

PUNJAB STATE POWER CORPORATION LIMITED

GHTP, LM BHATINDA UNITS #3 & 4 (2x250 MW)

TECHNICAL SPECIFICATION

FOR

MILL REJECT HANDLING SYSTEM

SPECIFICATION NO. PE- TS-226-160-A002



BHARAT HEAVY ELECTRICALS LIMITED

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT

PPEI, NOIDA- INDIA



TITLE:
**TECHNICAL SPECIFICATIONS FOR SITE VISIT,
SUPPLY OF MISSING ITEMS AND ERRECTION &
COMMISSIONING OF PARTIALLY ERRECTED
MILL REJECT HANDLING SYSTEM.
2X250 MW, GHTP STAGE-II, LEHERA MOHABAT UNIT 3 & 4**

BHEL DOCUMENTS NO.: PE-TS-226-160-A002

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**SECTION - A
(SCOPE OF ENQUIRY)**

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INTENT OF SPECIFICATION

- 1.1** The specification is intended to cover the scope of supply and work for Mill Reject Handling System for **2X250 MW GHTP STAGE-II LEHRA MOHABBAT THERMAL POWER PLANT AT BHATINDA PUNJAB** under the specification covers the design, engineering, manufacture, supply, assembly and testing at manufacturer's works, inspection, packing, forwarding, delivery FOR site, and handling, storage at site (i.e. taking delivery of materials from carriers, transportation to site), fabrication (as needed), construction, erection, commissioning, trial run, PG testing including painting protection of all items as specified hereinafter but without excluding any other necessary components, which are not mentioned herein but are required for the completeness and; efficient, easy and reliable operation of the system.

The supplier will provide the equipment including all necessary features, components, accessories, electrical and C&I accessories and appurtenances for efficient and reliable erection operation and maintenance whether mentioned in this specification or not. The equipment will consist of the following main components (however, not limited to the items listed in the tender specification).

All necessary tools and tackles required for the maintenance of the proposed system shall also be supplied.

- 1.2** It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgment is not in full accordance herewith.
- 1.3** The extent of work under the contract includes all items shown in the flow diagram, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly extent of work also includes all items mentioned in the specification and/or schedules, notwithstanding the fact that such items may have been omitted in the drawing.
- 1.4** While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any

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contradictory requirement in different sections of the specification and within a section itself to the notice of BHEL In case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Normally, in case of any contradiction in requirements between section-C and section-D, the requirements in Sec-C shall govern. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

- 1.5** Deviations, if any, should be very clearly brought out clause by clause in the enclosed schedule; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.
- 1.6** In the event of any conflict between the requirements of two clauses of this specification documents or requirements of different codes and standards specified, the more stringent requirement as per the interpretation of the owner shall apply.



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PROJECT INFORMATION

1. **Owner** : Punjab State Electricity Board
2. **Owner's Engineer** : TCE Consulting Engineers, Bangalore
3. **Purchaser** : Bharat Heavy Electricals Limited
Power Sector, Project Engineering
Management, 4th Floor, BHEL House, Siri fort,
New Delhi-110 049
4. **Purchaser's Consultant** : FICHTNER Consulting Engineers (I) Pvt. Ltd.
Ganesh Chambers,
64 Eldams Road,
Chennai 600 018

Fax : 044 - 2434 4579, 2434 5611
Tel : 044 - 2435 9158 (5 lines)

E-mail : mail@chn.fichtner.co.in
5. **Name of Project / Plant** : 2x250 MW GHTPS Stage-II Lehra Mohabbat
Units #3 & #4
6. **Plant Location** : Lehra Mohabbat, near Bhatinda, Punjab
7. **Elevation above sea level (MSL)** : 216.0 M
8. **Nearest Railway Station** : Bhatinda Junction
9. **Nearest Airport** : Amritsar / Ludhiana
10. **Access Road (National / State Highway)** : On State Highway Bhatinda to Sangrur
11. **Ambient temperature**
 - a. Maximum dry bulb (°C) : 46.2
 - b. Minimum dry bulb (°C) : 0.00
 - c. Design ambient (°C) : 40
12. **Design Ambient for Electrical & Electronic Equipment**
 - a. Reference temperature for design of electrical equipment (°C) : 50
13. **Relative Humidity (% RH)** :



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- a. Maximum (%) 100
- b. Minimum (%) 6
- c. Design (%) 70

14. Rainfall

- a. Maximum rainfall on one day (mm) : 354.3
- b. Annual average rainfall (mm) : 600
- c. Period : South westerly summer monsoon

15. Wind Data

- a. Basic speed (km/hr) : 40 km/hr to North/East
- b. Wind load : As per latest revision of IS 875/87
- c. Wind direction : NW to S/E

16. Seismic Data

- a. Seismic load : As per IS 1893/2002
- b. Seismic area : Zone IV

17. Power Supply

- i. The AC system voltage with permissible voltage variation : 415 V \pm 10%
- ii. The AC system frequency with permissible frequency variation : 50 Hz +3%, -5%
- iii. The fault level at various voltage levels : 50 kA for 1 sec for 415 V AC
- iv. The voltage level for AC motors : 415 V AC
- v. AC control supply voltage : 110 V AC
- vi. The AC voltage level for lighting fixtures and space heaters : 240 V AC
- vii. Main plant DDCMIS power supply : 240 V AC, 1 ϕ UPS
- viii. The voltage level for PLC power supply of mechanical auxiliary packages : 240 V AC UPS to be derived from 415 V AC, 3 ϕ feeder.
- ix. The voltage level for solid controls & annunciation / local control panel : 240 V AC & 24 V DC UPS to be derived from 415 V AC, 3 ϕ feeder.
- x. System earthing : 415 V system solidly grounded



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18. ***Demineralised Cooling Water***

- i. Design cooling water inlet temperature (°C) : 38
- ii. Maximum temperature rise allowed in auxiliary coolers (°K) : 7.3
- iii. Maximum inlet supply pressure of cooling water at terminal point (kg/cm²) : 10

19. ***Instrument air supply pressure***

- i. Maximum kg/cm²(g) : 8
- ii. Minimum kg/cm²(g) : 6

20. ***General nature of soil*** : Sandy silt

21. ***Ground Water Table***

- Average : 7m below existing ground level
- Maximum : At ground level (for design purpose)



TITLE: TECHNICAL SPECIFICATION COMPLIANCE CUM CONFIRMATION CERTIFICATE	SPEC. NO.: PE-TS-226-160-A002
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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" in section C and those resolved as per 'Schedule of Deviations', if applicable, with regard to same.
- b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'.
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CUSTOMER approval & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This shall be within the contracted price with no extra implications to BHEL after award of the contract.
- d) All drawings/ data-sheets/ calculations etc. submitted along with the offer shall be considered for reference only, same shall be subject to BHEL/ CUSTOMER approval in the event of order.
- e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified/ intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre - bid discussions, otherwise BHEL/ Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.

For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.
- f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.
- g) All sub vendors shall be subject to BHEL/ CUSTOMER approval in the event of order.
- h) Guarantee for plant /equipment shall be as per relevant clause of GCC /SCC /Other Commercial Terms & Conditions.
- i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities. This clause will apply in case during site commissioning additional requirements emerges due to customer and/ or consultant's comments. No extra claims shall be put on this account.
- j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.



TITLE:
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COMPLIANCE CUM CONFIRMATION
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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.



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SECTION – C
(SPECIFIC TECHNICAL REQUIREMENTS)

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1.0 GENERAL

This specification is intended to renovate the Pneumatic type Mill Reject Conveying system supplied by M/s United Conveyor Corporation Ltd at **2X250 MW, GHTP STAGE-II, LEHERA MOHABAT UNIT 3 & 4**. The renovation of existing system shall cover design, engineering, manufacturing, painting, inspection & testing at manufacturer's works, complete with all accessories including start up and commissioning spares, packing, shipment and delivery to Power Station Site, unloading, storage at site (in BHEL stores) for missing items and for dismantling of defective item in the existing partially supplied/ partially erected MRS package & replacing it with new item as per design and BHEL specification. In addition, the bidder's scope shall include overhauling/ servicing erection (except already erected) and commissioning, , unloading, storage and handling at site, functional/ performance guarantee site testing, trial run, handing over to customer the complete Mill Reject Handling System for 2X250 MW, GHTP STAGE-II, LEHERA MOHABAT UNIT 3 & 4. The scope of supply shall fully cover the requirement of the Design Criteria and Technical Specification of this specification. Also, bidder to include all necessary items like control cables, power cable, screened control/instrumentation cables, Cable trays, accessories & cable trays, Cable glands and lugs and conduit etc as required for electrical and control systems to make the system complete in totality. Any modification required in the already supplied equipment shall be in bidder scope. Any civil modification required by bidder for installation shall be in the scope of bidder. Safety of nearby and existing equipment shall be ensured by bidder while civil modification. Any major civil modification/ construction required by bidder for system/ equipment installation shall not be in bidder scope, however bidder shall intimate the same to BHEL in advance i.e at least 3 months prior to erection/installation activity to ensure timely front availability.

Bidders to note that originally the plant was supplied by M/s United Conveyer Corporation Ltd. The plant was left incomplete and abandoned. BHEL site feedback the related available material along with technical details is as listed in ANNEXURE-A. Bidder to note that items which needs to be erected /commissioned, shall be carried out by the bidder. Any additional item required for the completion of the package shall be in bidder's scope. To establish the extent of work involved, bidder to mandatorily visit the site prior to quotation for actual assessment of the scope of supply and work.


Bidder shall ensure that the additional items supplied by the bidder should be interchangeable / compatible (to the extent possible) with the MRS already supplied by M/s UCC and same shall be able to integrate / hook with the existing system. The bidder shall carry out required rectification, erection, commissioning and hand over the plant to customer in running condition. The plant to be commissioned in totality, including the control system, electrical system & mechanical system for successful run of the plant.

The necessary drawings/documents existing plant related to MRS package enclosed in the specification for the bidders reference. To the extent possible, the equipment shall be supplied in line with the already approved data sheet to match/accommodate the equipment to be supplied by bidder in existing facilities.

2.0 SCOPE OF SUPPLY

The scope for MRS package shall consist below but not limited to the followings:

1. Supply of items short/missing/ required as per bidder's system design/not available at site
2. Dismantling of defective/nonfunctioning items / existing erected Items not compatible with bidders design and fresh supply erection commissioning of these items.
3. Pipe racks if required by bidder if required
4. Supply of Power/ control/signal/instrumentation cables and associated cable trays for MRS package.
5. Start-up and commissioning spares as required.
6. Necessary flanges and counter flanges as applicable for interconnection.
7. Capacity augmentation of equipment, related items and its accessories as per bidder's design.
8. Final paint as per attached painting schedules of MRS equipment.
9. All steel inserts with lugs, plates, bolts, nuts, sleeves, edge angles and all other embedding components etc. as required to grout in civil works and to support/hold the equipment being supplied under this specification.
10. Any minor civil work ie chipping, pinning & grouting

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11. All auxiliary steel structures (U-clamps, nuts, bolts, channels etc.) for fixing/supporting the pipe on trestles.
12. Replacement of components, which have exhausted their life.
13. Replacement of components for which spare parts will not be available in future.
14. Repair of parts, which could be retained service without compromising reliability and safety.
15. Change of components that are needed to adhere to prescribed environmental standards.
16. Necessary modifications in the system to run the unit at rated capacity

Note: Bidder to note that break down of associated items (for MRS package only) during dismantling or during servicing, shall be replaced by bidder without any price implications. Hence bidder shall make a compulsory visit to site prior to quotation so that extent of work and assessing physical condition of material available at site and work may be correctly estimated.

3.0 SCOPE OF SERVICE

The bidder's scope also includes following services for scope under this specification:

- 1) Site visit for assessment of balance/fresh supply and erection and commissioning.
- 2) Erection and commissioning of all the items to make system complete, unloading, storage and handling at site.
- 3) If required Structural modification of existing item (to be carried out at site itself), overhauling/servicing (inside plant or outside plant) of items shall be in bidders scope. Bidder shall stand guarantee for his supplied or serviced items for the period specified as per commercial terms & condition.
- 4) In site transportation.
- 5) Arrangement of all instruments and facilities to carry out trial run/commissioning and Demonstration test/Performance guarantee test.
- 6) All personnel required during trial run, commissioning and Demonstration Test.
- 7) Statutory approval from concern agencies as required.

4.0 CIVIL SCOPE


Any minor civil work i.e. chipping, pinning, fixing of steel inserts/EPs, plates, bolts, nuts, sleeves and all other embedding components & grouting is in bidder scope. Any major civil modification/ construction required by bidder for system/ equipment installation including pit and trench modification (if required) shall not be in bidder scope, however bidder shall intimate the same to BHEL in advance i.e at least 3 months prior to erection/installation activity to ensure timely front availability.

5.0 FUNCTIONAL TEST REQUIREMENTS AS FOLLOWS

- a) Continuous effective discharge and conveying at the rated capacity of the mill rejects without spillage or blockage in the system Conveying rate.
- b) Particulate emission rate from bag filters less than 50 mg/nm³ of air shall be demonstrated at site

6.0 EXCLUSIONS

- a) Service water (3 M³/Hr SW is available per unit at 2 Kg/cm² in mill bay), Instrument air (0.8 NM³/Min IA is available per unit at 5-7 Kg/cm²(g)), ECW (8 m³/hr ECW is available at 6 Kg/cm² pressure) up to the terminal point.
- b) Drinking water and service water.

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7.0 DRAWING/DOCUEMNTS REQUIREMENT (FOR MECHANICAL/ELECTRICAL/C&I/ETC)


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

- a) Detailed Equipment & piping layout
- b) GA and data sheets of items to be supplied
- c) Civil & Mechanical modification drgs
- d) Detailed installation drawings for all instruments and instrumentation schedule.
- e) Details Data sheet for instrument etc.

8.0 DRAWING/DOCUEMNTS REQUIRED ALONG WITH THE BID .

- Deviation/clarification, if any, in the BHEL format only.
- Price Schedule duly filled.

NOTE-1: - Any item/work either supply of equipment or erection material which have not been specifically mentioned in but are necessary to complete the woks for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.

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ANNEXURE A

BHEL SITE FEED BACK DETAILS MENTIONED BELOW, RELATED TO MATERIAL AVAILABILITY. THIS IS BASED ON VISUAL INSPECTION. ACTUAL AVAILABILITY OF MATERIAL AND FUNCTIONAL CONDITION OF ITEMS/EQUIPMENT IS TO BE ASCERTAINED BY BIDDER DURING SITE VISIT PRIOR TO QUOTATION. THIS FEEDBACK IS FURNISHED FOR BIDDERS REFERENCE AND NOT FOR ESTIMATION. BIDDER SHALL QUOTE AS PER HIS ESTIMATION OF EXTENT OF WORK INVOLVED FOR RENOVATION OF MILL REJECT HANDLING SYSTEM. DURING CONTRAT STAGE BHEL REPORT SHALL NOT BE REFERRED BY BIDDER FOR AVAILABILITY OF MATERIAL OR ANY SCOPE/QUANTITY VARIATION.

Sr. No	Description	Quantity available/erected at site	Remarks
1	Pyrite Hopper Discharge Chute	12	After visual inspection these seem to be OK.
2	Pyrite Hopper	12	Hopper body condition for all the mills seems to be ok. Same can be restored after painting. 12 number of pyrite hopper are erected at site. The hoppers were seen from outside. The reusability of the same cannot be commented upon visual inspection from outside.
3	Air Receiver	2	On visual inspection two nos of air receivers seems to be ok. Pressure switch and auto drain traps are in place however working condition cannot be ascertained.
4	Vent Filter	1	Vent filter is erected. Visual inspection from outside was done. Re-usability cannot be commented upon from visual inspection.
5	Pressure Relief Valve at Silo	1	Sector gate, Pressure relief valve and bunker body is erected.
6	Depac Vessel	6 Nos. were Visible 6 Nos. were Covered under coal	Depac Vessel of Mill 3-C, Mill 3-A, Mill-4 E, Mill-4D, Mill 4C, Mill 4-B were covered under coal so the status of these 6 valves can't be confirmed whereas the other 6 Depac vessels were visible. The working condition or the vessel can be re-used cannot be commented upon by only visual inspection from outside.
7	Lateral for Pyrite Conveying Vessel	6	Vessel bends and laterals of unit 3 are dismantled by customer and physically seem to be OK. For unit 4 trench are covered hence physical inspection could not be done. As per visual inspection bends and conveying pipe lines seem to be OK. As per this report: The six pieces mentioned here are lying alongside the mills. For the rest the status cannot be ascertained as the pits are covered with plates.
8	125 NB ACI Bend for Mill Reject Conveying Line	48	Some of the bends are inside the pit which is covered with plates. So the status cannot be determined. The 48 bends traced are erected in 125 NB overhead conveying line to bunker.
9	125 NB ACI bend for lateral for mill reject conveying Line	6	The six pieces mentioned here are lying alongside the mills. For the rest the status cannot be ascertained as the pits are covered with plates.



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10	Coupling for mill reject conveying line	48 Couplings pairs	1 coupling constitutes one pair. One pair consists of two parts each part consists of two Semicircular pieces.
11	Structural and plate for Mill Reject Bunker	1 Bunker	Mill Reject Bunker is erected along with its structure and plates (Liner was not visible from outside so the status of Liner cannot be commented upon)
12	Conveying Air Compressor	2	Both Compressors are erected in Compressor Room whereas the working condition of the same cannot be commented upon by visual inspection.
13	Sector Gate at Mill Reject Bin	1	It is Cylinder operated. Function condition of sector valve is not known.
14	Expansion Joint	12	Erected
15	200 NB Cylinder operated Knife Gate Valve	12	12Nos. Erected whereas working condition of the cylinder operated knife gate valve cannot be commented upon by visual inspection.
16	200 NB Knife Gate Valve With Limit Switch (For oversize discharge chute)	12	Limit Switch Missing - in all the valves Spindle Missing- 1 Handle Missing - 1 Whether the valves can be re-used cannot be commented upon by visual inspection of the erected valves.
17	200 NB Knife Gate Valve With Limit Switch (For By pass chute)	11	Limit Switch Missing - in all the valves Spindle + Handle Missing- 1 Handle Missing - 2 Only Knife Gate Present -7 Complete Valve Missing - 1 Spindle + Handle + Knife Gate Missing- 1 Whether the valves can be re-used cannot be commented upon by visual inspection of the erected valves.
18	200 NB Manual Knife Gate Valve	12	Only Knife Gate Present - 2 Spindle Missing - 1 Handle Missing - 1 Spindle + Handle Missing - 6 Complete Valve Missing - 1 Knife + Handle + Spindle Missing - 1 Whether the valves can be re-used cannot be commented upon by visual inspection of the erected valves.
19	MS lines for 125 NB, 100 NB, 80 NB, 65 NB, 50 NB, 25NB	Erected	The lines of different sizes are erected.
20	GI lines for 25 NB and 15 NB	Erected	The lines of 15 NB and 25 NB sizes are erected but the exact quantity of erection is not known.
21	Monorail Hoist for Mill Reject Bin	1	Monorail Hoist is erected at Bunker top.
22	100 NB Gate Valve	2	Valves are erected. One at Each Air Receiver Outlet
23	80 NB Gate valve	2	Valves are erected. One at Each compressor outlet for Conveying Air
24	65 NB Gate Valve	2	Valves are erected. One at Each Air Receiver Intlet
25	25 NB Gate Valve	2	Valves are erected. One each at Instrument air station for each unit
26	15 NB Gate Valve	12	Valves are erected. One each at water station for quenching line of every Pyrite Hopper

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27	80 NB Butterfly Valve (Cylinder Operated)	12	Valves are erected. One each at Air station for every Mill.
28	65 NB Butterfly Valve (Cylinder Operated)	12	Valves are erected. One each at Air station for every Mill
29	65 NB Check Valve		Cannot be traced as the pits were covered with Checkered plates
30	50 NB Check Valve		Cannot be traced as the pits were covered with Checkered plates
31	Control Valves	24	There are in total 24 Valves of MIL make 25 NB erected at conveying air station(2 at each station for 12 mills).
32	40 NB Globe Valve	2	One each at cooling water inlet for two compressors
33	15 NB Globe Valve	24	2 each at every water station for quenching. There is separate water satation for each mill.
34	25 NB Ball Valve	2	One each at Instrument air station for each unit
35	15 NB Ball Valve	24	One each at instument air line to 12 Junction Box. One each at final bend to target box for 12 conveying lines.
36	Motors	2	Motors were erected in the compressor room but the working condition of the same cannot be commented upon by visual inspection.

PLC system comprising of PLC panel, Mimic Panel, UPS panels seems to be ok on visual inspection. Battery bank consisting 30 nos of batteries needs replacement.



TITLE

**TECHNICAL SPECIFICATION
MILL REJECT HANDLING SYSTEM
2 X 250 MW GHTP LEHRA MOHABBAT T.P.S**

SPECIFICATION NO. PE-TS-226-160-A002

VOLUME II B

SECTION C

REV 0

DATE

SHEET 4 OF 5

TECHNICAL DATA SHEET

1. Type of mill reject system : Pneumatic system
2. Capacity of pneumatic system : 500 Kg/Hr./mill
3. Nos. of Transport air compressors : 2 x 100% compressors (Non lubricating reciprocating; water cooled, cylinder balanced opposed).
4. No. of mills working and stand by at 100% BMCR with worst coal firing : 6 (5 working and 1 stand by)/unit
5. Capacity of mill reject silo : 16 Hours storage capacity for both units (Minimum 80 MT).
6. Dust loading condition of outlet air : 50 mg/NM³
7. Max. size of rejects to be handled : 50 mm (5% of total reject generated)
8. No. of denseveyor envisaged : 6Nos./unit
9. Material of construction :
 - a) Denseveyor : Mild steel IS-2062, Gr. A/
IS: 2825 permitted Material Of Construction
 - b) Dome valve/Inlet valve : Dome body- CI FG 260
Dome Alloy CI 225 BHN
10. Quantity of material to be conveyed per hour by each denseveyor (at worst coal firing per mill) : 500 kg
11. Capacity of denseveyor envisaged : To suit the conveying rate.
12. Material to be conveyed : Coal mill reject(Temp. upto 200 ° C)
13. Density of material : 1600kg/m³ for volumetric calculation
2400 Kg/m³ for structural design
14. Capacity for each mill rejects silo/bunker : Min 80 Metric Tonnes (Common for both units)
15. Any cooling envisaged for dome inlet valve : As required by system.
16. Pipe size : To suit the conveying rate and partial size.
17. Air supply pressure : As required by system.



TITLE
TECHNICAL SPECIFICATION
MILL REJECT HANDLING SYSTEM
2 X 250 MW GHTP LEHRA MOHABBAT T.P.S

SPECIFICATION NO. PE-TS-226-160-A001

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DATE

SHEET 5 OF 5

- 18. Outlet of mill/inlet of pyrite hopper : Pneumatic operated plate valve.
- 19. Material of pipeline and its thickness : MS ERW to IS:1239 Heavy grade/IS3589 (6.35 mm thick)
- 20. Sizing grides : Yes
- 21. Emergency discharge chute : Yes
- 22. Bends/fittings/laterals : Alloy C1 to min 400 BHN
- 23. Type of joint in pipeline : Flanged
- 24. Control system PLC based with hot standby : Yes
- 25. Reject outlet spout element : 2.254 m
- 26. Type of mills : XRP883
- 27. Mill arrangement : Rear mill arrangement with 6 mills in each unit.
- 28. Mill reject bunker/silo outlet : Pneumatic operated sector gate
- 29. Compressor design condition : 45°C & 75% RH
- 30. Velocities
 - a) Reject conveying velocity : 3.5 to 6 m/s
 - b) Air Velocities

Service	Velocity in m/sec		
	Pipe size below 50 mm	Pipe size of 50 mm to 150 mm	Pipe size of 200 mm & above
a) Compressed Air	15	18	20

	TITLE: TECHNICAL SPECIFICATIONS FOR SITE VISIT, SUPPLY OF MISSING ITEMS AND ERRECTION & COMMISSIONING OF PARTIALLY ERRECTED MILL REJECT HANDLING SYSTEM. 2X250 MW, GHTP STAGE-II, LEHERA MOHABAT UNIT 3 & 4	BHEL DOCUMENTS NO.: PE-TS-226-160-A002	
		VOLUME II-B	
		SECTION -C	
		REV. NO. 0.0	DATE:
		Page	

ANNEXURE-III DRAWING/DOCUMENT DISTRIBUTION SCHEDULE

Sl. No.		Soft copy	Hard Copy	CD
1	First Submission to BHEL	1 copy (in .pdf through wrench)	Not required	Not required
2	Subsequent re-submission to BHEL	1 copy (in .pdf through wrench)	Not required	Not required
3	First Submission to customer	1 copy (in .pdf through wrench)	5 copies	Not required
4	Subsequent re-submission to customer	1 copy (in .pdf through wrench)	Not required	Not required
5	After approval by customer	Not required	6 copies for formal approval by stamping & distribution	Not required
6	As-built drawing, O&M Manual & distribution drawings	1 copy (in .pdf through wrench)	As required, exact quantity to be informed later	As required, exact quantity to be informed later

Note: - AutoCAD copy of equipment layout, cable trench/tray/routing layout & foundation drawings as well as cable schedule in MS-EXCEL format shall be submitted along with soft copy in .pdf format.

Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web based Document Management System in addition to hard copies to be submitted. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end

1. Internet explorer version – Minimum Internet Explorer 7

2. Internet speed – 2 mbps (Minimum preferred)

Pop ups from our external DMS IP (124.124.36.198) should not be blocked

Vendor's Internal proxy setting should not block DMS application's link

<http://124.124.36.198/wrenchwebaccess/login.aspx>)"

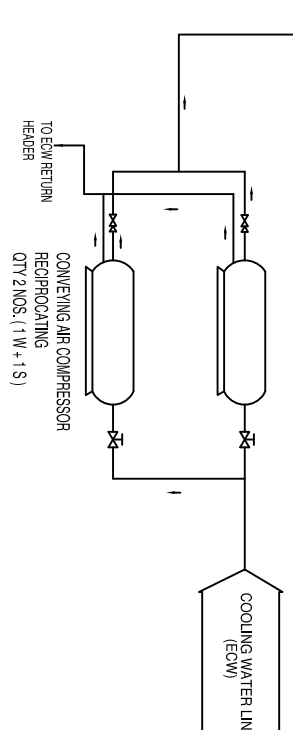
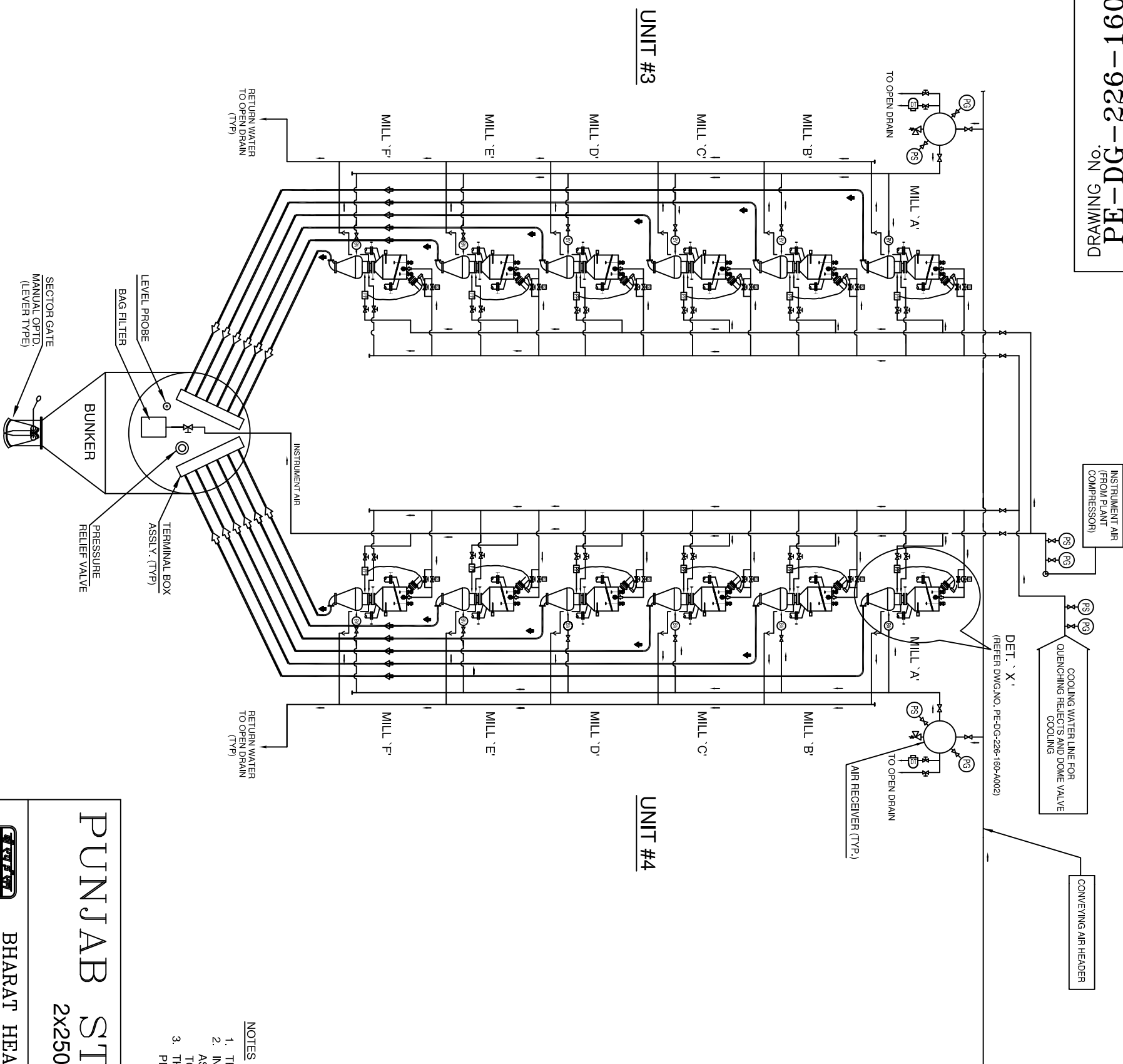
DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session. For quick access bidder may refer the link <http://bhelpem.com/DMSManuals/DMSManuals.html>

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DRAWING No.
PE-DG-226-160-A001

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM



LEGEND:

	MILL REJECTS
	CONVEYING PIPE
	CONVEYING AIR
	INSTRUMENT AIR
	COOLING WATER
	RETURN WATER
	GATE VALVE
	BALL VALVE
	NORMALLY CLOSED BALL VALVE
	NON RETURN VALVE
	DRAIN TRAP
	BLOW VALVE
	PNEUMATIC PANEL
	SAFETY VALVE
	PRESSURE GAUGE
	PRESSURE SWITCH
	SOLENOID OPTD. VALVE

- NOTES
1. THE DRAWING SHOWS THE SCHEME AND WORKING PRINCIPLE OF THE PLANT
 2. INSTRUMENTATION SHOWN IS TENTATIVE. ALL INSTRUMENT/CONTROL AS REQUIRED FOR SATISFACTORY OPERATION OF THE SYSTEM ARE TO BE PROVIDED
 3. THIS DRG SHALL BE READ IN CONJUNCTION WITH DESIGN MEMORANDUM. NO. PE-DC-226-160-A001 AND DRG NO. PE-DG-226-160-A002

REV.	DATE	ALTD	CHD	APPD	JOB No.	226
STATUS					CONTRACT	
DISTRIBUTION						

PUNJAB STATE ELECTRICITY BOARD
 2x250 MW GHTP LEHRA MOHABAT STAGE-II
 UNITS # 3&4

BHARAT HEAVY ELECTRICALS LTD
 POWER SECTOR
 PROJECT ENGINEERING MANAGEMENT
 NEW DELHI

FLOW SCHEME OF MILL REJECT HANDLING SYSTEM

DEPT CODE	NAME	SIGN	DATE
DRN	RN		27.10.04
DESN	GBC		27.10.04
CHD	PKD		27.10.04
APPD	GSM		27.10.04

DRAWING No. **PE-DG-226-160-A001**

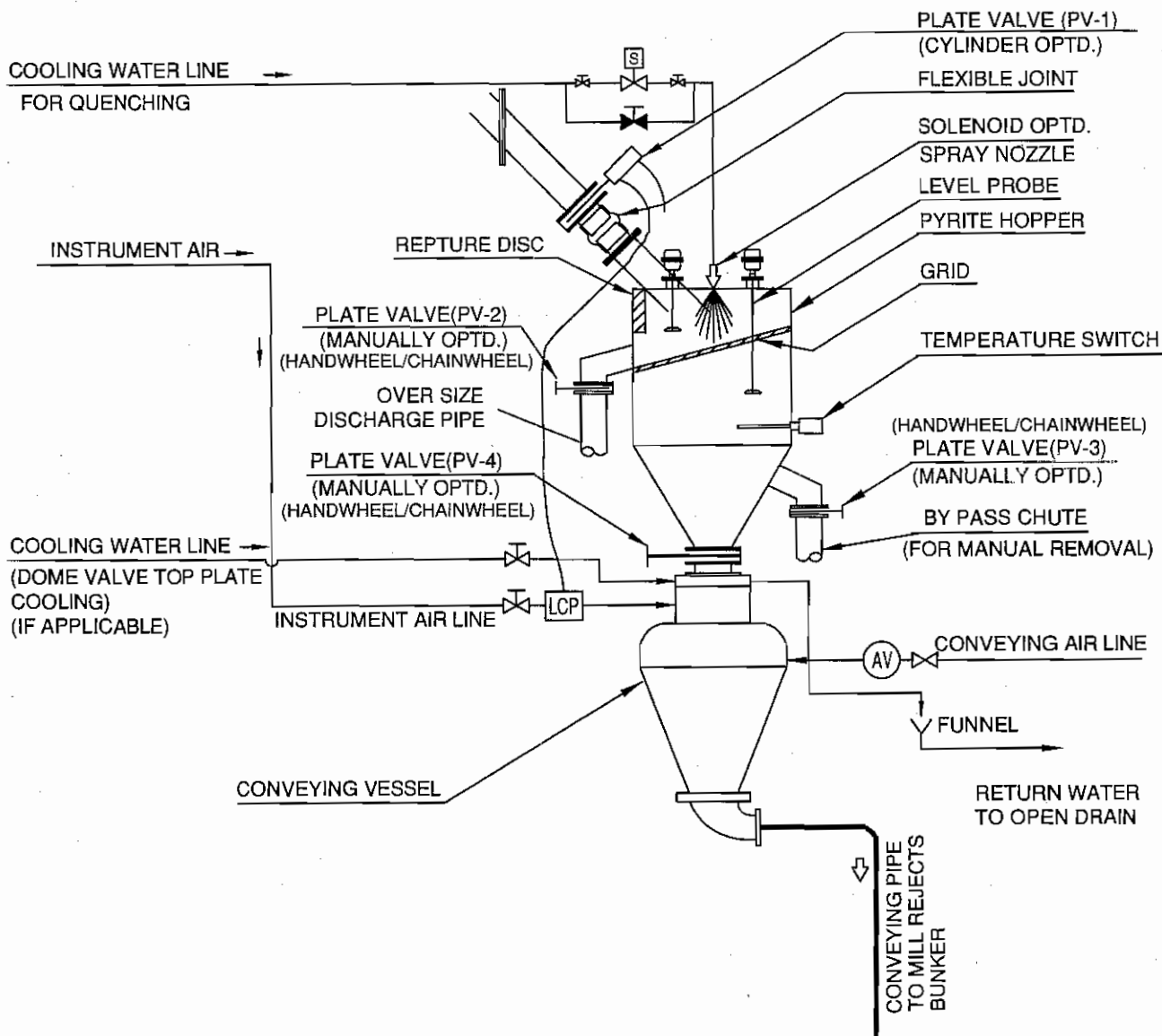
SHEET 01 OF 01 REV 0

SIZE-A3

REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHECKED			CHECKED

JOB No. 226

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NOTE:
READ THIS DRG. IN CONJUNCTION WITH DRG No. PE-DG-226-160-A001
AND THE TECHNICAL SPECIFICATION No. PE-TS-226-160-A002

DETAIL - X
(TYPICAL)



BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT.	CODE	SCALE	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM
-------	------	-------	--------------	-------------------	------

TITLE	NAME	SIGN	DATE
PUNJAB STATE ELECTRICITY BOARD 2 X 250 MW GHTP LEHRA MOHABBAT TPP STAGE-II, UNIT # 3 & 4	DRN	AJ	02/05/05
	DSGN	GBC	02/05/05
	CHD	PKD	02/05/05
	APPD	GSM	02/05/05

TYPICAL DETAILS OF MILL REJECT HANDLING EQUIPMENT

CARD CODE

DRAWING No.

PE-DG-226-160-A002

SHEET 01 OF 01 REV. 0

PEM-6666-0



TITLE

TECHNICAL SPECIFICATION
MILL REJECT HANDLING SYSTEM
2 X 250 MW GHTP LEHRA MOHABBAT T.P.S

SPECIFICATION NO. PE-TS-226-160-A001

VOLUME - II B

SECTION C

REV 0

DATE 21.11.05

SHEET

OF

VOLUME - II B
SECTION - C
PAINING SCHEDULE



TITLE

DOCUMENT NO. PE-DC-226-100-A999

PAINTING SCHEDULE

**LEHRA MOHABAT TPS (2X250 MW)
STAGE II**

REV.NO. 0 DATE 19/03/2005

SHEET 1 OF 3

1.0 **GENERAL PAINTING REQUIREMENTS**

1.1 Painting of equipment shall be carried out as per the specifications indicated below and attached annexures and shall conform to the relevant IS specification/ international standards for the material and workmanship.

1.2 The following Indian Standards may be referred to for carrying out the painting job :

- IS:5 : Colours for ready mixed paints and enamels
- IS:1303 : Glossary of terms relating to paints
- IS:2379 : Colour code for identification of pipelines
- IS:1477 : Code of practice for painting of ferrous metals in buildings (Parts I & II)
- IS:2524 : Code of practice for painting of non-ferrous metals in buildings (Parts I & II)
- IS:2395 : Code of practice for painting of concrete, masonry and plaster surfaces (Parts I & II)
- IS:2338 : Code of practice for finishing of wood and wood based materials (Parts I & II)
- IS:6278 : Code of practice for white washing and colour Washing
- IS:3140 : Code of practice for painting asbestos cement building products
- IS:158 : Ready mixed paint, brushing, bituminous, black, leadfree, acid, alkali, water and heat resisting
- IS:2074 : Ready mixed paint, air drying, red Oxide Zinc Chrome, priming
- IS:104 : Ready mixed paint, brushing, Zinc Chrome, priming
- IS: 2932 : Enamel , synthetic, exterior (a) undercoating (b) Finishing



TITLE

DOCUMENT NO. PE-DC-226-100-A999

PAINTING SCHEDULE

LEHRA MOHABAT TPS (2X250 MW)
STAGE II

REV.NO. 0 DATE 19/03/2005

SHEET 2 OF 3

1.3 Preparation of Surfaces

All surfaces to be painted shall be thoroughly cleaned of all grease, oil, loose mill scale, dust, rust and any other foreign matter. Mechanical cleaning by power tool and scrapping with steel wire brushes shall be adopted to clear the surfaces. However, in certain locations where power tool cleaning cannot be carried out sand scrapping may be permitted with steel wire brushes and /or abrasive paper. Cleaning with solvents shall be resorted to only in such areas where other methods specified above have not achieved the desired results. Cleaning with solvents shall be adopted only after written approval of the OWNER/OWNER REPRESENTATIVE. The sheet steel of electrical and instrumentation panels shall be pre-treated through chemical cleaning (7 tank) process of rinsing, degreasing, rinsing, derusting, rinsing, phosphating and rinsing. However, in case mechanical cleaning is also required the Contractor shall carry out the same to get a smooth finish.

1.4 Primer Paint

After the surface is prepared one coat of Zinc Phosphate primer conforming to IS 2074 shall be applied. After this first coat is dried up completely, second coat of primer shall be applied. Primer shall be applied by brushing, spray, roller as per manufacture recommendation to ensure a continuous film. The dry film thickness of each coat shall be minimum 30 microns. Insulated surfaces will have only primer coating and no finish painting.

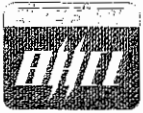
1.5 Finish Paint

Synthetic enamel paint conforming to IS 2932 shall be used for finish coats. The colour /shade shall be as approved by the OWNER. After cleaning the dust on the dried up primer, first coat of synthetic enamel shall be applied. After this first coat dries up hard, the surface is wet scrubbed cutting down to a smooth finish and ensuring that at no place the first coat is completely removed. After allowing the water to get evaporated completely, the second finish coat of synthetic enamel paint shall be applied.

1.6 Painting and Corrosion Protection for Pipes & Fittings

1.6.1 All uninsulated piping systems, hangers and supports shall have two coats of red oxide Zinc Chromate primer (conforming to IS 2074) with minimum dry film thickness (DFT) of 25 microns for each coat and finish paint using synthetic enamel paint to give a finish coat of 20 microns for each coat. Shades shall be as per IS 5 or as indicated by PURCHASER/OWNER. Service of the pipeline designations shall be painted on all pipes at visible locations.

1.6.2 Before application of paint, Contractor shall clean the pipes of all mill scale, dirt dust, soot grease, rust etc.,



TITLE	DOCUMENT NO. PE-DC-226-100-A999	
	PAINTING SCHEDULE	
	LEHRA MOHABAT TPS (2X250 MW) STAGE II	
	REV.NO. 0	DATE 19/03/2005
SHEET 3 OF 3		

1.6.3 All pipe lines, piping components shall be adequately protected against corrosion during manufacture, fabrication, shipment and storage by appropriate protective paint.

1.6.4 Shop fabricated equipment/items shall be dispatched with final paint. Necessary touch up shall be done at site. Site fabricated equipment/items shall be dispatched with primer painting only and final painting shall be applied at site.

1.7 Painting and Corrosion Protection for Valves & Specialties

Two coats of primer of thickness min. 30 microns for each coat shall be applied to all steel and cast iron exposed surfaces as required to prevent corrosion before dispatch. The use of grease or oil, other than light grade mineral oil, for corrosion protection is prohibited. Bores of all vales shall be covered immediately after testing, draining and drying with suitable plastic end covers to avoid ingress of foreign materials.

1.8 Suggested Colour Codes for Painting

Suggested colour codes shall be furnished by the successful bidder after award of contract. Colour codes for piping shall be as per IS 2379 with necessary modifications. Where band colour is specified for piping, same shall be provided at 30 metre intervals on long uninterrupted lines and also adjacent to valves and junctions.

1.9 Approved Paint Makes

- | | |
|--------------------------------|--------------------------|
| i) Asian Paints (I) Ltd. | vi) Shalimar Paints Ltd. |
| ii) Berger Paints India Ltd | vii) Addison Paints Ltd. |
| iii) Goodlass Nerolac | viii) Grand Polycoat |
| iv) Jenson & Nicholson (I) Ltd | ix) Bombay Paints |
| v) CDC carboline (I) Ltd. | |

2.0 PAINTING SCHEDULES

2.1 Painting schedules for various systems/ items are furnished as per enclosed Annexures-I and II . Vendors of different packages/ items will furnish detailed painting schedule for customer approval during detail engineering as per this guide specification.



TITLE

DOCUMENT NO. PE-DC-226-100-A999

PAINTING SCHEDULE

**LEHRA MOHABAT TPS (2X250 MW)
STAGE II**

REV.NO. 0

DATE 19/03/2005

SHEET 1 OF 2

Annexure-I

Paint Reference Scheme	Surface Preparation Grade / Surface Profile	Primer Coat			Intermediate Coat			Finish Coat			Total DFT in microns
		Premier Paint	No. of Coats	DFT in Microns	Intermediate Paint	No. of Coats	DFT in Microns	Finish Paint (See Note)	No. of Coats	DFT in Microns	
Various type of equipment/v alve, etc. (Temp. upto 90°C)	Degreasing and Mech. Cleaning with wire brushing/hand tool (Sa1/St2/St3 as applicable)	Zinc Phosphate (alkyd Medium)	2	25 – 35 per coat	-	-	-	Synthetic enamel (alkyd med.) as per IS:2932	2	20 – 25 per coat	90 - 120
LP Piping/structurals/ Vessels, etc. (Temp. upto 90°)	- do -	Red oxide zinc chromate as per IS:2074 (alkyd medium)	2	25 – 35 per coat	-	-	-	Synthetic enamel (alkyd med.) as per IS:2932	2	20 – 25 per coat	90- 120
Equipment with (Temp. upto 250°)	- do -	Heat resistant Al – paint	2	20 per coat	-	-	-	Heat resistant Al–paint	2	20 per coat	80
Equipment in corrosive areas like CPU (regeueration) Dosing skid, etc.	Blast clean to Sa 2 ^{1/2}	Epoxy resin based zinc phosphate primer	1	35 – 50 per coat	Epoxy based TiO ₂ pigmented paint	1	50 per coat	Polyamide cured Epoxy finish coat	2	25 – 35 per coat	135 - 170
Elect. / Control Panels, etc.	Seven tank process	Zinc phosphate (alkyd Medium)	2	25 – 35 per coat	-	-	-	Synthetic enamel (alkyd med.) as per IS:2932	2	20 – 25 per coat	90 - 120



TITLE

DOCUMENT NO. PE-DC-226-100-A999

PAINTING SCHEDULE

**LEHRA MOHABAT TPS (2X250 MW)
STAGE II**

REV.NO. 0

DATE 19/03/2005

SHEET 2 OF 2

Notes:

1. Surface preparation shown is as per Swedish Standards SIS 05-5900. Degreasing will be as per Standard SSPC-SP1.
2. In case of insulated surfaces, only primer coats shall be applied.
3. GM/SS items with piping and G.I. pipes will not be painted. However these items carrying under Fire Fighting System shall be painted Fire Red as per TAC guidelines. Further SS/GI piping shall be given necessary colour banding for identification as per colour scheme.
4. All instruments shall be painted as per manufacturer standard practice.
5. All structural steel items shall be painted at site. Piping shall go with primer coating & finish paint shall be applied at site. Equipment shall be finish painted at shop.
6. Method of painting application shall be as per paint manufacturer's recommendation.
7. **Based on above painting schedule, detailed painting schedule will be prepared by respective package supplier and these be submitted to PSEB for their approval.**

2x250 MW LEHARA MOHABBAT TPS - MILL REJECT HANDLING SYSTEM

SUB VENDOR LIST

Sl. No	ITEM/SERVICE	QAP/ INSP.CAT.	Scope of supply/manufacturer	Place	Remarks by BHEL
I	SELF MFG ITEMS				
1	Pyrite Hopper	I	Self manufacturer		
2	Blow Tank	I	Self manufacturer		
3	Bunker Discharge Gate (Sector Gate)	II	Self manufacturer		
4	Pressure Relief Valve	II	Self manufacturer		
5	Local Control Panel with accessories	II	Self manufacturer		Pneumatic
6	Mill Reject Conveying fittings/Bends	II	Self manufacturer		
7	Swing Valve(Pneumatic operated)	I	Self manufacturer		
II	BOUGHT OUT ITEMS				
A	MECHANICAL				
1	Terminal Box	II	BHEL/Customer Approved Fabricators	INDIA	
2	Air Receiver	II	PARKARE	DELHI	
		II	UNITED ENGG WORKS	NASIK	
		II	INTEGRATED ENGINEERS	PUNE	
		II	TEMASME VESELLEX	NOIDA	
		II	DIAMOND FABRICATIONS	PUNE	
3	DRAIN TRAP	III	SPIRAX MARSHAL	MUMBAI	
		III	GREAVES COTTON	MUMBAI	
		III	TRIDENT	COIMBOITORE	
4	Gate, Globe, Check valves/ NRV - C.I up to 600NB PN16	III	LEADER	JULLANDHAR	
		III	BANKIM	HOWRAH	
		III	H SARKAR	HOWRAH	
		III	KBL	KONDHAPURI	
		III	AV VALVES	AGRA	Upto 300 NB
5	Gate, Globe, Check valves/ NRV - G.M	III	LEADER	JULLANDHAR	
		III	BOMBAY METALS & ALLOYS (GG)	MUMBAI	
		III	SANT VALVES	JULLANDHAR	
6	Knife Gate/Plate Valve (H/W Operated & Cylinder Optd)	II	FOURESS	MUMBAI	
		II	VASS	CHENNAI	
		II	ORBINOX	COIMBATORE	
7	Ball Valves	III	Weir BDK	HUBLI	
		III	FLOW CHEM	KALOL	
		III	PRECISION ENGG	MUMBAI	
		III	LEADER	JULLANDHAR	
8	Safety Relief Valve	III	LEADER	JULLANDHAR	
		III	KAYSTONE(TYCO FLOW CONTROL)	HALOL	

		III	BHEL	TRICHY	
		III	SPIRAX MARSHAL	AGRA	
9	M.S G.I / ERW PIPES	II	JINDAL	GHAZIABAD	UPTO 350 NB
		II	SURYA ROSHINI	BAHADURGARH	
		II	SAIL	ROURKELA	
		II	WELLSPUN	ANJAR	
		II	INDUS	GB NAGAR	UPTO 300 NB
		II	TISCO	JAMSHEDPUR	UPTO 150 NB
		II	MAHARASHTRA SEAMLESS	MAHARASHTRA	200NB TO 400NB IS 3589
10	Metallic Expansion Bellow(Metallic)	II	METALLIC BELLOWS	CHENNAI	
		II	SUR INDUSTRIES	KOLKATA	
		II	LONESTAR	CHENNAI	
11	Rupture Disc	II	BS & B SAFETY SYSTEM	CHANNAI	
12	Chain Pulley Block (1 Ton)	II	HERCULES (INDEF)	MUMBAI	
		II	TRACTEL	FARIDABAD	
		II	LIFTING EQUIPMENTS & ACESSORIES	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	B & C	CHENNAI	
		II	SAM	COIMBOITORE	
		II	KIRLOSKER	PUNE	
		II	FLOWMORE	GHAZIABAD	
		II	WORTHINGTON	GHAZIABAD	
15	Pneumatic Actuator/Cylinder(Metallic)	III	SCHRADDER	MUMBAI	
		III	NUCON	HYDERABAD	
		III	ROTEX	MUMBAI	
		III	VAAS	CHENNAI	
16	GRATING	III	INDIANA	PUNE	
17	Tools & Trackles	III	BRANDED		
18	Steel Plate/ Structure/ Section/ SS liner	III	SAIL		
		III	JSW STEEL LTD.		
		III	TISCO		
		III	ESSAR STEEL		
		III	IISCO		
		III	LLOYDE STEEL INDUSTRIES LTD.		
		III	JINDAL STEEL & POWER LTD.		
		III	RINL	VIZAG	
		II	ORIENT FANS (ACCO)	KOLKATA	


19	Bag Filter	II	THERMAX	PUNE	
		II	FLAKT	MUMBAI	
		II	BATLIBOI	DELHI	
B	ELECTRICAL & INSTRUMENTATION				
1	Motor (LT)	I	MARATHON	KOLKATA	Refer Note:3 Upto 15kw, refer Note:3 HUBLI upto 90kw, refer Note:3 Refer Note:3 FARIDABAD upto 55kw, BANGALORE above 55 kw & upto 200kw, refer Note:3 Upto 160kw, refer Note:3
		I	SIEMENS	MUMBAI	
			NGEF	BANGLORE	
		I	KEC	BANGALORE/HUBLI	
		I	CGL	AHMED NAGAR	
		I	ABB	FARIDABAD/BANGLORE	
		I	BBL	MUMBAI	
2	Air Filter/Lubricator/Regulator	III	SHAVONORGAN	MUMBAI	
		III	PLACKA	CHENNAI	
3	Level Probes(RF)/Capacitance type	II	EIP ENVIRO LEVEL CONTROL	NOIDA	For RF type only
		II	NIVO CONTROL	INDORE	For capacitance type only
		III	E&H	GERMANY/AURANGABAD	
		II	FLOW STAR	FARIDABAD	For RF type only
4	Annunciator	III	IIC	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)	CHANNAI	
		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	TRAFAG	RANIPETH	
		II	GAUGE BOURDON (FOR PRESSURE SWITCH)	PANVEL	Not for temp switch
		II	ASHCROFT	GANDHINAGAR	
		II	ASHCROFT	USA/GERMANY	
7	Pressure Gauge & DP Gauge	III	GAUGE BOURDON	PANVEL	
		III	MANOMETER INDIA	MUMBAI	
		III	AUXITROL	UK	
		III	BUNDENBURG	UK	
		III	GOA THERMOSTATIC	GOA	
		III	GUCK INDIA	MUMBAI	
		III	WIKA	PUNE	
		III	SWITZER(DP INDICATOR)	CHENNAI	
		III	AN INSTRUMENTS	KOLKATA	
		III	H GURU (SI)	BANGALORE	
8	Temperature Gauge	III	AN INSTRUMENTS	KOLKATA	
		III	WIKA	PUNE	
		III	GIC	MUMBAI/GOA	
		III	BUDENBURG	UK	
		III	GOA THERMOSTATIC	GOA	
		III	H GURU (SI)	BANGALORE	
9	Pulse Jet Valves	III	WAREE	MUMBAI	
		III	ASCO	CHENNAI	
10	Cable Lug	III	MANIK	CHENNAI	
		III	BILLET (3D)	VALSAD	
		III	DOWELLS	MUMBAI	
11	Limit Switch	III	COMETT	NASIK	
		III	JAIBALAJI	CHANNAI	
12	Junction Boxes & Earthing Material ROD, FLAT etc.	III	SIEMENS	MUMBAI	
		III	Customer/BHEL APPROVED VENDOR		main contractor approved sources with galvanizin at Customer accepted source.
	INSTRUMENT CABLE	II	DELTON CABLES	BANGLORE	
		II	PARAMOUNT CABLES	FARIDABAD	
		II	POLYCAB	DAMAN	


14		II	UNIVERSAL CABLES	SATNA	
		II	NICCO	KOLKATTA	
		II	CORDS	BHIWADI	
		II	INCAB	PUNE	
15	Cable Tray	II	MJ ENGG	DELHI/BHIWADI	
		II	JAMUNA METALS	DELHI/SONEPAT	
		II	INDUSRIAL PERFORATION	KOLKATA	
		II	INAR PROFILES	ANAKAPLLI	
		II	INDIANA	MUMBAI	
		II	TECHNO	CHANDIGARH	
16	Cable Gland	III	COMMET	MUMBAI	
		III	SUNIL & CO	KOLKATA	
		III	ARUN ENGG.	KOLKATA	
		III	QUALITY PRECISION	KOLKATA	
17	Local Panel/LPBS	II	CONTROL DEVICES	KOLKATA	LOCALPANEL CAT I & LPBS CAT III
			PYROTECH	UDAIPUR	
			C&S	NOIDA/HARIDWAR	
			INDUS CONTROL AND APPLIANCE	MUMBAI	
			POSITRONICS	BARODA	
			SWITCHING CIRCUITS	KOLKATA	
			JACKSON	GR. NOIDA	
			JOLLY ENGG.	KOLKATA	
18	FRP JUNCTION BOXES	III	Customer/BHEL APPROVED VENDOR	INDIA	
19	LEVEL INDICATOR/GAUGE	III	SBEM PVT. LTD.	PUNE	
		III	PUNE CONTROL	PUNE	
		III	LEVCON	KOLKATA	
		III	SIGMA	MUMBAI	
		III	DK INSTRUMENTS	KOLKATA	
20	PLC System	I	Siemens	Mumbai	
			Rockwell Automation(Allen Bradley)	Sahibabad	
			GE Fanuc	Karnataka	
			L & T Ltd.	Mumbai	
			Schneider Electric	Bangalore	
			Honeywell	New Delhi	
			ABB	Bangalore	
LEGENDS					


	<p>1. QP/INSPN CATEGORY :</p> <p>CAT-I : For these items the Quality Plans are approved by Customer and the final acceptance will be on physical inspection witness by Customer.</p> <p>CAT-II : For these items the Quality Plans approved by Customer. However no physical inspection shall be done by Customer. The final acceptance by Customer shall be on the basis review of documents as per approved QP.</p> <p>CAT-III : For these items Main Supplier approves the Quality Plans. The final acceptance by Customer shall be on the basis certificate of conformance by the main supplier</p> <p>UNIT/WORKS : Place of manufacturing Place of Main Supplier of multi units/works.</p>
	<p>NOTE-1</p> <p>For steel following modalities to be adopted (Rev.-01)</p> <p>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.</p> <p>b) Material will be delivered directly from manufacturer's plant/stock yard/ godown to Customer project site.</p> <p>c) Correction of material with MTC will be done by Main Contractor before delivery and Correlated MTC along with delivery challan will be Customer-RIO for issuance of MDCC.</p> <p>NOTE-2</p> <p>It that the same Quality Plans as approved for main equipment and identified in the vendor list shall be applicable for the type of control measure i.e. make test/check the procurement of mandatory spares. However, for those spares which are not covered in the approved QP, main supplier shall furnish Certificate of Conformance (COC) along with guarantee and interchangeability certificate duly signed by the main contractor. However, in both cases, the Interchangeability certificate shall be generated by the main item manufacturer, for which the spares are made.</p> <p>NOTE-3</p> <p>A) LESS THAN 30 KW:-</p> <p>Acceptance of Motor less than 30 KW is based on COC of the manufacturer & the contractor confirming as follows: it is here confirmed that the above mentioned motor/motors was /were manufacture taking care of Customer specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise , distance between centre of stud & gland plate, space heater and tested in accordance with approved drawing/data sheet</p> <p>B) 30 KW AND ABOVE & upto 50KW:-</p> <p>Acceptance of Motor rating between 30 KW &50 KW is based on Customer review of Routine Test inspection report as per IS 325 witnessed by main contractor along with COC of the manufacturer & the contractor confirming as follows: It is hereby confirmed that the above mentioned motor /motors was/were manufactured taking care of Customer specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise , distance between centre of stud & gland plate, space heater and tested in accordance with approved drawing/data sheet</p> <p>NOTE :SUB-VENDOR SPECIFIED IN ABOVE SUB-VENDOR LIST OR PROPOSED ADDITIONAL SUB VENDORS DURING CONTRACT STAGE SHALL BE SUBJECT TO APPROVAL OF BHEL/CUSTOMER DURING DETAILED ENGINEERING WITHOUT ANY PRICE AND DELIVERY IMPLICATION TO BHEL.</p>

10.0.0 MANUFACTURING QUALITY PLANS


		S/Contactor : Mfgr:- Works:-			Manufacturing Quality Plan Item :-Local Panels QAP No. LOI Nos:- Contractor :- M/s BHEL			Project:- Package :- Mill Rejects System Client :- Consultant :-					
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 Chem. & Physical. Thickness	Major Major Major	Visual Chem.& Physical. Measurement	100% 100% 100%	Appr. Drg / IS: 513 Do App. Drawing	Appr. Drg / IS: 513 Do App. Drawing	IR TC IR/TC	- √ √	P V V	- V 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%	-	-	-					
SIGNATURES 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							

		S/Contractor :			Manufacturing Quality Plan			Project:					
		Mfrgr:- Works:-			Item :- Pyrite Hopper 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	N	
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	
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	√ √	P/V P/V	V V	V V	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	-	-	
Final Inspection													
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W*	V	* -> 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
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.:-			
SIGNATURES						Name & Signature of Approving Authority with Seal							


		<u>S/Contactor :-</u>			<u>Manufacturing Quality Plan</u>			<u>Project:-</u>					
		Mfr:- Works:-			Item :- Bunker Sector Gate QAP No. :- LOI Nos:-			Package :- Mill Rejects System Client :-					
					Contractor :- M/s BHEL			Consultant :-					
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	
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	- - 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	
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 V	V V V	Welders to be approved by BHEL / CLIENT
Final Inspection													
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	V	V	
3.2	Operation with job / shop actuator	Opening & Closing of Gate	Major	Visual	100%	Proper Working	Smooth Operation	IR	√	P/V	V	V	
3.3	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	V	-	Painting before disp.
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.:-			
				SIGNATURES			Name & Signature of Approving Authority with Seal						

		S/Contactor :-			Manufacturing Quality Plan			Project:-					
		Manufacturer :-			Item :- Rupture Disc			Package :- Mill Rejects System					
					QAP No. :-			Client :-					
					LOI Nos:-			Consultant :-					
					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	U	
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	V 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.:-				
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

		S/Contractor :-			Manufacturing Quality Plan			Project:-					
		Manufacturer :-			Item:- CHAIN PULLY BLOCK			Package :- Mill Rejects System					
					QAP No. :-			Client :-					
					LOI Nos:-			Consultant :-					
					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	N	
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	V	V	
		Functional Test	Major	Visual	100%	IS 3832 Appr. Drg /	3832 Appr. Drg / Appr.	IR	√	P	V	V	
		Load Test & Over Load Test	Major	Load Test	100%	Appr. Data Sheet	Data Sheet	IR	√	P	V	V	
		Overall Dimensions	Major	Measurement	100%			IR	√	P	V	V	
		Visual (After Load Test)	Major	Visual	100%	IS 3832	IS 3832	IR	√	P	V	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			Name & Signature of Approving Authority with Seal			
SIGNATURES			P->Perform, V-> Verification, W-> Witness										


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 :- Bag Filter (Without Enclosure) QAP No. :- LOI Nos:- Contractor :- M/s BHEL			Project:- Package :- Mill Rejects System Client :- 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	N	
1	Materials												
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	In Process												
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 M/s MBPL
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.:-

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	N			
3	Final Inspection														
3.1	Assembly \$-> Pneumatic Test at 1.1 times W/Pressure	Dimensional Pne. test \$of Manifold in Assly. Functional Test of Pulsing System	Major Major Major	Measurement Leakage by soap solution Pulse Sequence	100% 100% 100%	Appr. Drawing Appr. Data Sheet Appr. Data sheet / Testing Procedure	Appr. Drawing No Leakage Appr. Data sheet / Testing Procedure	IR IR IR	√ √ √	P P P	V V V	V V V	Pressure Drop across Filter Bags & Emission Level at Filter outlet shall be checked at Site		
4	Painting	Measurement & Visual	Major	DFT / Finish	100%	Appr. Painting Schedule	Appr. Painting Schedule	IR	√	P	-	-			
TESTING PROCEDURE TO BAG FILTER															
<p>1-> Functional test through compressed air , Sequential pulsing through valves and sequential controller on No - Load Condition to be conducted.</p> <p>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.</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.:-					
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

		S/Contactor :-			Manufacturing Quality Plan			Project:-					
		Manufacturer :-			Item :- MS GI ERW Pipes (IS:1239/IS3589) 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	N	
1	Final Inspection of Finished Pipes	Physical Dimensional Mechanical Properties Chemical Hydro Test	Major Major Major Major	Visual Measurement Tensile, elongation, Bend or Flattening Chemical Analysis Pressure Testing	100% 100% IS: 4711 1 per heat 100%	IS:1239 / IS:3589 / Approved Data Sheet	IS:1239 / IS:3589 / Approved Data Sheet	IR IR / TC TC IR / TC	- √ √ √	P P / V P / V P	V V V V	V V V V	* -> Random 5% of offered lot irrespective of size
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	V	V	# one sample for each size
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	V	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 & KPCL.													
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.													
SIGNATURES		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.:-			
		Manufacturer / Sub Vendor						Contractor		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 :-			Manufacturing Quality Plan			Project:-					
		Manufacturer :-			Item :- Knife Gate Valve [Manual / Pneumatic]			Package :- Mill Rejects System					
			Contractor :- M/s BHEL			Client :-				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	N	
1	Raw Material / Bought Out's												
1.1	Body	Chemical & Mechanical	Major	Foundary 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	V	BHEL to Witness 10 % of Quantity.
3.2	do	Function	Major	Operation	100%	Smooth Operation	Smooth Operation	IR	√	P	W	V	
3.3	do	Seat Leakage	Major	Hydro Static Test #	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	W	V	
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 :- Sump Pump QAP No. :- LOI Nos:- Contractor :- M/s BHEL				Project:- Package :- Mill Rejects System Client - 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	N	
1	Raw Material / Bought Out's												
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	In - Process Inspection												
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	

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	N	

3	Final Inspection												
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	V	V	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	V	V	
3.3	Painting	Visual & Measurement	Major	Visual & Measurement	100%	As per approved Painting Schedule	As per approved Painting	IR	-	P	-	-	
				LEGENDS:-			For Client Use:-		Document No.:-				
Manufacturer / Sub Vendor		Contractor		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

S/Contactor :-		Manufacturing Quality Plan						Project:-						
		Manufacturer :-		Item :-EXPANSION BELLOW						Package :- Mill Rejects System				
				QAP No. :-						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	N		
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	Flanges/ 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 ** For Bellows	Dimension Soundness Of Weld of L-Seam	Major major	Measurement DPT **(Before & After Forming)	100% 100%	Approved Drg. ASTM E- 165	Approved Drg. No Cracks/ Linear Indication	IR IR	√	P P	V V	V V		
3	Final Inspection													
3.1	Assembly	DP Test of Fillet Weld of Bellows to Pipe & Pipe to Flange	Major	visual	100%	ASTM E-165	No Crack / Linear Indication	IR	√	P	V	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	V V	V V		
		Spring Rate Test (Axial)	Critical	Stiffness Test	100%	EJMA / Data Sheet	EJMA / Data Sheet	IR	√	P	V	V		
		Deflection	Critical	Deflection Test	100%	EJMA / Data Sheet	EJMA/Data Sheet	IR	√	p	V	V		
3.30	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



TITLE TECHNICAL SPECIFICATION MILL REJECT HANDLING SYSTEM 2 X 250 MW GHTP LEHRA MOHABBAT T.P.S	SPECIFICATION NO. PE-TS-226-160-A001	
	VOLUME - II B	
	SECTION D	
	REV 0	DATE Apr. 18. 05
SHEET		OF

VOLUME - II B

SECTION - D

STANDARD TECHNICAL REQUIREMENTS

- MILL REJECT BUNKER AND ACCESSORIES
- TRANSPORTER VESSEL
- CONVEYING AIR COMPRESSOR
- ELECTRICAL SPECIFICATION
- CONTROL & INSTRUMENTATION



TITLE

**TECHNICAL SPECIFICATION
MILL REJECT BUNKER AND
ACCESSORIES**

2 X 250 MW GHTP LEHRA MOHABBAT TPP

SPECIFICATION NO. PE-TS-226-160-A001

VOLUME II B

SECTION D

REV 0

DATE -11-Apr-05

SHEET 1 OF 3

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 data sheet A of Section-D.

- | | | | |
|----|---|---|---------|
| 1) | Structural steel | : | IS-2062 |
| 2) | Rolled Steel Beams, Channels and
Angle Sections | : | IS-808 |
| 3) | Scheme of Symbols for Welding | : | IS-813 |
| 4) | Covered Electrodes for Metal Arc
Welding of Structural Steel | : | IS-814 |
| 5) | Code of practice for use of Metal Arc
Welding for general Construction in
Mild Steel | : | IS:816 |
| 6) | Code of practice for inspection of Welds | : | IS-822 |
| 7) | Code of practice for use of structural
steel in general building construction | : | IS-800 |
| 8) | Dimension for steel plate, sheet and
Strip for structural and general
Engineering purposes. | : | IS-1730 |
| 9) | Recommendation for metal arc welding | : | IS-9575 |

2.3 Where the above standards are in conflict with the stipulations of this specification, the specification supersedes 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 have a capacity as specified in data sheet-A and 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.



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TECHNICAL SPECIFICATION	VOLUME II B
MILL REJECT BUNKER AND	SECTION D
ACCESSORIES	REV 0 DATE -11-Apr-05
2 X 250 MW GHTP LEHRA MOHABBAT TPP	SHEET 2 OF 3

3.2 The reject bunker shall be complete with manually operated twin sector discharge gate, steel liners, flanged connections, plate forms, arches staircase, hand railings etc. The equipment shall be designed and equipped for outdoor operation, complete with all accessories and ready for erection and placed in serving for desired duty.

4.0 CONSTRUCTIONAL FEATURES

4.1 The bunker shall be fabricated to the design of vendor, but not less than 10 mm steel plate. 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.

4.2 Bidder shall furnish all steel work required for support and access for operation and maintenance. This shall include platforms, grating/chequered plates, stairways, railings, base plates, foundation bolts etc. Purchaser will provide only the foundation with pockets.

4.3 Only conical portion of the bunker shall be lined with 8 mm thick TISCRA/SAILHARD lining.

4.4 The storage bunker shall be so arranged that any 10 tonnes capacity truck can be conveniently loaded under it by an operator standing on the plate form. The bunker supporting column shall be so spaced to have a clear road access of 5 m width.

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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TECHNICAL SPECIFICATION MILL REJECT BUNKER AND ACCESSORIES 2 X 250 MW GHTP LEHRA MOHABBAT TPP	VOLUME II B	
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5.5 Inspection during fabrication at appropriate stage including fit up. Witness of dye penetrate testing at root and final run for all groove welds and final run for fillet welds as per ASTM E 165. All surfaces examined shall be free of:

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

5.6 Any other tests as specified in the fabrication code.

5.7 Dimensional check match marking as per approved drawings.

5.8 SCOPE OF INSPECTION FOR RACK AND PINION GATE

5.8.1 Examination of materials of construction, verification, correlation/testing and identification of material with test certificate for important items like body, drives, worm shaft, rack & pinion, wheel etc.

5.8.2 D.P. check on drive shaft & worm shaft as per IS-3653 and there shall be no surface defects.

5.8.3 Dimensional check

5.8.4 For chain, proof load shall be carried out.

5.6.5 Shore Hardness of rubber component

5.6.6 Check for overall dimension, completeness, and no load working after assembly.

5.6.7 Clearing, marking and painting.

6.0 PAINTING

6.1 Manufacture of paints, mixing of paints, preparation for painting etc. shall be generally accordingly to the relevant IS codes of practice.

6.2 As per enclosed painting specification.



TITLE TECHNICAL SPECIFICATION FOR CONVEYING AIR COMPRESSOR 2 x 250 MW GHTP LEHRA MOHABBAT TPS	SPECIFICATION NO. PE-TS-226-160-A001			
	VOLUME	II B		
	SECTION	D		
	REV	0	DATE	15-Apr-05
	SHEET	1	OF	3

CONVEYING AIR COMPRESSOR

1.0 GENERAL

This standard specification covers the design, material construction features, manufacture, inspection & testing at VENDOR'S and / or his sub vendor's works suitable painting and packing requirements of air compressor with drive.

2.0 CODES & STANDARDS:

2.1 The design, manufacture, inspection & testing of air compressor as specified hereinafter shall comply with the requirements of the latest applicable Indian / British American Standards. The following standards/codes shall be following in particular.

- i) IS:5456 - Code of practice for testing of positive displacement type air compressors and exhauster.
- ii) IS:5727 - Glossary of terms relating to compressors and exhauster.
- iii) IS:6206 - Guide for selection, installation and maintenance of air compressors.

2.2 The material of various components shall conform as specified in Data Sheet-A and where not specified, the material shall conform to the applicable IS / BS / ASTM / DIN Standards.

2.3 In case of any conflict between the above mentioned standards / codes and specification, the stipulations in the technical specification shall prevail. In case of any further conflict the same shall be referred to purchaser's engineer for clarification whose decision shall be final & binding.

3.0 DESIGN AND CONSTRUCTION

3.1 Air Compressor of reciprocating or rotary (screw) type shall be designed for continuous operation to satisfy the conveying air requirement for fail-safe operation.

3.2 The design, manufacture and performance of air compressors shall comply with the requirements of latest applicable Indian / British American / DIN standards.

3.3 The compressors shall be water-cooled, non-lubricated type along with all accessories as specified in the data sheet - A or as required. Intercoolers/ after coolers, if provided, shall also be of water-cooled, shell - tube construction.

3.4 The compressors shall be designed to ensure trouble free operation with min. vibration and noise. Multiple cylinders, if employed, shall be arranged in such a way as to ensure min. unbalance.



TITLE	TECHNICAL SPECIFICATION FOR CONVEYING AIR COMPRESSOR 2 x 250 MW GHTP LEHRA MOHABBAT TPS		SPECIFICATION NO. PE-TS-226-160-A001
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- 3.5 The wall thickness of the compressor cylinder shall be selected to withstand highest internal pressure and at the same time shall allow a number of re-borings.
- 3.6 The crankcase shall be provided with oil level dipstick, breather and drain plug.
- 3.7 Any oil adhering to the piston rod shall be wiped-off by suitable wiper ring, suitable collars shall also be fixed on the piston rod between the packing and wiper rings so that any trickling oil flow can be stopped from moving towards the cylinder.
- 3.8 Suction and discharge valves shall be suitable for quick opening and closing in conformity with the rotating speed of the crankshaft. Valves shall have large effective areas permitting low air velocity along with cushioning arrangement to minimize shock. Valve discs shall be of stainless steel (containing 15% or more chromium) heat treated, tempered and ground. The valve seats, guides & springs shall be of hardened stainless steel.
- 3.11 Crankshaft, crank pin piston pin bearings shall be of antifriction or journal type depending on manufacturer's standard practice.
- 3.12 Splash or forced feed type of lubrication shall be provided for all bearings and sliding components.
- 3.13 The air receiver shall be sized that even in the event of total stoppage of airflow from the compressor, operation of conveying is not stopped for 2 cycle time duration.
- 3.14 Drive motor shall be connected to the air compressor directly or through V-belt or any other suitable type of power transmission system as specified in the data sheets. Shafts should be coupled through heavy-duty flexible coupling in case of direct drive.
- 3.15 The power rating of the drive shall be selected such that a min. margin of 15% is available over the total input power required at compressor drive shaft at the rated condition. Total input power shall include air compression power plus any power consumed in auxiliaries etc., (if any), when the driver is not directly coupled to compressor, due account shall be made for losses in power transmission in addition to the above 15% extra margin.

3.16 **MATERIAL OF CONSTRUCTION**

The material of construction for various parts of package air compressors shall be as follows:-

- | | | |
|--------------------------------|---|-----------------------------------|
| a) Compressor cylinder | : | CI ,IS- 210, grade FG-260 |
| b) Piston | : | Aluminum;BS-1490 LM-13 |
| c) Piston rod | : | EN-8 as per BS -970 |
| d) Connecting rod | : | Forged steel as per IS-1875 CI IV |
| e) Piston ring | : | Teflon with 25-30% carbon. |
| f) Crank case | : | CI , IS-210 Grade FG-260 |
| g) Suction and delivery valves | : | S.S as per EN-56 of BS-970 |
| h) Air receiver | : | MS as per IS (2062) |



TITLE

**TECHNICAL SPECIFICATION
FOR
CONVEYING AIR COMPRESSOR**

2 x 250 MW GHTP LEHRA MOHABBAT TPS

SPECIFICATION NO. PE-TS-226-160-A001

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- | | | |
|--------------------|---|---|
| i) Crank shaft | : | Forged steel as per IS-1875 CI IV |
| j) Base plate | : | Mild steel |
| k) For other parts | : | As per latest IS/BS/ASTM/AIS/ equivalent standards depending upon the parts |

3.17.0 **Instrumentation and Accessories:**

The conveying air compressor and drive shall be supplied completed with the following instrumentation and accessories as minimum.

- a) Discharge air pressure gauge
- b) Pressure switch to control actuation of compressor drive motor.
- c) Starter for drives motor.
- d) Pressure relief valve
- e) Drain valve
- f) Delivery valve

4.0 **INSPECTION & TESTING**

4.1 The manufacturer shall conduct all tests to ensure that the equipment finished shall conform to the requirements of this specification and in compliance with requirements of applicable codes & standard.

4.2 All materials used for conveying air compressor and drive shall be of tested quality. Materials shall be tested as per the relevant standards and test certificates shall be made available to the purchaser.

4.3. Test at Shop:

- a) All pressure parts shall be subjected to hydraulic testing at a pressure twice the maximum working pressure or 150% of design pressure which ever is more for a period not less than one (1) hour.
- b) Assembled receiver shall be hydraulically tested at a pressure twice the maximum working pressure or 150% of the design pressure and the test pressure shall be maintained for at least 30 minutes. All joints shall be gently hammered during the test.
- c) Pneumatic test at design pressure shall also be carried out.

5.0 **PAINTING**

5.1 All parts of air compressors with drive shall be painted as specified in Data Sheet-A or as per the specification furnished elsewhere.

5.2 Before transportation of the equipment necessary cleaning, flushing etc., shall be done shop coats of rust inhibiting paints, lacquers etc., shall be applied to various parts as necessary.



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FOR	SECTION D
CONVEYING VESSEL	REV 0 DATE -18-Apr-05
2 X 250 MW GHTP LEHRA MOHABBAT TPS	SHEET 1 OF 3

1.0 **GENERAL**

1.1 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 vessel 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 vessel and accessories shall in general conform to the following standards/codes but will be subjected to any modification and requirement as specified in Data sheet A of Section D.

- i) Transporter Vessel : Mild Steel Construction as per IS 2062 Gr-A/As per material specification in IS 2825 for applicable class of vessel.
- ii) Dome/Metering valve : IS 210 FG 260 (body) , Dome- Alloy CI 225-250BHN (min)
- iii) Flange : MS as per ANSI-16.11

2.3 Where the above standards are in conflict with the stipulations of these specifications, 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 (**3.5 to 6 M/Sec.**) for conveying of materials as specified in Data Sheet-A.

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 an alloy CI 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 vessel and the feeding point.

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



TITLE	SPECIFICATION NO. PE-TS-226-160-A001
TECHNICAL SPECIFICATION FOR CONVEYING VESSEL 2 X 250 MW GHTP LEHRA MOHABBAT TPS	VOLUME II B
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- 3.6 Automatic drain filter and oil fog lubricator set shall be fitted into the instrument airline to dome/metering valve for use with pneumatic controls.
- 3.7 Any air line stop valve fitted in the air supply line of transporter vessel shall be of gate or 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. While designing the vessel, suitable thermal insulation protection shall be provided such that outer surface temperature of vessel does not exceed 60 degree C. The vessel will be airtight / leak proof in fully assembled condition.
- 4.2 Dome / Metering valve shall be of manufacturer's standard construction and will be easily open able and closeable type. Flanges will be of mild steel construction as per relevant standard. All joints will be flanged with asbestos or silicon rubber gaskets suitable for 200°C. Terminal boxes will be of mild steel body with cast deflector plate/TISCRA/L/SAILHARD LINER.
- 4.3 All bends will be of long radius cast bends of min hardness of 400 BHN. Conveying pipes will be of mild steel heavy-duty type of thickness as specified in Data Sheet-A.

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.



TITLE TECHNICAL SPECIFICATION FOR CONVEYING VESSEL 2 X 250 MW GHTP LEHRA MOHABBAT TPS	SPECIFICATION NO. PE-TS-226-160-A001	
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- 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.

6.0 **CLEANING AND PAINTING**

6.1 As per approved painting schedule enclosed in specification.



TITLE MILL REJECT BUNKER AND ACCESSORIES DATA SHEET -A 2 X 250 MW GHTP LEHRA MOHABBAT T.P.S	SPECIFICATION NO. PE-TS-226-160-A001	
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S.NO.	DESCRIPTION	UNIT	DATA/PARTICULARS
1.0	Number required for unit	-----	Common for both units
2.0	Material Handled	-----	Coal Mill rejects
3.0	Effective Capacity	Metric Tonnes	To store mill rejects for 16 effective running hours of number of mills operating at worst coal firing at 100% BMCR (Minimum effective capacity 80 T)
4.0	Number of outlet	-----	One
5.0	Minimum free board	mm	500
6.0	MATERIAL OF CONSTRUCTION AND THICKNESS OF: -		
6.1	Bunker Plates	mm	10mm thk. MS plates (min)
6.2	Liners	mm	8 mm TISCRAI/SAILHARD for conical portion
6.3	Discharge gate	----	Twin Sector gates Cast Iron IS210/MS to IS2062 with TISCRAI/SAILHARD Liner
6.4	Size of Bunker Discharge	mm	Minimum 400 mm
6.5	Method of Discharge gate operation	----	Pneumatically operated.
6.6	Minimum Valley Angle	----	60 Degrees
6.7	Density of rejects	Metric Tonnes/m ³	1.6 for Volume Calculation 2.4 for Structural Load calculation

Notes

Following Accessories shall be provided

- 1 RF type of level probe/switch shall be as per C&I specification requirement.
- 2 Counter weight type Pressure relief valve designed for max. pressure subjected. Bidder can propose pressure relief valve as per design/standard practice.
- 3 Reverse pulse jet Bag filter with emission level of 50 mg/m³ with air to cloth ratio 1.5



TITLE	SPECIFICATION NO. PE-TS-226-160-A001	
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2 X 250 MW GHTP LEHRA MOHABBAT T.P.S

S.NO.	DESCRIPTION	UNIT	DATA/PARTICULARS
1.0	Number required	-----	One (1) for each mill
2.0	Material Handled	-----	Coal Mill rejects
3.0	Number of outlet	-----	Three (3)
4.0	MATERIAL OF CONSTRUCTION AND THICKNESS HAVE: -		
5.1	Bunker Plates	mm	10mm thick. MS as per IS: 2062 Gr. A (Min)
5.2	Discharge Valve	----	Manual operated plate valve
5.3	Density of rejects	Metric Tonnes/m ³	1.6 for Volume Calculation 2.4 for Structural Load calculation
5.4	Inlet valve to pyrite hopper	----	Pneumatically operated KGV
5.5	Valves at discharge chute, by-pass chute and emergency chute	----	Manual operated KGV
5.6	Min. instruments required	----	Two nos. of level switches (High/High-High) One (1) no of temperature switch
5.7	Explosion vent	----	Rupture Disc
5.8	Water Spraying arrangement with Solenoid Valve	----	Yes



TITLE

TECHNICAL SPECIFICATION
FOR
SUMP PUMP
2x250MW GHTP LEHRA MOHABBAT T.P.S

SPECIFICATION NO. PE-TS-226-160-A001

VOLUME II B

SECTION D

REV 0

DATE Feb 21, 05

SHEET 1 OF 1

SUMP PUMP

Material of construction for sump pump:

- Casing & suction Bell : 2.5% Ni-CI to IS 210 Gr, FG-260
- Impeller : ASTM A 351 CF 8M
- Shaft/Sleeves : SS-316/SS-410

Alternate offer for sump pump MOC:

- Casing & suction Bell : 2.5% Ni-CI to IS 210 Gr, FG-260
- Impeller : 2.5% Ni-CI to IS 210 Gr, FG-260
- Shaft/Sleeves : EN-8

The make of pump shall be subjected to approval of Customer. Tentative makes are KBL & Kishore pumps etc. The rebate on account of alternate offer shall be given separately by the bidder.



TITLE :
**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
MILL REJECT SYSTEM**
2x250 MW LEHRA MOHABBAT GHGPS STAGE-II

SPECIFICATION NO.
VOLUME NO. : **II-B**
SECTION : **C**
REV NO. : **0** DATE : **02/05/05**
SHEET : **1** OF **1**

TECHNICAL SPECIFICATION
FOR
MILL REJECT SYSTEM
(ELECTRICAL PORTION)



TITLE :
ELECTRICAL EQUIPMENT SPECIFICATION
FOR
MILL REJECT SYSTEM
2x250 MW LEHRA MOHABBAT GHTPS STAGE-II

SPECIFICATION NO.
VOLUME NO. : II-B
SECTION : C
REV NO. : 0 DATE : 02/05/05
SHEET : 1 OF 2

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER :

The equipment and services to be provided by bidder under this specification shall be as detailed here below and as also specified in Electrical equipment Data sheets but shall not be limited to the following:

- a) REFER SCOPE ITEM NO.-IX.
Supply and installation of all drive motors and base plates required for pumps and other drives for the plant. Make of motors shall be as given in motor specification. For further items, bidder shall furnish list of sub-vendors, which shall be subject to purchaser's approval. Motor shall meet minimum requirement of motor specification as indicated in technical specification for Electric Motor included under Section D.
- b) Any item / work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Various drawings, data calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified.
- d) REFER SCOPE ITEM NO.-XII.
All equipment offered shall have suitable provision for termination and connection of power, control and special cables and shall also be complete with cable boxes, double compression tinned brass cable glands, cable lugs Cu (Heavy duty) to suit the cables etc.
- e) REFER SCOPE ITEM NO.-IV.
All power & control cables shall be terminated by bidder for bidder supplied equipments as per cabling, earthing & lightning protection E -19. This specification has been included for the cable laying and termination purpose only.
- f) REFER SCOPE ITEM NO.-VI & VII:
It may be noted that cable tray and support system for this project is conventional welded type. Specification E-19 should not be referred for cable trays & supporting system. As the cable trays & supporting system is in BHEL scope.
- g) REFER SCOPE ITEM NO.-VIII:
Conductor sizes for equipment earthing are as per enclosed Annexure -1.
- h) Special Erection & Maintenance tools & tackles along with list.
- i) Unpriced list of bill of material for electrical equipments shall be furnished with the technical offer.
- j) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.



TITLE :
ELECTRICAL EQUIPMENT SPECIFICATION
FOR
MILL REJECT SYSTEM

2x250 MW LEHRA MOHABBAT GHTPS STAGE-II

SPECIFICATION NO.
VOLUME NO. : II-B
SECTION : C
REV NO. : 0 DATE : 02/05/05
SHEET : 2 OF 2

- k) Bidder to furnish electrical load requirements for the plant in the enclosed format E01-1.
- l) Erection & commissioning spares along with list.

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:

- a. REFER SCOPE ITEM NO.-I.
415V MCC required for feeding power to various loads of Plant. Any other control panel/distribution board required for the Plant shall be provided by bidder.
- b. REFER SCOPE ITEM NO.-II.
Local push button stations for emergency stop of drives.
- c. REFER SCOPE ITEM NO.-III IV & XII.
All power & control cables, bidders shall furnish size and quantity of cables required for the Plant loads.
- d. REFER SCOPE ITEM NO.-VI.
Cable trench & cable trays.
- e. REFER SCOPE ITEM NO.-VIII.
Equipment Earthing including Earthing material.

3.0 SPECIFIC REQUIREMENTS

- a) In case of any deviation the bidder shall indicate the same clause by clause in enclosed deviation schedule. In the absence of dully filled in schedules, it will be construed that the offer confirms strictly to the specification.
- b) Bidder shall furnish dully filled in data sheet-B for electrical equipments along with offer.
- c) Bidder shall furnish quality assurance plans for approval.
- d) Bidder shall furnish all drawings/datas/catalogues as indicated in different electrical equipment specifications.
- e) Bidder shall be responsible for the following after award of the contract:
 - I. Power and control cable schedules.
 - II. Cable termination details interconnection drawings etc.
 - III. Electrical equipment layout.
 - IV. Cable block diagram.

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PROJECT: 2x250 MW LEHRA MOHABBAT GHTPS STAGE-II

PACKAGE: MILL REJECT SYSTEM REV-0

<u>S.NO</u>	<u>ITEM NO.</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	I	415V Switchgear (modification of switchgear if required)	vendor	vendor	Two (2) nos, 75 KW motor had been supplied by UCC
2	II	Local Push Button Station	vendor	vendor	For emergency stop only, located near the motors.
3	III	Power cables, ordinary control cables and screened control cables between equipment supplied by vendor. (Laying & termination of these cables at both end of vendor equipment by vendor.)	vendor	Vendor	Any special cable ie compensating, co-axial, prefab, MICC, serial interface etc. required will be in bidders scope. Laying & termination of special cables at both end of equipment by vendor.
4	IV	Power cables, ordinary control cables and screened control cables between equipment supplied by vendor and BHEL (Laying by BHEL & termination at vendor equipment by vendor.)	vendor	vendor	
5	V	Lighting	BHEL	BHEL	
6	VI	Cable trays and accessories	vendor	vendor	BOQ to be furnished by vendor after award of contract. Laying of cable trays between vendor equipment by vendor.
7	VII	Supporting system for cable trays	vendor	vendor	BOQ to be furnished by vendor after award of contract
8	VIII	Equipment earthing	BHEL	BHEL	BOQ to be furnished by vendor after award of contract
9	IX	Motors	Vendor	Vendor	For electric actuator motor, 3no. thermostat shall be provided (one no./ phase)
10	X	a) Cable schedules b) Cable interconnection detail/diagram c) Cable block diagram	a,b,c by Vendor	-	Cable listing for control cables for vendor supplied equipment in the cable schedule format (shall be furnished to vendor after award of contract)
11	XI	Cable tray layout drawings	Vendor	-	For equipment located within the boundary limits of plant supplied by vendor.

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PROJECT: 2x250 MW LEHRA MOHABBAT GHTPS STAGE-II

PACKAGE: MILL REJECT SYSTEM REV-0

12	XII	Cable glands and lugs for equipment supplied by vendor	Vendor	Vendor	Glands shall be tinned brass double compression type (suitable for selected cable size) Lugs shall be of heavy duty, crimping type tinned copper
----	-----	--	--------	--------	---

NOTE: SOFT COPY OF CABLE SCHEDULE IN THE CABLE SCHEDULE FORMAT SHALL BE FURNISHED BY VENDOR AFTER OF CONTRACT

PEM 6666-0



TITLE
**TECHNICAL SPECIFICATION
MILL REJECT HANDLING SYSTEM
2 X 250 MW GHTP LEHRA MOHABBAT T.P.S**

SPECIFICATION NO. PE-TS-226-160-A001	
VOLUME - II B	
SECTION C	
REV 0	DATE May. 3. 05
SHEET	OF

**VOLUME - II B
SECTION - D
ELECTRICAL PORTION**



2x250 MW GHTPS STAGE-II,
LEHRA MOHABBAT, UNIT 3 & 4

Doc. No. PE-TS-226-506-E615

Volume Section

TECHNICAL SPECIFICATION FOR LV MOTORS

Rev. : 0

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3.0.0	TECHNICAL REQUIREMENTS	3
4.0.0	DRAWINGS AND DATA	7
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	2x250 MW GHTPS STAGE-II, LEHRA MOHABBAT, UNIT 3 & 4	Doc. No. PE-TS-226-506-E615
		Volume Section
	TECHNICAL SPECIFICATION FOR LV MOTORS	Rev. : 0
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1.0.0 INTENT OF SPECIFICATION

This specification covers the requirements of Low Tension Motors rated for 415 / 240V AC supply for continuous duty applications.

2.0.0 CODES AND STANDARDS

Motors shall fully comply with the latest edition, including all amendments and revisions, of the following codes and standards except as modified by this specification.

IS 325 :	Three-phase induction motors
IS 900 :	Code of practice for installation and maintenance of induction motors
IS 996 :	Single-phase small ac and universal electric motors
IS 4722 :	Rotating Electrical Machines - Specification
IS 4791 :	Degree of Protection provided by enclosures for rotating electrical machinery
IS 4728 :	Terminal marking and direction of rotation for rotating electrical machinery
IS 1231 :	Dimensions of Three-phase Foot-mounted Induction Motors
IS 2223 :	Dimensions of flange mounted ac induction motors
IS 4029 :	Guide for testing three-phase induction motors
IS 8789 :	Values of performance characteristics for three-phase induction motors
IS 13555 :	Guide for Selection and Application of 3-Phase A. C. Induction Motors for Different Types of Driven Equipment
IS 2148 :	Flameproof enclosures for electrical apparatus
IS 5571 :	Guide for Selection of Electrical Equipment for Hazardous Areas
IS 12824 :	Type of duty and classes of rating assigned
IS 12802 :	Temperature-rise measurement of rotating electrical machines.
IS 12065 :	Permissible limits of noise level for rotating electrical machines.
IS 12075 :	Mechanical vibration of rotating electrical machines.

3.0.0 TECHNICAL REQUIREMENTS

3.1.0 Motors shall be of continuous duty, constant speed, squirrel cage, three phase / single phase induction motors.

3.2.0 Power Supply


3.2.1 Motors below 200 watts, except otherwise required for reversible service, shall be rated for use on a 240 V, Single phase, 50 Hz, solidly grounded system. Motors above 200 Watts, upto 180 kW shall be rated for use on a 415V, 3 phase, 50 Hz, solidly grounded system.

3.2.2 Motors shall run continuously at rated output with the following variations in voltage and frequency:


Voltage	± 10%
Frequency	+ 3 %, - 5%
Combined voltage and Frequency (Absolute sum)	10%

3.2.3 Motor shall be designed for direct on line starting at full voltage. The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage. Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminals.

3.2.4 The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.

	2x250 MW GHTPS STAGE-II, LEHRA MOHABBAT, UNIT 3 & 4	Doc. No. PE-TS-226-506-E615	
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- 3.2.5 Motors shall not stall due to drop in voltage upto 70% of the rated voltage for a duration of 2 seconds.
- 3.2.6 The motors may be subjected to sudden application of 150% rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.
- 3.2.7 The motors shall be designed to withstand any torsional and/or high current stresses, which may result during 'Auto bus transfer', without experiencing any deterioration in the normal life and performance characteristics.
- 3.3.0 Temperature rise**
- 3.3.1 Motors shall be designed for design ambient temperature of 50°C. Temperature rise of the stator winding shall not exceed 70°C over design ambient temperature of 50°C while delivering maximum continuous rating.
- 3.4.0 Design Margin**
- 3.4.1 Unless otherwise specified in the corresponding 'mechanical specification', Maximum continuous rating of motors shall be at least 15% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variation.
- 3.5.0 Torque Requirements**
- 3.5.1 The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating, pull up, breakdown and full load torques are available for the intended service. The accelerating torque at any speed with the lowest starting voltage shall be at least 10% of rated full load torque of the motor. The pull out torque at rated voltage shall not be less than 205% of full load torque.
- 3.6.0 Starting Requirements:**
- 3.6.1 Motors shall be suitable for the following starts under the specified conditions of load, torque and inertia in the motor initially at its normal operating temperature.
- | | |
|--|---|
| No. of consecutive startups with initial temperature of the motor at ambient level (cold) | 3 |
| No. of consecutive startups with initial temperature of motor at full load operating level (Hot) | 2 |
- 3.6.2 Starting current shall be not more than 600% subject to IS tolerance for AC motors. For DC motors it shall be 200% with usage of starting resistance.
- 3.7.0 Locked Rotor Withstand Time**
- 3.7.1 The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 seconds for motors with 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time and more than the starting time by atleast 10% of the starting time for motors with starting time more than 45 seconds. Starting time shall be at the minimum permissible voltage of 80% rated voltage. If the above conditions cannot be met in unavoidable cases, special provisions such as motor shaft speed switch, etc. shall be provided subject to the approval of the Purchaser/Consultant.

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3.8.0 Control

3.8.1 Motors rated up to 150 kW shall be suitable for contactor control and higher rating for breaker control.

3.9.0 Enclosure

3.9.1 Motors shall be totally enclosed fan cooled type (TEFC) having at least IP 54 degree of protection for indoor location and IP 55 degree of protection for outdoor location.

3.9.2 Motors located in hazardous area shall have flame proof enclosure as per applicable standard.

3.10.0 Cooling

3.10.1 Motors shall be self ventilated type, totally enclosed fan cooled (TEFC) with method of cooling IC0141 or closed air circuit air cooled with method of cooling IC0151/ IC0161.

3.11.0 Winding

3.11.1 All insulated winding shall be of copper. All motors shall have class B or class F insulation but limited to Class B temperature rise. Windings shall be impregnated to make them non-hygroscopic and oil resistant.

3.11.2 The windings, fittings and hardware shall be corrosion resistant. The windings shall be tropicalized and suitably varnished, baked and treated for operating satisfactorily in humid and corrosive atmosphere.

3.11.3 For motors rated above 30 kW, space heaters rated for 240V, 50 Hz supply shall be provided.

3.12.0 Bearings

3.12.1 Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application. Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred. However, if anti-friction bearings can take vertical thrust, thrust and guide bearings are not required.

3.12.2 Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.


3.12.3 Sleeve bearings shall be split type, ring oiled with permanently aligned, close running shaft sleeves. Grease lubricated bearings shall be prelubricated and shall have provisions for in-service positive lubrication with grease nipple and relief holes and shall be suitable for 8000 working hours without change of grease.

3.12.4 Lubricant shall not deteriorate under all service conditions. The lubricants shall be limited to normally available types.

3.13.0 Terminal Boxes

3.13.1 Separate terminal boxes of IP 55 degree of protection shall be provided for stator leads and space heaters. For single core cables, gland plate shall be non-magnetic material. Terminal box shall be capable of being turned 360° in steps of 90°, unless otherwise approved. The terminal boxes shall be split type with removable cover with access to connections.

3.13.2 Terminal boxes shall be capable of withstanding system fault level of 50 kA for 0.2 sec.

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3.13.3 Terminals shall be stud type, substantially constructed and thoroughly insulated from the frame. The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.

3.13.4 Terminal boxes shall be suitable for receiving armoured aluminium / copper cables. Motor terminal box shall be furnished with suitable crimping type cable lugs and double compression type brass cable glands. Size of cables will be intimated during detail engineering.

3.13.5 Cable size may be increased in some cases because of larger number of cables laid in trenches / trays (or) because of voltage drop consideration. The supplier shall supply motors with terminal box and cable accessories suitable for such higher size of cable at no extra cost.

3.14.0 Earthing Terminals

3.14.1 The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer. The cable terminal box shall have a separate grounding terminal. The earthing terminal shall be suitable for receiving the following tentative sizes of earthing conductors. However, the Earthing conductor sizes will be finalised during detail Engineering.

- Up to 3.7 kW : 8 SWG GI wire
- >3.7 to 11 kW : 4 SWG GI wire
- >11 to 30 kW : 25X3 GI flat
- >30 to 90 kW : 25X6 GI flat
- >90 to 160 kW : 50X6 GI flat
- >160 to 180 kW : 65X8 GI flat

3.15.0 Noise & Vibration

3.15.1 The Noise level shall not exceed the values specified in IS: 12065. The peak amplitude of the vibration shall also be within the specified limits of IS: 12075.

3.16.0 Name Plates

3.16.1 Motor shall have stainless steel nameplate(s) showing diagram of connections, all particulars as per IS : 325 and following additional information :

- Year of Manufacture
- Type of bearing and recommended lubricants.

3.17.0 Foundation bolts shall be supplied alongwith the Motor.

3.18.0 Rotor shall be dynamically balanced.

3.19.0 All the Motors shall be provided with 'Local Emergency Stop' push button near the drive in accordance with Indian Statutory Regulations.

3.20.0 Painting

3.20.1 Motors shall be painted with corrosion resistant paint as per IS : 5.

3.21.0 Tests

3.21.1 Motors should have been type tested and proven type. All the motors shall be subjected to routine tests as per applicable Indian Standard. In addition, any special test required for the driven equipment shall be performed. Type test reports shall be furnished for Approval.

DESIGN MEMORANDUM FOR EARTHING SYSTEM
SIZING CALCULATION FOR EARTHING OF PLANT AUXILIARIES

S.No	Equipment	No. of Leads	Conductor Size	Material
A	Neutral Earthing			
1	HV Neutral of Generator Transformer	Two	75X10	Galvanised MS Flat
2	HV Neutral of Station Transformer	Two	75X10	Galvanised MS Flat
3	Neutral of Generator NGT	Two	65X8	Galvanised MS Flat
4	Surge Arrester of Generator	One	50x6	Galvanised MS Flat
5	NGR of Station Transformer	Two	50X6	Galvanised MS Flat
6	NGR of Unit Auxiliary Transformer	Two	50X6	Galvanised MS Flat
7	LV Neutral of Auxiliary Transformer	Two	75X10	Galvanised MS Flat
8	LV Neutral of Lighting Transformer	Two	50X6	Galvanised MS Flat
B	Enclosure Earthing			
9	Generator	Two	65X8	Galvanised MS Flat
10	LAPT Cubicle	Two	50x6	Galvanised MS Flat
11	NGT Cubicle	Two	50x6	Galvanised MS Flat
12	IPB Busduct	One for each section in one phase	65X8	Galvanised MS Flat
13	Generator Transformer	Two	75X10	Galvanised MS Flat
14	Station Transformer	Two	75X10	Galvanised MS Flat
15	Unit Auxiliary Transformer	Two	50X6	Galvanised MS Flat
16	6.6 kV Switchgear	Two	50X6	Galvanised MS Flat
17	6.6 kV SPB Busduct	Two	50X6	Galvanised MS Flat
18	6.6 kV Motors	Two	50X6	Galvanised MS Flat
19	LT Transformers	Two	75X10	Galvanised MS Flat
20	LT Busducts	Two	75X10	Galvanised MS Flat
21	LT PCC/PMCC	Two	75X10	Galvanised MS Flat
22	LT MCC	Two	65X8	Galvanised MS Flat
23	LT DB	Two	50X6	Galvanised MS Flat
24	LT ACB operated Motors >150 kW	Two	65X8	Galvanised MS Flat
25	DG Set	Two	50X6	Galvanised MS Flat
26	Cable Trays	One	50X6	Galvanised MS Flat
27	Control Panel & Control Desk	Two	25X3	Galvanised MS Flat
28	Local Panels / Lighting Panels	Two	35X5	Galvanised MS Flat
29	Junction Boxes	Two	8 swg	Galvanised steel Wire
30	Push Button stations	Two	8 swg	Galvanised steel Wire
31	3 Phase Receptacles	One	25X3	Galvanised MS Flat
32	Structural Steel Columns	One	50X6	Galvanised MS Flat
33	Steel pipe rack	One	50X6	Galvanised MS Flat
34	Fence/Gate	One	35X5	Galvanised MS Flat
35	Risers	N.A	50x6 / 75x10	Galvanised MS Flat
36	Sub-mat buried in Floor Finish	N.A	75x10	Galvanised MS Flat
37	Runway conductor/Main Earth lead along Columns	N.A	75x10	Galvanised MS Flat
38	Battery Charger	Two	50X6	Galvanised MS Flat
39	DCDB	Two	50X6	Galvanised MS Flat
40	Local Starters	One	25X3	Galvanised MS Flat
41	Lighting Mast/Pole	Two	25X3	Galvanised MS Flat
42	Lighting Fixtures, Single phase receptacles, Power and lighting conduits	One	14 SWG	Galvanised steel Wire
43	LV Motors upto 5kW	Two	8 SWG	Galvanised steel Wire
44	LV Motors above 5kW & upto 30kW	Two	25X3	Galvanised MS Flat
45	LV Motors above 30kW & upto 90kW	Two	35X5	Galvanised MS Flat
46	LV Motors above 90kW & upto 150 kW	Two	50X6	Galvanised MS Flat

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QUALITY PLAN

SHEET 1 OF 2

CUSTOMER	PROJECT TITLE	SPECIFICATION NUMBER
BIDDER / VENDOR	QUALITY PLAN NUMBER PED-506-00-Q-006/0	SPECIFICATION TITLE
SYSTEM	ITEM AC ELECT. MOTORS BELOW 75 KW	SECTION VOLUME III

S. NO.	COMPONENT / OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	Painting	1.Shade	MA	Visual	Samples	Manuf's spec/BHEL spec./ Relevant Standard	BHEL Spec. same as Col.7	Log book	3	-	-	
2.0	Assembly	1.Workmanship	MA	Visual	100%	Manuf's spec.	Manuf's spec.	-do-	3	-	-	
		2.Dimensions	MA	-do-	-do-	Mfg.drg./ Mfg spec.	Mfg.drg./ relevants IS	-do-	3	-	-	
		3.Correctness completeness terminations/ making/ colour code	MA	visual	100% Is	Mfg.Spec./ relevant IS	Mfg.spec./ relevant IS	-do-	3	-	-	
3.0	Tests	1.Routine tests including special test as per BHEL spec.	MA	-do-	100%	IS-325/ BHEL Spec/ Data sheet.	Same as Col.7.	Test Report	3	2,1	2,1	Note - 1
		2.Overall dimensions and orientation	MA	Measurement & visual	100%	Approved drg/Data sheet	Approved drg/Data sheet & Relevant IS	Inspection Report	2	1	-	

2L

BHEL	PARTICULARS	BIDDER / VENDOR
	NAME	
	SIGNATURE	
	DATE	

BIDDER'S / VENDOR'S COMPANY SEAL



QUALITY PLAN

CUSTOMER

PROJECT TITLE

SPECIFICATION NUMBER

BIDDER / VENDOR

QUALITY PLAN NUMBER PED-506-00-Q-006/0

SPECIFICATION TITLE

SHEET 2 OF 2

SYSTEM

ITEM AC ELECT. MOTORS BELOW 75 KW (LV)


SECTION VOLUME III

S. NO.	COMPONENT / OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE / METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
		3. Nameplate details	MA	Visual	100%	IS-325 & Data sheet	IS-325 & Data sheet.	Inspection Report	3	1	-	

NOTES :- 1-Routine tests on 100% motors shall be done by the vendor. However, BHEL shall witness routine tests on random samples. The sampling plan shall be mutually agreed upon.
 2-Wherever customer is involved in inspection, (1) shall mean BHEL and customers both together.
 3-For exhaust/ventilation fan motors of rating upto 1.5 kw, only routine test certificates shall be furnished for scrutiny.

--	--	--	--	--	--	--	--	--	--	--	--	--

BHEL	PARTICULARS	BIDDER / VENDOR
	NAME	
	SIGNATURE	
	DATE	

	QUALITY PLAN				CUSTOMER			PROJECT TITLE			SPECIFICATION NUMBER	
					BIDDER / VENDOR			QUALITY PLAN NUMBER : PED-506-00-Q-002 / 01			SPECIFICATION TITLE	
	SHEET 2 OF 3				SYSTEM : ELECTRICAL			ITEM : BOUGHT OUT ITEMS			SECTION VOLUME III	
PRCS. S. NO.	COMPONENT / OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
	B) INSTRUMENTS, GAUGES, CONNECTORS, LUGS, GLAND SPACE HEATER, THERMOSTAT, TERMINAL BLOCKS, LAMPS, PUSHBUTTONS, SM ALL SWITCHES, NAMEPLATES, FERRULES, LABELS, STICKERS, PVC SLEEVES/ CHANNELS	1. PHYSICAL CONDITION	MA	VISUAL	100%	NO BREAKAGES/DAMAGES	NO BREAKAGES/DAMAGES	INSPN. REPORT	2	-	-	TO BE PROCURED FROM APPROVED MAKE.
		2. MAKE TYPE RATING ETC.	MA	VISUAL	100%	BHEL SPEC./ APPD. DRGS.	BHEL SPEC./ APPD.DRGS.	-DO-	2	-	-	
		3. FUNCTIONAL	MA	ELECTRICAL	100%	RELEVANT IS	RELEVANT IS	-DO-	2	-	-	
	C) RELAYS AND TIMERS	1: PHYSICAL CONDITION	MA	VISUAL	100%	NO BREAKAGES/DAMAGES	NO BREAKAGES/DAMAGES	-INSPN. REPORT	2	-	-	TO BE PROCURED FROM APPROVED MAKE.
		2. MAKE TYPE RATING ETC.	MA	VISUAL	100%	BHEL SPEC./ APPD. DRGS.	BHEL SPEC./ APPD.DRGS.	-DO-	2	-	-	
		3. FUNCTIONAL TEST	MA	ELECTRICAL	100%	RELEVANT IS :	RELEVANT IS :	-DO-	2	-	-	
	D) PCB ASSEMBLY	REFER TO QP NO.		PED-557-00-Q-002								
1.3	INSULATING MATERIALS (FRP, SMC, DMC, ETC)	1. ELECTRICAL	CR	ELEC. TEST	SAMPLE	BHEL SPEC. / RELEV. IS: / MANUF'S STD.	MANF. STD. / RELEV. IS: / MANUF'S STD.	TEST CERT.	2	-	1	
		2. MECH. PROPS.	MA	MECH. TEST	SAMPLE	-DO-	-DO-	-DO-	2	-	1	
		3. TRACKING INDEX	MA	ELEC. TEST	SAMPLE	-DO-	-DO-	-DO-	3/2	-	1	
1.4	WIRES / CABLES	1. SURFACE FINISH	MA	VISUAL	100%	NO VISUAL DEFECT	NO VISUAL DEFECT	LOG BOOK/ INSPN. REPORT	2	-	-	
		2. DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL SPECN.	BHEL SPEC.	-DO-	2	-	-	
		3. HV TEST AT 80% OF ORIGINAL HV	CR	ELEC.	100%	IS:694	IS:694	-DO-	2	-	-	
BHEL			PARTICULARS			BIDDER / VENDOR						
			NAME									
			SIGNATURE									
			DATE									



QUALITY PLAN

CUSTOMER

PROJECT TITLE

SPECIFICATION NUMBER

BIDDER / VENDOR

QUALITY PLAN NUMBER : PED-506-00-Q-002 / 01

SPECIFICATION TITLE

SHEET 3 OF 3

SYSTEM : ELECTRICAL

ITEM : BOUGHT OUT ITEMS

SECTION VOLUME III

S. NO.	COMPONENT / OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.5	BUS BARS	1. DIMENSION	MA	MEASUREMENT	SAMPLE	BHEL SPEC / APPD. DRGS.	BHEL SPEC / APPD. DRGS.	LOG BOOK / INSPN REPORT	2	-	-	
		2. SURFACE-FINISH	MA	VISUAL	100%	-DO-	-DO-	-DO-	2	-	-	
		3. MATERIAL GRADE	MA	VERIF. OF TC	1/LOT	-DO-	-DO-	TEST CERT.	2	-	1	
		4. CONDUCTIVITY	CR	ELEC. TEST	-DO-	-DO-	-DO-	-DO-	2	-	1	
1.6	SHEET SHEEL	1. THICKNESS	MA	MEASUREMENT	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		2. WAVINESS	MA	MEASUREMENT	100%	-DO-	-DO-	-DO-	2	-	-	
		3. DUCTILITY	CR	BEND TEST	SAMPLES	-DO-	-DO-	TEST CERT. / INSPN. REPORT	2	-	-	
1.7	TRANSFORMER & REACTORS	1. ROUTINE TESTS	MA	ELEC. TEST	100%	RELV. STD. AND BHEL SPEC.	RELV. STD. AND BHEL SPEC.	TEST CERT.	3	-	1,2	
		2. TEMP RISE TEST	MA	ELEC. TEST	1/RATING	-DO-	-DO-	-DO-	3	-	1,2	
1.8	PAINTS	SHELF LIFE	MA	VISUAL	100%	AS PER PAINTS	MANUF'S SPEC.	INSPN. REPORT	2	-	-	
1.9	GASKETS (SYN. RUBBER ONLY)	1. DIMENSION	MA	MEASUREMENT	SAMPLE	MANUF'S DRGS	MANUF'S DRGS	INSPN. REPORT	2	-	-	
		2. SHORE HARDNESS	MA	TEST	-DO-	MANUF'S STD.	MANUF'S STD.	INSPN. REPORT	2	-	-	
		3. AGEING	MA	TEST	-DO-	IS-3400/BS-2752	IS-3400/BS-2752	INSPN. REPORT	2	-	-	
BHEL			PARTICULARS			BIDDER / VENDOR						
			NAME									
			SIGNATURE									
			DATE									
BIDDER'S / VENDOR'S COMPANY SEAL												

INSTRUCTIONS FOR FILLING QUALITY PLAN
(Form No. PEM-6042 P)

The Quality Plan shall include all the Quality Control Measures and Checks adopted by the Vendor to ensure that the material/Component/Assembly/services supplied by him meet/will meet the requirements as per specifications and good practices. They shall include all stages of operation such as materials, processes, manufacture, assembly, packing and despatch. The following guide lines may be noted:

- Column 1- Serial Number.
 - Column 2- Component/Operation- The component and/or operation being checked shall be given here.
 - Column 3- Characteristics check- The characteristics being checked shall be given here. e.g. chemical composition, mechanical properties, leak tightness, surface defects etc.
 - Column 4- Category - 'CR' stands for critical characteristic - affecting safety of equipment and personnel
'MA' stands for major Characteristic - affecting safety of equipment and personnel
'MI' stands for minor characteristic - affecting appearance etc.
 - Column 5- Type/Method of check e.g. chemical analysis tensile testing, hydraulic test, visual examination radiography etc.
 - Column 6- Extent of check, such as, 100, 10, 1 per heat etc.
 - Column 7- Reference Documents - Documents, such as technical specification, drawings, standard specifications (IS, BS ETC.) procedure, etc. according to which check is done.
 - Column 8- Acceptance Norms - Standards etc. according to which acceptability or otherwise of the characteristics being checked is decided.
 - Column 9- Format of Record - Formats, log sheets, reports, etc. in which the observations are recorded. Standard log sheets, reports, formats etc. of the Vendors shall be numbered and such reference numbers shall be included here.
 - Column 10- Agency - The agency which performs the test/instruction shall be written in sub-column 'W'
The agency which verifies test certificates/inspection records and carries out audit check of the components/operation shall be written in sub-column 'V'
The agencies are codified. '1' stands for (BHEL)
as 1,2 & 3 '1' means the operation shall be cleared by BHEL before the start of the next operation.
'2' Stands for Vendor
'3' stands for sub-Vendor of the Vendor and so on.
- Example :
- Entry '3' in column 'P' means test/inspection to be performed by sub-Vendor's QC
 - Entry '2' in column 'W' means test/inspection to be witnessed by Vendor's QC
 - Entry '1' in column 'V' means verification shall be done by BHEL and next stage to be started only after the hold point is cleared by BHEL
- Column 11- Remarks - Any special remarks shall be given here.

NOTES :

In absence of correlation with the test certificate(s) (e.g. material identification) samples shall be drawn by BHEL and all tests as per relevant specifications shall be carried out in their presence or in recognized Government Laboratory.

When materials and components are initially identified and stamped by BHEL QS engineer, the identification marks shall be preserved till despatch. Wherever this is not possible, the identification mark shall be transferred to the components in the presence of BHEL QS Engineer unless otherwise agreed.

For castings and forgings integral test specimens shall be provided. When this is not possible for casting, they shall be poured in the presence of BHEL QS Engineer unless otherwise. If witnessing of test by BHEL is called for.

When welders qualified by reputed inspection agencies or statutory bodies are not available, qualification tests shall be conducted in the presence of BHEL QS Engineer.

This Quality Plan is liable to be modified as per the requirements of approved drawings and changes in technical specifications/drawings. If there are contradictions in respect of column 7 & 8 between this Quality Plan and the approved drawings specifications, the latter shall prevail.

Wherever inspection by BHEL's Purchaser/Third Party/Statutory authorities are mandatory, this shall be complied with

Inspection reports, log sheets, test reports/certificate etc. shall be furnished to BHEL at the appropriate stages or at the time of final inspection, as required.

This Quality Plan is also applicable to spares, if any, under scope of supply of Vendor.

The quality plan shall be submitted in septuplicate (7 Copies)

Clause No.	ELECTRICAL SYSTEMS		
	CABLING, EARTHING AND LIGHTNING PROTECTION (E19)		
1.00.00	CODES AND STANDARDS	IS:2309, IEEE:142, IEEE-80, IS:1255 IS:13573, IS:3043, IS:8309	
2.00.00	REQUIREMENTS		
2.01.00	The complete cable support system shall be supplied and installed for the entire work in bidder's scope. The system shall enable proper laying of all power, control, instrumentation and telephone cables, and shall provide necessary mechanical protection, ventilation and segregation for them as per latest engineering practices and cable manufacturers' recommendation. The cable installation shall be carried out as per IS:1255. All hardware and anchoring arrangement shall be included. All steel members shall be hot dip galvanised.		
2.02.00	No sub zero level cable vault/trenches shall be provided below control building/switchgear rooms in the entire project.		
3.00.00	DESIGN AND CONSTRUCTIONAL FEATURES		
3.01.00	Inter-plant cabling		
3.01.01	Interplant cabling for main routes shall be laid along overhead trestles/duct banks/ directly buried. However, from tap-offs, same can be through shallow trenches with approval of Owner. Cables from main plant to switchyard control room shall be laid in overhead trestles or duct bank. In case of Duct banks, pull-pits shall be filled with sand and provided with a PCC covering. Directly buried cables, if essential, shall not have concentration of more than 4 cables.		
3.01.02	Transformer yard and switchyard In transformer yard and switchyard area, cables shall be laid in RCC concrete trenches with RCC covers. Inter-pole cabling in switchyard shall be in GI conduits/shallow trenches. The main cable routes coming out from Main plant building and crossing the Transformer yard shall be laid in overhead trestles/duct banks. Minimum clear height of trestle shall be 2.5M and for Rail/road crossing, it shall be as per rail/road crossing norms. Falls floors are not to be provided for cabling purpose anywhere in the plant.		
3.01.03	Cable entry Cable entry from outdoor underground/cable routes to the buildings, if any, shall be above the finished floor level of the building.		
3.01.04	Trenches PCC flooring of built up trenches shall be sloped for effective drainage with sump pits and sump pumps.		
TECHNICAL SPECIFICATION FOR POWER PLANT TURNKEY PACKAGE		VOLUME - II	PART - B SECTION - E19
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Clause No.	ELECTRICAL SYSTEMS
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CABLING, EARTHING AND LIGHTNING PROTECTION (E19)	
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3.02.00	Cable trays, support systems and pipes		
3.02.01	<table style="width: 100%; border: none;"> <tr> <td style="width: 25%; border: none;">Support system for Cable Trays</td> <td style="border: none;">flexible Shall be pre-fabricated out of sheet steel and fully gal- vanised type consisting of channels, cantilever arms and associated brackets & hardware, installed at site by bolting or clamping. These shall be rigid enough to withstand max. possible loads during and after installation.</td> </tr> </table>	Support system for Cable Trays	flexible Shall be pre-fabricated out of sheet steel and fully gal- vanised type consisting of channels, cantilever arms and associated brackets & hardware, installed at site by bolting or clamping. These shall be rigid enough to withstand max. possible loads during and after installation.
Support system for Cable Trays	flexible Shall be pre-fabricated out of sheet steel and fully gal- vanised type consisting of channels, cantilever arms and associated brackets & hardware, installed at site by bolting or clamping. These shall be rigid enough to withstand max. possible loads during and after installation.		
3.02.02	<table style="width: 100%; border: none;"> <tr> <td style="width: 25%; border: none;">Type of cable trays</td> <td style="border: none;">Shall be ladder for power & control cables and perforated for instrumentation cables, complete with all accessories, fittings and hardware</td> </tr> </table>	Type of cable trays	Shall be ladder for power & control cables and perforated for instrumentation cables, complete with all accessories, fittings and hardware
Type of cable trays	Shall be ladder for power & control cables and perforated for instrumentation cables, complete with all accessories, fittings and hardware		
3.02.03	<table style="width: 100%; border: none;"> <tr> <td style="width: 25%; border: none;">Material of cable trays</td> <td style="border: none;">Shall be Rolled mild steel, min. 2mm thick for trays and 3mm thick for coupler plate</td> </tr> </table>	Material of cable trays	Shall be Rolled mild steel, min. 2mm thick for trays and 3mm thick for coupler plate
Material of cable trays	Shall be Rolled mild steel, min. 2mm thick for trays and 3mm thick for coupler plate		
3.02.04	<table style="width: 100%; border: none;"> <tr> <td style="width: 25%; border: none;">Finish of cable trays</td> <td style="border: none;">Shall be hot dip galvanised.</td> </tr> </table>	Finish of cable trays	Shall be hot dip galvanised.
Finish of cable trays	Shall be hot dip galvanised.		
3.02.05	<table style="width: 100%; border: none;"> <tr> <td style="width: 25%; border: none;">Duct banks</td> <td style="border: none;">Shall be Heavy Duty GI pipe /High Density PE pipes encased in PCC (10% spare of each size, subject to minimum one) with suitable water-proof manholes.</td> </tr> </table>	Duct banks	Shall be Heavy Duty GI pipe /High Density PE pipes encased in PCC (10% spare of each size, subject to minimum one) with suitable water-proof manholes.
Duct banks	Shall be Heavy Duty GI pipe /High Density PE pipes encased in PCC (10% spare of each size, subject to minimum one) with suitable water-proof manholes.		
3.02.06	<table style="width: 100%; border: none;"> <tr> <td style="width: 25%; border: none;">Pipe size & type</td> <td style="border: none;">Shall be Suitable with 40% fill criteria. GI conduits shall be of heavy duty confirming to IS:9537.</td> </tr> </table>	Pipe size & type	Shall be Suitable with 40% fill criteria. GI conduits shall be of heavy duty confirming to IS:9537.
Pipe size & type	Shall be Suitable with 40% fill criteria. GI conduits shall be of heavy duty confirming to IS:9537.		
3.02.07	<table style="width: 100%; border: none;"> <tr> <td style="width: 25%; border: none;">Junction & pull boxes</td> <td style="border: none;">Shall be hot dip galvanised sheet steel of 2mm thickness.</td> </tr> </table>	Junction & pull boxes	Shall be hot dip galvanised sheet steel of 2mm thickness.
Junction & pull boxes	Shall be hot dip galvanised sheet steel of 2mm thickness.		
3.02.08	<table style="width: 100%; border: none;"> <tr> <td style="width: 25%; border: none;">Cable glands</td> <td style="border: none;">Shall be Nickel-Chromium plated brass, heavy duty, Double compression conforming to BS 6121.</td> </tr> </table>	Cable glands	Shall be Nickel-Chromium plated brass, heavy duty, Double compression conforming to BS 6121.
Cable glands	Shall be Nickel-Chromium plated brass, heavy duty, Double compression conforming to BS 6121.		
3.02.09	<table style="width: 100%; border: none;"> <tr> <td style="width: 25%; border: none;">Cable lugs</td> <td style="border: none;">Shall be solderless tinned copper crimping type. However for HT cables, lugs/ ferrules shall be of aluminium as per DIN 46329. For rest, it shall be as per relevant IS.</td> </tr> </table>	Cable lugs	Shall be solderless tinned copper crimping type. However for HT cables, lugs/ ferrules shall be of aluminium as per DIN 46329. For rest, it shall be as per relevant IS.
Cable lugs	Shall be solderless tinned copper crimping type. However for HT cables, lugs/ ferrules shall be of aluminium as per DIN 46329. For rest, it shall be as per relevant IS.		
3.02.10	<table style="width: 100%; border: none;"> <tr> <td style="width: 25%; border: none;">HT cable terminations & joints</td> <td style="border: none;">Shall be proven design and type tested as per IS: 13573. However, dynamic short circuit test will be carried out at maximum system peak. Elastimold or equivalent fully insulated pre moulded, taped type or heat shrinkable type kits shall be preferred.</td> </tr> </table>	HT cable terminations & joints	Shall be proven design and type tested as per IS: 13573. However, dynamic short circuit test will be carried out at maximum system peak. Elastimold or equivalent fully insulated pre moulded, taped type or heat shrinkable type kits shall be preferred.
HT cable terminations & joints	Shall be proven design and type tested as per IS: 13573. However, dynamic short circuit test will be carried out at maximum system peak. Elastimold or equivalent fully insulated pre moulded, taped type or heat shrinkable type kits shall be preferred.		

Clause No.	ELECTRICAL SYSTEMS		
3.03.00	CABLING, EARTHING AND LIGHTNING PROTECTION (E19)		
	<p>Cable laying</p> <p>i) Cables shall be laid strictly in line with cable schedule.</p> <p>ii) Identification tags for cables.</p> <p>Indefible tags to be provided at all terminations, on both sides of wall or floor crossing, on each conduit/duct/pipe entry/exit, and at every 20m in cable trench/tray.</p> <p>iii) Cable tray numbering and marking</p> <p>To be provided at every 10m and at each end of cable way & branch connection.</p> <p>iv) Joints</p> <p>Joints for less than 250 Meters run of cable shall not be permitted. Joint marker shall be provided. Extra length shall be provided for one LT and two HT joints at a later stage.</p> <p>v) Buried cable protection</p> <p>With concrete slabs; Route markers at every 20 Meters along the route & at every bend.</p> <p>vi) Road crossings</p> <p>Cables to pass through buried high density PE pipes encased in PCC.</p> <p>vii) Separation</p> <p>At least 300mm clearance shall be provided between :</p> <ul style="list-style-type: none"> - HT power & LT power cables, - LT power & LT control/instrumentation cables, <p>Spacing between cables of same voltage grade shall be in accordance with the derating criteria adopted for cable sizing.</p> <p>viii) Segregation</p> <ul style="list-style-type: none"> a) Segregation means physical isolation to prevent fire jumping. b) All cables associated with the unit shall be segregated from cables of other units. 		
TECHNICAL SPECIFICATION FOR POWER PLANT TURNKEY PACKAGE	VOLUME - II	PART - B SECTION - E19	PAGE 3 of 8

Clause No.

ELECTRICAL SYSTEMS

CABLING, EARTHING AND LIGHTNING PROTECTION (E19)

c) Interplant cables of station auxiliaries and unit critical drives shall be segregated in such a way that not more than half of the drives are lost in case of single incident of fire. Power and control cables for AC drives and corresponding emergency AC or DC drives shall be laid in segregated routes. Cable routes for one set of auxiliaries of same unit shall be segregated from the other set.

d) In switchyard, control cables of each bay shall be laid on separate racks/trays.

ix) Minimum number of spare cores required to be left for interconnection in control cables shall be as follows:

No. of cores in cable	No. of spare cores
2C,3C	NL
5C	1
7C-10C	2
14C and above	3

x) Cable clamping

All cables laid on trays shall be neatly dressed up & suitably clamped/ tied to the tray. For cables in trefoil formation, trefoil clamps shall be provided.

xi) Cable fire protection

Wherever the cables pass through walls/floors, fire proof cable penetration seals rated for one hour shall be provided. This shall be by suitable block system using individual blocks with suitable framework or by silicon RTV foaming system. In case foaming system is offered, damming board, if used, shall not be considered for fire rating criteria. Any of the system offered shall be of proven type as per BS:476 (Part-20) or equivalent standard.

3.04.00

EARTHING/GROUNDING

3.04.01

Earthing system shall be designed as per IS:3043 and IEEE:80. Earthing system network/earthmat shall be interconnected mesh of mild steel rods buried in ground in the plant. All off-site areas shall be interconnected together by minimum two parallel conductors. The Contractor shall furnish the detailed design and calculations for Owner's approval. Contractor shall obtain all necessary statutory approvals for the system.

**TECHNICAL SPECIFICATION FOR
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No.	ELECTRICAL SYSTEMS		
2	CABLING, EARTHING AND LIGHTNING PROTECTION (E19)		
	<p>Operation requirements for Earthing of electrical equipments</p> <ul style="list-style-type: none"> i) Enclosures of all electrical equipment as well as all cabinets/boxes/panels/ etc. shall be earthed by two separate and distinct earth connections. ii) Metallic pipes, conduits, cable tray section, etc. shall be bonded to ensure electrical continuity and earthed at regular intervals as well as at both ends. Metallic conduits, pipes, etc. shall not be used as earth continuity conductor. All hinged doors shall be earthed by flexible braids of adequate size. iii) All steel structures shall be duly earthed. iv) Metallic sheaths and armour of all multicore cables shall also be earthed at both equipment and switchgear end. v) Railway tracks shall be bonded across fish plates and earthed at regular intervals. The point where track leaves plant area, the rail section shall be provided with insulated joint at both ends. vi) Earthing conductor shall be buried at least 2000mm outside the fence of electrical installations. Every alternate post of the fences and all gates shall be connected to earthing grid by one lead. vii) Earthing conductor embedded in the concrete floor shall have at least 50mm concrete cover. viii) Equipment earthing Earthing connections with equipment earthing pads shall be bolted type with at least two bolts, and joint surfaces shall be galvanised. The connections shall be painted with anti-corrosive paint after testing and checking. Connection between equipment, earthing lead and main earthing conductors and between main earthing conductors shall be welded or brazed type. ix) Neutral of power transformers shall be directly connected to two rod electrodes in treated earth pits, which in turn shall be connected to station earthing grid. x) The earthing terminal of surge arresters and voltage transformers and lightning protection down conductors shall also be connected to station earthing grid through separate rod electrode, which in turn shall be connected to station earthing grid. xi) Continuous length of cable tray shall be earthed at 30m intervals. 		
NICAL SPECIFICATION FOR PLANT TURNKEY PACKAGE	VOLUME - II	PART - B SECTION - E19	PAGE 5 of 8

Clause No.

ELECTRICAL SYSTEMS

CABLING, EARTHING AND LIGHTNING PROTECTION (E19)

- xii) Other requirements for Earthing system
 - (a) Standard/Code : IEEE-80, IS:3043
 - (b) Earthing system life expectancy : 40 years
 - (c) System fault level : 40kA for one second
 - (d) Soil resistivity : Contractor to measure at site at minimum 20 locations approved by Owner.
 - (e) Min. Steel corrosion rate : As per E0.
 - (f) Depth of burial of main earth conductor : 600mm below grade level; where it crosses trenches, pipes, ducts, tunnels, rail tracks, etc., it shall be at least 300mm below them.
 - (g) Conductor joints : By electric arc welding, with resistance of joint not more than that of the conductor.
 - (h) Welds to be treated with red lead for rust protection and then coated with bitumen compound for corrosion protection.
 - (i) Surface resistivity :
 - Gravel : 3000 ohm-meter
 - Concrete : 500 ohm-meter

3.04.03

The minimum conductor size for earthing system shall be as follows :

Equipment	Buried conductor	Conductor above ground & in trenches
i) Main station grid	40mm dia MS rod	65x8 mm GS flat
ii) Switchgear/MCC/HT Motors	—	65x8 mm GS flat
iii) 415V distribution boards	—	50x6 mm GS flat
iv) Transformer	—	50x6 mm GS flat
v) LT motors above ⁹⁰ 125 kW	—	50x6 mm GS flat

Clause No.	ELECTRICAL SYSTEMS
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CABLING, EARTHING AND LIGHTNING PROTECTION (E19)

Equipment	Buried conductor	Conductor above ground & in trenches
v) LT motors ^{>30 90} 25 to 125 kW	—	25x6 mm GS flat ³⁵
vi) LT motors ^{>5 30} 1 to 25 kW	—	25x3 mm GS flat
vii) Fractional HP LT motors ^{upto 5kW}	—	8 SWG GS wire
ix) Control panel & control desk ^{LOCAL PANELS}	—	25x6 mm GS flat ^{35x6}
x) Push button station & Junction box	—	8 SWG GS wire
xi) Cable trays, columns & structures	—	50x6 mm GS flat
xii) Busduct enclosures	—	50x6 mm GS flat
xiii) Rails & other metal parts	—	25x6 mm GS flat
xiv) Equipment earthing for switchyard	—	75x12 mm GS flat & 50x6 mm GS flat depending upon rating eqpt.

4.05.00

LIGHTNING PROTECTION SYSTEM

4.05.01

The lightning protection system shall be designed as per IS:2309. It shall cover all buildings and structures in the plant, Balance of plant and switchyard & transformer yard areas. It shall comprise horizontal/vertical air terminations, down conductors, test links and earth connections to the station earthing grid. The lightning protection for switchyard shall be provided by means of lightning masts suitably located. All conductors shall be of min. 25 x 6 mm size and shall be of galvanised steel only.

4.05.02

The lightning protection system shall not be in direct contact with under ground metallic service ducts and cables, and shall not be connected above ground level to other earthing conductors. All joints in the down conductors shall be of welded type. All conductors shall be of galavenised steel only.

4.05.03

Pulser system for lightning shall not be accepted.


TECHNICAL SPECIFICATION FOR
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VOLUME - II

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Clause No.	ELECTRICAL SYSTEMS		
4.05.04	CABLING, EARTHING AND LIGHTNING PROTECTION (E19)		
4.05.05	<p>The down conductors of lightning protection system shall have a test joint at about 1500mm above ground level. Each down conductor shall be connected to a 40mm dia, 3m long mild steel earth electrode as well as station earthing grid.</p> <p>Hazardous areas handling inflammable/explosive materials and associated storage areas shall be protected by a system of aerial earths as per IEEE:142.</p>		
TECHNICAL SPECIFICATION FOR POWER PLANT TURNKEY PACKAGE	VOLUME - II	PART - B SECTION - E19	PAGE 8 of 8

	2 x 250 MW GHTP STAGE-II, LEHRA MOHABBAT, UNIT #3 & 4	Doc. No. PE-TS-226-160-A001		
		Volume	Section	
	II B	D		
	Technical Specification for MRS	Rev. : 0		
		Sheet : 1		

VOLUME – II B

SECTION – D

**TECHNICAL SPECIFICATION FOR MRS
(CONTROL & INSTRUMENTATION)**

	TITLE: SPECIFICATION FOR PROGRAMMABLE LOGIC CONTROLLER SYSTEM	SPECIFICATION NO. PES-145-36	
		VOLUME II-B	
		SECTION D	
		REV. NO. 00	DATE March 24, 2004
		SHEET 1	OF 6

1. SCOPE

This specification covers the Design, Manufacture, Assembly, Inspection and Testing at manufacturer's works, proper packing and delivery to site, erection and commissioning of the PLC Control & Monitoring System comprising PLC Control panel/Remote I/O panel (housing Processors, I/O cards, power supply packs etc.), Operator workstations(OWS), Printers, Annunciation system, UPS, cables and all other equipments and accessories required for completeness of the system as mentioned in different sections of this specification.

2. GENERAL

- 2.1. The PLC shall perform protection logic, interlock and sequential control functions such as binary logic operation, set/reset operation, timers, counters, logic blocks, math functions, Boolean functions & timer functions.
- 2.2. The system shall be redundant in processor, power supply and communication interfaces unless otherwise specified. The system shall have self-diagnostic features. The control of all drives and equipment shall be effected through the keyboard/mouse in addition to panel mounted push button / control switches as per the system requirement.
- 2.3. The system shall have facility for connecting to Main Plant's Distributed control system (DCS) using serial link.
- 2.4. The mimic shall be displayed on the OWS screen and shall also be provided on the control desk/panel.
- 2.5. The PLC system shall be sized to meet process/system requirements as per the approved P&IDs and Control write-up.

3. TECHNICAL REQUIREMENTS

Details of various PLC system components shall be inclusive of but not limited to the following:

3.1. CODES AND STANDARDS

The equipment covered under this specification shall meet the requirements of latest edition of all applicable codes and standards like ANSI, NEMA, IEEE, IEC, NEC & IS.

PLC shall conform to IEC: 1131

3.2. CONTROL PANEL

- 3.2.1. PLC control panel shall be freestanding type with provision for mimic display, push-button stations, control switches, indicating lamps, metering instruments and critical alarms.
- 3.2.2. 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 3.0mm for load bearing sections(mounted with instruments) and Not less than 2.0mm for others

Gland plate thickness: 3.0mm



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- 3.2.3. Each panel shall be identified by a name plate, which shall be of non-rusting metal or three ply lamicold, with engraved lettering.
- 3.2.4. 25 x 3mm Copper ground bus to be provided for each panel.
- 3.2.5. 240V AC single phase, thermostatically controlled space heaters shall be provided. Each free standing panel shall have a door switch operated fluorescent lamp and a 240V AC plug point.
- 3.2.6. Painting treatment shall be as per IS:6005. Two coats of lead oxide primer shall be followed by powder painting. Paint shade shall be as specified in the "PLC system data sheet."

3.3. PROCESSORS


- 3.3.1. The microprocessors shall be 32 bit, as per 'PLC system data sheet' requirement / configuration drawing.
- 3.3.2. The cycle time for input scanning, execution of logics, overheads and output scan shall not exceed 120 m sec.
- 3.3.3. The processor & memory shall be utilized up to 50% and maximum up to 60% under worst loading conditions.

3.4. INPUT / OUTPUT Modules

- 3.4.1. Input/Output card assignments shall be modular i.e. no single card shall be assigned with more than one drive.
- 3.4.2. 20% spare capacity shall be ensured in each card channel assignment
- 3.4.3. Output command to MCC/Switchgear shall be through coupling relays.
- 3.4.4. Status feedback from MCC shall be in the form of changeover contact.
- 3.4.5. Signal multiplication where required shall be done in PLC.

3.5. OPERATOR WORK STATION (OWS)

- 3.5.1. The OWS and Keyboard shall be desktop mounted and shall be used for controlling, monitoring and programming function.
- 3.5.2. Colour CRT(s) with keyboard and mouse shall be as per "PLC system data sheet".. CRT shall have graphic display facility.
- 3.5.3. The OWS shall be with Windows based operating system having necessary Engineering/Configuring software.

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3.6. PRINTER

Printers shall be provided as per the 'PLC system data sheet'

3.7. ANNUNCIATION

The annunciation system shall be facia window type, driven by the PLC. Audible alarm, Acknowledge, Reset and lamp test facility as per ISA sequence – S18.1,M.

3.8. COMMUNICATION WITH OTHER SYSTEMS

- 3.8.1. The PLC system shall be provided with hardwired/serial interface for communication with plant DCS.
- 3.8.2. Serial communication to DCS where provided shall be engineered to ensure that signal communication time from instance of occurrence of event in the field till the receipt of signal at DCS shall not exceed 2 seconds.
- 3.8.3. Serial communication to DCS shall be TCP/IP or MODBUS Protocol based. The details of serial communication shall be finalized during detailed engineering.

3.9. POWER SUPPLY

- 3.9.1. **Panel and OWS:** PLC system shall be provided with 2x100% UPS fed from Two Nos redundant 415V, 3-ph feeders. The UPS shall have 30 minutes Battery back up. Input feeder failure shall be monitored in the PLC system. Necessary redundant power pack and transformers shall be provided (in the PLC panel) to derive the power supply for control desk, PLC panel and input / output cabinets etc
- 3.9.2. **Remote I/O panels:** 1x100% UPS fed from Two Nos redundant 415V, 3-ph feeders. The **UPS shall** have 30 minutes Battery back up. Input feeder failure shall be monitored in the PLC system. Necessary power pack and transformers shall be provided (in the Remote I/O panel) .

4. DRAWING/DOCUMENT AND DATA TO BE FURNISHED AFTER AWARD OF THE CONTRACT:

4.1. For Approval:

- PLC system configuration drawing along with functional write-up.
- Control desk/panel component layout drawing.
- Power distribution scheme.
- Block logic diagrams.
- Annunciation list.
- Control panel/control desk GA drawings.
- Control panel/control desk Foundation detail and cutout drawings.
- PLC control room layout drawing.
- List of soft signal exchange with Plant DCS.
- List of mandatory spares
- Quality plan
- Data Sheet-C



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4.2. For Information:

- Cable schedule and cable interconnection drawing.
- Electronic earthing requirements.
- Panel Heat dissipation data
- Product/component catalogues.
- Operation & Maintenance Manual on CDs.
- Softcopy of Final/As-built drawings on CDs.


The above list is the minimum requirements. Additional documents/calculations required shall be finalized during contract stage..

5. DRAWINGS AND DOCUMENTS TO BE SUBMITTED ALONG WITH THE BID

- Proposed PLC system configuration drawing with write-up
- Product catalogues and specifications.
- Proposed power supply schemes for PLC system, peripherals, and Remote I/O panels.

6. TESTING AND INSPECTION

- 6.1. The bidder shall adopt suitable quality assurance program to ensure that the equipments offered will meet the specification requirements in full.
- 6.2. The bidder shall furnish the Quality Plan in BHEL format. The Quality Plan shall be subject to purchaser's approval.
- 6.3. The complete PLC system, including all instrument and devices shall be subjected to standard factory tests (i.e. Type Tests and Routine Tests) as per relevant IS, NEMA, IEEE, IEC.
- 6.4. Factory Acceptance Test-FAT (Functional Tests) shall be performed prior to shipment and Owner/Purchaser shall be notified 15 days before the schedules dates of the test.
- 6.5. The following Type tests shall be conducted as a minimum requirement as per IEC Standard:-
 - Surge protection test as per IEC-255-4
 - Dry heat test as per IEC-68-2-2
 - Damp Heat test as per IEC-68-3
 - Vibration Heat test as per IEC-68-2-6
 - Electrostatic discharge test as per IEC-801-2 or equivalent
 - Radio frequency Immunity test as per IEC-801-6 or equivalent
 - Electromagnetic Immunity test as per IEC-801-3 or equivalent

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6.6. Routine Test

6.6.1. Burn-in Test & Elevated Temperature Test.

The entire PLC system shall be tested under continuously energized condition at elevated temperature for 48 hours at 50°C followed by operation under rated conditions and at maximum ambient temperature for not less than 120 hours prior to shipment.

7. SPARES AND CONSUMABLES

7.1. 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.

7.2. Mandatory Spares

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

7.3. 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.

7.4. Special Tools & Tackles

The bidder shall supply all Special Tools & Tackles 'as required' during Start-up and further maintenance of the system, as part of the main equipment supply.

7.5. Spares, Service support

Bidder shall provide availability of spares and service support for minimum 10 years after guarantee period.

8. MARKING AND PACKING

8.1. Marking:

A stainless steel name-plate shall be permanently fixed on each equipment giving its Tag/serial Number and salient technical specification.

8.2. Packing:

All equipment/materials shall be suitably packed and protected for the entire period of dispatch, storage and erection against impact, abrasion, corrosion, incidental damage due 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.



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9. PERFORMANCE AND GUARANTEE

The PLC system shall be guaranteed to meet the performance requirement as specified and also for trouble-free continuous operation for 12 months from the date of commissioning or 18 months from the date of delivery at site whichever is later unless specified otherwise in Vol-II B Section - B or Section - C.

10. APPLICABLE DATA SHEET FORMS

This document shall be read with the following data sheet forms :

- Data Sheet A & B for PLC system



DATA SHEET FOR PLC SYSTEM

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Data Sheet No.: PES-145-36-DS1-0

Data Sheet A & B

DATA SHEET - A FOR PLC SYSTEM
(TO BE FILLED BY PURCHASER)

DATA SHEET - B
(TO BE FILLED BY BIDDER)

GENERAL*	PROJECT			
	SERVICE	MILL REJECT SYSTEM		
	QUANTITY	<input checked="" type="checkbox"/> UNITISED <input checked="" type="checkbox"/> COMMON		
	LOCATION	<input checked="" type="checkbox"/> INDOOR <input type="checkbox"/> OUTDOOR		
PLC EQUIPMENT	MAKE / MODEL NO.	BIDDER TO INDICATE		
	PROCESSOR	<input type="checkbox"/> SINGLE <input type="checkbox"/> REDUNDANT WITH COLD STANDBY <input checked="" type="checkbox"/> REDUNDANT WITH HOT STANDBY		
	DATA BUS (HMI)	<input type="checkbox"/> COPPER WIRE <input type="checkbox"/> FIBRE OPTIC		
	DATA BUS (I/O - CPU)	<input type="checkbox"/> COPPER WIRE <input type="checkbox"/> FIBRE OPTIC		
	DATA BUS (REMOTE I/O - CPU)	<input type="checkbox"/> COPPER WIRE <input type="checkbox"/> FIBRE OPTIC		
	DESKTOP OWS	<input type="checkbox"/> ONE <input type="checkbox"/> TWO <input checked="" type="checkbox"/> NIL		
	DESKTOP MONITOR	<input checked="" type="checkbox"/> 19" <input checked="" type="checkbox"/> 21"		
	PRINTER (^{A3} A4) - QUANTITY	INKJET <input checked="" type="checkbox"/> COLOUR LASER B/W _____ COLOR INKJET _____ COLOR LASER _____		
	PRINTER (A4) - MODEL	INKJET _____ LASER B/W _____ COLOR INKJET _____ COLOR LASER _____		
	PROGRAMMING / CONFIGURATION FACILITY	A) <input checked="" type="checkbox"/> HAND HELD B) <input checked="" type="checkbox"/> ENGINEERING SOFTWARE <input type="checkbox"/> ONE OWS <input type="checkbox"/> ALL OWS <input type="checkbox"/> _____		
COMPUTER FURNITURE	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			
PANEL	MAKE / MODEL	BIDDER TO INDICATE		
	QUANTITY	BIDDER TO INDICATE		
	CLASS OF PROTECTION	<input checked="" type="checkbox"/> IP 42		
	COLOUR	AS PER IS-5 SHADE 275, OPALINE GREEN SEMI GLOSSY FINISH		
	MIMIC	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		
COMMUNICATION TO OTHER SYSTEM	HARDWIRED	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		
	SOFTLINK	<input checked="" type="checkbox"/> MODBUS <input type="checkbox"/> OPC		
	SERIAL LINK	COMMUNICATION PORT TYPE RS 485		
POWER SUPPLY INPUT FEEDER	PLC PANEL	BIDDER TO INDICATE LOAD DATA		
	REMOTE I/O PANEL	BIDDER TO INDICATE LOAD DATA		
NAME	PREPARED BY	CHECKED BY	APPROVED BY	COMPANY SEAL NAME ARUN KARKARA SIGNATURE <i>Karkara</i> DATE 25-4-05
	RAKESH MOHAN	SHAIENDRA BHATNAGAR	ARUN KARKARA	
	Signed	Signed	Signed	
DATE	29-03-2004	29-03-2004	29-03-2004	


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SECTION – D.2

STANDARD C&I SPECIFICATION FOR PACKAGE UNITS

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SECTION – D.2

STANDARD C&I SPECIFICATION FOR PACKAGE UNITS


1.0.0 SCOPE

- 1.1.0 This general specification together with enclosures if any cover the design of Control and Instrumentation system, complete with all accessories and materials along with special test equipment where the supply of such instruments is a part of a larger plant.
- 1.2.0 The detailed scope of work, specific requirements, exclusions, deviations, additions etc. if any, will be indicated in the respective equipment/package specifications and addendum to this specification.
- 1.3.0 Vendor shall be fully responsible for design, materials selection, sizing and selection of the proper instruments for their system.
- 1.4.0 All equipments supplied shall be of proven quality both with respect to design and materials. No prototype instrument or instrument of an experimental nature shall be offered or supplied.
- 1.5.0 Vendor shall prepare and submit a P&I diagram for the system within the scope of his supply, showing all the instruments and interlock/trip operations. Each instrument shall be given individual tag numbers from blocks of numbers allotted by the Purchaser/Consultant. Symbols shall be as per ISA S5.1.
- 1.6.0 Vendor shall supply complete process data to the Purchaser/Consultant to specify those instruments not appearing in the Vendor's scope of supply but are an integral part for the control of this package.
- 1.7.0 Vendor shall clearly define the operational philosophy suggested by him, which should be in line with requirements specified in the main package/equipment specification. Vendor shall also clearly specify the provision of control panels, UPS (Uninterrupted power supply) requirements for their package in their offer.


2.0.0 DESIGN PHILOSOPHY

- 2.1.0 Instrumentation shall be complete in every respect and liberal to the extent of providing data on all operation variables sufficient for the safe, efficient, easy operation, start up and shut down of the plant.
- 2.2.0 The design and installation of instruments shall be generally in accordance with ISA/API recommended practices and other applicable standards like ISI, IBR etc. Material specifications and practices shall, in general, conform to appropriate ASTM or equivalent standards. All standards, code of practices shall be of the latest edition.
- 2.3.0 All instruments and equipments shall be suitable for use in a hot, humid & tropical industrial climate in which corrosive gases and/or chemicals may be present. As a minimum, all instruments and enclosures in field shall be dust proof, weather proof to NEMA 4/ IP-65 and secure against the ingress of fumes, dampness, insects and vermin. All external surfaces shall be suitably treated to provide anti-corrosion protection against plant atmosphere.
- 2.4.0 All electronic/electrical instruments and equipments shall be suitable for area classification as per IEC/NEC codes. Certified intrinsically safe equipment shall be used, in general, in hazardous area. In case where this is not possible explosion proof enclosures may be considered.


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- 2.4.1 All intrinsically safe instruments shall be certified by the statutory bodies like CENELEC, BASEEFA, FM, PTB etc.
- 2.5.0 The instruments like control valves, pressure relief valves, thermowells, orifice flanges, level instruments etc., coming on pipes and vessels under IBR shall be certified by IBR or equivalent statutory body.
- 2.6.0 Location of process connections shall be either from the side or from the top of the process equipment but not from the bottom. This requirement is applicable to both pipes and vessels. The location of lower side connection shall be high enough to prevent plugging due to dirt or other suspended solids. In addition, the connections shall be short, vertical or horizontal and without any pockets.
- 2.7.0 Materials of construction of instruments shall be consistent with temperature, pressure, corrosion conditions and other process requirements.
- 2.8.0 In case where suitable material procurement is not feasible, diaphragm seal shall be considered.
- 2.9.0 The design of control panel shall incorporate provision for expansion by installing spare capacity. Each panel shall be designed to accommodate 10% minimum additional equipment including 10% spare cable/tube entry points.
- 2.10.0 Instrument power circuits shall be individually protected from fault with the help of fuses. Power supply to the individual instrument shall be disconnectable with the help of switch and protected with the help of fuse.
- 2.11.0 Ranges for instruments shall be selected, in general, such that in normal process operation the indication on the indicator or chart is between 40% to 60% of span for linear and 60% to 80% of span for square root.
- 2.12.0 All electronic controllers shall be located in the local control panel.
- 2.13.0 The complete instrument system shall be designed for safe operation, by using normally closed contacts which open on fault conditions.
- 2.14.0 Automatic trip circuits shall meet the following requirements:
- They shall not be taken from the same actuating device as measurement.
 - All trips shall have a pre-warning alarm and an alarm to indicate the trip condition.
 - If desired, adequate trip by-pass facilities are to be provided with warning lights to indicate that the trip has been by passed.
 - All the solenoids and relays shall be normally energised.
- 2.15.0 Adequate alarms shall be provided to give audible and visual warning of malfunction. Vendor shall also provide alarm contacts for the operation of parallel alarms, common pre-alarm and shut down alarm by the purchaser wherever indicated.
- 2.16.0 The design of the alarm annunciator system shall be such that the transient alarms of less than 330 m sec. duration shall be automatically discounted.

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- 2.17.0 All lamps shall be provided with lamp test facility.
- 2.18.0 Solid state digital temperature scanner shall be provided for bearing and winding temperature monitoring of motors, wherever applicable.
- 2.19.0 Gauge glasses shall be provided for all level measurements requiring automatic or manual control or monitoring. They shall have atleast the same pressure & temperature rating as that of equipments on which they are to be installed. They shall have ball check off-set valves.
- 2.20.0 All process switches shall be provided with DPDT switches with contact rating, as a minimum of 220 V AC, 5 Amps.
- 2.21.0 In general, block and bypass valves shall be installed with all control valves upto and including 2" size except for butterfly and 3 way valves, slurry and freezing services.
- Handwheel, shall be considered for all valves except shutdown valves.
- 2.22.0 Zener barriers shall be used for isolating signals between hazardous area mounted intrinsically safe transducers and safe area mounted receivers. Alternatively explosion proof instruments shall be used as per the area classification.
- 2.23.0 All transmitters shall be provided with output meter/output gauge at the transmitter end.
- 2.24.0 The vendor shall ensure that the packing of instruments and associated equipment is adequate to prevent damage from such contingencies as rough handling, weather, condensation, dew, vermin and vibrations.
- 2.25.0 All solenoid valves shall be universal type and continuous rated type.
- 2.26.0 Analysis, if any, shall be complete with sampling system and shall be supplied with complete calibration kit including zero and span samples or buffer solution in case of pH meter and special tools required for the maintenance.
- 2.27.0 Air supply of pressure specified elsewhere shall be made available to the vendor at the battery limit for distribution to the instruments. The vendor shall specify the total estimated power consumption under normal and peak load condition alongwith the offer.
- 2.28.0 Wherever applicable, instrument junction boxes shall be provided as interface marshalling areas between purchaser/vendor tubing and cabling with corresponding junction box termination tag number. Drawing shall be furnished separately for wiring and tubing for showing all instrument interface details between purchaser/vendor.
- 2.29.0 Instrument power supply shall be made available to the vendor at one point. Vendor shall be responsible for the further distribution. The vendor shall specify the total estimated power consumption under normal and peak load condition alongwith the offer.
- 3.0.0 GENERAL SPECIFICATIONS OF INSTRUMENTS**
- 3.1.0 General**
- 3.1.1 The basic concept for Control & Instrumentation system is the use of electronic instruments throughout for measurement, transmission and control with 4-20mA DC signal level.
- 3.1.2 Control valves shall be pneumatically operated.

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- 3.1.3 Pneumatic instrumentation may be used for local control loops. Pneumatic signal pressure shall be 0.2 - 1.0 kg/cm²(g).
- 3.1.4 Local control panels will be used for packages, e.g. instrument air compressors, D.M. Plant, etc. Repeat indications of critical parameters of such packages shall be provided on DCS.

3.2.0 Electrical Power

- 3.2.1 The power source for Control & Instrumentation shall be 240 V \pm 2% ; 50 Hz \pm 3%. Analysers, conventional panel instruments like recorders, indicators, controllers, shall operate at this voltage level or 24V DC voltage derived from this.
- 3.2.2 Solenoid valves and other instruments shall be suitable for 24 V DC and the same shall be derived internally by the manufacturer from 240 V 50 Hz.
- 3.2.3 2 wire transmitters powering and field instruments interrogation voltage level shall be 24V DC.
- 3.2.4 Any repeat relays used for alarm/interlock purpose shall be working on 24V DC.
- 3.2.5 Normal power supply of 240V, 50 Hz shall be used for illumination of panels/cabinets.

3.3.0 Instrument Air

Instrument air at pressure of 7 kg/cm²(g), temperature 20-40°C and dew point -40°C or below shall be the source of power for all pneumatic instruments. All pneumatic instruments shall be selected such that even if air supply pressure selected such that even if air supply pressure falls to 4 kg/cm²(g), instruments operate satisfactorily.

3.4.0 Panel Instruments


- 3.4.1 All panel instruments shall be microprocessor based.

3.4.2 Unit of measurement:

Flow	Liquid	:	m ³ /hr
	Steam	:	T/hr
	Gas & Vapours	:	Nm ³ /hr
Pressure	Gauge	:	Bar(g)
	Vacuum	:	Bar(abs.)
		:	mm of H ₂ O(abs.)
Temperature	:	°C	
Level	:	%	
Analysis	:	%	
			ppm

3.4.3 Graduations

Flow with DP cells	:	0 to 10 square root
Rotameters	:	1 to 10 linear
Pressure	:	Direct Reading
Level	:	0 to 100 Linear
Temperature	:	Direct Reading

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Multiplying factors for flow scales shall be specified on manufacturer's name plate.

Recorder charts shall be dual graduated, in general, in 0 to 10 square root.

3.4.4 Recorders shall be microprocessor based continuous pen type having 1/2/3 pens etc. and multipoint type having 6/12/24 points etc. and shall be operating on 4-20 mA ITC/RTD signals, received from transmitters, electrical transducers, thermocouples and PT-100 as per system requirement. Accuracy 0.2% and fan fold type with facility of varying chart speed from 20 mm/Hr to 1200 mm/Hr.

3.4.5 All controllers shall have facility for bumpless auto/manual and manual/auto transfer and set point adjustment. Flow, level and pressure controllers shall be provided with proportional plus integral action while temperature controller with proportional plus integral plus derivative action.

3.4.6 Annunciators, in general, shall be solid state type with plug in module, in a cabinet with back lighted engraved windows and integral power supply.

Field mounted annunciator circuit shall be intrinsically safe with power supply unit in a safe area.

Annunciator alarm sequence shall be as per ISA sequence.

A minimum of 20% spare windows with cards shall be provided as spares.

3.5.0 Control Panels

3.5.1 Control panels shall be free standing type and fabricated preferably from 3 mm thick cold rolled steel sheet or 5 mm thick hot rolled steel sheet. Angle iron frame work shall use a minimum section of 50 x 50 x 4 mm angle. The finish shall include sand blasting, grinding, chemical cleaning, surface finishing by suitable filter and two coats of high grade lacquer with wet sanding between coats. Two coats of paint in panel colour shall be given for non-glossy high stain finish. Panel face final colour to IS:5.

Light Admiralty Grey: IS:697

Panel rear surface, frame work and bulk head plates shall have a finish of pale cream IS:353 or Biege IS:388. A final coat of paint shall be given at site.


3.5.2 Control panel inside the control room shall be totally enclosed cubicle type with 2100 mm high, 1200 mm wide and minimum 800 mm deep if mounted locally. The panel depth to be increased if necessary.

3.5.3 Control panels shall have removable hinged doors, generally at the back for easy maintenance and accessibility of the instruments. Doors shall be double leaved type with handle and shall be provided with lock and key. Adequate illumination shall be provided inside the panel. All light fittings shall be suitable for 230V, 50 Hz A.C.

3.5.4 The local panel construction shall be suitable for the site condition and shall meet IEC requirements in accordance with electrical area classification. Pressurisation or purging shall be as per NFPA 496 or equivalent.

3.5.5 No process fluid, except air shall be piped to the control panel.

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3.5.6 Mounting heights

- a) Annunciators (top row)
- b) Miniature and subminiature instruments (next 3 rows)
- c) Electric push buttons (last row)

3.6.0 Panel Wiring

3.6.1 Open terminals shall generally be avoided. Terminal strips shall be of "Klippon" or equivalent type and shall be mounted in an enclosure.

3.6.2 1.5 sq.mm multi stranded PVC insulated copper conductor shall be used in general. These shall be laid in PVC troughs as far as possible.

3.6.3 Wire carrying measurement signals associated with thermocouples, resistance thermometers, pH instruments and other low level signals shall be routed in separate wire ways and not alongwith power cables.

3.6.4 All intrinsically safe wires shall be routed in separate wire ways from non-intrinsically safe and power wiring.

Intrinsically safe terminals shall be separated from non-intrinsically safe terminals atleast by 50 mm.

3.7.0 Local Gauge Board

3.7.1 Local gauge boards, where required, shall be constructed such that easy access is available at the rear for all instruments and accessories for maintenance.

3.7.2 All pressure gauges shall be provided with block and bleed valves securely fastened with identification tags.

3.8.0 Instrument Connection

3.8.1 The connection of Instruments installed on vessels, standpipes tanks and piping shall be as per Annexure - I.

3.8.2 Pneumatic connection for signal and air supply shall be ¼" NPTF.

3.8.3 Electrical connection shall be ½" NPTF.

3.8.4 Threaded end connection shall be to NPTF as per ANSI B2.1.


Flanged end connections shall be as per ANSI B16.5

3.9.0 Pressure Measurement

3.9.1 Pressure gauges

All local pressure gauges shall be bourdon/diaphragm type of material SS 316.

Pulsation dampener shall be used wherever pulsating pressure occurs in process.

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Diaphragm seal type shall be considered for corrosive services.

Dial size for local gauges shall be 150 mm.

For temperature greater than 70°C, necessary precautions shall be taken like use of syphon in steam services.

All pressure gauges shall be considered with safety vent consisting of rubber grommet at the back of housing.

3.9.2 Transmitters

All Transmitters shall be of smart type.

Transmitters shall be provided with integral output meter.

Material of construction of wetted part shall be SS 316.

In capillary type transmitters, capillary length shall normally be 5 meters. Also capillary shall be SS armoured.

3.10.0 Level Measurement

3.10.1 Level Transmitters

Level transmitters shall generally be differential pressure type with local indication.

Capacitance type level measurements can also be used as an alternative method wherever required for highly viscous fluids or bulk materials. PTFE sheathed SS tubes shall be used as measuring probe.

All DP type level transmitters shall be of smart type.

3.10.2 Gauge Glasses

Gauge glasses shall be considered generally as per process requirements. Maximum length of each gauge glass shall be limited to about 1000 mm. If greater distance is to be covered, several such gauge glasses shall be considered with minimum overlapping of about 50 mm.


Each gauge glass shall be considered with excess flow ball check valve. Chamber end connected check valve shall be of offset type to facilitate cleaning of chambers.

For clear/clean colourless liquid services, reflex type shall be preferred. For other services like liquids containing sediments and coloured liquids, steam services, two phase measurement, transparent type level gauges shall be considered.

Gauge glasses on steam services shall be protected with mica sheets.

Level indication with magnetic coupling of follower magnet, shall be considered for corrosive, dangerous/hazardous fluids.

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3.10.3 Level Switches

For interlock services separate level switches shall be provided.

Generally external float type level switches shall be selected.

3.11.0 Temperature Measurement

3.11.1 Thermowells

Thermowell shall be used for all temperature measurement except tube surface (skin) temperature measurement and motor winding temperature.

Thermowell material shall be SS 316 unless material of higher quality is called for according to process condition. For furnace temperature measurements Inconel Thermowell shall be employed.

Thermowell shall be made from bar stock for steam and water services and shall be fabricated type for Air and flue gas services. As per IBR regulation, IBR certificate shall be provided for steam application.

3.11.2 Temperature Gauges

Temperature gauges shall be bimetallic rigid stem, all angle type or filled system type. Bimetallic upto 300°C and mercury filled upto 600°C.

Dial size of 150 mm shall considered for local gauges.

3.11.3 Temperature Detectors (RTD's)

For remote indication of temperature less than 300°C duplex RTD PT-100, 3 wire system shall be used.

Normally mineral insulated type of RTD with SS 316 sheath-material shall be used.

RTD shall be designed to protect against vibrations. RTD calibration shall be as per DIN 43760.

RTD with temperature transmitter shall be considered.

However bearing and winding temperature RTD's shall be directly connected to receiver instruments / DCS.


3.11.4 Thermocouple

For temperature measurement above 300°C thermocouple shall be used.

Thermocouple of type K shall be considered in accordance to ANSI MC 96.1 for temperatures upto 1000°C. For temperature more than 1000°C "R" or "S" type thermocouple shall be used.

Thermocouple shall be mineral insulated type with a sheath of stainless steel or better material, if required.

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Hot junction shall be welded and ungrounded type.

Thermocouple with temperature transmitter shall be considered.

Compensating Cables

Generally, thermocouple extension wire shall be used for interconnection from thermocouple head to the temperature transmitter. Wire size AWG 16 or 14 gauge shall be used for extension wire. Colour coding and EMF error limitations of extension wires shall be generally as per ISA recommendations.

3.12.0 Flow Measurement

3.12.1 Orifice Meters

In general, orifice plates with DP transmitter or DP gauge (where only local indication is required) shall be used. Orifice bore calculation shall be based on ISO-5167 or BS 1042.

Flange taps shall be used in general.

Vortex meters can also be used for steam flow measurement on lines upto 150 mm and maximum pressure rating of 40 kg/cm²(g).

3.12.2 Rotameters

Rotameters shall be used for line sizes upto 3".

Metal tube rotameters shall be used wherever application warrants and glass tube rotameters shall be used for non-critical services like cooling water, purge applications, flushing applications etc.

3.12.3 Others

Magnetic flowmeters, turbine flowmeters, mass flowmeters may be used depending on process requirements.

Positive displacement type meters shall be used for flow totaliser application.

3.13.0 Control Valves

3.13.1 In general, control valves shall be flanged to ANSI and pressure rating shall be as per piping class. However, high pressure steam control valves shall have welded end connection.

3.13.2 Non-standard size i.e. 1¼", 2½", 3½", 4½", 5", 7" shall not be provided.

3.13.3 All control valves shall have 316 SS trim as a minimum better material shall be used depending on process requirements.

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- 3.13.4 Isolation valves & bypass valve shall be provided as per process requirements shown in P&ID's.
- 3.13.5 The position of the valves during air failure shall be such that they take safe position from process point of view.
- 3.13.6 While selecting the CV of the control valves, the sizing should be done for at least 33% over the normal flow.
- 3.13.7 While placing a control valve on steam line, it should be ensured that the steam passing through the control valve is dried by providing steam trap upstream to control valve. As per IBR regulation, IBR certificate shall be provided for such valves.
- 3.13.8 I/P converters shall be used to convert 4-20mA signal from DCS controller output to pneumatic signal of 0.2-1.0 kg/cm²(g) for valve positioner.
- 3.13.9 Solenoid valves shall be used on ON-OFF valves and on control valves having interlock.
- 3.13.10 Proximity type limit switches shall be used for open close position for all ON-OFF valves.

3.14.0 Zener Barriers

Barrier input/output voltage and current shall be 24V DC, 4-20 mA DC respectively with maximum fault voltage of 250V rms on safe area side. Barrier end to end resistance shall be less than 250 ohms and accuracy better than $\pm 0.1\%$.

4.0.0 ERECTION MATERIAL SUPPLY

- 4.1.0 The vendor shall ensure and supply all erection hardware required for installation of all instrumentation which form a part of the package unit. This includes items like cables, cable glands, junction boxes, instrument valves, mounting accessories, impulse piping/tubing, pipe/tube fittings, pneumatic signal tubes, air line pipes, filter regulators, steam/electrical tracing, insulation materials, cable trays, conduits, identification tags, structural material required for instrument supports and trays etc.
- 4.2.0 The above broadly covers the items required for any typical plant, however the vendor shall supply all necessary items to make the erection and commissioning work complete in all respects, irrespective of whether erection and commissioning is included in his scope or not.
- 4.3.0 The following are the minimum acceptable salient features of some of the erection materials:


4.3.1 Process Impulse Lines

- Impulse lines for instruments shall be ½" OD tubing of SS 316 material according to ASTM A 269 for pressure rating upto 40 kg/cm²(g). All fittings to be used for tubing shall also be SS 316, double compression type of standard make.
- Above 40 kg/cm²(g) pressure, ½" NB piping and associated fittings shall be employed. Impulse piping material shall be same as corresponding line material.

4.3.2 Pneumatic Tubing

For pneumatic signal transmission, PVC sheathed, ¼" OD, copper tubes shall be used. All fittings shall be of brass, double compression type.

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4.3.3 Instrument Airlines, fittings/valves

Seamless galvanised inside and outside carbon steel pipes shall be used for instrument air distribution, and shall be as per IS:1239 class heavy.

Isolation valves on instrument air service shall be packless gland type full bore ball/globe valves.

4.3.4 Instrument Valves and Manifolds

Vendor shall supply instrument valves (miniature type) and valve manifolds wherever required.

Body material and rating shall be as per piping class or SS whichever is better and shall be forged type.

Valve trim material shall be 316 SST as minimum or superior as required by process conditions.

Vendor shall supply a minimum of 10% of such instrument valve and manifolds as spare.

4.3.5 Instrumentation Cables

For 4-20 mA current signal, twisted pair stranded screened cables (1.5 sq.mm) shall be used. Multipair cables (0.5 sq.mm) stranded shall be considered from control room upto junction boxes. Multipair cable shall have overall screening & Individual pair screening. Required parameters for intrinsic safe signal handling shall be considered according to Indian Standards or British Standards, when applicable.

For thermocouple signals, thermocouple extension wire shall be used as mentioned in "Temperature Measurement". Normally, twisted screened single pair (16/20 AWG) shall be used from sensing element to junction box.

For RTD signals 0.5 sq.mm Triad cables shall be considered. Screening shall be provided for RTD signal cables.

For control cables, 1.5 sq.mm, 7 stranded, 2 core cables shall be considered between instruments and junction boxes, and 0.5 sq.mm, 7 stranded, multicore cables shall be considered between junction boxes and control panels.


For power supply to solenoid valves, 2.5 mm². 2 core cable shall be considered.

All field instrumentation cables shall be armoured type and shall be with electrolytic grade copper conductor.

The insulation grade shall be as a minimum 600 V.

4.3.6 Cable Glands

Vendor shall supply all cable glands required for glanding the above mentioned cables both at field instrument and at control room (local & main)/control room devices/junction boxes.

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All cable glands shall be of anodised aluminium alloy or of nickel-plated brass and they shall be double compression type suitable for armoured cables. Panel end cable glands shall be with locknut.

Explosion proof glands wherever required shall be supplied.

Vendor shall supply a maximum of 20% of cable glands as spare.

4.3.7 Junction Boxes

Vendor shall supply junction boxes wherever required. These shall be of die cast aluminium alloy body and shall be weather proof.

These boxes shall have terminals suitable for min 2.5 mm² cable termination (klip on) mounted on rails. 20% spare terminals shall be supplied in each junction box.

Telephone socket shall be provided in junction boxes.

Explosion proof junction boxes wherever required shall be supplied.

Each junction box shall have a minimum of 10% or 2 nos., whichever is more, spare entry duly provided with plugs (weather proof/explosion proof, as applicable).

4.3.8 Cable Trays

All cables/tubes shall run on cable trays.

These cable trays shall be made out of galvanised MS and shall be of sheet steel of 2.5 mm thick.

The width shall be so selected that 50% of tray space is available for future use of the complete installation.

Suitable cable clamps shall be supplied for binding the cables / tubes at every 500 mm.

4.3.9 Instrument Support/Structural Steel

Vendor shall supply instrument stands (stanchion) and other structural steel material required for supporting the cable trays, impulse lines and instruments.


Steam tracing tubes shall be 3/8" OD copper tubes of electrolytic grade copper.

4.4.0 Applicable Standards

Applicable codes & standards for control and instrumentation shall be as per Annexure - II.

5.0.0 INSTALLATION

5.1.0 Vendor shall be completely responsible for installation of all instruments within his battery limit.


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- 5.2.0 All direct mounted instruments like thermocouple, thermowells, temperature gauges, pressure gauges, pressure switches etc. shall be installed in such a way that they have better readability and accessibility.
- 5.3.0 All capillary type instruments shall have the capillary supported properly and shall have protection of capillary against mechanical damage.
- 5.4.0 All pressure, differential pressure instruments shall be provided with block and bleed, bypass, drain/vent valves etc. as per the installation sketches, and shall have accessibility.
- 5.5.0 All primary piping/tubing (impulse lines) shall have a slope of 10% on the horizontal run.
- 5.6.0 All welding shall be carried out as per the relevant code with proper electrodes. Any testing (non-destructive) like D.P. test on root weld and final weld shall be carried out as applicable. All consumables shall be part of vendor's scope of supply. Any pre/post weld treatment as required by the codes shall be carried out.
- 5.7.0 All threaded joints shall be joined by teflon tapes only.
- 5.8.0 All impulse lines shall be supported at regular intervals.
- 5.9.0 Instrument drain/vent connections shall be piped to safe area like OWS or above pipe racks to avoid accumulation of hazardous fluid in the plant atmosphere.
- 5.10.0 Steam tracing wherever required shall be carried out by 10 mm O.D x 1 mm thick copper tubes, and condensate traps shall be provided to collect all the condensate and shall be piped to the nearest pipe drain funnels.
- 5.11.0 All tubes/cables shall be properly laid on cable trays which shall be supported at regular intervals.
- 5.12.0 Separate routing or physical separation shall be maintained between signal cables and shut-down / power cables.
- 5.13.0 Wherever intrinsic circuit system cabling is employed the minimum separation of 150 mm shall be adhered between IS and non IS signal cables.
- 5.14.0 The cases of instruments shall be earthed by earthing wire to the nearest earth bus bar provided by others, for safety reasons.
- 5.15.0 In case the cables are to be buried or laid in concrete trench the same shall be carried out by vendor with prior intimation to client.
- 5.16.0 Painting of cable trays/ducts, M.S. cable ways, angle trays, instrument supports, all structural supports shall be as under:


The surface to be painted shall be thoroughly cleaned with brush sand paper to remove all scales. After cleaning, one coat of red oxide zinc chromate primer shall be given conforming to IS-2074 and allowed to dry. One coat of final paint shall be applied.

Second and final coats of paint of final colour shall be given before handing over the plant/commissioning.


6.0.0 TESTING AND CALIBRATION

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- 6.1.0 All impulse lines shall be properly flushed after isolating both the instrument and the vessel/piping.
- 6.2.0 All impulse lines shall be tested hydraulically at 1.5 times the maximum operating pressure. Ensure that instrument and vessel/piping is isolated during this test.
- 6.3.0 In case of special conditions where hydrotesting is not permitted due to service conditions, the impulse lines testing shall be carried out by using air or nitrogen.
- 6.4.0 All external cage type level instruments shall be tested upto 1.5 times operating pressure by using nitrogen only.
- 6.5.0 After pressure testing all these impulse lines shall be drained and dried with dry air to remove any moisture.
- 6.6.0 Instrument air lines will be service tested only for any leak after pressurising and isolating the main root valve, by soap solution.
- 6.7.0 Pneumatic signal tubes shall be flushed and tested with instrument air for any leak at a pressure of 1.5 kg/cm²(g). After pressurising the line, the source of pressure is cut off and rate of fall in pressure shall be less than 1 psi for each 100 feet for a period of 3 minutes.
- 6.8.0 All instrument cables shall be tested for continuity and insulation. While megger is used for insulation testing, ensure that all instruments and zener barrier are isolated at both ends.
- 6.9.0 All instruments supplied by the vendor shall be calibrated using proper test equipment.
- 6.10.0 All Instruments shall be calibrated for 0%, 25%, 50%, 75%, 100% and vice versa.
- 6.11.0 All temperature gauges shall be calibrated using temperature baths.
- 6.12.0 All thermocouple-activated instruments shall be calibrated by generating millivolts by a potentiometer.
- 6.13.0 All transmitters shall be calibrated as per instrument ranges.
- 6.14.0 All displacer type level transmitters shall be calibrated with water or suitable fluids and corrected for specific gravity.
- 6.15.0 All alarm and trip switches shall be calibrated over the entire range and finally set and checked for alarm/trip points and reset points as per the alarm/trip set point schedule. After setting these shall be sealed.
- 6.16.0 All control valves prior to stroke checking shall be externally cleaned thoroughly. The full stroke of valve shall be checked for opening and closing. Any adjustments required for obtaining full stroke and reducing hysteresis shall be carried out.
- 6.17.0 Bubbie tight shut-off control valves and shut down valves shall be checked for seat leak test and gland leak test.
- 6.18.0 Solenoid valve shall be checked functionally for its operation.
- 6.19.0 Safety valves and relief valves shall be set/tested by using dry air / nitrogen. Leakage if any shall be removed by proper lapping of seat and disc.

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- 6.20.0 All electronic/pneumatic receiver instruments shall be calibrated as per the manufacturer's instruction. Controllers shall be aligned properly.
- 6.21.0 All special instruments like analyser shall be checked and calibrated as per manufacturer's instruction. Prior to testing, all analyser sample lines shall be thoroughly cleaned by carbon tetra chloride or any other cleaning liquid. After cleaning, these lines shall be thoroughly purged with dry nitrogen.
- 6.22.0 No oil should be used on oxygen service lines.
- 6.23.0 The accuracy of overall loop shall be within $\pm 1\%$ for electronic and $\pm 1.5\%$ for pneumatic loops.
- 6.24.0 After performing the calibration of all instruments, the entire loop shall be checked for proper operation.
- 6.25.0 The entire shutdown scheme shall be simulated from the process trip switches and the scheme shall be tested for its proper operation, prior to start up of the unit.
- 6.26.0 If no instrument air is available vendor shall provide necessary N2 cylinders to carry out the above activity.
- 7.0.0 **COMMISSIONING**
- 7.1.0 This activity shall be carried out in a systematic manner so as to avoid any accident to plant and operating personnel.
- 7.2.0 During the plant start up all the instrument calibration, controller alignment, trip point settings shall be trimmed so as to meet the operation requirement.
- 7.3.0 Prior to guarantee run of any package unit the vital instruments as required by vendor have to be recalibrated and the results recorded.


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ANNEXURE - 1

INSTRUMENT TAPPING POINT DETAILS

Sl. No.	Instrument Type	Instrument Connection	Piping Connection	Equipment Connection (Flanged)
I.	Pressure			
1	Pressure Gauge/Pressure Switch	½" NPT (M)	¾" – Nozzle for < 40 bar 1" – Nozzle for ≥ 40 bar	1" Nozzle
2	Diaphragm gauge/pressure switch	2" Flanged	2" Nozzle	2" Nozzle
3	Pressure transmitter	½" NPT (M)	¾" – Nozzle for < 40 bar 1" – Nozzle for ≥ 40 bar	1" Nozzle
4	Flanged type	3" Flanged	3" Nozzle	3" Nozzle
5	Remote seal type	3" Flanged	3" Nozzle	3" Nozzle
II	Temperature			
	Temperature gauge/RTD / Thermocouple Thermowell			
a.	On vessels	1½" Flanged	1½" Nozzle	1½" Nozzle
b.	For steam and water lines	M 33 x 2 screwed & welded	1" Nozzle	1" Nozzle
c.	For air & flue gas lines	1½" Flanged	1½" Nozzle	1½" Nozzle
III	Level			
1	Level gauges	1" Flanged	-	1" Nozzle
2	Magnetic level indicator	1" Flanged	-	1" Nozzle
3	Lined level gauge	2" Flanged	-	2" Nozzle
4	Level switch (external float switch)	1½" Flanged	-	1½" Nozzle
5	DP level transmitter	½" NPT (F)	-	1" Nozzle
6	Flanged level transmitter	3" Flanged	-	3" Nozzle
7	Remote seal level transmitter	3" Flanged	-	3" Nozzle
8	Displacer level transmitter (External)	2" Flanged	-	2" Nozzle
9	Purge level transmitter	½" NPT (F)	-	1" Nozzle
10.	Stand pipe (size 3" or 4")	-	-	2" nozzle (min)
11.	Level switch (Internal float switch)	4" Flanged	-	4" Nozzle
12.	Level Switch (Vibration fork)	3" Flanged	-	3" Nozzle
13.	Level Transmitter/switch (Capacitance type)	2" Flanged	-	2" Nozzle
14.	Level Transmitter (Interface) (Internal Float, Displacer type)	4" Flanged	-	4" Nozzle

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ANNEXURE - 2

LIST OF CODES & STANDARDS

- | | | |
|-----|--|------|
| 1. | American Society of Mechanical Engineers | ASME |
| 2. | American Society for Testing and Material | ASTM |
| 3. | American Petroleum Institute | API |
| 4. | International Electro Technical Commission | IEC |
| 5. | International Standards Organisation | ISO |
| 6. | Bureau of Indian Standards | BIS |
| 7. | Instrument Society of America | ISA |
| 8. | British Standards Institute | BS |
| 9. | Deutsche Institute fur Normung | DIN |
| 10. | National Fire Protection Association | NFPA |
| 11. | American National Standards Institute | ANSI |
| 12. | Indian Boiler Regulations | IBR |

