 0-95% RH (max.) |



- 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..



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- 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.





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 separator, 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 |





- | | | | |
|------|----------------------|---|--|
| 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





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 gauge 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





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



- 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 guages 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





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



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





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/cabling 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



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.



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

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.





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.



6.08.02 Measurement & Channel Redundancy

To meet the failure and self checking criteria for the control system, measurement redundancy shall be provided for all the critical parameters. Throughout the control system, the security and validity of signals are to be ensured based on the following design principles.

- a) Where a plant measurement is to be duplicated or triplicated such signals shall be separately fed to the different input modules.
- b) Signals, after due security and validity checking by means of voting, averaging, median, difference monitoring or similar technique shall be used for control functions.
- c) Where duplex measurements are used, provision shall be there for selecting any one as the duty signal. Continuous monitoring of Deviation between the signals shall be made in the system.
- d) For binary and analog inputs required for protection of SG , TG and major auxiliaries whose non availability may result in loss of generation triple sensing devices shall be provided . Binary and analog inputs , which are required for protection of more than one equipment as well as protection signals for important auxiliaries and HT drives etc. triple sensing devices shall be provided .Also other binary and analog inputs required for CLCS dual sensing devices shall be provided . However,for those binary and analog inputs which are also required for protection in addition to CLCS, triple sensing devices shall be provided.
- e) Measurement system, CLCS and OLCS shall all be configured with redundancy at processor modules,communication modules, data bus and power supply modules.Triple redundancy shall be followed as described elsewhere in the specification. All servers shall be dual redundant.
- f) Both CLCS & OLCS shall be configured with Redundant I/O channels for each sensor/signals. Where redundant sensors are provided redundant I/O channels shall be provided for each sensors/signals.
- g) Redundant sensors shall be provided for all control applications. For all major closed loop controls (CLCS) triple redundant sensors shall be provided. For other CLCS loops dual redundant sensors shall be provided.
- h) Similarly for critical protection logic requirements triple redundant sensors for 2 out of 3 logic shall also be provided to avoid spurious tripping. For all other control application dual redundant sensors shall be provided. Dual and Triple redundant sensors shall also be provided as described elsewhere in the specification.
- i) Signals shall be verified against cable failure / non coincidence monitoring for critical trip signals.





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^o 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





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.



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- 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 mili 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 gasketted 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, : 1.5 Sq.mm
pushbuttons etc.)

Power supply /receptacle : 2.5 sq. mm or higher as per
/illumination wiring load





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.



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.

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- 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/cm²
 Differential Pressure : mm of H₂O column / Kg/cm²
- ii) Draught : mm of H₂O column
- iii) Vacuum : Kg/cm² (abs)/mm of Hg column



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iv)	Temperature	: Degree Celsius (⁰ 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.





SPECIFICATION FOR LOCAL PANELS

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

VOLUME II B

SECTION D

REV. NO. 03

DATE : 16-09-2013

SHEET 1 OF 6

1.0 SCOPE

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

2.0 CODES AND STANDARDS

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

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

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

3.0 TECHNICAL REQUIREMENTS

3.1 Panel Construction

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

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

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

3.1.4 The salient features of construction shall be:

Sheet material: Cold rolled sheet steel

Frame thickness: Not less than 3.0mm

Enclosure thickness: Not less than 3.0 mm for load bearing sections (Mounted with instruments)
2.0 mm for doors and Not less than 2.0 mm for others


Panel Height: Not less than 2365 mm (Refer data sheet-A (No. PES-145A-DS1-0)

Gland plate thickness: 3.0mm

Base channel: ISMC 100 with anti-vibration mounting & foundation bolts.

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

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

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

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

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

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

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

3.1.12 The internal wiring shall be carried out with 1100 volt grade PVC insulated copper multi strand wire / flexible of 1.5mm² size. AC & DC wires shall be kept separate from each other. Separate coloured wires to be used for AC and DC circuits. All wires shall be properly numbered and identified with ferrules as per the Control scheme / wiring diagram. Wires shall be routed and run through PVC troughs.


3.1.13 Terminal blocks shall be clip on type, 1100 volts grade. Separate terminal blocks shall be used for AC & DC circuits. The terminals shall be suitable for terminating 0.5 mm² to 2.5mm² external cables. The TB points in terminal block shall be cage clamp type / screw type. The terminal for ammeters shall be provided with removable links for shorting CTs. Each terminal strip shall be provided with identification strip. The terminal shall not be mounted below 250 mm height from finished floor. The panel shall have ten (20) percent spare terminal.

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

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

3.1.16 The panel shall be provided with a copper earth bus of 25 x 6 mm size running throughout the width of the panel. It shall be terminated internally with 10 mm bolts at extreme ends for connection to; main station earth. The panel mounted equipments / devices shall be connected to earth bus through green coloured PVC insulated stranded copper conductor of 2.5 mm² size.

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

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Sheet / 2 mm Anodised Aluminium Plate. The inscription shall be with white letters on black background on traffolyte sheet. The labels shall be fixed by self tapping non-rusting screws.

3.1.18 Vendor shall furnish electric load and heat load list (in case panel is to be placed in ac environment) of each panel.

3.2 Hazardous Area Panel Requirement

3.2.1 The Local Panel located in hazardous area shall be pressurized as per NFPA-496 requirements to render it non-hazardous. Alarms shall be provided for local and remote annunciation when pressurisation falls below 2.5 mm of water column. Protection shall be of type Z of NFPA-496. It shall not be possible to switch ON the power of purged section unless it is purged as per the recommendation of NFPA-496. Vendor must provide a protective device on the panel to protect the panel from over pressurisation.

3.2.2 Vendor shall supply pressurisation kit consisting of valves, restriction orifices, dual filter regulation, pressure gauges, pressure switches, rotameter etc. Pressurisation kit shall be surface mounting on a metal board and located outside the local panel. Pressurisation kit shall further consist of solenoid valve flow switch, timer blow off safety device etc., so as to make purging fully automatic. However final start shall be manual. Panel protection against over pressure to be provided as per NFPA-496.

3.2.3 Pressurised local control panel pressurization kit assembly design shall provide minimum leakage flow through the Local Control Panel. Panel venting shall be as per NFPA-496.

3.2.4 All components in the local panel like indicating instruments, push buttons switches, lamps etc., which are required to be energized without panel pressurization or before completion of purge cycle shall be explosion proof as per NEMA-7 & suitable for area classification.

3.2.5 All push buttons etc. requiring frequent operation during machine running shall have good positive sealing. Weatherproof housing or cover to be provided wherever necessary. Vendor shall provide pressurisation bypass switch outside explosion proof enclosure of pressurized panel with lamp indication. This shall be used only during maintenance. All hinges, screws, other non-painted metallic parts shall be of stainless steel material.

3.2.6 Provision to switch off manually all types of power shall be provided in the panel. In addition, it shall also be possible to switch off power circuits / components which are powered from motor control centre or control room manually in case of pressurization failure. All such cables from MCC and main control room shall be terminated in explosion proof boxes (NEMA-7).


3.3 Control & Monitoring devices

3.3.1 Instruments like Indicators, recorders, single loop controllers etc. as applicable and specified elsewhere for the plant / equipment shall be supplied and mounted on the panel.

3.3.2 Alarm Annunciator System
It shall be solid state discrete facia type having a sequence of ISA-S18.1A or as specified, opaque facia windows of 70 mm x 50 mm size, having two (2) lamps per window, and hooter of 10W, and provision for repeat group alarm at remote. The annunciator shall be provided with ten (10) percent spare windows or minimum two (2) windows along with electronics.

3.3.3 Relays
The relays shall be electromagnetic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However minimum contact rating shall be 5 Amp AC & 2 Amp DC as applicable. There shall be ten (10) percent spare contacts.

3.3.4 Timers
The timers shall be electronic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However, minimum contact rating shall be 5 Amp AC & 2 Amp DC as applicable.

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

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

RED	Motor OFF / Valve CLOSE	YELLOW	Alarm acknowledge
GREEN	Motor ON / Valve OPEN	BLACK	Lamp test

Left Hand Side
Right Hand Side

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

GREEN	Motor OFF / Valve CLOSED condition	AMBER	Motor tripped
RED	Motor ON / Valve OPEN condition	WHITE	Normal / healthy

Left Hand Side
Right Hand Side

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

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


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

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

4.0 TESTING AND INSPECTION

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

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

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

4.3.1 Routine Tests

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

4.3.2 Type Tests

1. Enclosure Class Test

5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

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

5.2. Mandatory Spares

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

5.3. Recommended Spares

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

6.0 DRAWINGS AND DOCUMENTS

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


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

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

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

7.0 MARKING AND PACKING

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


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

8.0 APPLICABLE DATA SHEET FORMS


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


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

	DATA SHEET FOR LOCAL PANELS		SPECIFICATION NO.: PES-145-054A	
			VOLUME	
			SECTION	
			REV. NO. 01	DATE: 24.01.2019
			SHEET 1	OF 2
TAG No. Qty.....			Data Sheet No.: PES-145A-DS1-0	
Data Sheet A & B				
DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
GENERAL	MANUFACTURER			
	CONSTRUCTION		<input type="checkbox"/> FOLDED <input type="checkbox"/> WELDED (As per requirement EDN)	
	ENCLOSURE SHEET THICKNESS	FRONT	<input checked="" type="checkbox"/> 3.0 mm (FOR FACES SUPPORTING INSTRUMENTS/TERMINALS)	
		OTHER	<input checked="" type="checkbox"/> 2.0 mm (FOR OTHER SIDES AND TOP)	
		DOOR	<input checked="" type="checkbox"/> 2.0 mm	
		HEIGHT	<input type="checkbox"/> 2365 mm for stand alone panels. (THIS SHALL BE DECIDED BY BHEL DURING DETAILED ENGG.)	
	OTHER	<input type="checkbox"/>		
TECHNICAL	INPUT POWER SUPPLY *		<input type="checkbox"/> 240V 50 Hz AC <input type="checkbox"/> 220V DC <input type="checkbox"/> 415V 3 PHASE 3W <input type="checkbox"/> 415V 3 PHASE 4W	
	NO. OF FEEDERS		<input type="checkbox"/> ONE <input checked="" type="checkbox"/> TWO	
	CONTROL SUPPLY		<input type="checkbox"/> 110V AC <input type="checkbox"/> 220V AC <input type="checkbox"/> 220V DC <input type="checkbox"/> Other. (As per requirement)	
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)		_____ NOS. (AS REQUIRED)	
	PAINT TYPE		<input type="checkbox"/> EPOXY ENAMEL <input checked="" type="checkbox"/> EPOXY POWDER COATED OR BETTER (THIS SHALL BE DECIDED BY BHEL DURING DETAILED ENGG.)	
	PANEL COLOUR (EXTERNAL)		<input type="checkbox"/> LIGHT GREY (Shade 631 IS-5) <input type="checkbox"/> OPALINE GREEN (Shade 275) . <input checked="" type="checkbox"/> RAL 7032 (THIS SHALL BE DECIDED BY BHEL DURING DETAILED ENGG.)	
	FINISH (EXTERNAL)		<input type="checkbox"/> MATT <input type="checkbox"/> GLOSSY <input type="checkbox"/> SEMI GLOSSY	
	PANEL COLOUR (INTERNAL)		<input type="checkbox"/> WHITE <input type="checkbox"/> CREAM <input type="checkbox"/> OFF WHITE <input checked="" type="checkbox"/> BRILLIANT WHITE	
	FINISH (INTERNAL)		<input type="checkbox"/> MATT <input type="checkbox"/> GLOSSY <input type="checkbox"/> SEMI GLOSSY	
	CLASS OF PROTECTION		<input type="checkbox"/> IP-42 (FOR INDOOR SERVICE) <input checked="" type="checkbox"/> IP-55 (FOR OUTDOOR SERVICE) <input type="checkbox"/> ANY OTHER	
	CONTROL HARDWARE		<input checked="" type="checkbox"/> RELAY BASED	
	FOUNDATION ARRANGEMENT		<input type="checkbox"/> FOUNDATION BOLTS <input type="checkbox"/> ANCHOR FASTENERS	
	WEIGHT OF PANEL (Kg.)			
	PANEL TYPE		<input type="checkbox"/> PRESSURISED <input type="checkbox"/> UNPRESSURISED As per Requirement	
	CABLE GLAND		<input type="checkbox"/> DOUBLE COMPRESSION	
	AMMETER (TYPE OF INPUT) *		<input type="checkbox"/> 1 Amp CT <input type="checkbox"/> 4-20 mA	

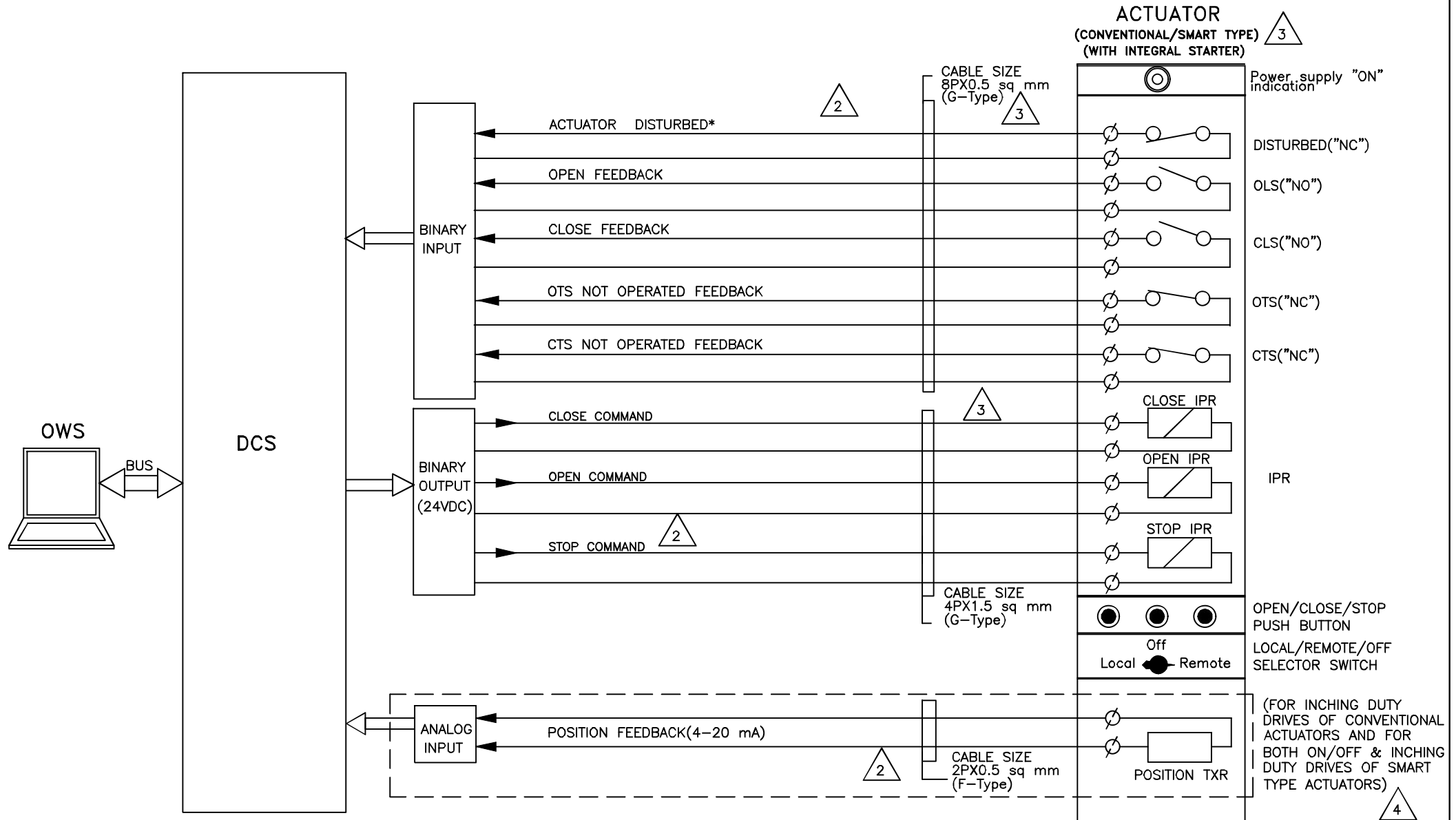
389490/2021/PS-PEM-MAX

FORM NO. PEM-6666-0

	DATA SHEET FOR LOCAL PANELS			SPECIFICATION NO.: PES-145-054A	
				VOLUME	
				SECTION	
				REV. NO. 01	DATE: 24.01.2019
				SHEET 2	OF 2
TAG No. Qty.....			Data Sheet No.: PES-145A-DS1-0		
Data Sheet A & B					
DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)				DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
* TO BE CO-ORDINATED WITH PEM ELECTRICAL					
NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY		
			COMPANY SEAL		
			NAME:		
			SIGNATURE:		
			DATE:		

	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	

SIGNL EXCHANGE BETWEEN DRIVES & DCS



PROJECT: 1X660MW SAGARDIGHI THERMAL POWER
EXTENSION PROJECT (UNIT #5)

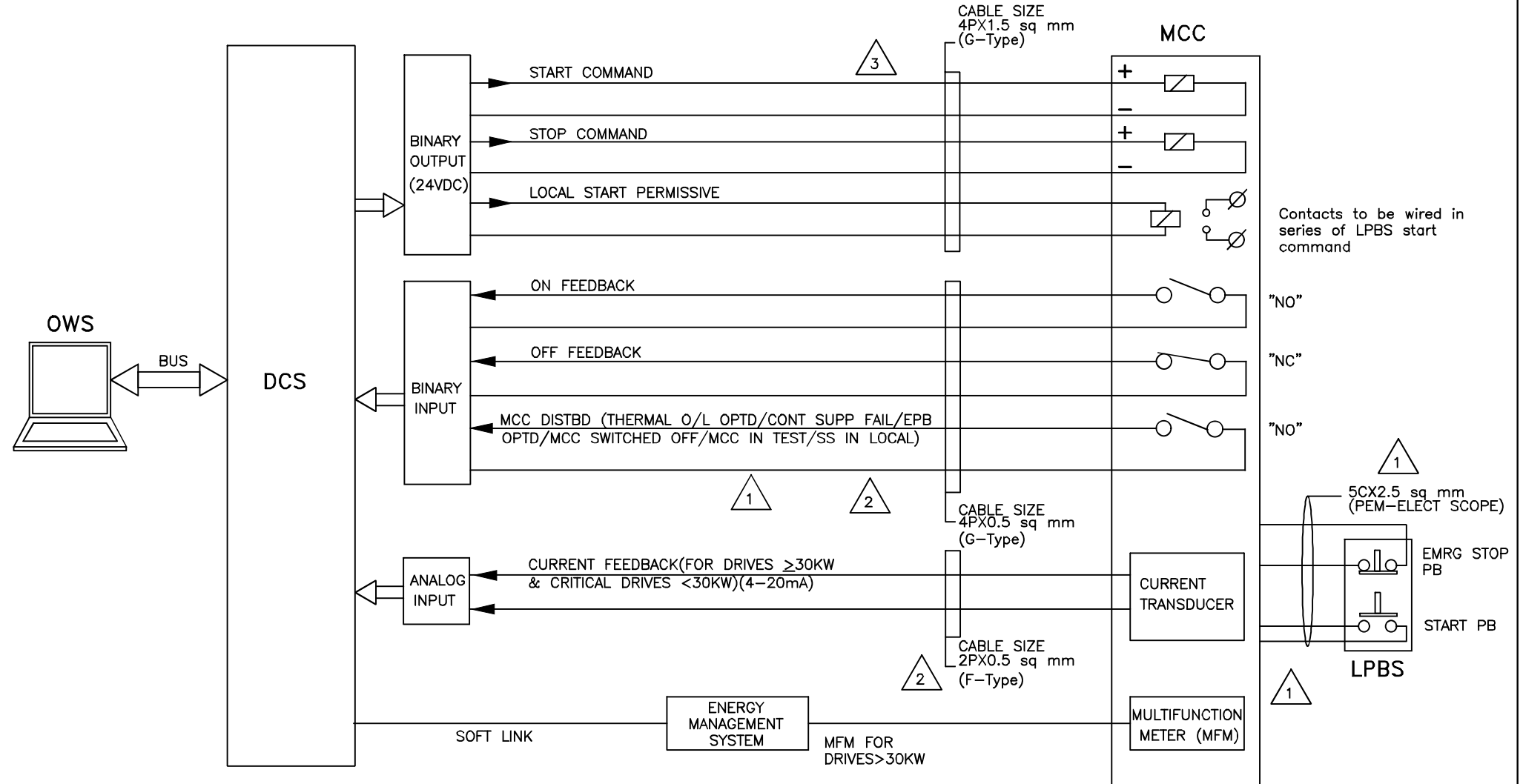
TITLE DDCMIS INTERFACE FOR
BIDIRECTIONAL DRIVE

DRG.NO.	PE-DM-445-145-I002
DATE	15.03.2021
REV.NO.	04
SHT	7 OF 11

389490/2021/PS-PEM-MAX

DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE (CONTACTOR OPERATED)

1



NOTES:

REDUNDANCY IN OUTPUT SHALL BE PROVIDED FOR ALL CRITICAL LT DRIVES

2



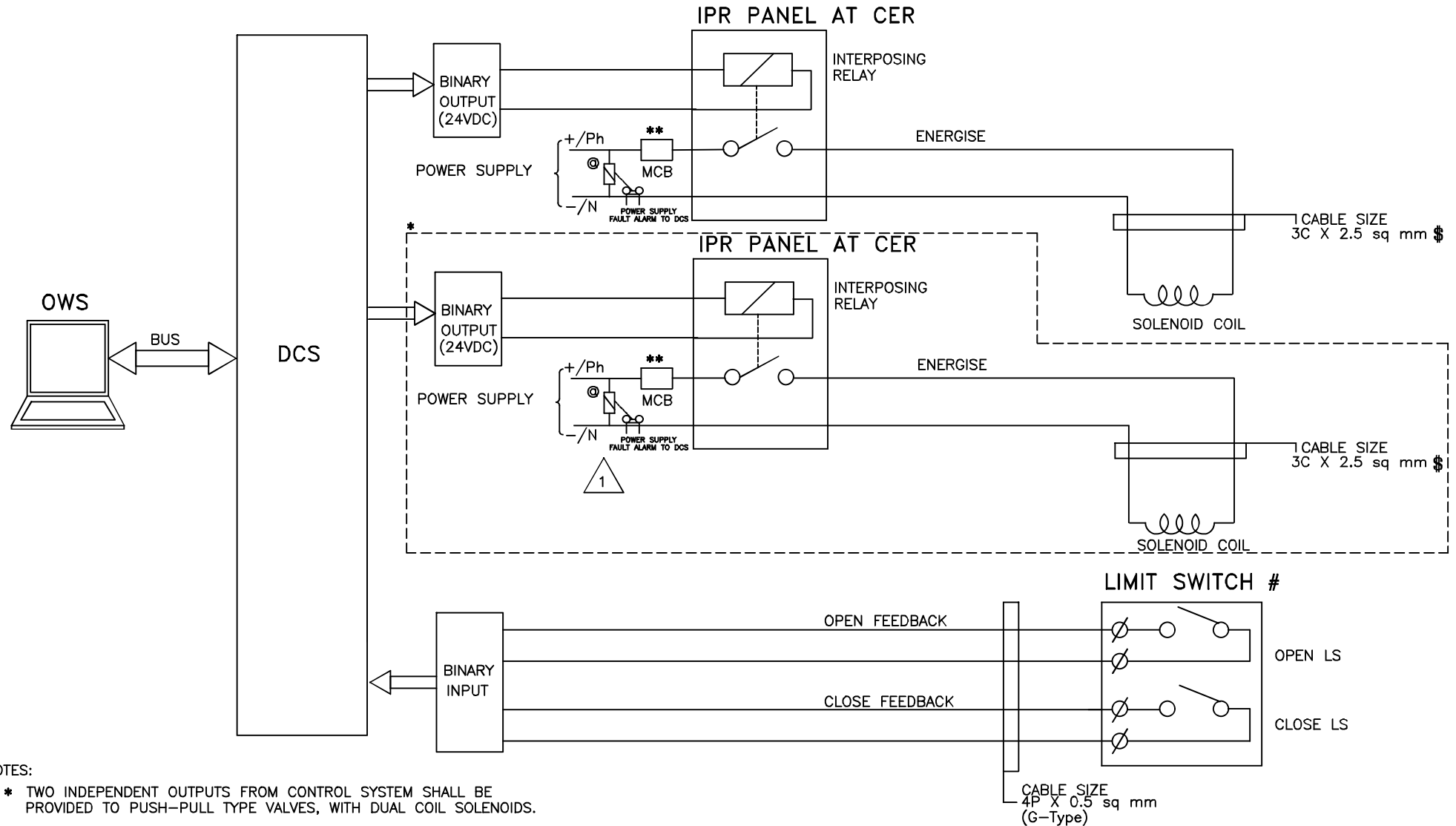
PROJECT: 1X660MW SAGARDIGHI THERMAL POWER
EXTENSION PROJECT (UNIT #5)

TITLE DDCMIS INTERFACE FOR
UNIDIRECTIONAL LT DRIVE (CONTACTOR OPERATED)

DRG.NO.	PE-DM-445-145-I002
DATE	15.03.2021
REV.NO.	04
SHT	8 OF 11

389490/2021/PS-PEM-MAX

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: 1X660MW SAGARDIGHI THERMAL POWER
EXTENSION PROJECT (UNIT #5)

TITLE


DDCMIS INTERFACE FOR
SOLENOID DRIVE

DRG.NO. PE-DM-445-145-I002

DATE 15.03.2021

REV.NO. 04

SHT 9 OF 11

	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	

**INSTRUMENT CABLE INTERCONNECTION AND
TERMINATION PHILOSOPHY**



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 :



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



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 /01 of 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).





- 11.05.04 Fiber optic cable shall be of loose tube design. Typically, fibers shall be housed in-groups of 6 (minimum) within gel-filled buffer tubes to protect against ingress of moisture and vibration. The tubes shall be manufactured with industry standard material like Poly-Butylenes Terathylate (PBT). They shall be colored for easy identification. Buffer tubes shall be approachable with industry standard tools and practices. The buffer tubes shall be stranded around the Central Strength Member utilizing Reverse Oscillating Lay (ROL). Blank fillers shall be used as necessary to maintain circular cable structure. The fiber optic cable shall withstand water penetration when tested with a one meter static head or equivalent continuous pressure applied at one end of a one meter length of filled cable for one hour. No water shall leak through the open cable end.
- 11.05.05 The central strength member of the cable shall be Fiberglass Reinforced Plastic (FRP) or other material with equivalent mechanical strength to provide both tensile and anti buckling strength to the cable.
- 11.05.06 In addition to central strength member, additional strengthening substance like aramid yarns shall be helically applied over the cable core to provide additional tensile strength to the cable.
- 11.05.07 The cable shall be of dual jacket & armoured. Inner sheath consists of a medium density polyethylene (MDPE) jacket extruded over the cable core. Two highly visible ripcords are placed under the jacket to aid in sheath removal. A co-polymer coated steel tape is corrugated and wrapped around the inner jacket to provide additional cable compression strength and rodent protection. The armor is covered with an outer black FRLS MDPE jacket. A ripcord is also placed underneath the armor for easy outer jacket removal.
- 11.05.08 Minimum bending radius shall be equal or more to 15 D (D= Diameter). A continuous strength member shall be provided for the entire length of the cables. Every tube and fiber shall be colour coded to provide easy identification. The outer sheath shall be marked to show fiber type and cable classification at suitable intervals.
- 11.05.09 The entire length of each cable shall be marked with the following items:
- Manufacturer's Name
 - Month and year of manufacturing
 - Coded description of the cable based on Telcordia's (Bellcore) SR-2014 Suggested Optical Cable Code (SOCC).
 - Sheath Identification Number
 - Sequential Length Marking in meter
 - A Telephone Handset symbol to distinguish communication from power cable as per NESC section –35 G.
- 11.05.10 Fiber optic cable shall provide a long life expectancy of minimum 25 years and shall meet the industrial standard of operation at temperature of 55⁰ C



and humidity to 100% without degradation to optical or mechanical performance.

- 11.05.11 Optical fiber used in the plant shall generally conform to the following specification.

SPECIFICATION FOR G.652 MONOMODE FIBER

ATTRIBUTES		VALUE
1.	Cladding Diameter	125 $\mu\text{m} \pm 1.0 \mu\text{m}$
2.	Cladding non-circularity	$\leq 1.0\%$
3.	Attenuation Coefficient at (a) 1290 nm to 1340 nm (b) 1525 nm to 1575 nm	$< 0.36 \text{ dB/km}$ $< 0.25 \text{ dB/km}$
4.	Chromatic Dispersion Coefficient at (a) 310 nm (b) 1550 nm	$< 3.5 \text{ ps/nm.km}$ $< 18 \text{ ps/nm}$
5.	Polarization Mode Dispersion (PMD)	$\leq 0.5 \text{ ps}/\sqrt{\text{km}}$
6.	Mode Field Diameter at (a) 1310 nm (b) 1550 nm	$9.2 \pm 0.4 \mu\text{m}$ $10.50 \pm 1.0 \mu\text{m}$
7.	Mode Field Concentricity Error	$\leq 0.5 \mu\text{m}$
8.	Proof Test	$\geq 1\%$
9.	Fiber Curl (ROC)	$\geq 4.0 \text{ m}$
10.	Macro-bend Test on Fiber at 1550 nm	$\leq 0.1 \text{ dB}$

- 11.06.00 Cable Assembly

- 11.06.01 Optical Fiber Environmental Splice Enclosure

Optical fiber environmental splice joint enclosures shall be re-enterable and rack / wall mountable. The interior splice case shall be equipped to mechanically accommodate single-mode optical fibers connected by the fusion method. Splice case shall be equipped to organize the splice trays and the required service loops of buffered incoming optical fibers and outgoing 'pigtails' in such a way that allows each completed splice and associated optical fiber to be maintained in an unstrained configuration. Splice enclosure shall be dust and weather proof.

- 11.06.02 Fiber Optic Distribution Patch Panel





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, then 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




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



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	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	
<div> <h2>ERECTION HARDWARE</h2> </div> <div> <p> </p> </div>		



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





- 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



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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.

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

PROCESS CONNECTION PIPING

[illegible]



04.	HOT REHEAT / DOWN STREAM OF AUX. STEAM PRESSURE REDUCING VALVE UPTO DESUPER- HEATER / FLASH TANK DRAIN MANIFOLD	D	ASTM- A335 GR. P-91/22 (NOTE-2)	160 (1/2 INCH)	ASTM- A182 GR.F-22	ASTM- A182 Gr.F-6a	3000 LB	900
05.	COLD REHEAT UPTO TEE-OFF FOR HP BYPASS / EXTRACTION STEAM NO. 5 TO HPH	E	ASTM- A335 GR. P-22	80 (1/2 INCH)	ASTM- A182 GR.F-22	ASTM-A- 182 GR. F6A	3000 LB	800
06.	COLD REHEAT DOWN-STEAM OF TEE-OFF (HP BYPASS)	F	ASTM- A106 GR. C	80 (1/2 INCH)	ASTM- A105	ASTM-A- 182 GR. F6A	3000 LB	800
07.	BFP SUCTION / CONDENSATE SYSTEM / EXTRACTION TO LPH / EXTRACTION-4 TO BFP-T, DEAERATOR / AUXILIARY STEAM	G	ASTM- A106 GR. B	80 (1/2 INCH)	ASTM- A105	ASTM-A- 182 GR. F6A	3000 LB	800
08.	AIR / FLUE GAS OUTSIDE FURNACE	M	ASTM- A106 GR. B/C	80 (3/4 INCH)	ASTM- A105	ASTM-A- 182 GR. F6A	3000 LB	800
09.	AIR / FLUE GAS INSIDE FURNACE	N	ASTM- A335 GR. P-22	80 (3/4 INCH)	ASTM- A182 GR. F-22	ASTM-A- 182 GR. F6A	3000 LB	800
10.	Purge Air	—	ASTM- A106 Gr. C	80 (3/4 inch)	ASTM- A 105 Gr. F-22	SS or better	3000 lb	800
11.	DM Cooling Water	—	ASTM A312 TP 316	40 (1/2 inch)	ASTM A182 F316	SS or better	3000 lb	800
12.	CW & ACW	—	ASTM- A106 Gr. C	80 (1/2 inch)	ASTM- A 105	SS or better	3000 lb	800

NOTE :

- (1) RATING OF PIPING / FITTINGS / VALVES ETC. IS SUBJECTED TO THE DESIGN PRESSURE & TEMPERATURE DURING THE DETAILED ENGINEERING.
- (2) IN CASE TEMPERATURE IS MORE THAN 540 DEG. C, THE MATERIAL SHALL BE P-91 ONLY.





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



- 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.





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 |





- 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





- 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





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



	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	

QUALITY ASSURANCE PLAN/CHECK LIST



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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 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/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



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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-1A (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





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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.





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- 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.



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- 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.



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

CHECK LIST FOR TEMPERATURE SWITCH

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	100%	APPROVED SPEC./ DATA SHEETS	P	W	V	
	TYPE						
	MODEL/TAG NO.						
	RANGE/SCALE						
	END CONNECTION						
2	DIMENSIONS CHECK	100%		P	W	V	
3	ACCURACY	100%		P	W	V	
4	SWITCHING DIFFERENTIAL	100%		P	W	V	
5	CONTACT RATING / No. OF CONTACTS	RANDOM		P	W	V	
6	MATERIAL TC FOR BULB, CAPILLARY, ARMOUR	ONE / LOT		P	V	V	
7	HV / IR	RANDOM		P	W	V	
8	DEGREE OF PROTECTION	TYPE TEST		P	V	V	
9	THERMOWELLS						
	DIMENSIONS, PROCESS CONN	100%		P	W	V	
	MATERIAL TC	ONE / LOT		P	V	V	
	HYD TEST	100%		P	W	V	
	IBR CERTIFICATE, IF APPLICABLE			P	V	V	
10	REPEATABILITY	100%		P	V	V	
11	HYSTERESIS	100%		P	V	V	
12	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW		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.
- Manufacturer to carry out routine test for 100%



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

CHECK LIST FOR PRESSURE SWITCH

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

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

Note :

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



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

CHECK LIST FOR FLOAT OPERATED LEVEL SWITCH

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	V	V	
	MODEL NO/TAG NO						
	TYPE						
	END CONNECTION						
2	ON/OFF DIFFL			P	W	V	
3	REPEATABILITY	SEE NOTE-5	---	P	W	V	
4	IR TEST			P	W	V	
5	HV TEST			P	V	V	
6	PR. TEST ON CHAMBER	FOR LOT	---	P	V	V	
7	MATL. TC FOR CHAMBER & FLOAT	FOR LOT	---	V	V	V	
8	CONTACT CONFIG. & RATING FOR MICROSWITCH	TYPE TEST	---	V	V	V	
9	TC FOR DEGREE OF PROTECTION		---	P	V	V	
10	MANUFACTURER TO ENSURE WELDING PROCEDURE, WELDERS & NDT AS PER ASME FOR PR >40 KG/CM2	SEE NOTE-1 BELOW	---	V	V	V	
11	CHECK FOR TEMP. SUITABILITY FOR MICROSWITCH AND LEAD WIRE		---	V	V	V	
12	ACCESSORIES AS APPLICABLE		APPROVED SPEC./ DATA SHEETS	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
- IBR certificates shall be provided wherever required.
- Contractor to provide compliance certificate for tests/checks verified by contractor and the same alongwith test certificates to be verified by BHEL



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

CHECK LIST FOR ANNUNCIATORS

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

Legend :

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P = Perform, W = Witness, V = Verification

Note :

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



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 :

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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 TYPE	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	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	FUNCTIONAL 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.



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			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						
	HOUSING						
	6			REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST	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			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	V	V	V		
	MATERIALS OF SENSOR						
	MOVEMENT						
	PROCESS CONNECTION						
	HOUSING						
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST	V	V	V		
7	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW	V	V	V		

Legend :

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

Note :

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



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

CHECK LIST FOR LEVEL GAUGE

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

Legend :

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Note :

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



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

CHECK LIST FOR SIGHT FLOW INDICATOR


[illegible]


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 verified by contractor and the same alongwith test certificates to be verified by BHEL

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								SHEET 1 OF 7				
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
1.0	INCOMING Sheet Steel (CRCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample	IS:1079 IS:513	IS:1079 IS:513	Test Certificate	3	---	2	
		2. Bend Test	CR	Mech. test	Sample	IS:1079 IS:513	IS:1079 IS:513	Log Book	2	---	---	
		3. Surface finish	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---	
		4. Waviness	MA	Visual	100%	Factory Standard	No Waviness	Log Book	2	---	---	
		5. Thickness	MA	Measurement	100%	BHEL Spec.	BHEL Spec.	Log Book	2	---	---	
		6. Mill marking	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	1	
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	IS:2062	IS:2062	Log Book	2	---	---	
		2. Surface Defects	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---	
		3. Straightness	MA	Measurement	100%	Factory Std.	Factory Std.	Log Book	2	---	---	
		4. Mill marking	MA	Visual	100%	IS:2062	IS:2062	Log Book	2	---	1	
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---	
		2. IR and HV	MA	Electrical	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---	
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics \$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test. 1 - BHEL 2 - Vendor 3 - Sub-vendor												

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

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


<div></div> <div>PEM :: C&I</div>	STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL						STD QUALITY PLAN NO.: PE-QP-999-145-1056					
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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^{\$}			Remarks
									P	W	V	
9.0	Pre-treatment and Painting	1. Pretreatment Process	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		2. Process parameters like bath temp. concentration etc.	MA	Measurement	Periodic	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		3. Dipping / Removal Time	MA	Measurement	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		4. Surface quality after every dip	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		5. Primer after phosphating	MA	Visual, Thickness	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		6. Putty Application & Rubbing after primer	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		7. Paint first coat	MA	Visual, Thickness	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		8. Putty Application and Rubbing after first coat of paint	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		9. Paint second coat	MA	Visual, Thickness, Scratch test Colour adhesion	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics ^{\$} P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test. 1 - BHEL 2 - Vendor 3 - Sub-vendor												

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

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

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


1 - BHEL
 2 - Vendor
 3 - Sub-vendor

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								REV. NO.		01		DATE: 22-02-2008	
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Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks	
									P	W	V		
		5. Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.	
		6. Door functioning	MA	Functional	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1		
		7. Paint Shade	CR	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1		
		8. Paint Thickness	CR	Measurement	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1		
		9. Workmanship of Gaskets	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1		
		10. Wiring Layout	MA	Visual	100%	BHEL approved drg.	BHEL approved drg.	Inspection Report	2	1	1		
		11. Wire Termination	MA	Pulling manually	Sample	-----	Firm termination	Inspection Report	2	1	1		
		12. Continuity	MA	Electrical	100%	-----	Continuity OK	Inspection Report	2	1	1		

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

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

1 - BHEL
 2 - Vendor
 3 - Sub-vendor


 PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL						STD QUALITY PLAN NO.: PE-QP-999-145-I056				
								VOLUME IIB				
								SECTION D				
								REV. NO. 01 DATE: 22-02-2008				
								SHEET 7 OF 7				
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	Type Test Certificate	3	---	1	
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant IS.	BHEL approved spec., drg., BOM & relevant IS.	Test Report	2	1	1	
15	FUNCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		2. Instrument Calibration	CR	Electrical	10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		3. Temperature rise	CR	Electrical	100%	BHEL approved spec/drg. & relevant IS.	BHEL approved spec/drg & relevant IS.	Inspection Report	2	1	1	

LEGEND: * CR - Critical characteristics
 MA - Major characteristics
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389490/2021/PS-PEM-MAX

	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	

TYPE TEST REQUIREMENT



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.



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	
17.	LIE / LIR / JUNCTION BOX	DEGREE OF PROTECTION TEST	IS-2147	YES	YES	

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	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	

APPLICABLE CODES AND STANDARDS



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



**WBPDC**

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





- 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



**WBPDC**

EPC Bid Document
Sagardighi Thermal Power Project
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- 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 .

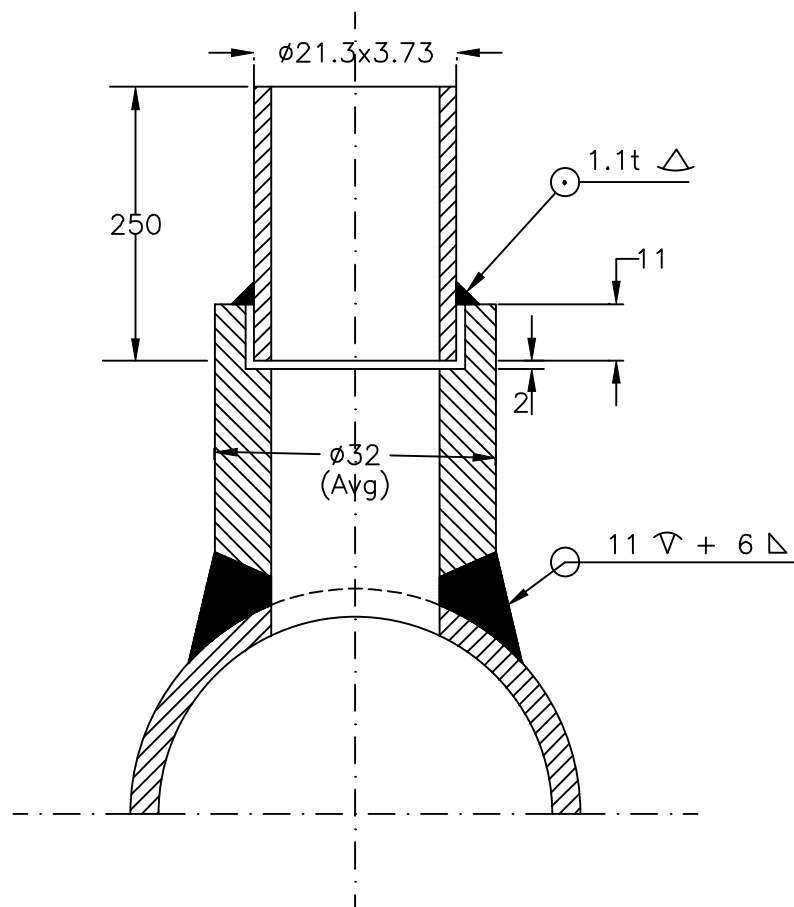
Items such as thermowells, control valves, flow elements and other in line devices in high and medium pressure steam, feed water and similar services, which fall under the purview of Indian Boiler Regulation Act shall be either certified by IBR or shall be certified by authorities acceptable to IBR. 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.




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	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	

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 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 

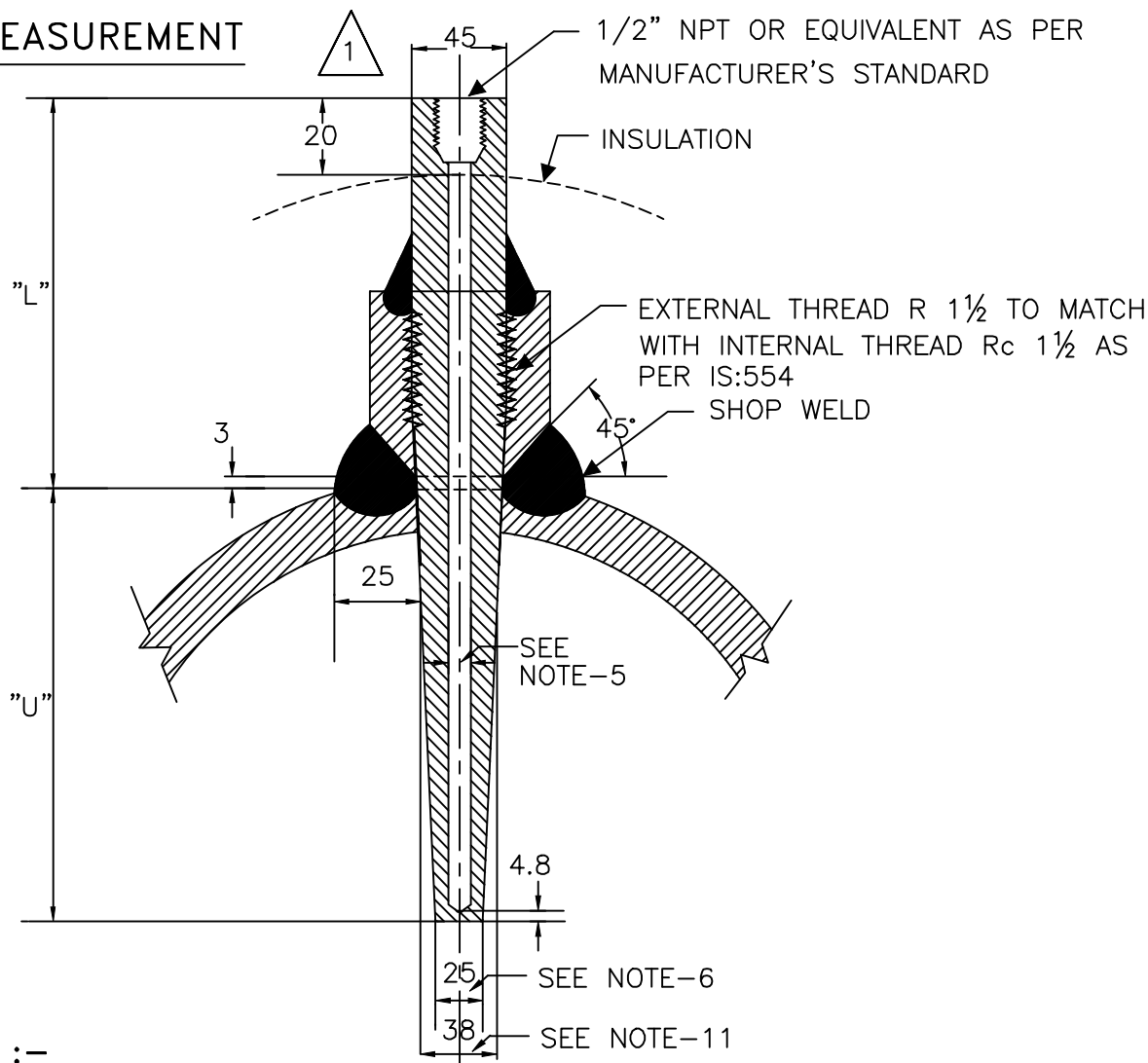


TITLE :
INSTRUMENT STUB DETAILS
FOR PRESSURE MEASUREMENT

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

DRG. NO.
PE-DG-445-145-I101
REV. 01
SH. 4 OF 8 SHS.

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]



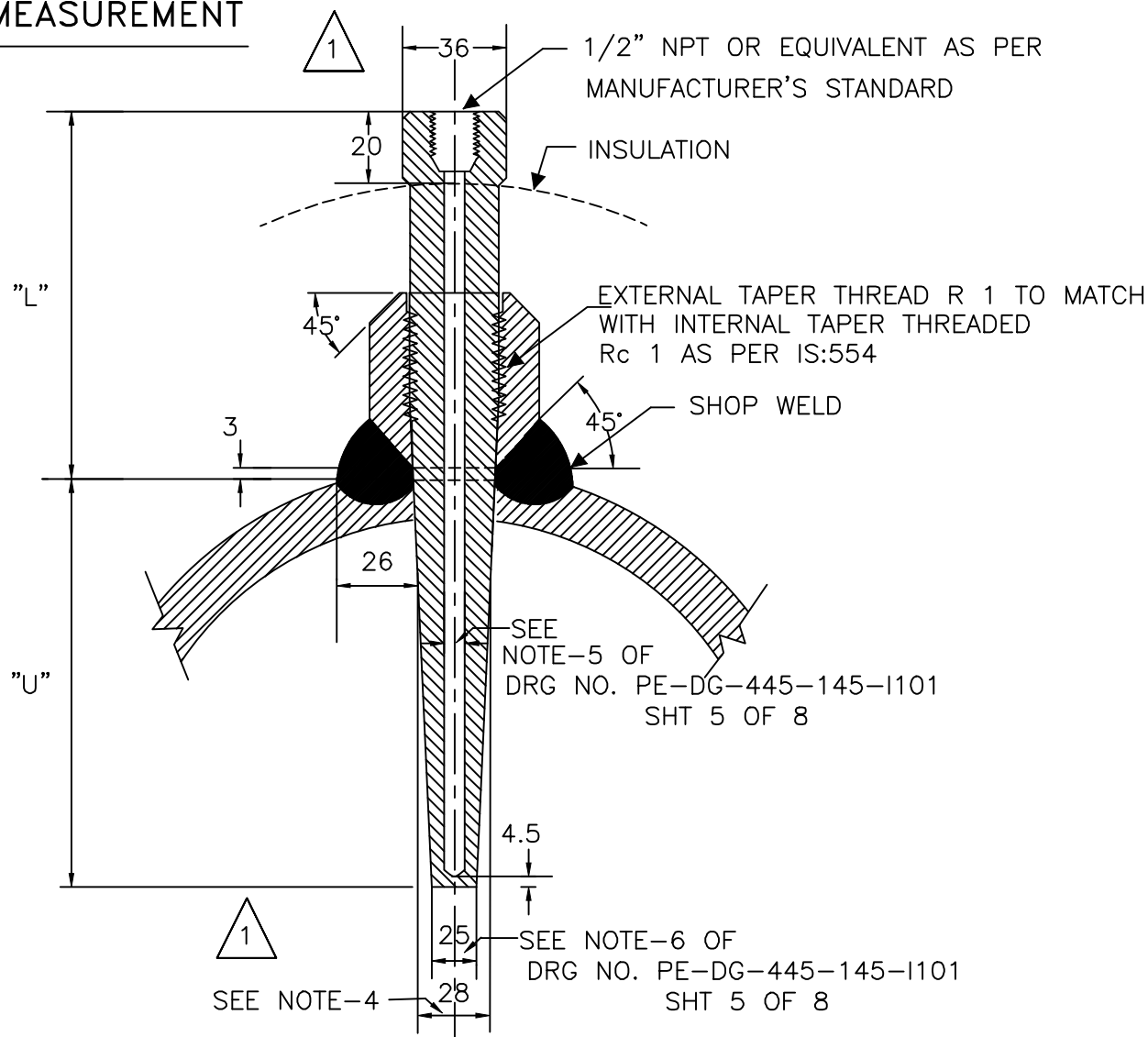
DRG. NO.

PE-DG-445-145-I101


REV. 01

SH. 5 OF 8 SHS.

TEMP. MEASUREMENT



NOTES :-

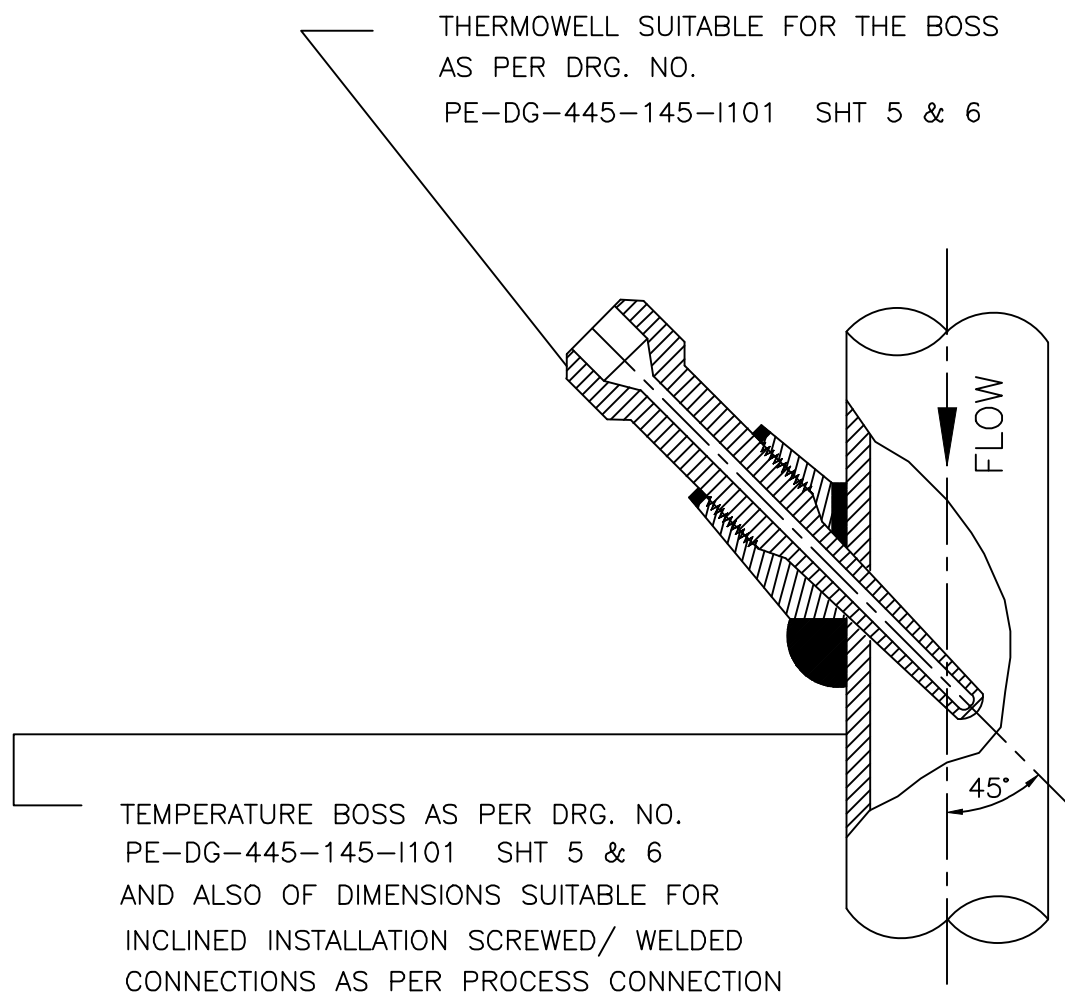
1. THIS TYPE OF TEMPERATURE BOSS IS APPLICABLE FOR THE DESIGN PRESS/ TEMP BELOW 40 KG/CM²(g)/400°C.
2. FOR PRESS. TIGHT JOINTS THE BOSS SHOULD HAVE INTERNAL TAPERED PIPE THREAD Rc 1 AS PER IS:554. THE LENGTH OF THREAD ENGAGEMENT SHOULD BE AS PER ABOVE STANDARD.
3. SEE NOTES-2 TO 10 IN SHT. 5 OF 8 OF THIS DRG. 
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")

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

DRG. NO.
PE-DG-445-145-I101
 REV. 01
 SH. 6 OF 8 SHS.



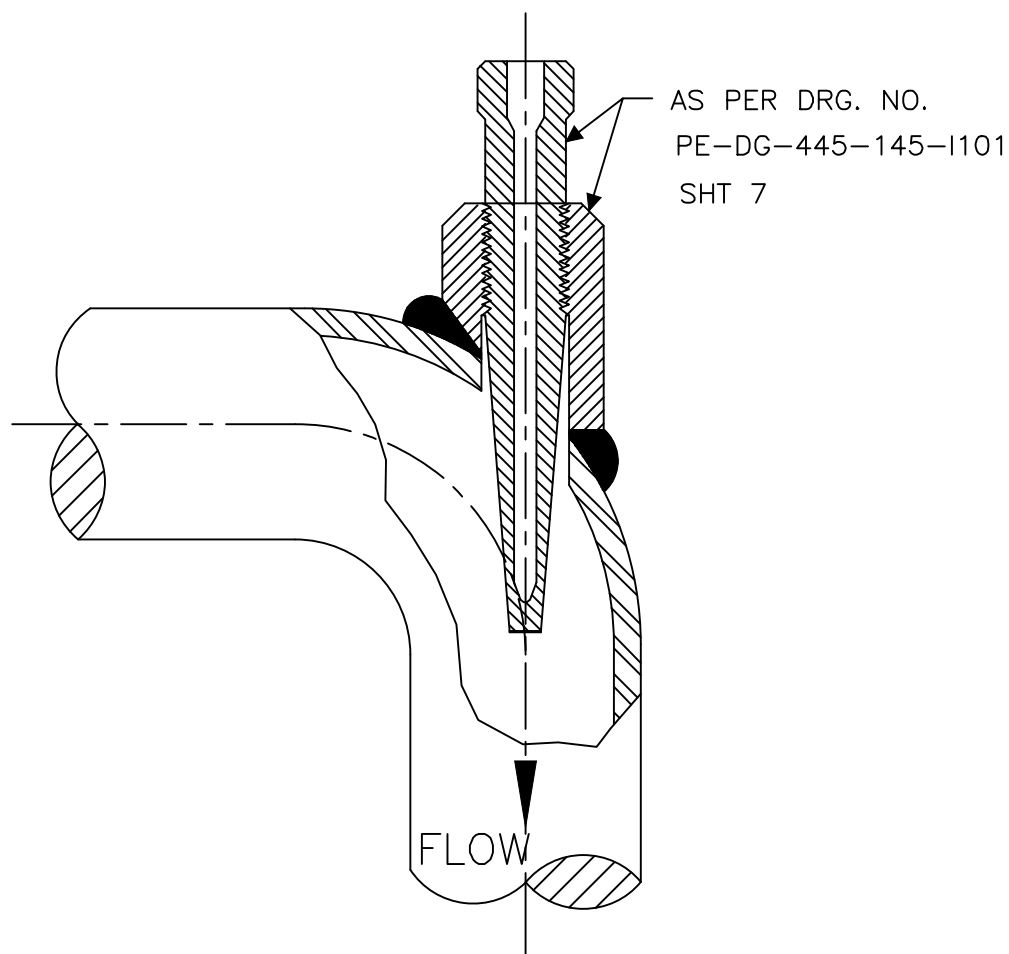
NOTES :-

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-I101
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

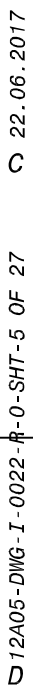
DRG. NO.
PE-DG-445-145-I101
REV. 01
SH. 8 OF 8 SHS.

389490/2021/PS-PEM-MAX

	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	

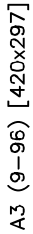
INSTRUMENT INSTALLATION & HOOKUP DIAGRAM

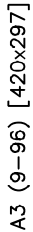
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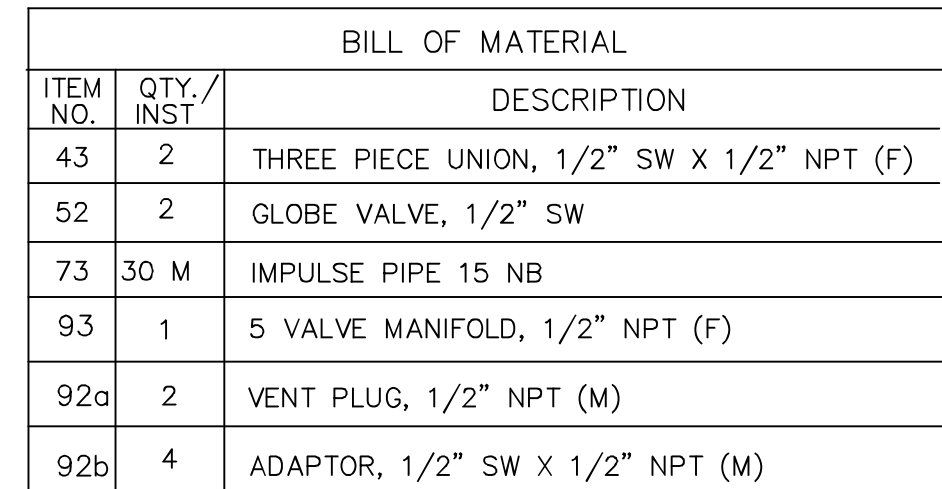


SERVICE : CONDENSATE, FEED WATER ETC.

A3 (9-96) [420x297]

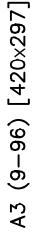


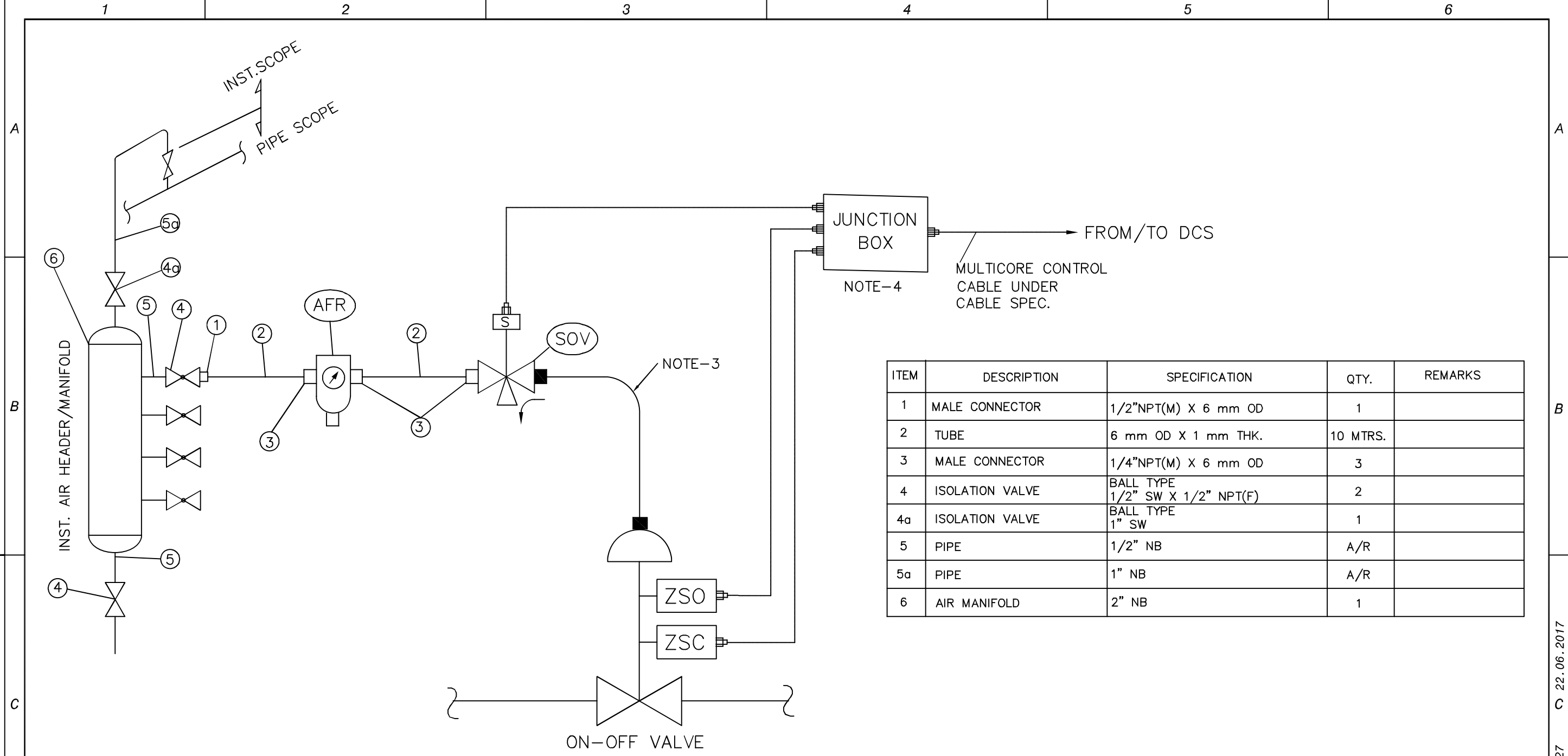




FOR TENDER PURPOSE ONLY

012A05-DWG-I-0022-A-U-SH1-14 UF 21 22.06.2017





PNEUMATIC SOV HOOK UP SCHEME

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

FOR TENDER PURPOSE ONLY

TYPICAL INSTRUMENT INSTALLATION DIAGRAM

THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.

KOLKATA, INDIA

SAGARDIGHI THERMAL POWER STATION

1 x 660 MW, PHASE-III

EXTN. UNITS # 5




DEVELOPMENT CONSULTANTS PVT. LTD

CONSULTING ENGINEERS

JOB NO. DCL- 12A05 SCALE : NIL

DWG. NO. 12A05-DWG-I-0022 REV. 0

389490/2021/PS-PEM-MAX

	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	
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Annexure-I

Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
8.03.27	Micro PLC system (i.e. integrated CPU & I/O system, where above mentioned components are not applicable)	One Complete Set
8.04.00	Field Instrument	
8.04.01	Electronic Transmitters	
(i)	Pressure	1(One) no. complete set for each type and model/range used in the system
(ii)	Differential Pressure	1(One) no. complete set for each type and model/range used in the system
(iii)	Level	1(One) no. complete set for each type and model/range used in the system
(iv)	Speed	1(One) no. complete set for each type and model/range used in the system
(v)	Flow Transmitter	1(One) no. complete set for each type and model/range used in the system
(vi)	3-D Ultrasonic level Transmitter	1(One) no. complete set for each type and model/range used in the system
8.04.02	Different type of Switches	
(i)	Pressure Switch	2(two)no. of each type & model/range used in the system
(ii)	Differential Pressure Switch	2(two)no. of each type & model/range used in the system
(iii)	Level Switch	2(two)no. of each type & model/range used in the system
(iv)	Flow Switch	2(two)no. of each type & model/range used in the system
(v)	Temperature Switch	2(two)no. of each type & model/range used in the system
(vi)	Dust Detector	1(one)no. of each type & model used in the system
8.04.03	Thermocouple	100% of each type and length used in one unit
8.04.04	RTD	100% of each type and length used in one unit
8.04.05	Thermo-well for both TC and RTD	2(Two) nos. for each type and rating/length used in the system
8.04.06	Solenoid Valve	
(i)	Complete Solenoid Valve Assembly	2Nos. for each type and rating used in the system
(ii)	Coil (single or double coil type)	10% of total nos. used in the system or minimum 5(five) Nos. whichever is more for each type and rating.
8.04.07	Different types of Gauge	10% of total nos. used in the system or minimum 1(one) no. whichever is more for each type and range.
(i)	Pressure Gauge	10% of total nos. used in the system or minimum 1(one) no. whichever is more for each type and range.
(ii)	Differential Pressure Gauge	10% of total nos. used in the system or minimum 1(one) no. whichever is more for each type and range.
(iii)	Temperature Gauge	10% of total nos. used in the system or minimum 1(one) no. whichever is more for each type and range.





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Annexure-I

Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
(iv)	Magnetic Level Gauge	10% of total nos. used in the system or minimum 1(one) no. whichever is more for each type and range.
8.04.08	Air Filter Regulator including moisture separator complete set with pressure gauges	10Nos.
8.04.09	Rotameter	10% of total nos. used in the system or minimum 2(Two) nos. whichever is more for each type, rating,/model and size used in the system.
8.04.10	Gauge Glass	1No. for each type and size
8.04.11	Erection Hardware	
(i)	Transmitter's Manifold	10% of total nos. used in the system or minimum 2(Two) nos. whichever is more for each type, rating,/model and size used in the system.
(ii)	Impulse Line Root/Source valve	10% of total nos. used in the system or minimum 4(four) nos. whichever is more for each type, rating,/model and size used in the system.
(iii)	Impulse Line Isolation valve	10% of total nos. used in the system or minimum 4(four) nos. whichever is more for each type, rating,/model and size used in the system.
(iv)	Impulse Line Drain valve	10% of total nos. used in the system or minimum 4(four) nos. whichever is more for each type, rating,/model and size used in the system.
(v)	Impulse Line fittings	Each type/size 25Nos.
(vi)	Impulse Pipe	Each type/size 100Mtrs.
(vii)	Copper/SS Tube	Each type/size 100Mtrs.
(viii)	Fittings for Copper/SS Tube	Each type/size 100Nos.
8.04.13	Conductivity Type Level Switch	
(i)	Conductivity Ttype level Probes	10% of total nos. used in the system or minimum 4(four) nos. whichever is more.
(ii)	Complete Electronics unit	1Set
(iii)	Isolating/Root Valve	2Nos.
8.04.14	Cable This particular items shall be common for BTG , CHP and AHP areas.	
(i)	Thermocouple Cable	3(three)Kms. of each type, size & rating of Cables
(ii)	Control & Instrumentation Cable	3(three)Kms. of each type, size & rating of Cables
8.04.15	Cold Junction Compensation Boxes	10% of total nos. used in the system or minimum 2(two) nos. for each type/size whichever is more.
8.04.16	Current/Voltage Transducers	1(one) no. each type/rating used in the system
8.04.17	MWatt/MVAR Transducer	1(one) no. each type/rating used in the system
8.04.18	Chlorine Leak Detector System	
(i)	Sensor Unit (complete)	2No.
(ii)	Transmitter/Processing Unit (complete)	2No.
8.05.00	SWAS	
8.05.01	Conductivity	
(i)	Conductivity Sensor/cell for each type of Cell Constant	20% of the total no. used in the system or minimum 2(two) nos. whichever is higher.
(ii)	Conductivity Transmitter Complete Set	20% of the total no. used in the system or





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Annexure-I

Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
(x)	Regulator & Gauge Assembly	1Set
8.06.03	Oxygen Analyser	
(i)	Field Sensor	4Nos. complete unit
(ii)	Field Transmitter/complete Electronic unit	2Nos. complete unit
(iii)	Power supply Card	2Nos.
(iv)	Instrumentation Hardware (viz, isolation valve, solenoid valve etc.)	2Nos. each items/type
8.07.00	Pneumatic Control Valve & Power Cylinder (Applicable for all Modulating Type & On-Off/Isolating Type)	
8.07.01	Control Valve	
(i)	Pneumatic Diaphragm for Diaphragm actuated valve	2(two) nos. for each type of Actuator
(ii)	Actuator Seal Kit for Pneumatic Cylinder actuated valve	2(two) nos. for each type of Actuator
(iii)	Gland Packing	1(one) set for each type of Control Valve
(iv)	Stem	1(one) No. for each type of Control Valve
(v)	Plug	1(one) No. for each type of Control Valve
(vi)	Seat	1(one) No. for each type of Control Valve
(vii)	Cage	1(one) No. for each type of Control Valve
(viii)	Retainer Ring	1(one) set for each type of Control Valve
(ix)	Seal Ring	1(one) set for each type of Control Valve
(x)	Gasket	2(two) Sets. for each type of Control Valve
(xi)	Smart Positioner of the Valve	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
(xii)	Seal Kit for the Positioner	2(two) Sets. for each type of Positioner
(xiii)	Position Feedback Transmitter (applicable if it is not integral with the Smart Positioner)	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
(xiv)	Complete Set of Solenoid Valve for Pneumatic type On/Off Valve	2Nos. for each type & ratings
(xv)	Solenoid Coil for Pneumatic type On/Off Valve	5Nos. for each type & ratings
8.07.02	Power Cylinder	
(i)	Actuator Seal Kit	2(two) nos. for each type of Power Cylinder
(ii)	Gasket	2(two) Sets. for each type of Power Cylinder
(iii)	Complete Set of Power Cylinder	1(one) no. each type for all application
(iv)	Smart Positioner of the Valve	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
(v)	Seal Kit for the Positioner	2(two) Sets. for each type of Positioner
(vi)	Position Feedback Transmitter (applicable if it is not integral with the Smart Positioner)	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
(vii)	Complete Set of Solenoid Valve for Pneumatic type On/Off Power Cylinder	2Nos. for each type & ratings
(viii)	Solenoid Coil for Pneumatic type On/Off Power Cylinder	5Nos. for each type & ratings
(ix)	Position Limit Switch for Pneumatic type On/Off Power Cylinder	10Nos. for each type & ratings





Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
8.07.03	I/P Converter for Control Valve/Power Cylinder (if applicable)	10% of total quantity used in the system or minimum 5(five) nos. whichever is more for each type and model.
8.07.04	Air Lock Relay	10Nos. for each type
8.07.05	Signal Air Booster Unit	2Nos. for each type
8.08.00	Turbine Supervisory Instruments & Plant Rotating Machinery Monitoring System	
8.08.01	Probes with extension cable	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
8.08.02	Signal Converter/Proximitors for Transducer system	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
8.08.03	Rack Mounted Monitors for Transducer system	10% of total quantity used in the system or minimum 1(one) no. whichever is more for each type and model.
8.08.04	Rack Interface Modules	10% of total quantity used in the system or minimum 1(one) no. whichever is more for each type and model.
8.08.05	Configurable type Relay Output Modules	10% of total quantity used in the system or minimum 1(one) no. whichever is more for each type and model.
8.08.06	Communication/Gateway Modules	10% of total quantity used in the system or minimum 1(one) no. whichever is more for each type and model.
8.08.07	Rack Mounted Power Supply Modules	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
8.09.00	Closed Circuit Television System	
8.09.01	Complete Camera Unit	Each type 1(one) no.
8.10.00	Control Panel And Local/Remote Control Desk	
8.10.01	Mosaic/Conventional Type Push button Station	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
8.10.02	Mosaic Type Push button Station with LED Indication	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
8.10.03	Mosaic Type LED Indication Station	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
8.10.04	Simaphore Indicator	2(two)Nos. each type
8.10.05	Annunciation System	
(i)	Each type of PCB (for non-PLC driven system)	1(one) No. each
(ii)	Lamp Box with Facia & Lamps (LED type)	10(ten)Nos.
(iii)	Hooter	1(one) No.
8.11.00	Thermocouple for Furnace Temperature Probes	2Nos.
8.12.00	Mill and Air Heater Fire Detection System	
8.12.01	Thermocouple	10% or 1 no. whichever is more
8.12.02	Process Actuator Switches	10% or 1 no. whichever is more





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Annexure-I

Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
7.12.00	Control Panel/Desk Mounted Items	
7.12.01	Push Button Complete assembly	10Nos for each colour
7.12.02	Push Button Contact Element (1NO + 1NC) Block	20Nos.
7.12.03	Selector Switch	10Nos. for each type and rating
7.12.04	Meter (Analog and Digital)	
(i)	Ammeter	2Nos. for each type and range
(ii)	Voltmeter	2Nos. for each type and range
(iii)	Frequency	2Nos. for each type and range
(iv)	MW	2Nos. for each type and range
(v)	MVAR	2Nos. for each type and range
(vi)	Power Factor	2Nos. for each type and range
(vii)	Synchroscope	1No. for each type and range
(viii)	Synchrocheck Relay complete set	1No. for each type and range
(ix)	Transducer	1No. for each type and range
7.12.05	Indicating Lamps complete assembly	20Nos. for each Colour and type
7.12.06	Mimic Lamps	10Nos. for each Colour and type
7.12.07	MCB	5Nos. for each type and rating
7.12.08	Door Limit Switch	5Nos.
7.12.09	Annunciation system	
(i)	Lamp Box with Facia & Lamps (LED type)	25Nos.
(ii)	Hooter	1No.
(iii)	Each type of PCB (for non-PLC driven system)	1(one) no.
7.13.00	Actuator	
7.13.01	Complete set of Actuator	2Nos. for each type, make and rating, 1 no. for H2 cooler Temperature controller and 1 no. for stator water temperature controller
7.13.02	Power Unit for Modulating Actuator	4Nos. of each type






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Annexure-I

Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
7.13.03	DC-DC Power Pack Unit	4Nos. of each type
7.13.04	Electronic cards	4Nos. of each type
7.13.05	Position Feed Back Transmitters	4Nos. of each type
7.13.06	Control Unit	4Nos. of each type
7.13.07	Limit Switch Assembly	2 Nos each type and rating
7.13.08	Torque Switch Assembly	2 Nos each type and rating
7.13.09	Power Contactor	5Nos. for each type and rating
7.13.10	Auxiliary Contactor	5Nos. for each type and rating
7.13.11	Thermal Over Load Relay	2Nos. for each type and rating
7.13.12	Motor	1No. each type and rating
7.13.13	Complete Seal kit	2Sets for each type and rating
7.13.14	Complete O-Ring Set	2Sets for each type and rating



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	1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	SECTION: C SUB SECTION : C&I
	C&I SPECIFICATION FOR MILL REJECT SYSTEM	
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EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase – III

Annexure-I

“The Vendor list as included is not exhaustive and prepared from prior experience of WBPDCL. In case of items not covered in the list or if the bidder seeks additional vendor on the items already covered in the list, the same should be done with proper written request for approval from WBPDCL enclosing the vendor credentials. Maximum effort should be exercised to include only such proven vendors who are already registered in the Bidder’s Vendor directory and the bidder has prior experience of supply items from such reputed vendors.”





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

Annexure-I

Sl. No.	Item Description	Vendor Name	
	(CENTRIFUGAL)FOR TDBFP	2	KIRLOSKAR EBARA, KIRLOSKARWADI
		3	SULZER, MUMBAI.
27.	LUBE OIL PUMPS (SCREW TYPE) FOR TDBFP	1	ALLWEILER, GERMANY
		2	IMO PUMP, USA
		3	TUSHACO, DAMAN
		4	LEISTRITZ (EMPIRE), GERMANY
28.	JACKING OIL PUMP TDBFP	1	TUSHACO, (DELTA CORP)
		2	HAGULLAND DENSION
29.	SCANNER AIR FAN	1	M/S.C.DOCTOR & CO.PVT.LTD.
		2	M/S PATELS AIRFLOW LTD.
		3	M/S.AIR CONTROL & CHEMICAL ENGG. CO.LTD.
30.	FLOW ELEMENTS	1	MICRO PRECISION PRODUCTS
		2	M/S ESPL KOLKATA
		3	IL PALGHAT
31.	OIL PURIFICATION UNIT (OIL CENTRIFUGE)/PORTABLE OIL PURIFIERS	1	PENNWALT LIMITED, INDIA
		2	ALFA LAVAL LIMITED, INDIA
		3	SERVIZE INDUSTRIAL, ITALY
32.	ELECTRICAL HOIST	1	AVON CRANES PVT.LTD.
		2	LIFTING EQUIPMENTS & ACCESSORIES
		3	REVA INDUSTRIES LTD
		4	CONSOLIDATED HOIST PVT LTD
		5	TUOBRO FURGUSON(INDIA)PVT.LTD
		6	HERCULES HOISTS LTD.
		7	DYNAMECH CRANES (P) LTD.
		8	UNIVERSAL HOIST – O- FABRIK
		9	ARMSEL MHE PVT.LTD
33	CHAIN PULLEY BLOCK	1	ARMSEL MHE PVT LTD
		2	LIFTING EQUIPMENT & ACCESPROES
		3	UNIVERSAL HOIS –O-FABRIK
		4	HERCULES HOISTS LTD.
		5	TUOBRO FURGUSON(INDIA)PVT.LTD
34	DOUBLE GIRDER EOT CRANE ABOVE 50T TO 150T (TG/GT HALL & OTHER AREAS)	1	HEAVY ENGG. CORPORATION LTD.
		2	MUKAND LIMITED,
		3	THE TATA IRON & STEEL CO.LTD
		4	UNIQUE INDUSTRIAL HANDLERS PVT.LTD
		5	WMI CRANES LTD.
		6	FURNACE & FOUNDRY EQUIPMENT





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

Annexure-I

Sl. No.	Item Description	Vendor Name
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83	LOCAL STARTER PANEL, LOCAL CONTROL PANEL, LIGHTING PANEL, ACELP, DCELP	1	PYROTECH
		2	L&T
		3	CONTROL DEVICE
		4	SCHNEIDER





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

Annexure-I

Sl. No.	Item Description	Vendor Name	
85	ACTUATOR	1	AUMA
		2	LIMITORQUE
86	CABLE for ROLLED -E-CHAIN	1	IGUS
87	CABLE GLAND	1	SUNIL & COMPANY
		2	ARUP ENGG. & FOUNDRY WORKS
		3	COMMET BRASS PRODUCTS
		4	ELECTROMAC INDUSTRIES
		5	BALIGA LIGHTING EQPT.
88	BAY CONTROL UNIT	1	ALSTOM
		2	SIEMENS
		3	ABB
89	TRANSFORMER BUSHING	1	ABB
		2	AREVA
		3	ALSTOM
		4	BHEL
90	EARTH LEAKAGE CB	1	SCHNEIDER
		2	L&T
		3	SIEMENS
		4	ABB
91	EARTH LEAKAGE RELAY [ELR] ALONG WITH CBCT	1	AREVA
		2	PRO'KDEVICES
92	PUSH BUTTON	1	BCH
		2	L&T
		3	SCHNEIDER
		4	SIEMENS
		5	TECKNIC CONTROL
		6	GE – POWER
		7	ABB
93	RELAYS (OTHER THAN INTERPOSING & NUMERICAL RELAYS)	1	ABB
		2	AREVA
		3	SIEMENS
		4	GE – POWER
		5	ALSTOM
94	ENERGY MANAGEMENT SYSTEM	1	SCHNEIDER
		2	SECURE





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

Annexure-I

Sl. No.	Item Description	Vendor Name	
CONTROL & INSTRUMENTATION SYSTEM VENDORS			
1	DISTRIBUTED CONTROL SYSTEM	1	ABB
		2	HONEYWELL
		3	EMERSON
		4	VALMET (FORMERLY METSO)
2	PLC (Programmable Logic Controller)	1	ROCKWELL AUTOMATION INDIA LTD.
		2	GE
		3	SCHNEIDER ELECTRIC INDIA PVT.LTD.
3	DIGITAL INDICATOR	1	ABB
		2	GOSSEN / CAMILLE BAUER / METRAWATT
		3	YOKOGAWA
4	VERTICAL MOVING COIL INDICATOR	1	ABB
		2	GOSSEN
		3	CAMILLE BAUER
		4	METRAWATT
		5	YOKOGAWA
5	TRANSDUCERS	1	SIEMENS
		2	ABB
		3	CAMILLEBAUER
		4	ELSTER
		5	PYROTECH
		6	SOUTHERN TRANSDUCERS
		7	ADEPT
6	LARGE VIDEO SCREEN	1	BARCO
		2	PLANAR
7	PC	1	DELL
8	TFT MONITOR	1	DELL
		2	HP
		3	IBM-LENOVO
9	DOT MATRIX PRINTERS	1	EPSON
		2	TVS
10	PRINTERS (LASER)	1	HP
		2	IBM
11	COMPUTER FURNITURE	1	ADARSH CONTROLS
		2	COSMOS MEDIA
		3	FEATHER LITE
		4	GODREJ
		5	OTS





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

Annexure-I

Sl. No.	Item Description	Vendor Name	
		6	PYROTECH
12	CONTROL PANEL/RACK	1	PYROTECH
		2	RITTAL
13	PRESSURE GAUGES	1	A. N. INSTRUMENTS PVT. LTD.
		2	ASHCROFT INDIA
		3	GENERAL INSTRUMENTS CONSORTIUM
		4	MANOMETER (INDIA) PVT.LTD
		5	WIKA
		6	FORBES MARSHALL LTD.
		7	GLUCK (INDIA) MFG.CO.
		8	WAAREE INDUSTRIES
		9	BUDENBERG GAUGE CO. LTD.
14	PRESSURE SWITCHES	1	ASHCROFT INDIA
		2	INDFOS INDUSTRIES LTD.
		3	SOR INC.
		4	SWITZER INSTRUMENT CO.
		5	TRAFAG-INDIA
		6	DELTA CONTROLS LTD.
15	ELECTRONIC TRANSMITTER	1	EMERSON PROCESS
		2	HONEYWELL
		3	YOKOGAWA
		4	FUJI
16	TEMPERATURE GAUGE	1	A. N INSTRUMENTS PVT. LTD.
		2	ASHCROFT INDIA
		3	GENERAL INSTRUMENTS CONSORTIUM
		4	GOA THERMOSTATIC INSTUMENTS
		5	WIKA
		6	FORBES MARSHALL
		7	WAREE
17	TEMPERATURE SWITCH	1	GENERAL INSTRUMENTS CONSORTIUM
		2	INDFOS INDUSTRIES LTD.
		3	SWITZER INSTRUMENT CO.
		4	AN INSTRUMENTS
18	TEMPERATURE ELEMENT	1	DETRIVE
		2	GENERAL INSTRUMENS CONSORTIUM





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

Annexure-I

Sl. No.	Item Description	Vendor Name	
		3	INDUSTRIAL INSTRUMENTS
		4	PYRO ELEC INSTRUMENTS GOA P. LTD.
		5	TEMPSENS INSTRUMENTS (I) PVT. LTD.
19	ROTA METER	1	EUREKA
		2	FLUIDYNE INSTRUMENTS
		3	IEPL
		4	PLACKA INSTRUMENTS INDIA PVT. LTD.
		5	TRAC
20	SIGHT FLOW INDICATOR	1	CHEMTROLS SAMIL
		2	LEVCON INSTRUMENTS PVT. LTD.
		3	V.AUTOMAT & INSTRUMENTS PVT LTD.
		4	FORBES MARSHALL LTD.
21	FLOW SWITCH	1	GENERAL INSTRUMENTS CONSORTIUM
		2	KROHNE MARSHALL
		3	SWITZER INSTRUMENT CO.
22	IMPACT HEAD TYPE ELEMENT	1	DETREICH / EMERSON PROCESS
		2	MIDWEST
		3	STARMECH
		4	SWITZER INSTRUMENT CO.
		5	VERIS INC.
23	LEVEL GAUGE	1	CHEMTROLS ENGG. (P) LTD.
		2	LEVCON INSTRUMENTS (P) LTD.
		3	S. B. ELECTRO-MECHANICALS PVT. LTD.
		4	V. AUTOMAT & INSTRUMENTS PVT. LTD.
		5	DK INSTRUMENTS
		6	SIGMA INSTRUMENTS COMPANY
24	LEVEL SWITCH (FLOAT TYPE)	1	CHEMTROLS
		2	MAGNETROL INTERNATIONAL NV
		3	DK INSTRUMENTS
		4	LEVCON INSTRUMENTS P LTD.
25	LEVEL SWITCH (CONDUCTIVITY TYPE)	1	LEVEL STATE, UK
		2	SOLARTON/MOBREY, UK
		3	YARWAY
26	LEVEL SWITCH	1	ENDRESS + HAUSER





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

Annexure-I

Sl. No.	Item Description	Vendor Name	
	(CAPACITANCE TYPE)	2	DK INSRTUMENTS
27	LEVEL SWITCH (DISPLACEMENT TYPE)	1	DRESSER VALVES INDIA LTD.
		2	CHEMTROLS
		3	DK INSRTUMENTS
		4	ECKARDT
28	LEVEL TRANSMITTER (ULTRASONIC TYPE)	1	EMERSON PROCESS
		2	ENDRESS + HAUSER
		3	SIEMENS MIL TRONICS
		4	VEGA
29	LEVEL TRANSMITTER (RADAR Type)	1	ENDRESS + HAUSER
		2	VEGA
30	BUNKER/SILO LEVEL 3D MONITORING (ULTRASONIC TYPE)	1	E & H
		2	SIEMENS
		3	VEGA-GERMANY
31	VIBRATION MONITORING SYSTEM /TURBINE SUPERVISORY MONITORING SYSTEM	1	GE (for BENTLY NEVADA SYSTEM)
		2	MEGGIT
		3	SHINKAWA, JAPAN
32	MERCURY MONITORING	1	DURAG GMBH AND CO KG
		2	SICK
		3	SHINKAWA
33	Dust Density Monitor	1	CODEL INTERNATIONAL LTD.
		2	DURAG GMBH AND CO KG
		3	LAND INSTRUMENTS INTERNATIONAL
		4	SICK GMBH
34	CO Analyzer (in situ type)	1	CODEL INTERNATIONAL LTD.
		2	LAND INSTRUMENTS INTERNATIONAL
		3	SICK GMBH
35	Oxygen Analyzer (Zirconia Probe type)	1	EMERSON PROCESS MANAGEMENT
36	SO ₂ -NO _x /CO/CO ₂ Analyzer(Insitu Type)	2	CODEL INTERNATIONAL LTD
		3	PROCAL
		4	SICK GMBH
37	SWAS system (with selected analysers from Rosemount Analytical / Hack Ultra-France, Orion – USA, Hach-USA. ABB – UK, Polymetron- France/Zeltwegger -Analyticals)	1	ABB LTD.
		2	EMERSON PROCESS MANAGEMENT INDIA PVT.
		3	FORBES MARSHALL
38	DUST MONITOR	1	SIEMENS MILLTRONICS





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

Annexure-I

Sl. No.	Item Description	Vendor Name	
		2	FILTER SENSE
		3	BIN MASTER
39	PULSE JET CONTROLLER	1	SWITCHING CIRCUIT
		2	ADVANCE CONCEPT
		3	VOLTCRAFT
		4	SQUARE M
		5	MICRO SYSTEM
40	AIR FILTER REGULATOR	1	JRU INSTRUMENTS (Formerly PLACKA)
		2	SHAVO NORGREN (INDIA) PVT. LTD.
41	ELECTRO PNEUMATIC CONTROLLER	1	MTL INDIA PVT. LTD.
		2	WATSON SMITH LTD.
		3	FAIRCHILD
42	SMART POSITIONER	1	EMERSON PROCESS MANAGEMENT
		2	SIEMENS
		3	ABB
43	SOLENOID VALVE	1	ASCO (I) LTD.
		2	ROTEX AUTOMATION LTD.
		3	NUCON INDUSTRIES PVT LTD
46	INSTRUMENTATION CONTROL CABLE/ COMPENSATING CABLE / THERMOCOUPLE EXTENSION CABLES	1	ADVANCE CABLES TECHNOLOGIES
		2	CORDS CABLE INDUSTRIES PVT. LTD.
		3	DELTON CABLES LTD.
		4	HAVIA CABLES
		5	KEI INDUSTRIES LTD.
		6	KERPEN CABELS



**WBPDCL**

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

Annexure-I

Sl. No.	Item Description	Vendor Name
		7 LAPP CABLES
		8 NICCO CABLE
		9 POLYCAB WIRES PVT.LTD
		10 THERMO CABLES LTD.
		11 THERMO ELECTRIC
		12 UNIVERSAL CABLES LTD.





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

Annexure-I

Sl. No.	Item Description	Vendor Name	
53	PUBLIC ADDRESSING SYSTEM (ANALOG SYSTEM)	1	BOSCH SECURITY SYSTEMS
		2	STENTOFONE (from ZENITAL GROUP)
	PUBLIC ADDRESSING SYSTEM (IP ADDRESSABLE)	3	INDUSTRONIC
		4	COMMEND
54	EPABX	1	ABB INDIA PVT. LTD.
		2	BPL TELECOM PVT. LTD.
		3	CROMPTON GREAVES LTD.
		4	HCL INFINET LTD.
		5	SIEMENS LTD
		6	ABC INDIA PVT LTD.
55	CCTV System	1	BOSCH
		2	HONEYWELL
		3	PELCO
56	LIE/LIR	1	CHEMIN CONTROLS
		2	ELECTRONICS CORP. OF INDIA LTD.
		3	PYROTECH
		4	FORBES MARSHAL
		5	INSTRUMENTATION LIMITED
		6	PRAMMEN INDUSTRIES
57	CONDENSATE POTS	1	FLOWTECH
		2	INSTRUMENTATION LIMITED
		3	PRECISION ENGG INDUSTRIES
		4	BALDOTA VALVE AND FITTING CO. PVT LTD.
		5	METPRESS ENGINEERING WORKS
		6	MICROPRECISION
58	IMPULSE PIPES	1	BHARAT HEAVY ELECTRICALS LTD.
		2	INDIA SEAMLESS METAL TUBES LTD. (only for CS Pipes)
		3	JINDAL SAW PIPES LTD.
		4	MAHARASHTRA SEAMLESS (only for CS Pipes)
		5	MANNESMANN AG
		6	SUMITOMO CORPORATION
		7	TPS TECHNITUBE ROHREN WERKE GMBH
		8	TROUVAY CAUVIN GULF E.C. DUBAI
		9	BALDOTA VALVE AND FITTING CO. PVT. LTD.



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

Annexure-I

Sl. No.	Item Description	Vendor Name	
		10	BHARAT HEAVY ELECTRICALS LTD.
		11	EXCEL HYDRO – PHEUMATICS PVT. LTD.
		12	INSTRUMENTATION LTD.
		13	METPRESS ENGINEERING WORKS
		14	MAHALAKSHMI SEAMLESS
		15	RATNAMANI METALS & TUBES LTD.
59	INSTRUMENT VALVES / MANIFOLDS	1	BHARAT HEAVY ELECTRICALS LTD.
		2	BALDOTA VALVE AND FITTING CO PVT LTD.
		3	INSTRUMENTATION LIMITED
		4	METPRESS ENGINEERING WORKS
		5	EXCEL HYDRO-PNEUMATICS PVT. LTD.
		6	METPRESS ENGINEERING WORKS
		7	FLOWTECH
60	COMPRESSION FITTINGS	1	PARKER HANNIFIN
		2	PRECISION ENGG INDUSTRIES
		3	TROUVAY & CAUVIN
		4	HOKE (TECHNICAL PARTS CO. MUMBAI)
		5	SWAGELOCK
		6	METPRESS ENGINEERING WORKS
61	SOCKET WELD FITTINGS	1	EXCEL HYDRO-PNEUMATICS PVT. LTD.
		2	METPRESS ENGINEERING WORKS
		3	V.K. INDUSTRIES
		4	VIKAS INDUSTRIAL PRODUCTS
		5	BALDOTA VALVE AND FITTING CO PVT LTD.
		6	FLOWTECH
FIRE DETECTION AND HYDRANT SYSTEM VENDORS			
1	HYDRANT VALVES	1	SHAH BHOGILAL
		2	SUKAN
		3	NEWAGE
		4	VENUS
		5	WINCO
2	FIRE HOSES	1	NEWAGE
		2	CHATTARIA RUBBER
3	WATER MONITOR & WATER-	1	SHAH BHOGILAL



389490/2021/PS-PEM-MAX

PACKAGE WISE REGISTERED SUPPLIER LIST (PERMANENT CATEGORY) AS ON 7/19/2021 2:41:14 PM

Sl No	Package Code	Package Name	Supplier Communication Address	Supplier Works Address
207	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	S.No. 36/1/1, Sinhgad Road, Vadgaon Khurd, Near Lokmat Press, Pune, Phone- 020-24393577, Pincode : Email : pressure@vsnl.com,	
208	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, -Kalol-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh.parmar@ashcroftindia.com
209	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Mr. V S Jayaprakash, 128, SIDCO North Phase, Ambattur Estates CHENNAI Phone- 044-26252017/2018 Pincode : 600050 Email : sales@switzerprocess.co.in	Works-1->C S Shankar 127, Sidco North Phase, Ambattur Estates, -CHENNAI-TAMIL NADU INDIA Phone- 8754491904 FAX : 044-26248849 Pincode : 600050 Email : cservice@switzerinstrument.com
210	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 02764-233682 Pincode : 382729 Email : Nishit.patel@ashcroftindia.com	
211	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	Works-1->LARRY DEGARMO/ ROY STUMBROUGH 14685 W. 105TH STREET, LENEXA -KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com
212	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Mr. Amarendra Kulkarni 194/195, Gopi Tank Road, Off. Pandurang Naik Marg, Mahim Mumbai Phone- 9323195251 Pincode : 400016 Email : amarendra@general-gauges.com	
213	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Michael Weileder Dorn Assenheimer, Strasse 27 Reichelsheim Phone- +91-9999107840 Pincode : D-61203 Email : msingh@barksdale.de	
214	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	B-20-21, INDUSTRIAL AREA, MEERUT ROAD, GHAZIABAD Phone- 0120-2712016 Pincode : Email : mktg@indfos.com	
215	145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	MR.L.C.VENKATRANGAN/MR.B.KANNAN New No.17, II Floor, Adwave Towers, Dr.Sevallia Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email : delhi@indfos.com	
216	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	MR SAILESH PATALAY/MR. M K SRINIVASAN PLOT NO.A-19/2, & T-4/2, IDA, NACHARAM, HYDERABAD Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com	Works-1->MR G.SRINIVASAN/MR ANUJ MALPANI PLOT NO:A-19/2 & T-4/2,I.DA. NACHARAM, -HYDERABAD-TELANGANA INDIA Phone- 09866550762 FAX : 040 27152193 Pincode : 560076 Email :
217	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, -Kalol-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh.parmar@ashcroftindia.com
218	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 A GIDC A Phase 1, VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
219	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode : 560022 Email : info@hgurusouth.com	Works-1->Shikha Hazra/ Shyamal Hazra 32, Industrial Suburb,Yeshwanthpur -BANGALORE-KARNATAKA INDIA Phone- 080-23370300 FAX : 080-23379890 Pincode : 560022 Email : shikahazra@hgurusouth.com
220	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Mr. G. D. Hazra/ Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net	Works-1->NA NA -- Phone- FAX : Pincode : Email :
221	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,	Works-1->Gauge Bourdon India Pvt. Ltd., Plot No-4, 5, 6,Jawahar Co-operative Industrial Estate, -Kalamboli Taluka Panvel-MAHARASHTRA India Phone- 022-27421095, FAX : 022-27421901, Pincode : 410209, Email : info@general-
222	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in	Works-1->Mr. Gautam Mukherjee Kusumba,Sonarpur Station Road,P.O. -Narendrapur, -Kolkata-WEST BENGAL INDIA Phone- 9836878855 FAX : 033-24342748 Pincode : 700103 Email : gkm_ani@hotmail.com
223	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Mr. Partha Bose 44, Saheed Hemanta Kumar Bose, Sarani, Kolkata Phone- +91 33 2548 7220 Pincode : 700074 Email : parthabosebpi@gmail.com; bousepanda@vsnl.net	Works-1->Mr. Partha Bose 44, Saheed Hemanta Kumar Bose,Sarani, -Kolkata-WEST BENGAL INDIA Phone- +91 33 2548 7220 FAX : +91 33 2548 0429, Pincode : 700074 Email : parthabosebpi@gmail.com bousepanda@vsnl.net
224	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
225	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	26/2, G Type, Global Industrial Park Near Nahuli Railway Crossing, Valvada Vapi Phone- 9920576002 Pincode : 396105 Email : sales@nesstech.co.in	Works-1-> Others 26/2, G Type, Global Ind. Park Near Nahuli Railway Crossing, -Vapi-GUJARAT INDIA Phone- 9920576002 FAX : Pincode : 396105 Email : sales@nesstech.co.in, bkapadia@nesstech.co.in
226	145-10000-A	TEMPERATURE GAUGE	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 A GIDC A Phase 1, VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
227	145-10000-A	TEMPERATURE GAUGE	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, -Kalol-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh.parmar@ashcroftindia.com
228	145-10000-A	TEMPERATURE GAUGE	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,	Works-1->Gauge Bourdon India Pvt. Ltd., Plot No-4, 5, 6,Jawahar Co-operative Industrial Estate, -Kalamboli Taluka Panvel-MAHARASHTRA India Phone- 022-27421095, FAX : 022-27421901, Pincode : 410209, Email : info@general-
229	145-10000-A	TEMPERATURE GAUGE	Mr. G. D. Hazra/ Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net	Works-1->NA NA -- Phone- FAX : Pincode : Email :
230	145-10000-A	TEMPERATURE GAUGE	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode : 560022 Email : info@hgurusouth.com	Works-1->Shikha Hazra/ Shyamal Hazra 32, Industrial Suburb,Yeshwanthpur -BANGALORE-KARNATAKA INDIA Phone- 080-23370300 FAX : 080-23379890 Pincode : 560022 Email : shikahazra@hgurusouth.com
231	145-10000-A	TEMPERATURE GAUGE	FLAT -B , GF, HILL CROWN APTS., COLLEGE ROAD, MAPUSA Phone- Pincode : 403525 Email : gtilworks@pyro-electric.in	Works-1->Mrs Saarni Naik BICHOLIM, -BICHOLIM-GOIA INDIA Phone- 9595855152 FAX : Pincode : 403 529 Email : saarni.naik@thermostatic.in
232	145-10000-A	TEMPERATURE GAUGE	D2/5, Mapusa Industrial Estate, Mapusa, Goa, Phone- 09326054551, Pincode : 403507, Email : sumukh@goainstruments.com,	Works-1->Mr. S.G. Dixit D2/5, Mapusa Industrial Estate, -Mapusa-GOIA INDIA Phone- 09326054551 FAX : 0832-2262331 Pincode : 403 507 Email : sumukh@goainstruments.com
233	145-10000-A	TEMPERATURE GAUGE	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in	Works-1->Mr. Gautam Mukherjee Kusumba,Sonarpur Station Road,P.O. -Narendrapur, -Kolkata-WEST BENGAL INDIA Phone- 9836878855 FAX : 033-24342748 Pincode : 700103 Email : gkm_ani@hotmail.com
234	145-10000-A	TEMPERATURE GAUGE	MR SAILESH PATALAY/MR. M K SRINIVASAN PLOT NO.A-19/2, & T-4/2, IDA, NACHARAM, HYDERABAD Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com	Works-1->MR G.SRINIVASAN/MR ANUJ MALPANI PLOT NO:A-19/2 & T-4/2,I.DA. NACHARAM, -HYDERABAD-TELANGANA INDIA Phone- 09866550762 FAX : 040 27152193 Pincode : 560076 Email :
235	145-11000-A	LEVEL GAUGE	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com	
236	145-11000-A	LEVEL GAUGE	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	Works-1->Mr. Bharat Kumar/ Mr. Sasi Kumar Plot No. 92B & 93B,Sec-V, IMTManesar -GURGAON-HARYANA INDIA Phone- 0124-4366000 TO 9 FAX : 0124-2290884 Pincode : 122002 Email : bharat@blissanand.com
237	145-11000-A	LEVEL GAUGE	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
238	145-12000-A	FLOW ELEMENT	MR. ANTONIO NOVIELLO/Mrs. Enrica Bazzocci VIA DELLE INDUSTRIE, 36 CREMONA Phone- 39037221574 Pincode : 26100 Email : info@imtecromatic.com	Works-1->Mrs. Enrica Bazzocchi VIA DELLE INDUSTRIE, 36, -CREMONA- Italy Phone- 39037221574 FAX : 39037228318 Pincode : 26100 Email : sales@imtecromatic.com

389490/2021/PS-PEM-MAX

PACKAGE WISE REGISTERED SUPPLIER LIST (PERMANENT CATEGORY) AS ON 7/19/2021 2:41:14 PM

Sl No	Package Code	Package Name	Supplier Communication Address	Supplier Works Address
239	145-12000-A	FLOW ELEMENT	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE Phone- 02026970450 Pincode : 411028 Email : marketing@starmech.net	Works-1->VIVEK GOTE/ MAHUNDR BANSODE Sr no.54, Plot No.II0,Swami VIVEkanand Industrial Est.,HADAPS -PUNE-MAHARASHTRA INDIA Phone- 02026970450 FAX : 02026970470 Pincode : 411028 Email :
240	145-12000-A	FLOW ELEMENT	KANJIKODE WEST, PALALKKAD, PALAKKAD Phone- 2566127-130,2567128 Pincode : 678623 Email : icvdlil@gmail.com;fa2@ilpigt.com	
241	145-12000-A	FLOW ELEMENT	Mr. Anil Bhatl, H.B. No.-40, Revenue Estate, Village-Dudhola,Tehsil & Distt. Palwal FARIDABAD Phone- 9560742713;095607427 Pincode : 121002 Email : anil.bhatl@wika.com	
242	145-13000-A	TEMP. ELEMENT	26/2, G Type, Global Industrial Park Near Nahuli Railway Crossing, Valvada Vapi Phone- 9920576002 Pincode : 396105 Email : sales@nesstech.co.in	Works-1-> Others 26/2, G Type, Global Ind. Park Near Nahuli Railway Crossing, -Vapi-GUJARAT INDIA Phone- 9920576002 FAX : Pincode : 396105 Email : sales@nesstech.co.in, bkpadia@nesstech.co.in
243	145-13000-A	TEMP. ELEMENT	320, TV INDUSTRIAL ESTATE, OFF.DR.A.BESANT ROAD, BEHIND GLAXO, WORLI, MUMBAI Phone- 24934125,24938403 Pincode : 400025 Email : trivtech@vsnl.com	Works-1->Mr. A.D.Solomon J-14, MIDC, TARAPORE, BOISER STN., -THANE-MAHARASHTRA India Phone- FAX : Pincode : Email : trivtech@vsnl.com
244	145-13000-A	TEMP. ELEMENT	Mr. Raghavendra M. Kulkarni 194/195, Gopi Tank Road Behind Citylight Cinema,Mahim Mumbai Phone- 09322664709 Pincode : 400016 Email : ramk@gicoinindia.com	Works-1->Mr. Raghavendra M. Kulkarni Survey No. 250A/B, Post-Mangaon,Tal.-Kudal, Dist.- Sindhudurg, --MAHARASHTRA India Phone- 09322664709 FAX : 022-24455026 Pincode : 416519 Email : ramk@gicoinindia.com
245	145-13000-A	TEMP. ELEMENT	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 A GIDC A Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
246	145-13000-A	TEMP. ELEMENT	M. D. BICHU/R. M. BICHU G.B, HILL CROWN APARTMENTS, COLLEGE ROAD, MAPUSA Phone- 9326114601 Pincode : 403507 Email : priyanka.marketing@pyro-electric.in	Works-1->A A KULKARNI/ VINOD C G PLOT NO. 71,BICHOLIM INDUSTRIAL ESTATE -BICHOLIM-GOA INDIA Phone- 9326114409 FAX : 91 832 2363381 Pincode : 403529 Email : pyroworks@pyro-electric.in
247	145-13000-A	TEMP. ELEMENT	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,	Works-1->Gauge Bourdon India Pvt. Ltd., Plot No-4, 5, 6,Jawahar Co-operative Industrial Estate, -Kalamboli Taluka Panvel-MAHARASHTRA India Phone- 022-27421095, FAX : 022-27421901, Pincode : 410209, Email : info@general-
248	145-13000-A	TEMP. ELEMENT	D2/5, Mapusa Industrial Estate, Mapusa, Goa, Phone- 09326054551, Pincode : 403507, Email : sumukh@goainstruments.com,	Works-1->Mr. S.G. Dixit D2/5, Mapusa Industrial Estate, -Mapusa-GOA INDIA Phone- 09326054551 FAX : 0832-2262331 Pincode : 403 507 Email : sumukh@goainstruments.com
249	145-13000-A	TEMP. ELEMENT	Industrial Estate, Makhapura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,	Works-1-> Khasra No.: 218-230& 235, Industrial Estate,Makhapura, -Ajmer-RAJASTHAN India Phone- 9887865856, FAX : 0145-2695174, Pincode : 305002, Email : rajeev.gupta@tipl.com
250	145-13000-A	TEMP. ELEMENT	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
251	145-13000-A	TEMP. ELEMENT	MR. V.P.RATHI/MR. HEMANT RATHI B-188A ROAD NO.5 , M.I.A UDAIPUR Phone- 09352420069 Pincode : 313003 Email : info@tempsens.com	Works-1->Mr. S.D Deval B-188A ROAD NO.5 ,M.I.A -UDAIPUR-RAJASTHAN INDIA Phone- 9352501530 FAX : 0294-3057750 Pincode : 313003 Email : deval@tempsens.com
252	145-14000-A	TRANSMITTERS	MR. RAJIV GOVIL 14, MATHURA ROAD, FARIDABAD Phone- 09971085678 Pincode : 121003 Email : vipin.swami@in.abb.com	
253	145-14000-A	TRANSMITTERS	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011-26819440 Pincode : 110 020 Email : production@vautomat.com
254	145-14000-A	TRANSMITTERS	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com	
255	145-14000-A	TRANSMITTERS	PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, BANGALORE, Phone- 080-41586000, Pincode : Email : uday.shankar@in.yokogawa.com,	Works-1-> PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, -BANGALORE-KARNATAKA INDIA Phone- 080-41586000, FAX : 080-28521442, Pincode : Email : uday.shankar@in.yokogawa.com
256	145-14000-A	TRANSMITTERS	Industrial Estate, Makhapura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,	Works-1-> Khasra No.: 218-230& 235, Industrial Estate,Makhapura, -Ajmer-RAJASTHAN India Phone- 9887865856, FAX : 0145-2695174, Pincode : 305002, Email : rajeev.gupta@tipl.com
257	145-14000-A	TRANSMITTERS	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in	Works-1->MR. MOHAN PADWAL 691A/2,BIBWEWADI INDL ESTATE -PUNE-MAHARASHTRA INDIA Phone- 918600042374 FAX : 912024215670 Pincode : 411037 Email : vm@sbem.co.in
258	145-14000-A	TRANSMITTERS	Mr. Prakash Vaghela 215-216, DLF Tower 'A', Jasola District Centre, New Delhi, Phone- 9717593001, Pincode : 110025, Email : prakash.vaghela@in.endress.com,	Works-1-> M-171 to 173, MIDC, Waluj, -Aurangabad-MAHARASHTRA India Phone- 9881000474, FAX : 0240-2555179, Pincode : 431136, Email : Narendra.Kulkarni@wetzler.endress.com
259	145-14000-A	TRANSMITTERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,	Works-1->Mr. Santosh Shukla Others R-628, TTC Industrial Area, MIDC Rabale, -Navi Mumbai-MAHARASHTRA India Phone- 9821350761, FAX : 022-27695559, Pincode : 400701, Email : sales@panamengineers.com
260	145-14000-A	TRANSMITTERS	Leonard.W. Moore/ Matt Moren 16650 Schoenborn St. North Hills Phone- +1 818 830 5548 Pincode : 91343 Email : mmoren@milinet.com	Works-1->Matt Moren/Gina Cruz 16650 Schoenborn St., North Hills -CALIFORNIA- USA Phone- +1 818 894 7111, ext FAX : +1 818 830 5588 Pincode : 91343 Email : gcruz@milinet.com
261	145-14000-A	TRANSMITTERS	Mr. Amit Patthankar/Vikram Raj Singh 206-210,BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI Phone- 9619121500 Pincode : 400051 Email : vikramraj.singh@emerson.com	Works-1->Kalpesh Chandan/Hrishikesh Aghor Plot No. A 145/4 TTC IND AREA,MIDC, PAWANE, -NAVI MUMBAI-MAHARASHTRA INDIA Phone- 9619688001 FAX : 022-66736000 Pincode : 400 705 Email :
262	145-14000-A	TRANSMITTERS	Mr. Praveen Toshniwal 104-115, Electronic Complex, Indore Phone- 0731-4081305 Pincode : 452010 Email : sales@nivocontrols.com	Works-1->Mr. S.L Sadani Others 104 - 115,Electronic Complex -Indore-MADHYA PRADESH INDIA Phone- 0731-4081307 FAX : Pincode : 452010 Email : sales@nivocontrols.com;sadanis@nivocontrols.com
263	145-14000-A	TRANSMITTERS	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com	Works-1->Ankit Varshney Kalwa Works, Thane-Belapur Road, Thane, -MUMBAI-MAHARASHTRA INDIA Phone- FAX : Pincode : 400708 Email :
264	145-14000-A	TRANSMITTERS	Mr. Ritwij Kulkarni 917, INTERNATIONAL TRADE TOWER, NEHRU PLACE, NEW DELHI Phone- 9890200584 Pincode : 110019 Email : rajesh.chaudhary@honeywell.com	Works-1->Mr.Kedar Tillu 53, 54, 56 & 57,Hadapsar Industrial Estate -PUNE-MAHARASHTRA INDIA Phone- 9665034625 FAX : 020 66039905 Pincode : 411013 Email : kedar.tillu@honeywell.com
265	145-14000-A	TRANSMITTERS	Agents: Digital Electronic Ltd. 74/11 'C' Cross Road MIDC Andheri (East) MUMBAI Phone- 28208477 Pincode : 400093 Email : corp@delbby.rpgms.ems.vsnl.net.in	
266	145-15000-A	TEMPERATURE SWITCH	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 02764-233682 Pincode : 382729 Email : Nishit.patel@ashcroftindia.com	
267	145-15000-A	TEMPERATURE SWITCH	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com	
268	145-15000-A	TEMPERATURE SWITCH	MR.L.C.VENKATRANGAN/MR.B.KANNAN New No.17, II Floor, Adwawe Towers, Dr.Sevallia Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email : delhi@indfos.com	
269	145-15000-A	TEMPERATURE SWITCH	Mr. V S Jayaprakash, 128, SIDCO North Phase, Ambattur Estates CHENNAI Phone- 044-26252017/2018 Pincode : 600050 Email : sales@switzerprocess.co.in	Works-1->C S Shankar 127, Sidco North Phase, Ambattur Estates, -CHENNAI-TAMIL NADU INDIA Phone- 8754491904 FAX : 044-26248849 Pincode : 600050 Email : cservice@switzerinstrument.com
270	145-15000-A	TEMPERATURE SWITCH	LARRY DEGARMO/Avdesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdesh@sherman-india.com,	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA -KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com

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272	145-16000-A	SIGHT FLOW INDICATORS	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	Works-1->Mr. Bharat Kumar/ Mr. Sasi Kumar Plot No. 240, Sector-3, HSIIDC, Bawal -Rewari-HARYANA INDIA Phone- 0124-4366000 TO 9 FAX : 0124-2290884 Pincode : 123501 Email : bharat@blissanand .com
273	145-16000-A	SIGHT FLOW INDICATORS	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	
274	145-16000-A	SIGHT FLOW INDICATORS	T. BALAKRISHNAN/S.VENKATESH 217 , ARCOT ROAD PORUR , CHENNAI Phone- 9444057761 Pincode : 600116 Email : bkequip@gmail.com	Works-1->V.KARUNANIDHI/P.BABU 217 , ARCOT ROAD,PORUR , -CHENNAI-TAMIL NADU INDIA Phone- 9444131187 FAX : 044-24766852 Pincode : 600116 Email : bkequip@gmail.com
275	145-16000-A	SIGHT FLOW INDICATORS	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, IDA, JEEDIMETLA HYDERABAD Phone- 9848407365 Pincode : 500055 Email : iedelhi@lefflowmeters.com	Works-1->MR. A.V.MURTHY/MR. K.T. RAVISANKER PLOTS 1,2,3, PHASE-III,IDA, JEEDIMETLA -HYDERABAD-TELANGANA INDIA Phone- 9885107312 FAX : 040-23096401 Pincode : 500055 Email : sales@lefflowmeters.com
276	145-16000-A	SIGHT FLOW INDICATORS	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
277	145-21000-A	DIFFERENTIAL PRESSURE SWITCH	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorlinc.com, avdhesh@sherman-india.com,	
287	145-25000-A	JUNCTION BOX	S Raghavan No. 72, 3rd Main, 1st Stage Industrial Suburb, Yeshwanthpur Bangalore Phone- 9880385770 Pincode : 560022 Email : sales1@ksinstruments.net	
288	145-25000-A	JUNCTION BOX	NO-2,OPP-27 AECS LAYOUT 2ND STG REJAMAHALVILAS EXTN 2ND STG BANGALORE Phone- Pincode : Email : suchitra.industriesblr@gmail.com	Works-1->B. Srinivas Suchitra Industries, Opp No 53, Muneshwara Black Devinagar, Lottagal hal -BANGALORE-KARNATAKA INDIA Phone- 080-23511247 FAX : Pincode : 560094 Email : suchitra_industries@yahoo.com
289	145-25000-A	JUNCTION BOX	Mr. Mitesh Shah/Mr. Pulin Shah 39 A/3 ,Panchratna Industrial Estate, Sarkhej-Bavla Road Ahmedabad Phone- 9825024921 Pincode : 382213 Email : sales@pustron.com, pulin@sumip.com	Works-1->Mr.Pulin Shah/ Mr. Kaloesh Parmar 39 A/3 ,Panchratna Industrial Est,Sarkhej-Bavla Road, Changodhar -Ahmedabad-GUJARAT INDIA Phone- 98250 80339 1 FAX : 079-26932424 Pincode : 382213 Email : sales@sumip.com
290	145-25000-A	JUNCTION BOX	Mr. Dineshbhai Zaveri C-1/ 27&37, GIDC, Kabilpore, Navsari Phone- 02637-265140,265003 Pincode : 396424 Email : flexpro@flexproitd.com	Works-1->Mr. Dineshbhai Zaveri CEO C-1/ 27&37, GIDC, Kabilpore, -Navsari-GUJARAT INDIA Phone- 02637-265140,265003 FAX : 02637-265308 Pincode : 396424 Email : flexpro@flexproitd.com
291	145-25000-A	JUNCTION BOX	JIGNESH MAHENDRA AJMERA DENA BANK BLDG., SHREE NAGESH INDL ESTATE,STATION ROAD, MUMBAI Phone- 022 67973578 Pincode : 400 088 Email : ajmera@ajmera.net, jmajmera@yahoo.com	Works-1->JIGNESH MAHENDRA AJMERA DENA BANK BLDG., SHREE NAGESHINDL ESTATE,STATION ROAD, -MUMBAI-MAHARASHTRA INDIA Phone- 022 67973578 FAX : Pincode : 400 088 Email : ajmera@ajmera.net
293	145-32000-A	INSTRUMENTS TUBE FITTINGS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com
294	145-32000-A	INSTRUMENTS TUBE FITTINGS	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	Works-1->ALEX BAPTIST/ K. SRINIVAS 7. SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com
295	145-32000-A	INSTRUMENTS TUBE FITTINGS	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com	
296	145-32000-A	INSTRUMENTS TUBE FITTINGS	Sophie Y. Mochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN,(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar, Shed No.8, Lonavia Indl.Co-op.Estate Ltd,Nagargaon, -Lonavia-MAHARASHTRA INDIA Phone- 9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-
300	145-34000-A	ROTAMETER	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, IDA, JEEDIMETLA HYDERABAD Phone- 9848407365 Pincode : 500055 Email : iedelhi@lefflowmeters.com	Works-1->MR. A.V.MURTHY/MR. K.T. RAVISANKER PLOTS 1,2,3, PHASE-III,IDA, JEEDIMETLA -HYDERABAD-TELANGANA INDIA Phone- 9885107312 FAX : 040-23096401 Pincode : 500055 Email : sales@lefflowmeters.com
301	145-34000-A	ROTAMETER	Mr V. K. Pandit/Mr Ashish Shaha 17-20, Royal chambers, Paud Road Pune Phone- 9370469466 Pincode : 411038 Email : sales@eurekaflow.com	Works-1->Mr S. M. Alawani/Mr V. V. Deshpande J-501, M.I.D.C. Pimpri, -PUNE-MAHARASHTRA INDIA Phone- 9325751732 FAX : 020-30681731 Pincode : 411018 Email : works@eurekaflow.com
302	145-34000-A	ROTAMETER	Mr. Vardhan Tamhankar, Unit No35/36/41,Om Anand Industrial Est. Mohanjee Sundarjee Road,Raghnunath Nagar, Thane Phone- 022-25832323 Pincode : 400604 Email : tansaindia@gmail.com	Works-1-> Others Mohanjee Sundarjee Road, Raghnunath Nagar, Thane -Mumbai-MAHARASHTRA INDIA Phone- FAX : Pincode : 400604 Email :
303	145-34000-A	ROTAMETER	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Centre, S.No. 65, Hissa No.7,By-Pass Juction, Kausa, -Mumbai-MAHARASHTRA INDIA Phone- 9892230623, FAX : 022-25491408/9 Pincode : 400 612, Email : sales@scientificdevices.com
304	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com
305	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Centre, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
306	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com	
307	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com	
308	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 A GIDC A Phase 1, VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
309	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
310	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	131, PALSHIKAR COLONY Contact Person- Mr. Ashwin (9826080207) INDORE Phone- +91-731-4085751, Pincode : 452004 Email : sales@sapconinstruments.com	Works-1->Mr. Ashwin R Palshikar/Mr. Navin Bodse 131 PALSHIKAR COLONY, -INDORE-MADHYA PRADESH INDIA Phone- 9754261005 FAX : 0731-2475475 Pincode : 452004 Email : sales@sapcon.in
311	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com	Works-1-> 38G, PICNIC GARDEN ROAD, -KOLKATA-WEST BENGAL INDIA Phone- FAX : Pincode : Email :
312	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	Works-1->Mr. Bharat Kumar/ Mr. Sasi Kumar Plot No. 92B & 93B,Sec-V, IMTManesar -GURGAON-HARYANA INDIA Phone- 0124-4366000 TO 9 FAX : 0124-2290884 Pincode : 122002 Email : bharat@blissanand .com
313	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	Mr. Vikash Agrawal/Mr. Tarun Debnath 119, PARK STREET , KOLKATA Phone- 033-22299045 Pincode : 700016 Email : sandeep@hitech.in	Works-1->Mr. Jitendra Kumar/Mr. Debasis Dey 82/1, Sarsuna Main Road, -KOLKATA-WEST BENGAL INDIA Phone- 9883994030 FAX : Pincode : 700061 Email : jitendra@hitech.in
314	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	Mr. N R Shenoy/Mr G B Vijh 8, First Floor.Plot : 160A Balt-Ush-Sharaf, 29th Road,Bandra(W) MUMBAI Phone- 09892331381 Pincode : 400050 Email : ramanbpl@vsnl.com	Works-1->NA -- Phone- FAX : Pincode : Email :
315	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com

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Sl No	Package Code	Package Name	Supplier Communication Address	Supplier Works Address
316	145-36000-A	LEVEL SWITCH-CONDUCTIVITY TYPE	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA -KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com
317	145-36000-A	LEVEL SWITCH-CONDUCTIVITY TYPE	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
318	145-37000-A	LEVEL SWITCH-FLOAT TYPE	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com	
319	145-37000-A	LEVEL SWITCH-FLOAT TYPE	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com
320	145-37000-A	LEVEL SWITCH-FLOAT TYPE	N.SIKDAR/ SUMIT SIKDAR 76/2,SELIMPUR RD DHAKURIA Kolkata Phone- 033-2415-1310. Pincode : 700031 Email : dkinst@vsnl.net	
321	145-37000-A	LEVEL SWITCH-FLOAT TYPE	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
322	145-37000-A	LEVEL SWITCH-FLOAT TYPE	Mr Shayak Gupta/Badal Jana Rajkama', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com	
323	145-37000-A	LEVEL SWITCH-FLOAT TYPE	Mr. Amarendra Kulkarni 194/195, Gopi Tank Road, Off. Pandurang Naik Marg, Mahim Mumbai Phone- 9323195251 Pincode : 400016 Email : amarendra@general-gauges.com	
324	145-37000-A	LEVEL SWITCH-FLOAT TYPE	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in	Works-1->MR. MOHAN PADWAL 691/A/2,BIBWEWADI INDL ESTATE -PUNE- MAHARASHTRA INDIA Phone- 918600042374 FAX : 912024215670 Pincode : 411037 Email : wm@sbem.co.in
325	145-37000-A	LEVEL SWITCH-FLOAT TYPE	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 A GIDC A Phase 1, VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
326	145-37000-A	LEVEL SWITCH-FLOAT TYPE	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
327	145-37000-A	LEVEL SWITCH-FLOAT TYPE	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA -KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com
328	145-38000-A	INSTRUMENTS PIPE FITTINGS	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com	
329	145-38000-A	INSTRUMENTS PIPE FITTINGS	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : pelks@vsnl.com	Works-1->ALEX BAPTIST/ K. SRINIVAS 7. SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com
330	145-38000-A	INSTRUMENTS PIPE FITTINGS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com
331	145-38000-A	INSTRUMENTS PIPE FITTINGS	Sophie Y. Mochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavia Indl.Co.op.Estate Ltd,Nagargaon, -Lonavia-MAHARASHTRA INDIA Phone- 9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-
361	145-45000-A	INSTRUMENT FITTINGS	Mr.Sanjay Brahman/Mr.Shyam Vazirani 102, Vora Industrial Estate No.4 Navghar, Vasai Road (E) Dist.Thane, Mumbai Phone- +91-250-2392246 Pincode : 401210 Email : arya@aryaengg.com	
362	145-45000-A	INSTRUMENT FITTINGS	MD Hussain Shaikh/Shahanawaz Khan Gala No. 168, Loheki Chwal,216/ 218, Maulana Azad Rd. Nagpada Junction Mumbai Phone- 91-9324383121 Pincode : 400008 Email : shahanawaz.khan@perfectinstrumentation.com	Works-1->Shahanawaz Khan Vishweshwar Ind. Premises Co-op Soc. Ltd,F-18/19, Pradhikaran,Bhosadi MIDC -PUNE-MAHARASHTRA INDIA Phone- 020-30694134 FAX : 022-23013010 Pincode : 411026 Email :
363	145-45000-A	INSTRUMENT FITTINGS	Mr. Abbas Bhola Potia Building No. 2, Office No. 3,292, Bellasis Road,Mumbai Central (East) Mumbai Phone- 9920044113 Pincode : 400008 Email : ab@fluidfitengg.com	Works-1->Mr. Abbas Bhola Unit No. 16, Supreme Industrial Estate,Kaman Bhiwandi Road,Devdal, -Vasai East-MAHARASHTRA India Phone- 9920044113 FAX : 07303178243 Pincode : 401208 Email : ab@fluidfitengg.com
364	145-45000-A	INSTRUMENT FITTINGS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com
365	145-45000-A	INSTRUMENT FITTINGS	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : pelks@vsnl.com	Works-1->ALEX BAPTIST/ K. SRINIVAS 7. SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com
366	145-45000-A	INSTRUMENT FITTINGS	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com	
367	145-45000-A	INSTRUMENT FITTINGS	Mr. Jeetu Jain/Mr. Vinay Sosa Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway Laxmipura, Nandasan Phone- 02764-267036/37 Pincode : 382705 Email : marketing@com-flt.com	Works-1->Miss Sonal Pithadia/Miss Pavan Chavda Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway, Laxmipura -Nandasan-GUJARAT INDIA Phone- 8460848087 FAX : 2764-267036/37 Pincode : 382705 Email : domestic@com-
368	145-45000-A	INSTRUMENT FITTINGS	S. Harichandran/P.S. Pandi B-11, Mugappair Industrial Estate, CHENNAI Phone- 044 26252537 Pincode : 600037 Email : sales@hpvalvesindia.com	Works-1->S. Harichandran/ P.S. Pandi B-11, Mugappair Industrial Estate, -CHENNAI-TAMIL NADU INDIA Phone- 044-25252537 FAX : 044-26252538 Pincode : 600037 Email : sales@hpvalvesindia.com
369	145-45000-A	INSTRUMENT FITTINGS	Sophie Y. Mochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavia Indl.Co.op.Estate Ltd,Nagargaon, -Lonavia-MAHARASHTRA INDIA Phone- 9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-
370	145-45000-A	INSTRUMENT FITTINGS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,	Works-1->Mr. Santosh Shukla Others R-628, TTC Industrial Area, MIDC Rabale, -Navi Mumbai-MAHARASHTRA India Phone- 9821350761, FAX : 022-27695559, Pincode : 400701, Email : sales@panamengineers.com

Notes:-

- 1) The above sub-vendor list is tentative & reference only. However sub-vendor list is subject to BHEL/end user approval without any commercial/delivery implication.
- 2) New subvendor if proposed by vendor during contract stage shall be subject to BHEL/ end user approval without any commercial/delivery implication.

	SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III. MILL REJECT SYSTEM (PNEUMATIC TYPE) & COAL BUNKER DEBLOCKING DEVICES STANDARD TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-445-160-A001	
		VOLUME: II B	
		SECTION-II	
		REV. 00	DATE: 17.07.21
		SHEET :	


SECTION-II

STANDARD TECHNICAL REQUIREMENT

SUB-SECTION IIA
SUB-SECTION IIB

STANDARD TECHNICAL REQUIREMENT (MECHANICAL)
STANDARD TECHNICAL REQUIREMENT (ELECTRICAL)


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	SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III. MILL REJECT SYSTEM (PNEUMATIC TYPE) & COAL BUNKER DEBLOCKING DEVICES STANDARD TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-445-160-A001	
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SUB SECTION-IIA

STANDARD TECHNICAL REQUIREMENT (MECHANICAL)


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	AGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III. MILL REJECT SYSTEM (PNEUMATIC TYPE) & COAL BUNKER DEBLOCKING DEVICES STANDARD TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-445-160-A001	
		VOLUME: II B	
		SECTION-II	
		SUB-SECTION-IIA	
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Mill Discharge Spout and Pyrite Hopper

- Each coal mill has a discharge spout with a pneumatic cylinder operated knife gate valve for discharging rejects into a pyrite hopper of adequate capacity. This hopper shall serve to store the mill rejects between each operating cycle of dense phase system. Minimum effective storage capacity shall be 2-3 times the effective (batch capacity) of the conveying vessel.
- Each pyrite hopper shall be provided with a knife gate valve of approved design at the bottom, adequately sized manhole/inspection door, sizing grid and emergency chute with Knife gate valve and reject quenching arrangement (water spray) shall be provided. Any platform/ structural support (as per IS 2062 Gr A/B) required to maintain the above equipment before transporter vessel's inlet valve. Necessary explosion vent (rupture disc with MOC Aluminium) of proven design shall be provided in each pyrite hopper.
- Each emergency chute shall be provided with a knife gate valve to transfer mill rejects from pyrite hopper to ground or to Owner's trolley. Necessary access and platform shall be provided. Limit switches shall be provided to indicate the valve position on control panel.
- Each pyrite hopper shall be provided with two level switches – one to start the operating sequence and the other to indicate the hopper above grid choked condition.
- Open & Close Limit switches shall be provided in all KGVs and these limit switches shall be interlocked with MRS control system. Solenoid box cum local control panel shall be provided. Same shall house system start stop, vessel pressure indication, probe over ride, purge button so that system can be locally optd. It shall be possible to operate individual vessel from local pneumatic panel for few cycles in emergency.
- Following control modes shall be provided
- Remote mode: System shall be controlled through MRS control System.
- Local Mode:
 - a) Energized mode: Manual override shall be selected from MRS control System. System logic shall be executed in MRS control system itself.
 - b) De-energized mode: MRS control system shall be delinked and system (individual stack up assembly) shall be operated manually.
- The sizing grid shall be provided inside the pyrite hopper to prevent oversized mill rejects, tramp iron etc. from entering the conveying vessel. The arrangement for collecting bigger pieces of coal rejects from the grid includes, among others, Knife Gate Valve, chute work etc. Bigger pieces of coal rejects shall roll down from the grid and through KGVs, chute work etc. Bigger pieces of coal rejects shall roll down from the grid and can be removed through the over sized seized reject removal gate (to be provided preferably at the bottom of inspection door) be discharged to Owners trolley. The arrangement shall be finalized during detail engineering. The grid shall be made of minimum 10 mm dia.

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	SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.		SPECIFICATION No: PE-TS-445-160-A001	
	MILL REJECT SYSTEM (PNEUMATIC TYPE) & COAL BUNKER DEBLOCKING DEVICES		VOLUME: II B	
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	STANDARD TECHNICAL REQUIREMENT		REV 00	DATE 17.07.21

CONVEYING VESSEL

1.0 GENERAL

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

2.0 CODES AND STANDARDS

- 2.1** The design, material, construction, manufacture, inspection and performance of the Transporter and accessories, shall comply with all statutory regulations and safety codes currently applicable in the locality where the equipment will be installed. The equipment shall also conform to the latest applicable Indian/British/USA/DIN Standards.
- 2.2** The material of construction and other works of the Transporter and accessories shall in general conform to the following standards/codes but will be subjected to any modification and requirement as specified in Section C of Technical Speciation.
- i) Transporter Vessel – Mild Steel to IS 2062 (Gr. A min); Construction as per IS-2825 / BS5500/ASME SEC-VIII, Div-1
 - ii) Material Handling Valve – As indicated in Sec-C of the specification
 - iii) Flange – MS as per ANSI B 16.5
- 2.3** Where the above standards are in conflict with the stipulations of this specification, this specification supersedes them. In case of any further conflict in this matter, the decision of the Engineer will be final and binding.


3.0 DESIGN REQUIREMENTS

- 3.1** The dense phase pneumatic conveying system shall be designed for low velocity for conveying of materials as indicated in Section C.
- 3.2** The system shall consist of dome shaped vessels made of Carbon Steel complete with pneumatically operated dome/metering valves capable of closing through a solid head of material to make a pressure tight seal.
- 3.3** The bottom of vessel shall have transition bend and a control air supply system to the side of the conveying vessel.
- 3.4** Airtight seal system shall be provided between the transporter and the feeding point.
- 3.5** Transporter shall be equipped with **air strainer** to prevent pipe scale /dirt from causing pressure regulator malfunctioning.
- 3.6** Automatic drain filter and oil fog lubricator set shall be fitted into the air line to dome valve/metering valve for use with pneumatic controls.
- 3.7** Any air line stop valve fitted in the air supply line of transporter shall be of ball type to avoid any restriction to air flow, when open.

4.0 CONSTRUCTIONAL FEATURES

- 4.1** The transporter vessel shall be fabricated from mild steel plate to the design of vendor. The vessel shall be of welded structure and shall be provided with necessary supporting structure. The vessel shall be airtight/leak proof in fully assembled condition. Conveying vessel shall be designed and tested as per IS 2825 vessel. Temperature of mill reject coming into the conveying vessel shall be considered as 200 °C. Conveying vessel shall be designed for a pressure 10% above the maximum pressure encountered

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	PARAGDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III. MILL REJECT SYSTEM (PNEUMATIC TYPE) & COAL BUNKER DEBLOCKING DEVICES STANDARD TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-445-160-A001	
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in the vessel. The conveying vessel shall be constructed with tested quality mild steel plates. They shall withstand the abrasive & hot condition of the mill rejects and operating air pressure. The conveying vessel shall be supported independently on steel columns. The vessel shall have suitably located and adequately numbered air connections for supply of compressed air for conveying mill rejects through pipes to overhead bin.

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

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

5.0 TESTING AND INSPECTION


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

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

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

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

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	SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.		SPECIFICATION No: PE-TS-445-160-A001	
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MILL REJECT BUNKER AND ACCESSORIES

1.0 GENERAL

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

2.0 CODES AND STANDARDS

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

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


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

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

3.0 DESIGN REQUIREMENT

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

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	AGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III. MILL REJECT SYSTEM (PNEUMATIC TYPE) & COAL BUNKER DEBLOCKING DEVICES STANDARD TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-445-160-A001	
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4.0 CONSTRUCTIONAL FEATURES

- 4.1 The bunker shall be of welded structure and shall be provided with necessary supporting structure. Flanged opening shall be provided at the bottom of the bunker for attaching the twin sector gate. The inclined part of the bunker shall be designed with a valley angle of not less than 60 deg. To the horizontal. The design of the bunker shall be such that the problem of formation of arch is eliminated. The inside surface shall be provided with liner MOC as specified elsewhere in the specification. Explosion diaphragm/Pressure relief valve shall be provided to release air from the bunker in case pressure inside the bunker exceeds 1 .0 kg/cm²(g)
- 4.2 Vendor shall furnish all steel work required for support and access for operation and maintenance. This shall include platforms, grating/chequered plates, stairways, hand railings, base plates, foundation bolts etc. Purchaser will provide only the foundation with pockets. The bunker shall have shed over it and shall be provided with monorail & hoist for equipment handling.
- 4.3 The storage bunker shall be so arranged that any 10 ton capacity truck can be conveniently loaded under it by an operator standing on the platform.
- 4.4 Access and platform shall be provided with 32 mm thick MS grating & 32 mm MS GI pipe hand railing.
- 4.5 The storage bunker shall be provided with filter bags as specified elsewhere in the specification. Filter bags shall be suitably treated to minimize the chances of filter catching fire. It shall be possible to plug opening for damaged bag filters, if any, to facilitate un-interrupted operation. Suitable explosion vents shall be provided for the bag filter unit. Sequential cleaning cycle shall be initiated with pressure drop signal across the bag filter once sufficient cleaning air pressure is available. Solenoid/pneumatic valves shall be provided for this purpose. Bag cleaning mechanism shall be automatic and shall comprise of solenoid valves. Air nozzles shall be provided just above the filter to facilitate individual cleaning of each bag.
- 4.6 The terminal boxes for terminating reject conveying pipes shall be of steel construction with necessary deflector or impingement plate to take care of impact and wear due to high velocity reject particles discharging into the bunker.

5.0 INSPECTION AND TESTING

- 5.1 The purchaser shall have a free access at all reasonable times to these parts of manufacturer's works which are concerned with the fabrication of the steel work and shall be afforded all reasonable facilities at all stages of preparation, fabrication and trial assemblies for satisfying himself that the fabrication is being undertaken in accordance with the provisions of this specification.
- 5.2 Should any structure or part of a structure be found not to comply with any of the provisions of this specification, it shall be liable to rejection. No structure or part of structure, once rejected shall be resubmitted for inspection/ test except in cases where the purchaser or his authorized representative considers the defect as rectifiable. Defects which may appear during fabrication shall be made good with the consent of and according to the procedure laid down by the purchaser. The purchaser may, at his discretion, check the test results obtained at the manufacture's works by independent tests at the government test house or elsewhere and should the material so tested be found to be unsatisfactory shall be rejected. The cost of such tests shall be borne by the contractor.
- 5.3 Examination of material of construction, verification, correlation and identification with material test certificate.
- 5.4 Ensuring that the relevant weld procedure and welder qualifications tests are in accordance with fabrication code.

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- 5.5 Inspection during fabrication at appropriate stage including fit up. Witness of dye penetrant testing at root and final run for all groove welds and final run for fillet welds as per ASTM E 165. All surfaces examined shall be free of:
- Relevant linear indications (Linear indications are those indications in which length is more than three times the width and only indication with major dimension greater than 1.6 mm shall be considered relevant).
 - Four or more rounded defects in a line separated by 1.6 mm or less (edge to edge). Rounded indications are those where length less than three times the width.


5.6 Any other tests as specified in the fabrication code.

5.7 Dimensional check match marking as per approved drawings.

6.0 SCOPE OF INSPECTION FOR RACK AND PINION GATE

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

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AIR RECEIVER

1.0 GENERAL

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

2.0 CODES & STANDARDS

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

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

IS: 2825 – Code for unfired pressure vessels

ASME – Section-VIII, Division-1

BS – 487-Fusion welded steel air receivers

IS: 7938 – Air receivers for compressed air installation

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

3.0 DESIGN AND CONSTRUCTION

3.1 The air receivers shall be vertical self-supporting cylindrical vessels with supporting stands for resting on the civil foundation.

3.2 Other design parameters and design internal pressure of the receiver shall be as per the data specification sheet, if any, enclosed. The receiver shall be designed as per IS:7938.

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


3.4 Receivers shall be provided with gasket inspection openings. Receivers below 500 mm diameter shall have at least two inspection holes. For receivers of larger diameter, manhole of minimum 450 mm diameter shall be provided. These openings shall be placed as far as possible from any welded seam and in no instance shall pierce any seam.

3.5 All welding shall be performed in accordance with relevant codes. Filler material that will deposit weld metal with a composition and structure as near as that of the material being welded shall be used. All welding electrodes shall be got approved by the Owner. The electrodes shall be dried in ovens immediately before use to ensure freedom from porosity. All the circumferential and longitudinal butt welds of the air receiver shall be subjected to spot radiography. Tee joints and dished welding shall be subjected to 100% radiography.


3.6 All other welding on the air receiver, including fillet weld and nozzle connection shall be DP tested as per IS: 2825 (Para 8.7.11).

3.7 Each finished receiver complete with all welded attachments shall be hydraulically tested at 150% of the design pressure. The test pressure shall be maintained for at least 30 minutes. All joints shall be gentle hammered during the test.

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- 3.8** Receivers shall be provided with relief valve of the capacity and set pressure of the same at least 10% above working pressure. The spring in the relief valve in service for pressure up to and including 250 psi shall not be reset for any pressure more than 10% above or below the design set pressure. For higher pressures, the spring shall not be reset for any pressure more or below 5% design set pressure.
- 3.9** Each air receiver shall be complete with drain connection of 25 mm NB with a trap station consisting of a trap, strainer, isolation and bypass valves.
- 3.10** The receiver shall be provided with necessary number of nozzles. The orientation of the nozzles shall be subjected to the approval of the Owner.
- 3.11** Local instruments like pressure gauge, switch and temp. gauge of suitable range shall be supplied. Please refer specification for conveying air compressor for other instrumentation required.
- 3.12** The vendor will have all welding procedures & welders qualified in accordance with the relevant codes prior to commencing any welding at the works. These tests shall be witnessed by customer/client representative.

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CHAIN PULLEY BLOCK & MONORAIL

1.0.0 GENERAL

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

2.0.0 CODES AND STANDARDS

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

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

3.0.0 EQUIPMENT

3.1.0 CHAIN PULLEY BLOCK

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

3.1.1 Frame

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

3.1.2 Chain

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


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

3.1.3 Hook

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

3.1.4 Reduction Gear

The reduction gear shall be spur or worm/worm wheel type. The spur gear and worm shall be of high-

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grade carbon steel and heat treated. The worm wheel shall be of bronze. A detachable steel cover shall be provided for total enclosure of the gear train and ample lubrication to be provided.

3.1.5 Brakes

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

3.1.6 Bearing

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

3.1.7 Wheel

The load chain wheel shall be made of heavy duty malleable casting and shall be designed to ensure, effective operation of the chain. Load chain, wheel shall be mounted on two ball bearings. Hand chain wheel shall be made from malleable casting/pressed sheet steel. The idler wheel shall be so shaped as to avoid the twisting of the chain during operation. The P.C.D of idler wheels shall be such that the bending action of the link is avoided. The hand chain wheel shall be provided with flanges and designed to ensure effective operation with hand chain.

3.1.8 Other components

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

3.2.0 MONORAIL TROLLEY

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

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


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

4.0.0 INSPECTION AND TESTING

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

- Material identification/co-relation for important items like hook, load chain, hand chain, wheels, nut and pawl etc.
- Hardness for pawl and ratchet
- Dye penetration test for hooks
- Operational test including operational effort, velocity ratio etc,

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- e) Proof load test up to 1.5 times of working load limit.
- f) Dimensional check of hook
- g) Marking

DATASHEET

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

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ANNEXURE-VIII

MAKES OF SUB VENDORS ITEMS

- 1) The vendor list at **Customer's Specification** "Annexure to Project Management and Site Services", Volume: II-A, Section: VI , of shall be applicable.
- 2) The items / makes indicated below but not covered at "Annexure to Project Management and Site Services, Volume: II-A, Section: VI , Project Management and Site Services" of Customer's Specification for makes as proposed by bidder shall be put up for Customer's approval during detailed engineering stage without any commercial & delivery implication to BHEL.
- 3) Bidder to propose sub vendor within 4 weeks of placement of LOI, thereafter no request for additional sub-vendor shall be entertained.
- 4) The inspection category will be finalized after award of contract during detailed engineering. Same will be adhered by the bidder without any commercial and delivery implication to BHEL.

Sl. No	ITEM/SERVICE	QAP/ INSP.CAT.	Scope of supply/manufacture	Place	Remarks
I	SELF MFG ITEMS				
1	Pyrite Hopper	I	SELF MANUFACTURED		
2	Blow Tank	I	SELF MANUFACTURED		
3	Local Control Panel with accessories	I	SELF MANUFACTURED		
4	Mill Reject Conveying fittings/Bends	I	SELF MANUFACTURED		
5	Swing Valve(Pneumatic operated)	I	SELF MANUFACTURED		
6	Bunker Discharge Gate (Sector Gate)	I	SELF MANUFACTURED		
7	Pressure Relief Valve	I	SELF MANUFACTURED		
II	BOUGHT OUT ITEMS				
A	MECHANICAL				
1	Terminal Box	I	BHEL/ WBPDC/DCPL APPROVED FABRICATORS	INDIA	
2	AIR RECEIVER	I	PARKARE	DELHI	
		I	UNITED ENGG WORKS	NASIK	
		I	INTEGRATED ENGINEERS	PUNE	
		I	TEMASME VESELLEX	NOIDA	
		I	DIAMOND FABRICATIONS	PUNE	
3	DRAIN TRAP	III	SPIRAX MARSHAL	MUMBAI	
		III	GREAVES COTTON	MUMBAI	
		III	TRIDENT	COIMBOITORE	
4	Gate, Globe, Check valves/ NRV - C.I	II	LEADER	JULLANDHAR	
		II	BANKIM	HOWRAH	
		II	H SARKAR	HOWRAH	
		II	KBL	PUNE	
		II	AV VALVES	AGRA	Upto 300 NB
5	Gate, Globe, Check valves/ NRV - G.M	III	LEADER	JULLANDHAR	
		III	BOMBAY METALS & ALLOYS (GG)	MUMBAI	
		III	SANT VALVES	JULLANDHAR	

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6	Knife Gate/Plate Valve (H/W Operated & Cylinder Optd)	I	FOURESS	MUMBAI	
		I	VASS	CHENNAI	
		I	(ORBINOX)	COIMBATORE	
7	Ball Valves	III	PRECISION ENGG	MUMBAI	
		III	Weir BDK	HUBLI	
		III	LEADER	JULLANDHAR	
		III	FLOW CHEM	GUJRAT	
8	Safety Relief Valve	III	LEADER	JULLANDHAR	
		III	SPIRAX MARSHAL	PUNE	
		III	KAYSTONE(TYCO FLOW CONTROL)	HALOL	
		III	BHEL	TRICHY	
9	M.S G.I / ERW PIPES	I	JINDAL	GHAZIABAD	UPTO 350 NB
		I	SURYA ROSHINI	BAHADURGARH	
		II	SAIL	ROURKELA	
		I	WELLSPUN	ANJAR	
		I	INDUS	GB NAGAR	UPTO 300NB
		II	TISCO	JAMSHEDPUR	UPTO 150NB
		I	MAHARASHTRA SEAMLESS	MAHARASHTRA	200NB TO 400NB IS 3589
10	Metallic Expansion Bellow(Metallic)	I	METALLIC BELLOWS	CHENNAI	
		I	SUR INDUSTRIES	KOLKATA	
		I	LONESTAR	CHENNAI	
11	Rupture Disc	II	BS & B SAFETY SYSTEM	CHENNAI	
12	Chain pulley Block (1 Ton)	II	hercules (INDEF)	mumbai	
		II	TRACTEL	FARIDABAD	
		II	LIFTING EQUIPMENTS & ACCESSORIES	DELHI	
13	Conveying Air Compressor (Reciprocating Type)	I	KIRLOSKAR PNEUMATIC	PUNE	
		I	INGERSOLL RAND	AHMEDABAD	
14	Sump Pump (Water Service)	II	KSB PUMP	PUNE	
		II	MATHER & PLATT	PUNE	
		II	SAM	COIMBOITORE	
		II	FLOW MORE	GHAZIABAD	
		II	B & C	CHENNAI	
		II	KIRLOSKAR	PUNE	
		II	WORHTINGTON	GHAZIABAD	
15	Pneumatic Actuator/Cylinder(Metallic)	III	SCHRADDER	MUMBAI	
		III	NUCON	HYDERABAD	
		III	ROTEX	MUMBAI	
		III	VAAS	CHENNAI	
16	Tools and Tackles	III	BRANDED		
17	Steel Plate/ Structure/ Section/ SS liner	III	SAIL		
		III	JSW STEEL LTD		
		III	JINDAL STEEL & POWER LTD		
		III	TISCO		
		III	ESSAR		
		III	IISCO		
		III	LLOYDE		
		III	RINL		
18	Grating	III	INDIANA	PUNE	

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19	Bag Filter	II	ACCO	KOLKATA	
		II	THERMAX	PUNE	
		II	BATLIBOI	DELHI	
B	ELECTRICAL & INSTRUMENTATION				
1	Motor (LT)	I	MARATHON	KOLKATA	Refer Note 3
		I	SIEMENS	MUMBAI	
		I	NGEF	BANGALORE	Upto 15KW, refer note 3
		I	KEC	BANGALORE/HUBLI	HUBLI upto 90 kw, refer note 3
		I	CGL	AHMED NAGAR	Refer note 3
		I	ABB	FARIDABAD/BANGLORE	Faridabad upto 55kw, Bangalore above 55kw & upto 200kw, refer note 3
		I	BBL	MUMBAI	upto 100kw refer note 3
		I			
2	Air Filter/Lubricator/Regulator	III	SHAVONORGAN	MUMBAI/BANGLORE	
		III	PLACKA	CHENNAI	
3	Level Probes(RF)	II	EIP ENVIRO LEVEL CONTROL	NOIDA	
		II	E&H	GERMANY / AURANGABAD	
		III	FLOW STAR	FARIDABAD	
4	Annunciator	III	HC	MUMBAI	
		III	PECON	AHEMDABAD	
		III	PROCON	CHENNAI	
5	Solenoid Valves	III	NUCON	HYDERABAD	For Nucon Cylinder only
		III	JEFFERSON	ARGENTINA	
		III	HARION	GERMANY/ AURANGABAD	
		III	ASCO(I)	CHENNAI	
		III	SCHRADER DUNCAN LTD.	MUMBAI	For Schrader Duncan cylinder only
		III	AVCON CONTROLS	MUMBAI	
		III	ROTEX AUTOMATION	BARODA/VV NAGAR	
6	Pressure Switch ,DP Switch/ Temp.Switch	II	SWITZER	CHENNAI	Except 900 series
		II	GAUGE BOURDON (FOR PRESSURE SWITCH)	PANVEL	Not for temp switch
		II	TRAFAG	RANIPET	
			INDFOS IND	GHAZIABAD	
		II	ASHCROFT	USA /GERMANY	
		II	ASHCROFT	GHAZIABAD	
7	Pressure Gauge & DP Gauge	III	GAUGES BOURDON INDIA	PANVEL	
		III	AUXITROL	UK	
		III	MANOMETER INDIA	MUMBAI	
		III	BUNDENBURG	UK	
		III	AN INSTRUMENTS	KOLKATA	
		III	GOA THERMOSTATIC	GOA	
		III	GUCK INDIA	MUMBAI	
		III	WIKA	PUNE	
		III	SWITZER (DP INDICATOR)	CHENNAI	
8	Temperature Gauge	III	WIKA	PUNE	

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		III	AN INSTRUMENTS	KOLKATA	
		III	GENERAL INST	MUMBAI /GOA	
		III	BUDENBURG	UK	
		III	H GURU (SI)	BANGALORE	
		III	GOA THERMOSTATIC	GOA	
		III	WAREE	MUMBAI	
9	Pulse Jet Valves	III	ASCO	CHENNAI	
		III	MANIK	CHENNAI	
10	Cable Lug	III	DOWELLS	MUMBAI	
		III	BILLET (3D)	VALSAD	
		III	CHETNA	NASIK	
11	Limit Switch	III	SIEMENS	MUMBAI	
		III	JAIBALAJI	NEWDELHI	
12	Junction Boxes & Earthing Material ROD, FLAT etc.		WBPDC/DCPL / BHEL APPROVED VENDOR		Main contractor approved sources with galvanizing at WBPDC/DCPL accepted sources
		III			
13	INSTRUMENT CABLE / SIGNAL CABLE	II	DELTON CABLES	BANGALORE	
		II	PARAMOUNT CABLES	FARIDABAD	
		II	POLYCAB	DAMAN	
		II	UNIVERSAL CABLES	SATNA	
		II	NICCO	KOLKATA	
		II	CORDS	BHIWADI	
		II	INCAB	PUNE	
14	Cable Tray	II	MJ ENGG	DELHI /BHIWADI	
		II	JAMUNA METALS	DELHI / SONEPAT	
		II	INAR PROFILES	ANAKAPALLI	
		II	INDIANA	MUMBAI	
		II	TECHNO	CHANDIGARH	
		II	INDUSTRIAL PERFORATION	KOLKATA	
15	Cable Gland	III	COMMET	MUMBAI	
		III	SUNIL & CO.	KOLKATA	
		III	ARUN ENGG.	KOLKATA	
		III	QUALITY PRECISION	KOLKATA	
16	Local panel/ LPBS	I	CONTROL DEVICES	KOLKATA	
		I	PYROTECH	UDAIPUR	
		I	C&S	NOIDA/ HARDWAR	
		I	INDUST CONTROLS & APPLIANCES	MUMBAI	
		I	POSITRONICS	BARODA	
		I	SWITCHING CIRCUIT	KOLKATA	
		I	JACKSON	GR. NOIDA	
		I	JOLLY ENGG.	KOLKATA	
17	FRP JUNCTION BOXES	III	BHEL/WBPDC/DCPL approved sources	India	
18	LEVEL INDICATOR / GAUGE	III	SBEM PVT LTD	PUNE	
		III	PUNE TECHTROL	PUNE	
		III	LEVCON	KOLKATA	
		III	SIGMA	MUMBAI	
		III	DK INSTRUMENTS	KOLKATA	

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		REV 00	DATE 17.07.21

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	COAL BUNKER DEBLOCKING DEVICES	KJN Enterprises)	MUMBAI	
		NAVCO	USA	
		VIBCO	USA	
		HINDON	USA	
		CLEVELAND VIBRATOR	USA	
		HOUSTON VIBRATOR	USA	
		INVICTAVIBRATORS	UK	
		OLI VIBRATORS	AUSTRALIA	
		MASCHINEN FABRIK (INDIA) PRIVATE LIMITED	KOLKATA	
		SINEXVIBRATORS	MAHARASHTRA	
		SAIDEEPSYSTEMS	MAHARASHTRA	

LEGENDS

1. QP/ INSPECTION CATEGORY :

CAT-I : For these items the Quality Plans are approved by WBPDC/DCPL and the final acceptance will be on physical inspection witness by WBPDC/DCPL.

CAT-II : For these items the Quality Plans approved by WBPDC/DCPL. However no physical inspection shall be done by WBPDC/DCPL. The final acceptance by WBPDC/DCPL shall be on the basis review of documents as per approved QP.

CAT -III : For these items main supplier approves the quality plans. The final acceptance by WBPDC/DCPL shall be on the basis certificate of conformance by the main supplier.

UNIT/WORKS : Place of manufacturing Place of Main Supplier of multi units/works.

NOTE-1

For steel following modalities to be adopted

a) Steel plate, structural steel and section shall be procured from main producers like SAIL/ TISCO/ ISSCO/ RINL/ JINDAL/ ESSAR/ ISPAT/ LLOYD'S STEEL/ JSW.


b) Material will be delivered directly from manufacturer's plant/ stock yard/ godown to WBPDC/DCPL project site.

c) Correction of material with MTC will be done by main contractor before delivery and correlated MTC along with delivery challan will be WBPDC/DCPL-RIO for issuance of MDCC.

NOTE-2

It that the same Quality Plans as approved for main equipment and identified in the vendor list shall be applicable for the type of control measure i.e. make /test/ check the procurement of mandatory spares. However, for those spares which are not covered in the approved QP, main supplier shall furnish Certificate of Conformance (COC) along with guarantee and interchangeability certificate shall be generated by the main item manufacturer, for which the spares are made.

389490/2021/PS-PEM-MAX

	SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III. MILL REJECT SYSTEM (PNEUMATIC TYPE) & COAL BUNKER DEBLOCKING DEVICES STANDARD TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-445-160-A001	
		VOLUME: II B	
		SECTION-II	
		SUB-SECTION-IIA	
		REV 00	DATE 17.07.21

ANNEXURE IX

Standard Quality Plans


The following Quality plans/ Check lists of mechanical items are attached for ready reference of supplier. Details of same shall be finalized during detail engineering in conjunction with "QUALITY ASSURANCE REQUIREMENTS, Volume II-A" of Customer's specification.


- a) Local control Panel
- b) Transport Vessel
- c) Pyrite Hopper
- d) Terminal Box
- e) Bunker Discharge Gate
- f) Pressure Relief Valve
- g) Air Receiver
- h) Rupture Disc
- i) Chain Pulley Block
- j) Bag Filter
- k) Pipes
- l) ACI Bends
- m) Knife Gate Valves
- n) Sump Pumps
- o) Expansion bellow
- p) Plates & Structures


The inspection requirements indicated in the above QP's / CL's shall be adhered to as a minimum. Inspection requirement of some of the items are also elaborated in the technical specification under Sec-IIA. The QP's for above items as well as other items not listed above but required, as part of the system shall be prepared by the successful bidder in project specific format to be finalised with the successful bidder after award of contract.


Standard Quality Plans of few instruments & motors are enclosed elsewhere in the specification, for compliance by the bidder.


All QP's/CL's shall be submitted by the bidder for Customer/Consultant's review and approval. All comments made by customer / consultant shall be incorporated by the successful bidder without any commercial and delivery implication.


		<u>S/Contactor :</u>			<u>Manufacturing Quality Plan</u>			Project:-SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III. Package :- Mill Rejects System & Coal De blocking devices Client :-					
		Mfgr:-			Item :-Local Panels QAP No. LOI Nos:- Contractor :- M/s BHEL								
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	N	
1	Materials CRCA Sheet	Visual	Major	Visual	100%	Appr. Drg / IS: 513	Appr. Drg / IS: 513	IR	-	P	-	-	
		Chem. & Physical.	Major	Chem. & Physical.	100%	Do	Do	TC	√	V	V	V	
		Thickness	Major	Measurement	100%	App. Drawing	App. Drawing	IR/TC	√	V	V	V	
2	Bought outs Verification of type, size & Make of FLV unit, PG, PS, SV	Visual	Major	Visual	100%	Appr. Drawing / Data Sheet	Approved Drawing / Data Sheet	IR/TC	√	V	V	V	
3	Painting Pre Treatment 7 tank process	Physical	Major	DFT / Shade / Finish	100%	Appr. Painting Schedule	Appr. Painting Schedule	IR/TC	√	V	V	V	
4	Final Inspection	Visual	Major	Visual	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	W	V	
		Dimension	Major	Measurement	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	W	V	
		Check for Pneumatic Circuit	Major	Visual	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	W	V	
		Check for Wiring / Mountings / Terminations	Major	Visual / Continuity	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	W	V	
		Functional Check for Solenoid Valve	Major	Functional	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	W	V	
5	QA Documents	Review	Major	verification	100%	-	-	-					
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N ->CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document. No.:				
									Name & Signature of Approving Authority with Seal				
SIGNATURES													


		S/Contractor :		Manufacturing Quality Plan			Project: SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.						
		Mfgr:-		Item :- Transport vessel			Package :- Mill Rejects System						
				QAP No.			Client :						
				LOI Nos:-									
				Contractor :- M/s BHEL									
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9	10	11			
								TYPE	D	M	C	N	
1	Raw Materials												
1.1	Dome & dome Valve Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Hardness Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / Standard	App. Drg. / Data Sheet / Standard	- - TC TC	- - √ √	P P P/V P/V	- - V V	- - V V	
1.2	Plates for Vessel	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - TC TC	- - √ √	P P P/V P/V	- - V V	- - V V	
1.3	Insert Seal	Surface Defects Hardness	Major	Visual Measurement	100% 1/Lot	Mfr's Drg. / Std	Mfr's Drg. / Std	- IR	- √	P P/V	- V	- V	
1.4	Shaft	Physical Check Chemical Check	Major	TS & Elongation Chemical Comp.	1/Heat 1/Heat	App. Drg. / IS Std.	App. Drg. / IS Std.	TC	√	P/V	V	V	
2	In - Process Insp.												
2.1	Welders & Welding	WPS / PQR / Welding Defects	Major Major Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	√ √ √	P/V P/V P/V	V V V	V V V	Welders to be approved by BHEL / CLIENT
2.3	Machining of Dome & dome Valve	Visual & Dimension	Minor	Visual, Measurement	100%	Mfr's Drg / Standard	Mfr's Drg / Standard	-	-	P	-	-	
2.4	Hydotest of Vessel	Soundness / Leakage	Major	Visual, Hydro Pressure Test	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	
3	Final Inspection												
3.1	Final Assly	Completeness & Dimension	Major	Visual / Measurement	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	At Painted Condition
3.2	Run Test / Performance	Operation of Dome Valve	Minor	Visual, 5 times Cycle operation	100%	Mfr's Standard	Mfr's Standard	IR	√	P/V	W	W	
3.3	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	√	P/V	W	W	
4	QA Documentation												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan		-	P/V	V	V	
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.				
			Name & Signature of Approving Authority with Seal										
SIGNATURES													


		S/Contactor :			Manufacturing Quality Plan			Project:SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III. Package :- Mill Rejects System Client :-					
		Mfgr:-			Item :- Pyrite Hopper QAP No. LOI Nos Contractor :- M/s BHEL								
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	N	
1	Raw Materials												
1.1	Plates for Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - MTC	- - √	P P P/V	- - V	- - V	
1.2	Spray Nozzle	Surface Defects Chemical Check Dimensions	Major	Visual Chemical Comp. Measurement	100% 1/Lot 100%	Mfr's Drg. / IS Standard	Mfr's Drg. / IS Standard	- MTC IR	- √ √	P P/V P	- V V	- V V	
2	In - Process Insp.												
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects	Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	√ √ √	P/V P/V P/V	V V W	V V W	Welders to be approved by BHEL
2.2	Fabrication	Fit up, Marking, Cutting, Grinding	Minor	Visual, Measurement	100%	Mfr's Standard	Mfr's Standard	-	-	P	-	-	
3	Final Inspection												
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W*	W*	* -> Witness 10%
3.2	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	W	-	Painting shall be Heat Resistance
4	QA Documentation												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan		-	P/V	V	V	
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> Client P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
							Name & Signature of Approving Authority with Seal						
SIGNATURES													

		<u>S/Contactor :-</u>		<u>Manufacturing Quality Plan</u>				Project:-SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.					
		Mfgr:-		Item :- Terminal Box QAP No. :- LOI Nos:- Contractor :- M/s BHEL				Package :- Mill Rejects System Client :-					
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	<u>Raw Materials</u>												
1.1	Plates for Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - MTC MTC	- - √ √	P P P/V P/V	- - V V	- - V V	
2	<u>In - Process Insp.</u>												
2.1	Welders Qualification & Welding	WPS / PQR / WPQ Welding Defects	Major	Procedure / Qualification	100%	ASME sec - IX	ASME sec - IX	WPS / PQR	√	P/V	V	V	Welders to be approved by BHEL / KPCL
			Major	DPT on Root run	100%	ASTM E-165	ASTM E-165	IR	√	P/V	V	V	
			Major	DPT on Final run	10%	ASTM E-165	ASTM E-165	IR	√	P/V	W	V	
2.2	Flange Machining and Drilling	Dimensions	Major	Measurement	100%	Mfr/Appr. Drg	Mfr/Appr. Drg	IR	-	P	-	-	
2.3	Connection -pipe to flange, pipe to body	Fit up	Major	Joint set up, PCD, Orientation	100%	Mfr/Appr. Drg	Mfr/Appr. Drg	IR	-	P	-	-	If Applicable
2.4	Fabrication	Fit up, Marking, Cutting, Grinding	Minor	Visual, Measurement	100%	Mfr's Standard	Mfr's Standard	-	-	P	-	-	
3	<u>Final Inspection</u>												
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	
3.2	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	W	-	Painting before disp.
4	<u>QA Documentation</u>												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan		-	P/V	V	V	
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
			Name & Signature of Approving Authority with Seal										
SIGNATURES													


		<u>S/Contactor :-</u>			<u>Manufacturing Quality Plan</u>			Project:-SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.					
		Mfgr:-			Item :- Bunker Discharge Gate QAP No. :- LOI Nos:- Contractor :- M/s BHEL			Package :- Mill Rejects System Client :-					
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	<u>Raw Materials</u>												
1.1	Plates for Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - TC TC	- - √ √	P P P/V P/V	- - V V	- - V V	
1.2	Shaft	Physical Check Chemical Check UT If Dia > 50 mm	Major	TS & Elongation Chemical Comp. Internal defect	1/Heat 1/Heat 100%	do	do	TC TC IR	√ √ √	P/V P/V P/V	V V V	V V V	
1.3	Cylinder / Actuator	Visual / Specification	Major	Visual	100%	do	do	Mfr's TC	√	V	V	V	
2	<u>In - Process Insp.</u>												
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects	Major Major Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	√ √ √	P/V P/V P/V	V V W	V V V	Welders to be approved by BHEL / CLIENT
3	<u>Final Inspection</u>												
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	
3.2	Operation with job / shop actuator	Opening & Closing of Gate	Major	Visual	100%	Proper Working	Smooth Operation	IR	√	P/V	W	W	
3.3	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	W	-	Painting before disp.
4	<u>QA Documentation</u>												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan		-	P/V	V	V	
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC -Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N-> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
							Name & Signature of Approving Authority with Seal						
SIGNATURES													

		S/Contactor :-			Manufacturing Quality Plan			Project:-SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.					
		Mfgr:-			Item :- Pressure Relief Valve QAP No. : LOI Nos:- Contractor :- M/s BHEL			Package :- Mill Rejects System & Coal De blocking devices Client :- .					
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	Raw Materials												
1.1	Plates for Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - MTC MTC	- - √ √	P P P/V P/V	- - V V	- - V V	
2	In - Process Insp.												
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects	Major Major Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	√ √ √	P/V P/V P/V	V V W	V V V	Welders to be approved by BHEL / KPCL
2.2	Fabrication	Fit up, Marking, Cutting, Grinding	Minor	Visual, Measurement	100%	Mfr's Standard	Mfr's Standard	-	-	P	-	-	
3	Final Inspection												
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	
3.2	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	W	-	Painting before disp.
4	QA Documentation												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan	-	-	P/V	V	V	
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
							Name & Signature of Approving Authority with Seal						
SIGNATURES													


		S/Contactor :-			Manufacturing Quality Plan			Project:-SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.					
					Item :- Air Receiver			Package :- Mill Rejects System & Coal De blocking devices					
					QAP No. :-								
					Contractor :- M/s BHEL								
SI. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	Raw Materials												
1.1	Plates for Shell, Dished End & Flange	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - TC TC	- - √ √	P P P/V P/V	- - V V	- - V V	
1.2	Formed Dished End	Dimensions Thickness/Thinning DPT of Knuckle	Major	Measurement Measurement DP Test	100% 100% 100%	App. Drg. / Data Sheet ASTM E-165	App. Drg. / Data Sheet ASTM E-165	IR IR TC	√ √ √	P P P/V	- - V	- - V	
2	In - Process Insp.												
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects do do	Major Major Major Critical	Procedure / Qualification DPT on Root run DPT on Final run Radiography Test on all C/S & L/S including T & X	100% 100% 10% 100%	ASME sec - IX ASTM E-165 ASTM E-165 IS 2825 Class-II / ASME Sec VIII	ASME sec - IX ASTM E-165 ASTM E-165 IS 2825 Class II / ASME Sec VIII	WPS / PQR IR IR RT Film / Report	√ √ √ √	P/V P/V P/V P/V	V V W V	V V W V	Welders to be approved by BHEL / CLIENT
2.2	Fabrication	Marking, Cutting, Rolling, Edge Preparation, Joint & Nozzle set up	Major	Visual, Measurement (Ovality, off set orientation)	100%	Mfr's Standard / Approved Drg.	Mfr's Standard / Approved Drg.	IR	-	P	-	-	
3	Final Inspection												
3.1	Final Assly	Completeness & Dimension	Major	Visual / Measurement	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	
3.2	Hydotest of Vessel	Soundness / Leakage	Major	Visual, Hydro Pressure Test	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	
3.3	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR		P/V	W	-	Painting before disp.
4	QA Documentation												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan	-	-	P/V	V	V	
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC -> Test Certificate , IR - Inspection Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N-> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
					Name & Signature of Approving Authority with Seal								
SIGNATURES													

		S/Contactor :- Manufacturer :-			Manufacturing Quality Plan Item :- Rupture Disc QAP No. :- LOI Nos:- Contractor :- M/s BHEL			Project:-SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III. Package :- Mill Rejects System Client :-					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	Materials -> Rupture Disc Material	Physical & Chemical Properties	Major	Chemical Analysis, YTS & UTS	1 per Heat	ASTM A240 Type - 304 / Appved Data Sheet / Drg.	ASTM A240 Type - 304 / Appved Data Sheet	MTC		V	V	V	
2	Final Inspection -> Dimension -> Burst Test of Rupture Disc	Measurement Functional	Major Major	Mesurement Burst Test @ 200 Degree Centigrade	100% 1 per lot offered	App. Drawing Approved drawing / Datasheet	App. Drawing Min 0.4 bar (g) @ 200 degree C Max 0.6 bar (g) @ 200 degree C / App. Data Sheet	IR IR / Burst Test Certificate	√ √	P P	W W	W W	
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & K ->Client P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
							Name & Signature of Approving Authority with Seal						
SIGNATURES													

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

		S/Contactor :-			Manufacturing Quality Plan			Project:-SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.					
		Manufacturer :-			Item:- CHAIN PULLY BLOCK QAP No. :- LOI Nos:- Contractor :- M/s BHEL			Package :- Mill Rejects System Client :-					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	Materials												
->	Load Chain	Mech. Properties Breaking Load Test, Proof Load test	Major	Review of Mfr's Test Certificate	1 per Lot	IS:6216 /Appr. Drg / Appr. Data sheet	IS:6216 /Appr. Drg / Appr. Data sheet	MTC	√	P/V	V	V	
->	Load Sheave	Mech. Properties Chemical Composition	Major	Lab Analysis	1 per Heat	IS:1865 /Appr. Drg / Data sheet	IS:1865 /Appr. Drg / Data sheet	MTC	√	P/V	V	V	
->	Gear & Pinion	Chemical Composition	Major	Lab Analysis	1 per Heat	IS:4432/Appr. Drg / Data sheet	IS:4432/Appr. Drg / Data sheet	MTC	√	P/V	V	V	
->	Hook	Mech. Properties Chemical Composition	Major	Lab Analysis	1 per Heat	IS:8610 / IS:1875 /Appr. Drg / Data sheet	IS:8610 / IS:1875 /Appr. Drg / Data sheet	MTC	√	P/V	V	V	
2	In Process												
->	Hook	Proof Load Test	Major	Load Test	100%	IS:8610 /Appr. Drg / Appr. Data sheet	IS:8610 /Appr. Drg / Appr. Data sheet	MTC / IR	√	P	V	V	
		DPT after Load Test	Major	DPT	100%	ASTM E-165	ASTM E-165 / No Defects	IR	√	P	V	V	
3	Final Inspection												
->	Assembly	Operation Check	Major	Visual	100%	Smooth Operation /	Smooth Operation / IS	IR	√	P	W	V	
		Functional Test	Major	Visual	100%	IS 3832 Appr. Drg /	3832 Appr. Drg / App.	IR	√	P	W	V	
		Load Test & Over Load Test	Major	Load Test	100%	App. Data Sheet	Data Sheet	IR	√	P	W	V	
		Overall Dimensions	Major	Measurement	100%			IR	√	P	W	V	
		Visual (After Load Test)	Major	Visual	100%	IS 3832	IS 3832	IR	√	P	W	V	
Manufacturer / Sub Vendor		Contractor	LEGENDS:-				For Client Use:-		Document No.:-				
			Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness										
SIGNATURES							Name & Signature of Approving Authority with Seal						

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

		<u>S/Contactor :-</u>			<u>Manufacturing Quality Plan</u>			Project:-SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.					
		Manufacturer :-			Item :- Bag Filter (Without Enclosure) QAP No. :- LOI Nos:-			Package :- Mill Rejects System Client :-					
					Contractor :- M/s BHEL			Consultant :-					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	<u>Materials</u>												
1.1	Manifold Body / Casings (MS Plate / Sheet / Pipe)	Chemical & Physical	Major	Chemical & Mechanical	1 per Lot	App. Drawing / Data Sheet / IS:2062 Gr. A / IS:1079 Gr. 0 / IS: 1239 Class Med.	App. Drawing / Data Sheet / IS:2062 Gr. A / IS:1079 Gr. 0 / IS : 1239 Class Med.	MTC	√	V	V	V	
1.2	Bag Cages (Inserts)	Chemical & Physical	Major	Chemical & Mechanical	1 per Lot	App. Drawing / data sheet / IS:7887 Gr.8 / IS:1079 Gr. 0	App. Drawing / data sheet / IS:7887 Gr.8 / IS:1079 Gr. 0	MTC	√	V	V	V	
1.3	Solenoid Valves	Functional	Major	Operational	100%	Approved Drawing / Appr. Data Sheet	Approved Drawing / Appr. Data Sheet	MTC	√	P	V	V	
1.4	Sequence Controller	Functional	Major	Operational	100%	Approved Drawing / Appr. Data Sheet	Approved Drawing / Appr. Data Sheet	MTC	√	P	V	V	
1.5	Filter Bags (Make :- Charminar / Supreme)	Physical	Major	Visual / Measurement	100%	Approved Drawing / Appr. Data Sheet	Approved Drawing / Appr. Data Sheet	MTC	√	P	V	V	
2	<u>In Process</u>												
2.1	Manifold	Dimensional & Visual	Minor	Dimensional & Visual	100%	As per Mfr's Drg.	As per Mfr's Drg.	IR	√	P	V	V	** -> DPT & Hydro - Test of Manifold to be witnessed by vendor
2.2		Welding	Major	DPT on Final Weld	100%	ASTM E-165	No Defect	IR	√	P	V**	V	
2.3		Hydro Test for 30 Minutes	Major	Leakage	100%	Appr. Data sheet	No Leakage	IR	√	P	V**	V	


Document No.:-

3	Final Inspection												
3.1	Assembly	Dimensional	Major	Measurement	100%	Appr. Drawing	Appr. Drawing	IR	√	P	W	V	Pressure Drop across


Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking	Remarks			
1	2	3	4	5	6	7	8	9	10	11			
								TYPE	D	M	C	K	
	\$-> Pneumatic Test at 1.1 times W/Pressure	Pne. test \$of Manifold in Assly. Functional Test of Pulsing System	Major	Leakage by soap solution	100%	Appr. Data Sheet	No Leakage	IR	√	P	W	V	Filter Bags & Emission Level at Filter outlet shall be checked at Site
			Major	Pulse Sequence	100%	Appr. Data sheet / Testing Procedure	Appr. Data sheet / Testing Procedure	IR	√	P	W	V	
4	Painting	Measurement & Visual	Major	DFT / Finish	100%	Appr. Painting Schedule	Appr. Painting Schedule	IR	√	P	-	-	
TESTING PROCEDURE TO BAG FILTER													
1-> Functional test through compressed air , Sequential pulsing through valves and sequential controller on No - Load Condition to be conducted. 2-> The Soenoid valve shall be connected to the sequential timer and suitable electric supply shall be provided. Air header to be connected to supply of compressed air. The Timer is set and Sequential operation of Solenoid operated valve is observed.													
Manufacturer / Sub Vendor		Contractor	LEGENDS:-				For Client Use:-		Document No.:-				
			Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				Name & Signature of Approving Authority with Seal						
SIGNATURES													

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final


- Test on bag filter casing: In case bag filter is assembled in casing at site, smoke/ bubble test shall be carried out on the bag filter casing to ensure that the casing is free of welding defect. However, if assembly of bag filter & casing is done at shop, relevant NDT shall be carried out as per approved MQP for checking the soundness of weld

		S/Contactor :-		Manufacturing Quality Plan			Project:-SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.						
		Manufacturer :-		Item :- MS GI ERW Pipes (IS:1239/IS3589)			Package :- Mill Rejects System & Coal Deblocking devices						
					QAP No. :-			Client :-					
					LOI Nos:-								
					Contractor :- M/s BHEL								
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	Final Inspection of Finished Pipes	Physical Dimensional	Major	Visual Measurement	100%	IS:1239 / IS:3589 / Approved Data Sheet	IS:1239 / IS:3589 / Approved Data Sheet	IR	-	P	W*	V	* -> Random 5% of offered lot irrespective of size
		Mechanical Properties	Major	Tensile, elongation, Bend or Flattening	IS: 4711			IR / TC	√	P / V	V	V	
		Chemical	Major	Chemical Analysis	1 per heat			TC	√	P / V	V	V	
		Hydro Test	Major	Pressure Testing	100%			IR / TC	√	P	W *	W*	
2	Galvanising (For GI Pipes)	Uniformity & mass of Zinc Coating, Adhesion test, Free bore test	Major	As per IS:4736	As per IS:4736			As per IS:4736 / Approved Data Sheet	As per IS:4736 / Approved Data Sheet	IR	√	P	
3	Identification	Verification of Batch No. / Mfg stamp / Heat No.	Major	Visual	100%	Mfgr Practise / IS 1239 / IS 3589	Mfgr Practise / IS 1239 / IS 3589	IR	√	P	W	V	
4	Review of QA Documents	-----	-----	-----	-----	As per QAP	As per QAP	-----	√	V	V	V	
NOTES :- For SAIL Pipes verification of reports for the tests mentioned in Sl. No. 1 & 2 by BHEL & WBPDC. For GI Pipes, Galvanising Check as per relevant standard shall be done. All material shall be as per approved data sheet in case of ambiguity in QAP, material as data sheet shall be final.													
Manufacturer / Sub Vendor		Contractor		LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness			For Client Use:-		Document No.:-				
							Name & Signature of Approving Authority with Seal						
SIGNATURES													


Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

		S/Contactor :-			Manufacturing Quality Plan			Project: -SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.					
		Manufacturer :-			Item :- ACI Bends QAP No. :- LOI Nos:- Contractor :- M/s BHEL			Package :- Mill Rejects System Client :-					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	Raw Material												
1.1	Scrap Receipt	Chemical	Major	Lab Analysis	Random Sample / Lot	Mfg's Std	Mfg's Std	Mfg's Log Sheet	-	P	-	-	
1.2	Ferro Alloys	Chemical	Major	Lab Analysis	Random Sample / Lot	Mfg's Std	Mfg's Std	Mfg's Log Sheet	-	P	-	-	
2	Final Inspection												
2.1	Product Analysis	Chemical Analysis	Major	Chemical	1 / heat	Mfg's Standard	Mfg's Standard	MTC	√	P	V**	V	** Chemical. Analysis to be Witnessed by Vendor
2.2	Leakage	Hydro Test	Major	Pressure Test	100%	Approved Drg / Data Sheet	No Leakage	IR	√	P	W*	W*	* 10% by Vendor / BHEL / CLIENT
2.3	Dimension	Dimension	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	W*	W*	
2.4	Hardness	Hardness	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR/TC	√	P	W*	W*	
Manufacturer / Sub Vendor SIGNATURES		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
			Name & Signature of Approving Authority with Seal										


Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

		S/Contactor :- Manufacturer :-			Manufacturing Quality Plan Item :- Knife Gate Valve [Manual / Pneumatic] QAP No. : LOI Nos:- Contractor :- M/s BHEL			Project:-SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III. Package :- Mill Rejects System Client :-					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	Raw Material / Bought Out's												
1.1	Body	Chemical & Mechanical	Major	Foundry TC	1 per Heat	Relevant IS / Appr. Drg / Data Sheet	Relevant IS / Appr. Drg / Data Sheet	TC	√	P/V	V	V	
1.2	Gate	do	Major	Lab Analysis	1 per lot	do	do	Mill / Lab TC	√	P/V	V	V	
1.3	Stem (For Manual Valve)	do	Major	Lab Analysis	1 per batch	do	do	do	√	P/V	V	V	
1.4	Pneumatic Cylinder (For Pneu. Valve)	Visual & Functional	Major	Mfr's TC Review	100%	Smooth Operation	Smooth Operation	Mfr's TC	√	P/V	V	V	
2	In - Process Inspection												
2.1	Body, Gate	Dimensional	Major	Measurement	100%	Mfr's Drawing	In-Process Insp. Record	-		P	V	V	# -> Test Pressure as per Data Sheet
2.2	Body Shell Test	Leak Tightness	Major	Hydro Static Test #	100%	Approved Drg / Data Sheet	No Leakage	IR	√	P	V	V	
3	Final Inspection												
3.1	Assembled Valve	Dimension	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	W	W	BHEL / Vendor/CLIENT to Witness 10 % of Quantity.
3.2	do	Function	Major	Operation	100%	Smooth Operation	Smooth Operation	IR	√	P	W	W	
3.3	do	Seat Leakage	Major	Hydro Static Test #	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	W	W	
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
							Name & Signature of Approving Authority with Seal						
SIGNATURES													

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final


		S/Contactor :-			Manufacturing Quality Plan			Project:-SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.					
		Manufacturer :-			Item :- Compressor QAP No. :- LOI Nos:- Contractor :- M/s BHEL			Package :- Mill Rejects System & Coal Deblocking devices Client :-					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	Raw Material / Bought Out's												
1.1	Cylinder	Chemical & Mechanical	Major	Mfr's TC	1 per Heat or Lot	Relevant IS / Appr. Drg / Data Sheet	Relevant IS / Appr. Drg / Data Sheet	TC	√	P/V	V	V	
1.2	Frame Head	do	Major	do	do	do	do	do	√	P/V	V	V	
1.3	Outer Head	do	Major	do	do	do	do	do	√	P/V	V	V	
1.4	Crank Shaft	do	Major	do	do	do	do	do	√	P/V	V	V	
1.5	Connecting Rod	do	Major	do	do	do	do	do	√	P/V	V	V	
1.6	Temp. Switch	Mfr's TC	Major	Visual Review	100%	do	do	do	√	V	V	V	
1.7	Control Panel	Mfr's TC	Major	Visual Review	100%	do	do	do	√	V	V	V	
2	In - Process Inspection												
2.1	Cylinder, Frame Head & Outer Head	Leak Tightness	Major	Hydro Static Test	100%	Appr. drg. / Data Sheet	No Leakage	IR	√	P	V	V	
2.2	After Cooler	Leak Tightness	Major	Hydro Static Test	100%	Approved Drg / Data Sheet	No Leakage	IR	√	P	V	V	
3	Final Inspection												
3.1	After Cooler	Dimension / Visual	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	W	W	
3.2	Control Panel	Dimension / Visual	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	W	W	
3.3	Compressor Assly	Nozzle Test (Mech. Run Test)	Major	Performance	100%	Approved Drg / Data Sheet / BS 1571 Part-2	Approved Drg / Data Sheet	IR	√	P	W	W	
Manufacturer / Sub Vendor SIGNATURES		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
			Name & Signature of Approving Authority with Seal										

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final


		<u>S/Contactor :-</u> Manufacturer :-			<u>Manufacturing Quality Plan</u> Item :- Sump Pump QAP No. :- LOI Nos:- Contractor :- M/s BHEL			Project:-SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III. Package :- Mill Rejects System Client -					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	<u>Raw Material / Bought Out's</u>												
1.1	Casing	Chemical, Mechanical, Hardness, Surface Defect	Major	Chem. Comp. Mechanical Hardness Visual	1 per Heat 1 per Heat 1 Per Heat 100 %	Relevant IS / Appr. Drg / Data Sheet	Relevant IS / Appr. Drg / Data Sheet	TC	√	P/V	V	V	
1.2	Impeller	do	Major	do	do	do	do	do	√	P/V	V	V	
1.3	Shaft	Chemical, Mechanical, Surface Defect	Major	Chem. Comp. Mechanical Visual & UT if Dia >50 mm	1 per Heat 1 per Heat 100 %	Relevant IS / Appr. Drg / Data Sheet / ASTM E 388 for UT	Relevant IS / Appr. Drg / Data Sheet / ASTM E 388	do	√	P/V	V	V	
1.4	Shaft Sleeve	Chemical Hardness	Major	Chem. Comp. Hardness	do	do	do	do	√	P/V	V	V	
2	<u>In - Process Inspection</u>												
2.1	Casing	Soundness of Casting / Leakage	Major	Hydro Static Test	100%	Appr drg. / Data Sheet / IS 5120	No Leakage	IR	√	P	V	V	Hyd. Test at 200% of pump rated head or 150% of Shut off head which ever is higher for 30 min.
2.2	Impeller	Residual unbalance	Major	Dyanamic / Static Balancing	100%	Approved Drg / Data Sheet / ISO 1940 Gr. 6.3	ISO 1940 Gr. 6.3	IR	√	P	V	V	
3	<u>Final Inspection</u>												

Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking				Remarks
1	2	3	4	5	6	7	8	9	D	M	C	K	11	
								TYPE						
3.3	Performance Test with Calibrated Test Lab Motor	Q Vs Head, Power & Efficiency, Noise & Vibration	Major	Measurement & Curves	100%	Approved Drg / Data Sheet / HIS	Approved Drg / Data Sheet / HIS	IR	√	P	W	W	Noise - 85 db max. & Vibration - 50 microns max.	
3.2	Pump strip test in case of doubt due to abnormal sound	Undue Wear	Major	Visual / Strip Test	100%	Mfr's Standard	No Undue Wear	IR	√	P	W	W		
3.3	Painting	Visual & Measurement	Major	Visual & Measurement	100%	As per approved Painting Schedule	As per approved Painting Schedule	IR	—	P	-	-		
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-					
							Name & Signature of Approving Authority with Seal							
SIGNATURES														

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

		S/Contactor :-			Manufacturing Quality Plan			Project:-SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.					
		Manufacturer :-			Item :-EXPANSION BELLOW QAP No. :- LOI Nos:- Contractor :- M/s BHEL			Package :- Mill Rejects System Client :-					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	Raw Material												
1.1	Bellows	physical & Chemical	Major	Lab Analysis	1 per Heat	AS204 TP304/ Approved Drg.	AS204 TP304/ Approved Drg.	MTC	√	V	V	V	
1.2	Fianges/ End Pipe	physical & Chemical	Major	Lab Analysis	1 per lot	IS 2062 / Approved Drg.	IS 2062 / Approved Drg.	MTC	√	V	V	V	
2	In - Process Inspection												
2.1	Bellows & Pipe	Dimension	Major	Measurement	100%	Approved Drg.	Approved Drg.	IR	√	P	V	V	
	** For Bellows	Soundness Of Weld of L-Seam	major	DPT **(Before & After Forming)	100%	ASTM E- 165	No Cracks/ Linear Indication	IR		P	V	V	
3	Final Inspection												
3.1	Assembly	DP Test of Fillet Weld of Bellows to Pipe & Pipe to Fiange	Major	visual	100%	ASTM E-165	No Crack / Linear Inication	IR	√	P	W	V	
3.2	Testing	Dimensions pressure	Major Critical	Measurement Hydraulic	100% 100%	Approved Drg EJMA D.3.2.1/ Data sheet	Approved Drg EJMA D.3.2.1/ Approved Drg.	IR IR	√ √	P P	W W	W W	
		Spring Rate Test (Axial)	Critical	Stiffness Test	100%	EJMA / Data Sheet	EJMA / Data Sheet	IR	√	P	W	W	
		Deflection	Critical	Deflection Test	100%	EJMA / Data Sheet	EJMA/Data Sheet	IR	√	p	W	W	
3.3	Painting	Visual/ Measurement	Major	DFT	100%	Approved Painting Schedule	Approved Painting Schedule	IR	√	p	-	-	
				LEGENDS:-			For Client Use:-		Document No.:-				
				Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report									
Manufacturer / Sub Vendor		Contractor		M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT									
SIGNATURES		P->Perform, V-> Verification, W-> Witness			Name & Signature of Approving Authority with Seal								


Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

	Manufacturer's Name & Address :		MANUFACTURING QUALITY PLAN				Project : SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.							
			Item : MS Plates & Structures		QP No. : Rev. No. : 0 Date : Page No. : 11 of 1		BHEL Ref. : Contract No. : Contractor : BHEL SUB-CONTRACTOR-							
Sub-System :														
Sl. No.	Components & Operations	Characteristic/Item	Class	Type/method of check	Extent of Check	Reference Document	Acceptance Norm	Format of Record		Agency			Remarks	
										P	W	V		
1	2	3	4	5	6	7	8	9	D	10			11	
RAW MATERIAL														
1	Steel Plates	Chemical composition and Mechanical test	Major	Review of corelated MTC	One/heat	IS:2062	IS:2062	Mfgr. TC	✓	3		2,1	Refer Note Below	
2		Visual and dimensional Check	Major	Visual and measurement	100%	Mfgr. TC	Mfgr. TC IS 1852	Mfgr. TC	✓	3	2,1			
3		Identification / Marking	Major	Co-relation establish	100%	AS per manufacturing practice	AS per manufacturing practice IS 2062	Mfgr. TC	✓	3	2	1		
			LEGEND : 1 - BHEL / CUSTOMER 2 - VENDOR 3 - Manufacturer CR - Critical Characteristics MA - Major Characteristics MI - Minor Characteristics				P - Agency Performing the Test W - Agency Witnessing the Test V - Agency Verifying the Test		BHEL Doc. No. PE-QP-279-166-A801 Rev. 0					
MANUFACTURER/ SUBCONTRACTOR		CONTRACTOR												
SIGNATURE								REVIEWED BY		NAME & SIGNATURE OF APPROVING AUTHORITY				

Notes:

- 1 In case material is despatched directly from SAIL/TISCO plant/stockyard or procured from dealer against co-related TC's witnessing by BHEL is waived off and material will be accepted based on MTC of SAIL/TISCO.
- 2 In case material is procured from dealer and co- related TC's are not available, check on 100% quantity of plates will be performed on sample drawn from each plate at NABL certified/ approved laboratory or any govt approved laboratory for chemical & physical properties, However dimensional check shall be witnessed by BHEL.
- 3 There will not be any inspection by CUSTOMER.

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ANNEXURE -X**Check List for Operation & Maintenance Manual**

0 Project name :
 1 Project number :
 2 Package Name :
 3 PO reference :
 4 Document number :
 5 Revision number :


Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	Cover page				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address , Emergency Contact number				
1.5	Name and sign of prepared by , checked by & approved by				
1.6	Revision history with approval Details				
2.0	Index				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	Description of Plant/System				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				
4.0	Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)				
4.1	Pre-Commissioning Checks				

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	<p>SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.</p> <p>MILL REJECT SYSTEM (PNEUMATIC TYPE) & COAL BUNKER DEBLOCKING DEVICES</p> <p>STANDARD TECHNICAL REQUIREMENT</p>	SPECIFICATION No: PE-TS-445-160-A001	
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4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	Operation Guidelines for plant personal/user/operator				
5.1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5.2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5.3	Do's & Don't of the equipments.				
5.4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5.5	Parameters to be monitored with normal values and limiting values				
5.6	Trouble shooting with causes and remedial measures				
5.7	Routine operational checks, recommended logs & records				
5.8	Changeover schedule if more than one auxiliary for the same purpose is given				
5.9	Painting requirement and schedule				
5.10	Inspection, repair , Testing and calibration procedures				
6.0	Maintenance guidelines for plant personal				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning,				

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	normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	Statutory and other specific requirements considerations.				
8.0	List of reference documents				
9.0	Binding as per requirement				

Checked by
Dealing Engineer

Key Resource Person

Section Head

	SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III. MILL REJECT SYSTEM (PNEUMATIC TYPE) & COAL BUNKER DEBLOCKING DEVICES	SPECIFICATION NO.: PE-TS-445-160-A001	
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PACKING PROCEDURE

COMMON GUIDELINES FOR PACKING

1. GENERAL:

The Components/Assemblies need to be packed suitably to avoid physical damage & corrosion during transit & storage. This packing shall be suitable for different handling operations and for the adverse conditions during transportation and during indoor / outdoor storage of materials.

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. The Contractor shall be responsible for all loss or damage during transportation, handling and storage due to improper packing.

The identification marking indicating the name and address of the consignee shall be clearly marked in indelible ink on two opposite sides and top of each of the packages. In addition the Contractor shall include in the marking gross and net weight, outer dimension and cubic measurement.

Each package shall be accompanied by a packing note (in weather proof paper) quoting specifically the name of the Contractor, the number and date of contract and names of the office placing the contract, nomenclature of contents and Bill of Material.

2. TYPES OF PACKING:

The following 5 types of packing have been standardized for packing of General Components/ Assemblies.

- 1) 'OP' - Open Type.
- 2) 'PP' - Partially Packed.
- 3) 'CP' – Crate/Box Packing - Components/Equipment requiring physical protection.
- 4) 'CQ' - Case Packing – Machined components-Small & Medium Components/ Assemblies/ Equipment which require corrosion & physical protection.
- 5) 'CR' - Case Packing – Electrical/Electronic Components/ Assemblies, which require special packing viz. Water Proof, Shock Proof etc...

3. DESCRIPTION OF TYPES OF PACKING:

The various types of packing, as standardized above, are described below.

3.1 'OP' - Open Type


In case, of components which are not affected by water & dust and do not require special protection, are generally not machined, shall be sent as open packages. However, these components may be sent in crates, wherever necessary.

3.2 'PP' - Partially Packed

Components which need special protection at selected portions only shall be despatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces should be protected with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film. All sharp corners and edges shall be protected by rubber mats to prevent damage to the polyethylene film.

3.3 'CP' - Crate Packing

Assemblies/Components which need only physical protection from the point of view of handling shall be despatched duly packed in crates.

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3.4 'CQ' - Case Packing - Machined Components/Assemblies/Equipment

Small and medium sized components/assemblies/equipment due to size/weight and to avoid handling and pilferage problems shall be packed in Case/Containers. Wherever required adequate quantity of silica gel or VCI Powder/Tablets, packed in thin muslin cloth cotton bags shall be suitably placed. Small machines/components of less weight shall be provided with suitable cushioning by Rubberised coir. The components inside the case shall be entirely covered with 100GSM (Colourless) Multi Layered Cross Laminated Polyethylene Film, wherever required. This may be prescribed for electronic parts/critical machined components/surfaces.

For mechanical product like valves where motors are separately securely wrapped in polyethylene, the requirement of individual component wrapping shall be exempted.

3.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies

Delicate components likely to be damaged e.g. Gauges, Instruments etc. are to be wrapped in waxed paper or polyethylene air bubble film and packed in cartons. Adequate quantity of Silica gel packed in cotton bags of 100grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with 100GSM (Colourless) Multi Layered Cross Laminated Polyethylene Film before being packed in the cases. VCI Powder/Tablets can be used as an alternative to Silica Gel.

Empty space in the cartons shall be filled with rubberized coir to get proper cushioning effect. The cartons shall be manufactured from corrugated Fiber Board.

4 PREPARATION OF PACKING CASES

4.1 DIMENSIONS:


- Thickness of planks for Front, rear, top and bottom sides and binding, jointing battens shall be 25/20mm +2/-3 mm as per applicable drawings of the respective units.
- Width of all planks including the tongue shall be more than 125mm and after planing it shall be minimum 100mm.
- Minimum number of planks shall be used for a shook.
- Horizontal, vertical, diagonal planks shall be given for binding (number of such planks depend on the dimension of panel).
- Width of binding planks shall be minimum 100mm.
- Distance between any 2 binding planks shall be less than 750mm.
- diagonal planks shall be used in between vertical binding planks when distance between inner to inner of vertical planks is more than 750mm
- Distance of the outer edges of these planks from the edge of case shall be less than 250mm.
- Diagonal planks are not required for top planks and width side, if the width of pallet is less than 750mm.

4.2 JOINTING OF PLANKS

Single length planks shall be used for cubicles whose overall length is less than 2400mm. For cubicles of length more than 2400mm, jointing is permitted. The jointing shall be done with one single or maximum of 2 planks of wood same as other planks of width 250 mm (minimum) with two rows of nails on either side of the joint in zigzag manner. From the joint along height side, it shall be of lap joint with overlap of at least the width of plank.

4.3 TONGUE AND GROOVE JOINTS

Two consecutive planks shall be joined by tongue and groove joint. Depth of tongue shall be 12+1 mm, thickness of tongue shall be 8 +1 mm. The groove dimensions shall be such that the tongue fits tightly into the groove to make a good joint. This type of joint can be done based on the product requirement wherever required.

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4.4 PERMISSIBLE DEFECTS

Wood shall be free from knots, bows, visible sign of infection and any kind of decay caused by insects, fungus, etc.

End splits: Longest end splits at each end shall be measured and lengths added together. The added length shall not exceed 60mm per meter run of shook's. Wood pins shall be used to prevent further development of split.

Surface cracks: Surface cracks with a maximum depth of 3mm are permissible. A continuous crack of any depth all along the length is not allowed.

4.5 OTHER MATERIALS

4.5.1 NAILS

The dia. of the nails shall be 3.15mm. The length of the nails shall be 65mm wherever two planks of 25mm thickness are joined and 75mm wherever a 25mm planks is joined to a 50mm plank.

4.5.2 BLUE NAILS

These are used for nailing bituminized Kraft paper/hessian cloth to the planks. The length of the nails shall be 16mm.

4.5.3 HOOP IRON STRIPS

These are used for strapping the boxes. The width of the strips shall be 19+1mm and thickness 0.6+0.01mm. The material shall be free from rust. If sufficient nailing is done for bigger boxes, strapping need not be done.

4.5.4 CLIPS

These shall be used for strapping the hoop iron strips on the boxes.

4.5.5 BRACKETS

These brackets are used for nailing to the corners of cubicle boxes. The brackets shall be of mild steel of thickness min 2mm and width 25+1mm. The brackets shall be of "L" shape, the length of each side being 100+2mm. Two holes shall be provided towards the end of each side for screwing /nailing.

4.5.6 FASTENERS

Bolts, double nuts, spring washers will have to be used for packing of some special items like transformers, reactors, breakers, etc., to hold the job to the bottom plank of the box. The bolts, nuts, washers will be provided by the vendor. Drilling of holes will have to be done using contractor's tools.

4.5.7 MULTI LAYERED CROSS LAMINATED POLYTHELENE FILM

100GSM (Colourless) Multi Layered Cross Laminated Polythelene Film are used to make covers to the jobs individually. The cross lamination gives qualities of extra toughness, together with flexibility and lightness coupled with good weather resistance to ultra violet rays.

4.5.8 RUBBERISED COIR:


The rubberized coir is used as cushioning material. For the packing of loose items, items are to be arrested by using rubberized coir. For the packing of cubicles rubberized coir of thickness 25mm and width 75mm shall be used.

4.5.9 FOAM RUBBER / 'U' FOAM:

This is used for covering the delicate items. This material is provided by the vendor.

4.5.10 MARKING PLATE:

This shall be of anodized aluminium sheet. Size of the marking plate shall be maintained minimum of size as

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per the details specified in the Figure 4.

4.5.11 PACKING SLIP HOLDER:

This shall be of galvanized iron tinned sheet /Aluminium sheet

4.5.12 SILICA GEL:

Silical gel shall be used for such products only where moisture needs to be avoided.

4.5.13 COTTON BAGS:

These are used for holding silica gel. The bags shall have the following matter indicated on them:

BHEL-UNIT NAME PLACE	-PINCODE
SILICA GEL	-INDICATING TYPE
BLUE :	-ACTIVE
ROSE :	-REDUCED ACTIVITY
WHITE :	-NO ACTIVITY. TO BE REPLACED WITH FRESH SILICA GEL

4.5.14 COTTON/ PLASTIC TAPE:

This is used for tying small items. And also to prevent vibrations of moving parts within the cubicles.

4.5.15 MARKING INK:

The ink used normally is black in color. In some special cases other color also will have to be used. The ink shall be non-fading/indelible and non-washable by water.

4.5.16 POLYETHYLENE BAGS:

These are to be used for keeping the Packing slips. The bag shall be of size 70mm X 100mm (minimum).

4.5.17 Hessian cloth, twine thread, paint will have to be used in packing certain items.

4.5.18 Mechanical Latching clamps:

For CLW Railway panels and similar Panels self-locking clamps can also be used on need basis in conjunction with or apart from regular bolt and nut fixing arrangement. For reusable boxes, these clamps provide easy locking and unlocking arrangement. These clamps will be made available from BHEL in some cases.


4.5.19 STICKERS

The following stickers to be put by the vendor on cubicles/Boxes after packing.

- 1) Case No sticker: 2 nos. Size 25.Cm x 0.45Cm
- 2) BHEL Monogram sticker: 1 no. Size 1.75Cm x 2.3Cm
- 3) Address sticker: 2 nos. Size 3.8Cm x 3.0Cm
- 4) Direction sticker "Front" & "Back" - 4 nos. Size 2.0Cm x 0.75Cm
- 5) Chain Mark Sticker: 4 Nos. Size – 3.0Cm x 0.75Cm
- 6) "Fragile" sticker: 2 Nos. Size. 2.1Cm x 1.5Cm
- 7) "DO NOT STACK" sticker - 2 Nos. Size 3.0Cm x 2.2Cm

In place of stickers, writing all the details legibly with paint shall be allowed & respective units may take decision accordingly.

5. PACKING OF CUBICLES:

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5.1 The packing is to be done as per clause 4 in all respects.

5.2 The cubicles are already fixed on wooden pallets. Hence the contractor need not arrange the bottom pallets normally.

5.3 The cubicles will be of different sizes both width wise and lengthwise. The cubicles may be made up of single suite, 2 Suite, 3 Suite, 4 Suite, etc., The width of the cubicles generally varies from 400 mm to 1650mm. The length of the cubicle, generally varies from 1500 mm to 4800 mm. The height is normally 2430 mm. In some cases, the height may be less/more.

5.4 MULTI LAYER CROSS LAMINATED POLY FILM

The inner surface of 4 sides of shook's shall be nailed with Multi-layer cross laminated poly film (as per 4.5.7) using blue nails (as per 4.5.2) wherever 2 pieces of Cross laminated poly film are used, the joint shall have an overlap of minimum 20mm.

The inner surface of top cover shall be nailed with Multi-layer cross laminated poly film (as per 4.5.7). This sheet shall project outside on 4 sides by at least 100mm and shall be nailed properly on sides. Joining of sheets should have overlap of minimum 20mm.

The cubicles shall be covered with Multi-layer cross laminated poly film (as per 4.5.7).

5.5 SILICA GEL:

Silica gel (as per 4.5.12) packed in cotton bags shall be kept at different places inside the cubicle as per BHEL-Unit directions. Each suit of cubicle shall be provided with 1 kg of Silica gel (for a 4 suit cubicle 4 kgs of Silica Gel to be used. The bag containing silica gel to be as per 4.5.13).

5.6 LOOSE PARTS:

Any loose parts in the cubicles shall be tied using cotton/ plastic tape. Wooden battens shall be provided wherever necessary.

5.7 WOODEN BATTENS:

In case of cubicle which are not rectangular in shape like control desks, sufficient number of wooden rafters/battens of proper size shall be provided to give strength to the package.

5.8 RUBBERISED COIR:

Gap between the cubicle and the case shall be filled with rubberized coir (as per 5.5.8) with distance between consecutive layers less than 500mm.

5.9 CLAMPING:

Packing shall be bound at edges by nailing M.S. Clamps / Brackets (as per 5.5.5). Each vertical edge shall have minimum 3 clamps. Top horizontal edges will have one clamp for every meter length of package. However, minimum 4 clamps shall be nailed at the top for any cubicle.

5.10 PACKING SLIP:


Packing slip kept in the polyethylene bag (As per 5.5.16) shall be placed in the box at appropriate place. In addition, one more packing slip covered in polyethylene cover and packing slip holder (as per 5.5.11) shall be nailed to front / rear of case.

5.11 MARKING PLATE:

One no. (As per 5.5.10) shall be nailed to the front side of the case.

5.12 CASE MOUNTING:

After complete packing, stencil marking of various details and marking of symbols shall be done as per BHEL instructions using indelible / non washable marking ink.

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5.13 Different types (Typical) of Cubicles with sizes for Packing

1. Single suite cubicle - 900 x 950 x 2500
2. Two suite cubicle - 1650 x 950 x 2500
3. Three suite cubicle - 2400 x 950 x 2500
4. Four suite cubicle - 3150 x 950 x 2500
5. Regulation cub - 1300 x 1350 x 2500
6. Thy cub - 2870 x 1350 x 2500
7. VFD Cub - 3800 x 1550 x 2500

6 PACKING OF LOOSE ITEMS/SPARES

- 1) Shape of cases shall be square, rectangular with single gabled roof or with double gabled roof depending on the nature of the job to be packed. Construction shall be as per drawings enclosed. Only gable will be additional as required.
- 2) Wood with Tongue and Groove joint as per clause 4.3.
- 3) Width of planks shall be at least 100 mm. Width of binding planks (battens) shall be at least 75mm.
- 4) External surface of planks on front and rear shall be plane 100% (except bottom plank).
- 5) Inner surfaces of all 6 sides shall be lined with Multi Layered Cross Laminated Polythelene Film (as per clause 4.5.7) using blue nails.
- 6) Rubberized coir of minimum 25mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of box.
- 7) Internal packing: Items that go into the box shall be packed using 100GSM, (Colourless) Multi Layered Cross Laminated Polyethylene Film. Any space left between the job and the sides and the top of the box shall be filled with rubberized coir to get proper cushioning effect.
- 8) Certain items like transformers, reactors, breakers, etc., shall be bolted to the bottom of the box using bolts, nuts and washers.
- 9) Silica gel as per clause 4.5.12 held in cotton bags as per clause 4.5.13 shall be kept at proper places in the box.
- 10) Packing slip kept in polyethylene bag (clause 4.5.16) shall be placed in the box.
- 11) Marking plate as per clause 4.5.10 shall be nailed to side of the box.
- 12) Two numbers of hoop iron strips as per clause 4.5.3 shall be strapped tightly on the case using clips.
- 13) Stencil marking of various details and marking of various symbols shall be done as per BHEL instructions using indelible/non-washable marking ink.
- 14) Loose items to be kept inside the cubicle


- The components which are removed from cubicle for shipping purpose only, such as meters shall be kept inside the cubicle individually, kept in wooden box and tied firmly in bottom of Cubicle.
- Other items which are given loose in addition to cubicle shall be packed in separate boxes.

7 BOX SIZES

7.1 BOX SIZES

Table 1 – SPARES WOODEN BOX DETAILS

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SNO	BOX	BOX SIZE	BOX Wt	Carrying Capacity
	TYPE	(in mm)	(in KG)	
1	A	800 X 200 X 200	15	
2	B	1500 X 200 X 200	22	
3	C	2000 X 200 X 200	27	
4	D	1100 X 200 X 200	15	
5	E	200 X 200 X 200	5	
6	F	320 X 250 X 260	13	
7	G	320 X 250 X 430	16	
8	H	430 X 370 X 430	23	
9	I	1100 X 400 X 400	45	
10	J	1500 X 500 X 400	65	
11	K	2000 X 500 X 400	93	
12	L	2500 X 500 X 400	88	
13	M	900 X 600 X 600	100	
14	N	3000 X 400 X 400	60	
15	P	600 X 500 X 400	35	
16	Q	710 X 630 X 600	90	
17	R	850 X 630 X 670	102	
18	S	1000 X 770 X 670	140	
19	T	2500 X 850 X 800	180	
20	U	1500 X 700 X 700	120	
21	W	1200X900X600	120	
22	Y	450 X 200 X 200	10	

Table 2 – WOODEN BOX DETAILS

BOX TYPE	BOX SIZE (in MM)	BOX Wt (in KG)	Carrying Capacity
1	320X250X260	10	
2	320X250X430	15	
3	430X370X430	25	
4	670X670X470	65	
5	720X630X600	75	
6	1000X770X660	100	
7	1100X430X670	80	
8	1200X1200X900	80	

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9	1300X770X1050	155	
10	2500X850X800	225	
11	2000X1500X1200	305	
12	1850X1050X1250	260	
13	2000X800X800	180	
14	2600X1500X1600	470	
15	250X250X600	20	
16	250X250X880	30	
17	300X300X700	25	
18	380X380X880	45	
19	510X510X1400	60	
20	570X570X1400	80	
21	575X575X1875	105	
22	3600X1100X1100	390	
23	900X500X800	110	
24	2000X950X740	225	
25	1600X1120X700	220	
26	2500X2000X1200	490	
27	2900X1900X1400	525	
28	3000X1000X900	370	
29	3200X2200X950	450	
30	2150X1100X750	325	
31	2000X2000X700	130	
32	700X1200X1325	130	

TABLE 3 STEEL BOXES

S.NO.	TYPE	DIMENSION IN MM			WEIGHT	CARRYING CAPACITY (KGS)
		LENGTH	BREADTH	HEIGHT		
1	I	2480	1680	1500	339	4500
2	II	1200	900	600	61	2000
3	IIB	1800	850	950	115	2500
4	III	900	600	600	29	1000
5	IV	600	450	500	19	750
6	V	400	350	300	11	500

TYPICAL PATTERN OF WOODEN BOX

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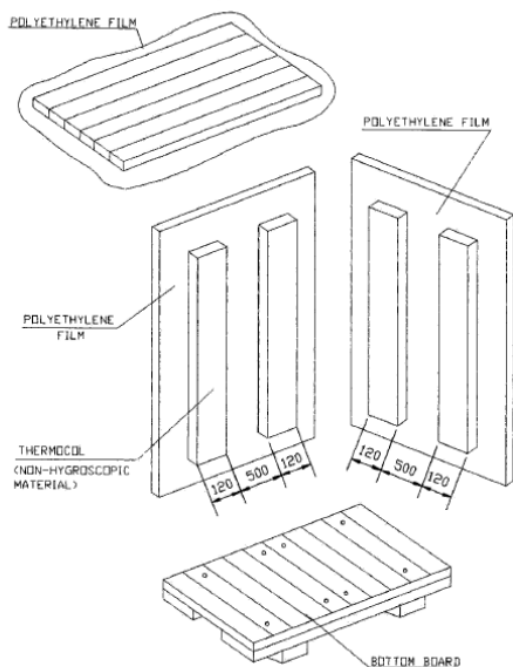


Figure 1

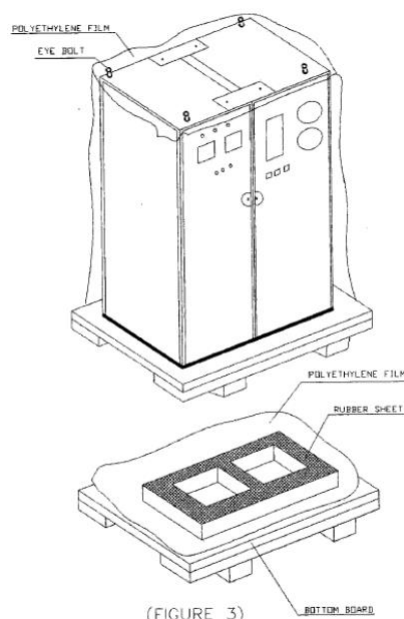



Figure 2

7.3 SEALED PACKING:

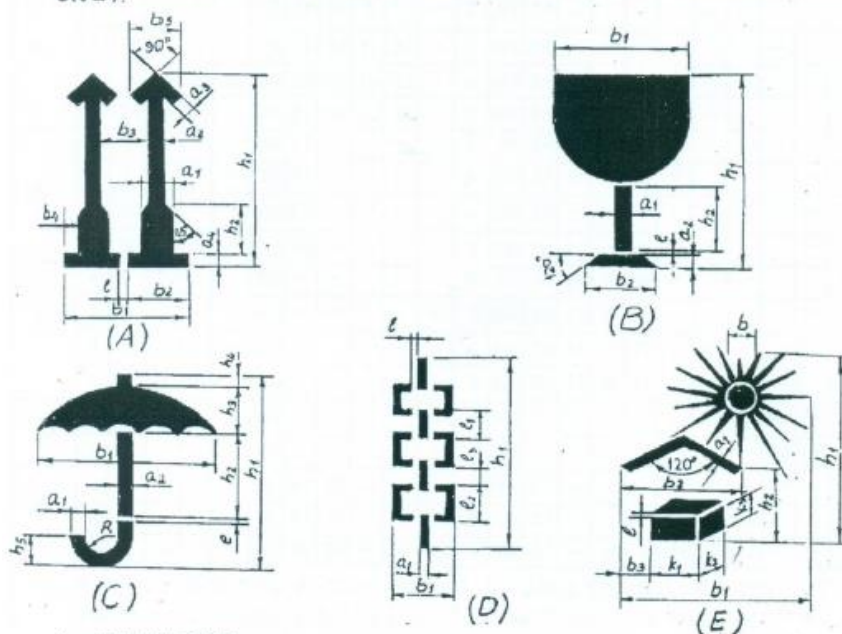
Components sub-assemblies and assemblies sensitive to climatic conditions shall be packed seal tight. All the openings of the sensitive components, sub-assemblies and assemblies shall be blanketed to prevent the ingress of dust and moisture. The components sub-assemblies and assemblies are completely covered with 2 layers of polyethylene sheet. All sharp corners and edges are to be protected by rubber mats to prevent the polyethylene sheet from damage. Top surface of the case shall be free from dents to prevent rain water pockets.

8 MARKINGS/STENCILINGS

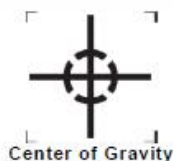
	SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.		SPECIFICATION NO.: PE-TS-445-160-A001	
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MARKINGS ON PACKING CASE S

1. THIS PLANT STANDARD PRESCRIBES THE VARIOUS CAUTION SIGNS AND OTHER MARKINGS ON PACKING CASES.
2. DIMENSIONS IN THE TABLE 1 SHALL BE USED FOR MAKING STENCILS ONLY.




- A. UPRIGHT
- B. FRAGILE
- C. PROTECTION FROM FALLING OR CONDENSING MOISTURE.
- D. SLINGING POSITION
- E. PROTECTION FROM DIRECT RADIATIONS.



Center of Gravity

Figure 3

	SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.		SPECIFICATION NO.: PE-TS-445-160-A001	
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DESIGN- ATION		DIMENSION IN MM																									
		a1	a2	a3	a4	b1	b2	b3	b4	b5	b	l	h1	h2	h3	h4	h5	k1	k2	k3	l1	l2	l3	R			
A	1	12	5	5	4	52	25	19	8	21		2	84	23													
	2	17	7	7	6	75	36	29	11	30		3	119	33													
	3	24	10	10	8	104	50	38	16	42		4	168	46													
	4	34	14	14	11	147	71	59	23	60		5	239	65													
B	1	5	5			50	33					2	84	25													
	2	7	7			71	47					3	119	36													
	3	10	10			100	66					4	168	50													
	4	14	14			142	94					5	239	71													
C	1	4	3			66						2	80	39	19	5	11								6		
	2	6	4			85						3	114	55	27	7	16								9		
	3	8	6			120						4	160	78	38	10	22								12		
	4	11	9			170						5	227	110	54	14	31								17		
D	1	6				30						4	148								30	30	10				
	2	9				42						5	209								42	42	14				
E	1	3				69	47	10			16	2	91	26				17	8	11							
	2	4				98	67	15			23	3	128	33				24	11	16							
	3	6				138	94	20			32	4	182	62				34	16	22							
Table 4																											

Table 4

Black and Red Marking Ink to IS:1234 "Ink, Stencil, Oil Base, For Marking Porous Surfaces" or duplicating ink stencilling, oil base for marking porous surfaces.

All cases containing fragile items are to be stencilled with red marking and stencilling paint/ink


"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".

Besides the caution signs the product information's shall be stencilled of letters with 13mm to 50mm height. In case of consignment consists of more than one package, each package shall carry its package no as given in shipping list. All caution signs shall be stencilled in high quality full glossy out door finishing paint red in colour (AA56126). All other markings shall be carried out in black enamel.

Caution signs & other markings shall be stencilled on both the end shooks & the side shooks.

Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.

Note: Incase the size of package is small for using the stencils, then hand written letters/figures shall be allowed.

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	BHEL – <unit> - <location> - <pin>			
CONSIGNEE				
MATERIAL				
CUSTOMER REF.			MO. NO.	
DESPATCH ADVICE NOTE NO			CASE NO	
DIMENSIONS(MM) L x B x H			NET WT –KGS	GROSS WT –KGS
SPECIAL INSTRUCTIONS	HANDLE WITH CARE - KEEP DRY DO NOT DROP - DO NOT TILT			

Figure 4 – TYPICAL MARKING PLATE (225 X 170)



Figure 5


Easy spares [Initial and O&M] Traceability and Identification at units and as well as at sites:

9 STANDARD METHOD OF PACKING

Table 5 - Standard Method of Packing


DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
-------------	------	-------	------	--------	------	------	---------------	---------------

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	<p>SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.</p> <p>MILL REJECT SYSTEM (PNEUMATIC TYPE) & COAL BUNKER DEBLOCKING DEVICES</p>	SPECIFICATION NO.: PE-TS-445-160-A001	
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PRESSUE VESSELS								
TOWERS					O			
TANKS					O			
VESSELS					O			
GASKETS	O							
FASTENERS	O							
COVERS		O						
EXCHANGERS								
HEAT EXCHANGERS					O			
TUBE BUNDLE	O							
SHELL					O			
AIR FIN COOLERS					O			
COLOUMNS, MOTOR SUSPENSIONS, PLENUM CHAMBERS, SCREEN GUARDS, ETC					O			
BEARING BLOCKS	O							
FANS	O	O						
MOTORS	O							
GASKETS	O							
FASTENERS	O							
TEST FLANGES			O					
TEST RINGS			O					
COVERS			O					
CRYOGENIC VESSELS								
COLD CONVERTERS					O			
HORIZONTAL STORAGE TANKS					O			
TRANSPORTATION TANK					O			
COLD BOX					O			
DRYING UNIT					O			
DRYING BOTTLES					O			
MOISTURE SEPARATORS					O			
SILENCERS					O			
ONGC SKIDS					O			
VAPORISER		O						
SPECIAL PRODUCTS								
SI/VI PIPING		O						
CRO BIO CONTAINERS	O							
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
AIR BOTTLES	O							
TITANIUM BOTTLE	O							

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	<p>SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.</p> <p>MILL REJECT SYSTEM (PNEUMATIC TYPE) & COAL BUNKER DEBLOCKING DEVICES</p>	SPECIFICATION NO.: PE-TS-445-160-A001	
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WAR HEAD CONTAINER	O							
MISSILE CONTAINER	O							
FUEL CONTAINER	O							
AIR LOCK ASSEMBLY	O							
BOILER DRUMS					O			
BOILER ITEMS								
COILS			O					
PANELS					O			
HEADERS			O		O			
FEEDERS								
MACHINED ITEMS								
SHELL SEGMENTS					O			
SHELL SEGMENTS IN STACKS					O			
SPHERE PETALS								
COLOUMNS, BASE PLATES, TIERCOS, PIPES, NOZZLE E1, F1, INTERNAL PIPES, PADS ETC.					O			
ROLLERS	O							
VALVE TRAYS								
VALVE TRAY COMPONENTS	O							
LATTICE GIRDERS		O						
FASTENERS	O							
GASKETS	O							
SUB CONTRACTS								
FAB STRUCTURALS					O			
SUPPORTING STRUCTURALS					O			
STRUCTURE SUB ASSEMBLY					O			
FAB PIPES					O			
GRATINGS					O			
STAIR CASES					O			
HANDRAILS/ PLATFORMS					O			
BOUGHT OUT COMPONENTS								
IRON & STEEL (LIKE PLATES, BEAMS, ANGLES, CHANNELS ETC.)					O			
PIPE FITTINGS								
CS PIPES, TUBES					O			
SS PIPES, TUBES					O			
FIN TUBES	O							
ELBOWS		O			O			
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
FLANGES	O	O						


	SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III. MILL REJECT SYSTEM (PNEUMATIC TYPE) & COAL BUNKER DEBLOCKING DEVICES	SPECIFICATION NO.: PE-TS-445-160-A001	
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VALVES	O							
GAUGES	O							
DEMISTERS		O						
ABSORBANTS (LIKE MOLECULAR SIEVES, ACTIVATED ALUMINA, MOBILE SORBID)						O		
PAINT TINS		O						
PAINT DRUMS						O		
IGNITORS	O							
SPRAY NOZZLES	O							
ELECTRICAL INSTRUMENTATION								
MOTORS, PUMPS, COMPRESSORS, TURBINES	O							
SWITCH BOARDS, DISTRIBUTION BOARDS, STARTERS, JUNCTION BOXES		O						
INDICATORS, VIBRATOR SWITCHES	O							
CABLE BUNDLES, CABLE DRUMS					O			
CABLE TRAYS, CABLE RACKS, EARTHING MATERIAL		O						
OPERATIONAL SPARES	O							

10 PROCEDURE FOR HANDLING OF COMPONENTS

The purpose of this procedure is to protect the quality of the components/equipment while handling in various stages of manufacturing packing & despatching.

- 10.1 Adequate care shall be taken in handling the material, and components to avoid damage during receipts, storage issue manufacture & despatch operations.
- 10.2 Appropriate material handling equipment like fork lifters, cranes etc. shall be used where needed.
- 10.3 Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. shall be done carefully.
- 10.4 For critical items, where specified, special handling fixtures shall be used for lifting.
- 10.5 Slings and shackles used for lifting the components/equipment shall be checked for fitness and suitability before use.
- 10.6 Slings used on machined surfaces shall be suitably padded. No slings shall be used on journal surfaces.
- 10.7 Precision machined components like blades, catches, rollers etc. shall be lifted using suitable wooden

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pallets.

10.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH

Before loading/unloading a packing case from the carrier look for the following shipping instructions painted on the packing case.

- The markings showing the upright position.
- The markings showing the sling position
- Markings showing the fragile contents.
- Other required markings as per clause no.10

10.8.1 Appropriate cranes and slings should be used for different components/ cases. Slings should normally make an angle as minimum as possible (width wise) but in no case more than 15°.

10.8.2 Handling and lifting should be done without jerks or impacts.

10.8.3 Immediately after receipt of the goods, the packing should be examined all-round for any sign of damage. If necessary, lift the cover or a number of boards of the case so as to make the contents visible. In the event of sealed packing being used the plastic sheeting should not be damaged. It is imperative that the packing material is restored in original condition after the inspection.

10.8.4 On receipt of the equipment it should be checked with the shipping list and missing or damage if any should be reported immediately. It is important to arrange for immediate examination to determine the extent of the damage, the cause of the damage and where applicable the person or persons responsible for the damage. According to general practice when transporting by railway or by road vehicle the carrier concerned should be immediately called upon (within specified periods) for jointly establishing a statement of the damage. This is essential as a basis for a subsequent claim and possible damage report to the insurance company.

10.8.5 Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.

10.8.6 Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

11 GENERAL GUIDELINES FOR ODC TRANSPORTATION/DESPATCH

Based on the Dimensions/Weight indicated in the Transportation Sketch, the type of Trailer is decided and indicated in the Tender Enquiry.


11.1 TRANSPORTATION:

1. LOW BED TRAILERS (LB 8):

Well Bed Length : 10000mm
Over Gooseneck : 13000mm
Width : 3000mm
Carrying Capacity : 40MT

2. LOW BED TRAILERS (LB 16):

Well Bed Length : 12000mm

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Over Gooseneck : 16000mm

Width : 3000mm

Carrying Capacity : 75MT

3. TOW TYPE TRAILERS (WITH FRONT DOLLEY 16 TYRES): 12000MM length
(for Exceptional equipment length: 30000mm and above)

Bigger Dia equipment are loaded in the Well with overhanging.

Smaller Dia equipment with excess length are loaded over Gooseneck with rear hanging.

The Vehicle Dimensions are defined above are only guidelines for selection based on actual Dimensions/
Weight of the Consignment

11.2 PACKING:

For all ODCs, Wooden Saddles are cut to the diameter of equipment as per the Transportation Sketch.

Wooden Saddles	For Diameter up to 4000mm	For Diameter above 4000mm
Length:	1836/2743mm (6'0"/9'0")	3353mm (11'0")
Width:	300mm (1'0")	300mm (1'0")
Height:	Saddle + one/two wedges a top	Saddle + three/four wedges a top

Number of Saddles:	
Minimum	3 in case of Loading inside Well +1 when loaded on Gooseneck
Maximum:	4 in case of Loading inside Well +2 when loaded on Gooseneck

For Securing the equipment firmly on the Trailer, 19mm (3/4"), wire rope with 25mm (1") Heavy Duty Turn Buckles / BD Clamps are used as Lashing for the equipment.

12 GUIDELINES FOR HANDLING/LOADING/LASHING

- Jobs to be checked for complete painting before loading.
- Components to be lifted with Nylon belts. This protects painting, edges and attachments.
- All the components to be transported by putting inside the properly fabricated Crating
- Small components may fall down while transporting without closed crating and there are chances of missing of small parts. Hence, it is always better to transport small components in closed containers/crating. Loose to be being shipped in a closed crating.
- No component loaded over the crating.
- LASHING:** Use Nylon belts only for lashing of all components. It prevents removal off painting and cut in the materials.

SITE STORAGE AND PRESERVATION GUIDELINES

FOR

MECHANICAL BOPs

(Doc No: PE-DC-SSG-A001 REV.00)



PROJECT ENGINEERING MANAGEMENT, POWER SECTOR
BHARAT HEAVY ELECTRICALS LIMITED-NOIDA

CONTENT

- 1 SCOPE OF THE DOCUMENT
- 2 PURPOSE OF STORAGE & PRESERVATION
- 3 MEASURES TO BE TAKEN FOR STORAGE AND PRESERVATION
 - a) GENERAL STORAGE REQUIREMENTS
 - b) GENERAL PRESERVATION REQUIREMENTS
 - c) GENERAL INSPECTION REQUIREMENTS
- 4 TYPE OF STORAGE FOR VARIOUS EQUIPMENT
5. CONCLUSION
6. STACKING ARRANGEMENT FOR PLATES AND STRUCTURAL STEEL

1. SCOPE OF THE DOCUMENT

This guideline is prepared in intent to provide proper site storage and preservation of the Mechanical, Electrical and C & I items / equipment supplied under various bought out packages/items. This storage procedure shall be followed at different power plant sites by concerned agency for storage and preservation from the date of equipment received at site until the same are erected and handed over to the customer.

2. PURPOSE OF STORAGE & PRESERVATION

Many of the items may be required to be kept in stores for long period. It shall therefore be essential that proper methods of storage and preservation be applied so that items do not deteriorate, loose some of their properties and become unusable due to atmospheric conditions and biological elements.

3. MEASURES TO BE TAKEN FOR STORAGE, HANDLING & PRESERVATION

a) GENERAL STORAGE REQUIREMENTS

1. To the extent feasible, materials should be stored near the point of erection. The storage areas should have adequate unloading and handling facilities with adequate passage space for movement of material handling equipment such as cranes, fork lift trucks, etc. The storage of materials shall be properly planned to minimise time loss during retrieval of items required for erection.
2. The outdoor storage areas as well as semi-closed stores shall be provided with adequate drainage facilities to prevent water logging. Adequacy of these facilities shall be checked prior to monsoon.
3. The storage sheds shall be built in conformity with fire safety requirements. The stores shall be provided with adequate lights and fire extinguishers. 'No smoking' signs shall be placed at strategic locations. Safety precautions shall be strictly enforced.
4. Adequate lighting facility shall be provided in storage areas and storage sheds and security personnel positioned to ensure enforcement of security measures to prevent theft and loss of materials.
5. Adequate number of competent stores personnel and security staff shall be deployed to efficiently store and maintain the equipment / material.
7. The equipment shall be stored in an orderly manner, preserving their identification slips, tags and instruction booklets, etc., required during erection. The storage of materials shall be equipment-wise. Loose parts shall be stored in sheds on racks,

preserving the identification marks and tags in good condition. The group codes shall be displayed on the racks

6. At no time shall any materials be stored directly on ground. All materials shall be stored minimum 200 mm above the ground preferably on wooden sleepers

b) GENERAL PRESERVATION REQUIREMENTS

1. All special measures to prevent corrosion shall be taken like keeping material in dry condition, avoiding the equipment coming in contact with corrosive fluid like water, acid etc.
2. Materials which carry protective coating shall not be wrapped in paper, cloth, etc., as these are liable to absorb and retain moisture. The material shall be inspected and in case of signs of wear or damages to protective coating, that portion shall be cleaned with approved solution and coated with an approved protective paint. Complete record of all such observations and protective measures taken shall be maintained.
3. Generally equipment supplied at site are properly greased or rust protective oil is applied on machined/ fabricated components. However periodic inspection shall be carried out to ensure that protection offered is intact.
4. While handling the equipment, no dragging on the ground is permitted. Avoid using wire rope for lifting coated components. Use polyester slings (if possible) otherwise protective material (e.g. clothes, wood block etc.) should be used while handling the components with rope / slings
5. For Equipment supplied with finished paint, touch paint shall be done in case any surface paint gets peeled off during handling. Otherwise such surfaces shall necessarily be wrapped with polythene to avoid any corrosion. Further for equipment wherein finish coat is to be applied at site, site to ensure that equipment is received with primer coat applied.
6. It shall be ensured by periodic inspection that plastic inserts are intact in tapped holes, wherever applicable.
7. Pipes shall be blown with air periodically and it shall be ensured that there is no obstruction.
8. Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.
9. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion/jamming due to prolonged storage.

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.
11. Following preservatives/preservation methods can be used depending upon type of equipment
 - a. Rust preventive fluid (RPF)
 - b. Rust protective paints
 - c. Tarpaulin covers, in case of outdoor storage
 - d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –
 - Ingress of moisture and corrosion damages.
 - Damage to protective coating.
 - Open ends in pipes, vessels and equipment -
 - In case any open ends are noticed, same shall be capped.
2. Any damages to equipment / materials.
 - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
 - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

The types of storage are broadly classified under the following heads:

i **Closed storage with dry and dust free atmosphere. (C)**

The closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated asbestos sheets / galvanised iron sheets for roofing. Brick walls / asbestos sheets can be used to cover all the sides. The floor of the shed can be finished with plain cement concrete suitably glazed. The shed shall be provided with proper ventilation and illumination.



ii **Semi-closed storage. (S)**

The semi closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated / asbestos sheets for roofing. The floor shall be brick paved. If required a small portion of sides can be covered to protect components from rainwater splashing onto the components.





iii Open storage (O)

The open yard shall be levelled, well consolidated to achieve raised ground with the provision of feeder roads for crane approach along with access roads running all sides. One part of the open yard shall be stone pitched, levelled and consolidated with raised ground suitable for storing / stacking heavier and critical components with due space to handle them by cranes etc . Adequate number of sleepers, concrete block etc. to be provided to make raised platforms to stack critical materials.

A separate yard to be identified as “scrap yard” slightly away from main open yard to store wooden/steel scraps, which are to be disposed off. This is required to avoid mix up with regular components as well as to avoid fire hazard.

Some of the components, which are having both machined & un-machined surfaces and are bulky, shall be stored in open storage area on a raised ground and suitably covered with water proof / fire retardant tarpaulin.



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The equipment listed below shall be stored and inspected as per requirement mentioned in the table below.

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
Raw material /mechanical items like pipes, plates, structure sections etc.)				
1.	Steel pipes (lined/unlined)	S	Damage , paint, corrosion, rubber lining peeling	Provide end cap
2.	MS Plates	S	Damage, paint, corrosion	
3.	SS Plates	S	Damage	
4.	Non-metallic pipes	S	Damage, cracks	Provide end cap
5.	Stainless steel pipes	S	Damage ,	Provide end cap
6.	MS sections, beams	S	Damage, paint, corrosion	
7.	Cable trays	S	Damage, condition of preservations	
8.	Insulation sheets	S	Damage	
9.	Insulation	C	Damage, packing	
10.	Hangers Rods	S	Damage, paint, packing	
11.	Tubes	S	Damage, paint , packing	Provide end cap
12.	Hume pipes	O	Damage	
13.	Castings	O	Damage, paint, corrosion	
Fabricated mechanical items (pressure vessels, tanks etc.)				
14.	Pressure vessels (unlined)	O	Damage, paint, corrosion,	Covered nozzles
15.	Atmospheric storage tanks (unlined)	O	Damage, paint, corrosion	Covered nozzles

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
16.	Pressure vessels (lined)	S	Damage, paint, corrosion, rubber lining	
17.	Atmospheric storage tanks(lined)	S	Damage, paint, corrosion, rubber lining	
18.	Support structures	O	Damage , paint, corrosion	
19.	Flanges	C	Damage , paint, corrosion	
20.	Fabricated pipes	S	Damage , paint, corrosion	Provide end cap
21.	Vessels internals	C	Damage , paint, corrosion ,packing	
22.	Grills	S	Damage , paint, corrosion	
23.	Angles	S	Damage , paint, corrosion	
24.	Bridge mechanism/clarifier mechanism	O	Damage , paint, corrosion	
25.	Cranes, rails	S	Damage , paint, corrosion	
26.	Stair cases	O	Damage , paint, corrosion	
27.	Ladders/handrails	O	Damage , paint, corrosion	
28.	Fabricated ducts	S	Damage , paint, corrosion	
29.	Isolation Gates	O	Damage , paint, corrosion	
30.	Fabricated boxes/panels	S	Damage , paint, corrosion	
Mechanical components like valves, fittings, cables glands, spares etc.)				
31.	Valves	S	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
32.	Fittings	S	Damage , packing	Provide end cap
33.	Cable glands	C	Damage , packing	
34.	Tools & tackles	C	Damage , packing	
35.	Nut , bolts, washers,	C	Damage , packing	
36.	Gasket & Packings	C	Damage , packing	
37.	Copper tubes	C	Damage , packing, corrosion	Provide end cap
38.	SS tubing	C	Damage , packing	Provide end cap
Rotating assemblies (pumps, blowers, stirrers, fans, compressors etc.)				
39.	Pumps	S	Damage , packing, corrosion	Shaft rotation
40.	Blowers/Compressors	S	Damage , packing, corrosion	Shaft rotation
41.	Agitators/stirrers/radial launders	C	Damage , packing, corrosion	Shaft rotation
42.	Rollers for chlorine tonner mounting	C	Damage , packing, corrosion	
43.	Centrifuge	S	Damage , packing,	
44.	Gear box	C	Damage , packing, corrosion	
45.	Bearings	C	Damage , packing, corrosion	
46.	Fans	S	Damage , packing, corrosion	
47.	Dosing skids	S	Damage , packing, corrosion	
48.	Pump assemblies	S	Damage , packing, corrosion	
49.	Air washers(INTERNALS)	S	Damage , packing	
50.	Air conditioners (split)	C	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H ₂ SO ₄)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
68.	Sodium hydroxide (NaOH)	Store in canes/ storage tank in dyke area	Date of production/ leakage/ fumes/ breather	hazardous chemical ,breather to be checked for air ingress
69.	Sodium hypo chlorite	To be stored under shed	Date of production/ leakage/ fumes	hazardous chemical ,self-life normally 15-30 days after which strength of chemical decays
70.	Ammonia	S	Date of production/ leakage/ fumes	Store in closed storage tanks, hazardous chemical
71.	CW treatment chemicals	S	Date of production , Self-life	Store in closed canes
72.	RO/UF cleaning chemicals	S	Date of production , Self-life	Store in closed canes
73.	Lime	C	Damage to packing , seepage	Prevent moisture, rain
74.	Alum bricks	C	Damage to packing	Prevent moisture, rain
75.	Poly electrolyte	S		Store in closed storage tanks
76.	Laboratory chemicals(powder)	C	Damage, Packing self-life	
77.	Laboratory chemicals(liquid)	C	Damage, Packing self-life	
78.	Lubrication oils	C	Leakage	
79.	Paints	S	Leakage ,air tightness	
80.	Sand	O	Damage of packing	No hooks
81.	Salt (NaCl)	C	Damage of packing, water ingress	Prevent moisture, rain
82.	Anthracite	S	Damage of packing	
83.	Activated carbon	S	Damage of packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
84.	Thermal insulation	S	Damage of packing	
85.	Cement	C	Damage of packing	Prevent moisture, rain
86.	Gravels	O	Damage of packing	
87.	ION exchange resins	C	Damage , packing	Refer manufacturer guidelines
88.	RO membranes	C	Damage , packing	Refer manufacturer guidelines
89.	UF membranes	C	Damage , packing	Refer manufacturer guidelines
90.	Cleaning chemicals	C	Damage , packing	Refer manufacturer guidelines
91.	Chemicals for analysers/calibration	C	Damage , packing	Refer manufacturer guidelines
Electrical and C & I items (motors, cables etc.)				
92.	Motors	C	Damage , packing	
93.	Cable drums	O	Damage	
94.	Control Panel /control desk, UPS ,JB	S	Damage, Packing	
95.	Instruments(gauges/analysers)	C	Damage	
Special items		As per Manufacturer's item, like Hydrogen cylinders, Ozonator, Analyser, Chlorine dioxide generators etc.		

5. CONCLUSION

Concerned storage agency at site should make sure that loss in equipment performance and wear & tear are minimised through proper storage and preservation. The above are broad guidelines and cover major equipment / materials. However specific storage practices shall be followed as per manufacturer recommendation. All the necessary measures even in addition to the ones mentioned above, if found necessary, should be taken to achieve the objective.

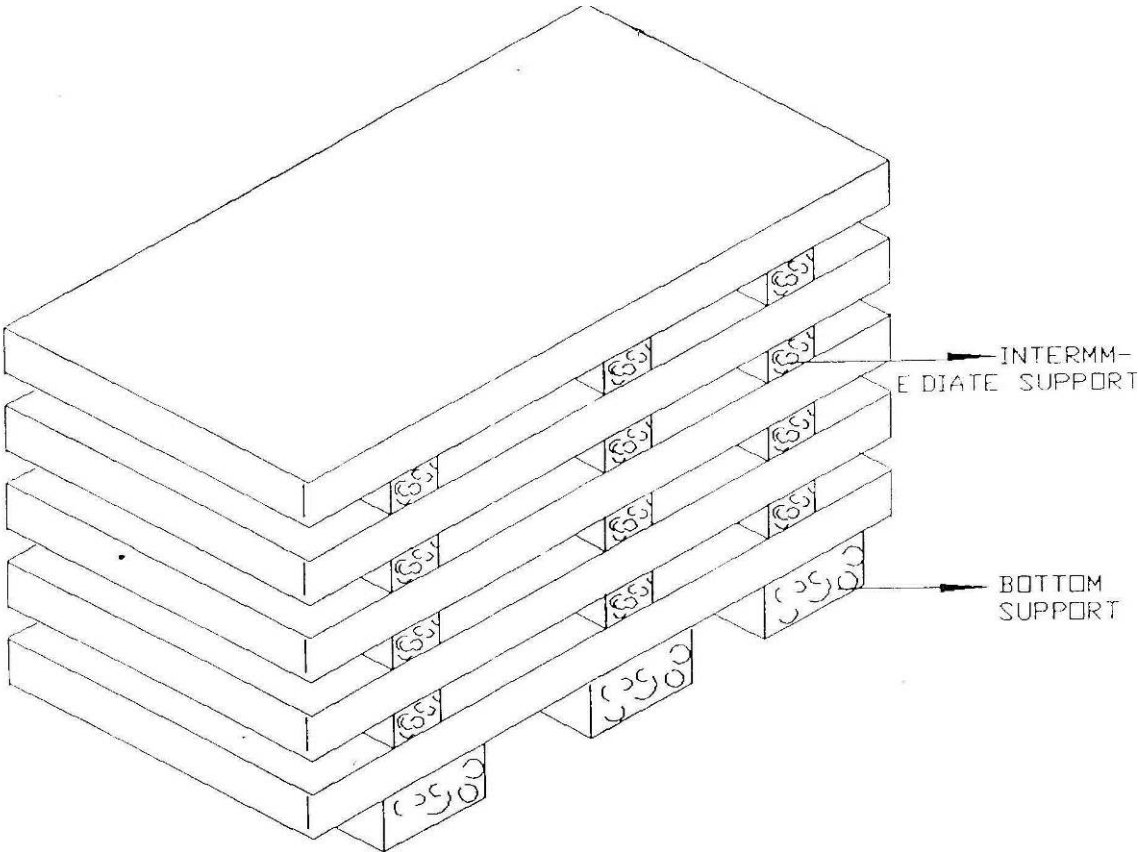


Figure – 1 – PLATE STACKING ARRANGEMENT

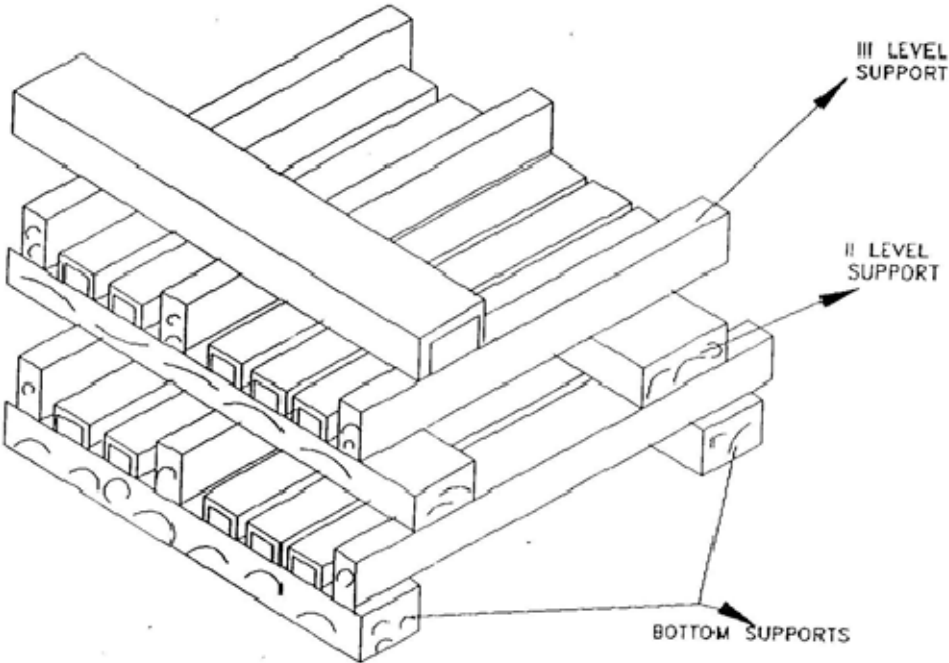


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT



SAGARDIGHI THERMAL POWER PROJECT,
1 X 660 MW UNIT NO 5, STAGE III.

MILL REJECT SYSTEM (PNEUMATIC TYPE)
&
COAL BUNKER DEBLOCKING DEVICES
DOCUMENTS TO BE SUBMITTED BY BIDDER

SPECIFICATION No: PE-TS-445-160-A001

VOLUME: III

SECTION-III

REV. 00


DATE: 17.07.21

SHEET :

SECTION-III

DOCUMENTS TO BE SUBMITTED BY BIDDER

IIIA	LIST OF DOCUMENTS TO BE SUBMITTED ALONG WITH BID
IIIB	COMPLIANCE CUM CONFIRMATION CERTIFICATE
IIIC	PRE BID CLARIFICATION SCHEDULE
IIID	UTILITY REQUIREMENT
IIIE	GUARANTEED POWER CONSUMPTION

	SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III. MILL REJECT SYSTEM (PNEUMATIC TYPE) & COAL BUNKER DEBLOCKING DEVICES	SPECIFICATION NO.: PE-TS-445-160-A001	
		SECTION: III	
		SUB SECTION: IIIA	
		REV: 00	DATE: 17.07.21
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DRAWINGS/ DOCUMENTS TO BE SUBMITTED WITH THE BID FOR TECHNICAL EVALUATION

Bidder shall submit the following drawings / documents along with their techno-commercial bid:-

- a) Copy of pre-bid clarifications, if any, duly signed & stamped
- b) Schedule of technical deviations (if any).


Deviation schedule with reference to specific clauses of the specification along with reason for such deviation and cost-of-withdrawal in the format given in GCC.

OR

“No deviation certificate” – Clearly mentioning that bidder has considered ‘No - Deviation’ from the technical specification provided by BHEL.

- c) Signed and stamped copy of Compliance cum Confirmation Certificate.
- d) Un priced copy of price format indicating quoted against each row/column.
- e) Filled Electrical load list.
- f) Pre-qualification requirement (PQR) documents.
- g) Filled guaranteed power consumption format.


Note: OFFER WILL BE CONSIDERED AS INCOMPLETE IN ABSENCE OF ANY OF ABOVE DOCUMENTS. DOCUMENT OTHER THAN ABOVE, IF ANY, SUBMITTED WITH THE OFFER WILL NOT FORM PART OF CONTRACT AND ACCORDINGLY WILL NOT BE CONSIDERED FOR BID EVALUATION.

	SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III. MILL REJECT SYSTEM (PNEUMATIC TYPE) & COAL BUNKER DEBLOCKING DEVICES	SPECIFICATION NO.: PE-TS-445-160-A001	
		SECTION: III	
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COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate (every sheet) and furnish same with the offer.

- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions other than those mentioned under "exclusion" and those resolved as per 'Schedule of Deviations', if applicable, with regard to same.
- b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'.
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CUSTOMER approval & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This shall be within the contracted price with no extra implications to BHEL after award of the contract.
- d) All drawings/ data-sheets / calculations etc. submitted along with the offer shall not be taken cognizance of.
- e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified / intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre-bid discussions, otherwise BHEL / Customer's decision shall be binding on the bidder whenever the deficiency is pointed out. For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.
- f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.
- g) All sub vendors shall be subject to BHEL / CUSTOMER approval in the event of order.
- h) Guarantee for plant/equipment shall be as per relevant clause of GCC / SCC / Other Commercial Terms & Conditions.
- i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities within the scope of work as tender specification. This clause will apply in case during site commissioning, additional requirements emerges due to customer and / or consultant's comments. No extra claims shall be put on this account.
- j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's / Customer's / Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.

	SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III. MILL REJECT SYSTEM (PNEUMATIC TYPE) & COAL BUNKER DEBLOCKING DEVICES	SPECIFICATION NO.: PE-TS-445-160-A001	
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- k) As built drawings shall be submitted as and when required during the project execution.
- l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.
- m) Successful bidder shall furnish detailed erection manual for each of the equipment supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.
- n) Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.
- o) In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.



SAGARDIGHI THERMAL POWER PROJECT,
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MILL REJECT SYSTEM (PNEUMATIC TYPE)
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PRE-BID CLARIFICATION SCHEDULE

S. No.	Section/Clause /Page No.	Statement of the referred clause	Clarification Required

The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE: _____


NAME: _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL

	SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III. MILL REJECT SYSTEM (PNEUMATIC TYPE) & COAL BUNKER DEBLOCKING DEVICES	SPECIFICATION NO.: PE-TS-445-160-A001	
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UTILITY REQUIREMENT

Sl. No	Description	Quantity	Pressure Requirement	Pressure Drop	Temp.	Scope	Tapping
1	Cooling water for compressor (DMCW)	30 m ³ /hr	5 - 6 Kg/cm ² (g) at 0.0m EL	1 MWC	Maximum inlet temperature- 39 °C & Rise 10 °C.	BHEL	80NB tapping with isolation valves at inlet and outlet header at 5 m distance from compressor house.
2	Service water	3-4 m ³ /hr per mill bay	2.5-3 Kg/cm ² (g)	—	—	BHEL	50NB tapping tentatively at elevation of 3-6 m at first column of each mill bay.
3	Instrument air	0.75 Nm ³ /min per mill bay	5–7Kg/cm ² (g)	—	—	BHEL	25NB tapping tentatively at elevation of 3-6 m at first column of each mill bay.

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AGARDIGHI THERMAL POWER PROJECT,
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SPECIFICATION NO.: PE-TS-445-160-A001

SECTION: III

SUB SECTION: IIIE

REV: 00

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GUARANTEED POWER CONSUMPTION FORMAT

Mode: Pneumatic Conveying

Sl.No.	Description / Item	Working	Standby	Power Consumption (kW) (at motor input terminal)	Duty Factor	Total Power Consumption (KW)
1	2	3	4	5	6	7 = 3 x 5 x 6
1	Conveying Air Compressor for Mill Reject System	1	1		1.0	
					Total kW	
Notes						
1	Power consumption (kW) of air compressors shall be measured at motor input terminals when operating at the rated capacity and pressure and performed on test rig at the vendor's works and actual motor shall be used for this purpose.					
2	<u>The base auxiliary power is 80Kw for Conveying Air Compressor for Mill Reject System.</u> Quoted power by bidder at column no. (7) shall be evaluated with respect to base auxiliary power. For bid evaluation purpose, excess power quoted by bidder over base auxiliary power, shall be loaded with Rs. 462,000/- or equivalent foreign currency for every one (1) kW.					
3	Power quoted by bidder shall be termed as 'Guaranteed Power consumption' (GPC). Bidder shall be liable to demonstrate actual power consumption during PG test/ Demonstration test at site. If the actual power consumption exceeds the guaranteed power consumption (indicated by bidder) or base auxiliary power (which is indicated at Sl no-2 above) whichever is higher, liquidated damages shall be payable by the vendor at the rate of Rs. 4,62,000/- or equivalent foreign currency for every one (1) kW. Such liquidated damages may be recovered by the BHEL by deduction from the contract price or by enforcing the contract performance guarantee or in any other manner deemed fit by the BHEL. For this purpose, the drives of standby equipment shall not be considered.					
4	This document is to be submitted by the bidder along with the techno-commercial bid.					
5	Guaranteed power consumption is not applicable for Coal de blocking device.					