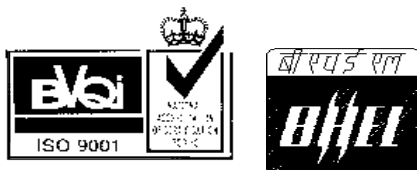


1X660 MW PANKI TPS EXTENSION (UPRVUNL)

TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREENING SYSTEM

Specification No.: PE-TS-426-172-N001 (REV. 00)



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA-201301**



**TITLE : TECHNICAL SPECIFICATION
FOR
TRAVELLING BAND SCREENING SYSTEM**

SPEC. NO. PE-TS-426-172-N001

SECTION

REV. NO. 0

DATE : 04.06.2019

CONTENTS

This Technical Specification consists of three Sections:

SECTION TITLE

SECTION I SPECIFIC TECHNICAL REQUIREMENTS

- IA SPECIFIC TECHNICAL REQUIREMENT-MECHANICAL.
- IB SPECIFIC TECHNICAL REQUIREMENT- ELECTRICAL.
- IC SPECIFIC TECHNICAL REQUIREMENT- C&I.
- ID DATA SHEET – A.

SECTION II STANDARD TECHNICAL REQUIREMENTS

- IIA STANDARD TECHNICAL REQUIREMENT-MECHANICAL
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- IIC STANDARD TECHNICAL REQUIREMENT- C&I.

SECTION III DOCUMENTS TO BE SUBMITTED BY BIDDER

- IIIA COMPLIANCE CERTIFICATE (TO BE SUBMITTED BY BIDDER DURING TENDER STAGE).
- IIIB ELECTRICAL LOAD (TO BE SUBMITTED BY BIDDER DURING CONTRACT STAGE).
- IIIC DATASHEET B & BALANCE DOCUMENTS AS PER CL. NO. 9.01.00 OF SECTION- IA (TO BE SUBMITTED BY SUCESSFUL BIDDER AFTER AWARD OF CONTRACT



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**SECTION IA
SPECIFIC TECHNICAL REQUIREMENT
MECHANICAL SYSTEMS**



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1.00.0 GENERAL

The Travelling Band Screens (TBS) complete with all accessories including special tools and tackles (if any) shall conform to the Data Sheet-A (Section ID) and other requirements of section II. In addition, the requirements of this Section I including Customer Specification attached at Appendix 1 (as applicable) shall also be complied with. In the event of Contradictions between Section IA /Customer Specification (Appendix 1)/ Datasheet A (Section IB), the same shall prevail in the order as:
Section IA, Datasheet-A (Section ID).

2.00.0 SCOPE OF SUPPLY AND SERVICES INCLUDED IN THE BIDDER'S SCOPE

A) The scope of supply under this specification shall be as follows:

- 2.1 Two (2) sets of Travelling Band Screens (TBS) viz. independent set of TBS for each inlet channel comprising of Electric drive with reduction gear box and fluid/hydraulic coupling, appropriate sealing arrangement to avoid escape of debris in clean side. All the Equipment supplied with this package should be suitable for Outdoor Location.
- 2.2 Spray wash/Flushing arrangement with necessary spray wash pumps, header isolation valves and spray wash nozzle headers with matching counter flanges complete with bolts, nuts and gaskets for all flanges at terminal points.
- 2.3 2x100% automatic self-cleaning strainers with debris discharge valves and other accessories as required.
- 2.4 Each travelling band screen stream shall be provided with required instrumentation as shown in Sketch-A, Sketch-B and mentioned in Datasheet-A and Sub-Section IC of this Specification.
- 2.5 Starter Panel (cum Switch Gear Panel) shall be as follows:
 - (i) 2 sets of TWS shall have one Common Starter Panel (cum Switch Gear Panel) for DCS based control system.

Switch Gear Panel should have suitable arrangement like Bus Coupler for providing redundancy to incoming supply feeder (1Working + 1 Standby feeder). For details of C&I scope please refer Section IC.

- 2.6 Supporting arrangement complete with foundation plates, anchor bolts, nuts, sleeves, embedment's, inserts etc. and installation materials like fixing bolts, clamps and other accessories etc for complete TBS as required to make TBS a complete package.
- 2.7 Two (2) nos. Debris segregation and collection baskets and other details as per Datasheet-A.
- 2.8 Complete Pipe work, including interconnection/distribution piping, valves, flanges/counter flanges (including Counter Flange at Terminal Point) for



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pipes/valves, bends, fittings, distributors, nozzles and support installation materials for equipment's/piping/valves etc. shall be in Bidder's scope.

- 2.9 Any other items not listed above but required to make Travelling Band Screening system as complete package, shall be deemed to be included in bidder's scope of supply.

B) **SCOPE OF SERVICES INCLUDED IN THE BIDDER'S SCOPE:** The bidder's scope also includes following services at site, for scope under this specification viz. Travelling Band Screen and its accessories.

- a) Supervision during critical stages of Erection
- b) Final installation checks before commissioning
- c) Commissioning of Travelling Band Screen and its accessories
- d) Trial run and Site Testing

Bidder to include Five site visits for four days each for above activities in their offer price.

3.00.00 EXCLUSIONS:

The following are excluded from the bidder's scope:

- 1. Coarse Bar Screens
- 2. Stop log Gates at the inlet of each section
- 3. Gantry Crane
- 4. Civil works required for installation
- 5. Erection of Travelling Band Screen and its accessories

4.00.00 DESCRIPTION OF EQUIPMENTS:

Travelling Band Screening System: -

- 4.01.00 The Travelling Band Screening system shall be installed upstream of pumps installed in Raw Water Intake Pump House and are intended to remove floating matter coming from the source through the open Raw water intake canal. The water analysis is enclosed with Data Sheet-A.

Coarse Bar screens (excluded from bidder's scope) shall be provided upstream of each Travelling Band Screen to collect the coarse floating/suspended matter up to the size as specified in Data Sheet-A.

The intake system comprises of 2 stream (1 Working+ 1 Standby) as specified in Data Sheet-A.

Each stream shall be provided with an Independent Travelling Band Screen. However, common Spray wash/Flushing pumps and Self-cleaning Strainers shall be provided for both the Travelling Band Screens.

- 4.02.00 The travelling band screens shall be dual speed and central flow or dual flow designs. Each travelling band screen unit shall consist of a series of screening



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elements fastened to two parallel vertical strands of chains.

The screen basket shall carry debris and refuse above the operating floor where the screen shall be cleaned by a water jet spray. The wash water, debris and refuse shall be collected in a concrete trough provided on the deck level by the purchaser upto the discharge point.

- 4.03.00 Flushing water shall be taken by the Bidder from the discharge of Raw water Intake Pumps at pressure specified in Data Sheet-A at Terminal point.

Bidder shall provide 2x100% Horizontal type booster pumps to raise the pressure of water so as to meet the requirements of the flushing operation. These pumps shall be provided with suitable control interlocks for satisfactory flushing/cleaning of screens.

Spray wash system for each Travelling Band screen shall be provided with a motorised inlet isolation valve, which shall be opened whenever a particular Travelling Band screen has to be spray washed/flushed.

Terminal point for Spray Wash/Flushing system shall be as per details shown in Sketch-A.

However, the bidder shall hydraulically design the equipments for purchaser's pump shut off head specified in Data Sheet-A, and taking into consideration the shut off head of the bidder's spray wash/flushing.

- 4.04.00 The details of the Travelling Band Screens with the quantity, design parameters etc. to be supplied shall be as per Data Sheet-A in Sub-Section ID.

5.00.00 CONTROL PHILOSOPHY:

- 5.01.00 The operation philosophy as detailed below is suggestive only and successful Bidder shall furnish the complete control & interlock scheme for Travelling Band Screen and Auxiliaries after award of contract and it shall be subject to purchaser/End Customer approval.

- 5.02.00 Travelling Band Screens, Spray wash/flushing pumps, spray wash valves, automatic self-cleaning strainers and other auxiliaries shall be controlled and operated from standalone DDCMIS of Raw water Intake pumps system located in Raw water Intake pump house control room, supplied by the Purchaser.

- 5.03.00 The following shall be provided in DDCMIS.

- a) All interlocks and protections for Travelling Band Screens, spray wash pumps, automatic self cleaning strainers shall be realized in the DDCMIS.
- b) Auto/Manual Selector Switch for
 - ❖ Travelling Band Screens
 - ❖ Spray wash pumps
 - ❖ Self cleaning strainer.



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- c) Indication(Running/ Stopped)/alarms/annunciations/ for
 - ❖ Travelling Band Screens
 - ❖ Spray wash pumps
 - ❖ Self cleaning strainer.
 - ❖ Spray wash valves
- d) Start/Stop facility for each TBS, spray wash pumps, spray wash valves, Self cleaning strainers, etc.
- e) Key lockable type emergency stop push button shall be provided in the Local to TBS and spray wash pumps for Stopping in case of Emergency.
- f) Differential Level indication for each Travelling Water Screens.
- g) Complete automatic shut-down of the system .
- h) Selection of various modes of operation as described in succeeding paras.

5.04.00 Differential Level Transmitter:

5.04.01 Two Nos. Differential Level Transmitter shall be provided across each Travelling Band Screen and following signals shall be derived:

- o Differential Level Display on DDCMIS
- o Differential Level High
 - ❖ Annunciation on DDCMIS
 - ❖ Starting of Spray Wash pump
 - ❖ Starting of Travelling Band Screen on slow speed
- o Differential Level Very High
 - ❖ Annunciation on DDCMIS
 - ❖ Starting of Spray Wash pump
 - ❖ Starting of Travelling Band Screen on high speed
- o Differential Level Normal
 - ❖ Stopping of Travelling Band Screen and Spray Wash pump

5.04.02 One number differential level switch shall be provided across each Travelling Band Screen and following signals shall be derived

- o Differential Level Very Very High
 - ❖ Annunciation on DDCMIS
 - ❖ Starting of Spray Wash pump
 - ❖ Starting of Travelling Band Screen on high speed

5.05.00 For Spray wash booster pumps, instrumentation as per Datasheet A shall be provided by bidder for spray wash pumps.

5.06.00 Travelling Band Screen Controls:

Each Travelling Band Screens (TBS) shall be provided with following modes of operation from DDCMIS.



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- Manual Mode
 - Timer Mode
 - Auto Mode thru' differential level between upstream and downstream of TBS's.
- **Manual Mode**
When Manual mode is selected and start push button is pressed/selected, TWS will start on low or high speed as selected, irrespective of the differential levels and shall continue to run until operator switches it off.
 - **Timer Mode**
The TWS will start on low/high speed/Very high speed (depending upon selection) thru' timer – at the selected time interval, irrespective of its differential level and shall stop after the preset run time.
Even though the run timer times out, but the differential level of the TWS has not fallen below “differential level normal” the TWS shall continue to rotate till the differential level falls below the preset limit.
 - **Auto Mode**
On receipt of high differential level signal, the TWS selected in 'Auto' mode will start on low speed and rotate until differential level falls below the preset limit.
TWS Operation (Slow speed): TWS shall start on slow speed when it senses “TWS \$ Differential Level High” and shall continue to operate until “TWS \$ Differential Level Normal” is sensed.

TWS Operation (High Speed): TWS shall operate on high speed when “TWS \$ Differential Level Very High” is sensed through Level Transmitter or “TWS \$ Differential Level Very Very High” is sensed through Differential Level Switch and shall continue to operate until “TWS \$ Differential Level High” is sensed.
- 5.07.00 In all modes of operation TBS once started shall complete minimum One (1) rotation before stopping.
- 5.08.00 TBS and its auxiliaries shall be designed for continuous operation.
- 5.09.00 Spray Wash Pumps Controls/ Instruments:**
- 5.09.01 Spray Wash Pump when selected in auto shall start with the starting of the Travelling Band Screen (in any mode of operation) and shall continue to run until all screens stop, in which case pump shall also stop.
- 5.09.02 The isolating valves at pump suction shall be provided with 'Open' limit switches and Motorized Valve at Pump Discharge for pump start permissive. On receipt of pump start command if any valve is closed/Not Open, it shall annunciate alarm in DDCMIS, trip the pump and start standby pumps.
- 5.09.03 Pump start permissive shall be provided as follows:
i. Suction/ discharge Valves Open
ii. “Suction Pressure Adequate”
- 5.10.00 Self-Cleaning Strainers Controls/ Instruments:**



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5.10.01 One number Differential pressure gage shall be provided across each SCS for local measurement of differential pressure across Self Cleaning Strainers.

5.10.02 Two (2) numbers Differential pressure transmitter shall be provided across each SCS and following signals shall be derived:

- "SCS Differential Pressure high" for starting of automatic back wash/self-cleaning/flushing
- "SCS Differential Pressure Normal" for stopping of automatic back wash/self-cleaning/flushing
- Remote differential pressure indication across Self-cleaning strainer to be displayed on DDCMIS

6.00.00 GENERAL REQUIREMENTS:

6.01.00 In addition to the requirements of Section-II the following shall also be complied with for packages/ projects under scope of this specification.

6.02.00 The typical flow diagram applicable, is enclosed herein in this Section (Sketch A) with scope demarcation for bidder's compliance.

6.03.00 General arrangement for Travelling Band Screens, Spray Wash piping, type of installations and location of the spray wash pump Skid etc shall be furnished along with the offer. Bidders to note that TBS with accessories shall be installed outdoors and therefore shall be suitable for outdoor duty.

6.04.00 The materials of construction specified in Data Sheet-A are minimum requirements and materials of construction for other components not specified shall be similarly selected by the bidder for the intended duty which shall be subject to purchaser's approval during detailed engineering in the event of order.

6.05.00 TBS and its support structure shall be designed and manufactured as per the applicable codes and to take care of following conditions

- Design Differential level
- During various mode of operations, at design flow and under all climatic conditions.

6.06.00 The TBS drive motor shall be sized to start the Travelling Band screen against differential head of 0.75 MWC and operate continuously thereafter.

6.07.00 Cathodic Protection for TWS and its accessories along with Sacrificial Anode shall be provided by the bidder in the equipment. Calculation for the same shall be provided during contract stage, subject to approval.

6.08.00 The TBS design shall be such as to ensure that Sea water at TBS outlet shall be free from any vortex and turbulence.

6.09.00 Each assembly and sub assembly shall be provided with suitable arrangement for lifting using gantry/crane/mono rail /chain pulley block. Lifting hooks shall be located so as to facilitate lifting in balanced position.

6.10.00 The make of various bought out items shall be subjected to purchaser's/owner's approval in the event of order.



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7.00.00 QUALITY PLAN

Quality Plans for some items along with additional quality assurance & inspection requirement are enclosed in the Specification are for bidder's guidance only and are not exhaustive. The quality requirements/QP furnished in specification are not complete. The bidder shall comply with these minimum requirements and submit the QPs comprehensively including all components of complete Travelling Band Screens with accessories at raw material/ in process /final stages shall furnish the same as per format in the event of order based on the guidelines given as above, same shall be subject to BHEL/ Customer /Consultant's approval.

8.00.00 SITE DEMONSTRATION TESTING AND TRIAL RUN:

The Travelling Band Screens shall be guaranteed to meet the performance requirements specified in Data Sheet-A and also for trouble free operation after commissioning at site.

8.01.00 Site Demonstration Testing:

Following site demonstration tests shall be performed at site at Full load.

- i) Pressure drop (Differential Level) in clean condition viz. after Spray wash/ Flushing.
- ii) Satisfactory cleaning operation of spray wash system
- iii) Smooth operation without any undue noise and vibration.

8.02.00 Above mentioned parameters shall be demonstrated by the supplier during demonstration testing. If the results of these tests show the non-performance of the TBS or its accessories, the supplier shall modify the TBS or accessories as required it to meet the test requirements.

8.03.00 If the vendor fails to demonstrate satisfactory operation as above after modification, the owner/purchaser may at his discretion reject the equipment.

9.00.00 DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE:

9.01.00 Documents to be submitted after award of LOI: Document submission schedule after the award of contract shall be as below:

BHEL DRG NO	DRG TITLE	Drg Sch for Vendors
PE-V9-426-172-N001	P&ID OF TWS SYSTEM	R-0 within 20 days from LOI/PO & subsequent revisions within 7 days of comments received from BHEL.
PE-V9-426-172-N002	GA OF TWS	
PE-V9-426-172-N003	CONTROL PHILOSOPHY & GA OF CONTROL PANEL- TWS	
PE-V9-426-172-N004	DETAILS OF DEBRIS SEGREGATION BASKET-TWS	
PE-V9-426-172-N007	DATASHEET FOR TWS	
PE-V9-426-172-N011	CIVIL DETAILS OF TWS	
PE-V9-426-172-N020	QP OF TWS	



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PE-V9-426-172-N005	PIPING INSTALLATION DIAGRAM	R-0 within 20 days from Cat-I(or)II approval of 'PID, Datasheet & GA of TWS' and subsequent revisions within 10 days of comments received from BHEL.
PE-V9-426-172-N006	GA OF STRAINER	
PE-V9-426-172-N008	DATASHEET OF STRAINER	R-0 within 30 days from Cat-I(or)II approval of 'Datasheet of TWS' & subsequent revisions within 10 days of comments received from BHEL.
PE-V9-426-172-N009	DATASHEET OF VALVES	
PE-V9-426-172-N010	DATASHEET FOR PIPE, FITTING & FLANGES	
PE-V9-426-172-N019	DATASHEET FOR GEARED MOTOR OF TWS	
PE-V9-426-172-N012	DATASHEET FOR PRESSURE/DIFF. PRESSURE GAUGE	R-0 within 30 days from Cat-I(or)II approval of 'PID & Datasheet of TWS' and subsequent revisions within 10 days of comments received from BHEL.
PE-V9-426-172-N013	DATASHEET FOR DIFF. LEVEL TRANSMITTER	
PE-V9-426-172-N014	DATASHEET FOR ELECTRICAL ACTUATOR	
PE-V9-426-172-N015	DATASHEET OF DIFF. PRE. INDICATOR SWITCH	
PE-V9-426-172-N016	WIRING DIAGRAM	R-0 within 30 days from Cat-I(or)II approval of 'Control Philosophy' and subsequent revisions within 10 days of comments received from BHEL.
PE-V9-426-172-N017	DATASHEET OF STARTER PANEL (CUM SWITCHGEAR PANEL)	
PE-V9-426-172-N018	CABLE SCHEDULE	
PE-V9-426-172-N021	O&M MANUAL	Within 30 days from MDCC

9.02.00 The following documents shall be furnished by the bidder with his offer:

- Compliance certificate duly signed and stamped.
- Deviation Schedule as per NIT.
- Electrical Load Data.
- GA Drawing for reference with following details clearly indicated/marked
 - a) All principal dimensions like dimensions of openings at Deck Level, etc.
 - b) Location and size of D wall, etc.
 - c) Recommended capacity and lift of the Gantry crane.



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ANNEXURE-1 PACKING PROCEDURE

1.0 Packing procedure before dispatch:

The purpose of this procedure is to outline the requirements and procedures for protecting the equipment's during shipment and preserving during the storage.

1.1 Preparation for Packing:

- After hydro testing, operation, all fluids e.g. water etc., shall be completely drained from all TWS's parts, and the equipment blown dry.
- All material shall be cleaned internally and externally to remove, scale, rust fillings and any other foreign material.
- The TWS shall be placed on a strong wooden base & bolted to the wooden base using the foundation holes for further transportation up to site.

1.2 Protection of parts:

- The TWS main components (Sprockets, Screen baskets, Frame etc.) shall be packed in properly in high grad bubble plastic wrap for transportation, and long storage at site.
- Actuators shall be packed in separate wooden box of proper sizes.
- TWS miscellaneous items shall be packed in proper sizes of wooden cases. High grade woods like Rubber woods, jungle wood, hard wood, mango wood, pine wood, etc. is used for packing.
- Loose material, & Electrical & Electronics items shall be packed in corrugated box and plastic bags with proper tagging and marking of handle with care in proper sizes of wooden cases
- All finished (or) machined (External C.S. Surfaces shall be protected against corrosion with corrosion resisting coating, which is easily removable (Compound shall be such that it will remain on the surface at temperature normally encountered during shipping & storage).
- All machined surfaces shall be protected from mechanical damage. All external unfinished carbon steel surfaces shall be sand blasted & shall be coated with rust preventive primer.
- Flanged opening if any shall be covered with blank flanges sealed with blank gasket of natural rubber or equivalent. Butt welded opening shall be closed with temporary closing covers. Internal threads shall be protected with metal plug sealed with Teflon tape (if applicable). External thread shall be protected with PVC sleeve.
- Wooden cases shall be covered with HDPE cloth from inside wooden box and the top. All the opening in plate heat exchanger shall be closed properly by suitably covering to prevent foreign material entering in plate heat exchanger.
- All fabricated wooden cases & crates conform to the requirement as per



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table given below:

Gross Weight [Kgs.]	Board Thickness	Batton / Rafter Thickness
2000 to 9000	Min. 30 mm	Min. 35 mm
9000 to 18000	Min. 50 mm	Min. 35 mm

- All the equipment shall be protected for entire period of dispatch, storage and erection against corrosion, incidental damage due to vermin, sunlight, rain, high temperature, humid atmosphere, rough handling in transit and storage. All MS parts which are not painted shall be provided with coating of grease.
- Clay Desiccant or such other moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.

1.3 Preservation

The equipment's shall be stored under closed/open space in packed condition until installation. The packages containing loose plates and gaskets are to be protected from extreme climatic conditions.

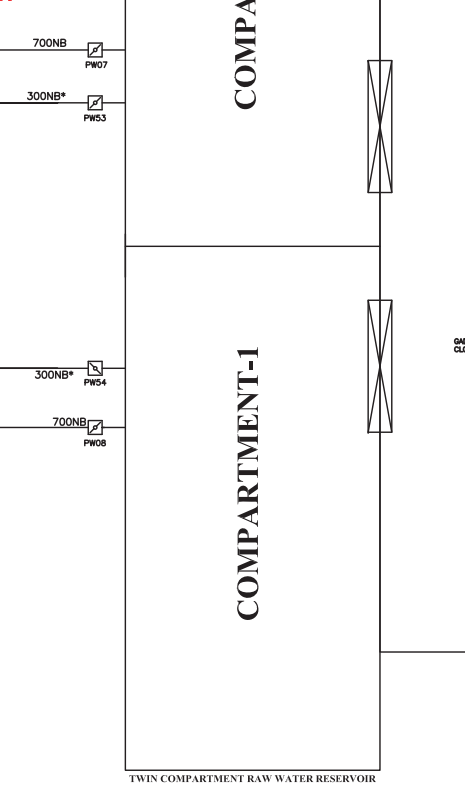
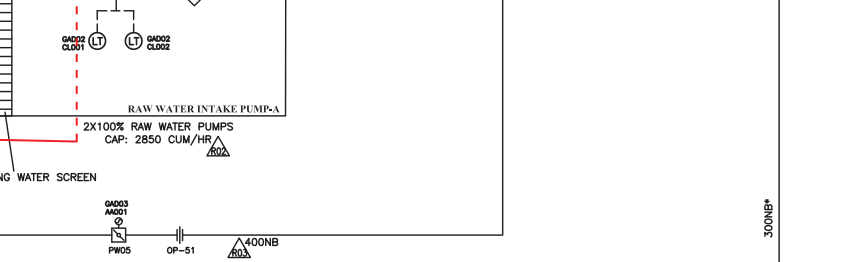
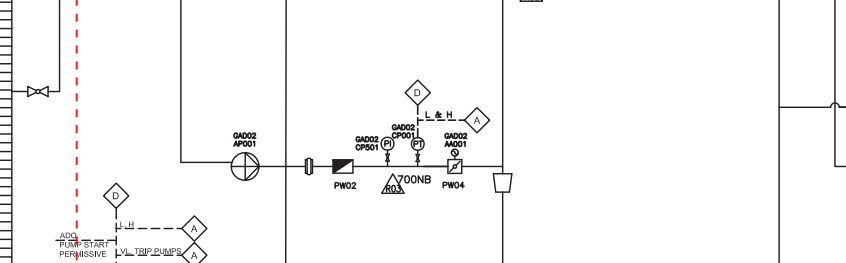
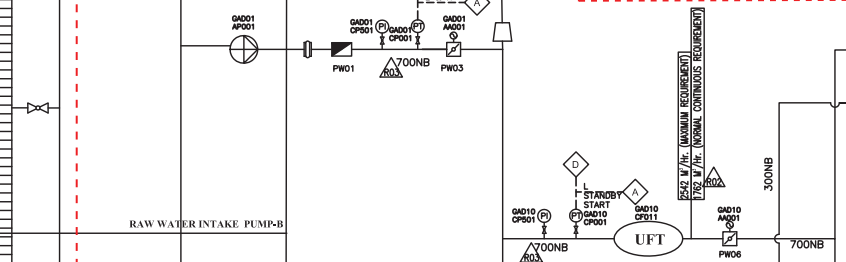
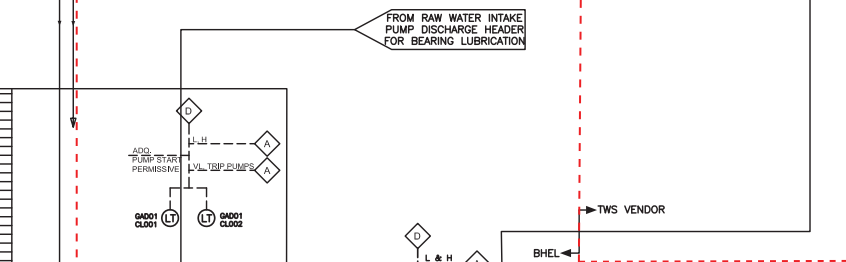
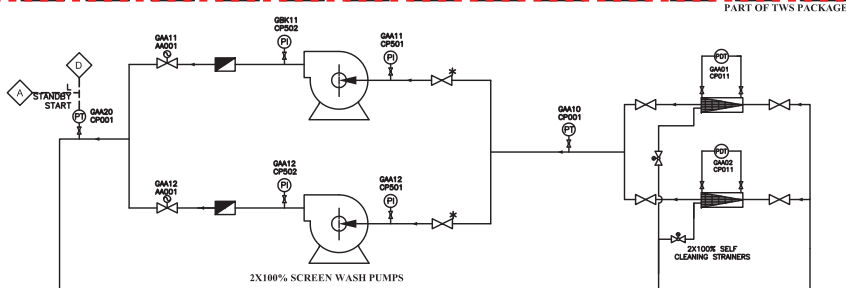
1.4 Photographs

Bidder to take photographs of all parts like Sprockets, Frame, Screen baskets, SCS, Spray wash pumps, piping, valves, instruments, actuators, panel (inside & outside) and sent to engineering deptt along with all inspection reports before final dispatch.

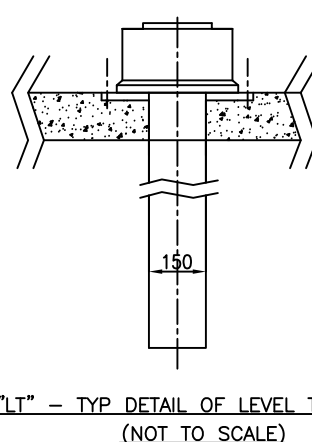
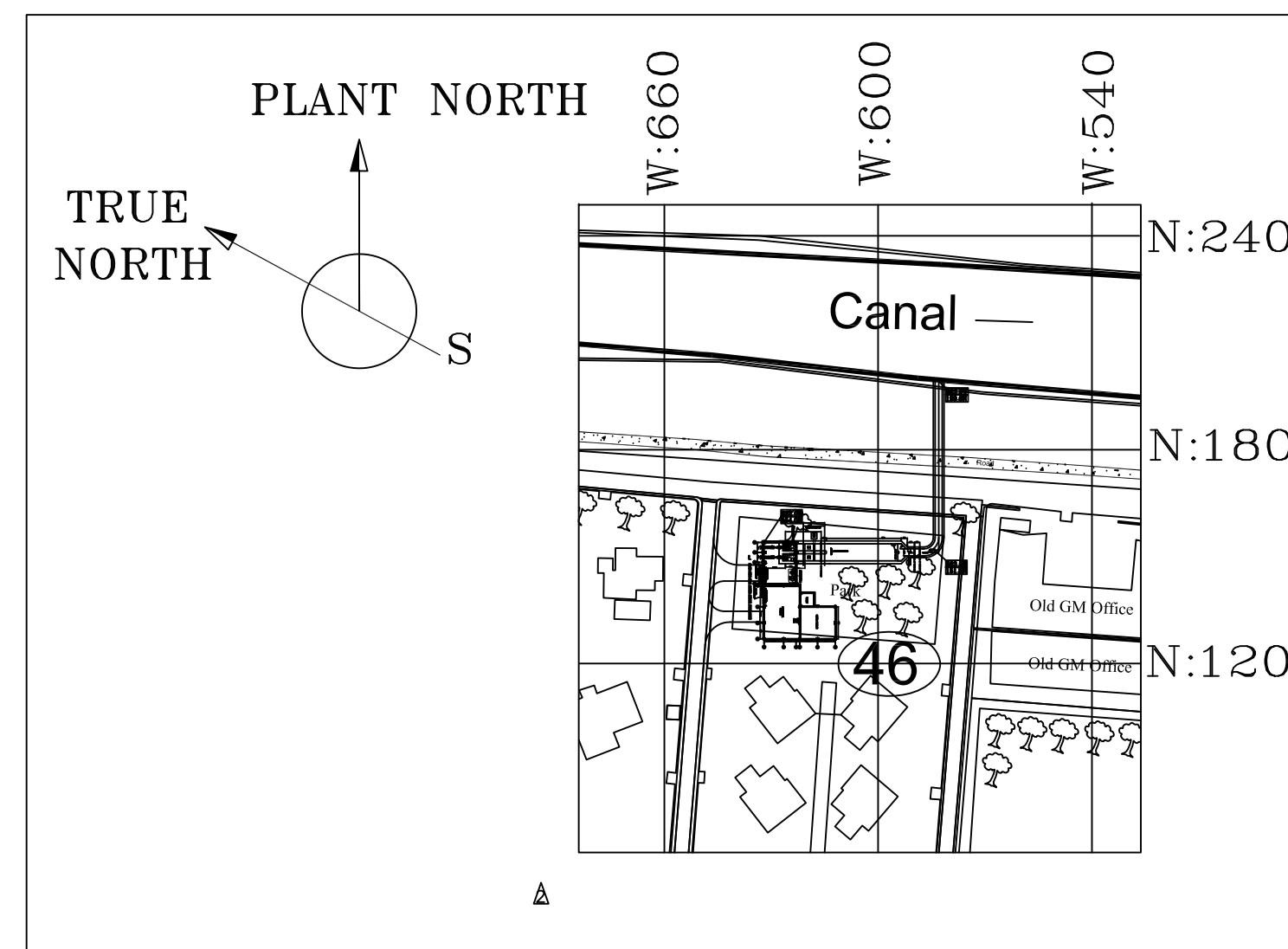
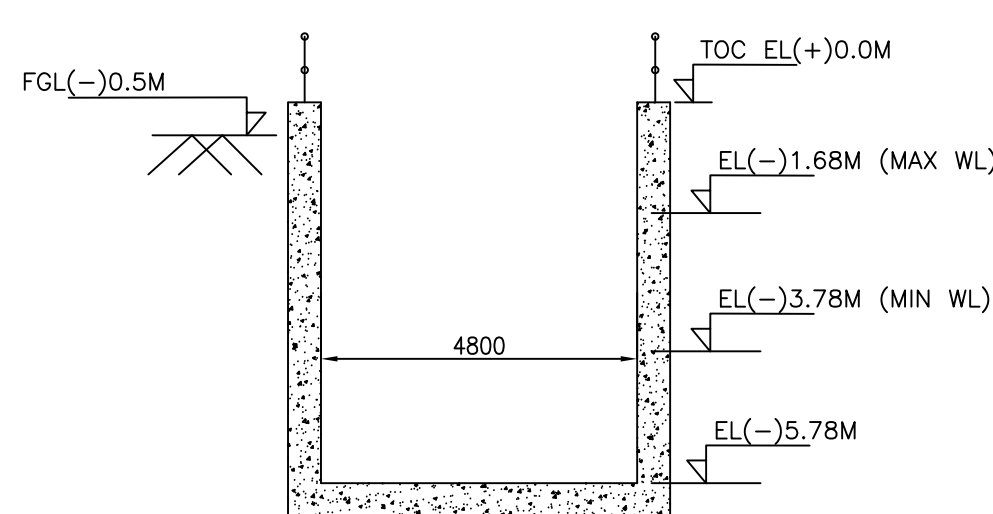
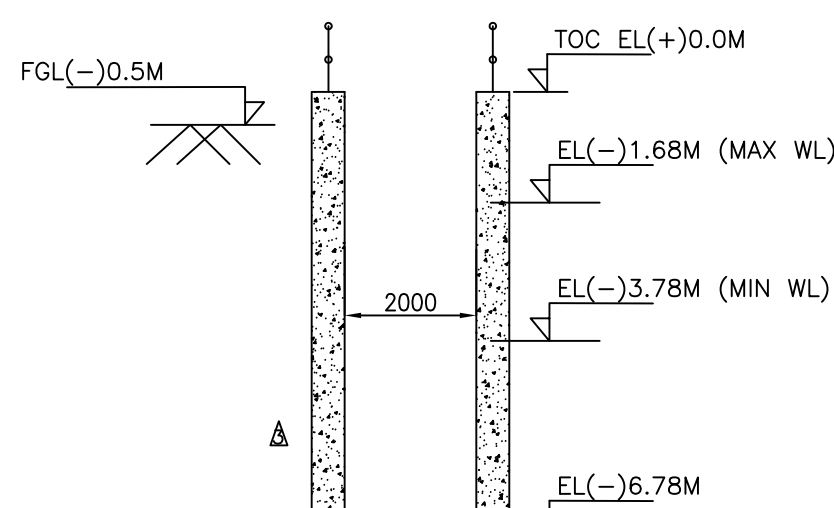
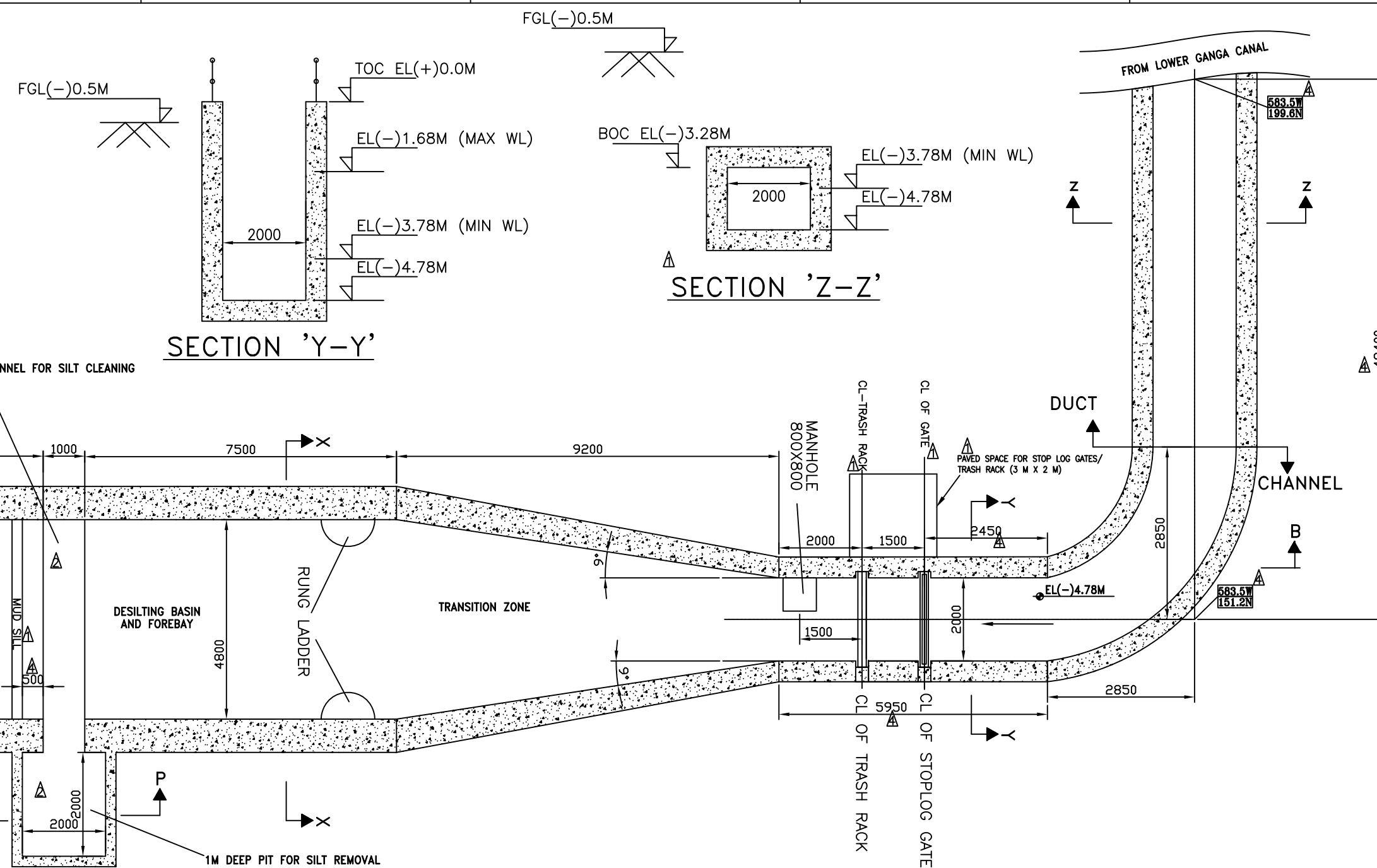
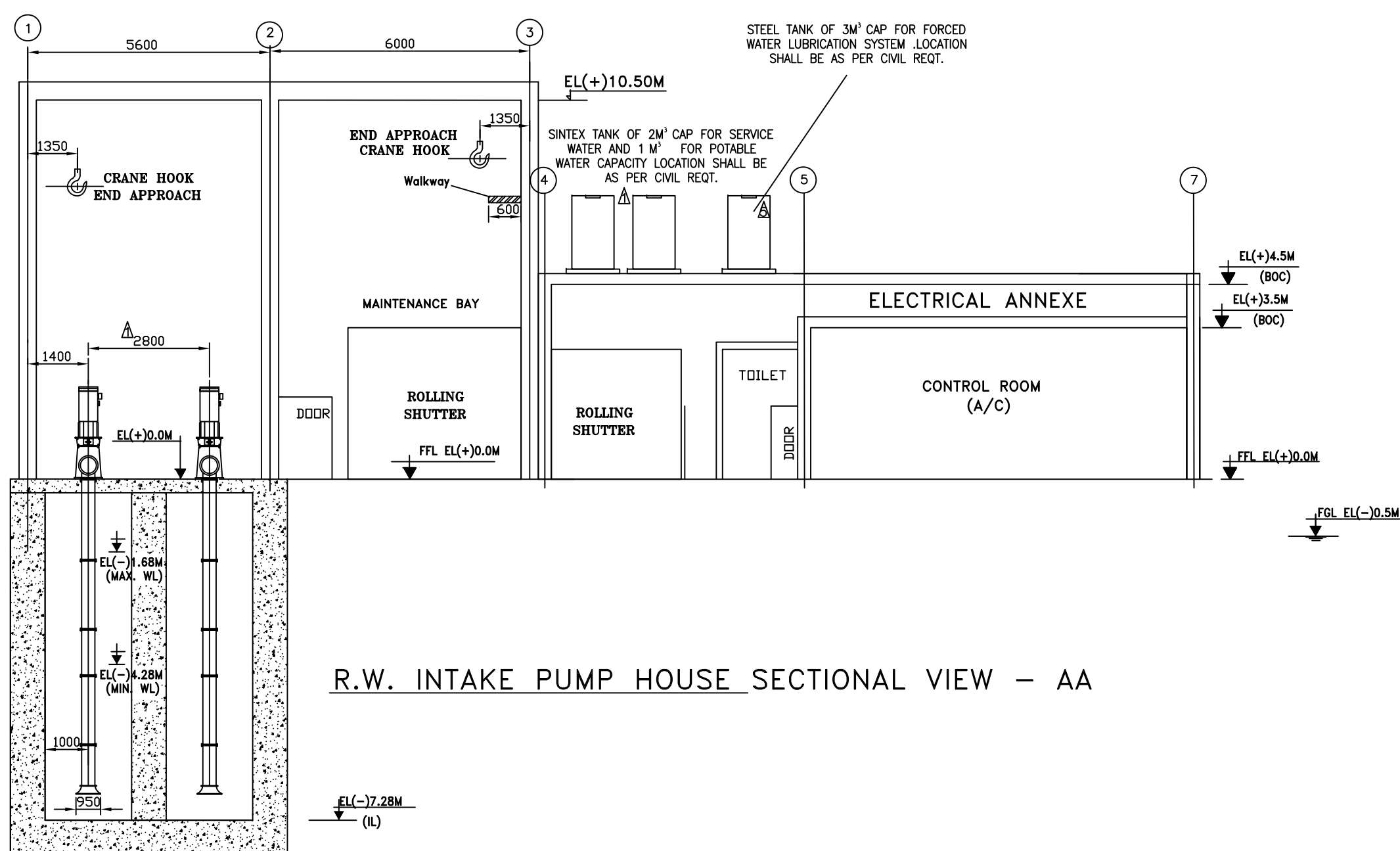
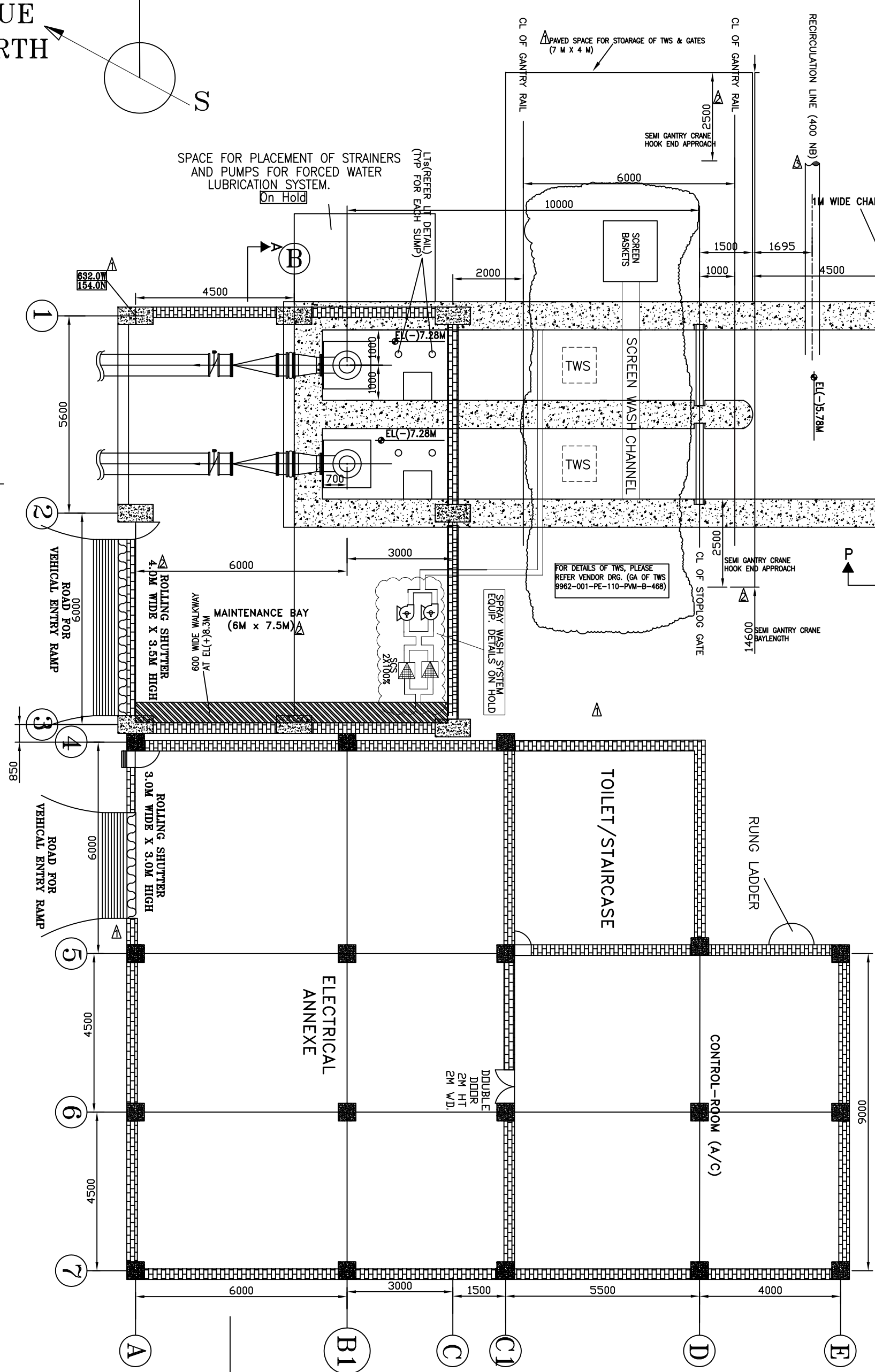
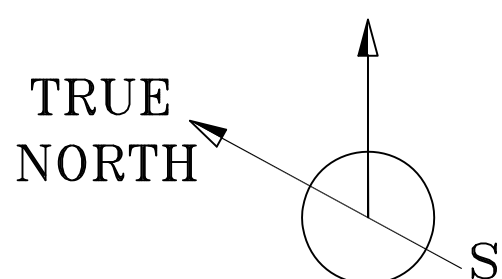
Sketch-A

DE-SILTING BASIN AND
RAW WATER INTAKE FOREBAY

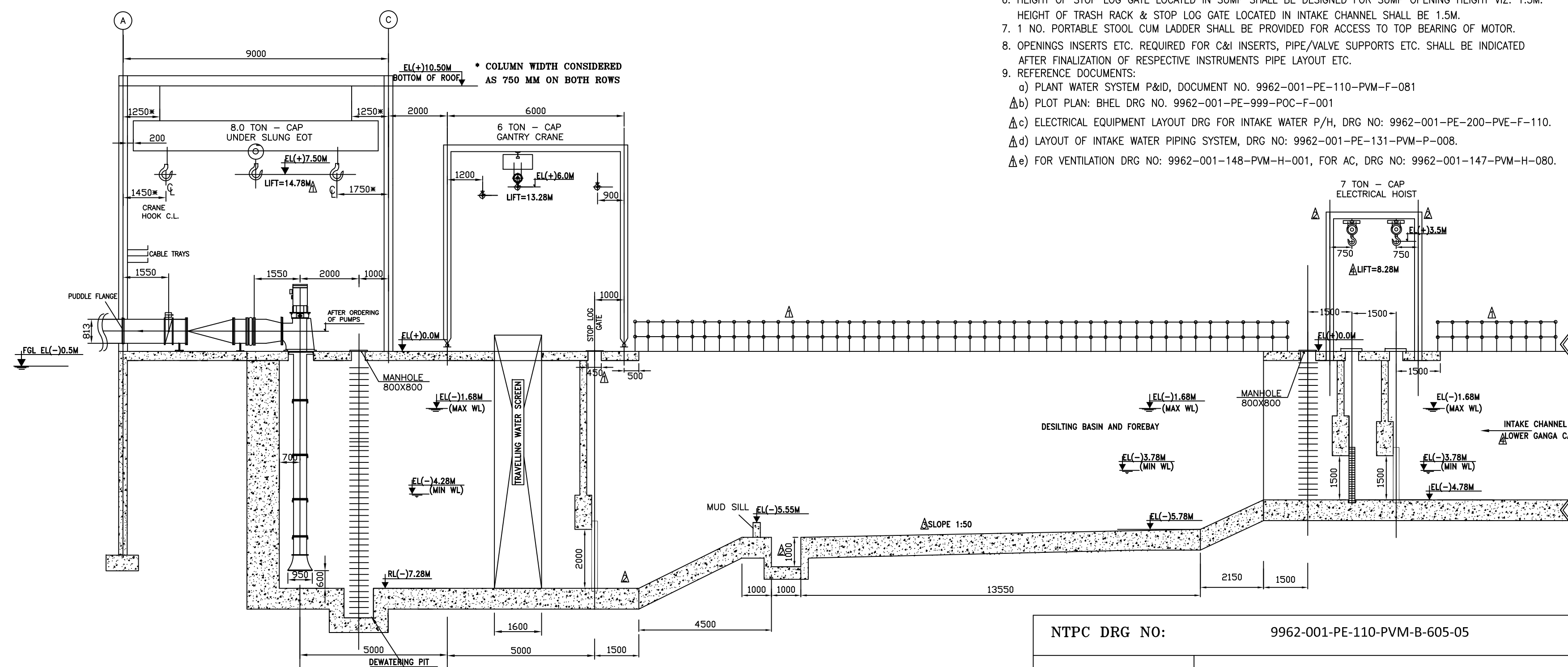
STOP LOG GATE
TRAVELING WATER SCREEN



TWIN COMPARTMENT RAW WATER RESERVOIR



- NOTES:-**
1. ALL DIMENSIONS ARE IN MM AND ALL ELEVATIONS ARE IN METRES UNLESS OTHERWISE STATED.
 2. CARBON STEEL GATE (TOTAL 3 NOS. VIZ. 1 NO. FOR EACH PUMP SUMP AND 1 NO. FOR INLET CHANNEL AND 1 NO. TRASH RACK OF 50 X 50 MM CLEAR OPENING IN RAW WATER INTAKE CHANNEL WITH CARBON STEEL FRAME SHALL BE BOUGHT OUT ITEM.
 3. 1 NO. UNDER SLING EOT, CAPACITY 80 BT CAP, 1 NO. GANTRY CRANE OF 6T CAP, 2 NOS. ELECTRIC HOIST OF 7 TON CAPACITY TO BE PROVIDED.
 4. ALL ELEVATIONS ARE REFERRED TO THE TG BUILDING FFL WHICH CORRESPONDS TO RL+126.5M. EL(+0.0M CORRESPONDS TO RL (+126.5M.
 5. ACCESS TO ROOF SHALL BE PROVIDED.
 6. HEIGHT OF STOP LOG GATE LOCATED IN PUMP SHALL BE DESIGNED FOR SUMP OPENING HEIGHT VIZ. 1.5M.
 7. HEIGHT OF TRASH RACK & STOP LOG GATE LOCATED IN INTAKE CHANNEL SHALL BE 1.5M.
 7. 1 NO. PORTABLE STOOL CUM LADDER SHALL BE PROVIDED FOR ACCESS TO TOP BEARING OF MOTOR.
 8. OPENINGS INSERTS ETC. REQUIRED FOR C&I INSERTS, PIPE/VALVE SUPPORTS ETC. SHALL BE INDICATED AFTER FINALIZATION OF RESPECTIVE INSTRUMENTS PIPE LAYOUT ETC.
 9. REFERENCE DOCUMENTS:
 - a) PLANT WATER SYSTEM P&ID, DOCUMENT NO. 9962-001-PE-110-PVM-F-081
 - Δb) PLOT PLAN: BHEL DRAW NO. 9962-001-PE-999-PCC-F-001
 - Δc) ELECTRICAL EQUIPMENT LAYOUT DRG FOR INTAKE WATER P/H, DRG NO: 9962-001-PE-200-PVE-F-110.
 - Δd) LAYOUT OF INTAKE WATER PIPING SYSTEM, DRG NO: 9962-001-PE-131-PVM-P-008.
 - Δe) FOR VENTILATION DRG NO: 9962-001-148-PVM-H-001, FOR AC, DRG NO: 9962-001-147-PVM-H-080.



R.W. INTAKE P/H SECTIONAL VIEW - BB

NTPC DRG NO: 4962-001-PE-11-PVM-B-605-05									
CUSTOMER					UTTAR PRADESH VIDYUT UTPADAN NIGAM LIMITED				
CUSTOMER'S CONSULTANT					NTPC LTD.				
JDB No. 426					DEVELOPMENT CONSULTANTS PVT. LTD., KOLKATA				
STATUS CONTRACT					1 X 660 MW PANKI TPS EXTENSION				
DISTRIBUTION									
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**TITLE : TECHNICAL SPECIFICATION
FOR
TRAVELLING BAND SCREENING SYSTEM**

SPEC. NO. PE-TS-426-172-N001

**SECTION : I
SUB-SECTION : IB**

REV. NO. 00 **DATE :** 04/06/19

Sheet 1 of 1

**SECTION IB
SPECIFIC TECHNICAL REQUIREMENT
ELECTRICAL SYSTEMS**



TITLE :
TECHNICAL SPECIFICATION
FOR
TRAVELLING WATER SCREEN (ELECTRICAL
PORTION)
1X660 MW UPRVUNL PANKI TPS

SPECIFICATION NO.

VOLUME NO. : **II-B**

SECTION :

REV NO. **00** : DATE : 12.06.19

SHEET : 1 OF 3

TECHNICAL SPECIFICATION
FOR
TRAVELLING WATER SCREEN
(ELECTRICAL PORTION)

	TITLE : TECHNICAL SPECIFICATION FOR TRAVELLING WATER SCREEN (ELECTRICAL PORTION) 1X660 MW UPRVUNL PANKI TPS	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION :
		REV NO. 00 : DATE : 12.06.19
		SHEET : 2 OF 3

1.0 **EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:**

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- 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) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for **TRAVELLING WATER SCREEN**.
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “ both end equipment in vendor’s scope”shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

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

Refer “Electrical Scope between BHEL and Vendor”.

3.0 **DOCUMENTS TO BE SUBMITTED ALONG WITH BID**

- 3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder

	TITLE : TECHNICAL SPECIFICATION FOR TRAVELLING WATER SCREEN (ELECTRICAL PORTION) 1X660 MW UPRVUNL PANKI TPS	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION :
		REV NO. 00 : DATE : 12.06.19
		SHEET : 3 OF 3
furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate. 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer. 4.0 List of enclosures : a) Electrical scope between BHEL & vendor b) Quality plan for motors c) Datasheet A (Annexure- I) d) Customer (M/s DCPL) specification for Motors e) Datasheet-C f) Electrical Load data format (Annexure –II) g) BHEL cable listing format (Annexure –III) h) Mandatory spares List		

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)**PACKAGE : TRAVELLING WATER SCREEN****SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT****PROJECT: 1X660MW UPRVUNL PANKI TPS**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL Vendor BHEL	BHEL BHEL BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Cabling/Termination by BHEL.
4	Junction box for control & instrumentation cable	Vendor	BHEL	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, optical fibre etc.	Vendor	BHEL	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
6	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL BHEL	BHEL BHEL	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
7	Cable glands ,lugs and bimetallic strip for equipment supplied by Vendor	Vendor	BHEL	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
8	Conduit and conduit accessories for cabling between equipment supplied by vendor	Vendor	BHEL	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	
10	Equipment grounding (including electronic earthing) & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)**PACKAGE : TRAVELLING WATER SCREEN****SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT****PROJECT: 1X660MW UPRVUNL PANKI TPS**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	BHEL	Makes shall be subject to customer/ BHEL approval at contract stage.
13	Mandatory spares	Vendor	-	Vendor to quote as per specification
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
15	Any other equipment/ material/ service required for completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).	Vendor	BHEL	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Electrical Equipment & cable tray layout drawings	Vendor	-	For preparation of cabling layout drawings by BHEL, vendor shall furnish Electrical equipment layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. In case the requirement of Junction Box arises on account of Power Cable size mismatch due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.
4. Vendor shall indicate location of Electronic Earth pit in their Civil assignment drawing.

DATA SHEET A		
SL NO.	DESCRIPTION	
		1X660 MW UPRVUNL PANKI TPS.
A	General	
1	Manufacturer & country of origin	DURING DETAILED ENGINEERING
2	Motor type	SQUIREL CAGE INDUCTION MOTOR
3	Efficiency class	IE3
4	Type of starting	DOL
5	Maximum acceptable kW rating of LV motor	200
6	Rating up to which Single phase motors permitted.	
7	Installation (Indoors/ Outdoors)	indoor/outdoor
8	Degree Of Protection	IP55 WITH CANOPY FOR OUTDOOR IP55 FOR INDOOR
9	Name of the equipment driven by motor & Quantity	DURING DETAILED ENGINEERING
10	Maximum Power requirement of driven equipment	DURING DETAILED ENGINEERING
11	Rated speed of Driven Equipment	As per system requirement
12	Design ambient temperature (Degree Celcius)	50 deg C
B	Design and Performance Data	
1	Frame size & type designation	DURING DETAILED ENGINEERING
2	Type of duty	AS PER REQUIREMENT
3	Rated Voltage	240/415 V
4	Rated Frequency	50 Hz
5	System fault level at rated voltage	50kA for 1 sec
6	LV System grounding	solidly grounded
7	Permissible variation for	
a	Voltage	+/-10%
b	Frequency	+/-5%
c	Combined voltage & frequency	10%
8	Rated output at design ambient temp (by resistance method)	as per requirement
9	Synchronous speed & Rated slip	as per requirement

10	Minimum permissible starting voltage	80% of rated voltage
11	TYPE OF STARTER PROVIDED IN MCC	As per system requirement
12	Starting time in sec with mechanism coupled	
a	At rated voltage	As per system requirement
b	At min starting voltage	
13	Locked rotor current as percentage of FLC (including IS tolerance)	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) (a) Below 110KW : 10.0 (b) From 110 KW & upto 200 KW : 9.0
14	Torque	
a	Starting	a) Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.
b	Maximum	B) Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.
15	Permissible temp rise at rated output over ambient temp & method	Thermal class 155 (F) insulation, temperature rise limited to class-B.
16	Noise level in (dB)	85 (dB) at 1 M
17	Amplitude of vibration	As per IS-12075/IEC-60034-14
18	Efficiency & P.F. at rated voltage & frequency	
a	At 100% load	Efficiency as per IS 12615, IEC: 60034-30 (Latest

b	At 75% load	revision), P.F. as per requirement.
c	At starting	Efficiency as per IS 12615, IEC: 60034-30 (Latest revision), P.F in line with starting requirement as per relevant standard.
C	Constructional Features	
1	Method of connection of motor driven equipment	As per system requirement
2	Applicable Standard	as per relevant standard
3	DOP of Enclosure	IP55 WITH CANOPY FOR OUTDOOR IP55 FOR INDOOR
4	Method of cooling	IC 411 (TEFC), IC 511 (TETV) or IC 611 (CACA).
5	Class of insulation	All motors shall have class F insulation but limited to class B temperature rise
6	Main terminal box	
a	Type	Refer Specific technical requirement for motors
b	Power Cable details (Conductor, size, armour/unarmour)	1.1 kV XLPE armour cable, size shall be provided during detailed engineering
c	Cable Gland & lugs details (Size, type & material)	Refer Specific technical requirement for motors
d	Permissible Fault level (kArms & duration in sec)	
e	Degree of Protection	
7	Earth Conductor Size & Material	Refer Specific technical requirement for motors
8	Space heater details (30KW & ABOVE) (Voltage & watts)	Refer Specific technical requirement for motors
9	Flame proof motor details (if applicable)	During detailed engineering
a	Enclosure	
b	suitability for hazardous area	
i	Zone O / I / II	
ii	Group IIA / IIB / IIC	
c	Degree of Protection	
9	No. of Stator winding	As per system requirement
10	Winding connection	As per system requirement
11	Kind of rotor winding	As per system requirement
12	Kind of bearings	Refer Specific technical requirement for motors
13	Direction of rotation when viewed from NDE	Motor shall be bi-directional

14	Paint Shade & type	Glossy light grey finish no 631 of IS 5, for details refer Specific technical requirement for motors
15	Net weight of motor	DURING DETAILED ENGINEERING
16	Outline mounting drawing No (To be enclosed as annexure)	DURING DETAILED ENGINEERING
D	Characteristic curves/ drawings	
1	(To be enclosed for motors of rating >55KW)	DURING DETAILED ENGINEERING
2	Torque speed characteristic	
3	Thermal withstand characteristic	
4	Current vs time	
5	Speed vs time	
E	Tests on motors	As applicable (As per QAP/For Project specific requirement if any refer Specific technical requirement for motors)

CHAPTER 17 : AC & DC MOTORS**1.00 MOTORS****1.1 SCOPE**

This specification is intended to cover design, manufacture, assembly and testing of AC Squirrel Cage Induction Motors for use in Thermal Power Plants and is supplement to the driven equipment specifications under which these motors are being procured for the project.

SITE CONDITIONS

Site conditions are covered in 'Project Data', contained in specification of the driven equipment.

1.2 Gases, Fumes & Dust Particles

1.2.01 General - Sulphur dioxide and/or trioxide fumes mildly present. Climate is tropical, conducive to fungus growth.

1.2.02 Dust Particles

1 Outdoor locations - Heavily dusty with abrasive dust and coal particles of size five (5) to hundred (100) microns present in atmosphere in large quantity.

2 Indoor Locations.

2.1 Coal conveyors - As for outdoor as per clause 1.02.02.1 above.

2.2 Other locations - Lightly dusty with abrasive dust and coal particles of size five (5) to twenty (20) microns present in atmosphere.

1.2.03 Special Fumes

1 Water treatment plant and acid cleaning room - Acid and alkali fumes present.

2 Fuel oil pumping areas & Hydrogen generation plant - Explosive fumes (flameproof motors required).

1.2.04 For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.

1.3 LOCATION OF MOTOR - As required

1.4 **SPECIFICATIONS & STANDARDS**.....Motors shall comply with the latest revisions of all relevant standards of BIS (IS-325, IS-900, IS-996, IS-1231, IS-1885, IS-2148, IS-2223, IS-2253, IS-2254, IS-2848, IS-3202, IS-4029, IS-4691, IS-4722, IS-4728, IS-4889, IS-6362, IS-7816, IS-8223, IS-8789, IS: 12615, IS:3177 and IEC : 60034 3Φ Induction motor) except as modified herein or in driven equipment specification.

Motors conforming to BS or IEC Publications, which ensure equivalent quality shall also be acceptable. In case of any difference between IS Specification/International Standards (IEC; NEMA etc.), this motor specification prevails.

1.5 TYPE

1.5.1 AC Motors:

- a) Squirrel cage induction motor suitable for direct-on-line starting.
- b) Continuous duty LT motors upto 160 KW Output rating (at 50 deg. C ambient temperature), shall be **Efficiency class-IE2**, conforming to IS 12615, or IEC:60034-30.
- c) Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement.

1.5.2 DC Motors Shunt wound.

1.6 VOLTAGE (NOMINAL)

1.6.1 LV Motors

For motors upto and including 200 KW - Four hundred fifteen (415) V.

1.6.2 MV MOTORS

For motors above 200kW upto and including 1500kW, Three point three (3.3) kV.

For CHP conveyors motor above 160 kW, 3.3 kV, AC supply is to be used. However all the motors on stacker reclaimer shall be on 415 V AC only.

1.6.3 HV Motors

For motors above 1500kW - eleven(11) KV

1.6.4 All motors are to be designed for system grounding described in "System Particulars" under site information of the Driven Equipment Specification.

1.7 FREQUENCY (NOMINAL) - fifty (50) Hertz

1.8 NUMBER OF PHASES - Three (3)

1.9 SPEED - As required by the driven equipment

1.10 TYPE OF STARTING :

Direct on-line (VFD/Soft-starter/star/delta starting in special cases)

1.11 DUTY

1.11.1 Continuous motor rating shall be arrived at considering 15% margin over the duty point input or 10% over the maximum demand of the driven equipment,

whichever is higher, considering highest system frequency and voltage variation. Crane motors shall be rated for S4 duty, 40% cyclic duration factor. If however, a higher margin is stipulated in the accompanying driven equipment specification, the higher stipulated margin shall prevail.

- 1.11.2 All HT motors shall have vibration pads for mounting vibration detectors.
- 1.11.3 All motors shall be designed to withstand hundred twenty (120) percent of rated speed without any mechanical damage for two (2) minutes.
- 1.11.4 Motors shall be designed to keep torsional and rotational natural frequencies of vibration of the motor and driven equipment atleast twenty five (25) percent above or below, preferably above the motor operating speed (to avoid resonance in vibration over the operating speed) range.
- 1.11.5 All LV motors rated 0.37kW and higher with S1 duty shall be compulsorily be of energy efficiency level IE 2 as per IS 12615:2011.
- Motors rated above 37kW shall have efficiency higher than 0.92 and high power factor of atleast 0.88.

1.12 **SUPPLY VARIATIONS**

Motors shall be capable of running continuously at full load under following variations in power supply:

- 1.12.1 All equipments shall be suitable for rated frequency of 50 Hz with a variation of (+) 3% and (-)5%, voltage variation of ($\pm$) 6% for 11 kV & 3.3 kV and ($\pm$)10% for 415V and 10% (absolute sum) combined variation of voltage and frequency unless specifically brought out in the specification.

1.13 **ABNORMAL CONDITIONS CAPABILITY**

Motor shall have following capabilities as specified design ambient temperature:

- 1.13.1 The motors shall also be capable of running up again after voltage collapse to about 40% for approximate duration of 0.5 sec. Subsequent rise in voltage to 70% and further to 80% and 100%, the total duration not exceeding 20 sec.
- 1.13.2 Low Voltage Running :
- Motor shall be capable of running satisfactorily at seventy five (75) percent nominal voltage for five (5) minutes.
- 1.13.3 Momentary Low Voltage Withstanding :
- Motor, when running at full load, shall not stall when voltage drops down to seventy (70) percent nominal voltage for one (1) minute.

1.14 **STARTING CAPABILITY**

- 1.14.1 Low Voltage Starting :

Motor shall be capable of starting and accelerating to full speed at full load (including loaded equipment e.g. mills and conveyors etc) at eighty (80)

percent nominal voltage at motor terminals. Mill motors may be permitted to start with terminal voltage not below 90%.

1.14.2 Cold Motor Starting Under specified voltage variations two (2) starts in quick succession and third start five (5) minutes thereafter, all with full load (including loaded equipment eg mills and conveyors etc) of driven equipment. No additional start will be made till lapse of further thirty (30) minutes.

1.14.3 Hot Motor Starting Under specified voltage variations, one (1) immediate and two (2) fifteen (15) minutes interval starts all with full load (including loaded equipment e.g. mills and conveyors etc) of driven equipment. No additional start will be made till lapse of further thirty (30) minutes.

1.14.4 Motor shall also be suitable for three (3) equally spread starts per hour when the motor is under normal service condition.

1.14.5 Break-away Starting Current Breakaway starting current as percent of full load current for various motor ratings shall not exceed the values given below:

1.14.5.1 Motors above 1500 KW upto 4000kW 600% without any positive tolerance except for ID Fan Motor.

1.14.5.2 Motors above 4000 KW 450%. Not subject to any positive tolerance.

1.14.5.3 For D.C. Motors the starting current shall be limited to 2 times full load current.

1.14.5.3 **Starting voltage requirement**

a) All Motors (except Mill Motors)

- 80% of rated voltage for Motors upto 4000 kW
- 75% of rated voltage for Motors above 4000 kW

b) For Mill Motors:

- 85% of rated voltage for Motors above 1000 kW
- 90% of rated voltage for Motors below 1000 kW

Except AOP & JOP motors running on D.G emergency supply, starting voltage shall be 80%.

1.14.5.4 **Starting Time**

1.14.5.4.1 For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.

1.14.5.4.2 For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.

1.14.5.4.3 For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.

1.14.5.5 Torque Requirements:-

- 1.14.5.5.1 Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10%. Motor full load torque.
- 1.14.5.5.2 Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty Motors.

1.15 SAFE STALL TIME

- 1.15.1 To avoid problem in selecting standard protective relays without using speed switches, safe stall time under hot conditions (corresponding to 110% nominal voltage at motor terminals) shall be more than the accelerating time (corresponding to 80% nominal voltage at motor terminals) by the following minimum values :
- 1.15.1.01 Two (2) seconds, where accelerating time (at 80% nominal voltage) does not exceed 20 seconds.
- 1.15.1.02 Three (3) seconds, where accelerating time (at 80% nominal voltage) exceeds 20 seconds.
- 1.15.1.03 At no stage, speed switch shall be provided to achieve the above requirements mentioned under Clause No. 1.14.5.4

1.16 CLASS OF INSULATION

- 1.16.1 LV Motors Class F.
- 1.16.2 MV & HV Motors Class F
- 1.16.03 However temperature rise shall be restricted to limits corresponding to Class 'B' insulation for both HT & LT motors. The temperature under abnormal running conditions shall be limited to 5°C above class 'B' limits.
- 1.16.04 The value of the polarization index for motors above 200kW should not be less than 2 when determined according to IS: 7816.
- 1.17 **TEMPERATURE RISE UNDER NORMAL CONDITIONS.....** Temperature rise over specified design ambient temperature when motor is running with full load at nominal supply voltage & frequency shall not exceed the values given below:

S.No.	Specified Design Ambient Temperature	Thermometer Method	Resistance Method
1.17.01	50°C	60°C	70°C
1.17.02	45°C	65°C	75°C
1.17.03	40°C	70°C	80°C

1.18 BUS TRANSFER WITHSTAND CAPABILITY

Motors will be connected to an automatic bus transfer system and hence may be subjected to one hundred and fifty (150) percent of the nominal voltage during changeover of buses due to the vector difference between the residual voltage and incoming supply voltage and the duration of this condition may be one second. Motors shall be capable of withstanding the voltage and torque stresses developed under such conditions without damage. The manufacturer/vendor shall indicate the special precautions taken to meet the above requirements and confirm.

- 1.18.01 That about 5000 bus transfers, in lifetime of motor, shall not puncture its insulation.
- 1.18.02 That motor shall be capable of withstanding heavy inrush transient current caused by such bus transfers without damage.
- 1.18.03 That the motor windings shall be adequately braced to satisfactorily withstand mechanical stresses under these conditions.
- 1.18.04 The motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torques under these conditions.

1.19 TYPE OF ENCLOSURE

- 1.19.01 Outdoor Motors IP 55 (Additional canopy to be provided by EPC contractor.
- 1.19.02 Indoor Motors IP 55
- 1.19.03 IP-55 degree of protection shall be achieved without application of any compound, putty etc.
- 1.19.04 Motor located in hazardous area shall have flameproof enclosure conforming to IS: 2148 /Equiv. as detailed below:
- a) Fuel Oil area : Group IIB
 - b) Hydrogen generation plant area : Group IIC (or Group-I, Div-II as per NEC or Class-1, Gr-B, Div-II as per NEMA/IEC60034).

1.20 METHOD OF COOLING

- 1.20.1 Method of cooling shall be IC 411 (TEFC), IC 511 (TETV) or IC 611 (CACA). However, motors rated 3000kW or above can be closed air circuit water cooled (CACW).
- 1.20.2 Large capacity motors not available with above types of cooling may be accepted with IC 81 W for IC 91 W (CACW) cooling subject to the approval of the Owner.

1.21 TYPE OF MOUNTING As required for the driven equipment.**1.21 MAXIMUM MECHANICAL VIBRATIONS**

- 1.21.01 Noise level for all the motors shall be limited to 85dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). Vibration shall be limited within the limits



prescribed in IS: 12075 / IEC 60034-14. Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.

1.21.02 Noise level

The noise level of motors shall not exceed 85 db (A) at 1m from operating motor measured in accordance with IS: 10265.

1.21.03 Motor body shall have two earthing points on opposite sides.

1.21.04 11 KV motors shall be offered with Separate Insulated Connector (Elastimould or Equivalent make) as per IEEE 386. The offered Elastimould terminations shall be provided with protective cover and trifurcating sleeves. Elastimould termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.

1.21.05 3.3 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Suitable termination kit shall be provided for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 MVA for 0.12 sec. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided.

1.21.06 The spacing between gland plate & centre of terminal stud shall be as per Table-I.

TABLE - I

DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS

Motor MCR in KW	Minimum distance between centre of stud and gland plate in mm
UP to 3 KW	As per manufacturer's practice.
Above 3 KW - upto 7 KW	85
Above 7 KW - upto 13 KW	115
Above 13 KW - upto 24 KW	167
Above 24 KW - upto 37 KW	196
Above 37 KW - upto 55 KW	249
Above 55 KW - upto 90 KW	277
Above 90 KW - upto 125 KW	331

Above 125 KW-upto 200 KW 203

For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.

1.21.07 All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.

1.21.08 For motors rated 1500 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.

1.21.09 The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) except for BFP motor.

(a)	Below 110KW	:	10.0
(b)	From 110 KW & upto 200 KW	:	9.0
(c)	Above 200 KW & upto 1000KW	:	10.0
(d)	From 1001KW & upto 4000KW	:	9.0
(e)	Above 4000KW	:	6 to 6.5

1.22 WINDING & INSULATION

- (a) Type : Non-hygroscopic, oil resistant, flame resistant
- (b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature.
- (c) 11kV & 3.3 kV : Thermal class 155 (F) insulation.
AC motors
The winding insulation process shall be total Vacuum Pressure Impregnated i.e resin poor method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15
- (d) 240VAC, 415V : Thermal Class(B) or better
AC & 220V
DC motors

1.23 DIRECTION OF ROTATION

1.23.1 As needed by driven equipment.

1.23.2 The 3 phase motor shall, however, be suitable for operation in both directions of rotation. A plate showing direction of rotation as determined by the phase sequence on the terminals marking shall be screwed at non-driving end of the body of the motor.

1.23.3 If, in the case of HT motors, fan is suitable for only one direction of rotation, the fan shall be so designed that with the slight modification work, it can be made suitable for other direction of rotation also. No extra material shall be required for doing above modification work.

1.24 BEARINGS



- 1.24.1 General Greased ball, roller and/or sleeve bearing shall be rated for minimum standard life of 20,000 hours taking bearing and driven equipment loads into account. Loss of grease shall be scarce and it shall not creep along shaft into motor housing.
- Bearing shall be effectively sealed against dust ingress and shall be pressure grease gun lubricated.
- If the bearings are oil lubricated, a drain plug shall be provided for draining residual oil and oil level gauge shall be provided to show precisely oil level required under standstill and running conditions.
- Unless otherwise approved, bearing lubricating system shall be such that no external forced oil or water is necessary to maintain required oil supply to keep bearing temperature within design limits.
- For MV & HV motors, the bearings shall be insulated wherever necessary to prevent damage to motor bearings from shaft current.
- When pressure oiling is required for horizontal motors, bearings shall be sleeve type arranged for pressure oiling supplied from lubrication system of driven machine, with ring oiling for starting and emergency duty. Ring oiling system shall be adequate for starting and continuous operation of motor for at least half an hour, without pressure oiling system in operation. Oil sight flow gauges shall be provided to indicate oil flow through each bearing.
- Lubricants shall be selected for prolonged storage and normal use of motors in tropical climate and shall contain corrosion and oxidation inhibitors. Greases shall have suitable bleeding characteristics to minimize setting. The selected lubricants shall be indigenously available.
- Sleeve bearings for use with motors having flexible coupling with limited end play, shall have adequate axial end play to prevent transmission of thrust from driven equipment to motor bearings.
- Bearings shall be of reputed make subject to the approval of the Owner/Consulting Engineer.
- 1.24.2 Large motors Large motors shall preferably have spherically seated babitted, ring forced, feed lubricated, water-cooled bearings. If anti-friction bearings are provided, these shall be roller bearings rated for a minimum standard life of 30000 hours taking all bearing and driven equipment loads into account.
- 1.25 **SHAFT EXTENSION** Key slotted bare shaft extension of required length with key on driving end.
- 1.26 **DRAIN HOLES** Two (2) drain holes with plugs, one (1) on either end of motor at the bottom most point.
- 1.27 **LIFTING DEVICES** Motors shall be provided with eyebolts, lugs or other means to facilitate safe lifting.
- 1.28 **DOWEL PINS**..... It shall be possible to drill holes vertically inclined through motor feet or mounting flange for installing dowel pins after assembling motor and driven equipment, before despatch (for completed driving + driven

equipment assembly) or at site after erection (for separate supplies of above equipment).

1.29 **CENTERING SPIGOT**..... Flange mounted motor shall have centering spigot to match driven equipment socket.

1.30 **EASE OF MAINTENANCE**..... Motor shall be so constructed that it can be de-assembled and reassembled with ease.

1.31 **NAMEPLATES**..... Motor shall have nameplate(s) showing diagram of connections, all particulars as per IS: 325 and following additional information:

In addition, an arrow block shall be screwed on to the body of motor on the non-driving end to indicate direction of rotation of motor.

1.31.1 Temperature rise under normal/abnormal conditions.

1.31.2 Type of bearing and recommended lubricants.

1.32 **FINISH**..... Motor shall have glossy, light grey finish No. 631 as per IS: 5 for withstanding site conditions as per Clause 1.00 above.

All sharp edges and scales shall be removed from the surface, which shall then be thoroughly degreased, de-rusted and given two (2) coats of primer and two (2) coats of finish paint. It is preferred that a phosphate coat is given to motor prior to application of primer coat. Motors for water treatment plant shall have Zinc Chromate base with acid resistant Epilex 4 paint.

1.33 **TERMINAL BOXES**

1.33.1 GeneralMotors shall be provided with separate terminal boxes for main, space heaters, embedded temperature detectors, bearing temperature indicators and moisture detectors terminals. When it is not possible to provide LT motors with separate terminal box for space heater terminals, space heater terminals shall be adequately segregated from the main terminals in the single box. Terminal boxes shall be weatherproof and water-tight confirming to minimum IP-55 degree of protection with removable front cover for making connections. IP-55 degree of protection shall be achieved without application of compound. Space between and around terminals shall be adequate for easily connecting aluminium conductor cables. Terminal box arrangement shall be to the approval of the Owner /Consulting Engineer. All terminal boxes shall be suitable for proper termination of the type and tentative size of cables specified in Clause 1.34 below, however, exact size of cables shall be furnished by Owner during engineering stage.

The terminal boxes shall be complete with cable glands and termination accessories as required. Suitable non-magnetic material construction shall be adopted for terminal boxes where single core cables are to be terminated. All HT motors shall be provided with phase segregated terminal box.

Terminal bushings and clamps shall be non-absorbent, non- inflammable, insulated material for connecting with cable.

1.33.2 **Main Terminal Box**



1.33.2.1 LV Motors Main terminal box shall be capable of being turned through 360 degrees in steps of 90 degrees.

1.33.2.2 MV & HV Motors Motor shall be provided with two (2) terminal boxes for stator terminals. One (1) terminal box shall be for phase terminals while other one for forming star connection. These should be interchangeable to facilitate cable routing.

Neutral terminal box for HT motors rated above 1500 KW shall be suitable for mounting of three (3) Nos. wound/bar primary/ring type cast resin insulated current transformers for differential protection. These transformers shall be supplied and mounted in the motor terminal box. In addition to above, 3 Nos. of identical current transformers shall be supplied loose for mounting in the switchgear. Stator phase terminal box may either be phase segregated or standard terminal box suitable for both top and bottom entry of cables (i.e. they should be capable of being turned through 180 Degrees). The terminal box shall be designed for termination of XLPE cables using heat shrinkable or push on type terminating Kit. Terminal leading shall be stud type or leading wire type.

1.33.2.3 Cable End Boxes.....Terminal Boxes shall be provided with cable end boxes having cable lugs and cable glands for cables of sizes as specified in Clause 1.34 below.

Cable box shall be suitable for glanding the cables; and shall have adequate space between cable glands terminating studs to allow suitable bends of cable inside the cable box for all 3 phases of relevant cable sizes specified.

1.33.2.4 The terminal boxes shall be capable of withstanding at the terminals the system fault level (as indicated below) without rupture for a duration of atleast 0.25 seconds.

Min. fault level for MV Motors - 40 KA

Min. fault level for LV & HV Motors - 50 KA

1.33.2.5 **PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:**

NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:

Motor MCR in KW	Clearance
UP to 110 KW	10mm
Above 110 KW and upto 150 KW	12.5mm
Above 150 KW	19mm

1.33.2.6 Terminal Accessories.....Each terminal end shall be furnished with bimetallic washers, spring washers, nuts and crimp type aluminium (preferably tinned) lugs suitable for cables of sizes as specified in Clause 1.34 below.

1.34 **TYPE AND SIZE OF CABLES**

1.34.1 **Space Heaters**



- 1.34.1.1 For LV Motors: Two point five (2.5) mm², two (2) core copper conductor PVC insulated, armoured and FRLS PVC sheathed heavy duty 650/1100 V grade cable to IS: 1554 (Part-I).
- 1.34.1.2 For MV & HV Motors: Six (6) mm² two core aluminium conductor PVC insulated armoured and FRLS PVC sheathed heavy duty 650/1100V grade cable to IS: 1554 (Part-I).
- 1.34.2 For Embedded Temperature Detectors two sets of six (6) Twisted triad 0.5 mm² ATC copper conductor armoured, shielded cable, 650/1100 V Grade IS: 1554 (Part-I). For bearing temperature, RTDS, two (2) sets of four (4) twisted triad 0.5 mm², ATC copper conductor armoured shielded 650/1100 V Grade, IS: 1554 (Part-I).
- 1.34.3 Bearing Temperature Indicators - For each indicator, 0.5 mm² six (6) tarnished triad ATC copper conductor, PVC insulated, shielded armoured and FRLS PVC sheathed heavy duty 650/1100 V grade cable as per IS: 1554 Part-I. Two (2) cables one (1) for each bearing temperature indicator.
- 1.34.4 For Moisture Detectors.....As for space heaters as per Clause 33.01.01 above.
- 1.34.5 **For Main Terminals**

LT Motors

1. Three (3) core cablesStranded aluminium conductor, XLPE insulated, colour coded, laid up, PVC sheathed, GI wire / strip armoured, FRLS PVC jacketed overall, 650 / 1100V grade, heavy-duty cables as per IS: 1554 (Part-I).
2. Single core cablesStranded aluminium conductor, XLPE insulated, hard drawn aluminium wire/ strip armoured FRLS PVC jacketed overall, 650 / 1100V grade, heavy duty cable as per IS: 1554 (Part-I).

HT Motors

1. Three (3) core cables stranded aluminium conductor, XLPE insulated, screened colour coded, laid up, PVC sheathed, GI wire/strip armoured FRLS PVC jacketed overall, 6.6 KV / 11 KV grade, heavy duty cables as per requirement for unearthed system as per IS: 7098 (Part-II).

The size and no. of cable to be intimated to the successful bidder during detailed engineering and the contractor shall provide terminal box, cable gland and lugs suitable for the same.

Cable size may be increased in some cases because of large number of cables in under-ground ducts or because of voltage drop consideration. The supplier shall supply with terminal box and cable accessories suitable for higher size of cable at no extra cost.

1.35 **EARTHING**

- 1.35.01 General..... Two (2) grounding terminals one (1) on either side at the bottom suitable for connecting mild steel/GI flat/GI wire grounding conductor, size of grounding conductor shall be decided during detailed engineering.



- 1.35.02 LV Motors.....At each earthing point, two (2) drilled and tapped holes with hexagonal head bolts, plain washers, spring washers and tinned lugs (for motors upto 5.5 KW) for size of conductor specified shall be provided.
- 1.35.03 MV & HV Motors.....Non-corrodible metallic grounding pad shall be welded or brazed at each earthing point. The size of grounding pad shall be 75x65x25 mm. Grounding pad shall have 40 mm apart two (2) drilled and tapped holes with hexagonal head bolts, plain washers and spring washers for size of conductor specified. In addition, one suitable earthing terminal shall be provided inside the stator phase terminal box for earthing metallic shield of XLPE cables.
- 1.36 **EMBEDDED TEMPERATURE DETECTORS**.....HT motor shall be provided with six (6) Nos. duplex resistance temperature detectors (RTDs) embedded in stator winding at locations where high temperatures are expected. In addition one (1) duplex type RTD shall be provided in each bearing. The RTDs shall be 3 wire duplex platinum resistance type having a value of 100 ohms at 0 Deg.C
- 1.37 **BEARINGS TEMPERATURE INDICATORS**..... HT motors shall be provided with dial type two (2) bearing temperature indicators and will have two (2) sets of contacts, each set having 2 NO + 2 NC contacts rated for 5A at 240V AC and 0.5A at 220V DC. One set will be set to operate at lower value to give alarm and other set at a higher value to trip the motor.
- 1.38 **SPACE HEATERS**.....Valve / Damper actuator motors; and Motors above 30 KW shall be provided with one (1) or two (2) space heaters suitable for 240V, 50 Hertz single phase AC supply and of adequate capacity to maintain motor internal temperature above dew point to prevent moisture condensation or deterioration of insulation during shut down. Heaters shall be mounted inside the motor in accessible locations so that their removal and replacement is simple. Motors upto 30 kW shall have stator windings suitable for connections to 24V, 50 Hz AC supply for space heating.
- Motors upto 30 kW shall have stator windings suitable for connection to 24V, 50 Hz ac supply for space heating
- The terminals of space heaters shall be brought out to a separate totally enclosed dust proof and weatherproof terminal box.
- 1.39 **HOT AIR TEMPERATURE DETECTOR**
- If the motor is of CACA or CACW enclosure, a thermometer with alarm contracts in hot air circuit shall be provided.
- 1.40 **WATER FLOW INDICATOR**
- If the motor is of CACW enclosure a provision shall be made for visual indication of water flow and flow switch shall also be provided with alarm contacts. Thermometers shall be provided in water inlet and outlet circuits.
- 1.41 **MOISTURE DETECTORS**.....Motors with type of cooling 1C 81W or 1C 91 W shall be provided with moisture detectors for raising alarm in the event of water tube failure.

- 1.42 **BED PLATE**.....Whenever motor is supplied with driven equipment the Supplier shall ensure that bed plate suits both motor and driven equipment and is adequately braced to keep vibration and misalignment within allowable limits to the approval of driven equipment and motor manufacturers.
- 1.43 **OTHER ACCESSORIES**..... Motor shall be supplied with all accessories and parts other than those, specified above which are necessary and/or useful for efficient operation.
- 1.44 **TYPE TEST**
- 1.44.01 **HT MOTORS**
- a) The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract.
 - b) The type tests shall be carried out in presence of the Purchaser's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the Purchaser's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.
 - c) In case the contractor has conducted such specified type test(s) within last five years as on the date of bid opening, he may submit during detailed engineering the type test reports to the Purchaser's for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The Purchaser's reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.
 - d) Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED" and carried out within last five years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last five years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the Purchaser's either at third party lab or in presence of client representative and submit the reports for approval.
 - e) **LIST OF TYPE TESTS TO BE CONDUCTED**

The following type tests shall be conducted on each type and rating of HT motor

- i) No load saturation and loss curves upto approximately 115% of rated voltage
- ii) Measurement of noise at no load.
- iii) Momentary excess torque test (subject to test bed constraint).
- iv) Full load test(subject to test bed constraint)
- v) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.

f) LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED

The following type test reports shall be submitted for each type and rating of HT motor

- i) Degree of protection test for the enclosure followed by IR, HV and no load run test.
- ii) Terminal box-fault level withstand test for each type of terminal box of HT motors only.
- iii) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15
- iv) Surge-withstand test on interturn insulation shall be as per clause no. 4.2 of IEC 60034, part-15

1.44.02

LT Motors

- a) LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Purchaser's approval the reports of all the type tests as listed in this specification and carried out within last five years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.
- b) However if the contractor is not able to submit report of the type test(s) conducted within last five years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the Purchaser's shall conduct all such tests under this contract at no additional cost to the Purchaser either at third party lab or in presence of client representative and submit the reports for approval.

1.44.03

LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED

1 x 660 MW – Panki Thermal Power Station

Bidding Doc. No. : 14A14-SPC-G-0001



The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only

- i) Measurement of resistance of windings of stator and wound rotor.
- ii) No load test at rated voltage to determine input current power and speed.
- iii) Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors)
- iv) Full load test to determine efficiency power factor and slip .
- v) Temperature rise test.
- vi) Momentary excess torque test.
- vii) High voltage test.
- viii) Test for vibration severity of motor.
- ix) Test for noise levels of motor(Shall be limited as per clause no 1.21.01 of this section)
- x) Test for degree of protection and
- xi) Over speed test.
- xii) Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1

1.44.04 All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

1.45 INFORMATION WITH PROPOSAL

1.45.1 AC Motor Data Sheet.

1.45.2 Dimension Drawing/Foundation load details of motor and driven equipment.
1.45.03 Manufacturer's catalogue showing constructional details.

1.46.00 **INFORMATION ON AWARD OF CONTRACT**.....Within six (6) weeks from the date of award of the Contract, following shall be furnished:

1.46.01 Motor Data Sheet.

1.46.02 Certified binding dimension drawing of motor complete with all accessories and fittings specifically showing terminal boxes, terminal spacing and sizes, earthing connections and sizes thereof, mounting details, lifting lugs, final foundation loads and dimensions with tolerances of centering spigot (where needed), shaft extension and key.

1.46.03 Following characteristics curves:

1.46.03.01 Torque-speed curves for motor at eighty (80), hundred (100) and hundred ten (110) percent rated voltage as well as torque-speed curve for driven equipment.

1.46.03.02 Current-speed curves at eight (80), hundred (100) and hundred ten (110) percent rated voltage

1.46.03.03 Current-time curves at eighty (80), hundred (100) and hundred ten (110) percent rated voltage.

1.46.03.04 Thermal withstand curves for hot and cold at eighty (80), hundred (100) and hundred ten (110) percent rated voltage.



- 1.46.03.05 Efficiency, power factor, current and speed versus power output curves.
- 1.46.03.06 Speed-time curves at eight (80), hundred (100) and hundred ten (110) percent rated voltage.
- 1.46.03.07 Negative phase sequence current withstand characteristics.

1.47 COMMISSIONING CHECK LIST (HT MOTORS)

A PRELIMINARY CHECKS

Check the following:

1. Check the name plate details according to specification. Discrepancies, if any, to be satisfactorily resolved.
2. Check tightness of all bolts, clamps and connecting terminals.
3. Check body earthing
4. Check whether bearing lubrication is adequate
5. Check clearance inside terminal box
6. Checking stator (motor air gap) Check – Grease lubrication (for ball or roller bearing) is adequate if the motor was in storage for very long period replace the grease, by fresh grease after flushing the bearing clean. Excess grease in the bearing (housing ... is overheat of bearings) Check the free rotation of the rotor in decoupled condition. Check the air gap between stator and rotor at four positions 90° apart at driving and non-driving end. Compare the recorded values with factory results. For slip ring motors : with starting resistances.
 - a) Check the variation of resistance
 - b) Check brush lifting and slip ring short.

B COMMISSIONING CHECKS

1. Meggar tests of motor winding and cables
2. Continuity check of motor windings control and power cables
3. Measure resistance of motor winding (in case of large motors)
4. Control and interlocks should be checked
5. Motor protection relay to be calibrated
6. Phase sequence and direction of rotation
7. Other than DOL scheme to be checked example trafo starts
9. Measure starting current starting timer and no load current
10. On load operations starting and running currents (observed vibrations, temperatures of bearings and body)
11. On load operation, starting and running currents (observed vibrations, temperatures of bearings and body)
12. In case of forced water cooling of start or check winding temperatures as ready by built in RTDs.
13. Water level (start up cooling) low to be checked for limit switch operation.

1.48 COMMISSIONING CHECK LIST (LT MOTORS)**A PRELIMINARY CHECKS**

Check the following:

1. Check the name plate details according to specification. Discrepancies, if any, to be satisfactorily resolved.
2. Check tightness of all bolts, clamps and connecting terminals.
3. Check body earthing
4. Check whether bearing lubrication is adequate
5. Check clearance inside terminal box

B COMMISSIONING CHECKS

1. Meggar tests of motor winding and cables
2. Continuity check of motor windings control and power cables
3. Over load and short circuit relay tests and settings
4. Control and interlocks should be checked
5. Phase sequence and direction of rotation
6. Operation of timer in case of star delta starting
7. Measure starting current starting timer and no load current
8. On load operations starting and running currents

1.49 DC MOTOR SPECIFICATION

DC Motor will be of continuous duty type totally enclosed fan cooled (TEFC) having IP-54 degree of protection suitable for 220 V DC supply. DC motor will be shunt wound type having high torque characteristic suitable for Bi-directional rotation at rated speed and output. The general constructional features and details of DC motor will be in line with details/ particulars stipulated in the specification for AC squirrel cage induction motors.

Contractor will furnish the data in respect of DC motors.

DATASHEET

	Auxiliary power supply	
1.1	HV supply	
	11kV, 3Φ, 3W, 50 Hz non effectively earthed	Motors rated above 1500 kW
	Fault level	50 kA for 1 second
1.2	MV supply	
	3.3kV, 3Φ, 3W, 50 Hz non effectively earthed	Motors above 200kW upto and including 1500kW
	Fault level	40 kA for 1 second
1.3	LV supply	
	415V, 3Φ, 3W, 50 Hz effectively earthed	Motors below and including 200kW
	Fault level	50kA for 1 second
	110V, 1Φ, 2W, 50 Hz effectively earthed	Lighting, space heating, AC control and protective devices
1.4	DC supply	
	220V, 2W, unearthed	DC alarm, control and protective devices.
	Fault level	25 kA for 1 second
2	Range of variation	As indicated in the specification
2.1	AC supply	
	voltage	-----
	Frequency	-----
	Combined voltage & frequency	-----
2.2	DC supply	198 to 240 V
Note: During starting of largest motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance.		



**TITLE : TECHNICAL SPECIFICATION
FOR
TRAVELLING BAND SCREENING SYSTEM**

SPEC. NO. PE-TS-426-172-N001

**SECTION : I
SUB-SECTION : IC**

REV. NO. 00 **DATE :** 04.06.2019

Sheet 1 of 1

**SECTION IC
SPECIFIC TECHNICAL REQUIREMENT
CONTROL & INSTRUMENTATION SYSTEMS**

**1x660 MW PANKI TPEP
TRAVELLING WATER SCREEN**

1.00	SYSTEM	TRAVELLING WATER SCREEN	
2.00	COMMON / PER UNIT	COMMON	
3.00	CONTROL SYSTEM	Standalone DDCMIS (Intake Pumps)	
3.10	PROCESSOR CONFIGURATION FOR PLC SYSTEM	NA	
4.00	LOCATION OF CONTROL SYSTEM	Intake water Pump House Control Room	
4.10	CONTROL SYSTEM SCOPE (BIDDER/ BHEL/ CUSTOMER)	BHEL	
5.00	HARDWIRED INTERFACE WITH DCS (Y/N)	NA	
5.10	PURPOSE OF HARDWIRED INTERFACE WITH DCS		
5.11	<i>a) COMMAND FROM DCS (Y/N)</i>	NA	
5.12	<i>b) STATUS FEEDBACK TO DCS (Y/N)</i>	NA	
5.13	<i>c) GROUP FAULT ALARM TO DCS (Y/N)</i>	NA	
6.00	SOFTLINK TO DCS (Y/N)	NA	
6.10	PURPOSE OF SOFTLINK TO DCS		
6.11	<i>a) COMMAND INTERFACE WITH DCS (Y/N)</i>	NA	
6.12	<i>b) STATUS MONITORING IN DCS (Y/N)</i>	NA	
7.00	PROTECTION CLASS FOR PLC / RIO PANEL	NA	
8.00	CONTROL FROM PB's ON LCP/OWS ON LCP	CONTROL FROM PB's ON LCP	
9.00	ANNUNCIATION ON LCP (Y/N) -- IF Y, MIN NO. OF HARDWIRED ALARMS / INDICATIONS	YES BIDDER TO PROPOSE MIN NO OF ALARMS/INDICATIONS	
9.10	MIMIC ON LCP (Y/N)	N	
10.00	CONTROL FROM DCS IN CCR (Y/N)	Y	
11.00	TYPE OF SOFTLINK (TP/OFC)	NA	
11.10	COMMUNICATION CABLE SCOPE (BIDDER/ PEM/ EDN/ CUSTOMER)	NA	
11.20	REDUNDANT CABLE (Y/N)	NA	
11.30	PROTOCOL	NA	
12.00	RIO / RPU (Y/N)	NA	
13.00	## NO. OF OWS / LAPTOP	NA	

**1x660 MW PANKI TPEP
TRAVELLING WATER SCREEN**

13.10	SIZE OF OWS/ CRT OR LCD	NA	
14.00	NO. OF PRINTER	NA	
14.10	PRINTER SIZE AND TYPE	NA	
15.00	\$\$ POWER SUPPLY AVAILABLE FOR BALL MONITOR (24V DC / 110 V AC UPS / 230 V AC UPS)	NA	
15.10	&& POWER SUPPLY AVAILABLE FOR PLC PANEL (3PHASE, 415 V AC/ 1PHASE, 110 V UPS/ 1PHASE, 230 V UPS)	415 V AC, 3 PHASE	
15.20	REDUNDANT FEEDERS (R) / NON-REDUNDANT (NR) FEEDERS FOR POWER SUPPLY	R	
15.30	UPS BATTERY CONFIGURATION (1X100% / 2X100%)	NA	
15.40	BATTERY TYPE (LEAD ACID/ Ni-Cd)	NA	
15.50	BATTERY BACK-UP TIME (in minutes)	NA	
16.00	ACTUATOR WITH INTEGRAL STARTER (Y/N)	Y	
17.00	PG/ DPG/ PS/ DPS/ PT/ DPT/LT for TWS	DPT=2 no. & DPG = 1 no(ACROSS EACH STRAINER) , ultrasonic LT (4 Nos.) for each screen and in addition other Instrument BOQ as finalised during detail engineering.	
18.00	REMARKS		
19.00	PROJECT SPECIFIC INFO		
	NOTES:		
1.00	OPERATION THROUGH HARDWIRED PUSH BUTTON MOUNTED ON LOCAL CONTROL PANEL SHALL BE PROVIDED.		
2.00	BIDDER TO TERMINATE ALL INSTRUMENTATION AND CONTROL ELEMENTS IN JUNCTION BOXES FOR FURTHER CABLING TO DCS BY BHEL/CUSTOMER. BIDDER TO PROVIDE INPUT/OUTPUT LIST, DRIVES LIST, JUNCTION BOX SCHEDULE AND TERMINATION DETAILS, RECOMMENDED CONTROL LOGICS / WRITE-UP ETC. DURING DETAILED ENGINEERING		
3.00	ALL THE INSTRUMENTS ALONG WITH NECESSARY FITTINGS, ACCESSORIES AND VALVE MANIFOLD ETC., INSTRUMENT RACK & JUNCTION BOXES, ERECTION HARDWARE SHALL BE IN BIDDER SCOPE OF SUPPLY.		
4.00	INSTRUMENT RACK AND JUNCTION BOXES SHALL BE IN BIDDER'S SCOPE OF SUPPLY.		
5.00	BIDDER TO FURNISH ELECTRICAL LOAD DATA DURING DETAILED ENGINEERING.		
6.00	ALARM FACIA SHALL BE UNDER BIDDER'S SCOPE. NO. OF FACIA SHALL BE DECIDED DURING DETAILED ENGINEERING.		
7.00	THE SCOPE OF CABLE SHALL BE REFERRED IN ELECTRICAL SCOPE SPLIT SHEET IN ELECTRICAL PORTION OF THE SPECIFICATION.		



Technical specification
for
1X660 MW TPS PANKI EXTN.

REV. NO.

00

DATE : 30.05.19

C&I SPECIFICATION

FOR

TRAVELLING WATER SCREEN



Technical specification
for
1X660 MW TPS PANKI EXTN.

REV. NO. 00 DATE 30.05.19

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Technical specification
for
1X660 MW TPS PANKI EXTN.

REV. NO.

00

DATE : 25.04.19

SECTION -C

SPECIFIC TECHNICAL REQUIREMENT

	1X660MW PANKI TPS EXTN.	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) TWS	
Specific Technical Requirements (C&I): 1. The Contractor shall provide complete Instrumentation for control, monitoring and operation of entire System. The requirements given are to be read in conjunction with detailed Technical specification. Further in case of any discrepancy in the requirement within the same section noted by the bidder in the specification, the same will be brought to the notice of BHEL in the form of pre bid clarification. In absence of any pre bid clarification, the more stringent requirement as per interpretation of customer shall prevail without any commercial and time implication. 2. The complete system, equipment, layout shall be designed as per the guidelines of explosive authority and other statutory authorities for the design and installation of the plant. All transmitters & electronics items including JB's will be explosion proof / intrinsically safe as per hazardous area classification. 3. The scope of C&I cable shall be referred in Electrical scope split sheet in Electrical portion of the specification. 4. All instruments shall be protected by cases. The cases shall have enclosure classification not less than IP 42 according to EN 60529 when mounted indoors in totally enclosed rooms with provision for limited ingress of dust, IP 54 else in an enclosed building and IP 55 for mounting outdoors. 5. All KKS tag nos. shall have prefix 10. 6. The quantity of instruments for the system shall be as per tender P & ID wherever provided of the respective system as a minimum, for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering if any additional instruments & items are required for safe & reliable operation of plant, bidder shall supply the same without any price implication. Instrument installation and required accessories shall be in bidder's scope. 7. Redundancy of sensors shall be provided, irrespective of instrumentation shown in the PID, by bidder as per sheet attached in the specification. (ANNEXURE 1)		

	1X660MW PANKI TPS EXTN.	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) TWS	
8. Contractor's C&I representative shall be present at BHEL-PEM for 3 man-days, for preparation of Control scheme. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope. 9. Contractor shall furnish Instrument Schedule, I/O list, Drive list, Cable Schedule, Cable interconnection (DCS end terminal details shall be provided to vendor during detail engineering to incorporate in cable interconnection), JB grouping, Annunciation list, SOE list, List of Instruments/devices for HART in BHEL approved format. Also reusable database format like MS Excel, MS Access etc. of these documents shall also be provided by Contractor in BHEL approved format. Soft copy of the formats shall be provided to the successful bidder. 10. For cable scope refer to electrical scope between BHEL and vendor defined in electrical specification. 11. Bidder shall provide Cable Schedule in BHEL excel format which shall be provided during detailed engineering. Also, Cable Interconnections for Complete System shall be in Bidders' scope. DCS side details for hardwired signals shall be furnished by BHEL during detailed engineering. 12. Interface of control panel, field instruments, actuators etc. with DCS based control system shall be as per Drive Control Philosophy enclosed in Section-D. 13. Electrical Actuators with integral starter shall be provided for all on/off and inching type valves along with necessary interface units for linking to corresponding Control System as applicable, typical Hook-up diagram of drives is included for reference. 14. MOVs (Motorized Valves) shall be integral type, if applicable. 15. Bidder to furnish electrical load/UPS load data during detailed engineering. 16. Non-UPS 240 V AC (supply feeder)/415 V, 3 phase, 4 wire AC supply shall be provided by BHEL based on the load data provided by the bidder at contract stage for all equipment supplied by the bidder as part of contract. Any other voltage level (AC/DC) required will be derived by the bidder. Bidder to include necessary power distribution board in his scope and all necessary hardware/software for the same shall be in bidder's scope. 17. Power supply derived for Transmitters, contact interrogation, interposing relay and solenoid shall generally be ungrounded 24V D.C only.		

	1X660MW PANKI TPS EXTN.	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) TWS	
18. The solenoid operated valves/Dampers/Gate shall have a limit switch for open/close feedback. Solenoid Valve shall be rated for 24V DC only. 19. Bidder shall provide starter panel for local start/ stop monitoring of auxiliaries and equipment along with status indications and alarms as per requirement. The requirement shall be decided during detailed engineering. 20. Local push buttons in the field shall be in Vendor's scope. 21. Local control panel if any required for operation shall be in bidder scope. 22. Bidder to supply all the instruments (PT, LT, DPG, LG and DPS etc.) required for the package along with necessary fittings, accessories and valve manifold etc. All instruments shall be provided with durable epoxy coating for housing and all exposed surfaces of the instruments. Instrument Installation along with hardware shall be in bidder scope. Double root valves shall be provided where pressure is above 40 Kg/cm². 23. All transmitters shall be smart type and shall have 4-20mA DC signal with superimposed digital communication (HART). Each Temperature element shall be complemented with temperature transmitters, compensating cable, JB/rack & other erection hardware. All transmitters shall be fitted with a local analog/digital indicator displaying appropriate physical units which may be read clearly from an easily accessible position. 24. Use of process actuated switches shall be avoided unless Unavoidable. 25. All instruments and control elements shall be terminated on JB/LCP in field and both instrument and JB/LCP are in bidder scope. Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 12-15 mtrs) and trunk cable. 26. Instrument installation and accessories required for the same shall be in Bidder's scope and shall be submitted after award of contract. However, any instrument/ analyser installation not covered in the same shall be subject to customer and BHEL approval during detailed engineering. 27. DP instruments with minimum Capillary length of 15m is to be supplied. 28. All Temperature sensors shall be Duplex type and temperature transmitter shall be provided for all temperature measurement applications.		

	1X660MW PANKI TPS EXTN.	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) TWS	
29. All field instruments enclosure shall be IP65 local panel/cabinet enclosure shall be IP 55, unless otherwise specified. 30. All the outdoor field instruments such as analysers/transmitters/meters etc. shall be provided with suitable Free standing cabinet(s)/panel/rack so that the equipments are protected against rain/ sunlight etc. 31. The junction boxes/LIEs for termination of instruments are in bidder's scope. 32. The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial/ time implication in this regard shall be acceptable. In case of any conflict or repetition of clauses in the specification, the more stringent requirements among them are to be complied with. 33. The make of all the items shall be from approved sub-vendor list. 34. Provision for separate Terminal block/wiring diagram for power and control blocks of control panel to be ensured. 35. All Instruments must have separate tapping lines. Sharing of the same tapping pipe for redundant instruments or various different instruments is not acceptable. 36. As a general rule, measuring points and measuring equipment for critical protection shall be separate from and not combined with measuring equipment for the automatic control equipment. 37. Electronic instruments shall not be located close to hot lines, vessels or other hot equipment. Ambient temperatures exceeding 80 °C shall not result in calibration difficulties or rapid deterioration of electronic components. 38. All the instruments/equipment/electrical items shall be provided & designed with maximum star rating in line with energy conservation policies as per latest international standards at the time of supply. 39. Bidder to note that all the transmitters/instruments supplied by Bidder shall be rack mounted. The racks shall be preassembled and provided by Bidder. Also no Instruments/ analysers & JBs/Racks should be protruding on the walkway. 40. All field instruments shall be terminated on Junction box/Local control panel in field. All the instruments along with necessary fittings, accessories and valve manifold etc., erection hardware including racks, junction boxes,		

	1X660MW PANKI TPS EXTN.	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) TWS	
canopies, structural steel, LIE, LIR, actuator limit switches etc.as required shall be in vendor's scope of supply. 41. Bidder to provide erection hardware including canopies, structural steel as required. 42. Bidder to perform tests of C&I items/instruments/systems as per quality plans/type test attached in the specification. 43. Every panel-mounted instrument, requiring power supply, shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus. 44. Each valve/instrument shall be fitted with a stainless steel or aluminum nameplate indicating the valve/instrument service and reference number in accordance with the approved equipment coding system. 45. Provision for separate Terminal block/wiring diagram for power and control blocks of control panel to be ensured. 46. Mandatory spares have to be supplied by bidder as mentioned in the specification. 47. The design, manufacture, inspection, testing, site calibration and installation of all C&I equipment and systems covered under this specification shall conform to the latest editions of applicable codes and standards eg. ANSI, ASME, IEEE, ISO, IEC, IGCI, AWS, NFPA, AISC, IGS, SAMA, UBC, UL, NESC, NEMA, ISA, DIN, VDE, IS etc. 48. The specifications for instruments mentioned in the specification are minimum requirements. Datasheets of instrument shall be subject to customer/owner approval. 49. All approval/Inspection are to be carried out by Owner or owner appointed agency only. 50. Drawings/Documents and data to be furnished after award of the contract shall be in line with MDL furnished elsewhere in the specification. 51. Mandatory spare list as per 'List of mandatory spares' attached elsewhere in the specification is in vendor's scope.		

	1X660MW PANKI TPS EXTN.	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) TWS	
52. Editable & pdf copy of Drawings/Documents and data to be furnished after award of the contract: • GA & wiring diagram of local panel. • Local control panel & instruments data sheet. • Any other document decided during detailed engineering. Note: - 1. All equipment items shall be of latest design with proven on track record from reputed experienced manufacturers of specified type and range of equipment. The make/model of various instruments/items/systems and instrument sub-vendor shall be subject to approval of BHEL/Customer during detailed engineering stage. 2. The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL. 3. Documents of C&I System shall be submitted to end user/owner for approval during detail engineering. Changes, if any, shall be accommodated by the bidder without any price/time implication. 4. Uniformity of make and type of instruments and control components shall be followed throughout for rationalization of spares' inventory, except for certain proprietary items where this requirement cannot be met. 5. In case of any discrepancy in Section-C and Section-D of the specification, Section-C shall prevail.		

ANNEXURE - 1**(g) Redundancy requirements****i Triple Redundancy**

Triple Sensing device shall be provided for following applications:-

- a. **For** Binary and analog inputs required for protection of boiler, turbine and major auxiliaries of main plant whose non-availability may result in 50% loss of unit availability and loss of generation.
- b. Binary and analog inputs, which are, required for protection of more than one equipment as well as protection signals for important auxiliaries and HT Drives of main plant (fed by a supply feeder of ratings 3.3 kV onwards)/MDBP/TDBFP etc.,
- c. Separate triple sensors for Instruments required for auto starting of HT driven pumps or HT driven pump tripping due to very low level of water & discharge pressure very low.
- d. For binary and analog inputs which are also required for protection in addition to CLCS. The same shall include but not limited to the critical measurement used for following CLCS :-
Furnace draft, main steam and reheat steam temperatures, feed-water flow, throttle pressure, turbine first stage pressure, separator level, LPH and HPH level, deaerator level, hotwell level, CEP minimum recirculation, BFP minimum recirculation etc.
- e. For lube oil protection of all the HT drives, 2 out of 3 logics and necessary pressure transmitters for lube oil pressure shall be provided by bidder accordingly. However for bearing / winding temperature of HT motor, refer Electrical subsections, Vol. IV.
- f. Left and right side shall be treated as individual path / individual parameter, and each side/path shall have own triple redundancy accordingly.

ii Dual Redundancy

Dual Sensing device shall be provided for following applications:

- a. For binary and analog inputs required for all other closed loop control system (CLCS), protection and interlock conditions purpose of other equipments.
- b. For Instruments required for auto starting of LT driven pumps or LT driven pump tripping due to very low level of water/discharge pressure very low.
- c. Dual redundant position transmitters shall be provided for Steam Admission Valves i.e. (Emergency Stop & Control Valves, Reheat Stop Valves & Control valves), Extraction steam QCNRV, CRH NRV.
- d. For instruments required for Heat rate measurements & PADO calculations.

- iii. For binary and analog inputs used for alarm and monitoring only, single sensor criteria shall be applicable.



**TITLE : TECHNICAL SPECIFICATION
FOR
TRAVELLING BAND SCREENING SYSTEM**

SPEC. NO. PE-TS-426-172-N001

**SECTION : I
SUB-SECTION : ID**

REV. NO. 00 **DATE :** 04.06.2019

Sheet 1 of 1

**SECTION ID
DATA SHEET – A**

	TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM TECHNICAL DATA SHEET- A		SPEC NO: PE-TS-426-172-N001
			SECTION : ID
			REV.NO: 0 DATE: 04/06/19
S.no.	Description	Units	Data/Parameters
1	General		
1.1	Nos. of Traveling Band screening systems sets required	Nos.	2 Nos. for station
1.2	Nos. of Spray wash pumps common for all TBS	Nos.	2 Nos. (1 Working + 1 Standby)
1.3	Liquid handled		River water (Analysis attached)
1.4	Type of Travelling Band Screen		Central Flow / Dual Flow / Single Flow
1.5	No. of speed levels for the TBS		Dual Speed
1.6	Hydraulic /Fluid coupling		Required
1.7	Drive Mechanism Safety Devices		Required (Type details : As per Manufacturer standard)
2	Site Data		
2.1	FGL of the Site	m	EL (-) 0.5 M
2.2	Elevation of the TBS Operating Floor	m	EL (+) 0.0 M
2.3	Invert level of the Intake canal at TBS Inlet	m	EL (-) 7.28 M
2.4	Min. W.L. at upstream of TBS	m	EL (-) 4.28 M
2.5	Max. W.L. at upstream of TBS	m	EL (-) 1.68 M
2.6	Clearance between bars of coarse bar screens at upstream of TBS (BAR screen is Not in Bidder scope)	mm	50
2.8	Maximum Chamber length (Excluding end walls) & width for the TBS		2000 mm X 1600 mm
2.9	Design Mechanical temperature	Deg. Cel.	50
2.10	Spray wash/Flushing water source		Raw water Intake pump Discharge at Downstream of TBS
2.11	Pressure available at Tap off from discharge of purchaser's pump	mwc	10 to 13 MWC (g)
2.12	Max. Limit on shut off head of purchasers pump"	mwc	22 MWC (g)
2.13	Location of TBS		Outdoor
3	Design Data		
3.1	Flow rate per stream		
-	Design/Normal	cum/hr	2850
-	Maximum	cum/hr	3710
3.2	No. of Speed levels of TBS		By Bidder (Minimum 2)
3.3	Protection Mechanism for Differential level $\geq$ Design Differential		Required (Type details : As per Manufacturer standard)
3.4	Travelling Band Screen clear opening	mm ²	10 mm X 10 mm
3.5	Screen wire mesh size (Diameter)	mm	2 (Minimum)
3.6	Maximum water velocity through screen at min. WL	m/sec	0.15
3.7	Design differential head for Travelling Band screens	MWC	1.5
3.8	Maximum head loss permitted across TBS (i.e. between inlet and outlet) in clean condition at Min WL	MWC	0.1
3.9	Screen backwashing/flushing start "ON" Slow speed head loss across TBS	MWC	0.2
3.10	Screen backwashing/flushing start at fast speed	MWC	0.35
3.11	Corrosion Protection system		YES, with Sacrificial anode type Cathodic protection by Bidder. (Calculation for same to be furnished during contract stage for approval)
3.12	Service Factor for Gear Box		2 (minimum)
3.13	The velocities for Calculating the inside diameters shall be limited to		At Pump Suction: 1.8 m/sec At Pump Discharge and Headers: 2.4 m/sec
4	Spray Wash/Flushing system		
4.1	Spray wash/flushing water Piping		
	a) Material		a) Up to 150 Nb - Carbon steel ERW, IS:1239 (Heavy Grade). b) 200 Nb and above - CS to IS 2062 Gr. B, rolled & butt welded, conforming to IS 3589
	b) O.D.Xthickness of Stub at Terminal Point	mmXmm	219.1 X 6.35
4.2	Motor Rating of Spray Wash pump		Continuous motor rating (at 50 deg. C ambient) shall be 15% above the maximum power requirement at any condition of the entire characteristic curve of the pump.

	TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM TECHNICAL DATA SHEET- A		SPEC NO: PE-TS-426-172-N001
			SECTION : ID
			REV.NO: 0 DATE: 04/06/19
S.no.	Description	Units	Data/Parameters
5	Self Cleaning Strainer		
5.1	Screen perforation size	mm	1.1 mm (Max.) & less than spray Nozzle hole
5.2	Free flow area in the Screen basket		Minimum 110 % of Pipe Inlet Area
6	Debris Segregation and collection baskets		
6.1	Quantity	Nos.	2 (viz. 1 No. for each TBS)
6.2	Size(Preferable) - L x B x H	MxMxM	1 X 1 X 0.75
6.3	Discharge mechanism for emptying the basket		Lever operated bottom mechanism
6.4	Type of arrangement for handling by Gantry crane provided		YES, By Purchaser (6 Ton capacity with crane hook level EL(+) 6.0 M)
6.5	Basket frame plate thickness	mm	Min. 6
6.6	Wire Mesh size dia	mm	Min. 5
6.7	Guide Ways		
6.7.1	Number (For each TBS)	Nos.	4
6.7.2	Type		Embedded in wall
7	Guide ways section		
7.1	Cathodic Protection to be provided against corrosion		YES, with Sacrificial anode type Cathodic protection by Bidder. (Calculation for same to be furnished during contract stage for approval)
7.2	Fixing method of guide ways to be supplied by Bidder		YES, By Bidder
8	Control and Instrumentation		
8.1	Control Panel		N.A. (DDCMS control). Only Starter cum Switchgear Panel to be provided by Bidder as per Section IC
8.2	Differential Level Switch		1 no. per stream
8.3	Differential Level Transmitters		2 no. per stream
8.4	Pressure Transmitters		
8.4.1	Spray wash Suction Header		1 no . Common for all the pumps
8.4.2	Spray wash Discharge Header		1 no . Common for all the pumps
8.5	Pressure Gauges		
8.5.1	Spray wash individual suction line		1 no for each pump
8.5.2	Spray wash individual discharge line		1 no for each pump
8.6	Differential Pressure Very High Switch		NA
8.7	Differential Pressure Transmitters		2 nos . Per SCS
8.8	Differential Pressure Gauge		1 no . Per SCS
8.9	Limit Switches		1 No . Per suction valve (OPEN) of TBS Spray wash pumps
8.10	Pressure switch		NA
9	Operation		
9.1	Travelling Band Screening sysetm shall be designed for the following operation modes:		
9.1.1	Automatic start up initiated by High differential level		YES
9.1.2	Automatic start-up initiated by timer.		YES
9.1.3	Manual mode of operation		YES
9.1.4	Provision for manual operation of the Travelling band shall be made in case of control system failure.		YES
10	Spray wash/Flushing system/Self Cleaning Strainer		
10.1	Spray wash pumps		Applicable
10.1.1	No. of Spray wash pumps	Nos.	2 Nos. (1 W + 1 S)
10.2	No. of Self Cleaning Strainer	Nos.	2 Nos. (1 W + 1 S)
10.3	Whether Inserts/embedments/packers for Spray wash pumps/distributors and nozzles being supplied.		YES, By Bidder
10.4	Hydrostatic Test		
10.4.1	Hydrostatic test pressure for Spray wash/ flushing system/Self Cleaning Strainer	Bar (g)	Refer Section IIA
10.4.2	Test duration	Min	Refer Section IIA
11.0	Painting		
11.1	Surface preparation		Refer Section IIA
11.2	Primer coating thickness		Refer Section IIA
11.3	Finish coating thickness		Refer Section IIA
12.0	Materials of Construction		
12.1	Screen Wire mesh		SS-304
12.2	Clamping Plates/Clamps		SS-304
12.3	Basket frame and wire damping bars		CS to IS 2062 Gr. B
12.4	Fasteners		CS to IS 2062 Gr. B
12.5	Head Shaft		CS to IS 2062 Gr. B

	TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM TECHNICAL DATA SHEET- A		SPEC NO: PE-TS-426-172-N001
			SECTION : ID
			REV.NO: 0 DATE: 04/06/19
S.no.	Description	Units	Data/Parameters
12.6	Foot Shaft (if applicable)		CS to IS 2062 Gr. B
12.7	Head/Foot Sprockets		CS to IS 2062 Gr. B
12.8	Carrying chain		CS to IS 2062 Gr. B
12.9	Rubber Seals		As per Appendix-B of IS-4622
12.10	Carrying chain & rollers		
12.10.1	Carrying Chain pins,&Bushing		SS-304
12.10.2	Drive Chain type		SS-304
12.10.3	Drive chain pin/Bushing		SS-304 for Pin SS 420 Hardened to at least 450 BHN for Bush or vice versa
12.10.4	Shaft bearing Bushing spherical roller		SS-304
12.10.5	Sprocket		SS-304
12.10.6	Torque tube		SS-304
12.10.7	Main supporting frame		SS-304
12.10.8	Screen chain side bars		SS-304
12.10.9	Drive Chain guard		SS-304
12.10.10	Baffle plate in boot section		SS-304
12.10.11	Guide ways / Anchor		SS-304
12.10.12	Splash housing and refuse chute		MOULDED FIBRE GLASS/ SS-304/ Equivalent or superior
12.10.13	Basket frame		SS-304/ Equivalent or superior
12.11	Pipe & Nozzles		
12.11.1	Spray nozzle		SS-304/ PVC
12.11.2	Pipe work		
12.11.2.1	Upto 50 NB		SS-304
12.11.2.2	above 50 NB		SS-304
12.12	Valves		
12.12.1	Valve 400 NB and above (Butterfly Valves only)		
12.12.1.1	Body & Disc		ASTM A48, Gr. 40 With 2% Ni / IS 210,Gr. FG 260 With 2% Ni and epoxy coated
12.12.1.2	Shaft		BS 970 431 S: 291 / EN 57, or AISI-410 or AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better
12.12.1.3	Seat Ring		18-8 Stainles steel
12.12.1.4	Bearings		Sleeve Type Self Lubricated
12.12.1.5	Seal		Nitrile rubber
12.12.1.6	Gland packing		Poly Tetra Fluoro Ethylene (PTFE) or eq.
12.12.2	Valve 350 NB and Below (Gate/Globe Valves only)		
12.12.2.1	Body, Bonnet		ASTM A 216, Gr WCB / ASTM A 105
12.12.3	Trim		ASTM A 182 Gr F6 or eq
12.12.3	Check Valves		
12.12.3.1	Body & Bonnet		ASTM A 216, Gr WCB / ASTM A 105
12.12.3.2	Seating surface &stem		ASTM A 182 Gr F6 or eq
12.12.3.3	Disc		ASTM A 216, Gr WCB / ASTM A 105
12.13	Spray Wash pump		
12.13.1	Spray Wash pump Casing		2.0 % Ni Cl to IS 210 Gr. FG 260
12.13.2	Spray Wash pump impeller		ASTM-A-351 CF 8M
12.13.3	Spray Wash pump Shaft		SS-410
12.13.4	Spray Wash pump shaft sleeve		SS-316
12.13.5	Screen wash pump Base frame		IS 2062 Gr. B. with Epoxy coating
12.13.6	All hardware under water		SS-304
12.13.7	Material of Gland Packing /Mechanical Seal (If applicable)		AS PER MANUFACTURER PRACTICE
12.14	Debris Segregation and collection baskets		

	TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM TECHNICAL DATA SHEET- A		SPEC NO: PE-TS-426-172-N001
			SECTION : ID
			REV.NO: 0 DATE: 04/06/19
S.no.	Description	Units	Data/Parameters
12.14.1	Frame		CS to IS 2062 epoxy painted inside.
12.14.2	Wire Mesh		SS-316
12.14.3	Flanges		CS to IS 2062 epoxy painted inside.
12.15	Self Cleaning Strainer		
12.15.1	Body/Housing/Flange		CS to IS 2062 epoxy painted inside.
12.15.2	Screen / Internals		SS-316
12.16	All Fastners		SS-316
13.0	MANDATORY SPARES		AS PER ANNEXURE-A OF THIS DATASHEET
	NOTE: The material of construction of each component of the Travelling Band Screen shall be such as to resist corrosion/ erosion and give a long and satisfactory life for plant. MOC indicated above is minimum requirement and Bidder to provide suitable MOC for various components for the attached water analysis. For components not mentioned above, suitable compatible MOC shall be provided for the attached water analysis, same shall be subject to BHEL/End customer/consultant approval during detail engineering stage.		

Mandatory Spares For TWS

SI nos.	Item Description	UNIT	QTY
1	Measuring Instruments		
1.1	Temperature Transmitters and Electronic Transmitters of all type, range and model no. (For Pressure, DP, Temp, Flow, Level), Process Transmitters, Radar type level transmitter, 3D type level Transmitter with local display, Magnetic/Electromagnetic flow meter with local display, mass flow meter with local display., Process meters, Junction Box, Position Transmitter, Transducer or any other instrument etc.	Nos.	10% of total number of instruments/ transducers offered for each model and type, rating or a minimum of one number for each model, rating and type , whichever is more
1.2	Differential pressure Switches	Nos.	5% of total nos. or 1 no. of each make, model, range and type whichever is more
1.3	Pressure switches	Nos.	5% of total nos. or 1 no. of each make, model, range and type whichever is more
1.4	Flow switches	Nos.	5% of total nos. or 1 no. of each make, model, range and type whichever is more
1.5	Level Switches	Nos.	5% of total nos. or 1 no. of each make, model, range and type whichever is more
1.6	Local Gauges like temperature gauges, pressure gauges, differential Pressure gauges, flow gauges, flow meters with local display etc.	Nos.	10% of total number of instruments/ transducers offered for each model and type, rating or a minimum of one number for each model, rating and type , whichever is more.
2	415 V Motors		
2.1	Terminal plates	Nos.	10 Nos. each for small motors upto 30 kW & 4 Nos. each for more than 30 kW
2.2	Heaters	Sets	2 sets
2.3	Greasing arrangements	Sets	4 sets each type of motor
2.4	Motor of each type and rating	nos.	10% of the installed quantity or minimum 1 number whichever be higher
2.5	Bearings (DE and NDE) for each type and rating of motors.	sets	4 sets
2.6	Stator winding coils for all type of LT motors	sets	One (1) set
2.7	Dust seals and gaskets for each type of motors	sets	Three (3) sets
Note			
1. *List of Measuring Instruments as specified with individual system/ sub-system shall be applicable for the respective system. Spare list of measuring Instruments will be governed by this clause, for syslem/sub-system which are not mentioned/specified exclusively in the list of spares.			
2. Spares not applicable for the Package to be specifically quoted as “NOT APPLICABLE”.			
3. In case if such items of spares indicated as “not applicable” by bidder in its offer, are found applicable at a later date during execution of the project, such items of spares are to be supplied within the ordered cost of the mandatory spares.			
4. Wherever % is indicated for the mandatory spares, the quantity shall be calculated for % of supply for total quantity for station, unless otherwise specified. The quantity to be reckoned for % indicated shall be rounded off to the next higher whole number. For example if the % arrived is 0.2 the quantity to be supplied shall be 1 and if the % arrived is 5.1 the quantity to be supplied shall be 6.			
5. In respect of quantity mentioned as 'Set' means the total quantity of all the components/items used in particular equipment unless otherwise specified.			

ANNEXURE- I

RAW WATER ANALYSIS –UPSTREAM / DOWNSTREAM OF GANGA CANAL

S. No.	Description	Unit	Parameter
1	Physical characteristics		
	pH at 25°C	-	8.00
	Turbidity	Silica Scale	500
	Total Suspended solids	ppm	250
	Total Dissolved solids	ppm	241
	Colour	Hazen	< 5
2	Cations		
	Calcium Hardness	ppm as CaCO ₃	80
	Magnesium Hardness	ppm as CaCO ₃	40
	Sodium + Potassium	ppm as CaCO ₃	36
	Iron	ppm as CaCO ₃	1.5
	Total Cations	ppm as CaCO ₃	157.5
3	Anions		
	Bicarbonate	ppm as CaCO ₃	100
	Carbonate	ppm as CaCO ₃	0.95
	Hydroxyl	ppm as CaCO ₃	0.05
	Chlorides	ppm as CaCO ₃	20
	Sulphate	ppm as CaCO ₃	36
	Nitrate	ppm as CaCO ₃	0.5
	Total Anions	ppm as CaCO ₃	157.5
4	Carbon Di-oxide as CO ₂	ppm	1.97
5	Dissolved Silica	ppm as SiO ₂	10.0
6	Colloidal Silica	ppm as SiO ₂	0.5
7	Organic Matter	ppm as O ₂	4.0

The DM Plant shall be designed considering the following chemical dosing rates :-

NON FERRIC ALUM - 60 ppm (max)

LIME - 25 ppm (max)

POLYELETROLYTE - 2 ppm (max)

CHLORINE - 5 ppm (Max.)



1 x 660 MW - Panki Thermal Power Station

Bidding Doc. No. : 14A14-SPC-G-0001





**TITLE : TECHNICAL SPECIFICATION
FOR
TRAVELLING BAND SCREENING SYSTEM**

SPEC. NO. PE-TS-426-172-N001

**SECTION : II
SUB-SECTION : IIA**

REV. NO. 00 **DATE :** 04.06.2019

Sheet 1 of 1

**SECTION IIA
STANDARD TECHNICAL REQUIREMENT
FOR
MECHANICAL SYSTEMS**

	TITLE : STANDARD TECHNICAL SPECIFICATION TRAVELLING BAND SCREENING SYSTEM	SPECIFICATION NO. PE-TS-999-165-N004	
		SECTION : II A	
		REV. NO. 01	DATE : 14.06.16
		SHEET 1 OF 12	

1. GENERAL

This specification covers the design, performance and operational requirements, configuration and constructional features, manufacture, assembly, inspection and testing at the manufacturer's and/or his sub-contractor's works and painting for delivery of Travelling Band Screening System complete with all accessories as specified hereinafter.

2. CODES AND STANDARD

2.1. The design, manufacture and performance of travelling water screens and accessories shall comply with all currently applicable statutes, regulation and safety codes in the locality where the system will be installed. The equipment shall also conform to the latest applicable codes / standards. Nothing in this specification shall be construed to relieve the vender of this responsibility.

2.2. The design, materials, manufacture, inspection and testing of the travelling band screening system complete with all accessories, shall comply with the requirements of the latest versions of the following appropriate codes and standards.

2.2.1. IS/BS/DIN/US Standards regarding pumps, piping, flanges and others as necessary.

2.2.2. IS/BS/DIN/ASTM Standards for materials specification and testing procedures.

2.2.3. IS/BS/DIN/AWWA Standards for valves and the testing.

2.2.4. In case of any conflict between the above codes/standards and this specification, the later shall prevail and in case of any further conflict in the matter, the interpretation of the specification by the Engineer shall be final and binding.

3. DESIGN

Unless otherwise necessary, manufacturer's standard and proven models of the Travelling Band Screening System shall be supplied. The Travelling Band Screening System shall be capable of safe, continuous and trouble-free operation under all prevailing climatic and load conditions, for removal of floating and suspended matter coming along with the Raw Water intake coming from the Raw water source, before the Pumps. Vibration, noise, mechanical stresses shall be kept within allowable limits specified by relevant codes/standards. In design, due attention shall be given to ease of maintenance, repair and cleaning. Suitable corrosion allowance shall be provided whenever necessary. The Travelling Band Screening System shall consist of Travelling Band Screens, Spray wash/flushing pumps, differential level measuring system, instrumentations, control panel, interconnecting cables and others as necessary. The configuration of the Travelling Band Screening System shall be as specified in Data Sheet-A. Each travelling screen unit shall consist of appropriate quantity of screening elements arranged in a series to form an endless arrangement and fastened to two parallel vertical strands of chains. Material of construction shall be suitably selected to prevent Galvanic corrosion between various components.

3.1. The provision for sacrificial anode for corrosion protection shall be made for future use as specified in the Data sheet-A.

4. CONSTRUCTION FEATURES

4.1. **Main Frame**

4.1.1. The main frame of the screens shall be of rugged construction from structural material as mentioned in Data Sheet-A, not less than 10 mm thick.

4.1.2. All the members of the main frame shall be able to withstand the full hydraulic thrust on the upstream side when the screen becomes choked.

	TITLE : STANDARD TECHNICAL SPECIFICATION TRAVELLING BAND SCREENING SYSTEM	SPECIFICATION NO. PE-TS-999-165-N004	
		SECTION : II A	
		REV. NO. 01	DATE : 14.06.16
		SHEET 2 OF 12	
4.1.3. The main frames, sprocket shaft assemblies, bearings and all components of the drive system (except the shear pin. If provided) shall be designed to resist all forces without damage resulting from the full breakdown torque of the motor while the screen is jammed at any point in its travel. 4.1.4. Suitable guides shall be furnished for both sides of the screen frames so as to set in guideways on the sump pit walls. 4.1.5. Guide shall be continuous so that no open space exists for entrance of refuse between the screen frame and pit walls. 4.1.6. The guides shall prevent the front or ascending side of the chain from weaving. 4.1.7. The construction shall be such that no open space is left between the traveling screening media and the screen frame except the minimum running clearance required for satisfactory operation. 4.1.8. The main frame shall have a suitable provision for lifting the screen from the deck by means of an monorail hoist for erection and maintenance. Tension on the carrier chains shall be adjustable from accessible location near the head shaft by means of take-up screws made of stainless steel. 4.2. Screening Elements 4.2.1. The screening elements shall be constructed to offer minimum practical obstruction to free passage of water within the width of screen. 4.2.2. The screening elements shall have frames of welded steel construction provided with curved end plates/shrouds or any other suitable mechanism to provide sealing between adjacent screening elements and screening elements & the travelling band screen boots and frames, so as to stop the ingress of floating/suspended matter above guaranteed particle size as mentioned in the Data Sheet-A. 4.2.3. The screening materials shall be attached to the screen basket frames in a manner which provides easy replacement of screens without projecting bolting of clamping bars on the inlet side of the screen unit. 4.2.4. The min. size of the screening element wire and its material of construction mesh shall be as per Data Sheet-A. 4.3. Carrying Roller Chains 4.3.1. The screen chains to which the screening elements shall be fastened shall be made with side bars pins, bushings and rollers, with materials as per Data Sheet-A. The chain pitch shall be equal to the screening element's spacing. 4.3.2. The rollers shall be of high quality rust resistant material. 4.3.3. The pins, bushing and their respective side pars shall present a water tight, corrosion resistant assembly. 4.3.4. The chain side bar material shall be as per Data Sheet-A not less than 10 mm thick. The chains shall be especially designed for travelling water screen service and shall operate			

	TITLE : STANDARD TECHNICAL SPECIFICATION TRAVELLING BAND SCREENING SYSTEM	SPECIFICATION NO. PE-TS-999-165-N004 SECTION : II A REV. NO. 01 DATE : 14.06.16 SHEET 2 OF 12
4.1.3. The main frames, sprocket shaft assemblies, bearings and all components of the drive system (except the shear pin. If provided) shall be designed to resist all forces without damage resulting from the full breakdown torque of the motor while the screen is jammed at any point in its travel. 4.1.4. Suitable guides shall be furnished for both sides of the screen frames so as to set in guideways on the sump pit walls. 4.1.5. Guide shall be continuous so that no open space exists for entrance of refuse between the screen frame and pit walls. 4.1.6. The guides shall prevent the front or ascending side of the chain from weaving. 4.1.7. The construction shall be such that no open space is left between the traveling screening media and the screen frame except the minimum running clearance required for satisfactory operation. 4.1.8. The main frame shall have a suitable provision for lifting the screen from the deck by means of an monorail hoist for erection and maintenance. Tension on the carrier chains shall be adjustable from accessible location near the head shaft by means of take-up screws made of stainless steel. 4.2. Screening Elements 4.2.1. The screening elements shall be constructed to offer minimum practical obstruction to free passage of water within the width of screen. 4.2.2. The screening elements shall have frames of welded steel construction provided with curved end plates/shrouds or any other suitable mechanism to provide sealing between adjacent screening elements and screening elements & the travelling band screen boots and frames, so as to stop the ingress of floating/suspended matter above guaranteed particle size as mentioned in the Data Sheet-A. 4.2.3. The screening materials shall be attached to the screen basket frames in a manner which provides easy replacement of screens without projecting bolting of clamping bars on the inlet side of the screen unit. 4.2.4. The min. size of the screening element wire and its material of construction mesh shall be as per Data Sheet-A. 4.3. Carrying Roller Chains 4.3.1. The screen chains to which the screening elements shall be fastened shall be made with side bars pins, bushings and rollers, with materials as per Data Sheet-A. The chain pitch shall be equal to the screening element's spacing. 4.3.2. The rollers shall be of high quality rust resistant material. 4.3.3. The pins, bushing and their respective side pars shall present a water tight, corrosion resistant assembly. 4.3.4. The chain side bar material shall be as per Data Sheet-A not less than 10 mm thick. The chains shall be especially designed for travelling water screen service and shall operate		



TITLE :
STANDARD TECHNICAL SPECIFICATION
TRAVELLING BAND SCREENING
SYSTEM

SPECIFICATION NO. PE-TS-999-165-N004

SECTION : II A

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SHEET 3 OF 12

satisfactorily for the type water as specified in Data Sheet-A. Each pin shall be drilled for pressurized grease lubrication.

4.4. Shafts and Sprockets

4.4.1. Head Shaft

The head shaft shall be made of material as specified in Data Sheet-A and will have suitable bearings, provided with pressurized grease lubrication. The head shaft bearing shall be readily accessible and provided with an arrangement for maintaining adequate tension in the screen assembly and to compensate for any slackness during operation.

4.4.2. Sprocket Assemblies

Head sprocket wheel shall be constructed of material as specified in Data Sheet-A. Head wheels shall have replaceable tooth inserts of material as specified in Data Sheet-A and shall be interconnected using a torque tube or an extra large diameter solid shaft.

The tooth shall be adequately sized to withstand impact loading and starting torque of driving motor due to jamming. Bolts and nuts for attachment of the tooth to sprocket wheel shall be constructed of stainless steel.

4.4.3. Screen Drive Units

Each screen unit shall be provided with a drive unit assembly mounted on a welded steel based plate on top of the screen frame splash housing. The drive unit shall have an electric motor directly connected through an all metal flexible coupling to a reduction gear unit.

There shall be arrangement for jogging control of the screen drive motor in case of emergency.

The reduction gear unit shall be of the helical or herring bone gear type operation in an oil bath and completely enclosed in a waterproof, oil-tight housing.

The reduction gear unit shall drive the head sprockets through a hardened steel roller chain or it may be coupled as per manufacturer standard.

The drive sprocket (if supplied) on the output shaft of the reduction gear unit shall incorporate shear-pin safety device to provide protection against overload.

Alternatively suitable fluid coupling may also be incorporated in the screen drive system.

4.4.4. Guards

All couplings/ chain drives and exposed shafts shall be provided with suitable guards for protection of personnel.

4.4.5. Splash Housing

Each screen shall be provided with splash housing which will enclose the screens, spray system and chain drives above the deck level.

The housings including access doors shall be constructed of 5mm (minimum) nominal thickness moulded fibre glass reinforced with stainless steel.

Reinforcing shall be located on the inside of housing wherever possible. Enclosures for external drive chains and sprockets may be either integral with the main housing



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enclosures or there may be separate stainless steel enclosures attached to the main housing.

Enclosures for external drive mechanism shall be of watertight designs and shall be furnished complete with shaft seals.

Inspection and access door hinges, latches and dogs shall be constructed of Carbon Steel and shall be designed to minimize the projection of these devices beyond the exterior surface of the main housing a system of Carbon steel or fibre glass deflector plates and seals shall be provided as necessary to direct the refuse into the refuse trough and to prevent refuse from being deposited on the screen deck.

The refuse trough shall be provided common to all travelling water screens. Refuse removal shall be done by pressurized water or by other approved means.

4.4.6. Spray Cleaning/Back Wash System

A complete spray cleaning system with minimum two sets of spray system at different elevations shall be provided with each screen unit. The system shall be located near the top of the unit. The spray cleaning shall take place in the ascending run of the basket. The refuse chute shall be arranged accordingly.

The spray nozzles shall be removable and of non dogging type constructed from stainless steel. The nozzles shall be designed to pass any object passed by the travelling screen.

The spray nozzles headers and all feed piping between the spray nozzle header and the spray water valves shall be constructed of material as specified in Data Sheet-A. Flanged joints (125 lbs) shall be provided in the piping for easy removal of the spray nozzle headers. All counter flanges, gaskets, nuts, bolting etc. for terminal connections shall be furnished by the bidder.

4.5. Spray wash/Flushing Pumps and Accessories

4.5.1. Horizontal centrifugal type booster pumps (2x100% Capacity) shall be employed for screen washing, the pump shall be furnished complete with drive motors, base plates and other accessories along with suction and discharge pipe work. The total head developed by the pump shall meet the requirement of pressure at spray nozzle inlet including losses in the pipeline and fittings. Capacity of the pumps shall be so selected that it shall be possible to meet the spray water requirement of each screen with all rows of spray.

4.5.2. The design, and material features of construction of pumps shall be as per specification titled "Horizontal Centrifugal Pumps" annexed therewith. All the pumps shall be connected to one common discharge header through individual check valves and isolating valves. All the pumps shall be provided with pressure gauges on its discharge and suction lines and required instruments as per Control Philosophy described elsewhere.

4.5.3. The casing shall be designed to withstand 1.5 times the shut-off pressure or twice the operating pressure, whichever is higher.

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4.5.4. The impeller shall be non-clog type. The impeller shall be secured suitably to the shaft and shall be retained against circumferential movement by keys, pins or lock rings. Loctite compound shall be applied after tightening of locknuts to prevent dislocation of impeller.

4.5.5. Replaceable type wearing ring shall be provided to prevent damage to the casing and impeller. Pumps shall be provided with mechanical seals to the extent feasible. If Gland packing is provided it should be of good quality to be provided to prevent leakage of water from pump glands. Shaft size selected shall take into consideration the critical speed which shall be away from the operating speed as recommended in applicable codes / standards. Renewable type fine finished shaft sleeves shall be integral with water thrower plates at the end and the length must extend beyond the outer faces of gland packing so as to distinguish between the leakage between shaft and the shaft sleeve and that past the seals / glands.

4.5.6. Bearings of adequate design shall be provided for taking the entire pump load arising from all probable conditions of continuous operation through its range of operation. The bearings shall be designed on the basis of 20,000 working hours minimum for the load corresponding to the duty point. Proper lubricating element does not contaminate the liquid being pumped. Bearings shall be easily accessible without disturbing the pump assembly.

4.5.7. Stuffing box of suitable design to permit replacement of packing without removing any part other than the gland shall be provided. The stuffing boxes shall be sealed / cooled by the fluid being pumped.

4.5.8. Pumps shall be of self-lubricated, self - sealed and self-cooled type. All pipework, fitters etc., for sealing, cooling and lubricating purpose shall be supplied and no external cooling/lubricating/sealing water will be supplied. Pump capacity shall take into account the cooling/lubricating/sealing water requirement.

4.5.9. All rotating components shall be statically and dynamically balanced.

4.5.10. The pump shall be designed such that pump impellers and other accessories of the pump, are not damaged due to flow reversal.

4.5.11. The pump shall be capable of developing the required total head at rated capacity for continuous operation. Also the pumps shall be capable of being operated to give satisfactory performance at any point on the head Vs. flow characteristic curve over a range or 40% of rated flow to 120 -130 % of rated flow.

4.5.12. The pump shall preferably be non-overloading type. The total head Vs. capacity curve shall be continuously rising from the maximum flow point towards shut-off without any zone of instability.

4.5.13. The pump shall run smoothly without undue noise and vibration. Peak to peak vibration limits and noise level shall be within the acceptable values of applicable codes/standards.

4.5.14. The pump and motor shafts shall be connected through a pin and rubber bush flexible type of couplings. Suitable coupling guards shall be provided for the couplings.

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4.5.15. The pump shall be capable of being started with discharge valve fully opened. Motor rating shall be adequate for this condition.

4.5.16. Pump shall be Dynamically balanced to grade 6.3 or better as per ISO 1940 of assembled rotors.

4.5.17. Following shall be applicable for spray wash pumps

- Pumps with 1500rpm shall be preferred
- No negative tolerance shall be permitted in rated capacity & TDH.
- No negative tolerance shall be permitted in efficiency at rated capacity.
- The shut off head of pumps shall be at least 115% of pump rated TDH.

4.6. **Strainers on Spray wash System**

4.6.1. 2X100% strainers shall be provided on the common discharge header of the spray wash/back wash pumps, to prevent choking of the spray nozzles.

4.6.2. The Screen perforation size of Self Cleaning Strainer shall be lesser than spray nozzle opening but not to exceed 2 mm.

4.6.3. The free flow area in the Screen basket shall be at least 150% of inlet pipe.

5. **Differential Level Measuring System.**

Each travelling band screen shall be provided with a differential level measuring system for differential level across the Travelling Band screen, to check debris accumulation and to initiate the spray wash/flushing operation. This shall consist of a differential level switch/transmitter for automatic spray wash/flushing operation, a differential level indicator/display for manual observation.

The contacts for differential level switch/transmitter and for differential level gauge shall be independent so that in the event of failure of one, the other is available.

6. **Piping, Fittings, Valves, Distributors and Spray Nozzles.**

6.1. The Bidder shall supply all the piping, valves, fittings, pipe supports, flanges gaskets etc.

6.2. All piping shall be of ERW steel pipe as per IS-3589 (Pipes > 150 Nb) /IS – 1239 (Heavy Grade) Pipes ≤ 150 Nb).

6.3. The valve shall have cast body as specified in Data Sheet-A Counter flanges, gaskets, bolt, nuts, etc. shall be furnished by the bidder.

6.4. Interconnecting piping, valves, spray nozzles and other fittings shall be designed to withstand 2.0 times the operating pressure or 1.5 times the pump shut-off pressure whichever is higher.

6.5. Interconnecting piping shall be sized and routed optimally.

6.6. Necessary isolation valves, vent and drain valves for various equipments shall be provided. Valves shall conform to appropriate standards. Gland packing of all valve shall be of superior quality to avoid leakage.

6.7. Adequate number of spray nozzles be provided for proper distribution of spray along the width of the Travelling Band Screen. All joints in the spray wash system shall be flanged type for ease of removal during repairs or checking.

6.8. Bidder shall provide proper arrangement for draining and venting of the system.

6.9. **Debris Segregation Basket**

6.9.1. Debris Segregation Basket shall be kept at the end of the refuse trough to remove and



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collect debris and shall have suitable arrangement of drainage of spray wash/flushing water.

- 6.9.2. Debris Segregation Basket shall have provision for handling using gantry crane/monorail etc. as specified in the Data Sheet-A.
- 6.9.3. Suitable emptying mechanism shall be made for emptying the Debris Segregation Basket by lifting it using the material Handling equipment as mentioned above and emptying the debris in a cart/truck etc. Bottom discharge baskets with a lever assisted discharge and a locking mechanism are preferable.

7. Actuators

Travelling Band Screening System shall be provided with actuators wherever necessary for various automatic operations. The actuators shall be electric motor operated and shall meet the requirements of the enclosed specification.

The actuator shall be provided with auxiliary hand wheel for manual operation in the event of control system failure.

8. Electric Motors

The drive motors for recirculation pump and other pumps if any shall conform to the requirements of the enclosed specification.

9. Instrumentation and Control System.

- 9.1. Complete instrumentation and control system for automatic operation of Travelling Band Screen, protection, interlocking, indication / annunciation of differential pressure and other malfunctions etc., shall be provided. This shall consist of adequate operational hardware, local control panel and interconnecting control and power cabling between the control panel and various equipments in the Travelling Band Screen.
- 9.2. The control panel shall house all necessary instruments, indicating / annunciation lamps, alarms, differential level indicator, timer, function selection switches, relays, protection and interlocking systems, start / stop push button etc., and shall be complete with internal wiring. The control panel shall meet the requirements of the enclosed specification.
- 9.3. Pressure gauges shall be provided at spray wash/flushing pump suction and discharge. All instrumentation shall be of reputed make and shall meet the requirements of the enclosed specifications.
- 10. Other Accessories**
- 10.1. Counter flanges, flat faced slip on type, complete with gaskets, bolts and nuts etc., shall be supplied for inlet, outlet connections and all other terminal points. Fabrication, dimensions and drilling of the flanges shall conform to the codes/standards specified in Data Sheet-A
- 10.2. Spray wash/flushing pump with interconnecting piping and valves, shall be mounted on a frame/skid. For fixing the frame/skid, necessary foundation plates, bolts, nuts etc. shall be provided.
- 10.3. Suitable lifting arrangements shall be provided for various equipments of the travelling band system, for handling during erection and maintenance.
- 11. Materials of Construction**
- Materials of various equipments in the travelling band screening system shall be



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corrosion resistant and consistent with the fluid handled. However, material specification for various components shall be equal to or superior to those specified in Data Sheet-A. Bidder to ensure that no galvanic corrosion takes place in any component, for the quality of water handled. Details of water analysis are as per Data Sheet-A.

12. Performance Requirements.

- 12.1. The Travelling Band Screening System shall perform satisfactorily under the flow and pressure drop/ differential level conditions specified in Data Sheet - A and shall be capable of removing the various forms of floating and suspended matter from raw water intake. The pressure drop/differential level maximum particle ingress shall be guaranteed that it will be permanently maintained as long as the system is in operation.
- 12.2. The travelling band screen, shall be designed such that the pressure drop/differential level across the system under clean conditions shall not be more than that specified in Data Sheet - A. The performance of the system shall be continuous with minimum number of flushing/spray wash operations.
- 12.3. The power consumption by Travelling Band screen actuators and spray wash/flushing pumps during various operations shall be minimum possible.

13. Operational Requirements.

- 13.1. The travelling band screens shall be designed with completely automatic system for continuous unattended operation.
- 13.2. The Travelling Water Screens shall be controlled through a Local Control Panel and shall be common for all Travelling Band Screens.
- 13.3. The drive motor shall have ample power to start the screen against design differential head as mentioned in the Data Sheet-A and operate continuously there after.
- 13.4. Level switches, alarms and annunciations shall be provided for each stream in Local Control Panel.
- 13.5. The start/stop facility, operation mode selection annunciation etc. for Travelling Band Screens shall be provided in LCP.
- 13.6. System interface of the Local control panel with the DDCMIS and other plant control panel as specified in the Data Sheet-A

14. Safety Features and Mechanism

- 14.1. Sufficient no. of safety mechanism of proven design shall be installed in the Travelling Band screening system to avoid failure in part or total of the system, if differential Level during choked condition exceeds the design differential Level.
- 14.2. Suitable (foolproof) isolation mechanism for drive isolation of TBS in case of overload, other than the motor overload shall also be provided.

15. PAINTING

- 15.1. The surface of SS, Gun metal, brass, bronze and non metallic component shall not be applied with any painting.
- 15.2. For all the steel surfaces, after surface preparation, shall be a coated with zinc chromite primer of min. thickness of 50 microns followed up with under coat of epoxy paint of min. thickness of 50 microns shall be applied. the top coat shall consist of two coats each of min. thickness of 50 microns of Epoxy paint and thus total thickness shall be min. 200

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microns. Epoxy paint shall be of approved make and quality.

- 15.3. The surface preparation of the various equipments / components of the travelling band Screens shall be done as per the agreed procedure and shall include the following :
- Removal of oil, grease, dirt and swarf etc.
 - Removal of rust and scale etc.
 - Sand blasting / shot blasting.

16. **SHOP INSPECTION AND TESTS**

16.1. **General**

- 16.1.1. Manufacturer shall conduct all tests and stage inspections as per the approved quality plan to ensure that the various equipments and other accessories of the travelling band screening system shall conform to the requirements of this specification and of the applicable codes / standards.
- 16.1.2. All materials used for manufacture / fabrication of the various equipments of the travelling band screening system shall be of tested quality. Relevant test certificates for chemical analysis, mechanical tests and heat treatment shall be made available before the final shop inspection. In case the relevant test certificates are not available, the manufacturer shall arrange to carry out the necessary tests as per the approved quality plan and applicable codes at his cost for which samples shall be identified by BHEL's representative.
- 16.1.3. All shop tests shall be conducted and test certificates / reports for the same shall be furnished to BHEL for approval.
- 16.1.4. Qualification of welding procedures and welders shall be as per applicable codes.

16.2. **Travelling Band Screen**

- 16.2.1. Chemical analysis, mechanical tests shall be carried out on materials used for body, Travelling Band Screen frame, Basket frame, screen and drive shaft and other appurtenances as per the applicable material specification standards.
- 16.2.2. All butt welded joints shall be subjected to radiographic/ ultrasonic testing as per applicable codes. However, all welded joints shall be subjected to 100% magnetic particle / penetrant testing to ensure freedom from defects.
- 16.2.3. Travelling Band Screen drive shafts shall be subjected to ultrasonic test as per ASTM-A388 for subsurface defects with acceptance norms as per applicable codes.

16.3. **Spray Wash/ Flushing Pump**

- 16.3.1. Chemical analysis, mechanical tests shall be carried out on materials used for casing, impeller, shaft, sleeves, wear rings etc., as per the applicable material specification standards.
- 16.3.2. The casting used for pump casing and impeller shall be sound, clean and free from porosity, blow holes, hard spots, cold shuts, distortion and other harmful defects. All accessible surfaces of the impeller shall be subjected to penetrant test as per ASTM-E165 for surface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1. No welding or repairs shall be carried out without prior permission of BHEL.
- 16.3.3. Pump shaft and sleeves shall be subjected to ultrasonic test as per ASTM - A388 for



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sub-surface defects and penetrant test after finish machining as per ASTM-E165 for surface defects.

16.3.4. Wear rings shall be subjected to penetrant test as per ASTM-E165.

16.3.5. Pump impellers and rotor assembly shall be statically and dynamically balanced as per ISO-1940.

16.4. **Piping, Valves, Distributors, and Spray Nozzles.**

16.4.1. Chemical analysis, mechanical tests shall be carried out for materials used for piping, fittings, valves, distributors and injection nozzles.

16.4.2. All welded joints of distributors & injection nozzles shall be subjected to penetrant test as per ASTM-E165 for surface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1.

16.4.3. Inspection and testing of valves including leakage test shall be carried out as per the requirements of the applicable standards. Valve stem and ball shall be subjected to penetrant test as per ASTM-E165.

16.4.4. All materials for various nozzles, stubs, gaskets, nuts, bolts etc. shall be of tested quality and correlating test certificates for chemical and mechanical properties shall be furnished.

16.5. **Flanges**

16.5.1. Chemical and mechanical test certificates shall be furnished for flange materials.

16.5.2. In case of fabricated flanges, all the welds shall be subjected to 100% radiography.

16.5.3. In case of forged flanges, ultrasonic testing shall be carried out as per ASTM-A 388.

16.5.4. If the thickness of the plate used for flanges is 40mm or more, the same shall be checked ultrasonically as per ASTM-A435 to demonstrate the absence of lamination and lack of fusion etc.

16.5.5. Flanges shall be checked for edge preparation, fit up and satisfactory working with matching parts.

16.6. **Dimensional Checks.**

Dimensional checks for various equipments/components of the travelling band screening system shall be carried out as per assembly drawing approved by BHEL. Alignment and fit up of movable parts shall be checked.

16.7. **Hydrostatic Test**

Hydrostatic test shall be conducted on various assemblies / equipments / components (wherever applicable) of the Travelling Band Screening System at a pressure of 1.5 times and design pressure. The duration of the test shall be minimum 30 minutes.

16.8. **Functional Tests**

16.8.1. Various assemblies / equipments / components of the travelling band screening system shall be subjected to functional tests and the following shall be checked.

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16.8.2. Smooth and free operation of all movable parts.

16.8.3. Interlock and sequential operation.

16.8.4. Satisfactory operations of actuators torque switches, limit switches etc.

16.9. TESTING AT SITE

After completion of installation at site, the travelling band screening system will be tested to check that the travelling band screening system performance meets the requirements of this specification. Rectification of all defects shall have to be done by the supplier at no extra cost to the owner / purchaser. However, the owner / purchaser reserves the right to reject the equipments / parts not meeting the requirement if the deficiency still persists.

17. PERFORMANCE GUARANTEE

17.1. The travelling band screening system complete with all accessories shall be guaranteed to meet the performance requirements as given in Data Sheet-A / Section-C and also for trouble-free operation after commissioning.

17.2. If the guarantees specified are not achieved by the supplier, the owner / purchaser, at his discretion, reject or accept the travelling band screening system after assessing the liquidated damages listed in Section-C / Data Sheet-A against the supplier and such amounts shall be deducted from the contract price.

17.3. Performance of the control scheme as specified.

17.4. Performance of the travelling water screen shall be free from vibration.

18. QUALITY ASSURANCE & QUALITY PLAN

18.1. The travelling band screening and other accessories to be supplied, shall have assured quality and workmanship.

18.2. Typical quality plans are enclosed herewith this specification for bidder's guidance. The bidder shall furnish his own quality plan based on materials, equipments and components of the Travelling Band Screening System being offered

19. NAME PLATE AND TAG NUMBERS

19.1. Various equipments and sub assembly of travelling band screening system shall be provided with a permanently attached brass or stainless steel plate indicating the following details :-

- Design and maximum flow rates.
- Design and test pressures (wherever applicable)
- Design temperature.
- Empty and operating weights.

19.2. Each valve in the travelling band screening system shall be provided with a name plate indicating the following :-

- Service.
- Design and test pressures.
- Maximum flow and flow direction.
- Size.
- Engineer's Tag Number.

Tag Numbers will be indicated on the drawings submitted for approval during contract stage.



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19.3. Each motor shall be provided with a name plate indicating the following details

- a) Supply conditions.
- b) KW Rating.
- c) Make.

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VENDOR		STANDARD QUALITY PLAN							SECTION : II A ITEM : TRAVELLING BAND SCREEN			
SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CATEGORY	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	Raw Material											
1.1	Head shaft, foot shaft Sprocket tooth insert, etc.	a) Verification of Mill TC for mech. / chem. Props., dimensional check. b) Ultrasonic test c) DPT on machined surface	MA MA MA	Visual, Measurement Chemical analysis, Mech. Test NDT NDT	100% 100% 100%	Appvd. Data Sheet Drugs. ASTM A 388 ASME Sect V / ASTM E 165	Appvd. Data Sheet Drugs. ASTM A 388 ASME Sect VIII & No surface defect	Mtrl. Test cert./ Lab. Report Inspection report Inspection report	3 3 3	3 3 3	2 2 2	For bar < 50 mm dia shall be MPI tested instead of UT Test certificates shall be submitted Test certificates shall be submitted Test certificates shall be submitted
1.2	Carrying chain side bars	a) Verification of Mill TC for mech. / chem. Props., dimensional check. b) DPT on machined surface	MA MA	Visual, Measurement Chemical analysis NDT	100% 10%	Appvd. Data Sheet /Drugs. ASTM E 165	Appvd. Data Sheet /Drugs. No Surface Defects 100%	Mtrl. Test cert./ Lab. Report Inspection Report	3 3	3 3	2 2	Test certificates shall be submitted Test certificates shall be submitted
1.3	Guides, embedments	Verification of Mill TC for mech /chem. props., dimnl.		Visual, Measurement	100%	ASTM E 165	No Surface Defects	Inspection Report	3	3	2	Test certificates shall be submitted
1.4	Fasteners	a.)Surface finish b.)Chemical properties c.)Physical properties	MA MA MA	Visual Verification of MTC Verification of MTC	100% 1 per heat 1 per heat	SS : SA193 CS: IS 1364/ IS 1367 SS : SA193 CS: IS 1364/S 1367 SS : SA193 CS: IS 1364/S 1367	SS :SA193 Gr B8M CS: IS 1364/S 1367 SS :SA193 Gr B8M CS: IS 1364/S 1367 SS :SA193 Gr B8M CS: IS 1364/S 1367	Insp. Report Material Test Certificate Material Test Certificate	3 3 3	3 3 3	2 2 2	Test certificates shall be submitted Test certificates shall be submitted Test certificates shall be submitted
1.5	Rubber Seals	a.)Surface defects b.)Resistance to scratch	MA CR	Visual Hardness	100% 10% of the Lot	No surface defect As per approved Drawing/Data Sheet	No surface defect As per approved	Insp. Report Insp. Report	3 3	3 3	2 2	Test certificates shall be submitted
1.6	Screen wire mesh	a.) Visual, Dimension & b.) Chemical composition	MA MA	Visual, Dimension and verification of MTC	100% / 1 / Lot	As per approved Drawing/Data Sheet As per approved Drawing/Data Sheet	As per approved Drawing/Data Sheet As per approved Drawing/Data Sheet	Insp. Report / Material Test Certificate	3 3	3 3	2 2	Test certificates shall be submitted
1.7	Splash housing,	a.) Surface defects,	MA	Visual	100%	As per approved Drawing/Data Sheet	As per approved Drawing/Data Sheet	Insp. Report	3	3	2	
MANUFACTURER				LEGENDS								
SIGNATURE:				P - Perform W - Witness V - Verification 1 - BHEL 2 - Vendor 3 - Vendor's Sub Vendor MA - Major CR - Critical MTC - Material test certificate				REVIEWED BY				

BHARAT HEAVY ELECTRICALS LIMITED												
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VENDOR		STANDARD QUALITY PLAN						SECTION II A ITEM : TRAVELLING BAND SCREEN				
SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM 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
1.8	Head Sprocket	b.) Dimension	MA	Measurement	100%	As per approved Drawing/Data Sheet	As per approved Drawing/Data Sheet	Insp. Report	3	3	2	Test certificates shall be submitted
		a.) Surface defects,	MA	Visual	100%	As per approved Drawing/Data Sheet	As per spec./		3	3	2	
		b.) Dimension c.) NDT	MA CR	Measurement Ultrasonic testing	100% 100%	Drawing As per approved procedure	Drawing As per approved procedure		3 3	3 3	2 2	
1.9	Reduction gearbox	a.)Routine test	CR	Functional test	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet	Supplier's test certificates	3	3	2	Test certificates shall be submitted
		b.)Surface finish	MA	visual	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet		3	3	2	
1.10	Fluid coupling	a.)Routine test	CR	Functional test	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet	Supplier's test certificates	3	3	2	Test certificates shall be submitted
		a.)Surface finish	MA	visual	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet		3	3	2	
1.11	Valves	Hydraulic Test of Body & Bonnet, Air Test, Phy./Chem. properties-TC reviews,	Major	Visual, Measurement Chemical analysis	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet	Supplier's test certificates/Test Report	3	3	2	Test certificates shall be submitted
1.12	Spray wash Pump	a.) Run Test	CR	Performance Test	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet	Supplier's test certificates Test report	3	3	2	Test certificates shall be submitted
		b.) Surface finish	MA	Visual	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet		3	3	2	
1.13	Self cleaning Strainer	a.)Run Test	CR	Performance Test	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet	Supplier's test certificates Test report	3	3	2	Test certificates shall be submitted
		b.) Surface finish	MA	Visual	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet		3	3	2	
1.14	Control Instruments: a) Pressure gauge, b) Pressure switch, c) Diff. Pr. Gauge, d) Diff. Pr. Switch e) Diff. Pr. Transmitter, f) Diff. Level transmitter & g) diff. Level switch	a.) Accuracy Class b.) Calibration	MA	AS per approved make			Supplier's test certificates	3	3	2	Test certificates shall be submitted	
2.0	Inprocess Inspection		MA									
2.1	All machined items	Visual Dimension	MA	Visual Measurement	100%	As per appvd dwg.	As per appvd dwg.	Insp. Report	2	2	1	
MANUFACTURER				LEGENDS								
SIGNATURE:				P - Perform W - Witness V - Verification 1 - BHEL 2 - Vendor 3 - Vendor's Sub Vendor MA - Major CR - Critical MTC - Material test certificate				REVIEWED BY				

BHARAT HEAVY ELECTRICALS LIMITED												
PROJECT		PROJECT ENGINEERING MANAGEMENT						SECTION II A				
VENDOR		STANDARD QUALITY PLAN						ITEM : TRAVELLING BAND SCREEN				
SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.2	Welding procedure qualification	Correctness of welding	CR	Scrutiny	100%	ASME sec IX	ASME sec.IX	QW-482 of ASME sec.IX	2	2	1	All TBS will be offered for functional test
2.3	Welder Performance Qualification	Ability of welder	MA	Welder qualification	100%	ASME sec IX	ASME sec IX	PQR / WPQ	2	2	1	
2.4	Root run	Surface defects	MA	LPE	100%	As per appvdprocedure	As per appvdprocedure	Insp. Report	2	2	1	
2.5	LPE on butt joints	NDE	MA	LPE	100%	As per appvdprocedure	As per appvdprocedure	Insp. Report	2	2	1	
3.0	Final inspection											
3.1	Part assembly and shop testing (Head shaft assy. with drive unit & few baskets)	No load dry run test	CR	Functional test	100%	As per appvd procedure	As per appvd procedure	Test Report	2	2,1	1	
3.2	a.)Sub-assembly (basket assly, link chain assly)	Dimension	MA	Measurement	100%	As per dwg	As per dwg	Insp. Report	2	2,1	1	
	b.) Sub-assembly (basket assly, link chain assly)	Surface defect	MA	Visual	100%	/Spec.	/Spec.	Insp. Report	2	2,1	1	
	c.) spray header assly & piping layout assly)	Leak test	CR	Hydro test	100%	As per appvd procedure	As per appvd procedure	Insp. Report	2	2,1	1	
3.3	Surface Preparation	Surface finish	MA	Visual	100%	As per appvd procedure	As per appvd procedure	Insp. Report	2	2,1	1	
	and Painting	Coating thickness	MA	DFT	At random	As per appvd procedure	As per appvd procedure		2	2,1	1	Report to be provided
3.4	Packing	Soundness & asthetics		Visual	100%	As per Manufacturer's practice	As per Manufacturer's practice		2	2	2	Packing as per attached Annexure-1.
MANUFACTURER				LEGENDS								
SIGNATURE:				P - Perform 1 - BHEL MA - Major W - Witness 2 - Vendor CR - Critical V - Verification 3 - Vendor's Sub Vendor MTC - Material test certificate				REVIEWED BY				



**TITLE : TECHNICAL SPECIFICATION
FOR
TRAVELLING BAND SCREENING SYSTEM**

SPEC. NO. PE-TS-426-172-N001

**SECTION : II
SUB-SECTION : IIB**

REV. NO. 00 DATE : 04.06.2019

Sheet 1 of 1

**SECTION IIB
STANDARD TECHNICAL REQUIREMENT
FOR
ELECTRICAL SYSTEMS**

QUALITY PLAN FOR MOTORS 55 KW & ABOVE

		QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :		
				BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE		
		SHEET 1 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	RAW MATERIAL & BOUGHT OUT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVENT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVENT IS/	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

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

		QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :		
				BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE		
		SHEET 3 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	2	FOR MV MOTOR INSULATION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT * MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.
		2. OTHER CHARACTERISTICS	MA	TEST	SAMPLE	MANUF'S SPEC.	MANUF'S SPEC.	LOG BOOK AND OR SUPPLIER'S TC	3	-	2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK	3	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG. .	MANUFR'S DRG.	-DO-	3	-	2	
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	-DO-	MANUF'S SPEC./ RELEVANT IS	RELEVANT IS	SUPPLIER'S TC	3	-	2	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	LOG BOOK	3*	-	2*	
		2.ELECT. PROP, & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	RELEVANT IS/ BS OR OTHER STANDARDS	RELEVANT IS/ BS OR OTHER STANDARDS	SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3	-	2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :			
				BIDDER/ VENDOR :		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
		SHEET 4 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2	
		1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2	
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2	
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE					BIDDER'S/VENDORS COMPANY SEAL				

		QUALITY PLAN		CUSTOMER :		PROJECT			SPECIFICATION :			
				BIDDER/ :		TITLE			NUMBER :			
		SHEET 5 OF 9		VENDOR		QUALITY PLAN			SPECIFICATION :			
		SYSTEM		NUMBER PED-506-00-Q-007, REV-03			TITLE					
				ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVANT SPEC./ ASTM-E165	MANUF'S SPEC./ BHEL SPEC./	-DO-	2	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC/BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE				
		SHEET 6 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6	7	8	9	10	P	W	V	11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	2	-	-		(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE FOR MV MOTOR THREE DIPS TO BE GIVEN
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-		
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1		
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-		
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-		
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1		
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1		
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-		
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1		
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-		
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-		
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1		
BHEL			PARTICULARS		BIDDER/VENDOR								
			NAME										
			SIGNATURE										
			DATE						BIDDER'S/VENDORS COMPANY SEAL				

		QUALITY PLAN		CUSTOMER :			PROJECT TITLE		SPECIFICATION : NUMBER :				
				BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
		SHEET 7 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6	7	8	9	10	P	W	V	11
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1		VERIFICATION FOR MV MOTOR ONLY
		1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-		
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-		
		2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2		1		
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2		1		
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2		1		
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2		1		
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-		
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-		
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1		
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-		
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-		
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2		1		
BHEL			PARTICULARS		BIDDER/VENDOR								
			NAME										
			SIGNATURE										
			DATE					BIDDER'S/VENDORS COMPANY SEAL					

		QUALITY PLAN		CUSTOMER :		PROJECT			SPECIFICATION :			
				BIDDER/ :		TITLE			NUMBER :			
		SHEET 8 OF 9		VENDOR		QUALITY PLAN			SPECIFICATION :			
		SYSTEM		NUMBER PED-506-00-Q-007, REV-03			TITLE			SECTION		
				ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			VOLUME III					
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	^{\$} NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1 ^{\$}	1	^{\$} NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	^{\$} NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	^{\$} NOTE - 2
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1 ^{\$}	1	^{\$} NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1 ^{\$}	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY ^{\$} NOTE - 2
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
BIDDER'S/VENDORS COMPANY SEAL												



		QUALITY PLAN		CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :			
				BIDDER/ VENDOR :		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE			
		SHEET 9 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY		REMARKS
									P	W	V
1	2	3	4	5	6	7	8	9	10		11
NOTES: 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED. 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON. 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED. 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY											
BHEL			PARTICULARS		BIDDER/VENDOR						
			NAME								
			SIGNATURE								
			DATE					BIDDER'S/VENDORS COMPANY SEAL			



**TITLE : TECHNICAL SPECIFICATION
FOR
TRAVELLING BAND SCREENING SYSTEM**

SPEC. NO. PE-TS-426-172-N001

**SECTION : II
SUB-SECTION : IIC**

REV. NO. 00 DATE : 04.06.2019

Sheet 1 of 1

**SECTION II C
STANDARD TECHNICAL SPECIFICATION
FOR
CONTROL & INSTRUMENTATION SYSTEMS**



Technical specification for
CONTROL & INSTRUMENTATION
1X660 MW TPS PANKI EXTN.

SPEC NO.:

VOLUME

SECTION -D

REV. NO.

00

DATE :

SHEET

OF

SECTION-D



Technical specification
for
1X660 MW TPS PANKI EXTN.

REV. NO.

00

DATE : 04.04.2019

INSTRUMENTS, JB & VALVES SPECIFICATIONS

CHAPTER-2: FIELD AND MEASURING INSTRUMENTS

2.00.00 MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)

- 2.00.01 Measuring instruments/equipment and subsystems offered by the Bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Refer Sub-section/chapter 1, Vol. V, Basic Design Criteria. Further, all instruments shall be of proven reliability, accuracy, and repeatability requiring a minimum of maintenance and shall comply with the acceptable international standards and shall be subject to Owner's approval.
- 2.00.02 Every panel-mounted instrument requiring power supply shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.
- 2.00.03 All transmitters, sensors, and switches, Gauges for parameters like pressure, temperature, level, flow etc. as required for the safe and efficient operation and maintenance as well as for operator and management information (including all computation) of equipment in the system under the scope of specification shall be provided on as required basis with in quoted lump sum price. The Bidder shall furnish all Instrumentation / Control equipment & accessories under this specification as per technical specification, ranges, makes & model as approved by the Owner during detailed engineering.
- 2.00.04 The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments, sensors, switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. **Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg./sq.cm.**
- 2.00.05 **For corrosive applications, all instruments applications, they shall be provided with wetted parts made of Monel/ Hastelloy C or any other material (if proven ness experience of the proposed material for such applications is established by bidder).**
- All instruments shall be provided with **durable epoxy coating for housings** and all exposed surfaces of the instruments.
- 2.00.06 All field instruments shall be weatherproof, drip tight, dust tight and splash proof suitable for use under outdoor ambient conditions prevalent in the subject plant. All field-mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance is achieved. **The enclosures of all electronic instruments shall conform to IP-65 unless otherwise specified** (Explosion proof for NEC article 500, class 1/2, Division 1 area & Flame proof area) and an anti corrosive paint shall be applied to the field mounted enclosures / instruments.

In general, double cable entry shall be provided, wherever available, unused cable entry shall be provided with blind metal plug. All the field instruments shall also be provided with SS tag nameplate. Counter and mating flange (SS316 material), fastener, gaskets, Nuts, bolts etc. shall also be included wherever required with the field instruments.

- 2.00.07 In general, front draw out type instruments with plug-in facility at the rear for connecting cables for power supply and signal shall be provided unless otherwise specified like for Explosion proof area, Flame proof area and high vibration prone area. Separate plugs & socket connection shall be provided for connecting power supply cables and signal cables.

The plug & sockets shall be polarized to prevent wrong connections and have facility for secure coupling in plug-in position to prevent loose connections.

Signal and Electrical connection shall be screwed connection with double compression type Nickel-plated brass/SS316 cable glands (Material as decided by owner) for Explosion proof area, Flame proof area and high vibration prone area.

- 2.00.08 The quantity of secondary instruments etc. to be provided by Bidder shall be adequate to meet the requirements of Technical Specifications. Any other additional quantity of secondary instruments envisaged by Bidder as per system and process requirements shall also be supplied without any cost implication.

2.01.00 SPECIFICATION FOR ELECTRONIC TRANSMITTERS

2.01.01 SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, DIFF. PRESSURE AND DP BASED FLOW, LEVEL MEASUREMENTS

Sl. No.	Features	Essential/Minimum Requirements
1	Type of Transmitter	Microprocessor based 2 wire type, Hart protocol compatible
2	Accuracy	± 0.1% of calibrated span (minimum) (upto turn down ratio of 10:1).
3	Output signal range	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol)
4	Turn down ratio	10:1 for vacuum/very low pressure applications. 5:1 for very high pressure application. 30:1 for other applications.
5	Stability	± 0.1% of calibrated span for six months for Ranges up to and including 70Kg/cm ² . ± 0.25% of calibrated span for six months for Ranges more than 70Kg/cm ² .
6	Zero and span drift	+/- 0.015% per deg.C at max span.



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		+/- 0.011% per deg.C at min. span.
7	Load impedance	500 ohm (min.)
8	Housing	Weather proof as per IP-65 with durable corrosion resistant coating.
9	Over Pressure	150% of max. Operating pressure.
10	Connection (Electrical)	Plug and socket type
11	Process connection	1/2 inch NPT (F)
12	Span and Zero	Continuous, tamper proof, Remote as well as adjustability manual from instrument with zero suppression and elevation facility
13	Material	Die cast Aluminum with epoxy coating/SS316 for body. SS316 for Diaphragm.
14	Accessories	-Diaphragm seal, pulsation dampeners, syphon etc. as required by service and operating condition. - LCD/TFT digital integral Indicators with scale of Engg. Units. -2 valve SS316 manifold for absolute & Gauge pressure transmitters, 3-valve SS316 manifold for vacuum pressure transmitters & where DP transmitters are being used for pressure measurement and 5 valve SS316 manifold for DP/Level/Flow applicable. Transmitters should not be mounted directly on the manifold; Manifold shall be non integral type only. - Snubbers/Pulsation dampners shall be used where the process media is unstable for measurement such as the discharge of a pump. -For hazardous area, explosions proof enclosure as described in NEC article 500.
15	Diagnostics	Self Indicating feature
16	Power supply	24V DC $\pm$ 10%.
17	Adjustment/calibration From hand held calibrator/centralized OWS based system n/maintenance (as applicable).	From hand held calibrator/centralized OWS based system

Notes

For primary air/ secondary air/flue gas applications, DP type transmitters shall be provided for pressure measurement.

LVDT type is not acceptable.

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

2.02.00 Specification for Pressure Gauge, D.P Gauge, Temperature Gauge and Level Gauge

s. no.	Features	Essential minimum requirements		
		Pr. Gauge/DP Gauge/Draught gauges	Temperature gauge	Level Gauge
1	Sensing Element and Material	Bourdon for high pressure, Diaphragm/ Bellow for Low pr. Of SS 316	Mercury in Steel/Bimetallic type for below 450°C and inert gas actuated for above 450°C of SS bulb and capillary	Tempered * toughened Borosilicate gauge glass steel armoured reflex or transparent type.
2	Body Material	Die Cast Aluminum with stoved enamel black finish /SS316	Die Cast Aluminum with stoved enamel black finish /SS316	Forged carbon steel/SS 304
3	Dial Size	150 mm with toughened shatter proof glass	150 mm with toughened shatter proof glass	Tubular covering entire range
4	End Connection	½ inch NPT (M)	¾" NPT (M)	Process connection as per ASME PTC and drain/vent 15 NB
5	Accuracy	+/- 1% span	+/- 1% span	+/- 2%
6	Scale	Linear, 270° arc graduated in metric units	Linear, 270° arc graduated in °C	Linear vertical
7	Range Selection	Cover 125% of max. of scale	Cover 125% of max. of scale	Cover 125% of max. of scale

8	Over range test	Test pr. For the assembly shall be 1.5 to the max. Design pr. At 38°C		
9	Housing	Weather and dust proof as per IP-65	Weather and dust proof as per IP-65	CS/304 SS leak proof.
10	Zero/span Adjustment	Provided	Provided	-
11	Identification	Engraved with service legend or laminated phenolic name plate		
12	Accessories	Blow out Disc, siphon, snubber, pulsation dampener, chemical seal (if required by process) gauge isolation valve	SS316 Thermowell	Gasket for all KEL-F shield for transparent type vent and drain valves of steel/SS as per CS/ alloy process requirement.
13	Material of Bourdon/ movement	SS 316	SS 316	

Notes – *Bicolour type level gauges will be provided for applications involving steam and water except for condensate and feed water services.

Length of gauge glass shall not be more than 1400 mm. If the vessel is higher, multiple gauge glasses with 50 mm overlapping shall be provided.

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

2.03.00 GUIDED WAVE RADAR TYPE LEVEL TRANSMITTER

Guided wave radar type level transmitters shall be provided for level measurements of the vessel under vacuum or low pressure applications as specified in Part-A.	
Type	Guided wave Radar
Principle	TDR (Time domain reflectrometry)
Probe Type & Material	Coaxial, SS316/316L. If required, probe shall be suitable for overfill prevention.
Connection type and material	Flanged and SS316/316L.
Signal o/p	4-20mA with HART signal suitable for overfill prevention.
Display	Integral
Power supply	24 VDC



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Accuracy	5mm
Electromagnetic compatibility	Shall meet EN 61326-1 (1997) and AmdtA1, class A equipment/EN 50081-2 & EN 50082-2
Housing material	Die cast Aluminum/SS316.
Vent & Drain Plug material	SS 316
Local Display	LCD digital type, configured in engg. Units.
Accessories	Integral cable between sensor and transmitter unit with connectors on both side, gasket and cable gland, digital panel meter, name plate and metal tag. All material of accessories will be SS 316.
Mounting	External cage mounting
The transmitters shall be provided with IP-65 protection class with durable corrosion resistant coating. The transmitters shall be able to provide digital signals super imposed on 4-20 mA signal as per HART protocol.	

2.04.00 Ultrasonic Type level Transmitter

Sl.No.	Features	Essential/Minimum requirement
1.	Type of Transmitter	Non contact Microprocessor based 2 wire type, HART protocol compatible Ultrasonic transmitter. Also refer note-3.
2.	Output signal	4-20mA DC (Analog) along with superimposed digital signal (based on HART protocol)
3.	Sensor Accuracy	+/- 0.5% of calibrated span.
4.	Sensor Repeatability	3mm or better
5.	Power supply	24 V DC +/-10%
6.	Temperature compensation	To be provided within transducer
7.	Configuration	
8.	Housing	Weather proof as per IP-65 with durable corrosion resistant coating.
9.	Adjustment/Calibration/maintenance	From hand held calibrators/ centralized OWS HART based system (as applicable)
10.	Zero and Span adjustment	Continuous, tamper proof, remote as well as manual adjustability from instrument. It shall be possible to calibrate the instrument without any level in the tank/sump etc.

11.	Sensor Material	Corrosion resistant material to suit individual application requirement.
12.	False signal tolerance	Transmitter shall be capable of ignoring false echoes from internal tank/sumps obstructions such as pipes, heating coils or agitator blades. Also transmitter shall have adjustable damping circuitry
13.	Range	Range of transmitter shall be capable of covering the complete level span of tank taking care of blocking distance, frequency attenuation due to surface, obstructions, vapors etc.
14.	Display	LCD display with integral keypad to be provided.
15.	Diagnostics	Loss of echo alarm etc.
16.	Load Impedance	500 ohms minimum.
17.	Electrical Connection	Plug and socket.
18.	Accessories	- All weather canopy for protection from direct sunlight and direct rain. - All mounting hardware and accessories required for erection and commissioning mounting fittings materials shall be SS 316. For hazardous area, explosion proof enclosure as described in NEC article 500.
Note:- 1) Bidder can also provide Radar type transmitter in place of ultrasonic transmitters subject to approval by Owner during detailed Engineering. 2) The frequency used for Ultrasonic /sonic measurements shall be suitable for envisaged applications and this shall be supported by the standard product catalogue of the instrument manufacture. 3) Four wire type transmitters can also be provided subject to Owner's approval during detailed engineering stage. However, in such cases isolated 4-20mA DC (analog) output shall be provided. Power supply required for such transmitters shall be 24V DC for main plant and CW system applications. Power supply can be 240V AC (UPS) / 24V DC for other application.		

	4) Additional separate local display unit with large Alphanumeric back light LCD/LED & to be provided for the applications which will be decided by owner during detailed engineering. Separate Sensor unit & electronics unit with LCD display to be provided for the applications, which will be decided during detailed engineering by owner.
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2.05.00 ~~HART Hand Held calibrator~~

~~Hand held calibrator shall be provided for adjustment/calibration/maintenance of the HART compatible transmitters. The hand held calibrator shall be suitable for all types of transmitters supplied in the package. If one type of hand held type calibrator is not suitable for communicating with all types of transmitters then separate hand held calibrator will be provided.~~

~~HART hand held calibrator shall be provided with following minimum accessories per set:-~~

~~- i. Soft carrying case with adjustable shoulder straps & lead compartments.
- ii. HART lead set.
- iii. Rechargeable batteries.
- iv. Battery charger.
- v. Power adaptor.
- vi. Universal plug kit for power adaptor.
- vii. Load resistor.
- viii. Interfacing cables of each type as per requirements.
- ix. Protective boot.
- x. Standard banana jack.
- xi. Operation manual & software CD.~~

~~The quantity of HART hand held calibrator to be provided by Bidder is listed in Appendix- I to Vol.V, Table IV, Part A of Technical Specifications.~~

2.06.00 Temperature Elements and accessories

2.06.01 Thermocouples

S.No.	Features	Essential/Minimum Requirements
1.	Type of Thermocouple	16 AWG wire of Chromel-Alumel (Type K) or 24 AWG wire Pt-Rhodium Pt (Type S/R) depending on operating temperature Range (ungrounded type).
2.	No. of element	Duplex
3.	Housing/Head	IP-65/Die cast Aluminum. Head of TE to be provided with sufficient space and arrangement to head

		mounted temperature transmitter (as applicable). Plug in connectors are to be provided for external signal cable connection.
4.	Sheathing of Thermocouple	Swaged type magnesium oxide insulation
5.	Calibration and accuracy	As per IEC-751/ANSI-C-96.1(special class) for T/C
6.	Characteristic	Linear with respect to temp, within $\pm 1/2$ percent of top range value
7.	Accessories	Thermo well (as specified below) and shall be spring loaded for positive contacts with the well.
8.	Standard	ANSI C 96.1 for Thermocouple and ASME PTC-19.3 (latest edition) for Thermo-well.
9.	Sheath Material/ Insulation	316SS/Compacted Magnesium Oxide.
	Sheath O D	8 mm.
10.	Response Time	6-10 Sec bare & 30 Sec. With protective sheath/thermowell
11.	Instrument Connection	1/2 " NPT (F).
12.	Electrical connection	Gold plated Plug in type. Double entry, one unused entry with blind plug.
13.	Enclosure Class	IP-65 or better.
14.	Process Connection	i) M33 x 2 ii) Flanged for Air & Gas systems with mating flanges, fastner, gasket etc.
15.	Extension	Threaded union (SS316) 1/2" NPT (F) with two nipples of SS 316 having 1/2"NPT(M) threads at both ends
16.	Extension neck length	Minimum 100 mm above Insulation of pipe and Minimum 160 mm when there is no insulation on pipe.

Notes

1. Extension cable exposed to atmosphere in the conventional method melts away due to high temperature at the top of mill or due to coal burning. Hence The terminals of temperature sensors shall not be at the top of mills



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itself. The temperature sensors wires are to be laid up to JB though SS tube of required diameter and the head shall be placed nearer to the JB.

2. Thermocouples provided for steam services like super heater / de super heater area, where the process pipe is inside the insulation of boiler penthouse, Thermowells are inaccessible and terminal head and connecting cable cannot withstand high temperature, for such services thermocouples shall be provided with flexible extension SS316 Sheath of 10-15 meters.
3. The specification for thermocouples of bearings metal and winding temp measurements can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However type of thermocouples shall be K-type.

2.06.02 Resistance Temperature Detector (RTD)

S.No.	Features	Essential/Minimum Requirements
1.	Type of RTD	Four /Three wire, Pt-100 (100 Ohms resistance at zero degree Centigrade).
2.	No. of element	Duplex
3.	Housing/Head	IP-65/Diecast Aluminum. Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable). Plug in connectors are to be provided for external signal cable connection.
4.	Sheathing of RTD	Metal sheathed, ceramic packed
5.	Calibration and accuracy	As per DIN-43760/IEC 60751 Class-A for RTD
6.	Characteristic	Linear with respect to temp, within $\pm 1/2$ percent of top range value.
7.	Accessories	Thermo well (as specified below) and shall be spring loaded for positive contacts with the well
8.	Standard	DIN-43760/IEC 60751 for RTD and ASME PTC-19.3 (latest edition) for Thermo-well.
9.	Sheath Material/ Insulation	316SS/Compacted Magnesium Oxide.



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	Sheath O D	8 mm.
	Gauge	18 SWG
10.	Response Time	6-10 Sec bare & 30 Sec. With protective sheath/thermowell
11.	Instrument Connection	1/2 " NPT (F).
12.	Electrical connection	Gold plated Plug in type. Double entry, one unused entry with blind plug.
13.	Enclosure Class	IP-65 or better.
14.	Process Connection	i) M33 x 2 ii) Flanged for Air & Gas systems with mating flanges, fastner, gasket etc.
15.	Extension	Threaded union (SS316) 1/2" NPT (F) with two nipples of SS 316 having 1/2"NPT(M) threads at both ends
16.	Extension neck length	Minimum 100 mm above Insulation of pipe and Minimum 160 mm when there is no insulation on pipe.

NOTES:

- 1) The specifications for RTDs of winding/ bearings of motor/ pump can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However the type of RTD shall be PT100.

2.06.03 Metal Temperature Thermocouples

S.No.	Features	Essential/Minimum Requirements
1.	Measuring Medium	Metal Temperature
2.	Material of Thermocouple	Chromel Alumel Type K
3.	Type of Thermocouple	Duplex with separate hot junctions, ungrounded Insulation Mineral Insulation Magnesium Oxide.
4.	Thermocouple wire gauge	16 AWG
5.	Protective sheath	SS 321
6.	Protective sheath dia	8 mm O.D
7.	Characteristics of Thermocouple	Special limits of error as in ANSI thermocouple MC 96.01, 1975
8.	Mounting accessories	1/2" BSP SS sliding end connector, weld pad, clamps of heat resistant steel SS310



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		or as per OEM design
9.	Cold end sealing	SS pot weal with colour coded PTFE headed sleeve Insulated flexible tails. Sealing compound- Epoxy resin
10.	Minimum bending radius	30 mm
11.	Length of T/C	30 Mtr. (minimum)

Notes:

- 1) The specification for thermocouples of bearings metal and winding temp measurements can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However type of thermocouples shall be K-type.
- 2) For boiler metal temperature applications considering the location of installation and response time, manufacturers standard and proven specification for metal temperature measurement can also be a accepted subject to OWNER approval. The manufactures shall submit adequate supporting documents for establishing their standard and proven practice.

2.06.04 Thermo well (for all process temp. elements) - (As per ASME PTC 19.3, latest edition)

- a. Shall be one piece solid bored type of 316 SS/F11/F22/F91 of step-less tapered design for water and steam Services depending upon process parameters.
- b. For Mill classifier outlet long life solid sintered tungsten carbide material of high abrasion resistance shall be provided.
- c. For Air & Flue gas 316 SS protecting tube with welded cap. (However bidder shall provide better material for Flue gas service if required based on the specified boiler design parameters).
- d. For furnace zone, impervious ceramic protecting tube of suitable material along with Incoloy supporting tubes and adjustable flanges.
- e. Bidder shall provide calculation for thermowell as per ASME – PTC-19.3 (latest edition).

"All Thermowells in high velocity steam service shall be checked for Strouhal's frequency limit to arrive at a safer size and design of Thermowells".

2.06.04 Void

2.06.05 TEST THERMOWELLS (TW)



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Applicable Standard	:	ASME PTC 19.3 TW - 2010
Type/Construction	:	Machined from Bar Stock
Material	:	316 SS/F11/F22/F91
Connection		
- Pipe	:	M33 x 2
- Test Instrument	:	To suit test instruments
Accessories	:	Plug with SS chain
IBR Certification	:	For high pressure service, Steam Temp., Fuel oil temp. measurement as per IBR rules and regulations Bidder shall provide calculation for thermowell as per ASME – PTC- 19.3 TW - 2010.

Test wells shall be provided on main steam, reheat steam, extraction steam, feed water, condensate, spray water lines and other piping as required to meet ASME test requirements.

2.07.00 TEMPERATURE TRANSMITTER

Following types of 2-wire temperature transmitter (directly powered from 4-20mA input cards of DDCMIS/PLC) shall be provided. The temperature transmitter shall be fully compatible with thermocouples and RTDs being provided by the bidder as well as Owner. Temperature compensation of the thermocouples shall be performed in the temperature transmitter itself.

a. Single Input Head mounted Temperature Transmitter

These shall be suitable for mounting in the head of temperature element itself. The protection class of head of thermo well along with its plug-in connector shall be min. IP65.

b. Single Input DIN-rail mounted Temperature Transmitter

These shall be suitable for mounting on DIN-rails in JB's. The specifications of the JB's shall be same as indicated in Subsection INST CABLE with additional DIN-rails and IP 65 Protection class. This temperature transmitter shall be the ones which are especially designed for DIN-rail mounting with IP 20 protection class. These shall have terminals for input/output provided on front side when mounted on DIN-rail.

Head mounted temperature transmitter with clamps to make it suitable for DIN-rail mounting shall not be acceptable under this category.

c. Dual-input Temperature Transmitter with Indicator:



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These shall be suitable for mounting on pipes/ support. Indicator shall be provided with these transmitters. These transmitters shall have bump less change over facility to second sensor in case first sensor fails. This change-over is to be alarmed. Protection class shall be IP65 minimum.

The exact applications for which this type of transmitter is to be provided shall be finalized by owner during detailed engineering.

d. Common requirements for each of the above type of temperature transmitters.

Output	:	2-wire (power supply from input card of Control System) with 4-20mA output with superimposed HART protocol signal.
Input	:	Same transmitter shall be capable to handle Pt-100 RTD, Thermocouples –K&R types (input type to be selectable at site through HART terminal)
Isolation	:	Min. 500 V AC
EMC compatibility	:	as per EN 61326
Operating ambient temperature	:	0 to 85 deg C (without indicator) 0 to 70 deg C (with indicator)
Power supply	:	Compatible with input module of Control System
Accessories	:	Mounting arrangements including Clamps etc.
Composite Accuracy	:	(a) For head mounted and DIN-rail mounted type Refer note-2 RTD = <0.4% of 0-250 deg C span T/C-K type = <0.4% of 0-600 deg C span T/C-R type = <0.4% of 0-1000 deg C span

	(b) For dual-input type:
RTD	= <0.25% of 0-250 deg C span
T/C-K type	= <0.2% of 0-600 deg C span

e. Field bus compatible temperature transmitters

Temperature transmitters of this category shall be field mounting type & shall be capable of withstanding operating ambient temperature upto 85 deg C. These modules shall be connected to DDCMIS through field bus such as Profibus, Foundation Field bus etc directly from the transmitter. **Maximum Number of inputs per such temperature transmitter shall be eight.** These shall be mounted in cabinets in non-AC areas.



As an alternate, these signals from temperature transmitters can be connected to DDCMIS through standard remote I/O modules of the DCS, in which case, the temperature transmitter signals will be acquired through 4-20mA input modules in the remote I/O cabinet for connecting to DDCMIS through remote I/O bus.

Notes (Common for a to e above):-

1. In case of failure (open or burn-out) of RTD/thermocouple, temp. Transmitter shall provide low temperature output.
2. Composite Accuracy is to be calculated as summation of all applicable accuracies of temp transmitter, for converting sensor input to output in 4-20 mA (e.g., basic accuracy, digital accuracy, D/A accuracy, etc.) and temperature effect on these accuracies at ambient temperature of 50 deg C, based on the figure/ formula given in the standard product catalogue for span as specified above for various types of Temperature Elements specified. All such accuracy/ temp effect figures in catalogue shall be first converted to deg C, and then percentage of this converted accuracy in specified span shall be calculated to compare with the specified composite accuracy figures.

2.08.00 IMPACT HEAD TYPE FLOW ELEMENT

The impact head type element shall be tubular insert type with four impact ports facing upstream direction, located precisely for determination of average flow velocity and shall be of SS 316 L.

Accuracy shall be 1.0% of actual value or better. Repeatability shall be $\pm 0.1\%$ of actual value or better.

The elements shall be supplied complete with mounting hardware; end support plugs and SS316 valve manifold (1/2" NPT connection) for instrument connections. All pertinent data including Owner's instrument tag no. for the flow element shall be punched on a stainless steel plate and affixed to the element.

Flushing arrangement shall be provided.

Dual path transit time clamp-on Ultrasonic Flow meter may also be used for measurement of CW flow.

2.09.00 FLUE GAS ANALYSER

The following flue Gas analyzers are envisaged:-

- i) Flue Gas analyzers for control and monitoring – quantities as indicated in Vol. V, Appendix I, Sr. no. G1, Part A.
- ii) Flue Gas Dust Emission analyzer for each ESP (at each Path) – quantities as indicated in Vol. V, Appendix I, Sr. no. G1, Part A.

Each analyser shall be independent and shall not share power supply, processor etc. with other analyser except compressor for purging air. The common requirements to be met for all types of analysers are as below. The specific requirements to be met by each type of analyser are detailed in the subsequent clauses.

2.09.01 Common Requirements for all Analysers:-

S.No.	Features	Essential/Minimum Requirements
1	Output signals	
	Analog	4-20 mA DC galvanically isolated. If analyser provides superimposed HART signal on 4-20 mA DC output, It shall also be connected to OWS/PC based station.
	Binary	2 NO + 2 NC for high alarm
2	Zero & span Adjustment	To be provided with range selection facility.
3	Ambient temp.	50°C
4	Indication	Digital Alphanumeric Display. Display of reading in engineering units shall be provided.
5	Enclosure Type/Material	Weather & Dust proof (IP 65) Die cast Aluminium/SS.
6	Type of Electronics	Microprocessor based with self diagnostic.
7	Digital Signal transmission	HART/RS 485 Port Modbus Protocol/Ethernet TCP/IP protocol.
8	Calibration	Auto & Manual (from Remote)
9	Power Supply	To be arranged by Bidder subject to Owner's approval.
10.	Others	I) All interconnection tubing and cabling between probe and analyser / analyser panel and cabling from analyser/ analyser panel to DDCMIS (in central control room) & OWS/PC station are to be provided by Bidder.
		ii) All the calibration gases required for one year continuous operation shall be provided. The calibration gas container material shall not contaminate the calibration gas.
11	Location of probe	High temp O2 –SH zone Low temp O2:- ECO outlet, AH outlet and ID inlet. Dust emission analyser – In each ESP gas stream/path
12	Compliance to standards	USEPA, TUV, MCERTS or equivalent standards
13	Type of Technology	Dust emission analyser – Opacity In situ (Path)type/ Tribo Electric Induction method In situ type

		Low temp O2 & High temp O2-Insitu type
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2.09.02 Low temp O2 and High temp O2 Analyser cum monitor:-

Specification Requirements system	Oxygen Analyser cum Monitor (High Temp.)	Low temperature O2 Analyser cum monitor
Type of instrument	Non-heated in-situ dry type	Heated type in-situ
Principle of Measurement	Partial-pressure using Zirconium Oxide Cell	Partial-pressure using zirconium oxide cell
Measurement Range	0.01% to 10% oxygen	0 to 25% oxygen programmable up to min 0.5% of O ₂
Accuracy	+/-1% of F.S. or 0.5 % O ₂ , whichever is more	+/-1% of Full Scale
Linearity	± 1% of F.S.	± 1% of F.S.
Repeatability	≤ 0.5% of span	≤ 0.5% of span
Response time(up to 90% of full scale)	≤ 5 secs	≤ 5 secs
a) Temperature Drift	-	-
b) Zero Drift	-	< 1% span/week
c) Span Drift	Stability:- 1% deviation throughout life of sensor	< 1% measured value/week
Operating Temperature Range	600-1600 deg. C	0-450 deg. C
Filter	Cell shall be protected using ceramic boot	Suitable filter to be provided
Accessories system purging	Not applicable	Not applicable
Temperature	Yes With R/B type thermocouples (to be finalised during detailed Engineering) required.	Automatic temperature control of heating circuit through thermostat

Note: 01. For O2 Analyzer, the construction of the sensor shall be such that joints between dissimilar materials are avoided to prevent formation of cracks.

- (c) Air supply line to pneumatic interlocked block valves.
- (d) For each instrument rack, field instruments enclosure for purging.

2.11.02 E-P CONVERTER

E-P converters and associated accessories shall be furnished in accordance with the specifications given below:

Air supply: 1.5 kg/cm sq., Input signal: 4-20mA dc (as required by the design of control system), Output signal: 0.2 to 1.0 kg/cm sq., Linearity: 0.5% of span or better, Hysteresis: 0.5% of span or better, Ambient Temperature Effect: less than 0.02% of span per deg C between -20 to +60 deg C. Mounting: Close to actuator (but not on the actuator), output capacity to suit the actuator, protection class IP 65. On loss of control signal, the last set point pressure shall be maintained so that the associated control valve remains in stay put condition without any additional solenoid valve. The allowable drift rate will be +2% of set point/ hour maximum. Material of accessories will be SS. E/P converters shall have fail freeze (stay put) feature also. Zero/span adjustment facility shall be provided.

2.12.00 SPECIFICATION FOR FLOW ELEMENTS & FLOW METERS

2.12.01 Orifice Plate

Sr No.	Features	Essential/Minimum Requirements
1	Features	Essential/Minimum Requirements
2	Type	Concentric as per ASME PTC-19.5 (Part-II), ISA RP-3.2, 1960 or BS-1042, ISO 5167
3	Material	316 SS
4	Thickness	3 mm for main pipe diameter up to 300 mm and 6 mm for main pipe dia above 300 mm.
5	Material of branch pipe	Same as main pipe
6	Root valve type	Globe
7	Root valve material	316 SS
8	Root valve size	1 / 2 inch or 1 inch (as applicable)
9	Impulse pipe of same material up to root valve	Required
10	Tapping	Flanged weld neck or D & D/2 with 3 pairs of tapping (as applicable). Root valves to be provided in all the tappings.
11	Beta Ratio	0.34 to 0.7
12	Beta Ratio	Yes

	calculation to be submitted	
13	Assembly drg. and flow Vs DP Curves	Yes
14	Accessories	Root valves, flanges, Vent/drain hole (As required)
Bidder shall submit certified flow calculation and differential pressure vs. flow curves for each element for Owner's approval. Sizing calculation, precise flow calculation for all the flow elements, fabrication and assembly drawings and installation drawings shall be submitted for Owner's approval. One Flow element of each type shall be calibrated in the test laboratory for validation of commutated flow calculations		

2.12.02 Flow Nozzle

Sr No.	Features	Essential/Minimum Requirements
1.	Type	Long radius, welded type as per ASME PTC- 19.5 (Part-III) or BS-1042
2	Material	316 SS
3	Thickness	Suitable for intended application.
4	Material of branch pipe	Same as main pipe
5	Root valve type	Globe
6	Root valve material	316 SS
7	Root valve size	1 inch
8	Impulse pipe of same material up to root valve	Required
9	Tappings	Flanged weld neck or D & D/2 with 3 pairs of tapping (as applicable).
10	Beta Ratio	Around 0.7
11	Beta Ratio calculation to be submitted	Yes
12	Assembly drg. and flow Vs DP Curves	Yes
13	Accessories	Root valves, vent and drain hole.
Bidder shall submit certified flow calculation and differential pressure vs. flow curves for each element for Owner's approval. Sizing calculation, precise flow calculation for all the flow elements, fabrication and assembly drawings and installation drawings shall be submitted for Owner's approval. One Flow element of each type shall be calibrated in the test laboratory for validation of commutated flow calculations		

2.12.03 ROTAMETERS

Sr No.	Features	Essential/Minimum Requirements
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1	Type	Variable Area Metal Tube
2	Fluid media	Water/oil
3	Tube body	SS316
4	Material of float	316 SS
5	Indicator	Linear scale
6	Accessories	Flange, orifice in case of bypass Rota meter (for line size above 100 mm)
7	Housing protection class	IP-65
8	Accuracy	$\pm 2\%$ of measured value

2.12.04 POSITIVE DISPLACEMENT TYPE FLOW TRANSMITTERS

The meter shall be a volumetric meter type consisting of two meshing oval wheels driven by the fluid. Each revolution of the oval wheels shall displace a precisely known volume of the fluid from inlet to outlet. The housing/measuring chamber and oval wheels shall be of 316 SS. Air eliminators shall also be provided to ensure maximum accuracy.

The measurement accuracy of the transmitter shall be better than $\pm 0.2\%$.

The transmitter shall provide suitable 4-20mA dc output signal for control and indication/recording. Converters if necessary shall be provided to generate the 4-20mA signal.

A local indicator of fuel oil flow shall also be provided. The instrument shall be calibrated in Tons/hr.

Suitable strainer shall be provided before the transmitter for the protection of oval wheel meters against foreign matter contained in the fuel oil.

The exact model no. and type of material being used, etc., shall be subject to Owner's approval during detailed engineering without any price repercussion to Owner.

2.12.05 DUAL PATH TRANSIT TIME CLAMP-ON ULTRASONIC FLOW METER

The flow meters shall be of proven reliability, accuracy and repeatability requiring a minimum of maintenance. They shall comply with relevant international standards and shall be subject to owner's approval.

All accessories required for mounting/erection of this instrument shall be furnished, erected and installed as necessary for completeness of the system though not specifically asked for. Also the equipment shall include necessary cables, flexible conduits, junction boxes required for the purpose.

Flow meters shall be provided with suitable environment protection devices/structures such that they shall be suitable for continuous operation in the

operating environment of a coal fired utility station without any loss of function or departure from the specification requirements.

TECHNICAL REQUIREMENTS

Type	Transit time Clamp On Ultrasonic meter
Mounting Style	Dual path with two sets of transducers on the same pipe
Flow measurement	Instantaneous Flow rate as well as totalized flow
Power supply	230 V AC from UPS.
Outputs: Analog Current Binary	Isolated 4-20mA linear outputs for each path Contact relay outputs, 2 NO + 2 NC for alarm
Communication ports	RS 232 C digital Hand held terminal port
Display/Indication	Flow meter with LCD screen backlight based local display and keypad If required, transmitter shall be suitably located away from the sensor for better access and visibility.
Recording / Totalizing/Logging Facilities	Yes. Should be able to compute cumulative flow over intervals selectable by owner i.e., daily, weekly, monthly etc. The data shall be stored in the memory of flow computer for access in future
Software features	Compensation for any cross path errors. Programming, configuration, shall be possible from front panel.
Diagnostics	False signal tolerance , power supply failure etc
Protection class	IP-65 'or better, Weather protection against direct sunlight, rain etc for Flow .' meter and suitable for Cooling water for Transducer
Accuracy	+/- 1%
Electrical connection	Plug and socket
Pipe location	Underground
Accessories	All mounting hardware required like clamping fixtures, mechanism to remove the transducers online, interconnecting cables etc All weather canopy for protection from direct sunlight and direct rain. Material of all fittings shall be SS 316.

integrator convert this signal into time based flow rate indication & provide totalized flow also.

Sensing plate	:	316 SS
Sensing head	:	Sensing mechanism shall be mounted outside the process flow line.
Enclosure	:	316 SS
Enclosure protection	:	IP 67)/ Explosion proof for NEC Class-1/2, Division 1 area)/ flame proof (IEC-79.1, Part I). As applicable).
Class		
Accuracy	:	+/-1% of measured value.
Repeatability	:	+/- 0.1%
Drift	:	Both zero & span + 2% / month
Output	:	4-20mA DC isolated, load 600 ohm (min)
Digital communication (HART) facility	:	yes
Power supply	:	230 V AC, 50Hz. UPS
Ambient condition	:	Temperature -600 C, RH-95% Environment – Highly Dusty
Accessories	:	Shall be complete with all the accessories including digital display for flow rate, integral vents, baffles for air separation, etc. whichever required for satisfactory operation.

Note:-

1. The above on line flow meter shall not create any obstruction on flow.
2. User's list shall be submitted to support on proven satisfactory performance for similar process application.

2.13.00 PROCESS ACTUATED SWITCHES

Sr No.	Features	Essential/Minimum Requirements		
		Pressure/Draft Switches/ DP Switches	Temperature switches	Level switches
1	Sensing Element	Piston actuated for high pressure and diaphragm or bellows for low pr./ vacuum	Vapor pressure sensing, liquid filled bellow type with SS bulb and capillary (10 m minimum)	Capacitance types for oil and dirty medium, water, condensate application. Float type for applications as



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				decided by owner during detailed engineering. Capacitance/Conductivity/Ultrasonic type for acid and alkali application. RF/ Ultrasonic type for ash hopper, ash slurry application. Detailed spec are also included below.
2	Material of sensing element & movement.	316 SS	Bulb 316 SS/ capillary 304 SS	316 SS
3	End connection	½ inch NPT (F)	½ inch NPT (F)	Manufacturer standard
4	Over range proof pressure	150% of max. design pr	-	150% of max. design pressure
5	Repeatability	± 0.5% of full range		
6	No. of contacts	2 Nos. +2NC. SPDT snap action dry contact. Auto reset with internal Adjustable snap action micro switch.		
7	Rating of contacts	60 V DC, 6 VA (or more if required by DDCMIS/PLC)		
8	Elect. Connection	Plug in socket		
9	Set point	Provided over full range. Differential shall be adjustable.		
10	Dead band adjustment	Adjustment upto 10% at set points.		
11	Enclosure	Die cast Aluminum with stoved enamel black finish/SS316, Weather and dust proof as per IP-65. Epoxy painting shall be provided for corrosive atmosphere.		
12	Accessories	Siphon, snubber, chemical, pulsation dampers as required by process.	Thermo well of 316 SS and packing glands	All mounting accessories
13	Mounting	Suitable for enclosure/rack mounting or direct mounting	Suitable for rack mounting or direct mounting	-
14	Power Supply (wherever	24 V DC, to be arranged by Bidder except for Ash Level Switches, where the same shall be as per Bidder's Standard practice.		

Accessories : Counter flange, Cable gland, prefab cable and stainless steel name plate engraved with alpha-numeric.

2.13.03 RF TYPE LEVEL SWITCH

A. Electronic Controller

1. Input Supply : 230 V AC from UPS
2. Construction : Cast Aluminum Housing
3. Relay Output : 2 Nos. Relay Changeover Potential Free Contacts (2 SPDT)
4. Contact Rating : 5A at 240 V AC & 0.25 at 220 V DC
5. Class of Protection : IP-66
6. Ambient Temperature: 55 Deg. C (Max)
7. Local Indication : Local LED Indications
 - Green : Normal Level
 - Red : Alarm Level
 - Yellow : Probe Healthy
8. Cable Connection : 3/4" ET (2 Nos.) for Supply and Output
5/8" ET (1 No.) for Probe Connection
9. Repeatability : 100%

B. Sensing Probe

1. Type of Probe : Rigid
2. Material : Stainless steel SS 316
3. Probe Head Housing : Cast Aluminum
4. Insulation (B/W Active & Shield And Shield & Ground) : PTFE
5. Probe Head Protection : IP-66
6. Mounting : Side Mounted
7. Cable Connection : 5/8" ET (1No.)
8. Process Connection : 40 NB BSP THREADED

C. Signal Cable : Coaxial cable for Connection Between Sensing probe and electronic Controller (@ 10 Mtrs. Per Level Probe)

D. Application : Silos

2.14.00 SOLENOID VALVES

Solenoid valves shall fulfill the following requirements:



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- a. Type 2/3/4 way with body material of SS 316/Forged Brass and epoxy painting (depending on the application subject to Owner's approval during detailed Engg.). Material of Wetted parts shall be SS316.
- b. Power supply 24 V DC + 10%.
- c. Plug and socket electrical connection.
- d. Insulation: Class 'H'.
- e. All solenoid shall be with, LED indication, surge suppression diode circuits.

2.15.00 Power Cylinders (Pneumatic)

Mounting Type	:	a) Fixed position mounting (End mounting).
	:	b) Trunnion mounting
Control Signal	:	0.2 to 1 Kg/Sq. cm. from I/P converter for modulating purposes. 24V/48VDC operated solenoid valve operating on pneumatic line. The Pilot solenoid will have separate coils for open closing purpose.
Supply Air	:	0-7 Kg / Cm ² .
Selection	:	Based upon thrust / torque, stroke length, angular movement, full-scale travel time, repeatability, space factor etc. Provision for air-to-open and air-to-close operation.
Casing	:	IP-65.
Accessories (as required)	:	a) Air lock relay b) Hand wheel. c) Air filter regulator with gauge. d) Volume Booster. e) Limit Switches. f) Positioner with Input, Output and supply pressure gauges. g) Pilot Solenoid Valve (Double Coil type) h) Position Transmitter (4-20 mA DC linear output, LVDT or non contact type).
Fail-safe operation	:	Stay put, open or close position on pneumatic / electrical power supply failure as per process safety criteria.
Repeatability	:	Better than 0.5% of full travel.



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Hysteresis : Less than $\pm 1\%$ of full travel.

2.16.00 WATER SYSTEM RELATED SPECIAL INSTRUMENTS (CW plant, DM PLANT, CPU PLANT, PT PLANT, AWRS, Service water, Potable water, etc.)

2.16.01 ANALYSER INSTRUMENTS:

For Technical specification of Cation/Specific Conductivity, pH, Sodium, Silica, Turbidity, Total Dissolved Solids (TDS) and Concentration analysers, and other requirements, please refer Specification of Analysers, Vol.-V, Part A and Part-B, chapter 5, SWAS chapter of this specification.

2.16.02 Residual Chlorine Analyser

- (a) An automatic chlorine residual analyser of amperometric type shall be provided alongwith the chlorinating plant for monitoring the residual chlorine content of cooling water. The analyser shall be suitable for accurate residual measurement in open/closed systems. The measurement accuracy shall not be affected by presence of treatment chemicals as chromates, phosphates, de-former highly polluted water, change in temperature etc.
- (b) The analyser shall comply with the following specification requirements, as a minimum
- | | | |
|--------|--------------------|--|
| (i) | Indicator | : Provision of LC display in the panel of analyser. |
| (ii) | Range | : 0 to 20.0 mg/L (ppm) |
| (iii) | Accuracy | : 2% or better |
| (iv) | Sensitivity | : 0.01 mg/l |
| (v) | Output signal | : 4-20mA DC isolated output |
| (vi) | Alarm annunciation | : High and low alarms to be provided on panel and shall be field adjustable |
| (vii) | Calibration | : Zero and span adjustment facility to be provided. Final calibration adjustments of the analyser to be done at site and duly verified by titration. Temperature compensation range 0 to 50degC. |
| (viii) | Mounting | : The analyser shall be suitable for field mounting conform to protection class IP-65. |
| (ix) | Electrodes | : Platinum/Gold and copper electrodes shall be provided with cell cleaning system. |
| (x) | Power Supply | : 230 V AC, +/- 10%, 50 Hz. From UPS |
- (c) Circulating water as sample to residual chlorine analyser shall be taken from hot circulating water pipe work before entry to cooling towers. Exact location and layout of sampling arrangement shall be finalised during detailed engg. stage. Bidder shall provide necessary pumping system (with 100% standby) for meeting the analyser requirements, if needed. All the



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drains shall be terminated up to the nearest plant drainage system.

2.16.03 All the outdoor field instruments such as analysers/transmitters/meters etc. shall be provided with suitable Free standing cabinet(s)/panel/rack so that the equipments are protected against rain/ sunlight etc.

2.16.04 Parshall Flume

The Bidder shall provide all the control and Instrument devices including primary sensors, transmitters, flow indicator cum integrator / totaliser and shall include all required accessories for the flow measurement of raw water through the clarifier. The system shall be of reputed make and acceptable to the owner.

Level measurement shall be based on ultrasonic/radon technology. The flow compensation is to be implemented in the transmitter itself. The transmitter shall provide 4-20 mA DC in direct proportion to flow and shall be able to drive a load impedance of 500 ohms minimum

Accuracy shall be +/- 1 % or better.

All the mounting hardware and accessories required for erection and commissioning of the same are to be provided by the bidder. Mounting fittings material shall be SS316. All weather canopy is to be provided for electronics/sensor to protect the same from rain/ sunlight etc.

The Type makes and models no. shall be subject to Owner's approval.

2.16.05 Electronic Flow-Meter

The electronic flow meter shall include flow sensor and flow indicator cum integrator / totaliser and shall include all required accessories for satisfactory operation. The flow meter shall be based on full bore ultrasonic / electromagnetic principle and shall be electronic type of proven design, make and model acceptable to the owner.

The Bidder shall submit all necessary technical literature and details of selection criteria of the instrument offered to substantiate the model selected. The Bidder shall also furnish list of similar installation along with feed back on satisfactory performance of the instruments.

The flow meter shall meet or exceed the following requirement:

(a)	Output	4-20 mA DC Isolated output HART compatible
(b)	Accuracy	± 0.5% of calibrated span or better *
(c)	Repeatability	± 0.2% of calibrated span or better
(d)	Ambient Temp. &	4 deg.C to 55 deg.C.
	Humidity	5% to 100% RH

(e)	Power Supply	UPS 240V AC $\pm$ 10%, 50 HZ $\pm$ 5%/ 24 V DC, to be arranged by the bidder.
(f)	Protection class	IP-65
(g)	flange material, Measuring tube & electrode material	SS 316
(h)	Liner material.	Teflon.
(i)	Features	zero stability, zero and span field adjustable, suitable for process medium with $\leq$ 5 micron Siemens conductivity.

The flow meter shall provide local indication for instantaneous flow. It should also be possible to get local display for daily and monthly discharge. The flow meter shall indicate totaliser / integrator to get the daily and monthly discharge as stated above.

2.16.06 **REVERSE ROTATION INDICATOR (RRI)**

For each of CW pumps & ACW pumps, a reverse rotation indicator comprising of proximity sensors, processing electronics with output of 4-20mA (corresponding to speed) interconnecting cables, speed display in rpm, normal, reverse indication and required channel alarm contact shall be provided. The contact rating shall be 60 VDC, 6VA (or more if required by Control system). The exact details of the RRI shall be strictly as approved by Owner during detailed engineering. The power supply of RRI is to be arranged by the Bidder from UPS.

2.16.07 **Non - Nucleonic (Vibration) Type Density Meter (For DM & AHP Plant):-**

Application : Liquid Density measurement

Detector

- | | | | |
|----|----------------------|---|-------------------------------|
| 1. | Orientation | : | As per requirement. |
| 2. | Case Material | : | SS 316L/ Cast Aluminum alloy |
| 3. | Wetted part material | : | SS 316L |
| 4. | Operating Principle | : | Vibration Density measurement |

Convertor

- | | | | |
|----|-----------------------|---|---|
| 1. | Output | : | 4-20 mA DC isolated. |
| 2. | Electrical Connection | : | 1/2" NPT |
| 3. | Enclosure Class | : | IP 65 |
| 4. | Local Display | : | Digital 5 digit, density display with temp. compensation. |
| 5. | Accuracy | : | +/- 1% |
| 6. | Response time | : | < 1 minute. |
| 7. | Power Supply | : | 230 V AC, +/- 10%, 50 Hz. From |



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UPS

2.16.08 FLOAT & BOARD TYPE LEVEL GAUGE

Type of Instrument	:	Mechanical Type (Float Operated)
Service/ Application	:	As per service requirement
Measuring Range	:	As per requirement
Material Specification		
a) Float Material	:	SS316 having 2 nos. Guide wires
b) Float Wire Pulley	:	Shall comprise of 2 nos. Cast Aluminum Pulley housing Assembly with SS 304 pulley and pulley shaft. Steel ball bearings shall be provided in pulley housing for easier float movement. Float wire material shall be SS316L. Between 2 pulleys, 1" NB G.I. short pipe.
c) Guide wire Assembly	:	CS chamber with spring and adjuster having 1" Class 150 ANSI RF MS flange. Guide wire rope shall be SS316L.
d) Counter Weight	:	MS counter – weight with Aluminum Pointer and Brass assembly Pull Chain.
e) Scale details	:	Aluminum/SS316 scale Graduated in mm with 1% accuracy of full scale range with arrow.
Nozzle Details	:	For float wire pulley assembly, one tapping and for guide wire assembly two tapping at the top of the tank; Size 1" NB (Top Mounting Type).
Process Connection	:	Flanged as per ANSI B 16.5 to suit 1" NB nozzle
		(Nozzle length - 150 mm for float wire, 100 mm for guide wire)
Accessories (to be supplied with the instrument)		
a) Counter flange	:	All mating Flanges, Nozzle
b) Mounting Accessories	:	All mounting accessories
c) Tag Plate	:	To be provided (material SS316)



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Location : Field (Direct Mounting)

2.17.00 AC PLANT AND COMPRESSOR RELATED SPECIAL INSTRUMENTS

2.17.01 (HUMIDITY SENSOR)

Sensor : Capacitance type
Accuracy : +/-3% R.H
Range : 0-100% R.H
Output : 4-20 ma
Time constant: 2 mins.

Output from the sensor is to be connected to respective control system. Bidder can also provide combined instrument for measurement of humidity and temperature subject to Owner's approval during detailed engineering. In all such cases, 4-20 ma outputs, each for temperature and humidity measurements are to be provided.

2.17.02 TEMPERATURE/ HUMIDITY INDICATOR

Sensor : RTD for (Pt 100) for temperature
: Capacitance Type for Humidity (specs for humidity and temperature shall be as mentioned above)
Display : Combined enclosure with two three digit seven segments LED display with decimal point after two digits. LED height shall be 4 inches, clearly legible from a distance of at least 10 meters.
Range : 0-60 Deg C for temperature.
: 0-95.0 % for Relative Humidity.
Accuracy : Better than +/-0.5 % for Temperature
: Better than +/-2.5 % for Relative Humidity
Mounting : Table Top/ wall mounting
Power supply : 240 V AC, 50 Hz.
Output : 4-20 mA signal each for temperature.
Qty. : 15 nos. each of temperature & Humidity indicators (combined indicators for Humidity and temperature is also applicable).

One Set of output signal is to be connected to respective control system. Apart from displaying the temperature/humidity values on indicator.

2.17.03 DEW POINT METER

Type : 2 Wire Loop Powered Dew point
Transmitter



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Overall Range	:	-60°C to +20°C Dew point
Accuracy	:	± 2°C Dew point
Material	:	SS316 (wetted parts)
Features	:	a) AUTOMATIC CALIBRATION (b) Can be Configured for Linear 4-20mA signal in °C & °F Dewpoint, ppm(v), ppb(v), g/m3 (c) Temperature Compensation (d) Failure Diagnostics (e) Long Term Stability (f) Fast Response (g) IP 66 / NEMA4X Protection (h) Supplied with Calibration Certificate Traceable to National & International Humidity Standards (i) Sensor protection with sintered filter (j) Local LCD Display for Dew Point

2.18.00 Limit switches

For offsite plant application Limit switches shall be gold plated with high conductivity and non corrosive type. Contact rating shall be sufficient to meet the requirement of DDCMIS subject to a minimum of 60 V, 6 VA rating. Protection class shall be IP 65. Contact shall be either 1 no, DPDT or 2 nos. SPDT minimum.

For main plant application, limit switches are to be provided as per bidder standard and proven practice.

All limit switch shall be conform to IEC-60947-5-1.

2.19.00 MATERIAL HANDLING SYSTEM RELATED SPECIAL INSTRUMENTS

2.19.01 PULL CORD SWITCH

Type	:	Addressable Type
Body	:	Cast Iron
Contact rating	:	Continuous 10 Amp, Breaking 2 Amp. (240 V AC)
No. of contact	:	2 NO + 2 NC
Reset facility	:	Manual Reset
Type of enclosure	:	Die Cast Aluminum
Degree of protection	:	Flame proof/Explosion proof for NEC class 2, Division 1 area
Local trip indication	:	Required
Accessories	:	1. Canopy over lever of pull Cord switch. 2. Linking of switches through a single cable for each section.

Interface Units, Surge suppressors, Opto isolators, Interface Converters, Fibre Optic Card Cage, Fibre Optic Line Driver, Repeater / Modem (for Optical Fibre Cables), cable glands, grommets, lugs, termination kits etc. on as required basis.

9.07.02 Cables, which terminate in cabinets of draw out sections shall have sufficient cable coiled in the bottom of the cabinet to permit full withdrawal of draw out sections without disconnecting the cables. When prefabricated cables with factory connectors on both ends are longer than required, the excess cable shall be coiled in the bottom of one or both termination cabinets.

9.07.05 The Bidder shall be responsible for proper grounding of all equipment under this package. Further, proper termination of cable shields shall be verified and the grounding of the same shall be coordinated so as to achieve grounding of all instrumentation cable shields at same potential. This shall be completed prior to system tests.

9.07.06 The Bidder shall take full care while laying / installing cables as recommended by cable manufacturers regarding pulling tensions and cable bends. Cables damaged in any way during installation shall be replaced at the expense of the Bidder.

9.08.00 Field Mounted Local Junction Boxes

Type of Enclosure	:	Flame proof/weather proof IP-65 /Explosion Proof as per area classification. Design as per NEC-370 Article 18, 19 & 20.
No. of Ways	:	12/24/36/48/64/72/96/128 with 20% spares terminals.
Material	:	4 mm min. thick FRP (Fiberglass Reinforced Polyester) with protective Coating
		3 mm min. thickness Die cast aluminum for Flame proof/Explosion proof area.
Cable entry	:	Bottom or Side
Cable glands	:	Double compression type – Nickel plated Brass/SS316 with PVC hoods.
Mounting	:	Indoor/Outdoor
No. of terminals	:	As required with standardization with 20% spare of each size & type.
Terminals	:	Phoenix/Wago (screw less rail mounted cage clamp type spring loaded suitable for conductor size up to 2.5 sq. mm)
Grounding	:	Two terminals for body and shield ground
Door	:	Hinged, lockable type.
Accessories	:	Suitable mounting clamps and other accessories shall be in scope of bidder.
		The brackets, bolts, nuts, screws, glands, lugs required for erection shall be of SS304, included in bidder scope of supply. High voltage & insulation resistance test shall also be conducted.



M6 Ni plated Brass earthing stud shall be provided (external 2 nos. internal 1 no.)

Gasket (Normal)- Neoprene/Polyurethane thickness 6.0 mm. Silicon for high Temp. area.

Colour : To be decided during detailed engineering & subject to owner's approval.

9.09.00 **Conduits**

Conduits shall be generally used for interconnecting cables from field instruments to local JB's. All rigid conduits, couplings and elbows shall be hot dipped galvanised rigid mild steel in accordance with IS:9537 Part-I (1980) and Part-II (1981). The conduit interior and exterior surfaces shall have continuous zinc coating with an overcoat of transparent enamel lacker or zinc chromate. Flexible conduit shall be heat resistant lead coated galvanised steel with, water leak, fire and rust proof protected for the areas of Mills, Drum, Main steam, RH steam Air Heaters and Furnace, BFPDT's.

And for remaining application, water leak, fire and rust proof flexible GI conduits shall be provided. The temperature rating of flexible conduit shall be suitable for actual application.

The Bidder shall install conduits according to the general routing as approved by owner and shall coordinate conduit locations with other works.

All grounding bushings within all enclosures shall be wired together and connected internally to the enclosure grounding lug or grounding bus with 8 AWG bare copper conductors. Conduit runs to individually mounted equipment shall be grounded to the Owner's cable tray grounding conductor with 12 AWG bare copper conductor. All grounding bushing, clamps, and connectors shall be subject to approval of the owner.

All rigid conduit fittings shall conform to the requirements of IS: 2667, 1976. Galvanised steel fittings shall be used with steel conduits. All flexible conduit fittings shall be liquid tight, galvanised steel. The end fittings shall be compatible with flexible conduit supplied.

All individually mounted equipment and devices shall be connected to the supply conduit, using not more than one meter of flexible conduit adjacent to the equipment or device. Flexible conduit shall be installed in all conduit runs, which are supported by both building steel and structures subject to vibration or thermal expansion. This shall include locations where conduit supported by building steel enters or becomes supported by the turbine generator foundation and where conduit supported by building steel or foundation becomes supported by steam generator framing.

Special areas, such as control rooms in which external noise is to be minimized, shall have flexible conduit in conduit runs where the runs cross from the main Building framing to the control room framing.



SPECIFICATION FOR MOTORISED VALVE ACTUATOR

SPECIFICATION NO.:

VOLUME II B

SECTION D

REV. NO. 00

DATE: 26.02.18

SHEET 1

OF 4

Data Sheet A & B

DATA SHEET-A
(TO BE FILLED BY PURCHASER)

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

GENERAL*	* PROJECT	1 x 6600 MW PANKI Thermal Power Project	
	OFFER REFERENCE		
	* TAG NO. SERVICE		
	* DUTY	☐ ON / OFF	☐ INCHING
	* LINE SIZE (inlet/outlet): MATERIAL		
	* VALVE TYPE	☐ GLOBE ☐ GATE ☐ REG. GLOBE ☐ BUTTERFLY	
	* OPENING / CLOSING TIME		
	* WORKING PRESSURE		
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF -20 to 70 DEG C AND RELATIVE HUMIDITY OF 0-95%	
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY	
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY	
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY	
CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF, DUST TIGHT SUITABLE FOR OUTDOOR USE WITHOUT CANOPY, NEMA6/IP:68	
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL	
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.	
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.	
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 90% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR REGULATING SERVICE - 150 STARTS/HR MINIMUM OR REQUIRED CYCLES WHICHEVER IS HIGHER..	
HANDWHEEL	* REQUIRED	☒ YES ☐ NO	
	* ORIENTATION	☐ TOP MOUNTED ☐ SIDE MOUNTED	
	*TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.		
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY	
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY	
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT-INCLUSIVE OF I.S. TOLERANCE	
	ACTUATOR APPLICABLE WIRING DIAGRAM	☒ ENCLOSED (BIDDER TO CONFIRM) A: ☐ DRG. NO. 3-V-MISC-24227 R00 B: ☐ DRG. NO. 3-V-MISC-24550 R00 C: ☒ DRG. NO. 3-V-MISC-24283 R00 D: ☐ DRG. NO. 4-V-MISC-90271 R11 E: ☐ For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram	
	COLOUR SHADE	☒ RAL 7032	
	PAINT TYPE (## Refer Notes)	☐ ENAMEL ☒ EPOXY ☐	
	SHAFT RPM	BIDDER TO SPECIFY	
	OLR SET VALUE	BIDDER TO SPECIFY	
	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY	
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY	
	@ PWR SUPP TO MTR / STARTER	415V +/- 10%, 3 Phase, 3 Wire 50HZ +/-5%	
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☒ 110 V	



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Data Sheet A & B

DATA SHEET-A
(TO BE FILLED BY PURCHASER)

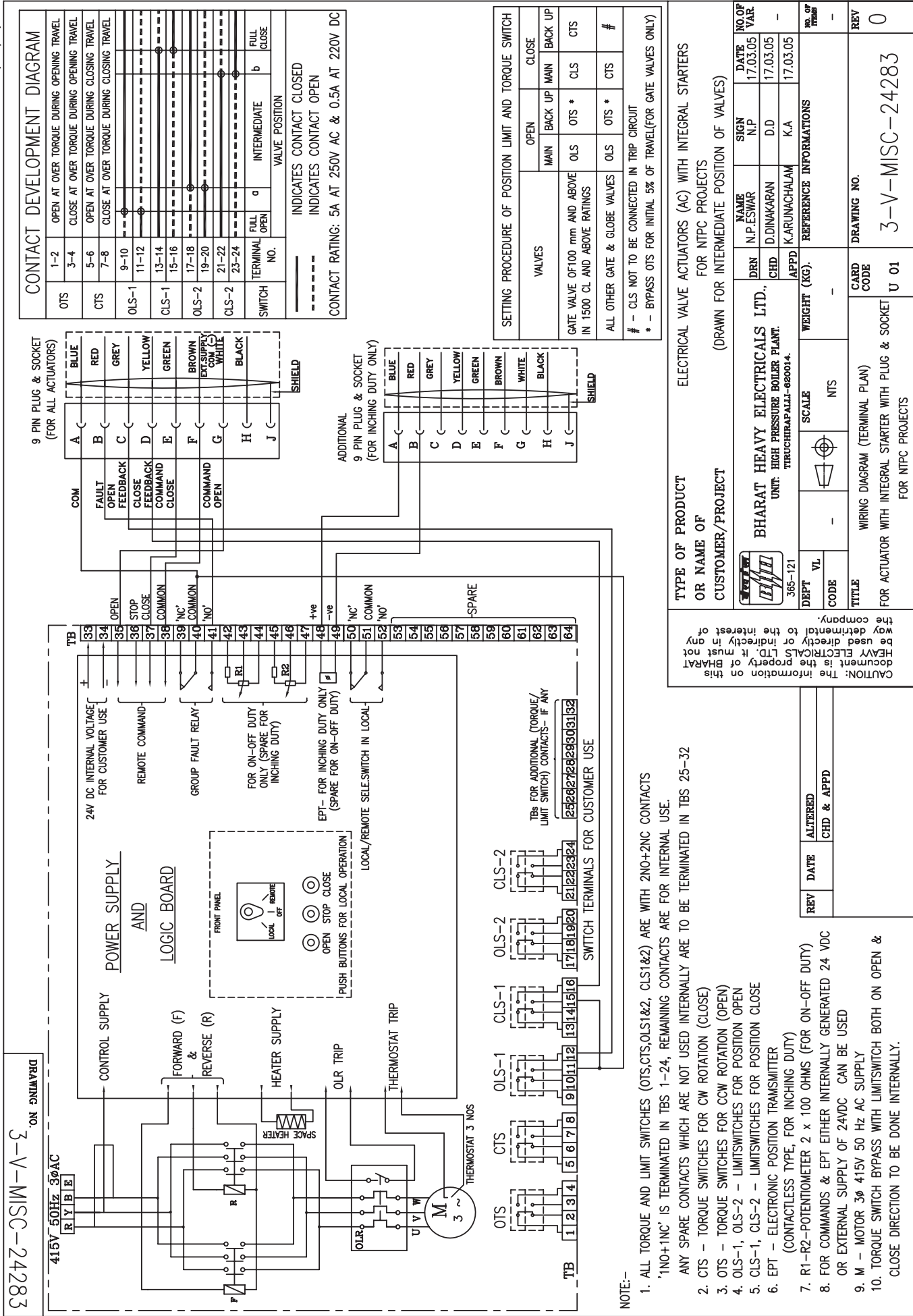
DATA SHEET-B
(TO BE FILLED-UP BY BIDDER)

	@ ENCLOSURE CLASS OF MOTOR	☐ IP 67 ☐ FLAME PROOF		
	@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B		
	@ WINDING TEMP PROTECTION	☒ THERMOSTAT (3 Nos., 1 IN EACH PHASE) ☐ -----		
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED		
INTEGRAL STARTER	INTEGRAL STARTER	☒ REQUIRED ☐ NOT REQUIRED		
	TYPE OF SWITCHING DEVICE	☒ CONTACTORS(Reversing type) ☐ THYRISTORS		
	TYPE	☒ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)		
	IF SMART			
	a) SERIAL LINK INTERFACE	☐ INTEGRAL ☐ FIELD MOUNTED		
	b) SERIAL LINK PROTOCOL	☐ FOUNDATION FIELD-BUS ☐ PROFI-BUS ☐ DEVICE NET ☐		
	c) SERIAL LINK MEDIA	☐ TWISTED PAIR Cu-CBL ☐ CO-AXIAL Cu-CBL ☐ OFC		
	d) HAND HELD PROGRAMMER	☐ REQUIRED ☐ NOT REQUIRED		
	e) TYPE OF HAND HELD PROGRAMMER	☐ BLUETOOTH ☐ INFRARED ☐		
	f) MASTER STATION	☐ REQUIRED ☐ NOT REQUIRED		
	g) MASTER STN INTRFACE WITH DCS	☐ MODBUS ☐ TCP/IP		
	h) DETAILS OF SPECIAL CABLE	☐ ENCLOSED ☐ NOT REQUIRED		
	STEP DOWN CONT. TRANSFORMER	☒ REQUIRED		
	OPEN-STOP-CLOSE PB(running open/close LED) THREE POSITION SELECTOR SWITCH	☒ REQUIRED ☐ NOT REQUIRED		
	INDICATING LAMPS	☒ REQUIRED ☐ NOT REQUIRED		
	LOCAL-OFF- REMOTE S/S(THREE POSITION SELECTOR SWITCH)	☒ REQUIRED ☐ NOT REQUIRED		
	STATUS CONTACTS FOR MONITORING	☒ REQUIRED ☐ NOT REQUIRED		
	INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (MOTOR THERMOSTAT TRIP/O/L RELAY OPERATED, CONT. /POWER SUPPLY FAILED, S/S IN LOCAL/OFF MODE, TORQUE SWITCH OPEN/CLOSE CUT OFF/STOP PB OPTD.)		
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter)	TYPE OF ISOLATING DEVICE	☐ INTERPOSING RELAY ☒ OPTO COUPLER ☐ EITHER		
	QUANTITY	☒ 2 NOs. ☐ 3 NOs.		
	DRIVING VOLTAGE	☒ 20.5 – 24V DC ☐ _____ V DC		
	DRIVING CURRENT	☒ 125mA MAX ☐ _____ mA MAX		
	LOAD RESISTANCE	☒ > 192 ohms - <25 k ohms ☐ > _____ ohms - < _____ ohms		
TORQUE SWITCH (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN / CLOSE	☐ 1 No. ☒ 2Nos. / ☐ 1 No. ☒ 2Nos		
	CONTACT TYPE	2 NO + 2 NC		
	RATING	5A 250V AC AND 0.5A 220V DC		
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE		
	ACCURACY	+3% OF SET VALUE		
LIMIT SWITCH (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN : INT : CLOSE	☒ 2 Nos. 2 nos(adj) 1 No.	☒ 2Nos.	
	CONTACT TYPE	2 NO + 2 NC		
	RATING (AC / DC)	5A 250V AC AND 0.5A 220V DC		

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR	SPECIFICATION NO.:		
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Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	

POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty & other specific applications)	REQUIRED for regulating/inching duty only.	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	☐ ELECTRONIC (2 WIRE) R/I CONVERTER ☒ ELECTRONIC (2 WIRE) contactless inductive type	
	SUPPLY	☒ 24V DC ☐	
	OUTPUT	☒ 4-20mA	
	ACCURACY	$\pm 1\%$ FS	
SPACE HEATER	@SPACE HEATER	REQUIRED	
	@ POWER SUPPLY (NON INTEGRAL)	230V AC, 1 PH., 50 Hz	
	@ POWER SUPPLY (INTEGRAL)	BIDDER TO SPECIFY	
	@ RATING		
TERMINAL BOX	ACTUATOR/MOTOR TERMINAL BOX	REQUIRED	
	ENCL CLASS ACTUATOR/MOTOR T.B.	@ ☒ IP 68 @ ☐ NEMA6	
	@ EARTHING TERMINAL	REQUIRED	
	PLUG & SOCKET (9 PIN) (FOR COMMD, LS/TS FEED BACK, PoT)	☒ REQUIRED ☐ NOT REQUIRED ☒ 2 NOS. ☐	
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:-----	
	@ SPACE HEATER CABLE GLAND	SIZE:-----	
	OTHER CONTROL CABLE GLANDS-1	☐ 1No. for BFV of CW PUMP (Cable size 2Px1.5mm ²)	
	OTHER CONTROL CABLE GLANDS-2	1 no suitable for 8P X 0.5 sq mm Additional 1 no suitable for 2P X 0.5 sq mm (inching duty only)	

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.:	
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DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY	_____ Kg.	
NOTES: SCOPE: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY. CODES & STANDARDS: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATIONAL STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH: IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722 - TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C. - CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED. - THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION. THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE. - THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%. - THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING. \$\$ TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE. ## EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS. - IT SHOULD BE POSSIBLE TO OPERATE THE ACTUATOR LOCALLY. LOCKABLE LOCAL/REMOTE SELECTION SHALL BE PROVIDED ON THE ACTUATOR. - POSITION INDICATOR SHALL BE PROVIDED FOR 0 TO 100 % TRAVEL - WIRING SHALL BE SUITABLE VOLTAGE GRADE COPPER WIRE 1.5 SQ. MM. - THE MOTOR SHALL BE CAPABLE OF STARTING AT 85 PERCENT OF RATED VOLTAGE AND RUNNING AT 80 PERCENT OF RATED VOLTAGE AT RATED TORQUE AND 85 PERCENT RATED VOLTAGE AT 33 PERCENT EXCESS RATED TORQUE FOR A PERIOD OF 5 MINUTES EACH. - THE ACTUATORS SHALL BE DESIGNED TO BE SELF-LOCKING UPON LOSS OF POWER. MOTOR SHALL BE DESIGNED TO CLOSE IN 30 SECS. FROM FULL OPEN POSITION AND SHALL HAVE ADEQUATE CAPACITY TO OPEN AND CLOSE UNDER FULL UNBALANCED DESIGN PRESSURE. - ALL SIX (6) LIMIT SWITCHES SHALL BE CHANGEOVER TYPE AND ADJUSTABLE BESIDES HAVING THE SNAP FACILITY. - THE INTEGRAL STARTER WHICH SHALL HAVE SOPHISTICATED ELECTRONIC CONTROLS WITH FIELD PROGRAMMING FEATURE. IT SHALL BE DESIGNED FOR REMOTE CONTROL FROM DCS/RESPECTIVE CONTROL SYSTEM. REQUIRED INTERPOSING RELAYS FOR RECEIVING OPEN/CLOSE/STOP COMMAND FROM DCS/RESPECTIVE CONTROL SYSTEM SHALL BE PROVIDED. POTENTIAL FREE CONTACTS AND TRANSDUCERS SHALL BE PROVIDED TO PROVIDE STATUS INDICATION AT REMOTE DCS/RESPECTIVE CONTROL SYSTEM. - THE REMOTE COMMAND SIGNAL (OPEN-STOP-CLOSE) FROM DCS/RESPECTIVE CONTROL SYSTEM/CONTROL PANEL SHALL BE ISOLATED FROM CONTROL ELECTRONICS THROUGH OPTO-ISOLATOR. - THE FOLLOWING INDIVIDUAL STATUS ANNUNCIATION LED'S (COLOUR-GREEN) SHALL BE PROVIDED LOCALLY (INTEGRAL TO ACTUATOR) TO ANNUNCIATE THE FOLLOWING FOR EASY LOCAL MONITORING. ACTUATOR IN LOCAL MODE ACTUATOR IN REMOTE MODE ACTUATOR RUNNING IN OPEN DIRECTION ACTUATOR RUNNING IN CLOSE DIRECTION ACTUATOR IN INCHING MODE. ACTUATOR IN SELF-RETAINING MODE LIMIT SWITCH OPEN TRIP LIMIT SWITCH CLOSE TRIP CONTROL VOLTAGE AVAILABILITY				
NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @= TO BE FILLED BY ELECTRICAL				



CHAPTER –11: CONTROL VALVES WITH ACTUATORS**11.01.00 CONTROL VALVES, ACTUATORS & ACCESSORIES****11.01.00 General Requirements**

- 11.01.01 The control valves and accessories equipment furnished by the Bidder shall be designed, constructed and tested in accordance with the latest applicable requirements of code for pressure piping ANSI B 31.1, the ASME Boiler & pressure vessel code, Indian Boiler Regulation (IBR), ISA, and other standards specified elsewhere as well as in accordance with all applicable requirements of the "Federal Occupational Safety and Health Standards, USA" or acceptable equal standards. All the Control Valves, their actuators and accessories to be furnished under this Sub-section will be fully suitable and compatible with the modulating loops covered under the Specification.
- 11.01.02 All the control valves and accessories offered by the Bidder shall be from reputed, experienced manufacturers of specified type and range of valves.
- 11.01.03 For special type of control valves such as combined pressure and temperature control valves for Aux PRDS application, separator drain control valves, also refer to the corresponding mechanical sections.

Control valve station shall be provided at the interconnection line between service air header and instrument air header before air dryer unit. When instrument air header pressure falls below set value, the control valve will start opening and maintain the instrument header pressure at specified level in line with plant requirement. Again when instrument air header pressure goes above specified level in line with plant requirement the control valve will fully close automatically. Complete system shall be in bidder scope.

11.02.00 CONTROL VALVE SIZING & CONSTRUCTION

- 11.02.01 The design of all valve bodies shall meet the specification requirements and shall conform to the requirements of ANSI (USA) for dimensions, material thickness and material specification for their respective pressure classes.
- 11.02.02 The valve sizing shall be suitable for obtaining maximum flow conditions with valve opening at approximately 80% of total valve stem travel and minimum flow conditions with valve stem travel not less than 10% of total valve stem travel. All the valves shall be capable of handling at least 120% of the required maximum flow. Further, the valve stem travel range from minimum flow condition to maximum flow condition shall not be less than 50% of the total valve stem travel. The sizing shall be in accordance with the latest edition of ISA handbook on control valves. While deciding the size of valves, Bidder shall ensure that valves trim exit outlet velocity as defined in ISA handbook does not exceed 8 m/sec for liquid services, 150 m/sec. for steam services and 50% of sonic velocity for flashing services. Bidder shall furnish the sizing calculations clearly indicating the outlet velocity achieved with the valve size selected by him as well as noise calculations, which will be subject to Owner's approval during detailed engineering.
- 11.02.03 Control valves for steam and water applications shall be designed to prevent cavitation, wire drawing, flashing on the downstream side of valve and downstream piping. Thus for cavitation/flashing service, only valve with anti cavitations trim shall be provided. Detailed calculations to establish whether cavitation will occur or not for any given application shall be furnished.



- 11.02.04 Control valves for application such as Feed water control valve, HP & LP by pass spray control valves, APRDS control valves, Soot blower control valve, separator drain control valve, SH Spray Control, RH spray Control, Heavy Oil Heating, pressurizing and Control system, HP/LP heater Emergency level control, Emergency Make-up to condenser hotwell, GSC minimum flow, Deaerator Drain to Condenser Hotwell, Condensate spill to condensate reserve tank, condenser normal make- up and valve gland sealing supplying pressure control, CEPs minimum flow control, BFP minimum circulation control valve shall have permissible leakage rate as per leakage Class V. All other control valves shall have leakage rate as per leakage Class-IV.
- 11.02.05 The control valve induced noise shall be limited to 85 dba at 1 meter from the valve surface under actual operating conditions. The noise abatement shall be achieved by valve body and trim design and not by use of silencers.
- 11.02.06 The Liquid pressure recovery factor (FL) shall be 0.995 or better for severe flashing/cavitation services.
- 11.02.07 The Liquid pressure recovery factor (FL) shall be 0.985 or better for low flashing/cavitation services.
- 11.02.08 The valve travel time shall be less than 10 second for non critical services valves.
- 11.02.09 Rangeability should be 50 to 1 (min.) for non critical services valves.
- 11.02.10 Modulating Type Control Valve's Linearity, Hysteresis, Accuracy shall be < +1% and Sensitivity shall be < + 0.5%.

11.03.00 VALVE CONSTRUCTION

- 11.03.01 All valves shall be of globe body design & straightaway pattern with single or double port, unless other wise specified or recommended by the manufacturer to be of angle body type. Rotary valve may alternatively be offered when pressure and pressure drops permit.
- 11.03.02 Valves with high lift cage guided plugs & quick-change trims shall be supplied.
- 11.03.03 Cast Iron valves are not acceptable.
- 11.03.04 Bonnet joints for all control valves shall be of the flanged and bolted type or other construction acceptable to the Owner. Bonnet joints of the internal threaded or union type will not be acceptable.
- 11.03.05 Plug shall be of one-piece construction cast, forged or machined from solid bar stock. Plug shall be screwed and pinned to valve stems or shall be integral with the valve stems.
- 11.03.06 All valves connected to vacuum on down stream side shall be provided with packing suitable for vacuum applications (e.g. double vee type chevron packing)
- 11.03.07 Valve characteristic shall match with the process characteristics.
- 11.03.08 Extension bonnets shall be provided when the maximum temperature of flowing fluid is greater than 280 deg. C.
- 11.03.09 Flanged valves shall be rated at no less than ANSI press class of 300 lbs.

11.04.00 VALVE MATERIALS

Sr.No.	Service	Body material	Trim Material
1	Non-corrosive, non-flashing, and non-cavitation service except DM water	Carbon steel ASTM-A216 Gr WCB for fluid temperature below 275 Deg. C Alloy steel ASTM-A217Gr. WC9 for fluid temperature above 275 Deg. C	316SS stellited with faced guide posts and bushings.
2	Severe flashing/cavitation services	Alloy steel ASTM-A217 Gr. WC9	440 C
3	Low flashing/cavitation services	Alloy steel ASTM-A217 Gr. WC6	17-4 PH SS
4	DM water services	SS 316	316 SS

NOTE Valve body rating shall meet the process pressure and temperature requirement as per ANSI B16.34.

However, Bidder may offer valves with body and trim materials better than specified materials and in such cases Bidder shall furnish the comparison of properties including cavitation resistance, hardness, tensile strength, strain energy, corrosion resistance and erosion resistance etc. of the offered material vis-a-vis the specified material for Owner's consideration and approval.

11.05.00 END PREPARATION

Valve body ends shall be either butt welded/socket welded, flanged (Rubber lined for condensate service) or screwed as finalized during detailed engineering and as per Owner's approval. The welded ends wherever required shall be butt welded type as per ANSI B 16.25 for control valves of sizes 65 mm and above. For valves size 50 mm and below welded ends shall be socket welded as per ANSI B 16.11. Flanged ends wherever required shall be of ANSI pressure-temperature class equal to or greater than that of the control valve body.

11.06.00 VALVE ACTUATORS

All control valves shall be furnished with pneumatic actuators except for pressure and temperature control valve for auxiliary PRDS application (Electro-hydraulic / pneumatically operated) and HP & LP bypass valves, separator drain control valve (Electro-hydraulic type). The Bidder shall be responsible for proper selection and sizing of valve actuators in accordance with the pressure drop and maximum shut off pressure and leakage class requirements. The valve actuators shall be capable of operating at 60 deg.C continuously.

Valve actuators and stems shall be adequate to handle the unbalanced forces occurring under the specified flow conditions or the maximum differential pressure specified. An adequate allowance for stem force, at least 0.15 Kg/sq.cm. per linear millimeter of seating surface, shall be provided in the

selection of the actuator to ensure tight seating unless otherwise specified.

The travel time of the pneumatic actuators shall not exceed 10 seconds.

11.07.00 CONTROL VALVE ACCESSORY DEVICES

11.07.01 All pneumatic actuated control valve accessories such as air locks, hand wheels/hand-jacks, limit switches, microprocessor based electronic Positioner, diffusers, external volume chambers, position transmitters (capacitance or resistance type only), reversible pilot for Positioner, tubing and air sets, solenoid valves and junction boxes etc. shall be provided as per the requirements.

11.08.00 SPECIFICATIONS FOR MICROPROCESSOR BASED ELECTRONIC POSITIONER

1	Electrical	a) Input Demand Signal	4-20 mA
		b) Power Supply	Loop Powered from the output card of Control System.
		c) HART Protocol	Compatibility for Remote Calibration & Diagnostics (Super-imposed HART signal on input Signal (4-20 mA)
		d. Valve position sensing	Position sensing, 4-20 mA output signal to be provided for control system.
2	Environment	a) Operating temp.	(-)30 To 80 Deg. C
		b) Humidity	0-95 %
		c) Protection class	IP-65 Minimum with Die cast Aluminum/SS316 enclosure.
3	Software for Configuration and Diagnostics	Software	Windows based software. Software shall meet the requirements for Configuration, Diagnostics, Calibration and Testing of the actuator.
		Diagnostic/Test features	Advanced diagnostic features like Stroke counter or Travel counter, Leakage in actuators, Valve Signature analysis, Step Response test, Valve friction /Jamming detection etc. to be provided.

4	Test reports/ Certificates	Factory Valve Signature Tests Reports (Pressure versus Valve travel and Travel versus I/P signal) are to be provided.	
		Test certificates as per Manufacture Standard/Relevant Standard are to be submitted.	
5	Configurat ion/ Calibration	Remote & Local Calibration, Auto & Manual Calibration shall be possible.	
6	Operating Range	Full range/ Split range.	
7	Modes	Valve Action	Direct / Reverse Valve Action
		Flow Characterization	Possible to fit Valve Characteristic Curves- Linear , Equal percentage etc.
8	Fail Safe/Fail Freeze	Fail Safe/Fail Freeze feature is to be provided. (In case the fail freeze feature is not intrinsic to the positioner, Bidder shall achieve the same externally through solenoid valve connected in the pneumatic circuit).	
9	Pneumatic	Air capacity	Sufficient to handle the valves & actuators selected/ Boosters to be supplied, if required.
		Air pressure	To suit the air supply pressure/quality available.
		Process connection	1/4" NPT
10	Performance	Characteristic deviation	≤ 0.5 % of span.
		Ambient temp effect	≤ 0.01 %/ deg C or better.
11	EMC & CE compliance	Required to International Standard like EN/IEC.	EN50081-2 & EN 50082 or equivalent.

12	Accessories	In-built Operator Panel	Display with push buttons for configuration and display on the positioner itself (Password protected/Hardware lock).
		Hand Held Hart Calibrator	Universal Hart Calibrator to be provided (for quantity, refer Part-A Vol-V C&I :).
		Pressure Gauge Block & Position Indicators.	For supply & output pressures, Air Filter Regulator, integral type position transmitter, in built mechanical position indicator and other accessories shall be provided on as required basis for making system complete.
		Electrical Cable Entry	1/2" NPT, side or bottom entry to avoid water ingress.
		Valves Mounting Assembly	For Sliding Stem/Rotary/Single acting/Double acting actuators on as required basis.

*** Note:**

The HART signals shall be picked up from marshalling terminals of DDCMIS (SG/TG DDCMIS as well as BOP DDCMIS), as applicable. The details of the above mentioned HART management system specification are mentioned in HART system Vol-V, Part B, Chapter 3, DDCMIS, cl. no. 3.45.00

The positioners shall be monitored from this HART management system .To achieve this, Bidder shall provide the necessary software to achieve the functionalities described above under "Remote Configuration and Diagnostics", and this software shall be loaded in the HART management system.

11.09.00 FOR FOLLOWING CRITICAL APPLICATION SPECIAL CONTROL VALVES ARE REQUIRED:

1. HP & LP Bypass Valves and Control System
2. BFP – Minimum Re-circulation Valve
3. Feed Water Control Valve
4. SH & RH spray Control Valves
5. APRDS System
6. Soot Blower control valve
7. Separator Drain Control Valve.
8. Fuel oil heating and pressurizing
9. Minimum economizer flow control
10. DM make up (emergency / normal)



11. Control valves whose down stream are connected to vacuum such as HP/LP heater emergency level control.
12. CEP minimum flow control

11.09.01 General Requirements for Critical Application Control Valves -

- i) The valve accessories shall include hand wheels, limit switches, smart valve positioner (4-20mA DC type), electro pneumatic converter, Air lock relay, Solenoid valve and all other items required for the completeness and the accessories shall be explosion proof type as per hazardous area classification wherever applicable.
- ii) Control valves shall be furnished with IBR certification wherever required.

1. **Noise:** The maximum allowable noise level shall be 85 dba or less at 1 m. distance from the downstream bare pipe surface. The specified noise level shall be attained without the use of orifices, mufflers, diffusers. No credit for thermal or acoustical insulations shall be taken.

2. **Valve Trim:** Valve shall have quick change type trim utilizing top entry. No components shall be screwed or welded into the body. The valve shall have equal pressure distribution around the plug to avoid chattering / vibration.

Trim of severe/critical service valve shall be of multi stage & multi path design with sufficient no. of discrete pressure drop stage to eliminate the chance of erosion, cavitations, noise, vibration through out the control range of valve.

3. **Leakage Class:** The valve shall have minimum class-V leakage for all steam applications including RH/SH, APRDS, Soot Blower control valve, HP/LP Bypass spray control valves, BFP minimum recirculation valve & Low Load feed water control valve.

In case of HP/LP Bypass control valve application, the leakage class should be MSS-SP 61 (block valve leakage).

4. **Actuator:** Actuator type should be pneumatic double acting piston/electro-Hydraulic.

11.10.00 TEST AND EXAMINATION

All valves shall be tested in accordance with the quality assurance program agreed between the Owner and Contractor, which shall meet the requirements of IBR and other applicable codes mentioned elsewhere in the specifications. The tests shall include but not be limited to the following:

- 11.10.01 Non Destructive Test as per ANSI B-16.34.
- 11.10.02 Hydrostatic shell test in accordance with ANSI B 16.34 prior to seat leakage test.
- 11.10.03 Valve closure test and seat leakage test in accordance with ANSI-B 16.34 and as per the leakage class indicated above.
- 11.10.04 Functional Test: The fully assembled valves including actuators control devices



and accessories shall be functionally tested to demonstrate times from open to close position.

11.10.05 CV Test: Please refer CI No. 13.00.00, Vol. V Part-B, Chapter : 13 (Type test requirements), Control Valves.

Bidder shall furnish all the control valves under this main plant package as finalized during detailed engineering stage without any price repercussions whatsoever depending on the process requirements. All the control valves provided by the Bidder for this project shall meet the specifications requirements specified herein. Specification for control valves in this chapter has to be read in conjunction with other relevant chapter of this specification.



Technical specification
for
1X660 MW TPS PANKI EXTN.

REV. NO.

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DATE : 04.04.2019

PROCESS CONNECTION & PIPING

Chapter 8 PROCESS CONNECTION AND PIPING**8.00.00 PROCESS CONNECTION PIPING**

8.01.00 The Bidder shall provide, install and test all required material for completeness of Impulse Piping System and Air Piping System as per the requirements of this chapter, enclosed installation drawings and source connection drawings on as required basis for the connection of instruments and control equipments (provided by the bidder) to the process on as required basis for the connection of all instruments and control equipments of entire plant.

The installation and source connection of various items shall generally as per NIT installation drawings (Drawing No. 14A14-DWG-I-0010), however, the bidder shall furnish during detailed Engineering. Installation drawings, GA and fabrication drawings of LIES/LIRs, other relevant drawings, material and tech data sheets of various items service wise for owner's approval/information.

8.01.01 All material, furnished under this chapter and the installation there of shall conform to the latest editions of American National standard Code for pressure piping, power piping ANSI B 31.1, ANSI B16.11, ASME Boiler and pressure Vessel codes, IBR and other applicable ASME, ANSI and state standards.

8.01.02 All material supplied under this chapter shall be suitable for intended service, process, operating conditions and type of instructions used and shall fully conform to the requirements of this specification. The bidder is responsible for the performance of equipments furnished under this specification on system basis. The bidder may offer suggestions for improvement based on his experience, during detailed engineering, which shall be subjected to the Owner's approval.

8.01.01 IMPULSE PIPING, TUBING, FITTINGS, VALVES AND VALVE MANIFOLDS

8.01.02 All impulse pipes shall be of seamless type conforming to ANSI B36.10 for schedule numbers, sizes and dimensions etc. The size of impulse pipe shall be 1/2" for steam and water applications and 3/4" for air and flue gas applications. The material of impulse pipe shall be same as that of main process pipe. For various applications specification of impulse pipe materials and associated fittings and valves shall be as given in table PCP..

8.01.03 SS tube shall be provided inside enclosures & racks from tee connection to valve manifold and then to instrument. For high pressure/temperature applications (piping class A, B, C & D of the table no PCP) the material shall be ASTM A 213 TP 316H it and for other applications material shall be ASTM A 213 TP 316L. The wall thickness of the tube shall be in accordance with the ANSI B31.1 standard. The bending radius of the tube shall be greater than 6D.

8.01.04 All fittings shall be forged steel and shall conform to ANSI B16.11. The material of forged tube fittings for shaped application (e.g. tee, elbow etc) shall be ASTM A 182 Gr 316 H for high pressure/temperature applications (as defined above) and ASTM A 182 Gr 316 L for other applications. The material for bar stock tube fitting (for straight application) shall be SS 316. Metal thickness in the fittings shall be adequate to provide actual bursting strength equal to or greater than those of the impulse pipe or SS tube, with they are to be used.



The source shut off (primary process root valve) and blow down shall be ½ inch size globe valve type for all applications except for air and flue gas service wherein no source shut off valves are to be provided. For various applications the valve body material, stem material and pressure class shall be as given in table 8.1. The end connections of valves shall be of socket welded type unless otherwise specified in the instrument installation diagrams. The disc and seat ring material of carbon Steel and alloy steel valves be ASTM-A-105 and ASTM-A-182 Gr F22, hard faced with satellite (minimum hardness-350 BHN). The surface finish of 16 RMS or grater is required in the area of stem packing. The valve design shall be such that the seats can be reconditioned and stem and disc may be replaced without removing the valve body from the line.

For Pr/D.P. gauges in fluid application two way globe valve on each impulse line to the instrument and in air/flue gas application two way gate valve on each impulse line to the instrument shall be provided near the instrument. These shall be in addition to the three ways gauge cock provided along with the Pressure/Differential pressure gauges.

The rating of material of impulse pipes, tubes, fittings, valves and their installation thereof shall conform to the latest edition of standards as per following table:

Impulse Pipe, Tube (material & rating)	ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70
Valves (Material Pr. Class, size)	ASTM A 182/ ASTM A 105 as per ASME 16.34
Fitting (Size, rating, material)	ANSI B31.1, ANSI B31.1a, ASME B16. 11-2009
Installation Scheme	BS 6739-2009, ANSI/ISA 77.70

Stainless steel tube shall be provided inside enclosures & racks from tee connection to valve manifold and then to instrument. The source shut-off (primary process root valve) and blow down valve shall be of 1/2 inch size globe valve type for all applications except for air and flue gas service wherein no source shut-off valves are to be provided. Two root valves are to be used wherever pressure is more than 40 Kg/cm² or Temp>280 deg C. The end connections of valves shall be of socket welded type.

8.01.03 The valve manifolds of 316 SS with pressure rating suitable for intended application shall be provided as given below:

Manifold	Application/Measurement
2 Valve	Pressure measurements using pressure transmitters/pressure switches.
3 Valve	Pressure measurements using differential pressure transmitter/switches.
5 Valve	Differential Pressure, Flow and Level Measurements

For Pr./D.P gauges, two-way globe/gate valve shall be provided on each impulse line to the instrument in Fluid/Air & Flue Gas applications respectively .



8.01.04 Double ferruled compression type fittings shall be used only, wherever required.

8.02.00 **AIR SUPPLY PIPING**

8.02.01 All pneumatic piping, fittings, valves, air filter cum regulator, purge rotameter and other accessories required for instrument air for the various pneumatic devices/ instruments shall be provided. This will include as a minimum air supply to pneumatically operated control valves, actuators, instruments, continuous and intermittent purging requirements etc.

8.02.02 Instrument air and Service air supply shall be provided for continuous and intermittent purging respectively for all transmitters of mill, dirty air and flue gas applications. Purging scheme shall be as per drawing no. 14A14-DWG-I-0010.

8.02.03 The Bidder shall also provide and connect pneumatic tubing to E/P convertors and then to control valves. For individual supply line and control signal line to control valve, 1/4-inch size light drawn tempered PVC coated copper/SS tubing conforming to ASTM B75 shall be used. It shall be at least 0.065 inch. The fittings to be used with copper/SS tubes shall be of cast brass/SS, screwed type. All other air supply lines shall be of mild steel hot dipped galvanized inside and outside as per IS-1239, heavy duty with threaded ends. Fittings for air supply line shall be of forged carbon steel A234 Gr. WPB galvanized inside and outside, screwed as per ASA B2.1. Dimensions of fittings shall be as per ASA B16.11 of rating 3000 lbs. Air supply piping shall be adequately sloped to prevent accumulation of condensed water within the pipe. The air supply headers, sub-headers and branch pipes shall be supported properly by clamps or supports.

8.02.04 The instrument/service air supply to each equipment/devices requiring air supply shall be provided by a well designed air distribution scheme comprising of 2" GI Pipe Header with isolation valve from the instrument air and service air terminal points. In the boiler/turbine area the 2 inch header shall be provided upto most elevation of boiler/turbine floor and from this 2 inch header, 1 inch sub header shall be branched off at each floor with isolation valve. From this 1 inch sub-header, branch line of ½ inch, with isolation valve shall be provided upto various devices. Similar system is to be followed for service air required for intermittent purging in the local instrument enclosures (LIEs) Instrument air filters cum regulator set with mounting accessories shall be provided for each pneumatic device requiring air supply except for Ash Handling System wherein it shall be provided on instrument air header at each location. The filter regulators shall be suitable for 10 kg/cm² max. Inlet pressure. The filter size shall be 5 microns and of material sintered bronze. The air set shall have 2 inch size pressure gauge and built in filter housing blow down valve. The end connection shall be ¼ inch/1/2 inch / 3/4 inch NPT as per the requirement to be finalised during detailed engineering.

8.02.05 All the isolation valves in the air supply line shall be gate valves as per ASTM B62 inside screw rising stem, screwed female ends as per ASA B2.1. Valve bonnet shall be union type & trim material shall be stainless steel, body rating 150 pounds ASA. The valve sizes shall be ½ inch to 2 inch.



8.02.06 Purge Air Connection for Air & Flue Gas applications

The continuous purging with instrument air shall be done, for all air and flue gas measurements, at the process source connection end. Necessary arrangements required for continuous purging shall be provided inside all instruments enclosures and instrument racks for Aot and flue gas applications.

For intermittent purging with service air, necessary arrangements inside all the air and flue gas enclosures shall be provided. The SS316 four ways valve provided in the SS316 tubing shall be used for isolating the transmitter and connecting the service air quick disconnect line.

Purging arrangement is not required for instrument air and service air measurement applications. Purge air lines shall be of mild steel hot dipped galvanised inside and outside as per IS1239, heavy duty with threaded ends.

8.03.00 Process Connections

The type of instrument source connection shall depend upon the process parameters and the tapping size. The source connection drawings shall be finalised during the engineering stage.

Size of tapping point stub, number and size of root valves for different types of measurements are as follows:

Sl. No.	Quantity of root valves	Size of stub and root valve	Service Condition
Pressure and Differential Pressure Measurement			
(i)	2	25NB	$\geq 40 \text{ bar(g)}$ OR 425°C
(ii)	1	15NB	$< 40 \text{ bar (g)}$ AND 425°C .
Level Measurement			
(a) Level Gauge & Switch			
(i)	2	25NB	$\geq 40 \text{ bar(g)}$ OR 425°C
(ii)	1	25NB	$< 40 \text{ bar(g)}$ AND 425°C
(b) Level transmitter (displacement type)			
(i)	2	40NB	$\geq 40 \text{ bar(g)}$ OR 425°C
(ii)	1	40NB	$< 40 \text{ bar(g)}$ AND 425°C
(c) Stand pipe for level measuring instrument			
(i)	2	80 NB	$\geq 40 \text{ bar(g)}$ OR 425°C
(ii)	1	80 NB	$< 40 \text{ bar(g)}$ AND 425°C
Flow Measurement			
(i)	2	25NB	$\geq 40 \text{ bar(g)}$ OR 425°C
(ii)	1	25NB	$< 40 \text{ bar(g)}$ AND 425°C
<u>Sampling system measurement (Steam and Water Service)</u>			
(i)	2	25 NB	$\geq 40 \text{ bar(g)}$ OR 425°C
(ii)	1	25 NB	$< 40 \text{ bar(g)}$ AND 425°C

8.04.00 **INSTALLATION AND ROUTING**

8.04.01 All instrument piping, tubing and its accessories shall be supported in a safe



manner to prevent excessive vibrations and anchored sufficiently to prevent undue strain on connected equipment.

Instrument piping & tubing shall not be routed across equipment removal areas, above or below monorails, cranes, removable gratings, cable trays.

For steam and liquid measurements, the impulse pipe should preferably slope downward from source connection to instrument and instrument shall be installed below the source point. If due to any reason instrument is installed above the source point, the impulse pipe should slope upwards continuously and a 'pigtail' should be provided at the instrument to assure water seal for temperature protection. For vacuum measurements instruments shall be installed above source point and impulse pipe should slope upwards.

Impulse piping for air and flue gas shall slope upwards and instrument shall be installed above source point. If this requirement cannot be met special venting or drain provision shall be provided with vent and drain lines along with isolation valves and other accessories including drain pipes this drain is to be connected to plant drain through open funnel also. Horizontal must have a slope of not less than 40 mm per meter and must be adequately supported to maintain a constant slope and to prevent sag in piping.

All impulse piping shall be installed to permit free movement due to thermal expansion, wherein required expansion loops shall be provided.

Special accessories such as condensing pots/reservoirs shall be provided and installed wherever required. In any case condensing pots shall be provided for all level measurements in steam and water services and all flow measurements in steam and water services above 120 Deg. C. For drum level measurement required balancing chamber shall be provided and installed.

Colour coding of all impulse pipes shall be done by the bidder in line with the colour coding being followed for the parent pipes.

Instrument Air & Service Air piping/tubing system

The air supply headers, sub headers and branch pipes shall be supported properly by clamps or supports to be provided and fabricated by the bidder. Air supply piping shall be installed with a slope of over 1/100 to prevent accumulation of condensed water within the pipe. Signal/control air tubing shall run with the minimum number of changes in direction. Suitable identification tags shall be provided for easy link up and checking of proper connections. Single and multi tubes shall run with the minimum number of changes in direction. Suitable identification tags shall be provided for easy checkups and for connections.

PIPING /TUBING SUPPORT

Impulse piping and sample piping shall be supported at an interval not exceeding 1.5 meters. Each pipe shall be supported individually using slotted angle mounted clamps with necessary fixtures. Tubing shall run in proper perforated trays with proper cover. Tubing shall be supported inside the trays by aluminium supports.

Hangers and other fixtures required for support of piping and trays shall be provided, either by welding or by bolting on walls, ceilings and structures. Hanger clamps and other fastening hardware shall be of corrosion resistant



metals and hot-dip galvanised.

8.05.00 SHOP AND SITE TESTS

8.05.01 The equipment and work performed as per this chapter shall be subject to shop and site test as per requirements of Vol. II & Vol. V (Quality Assurance & Inspection) other applicable clauses of this chapter and Owner approved quality assurance plan.

8.05.02 Hydrostatic and Pneumatic leakage tests shall be performed on all pipes, tubing and systems and shall conform to ANSI B31.1.

8.05.03 Hydrostatic testing

All instrument piping/tubing shall be hydrostatically tested upon completion of erection. The test pressure shall be 1.5 times the maximum process pressure. The test shall be performed either with the testing of associated process piping or without the associated process piping (by closing the root valve). In both the cases the instrument shall be isolated by closing the shut-off valve.

Air testing

All air headers & branch pipes shall be air tested by pressure decay method as per ANSI B31.1. Flexible hoses and short signal tubing shall be tested at normal pressure for leakage. Long signal tubing shall be tested by charging each tube with air at 2 Kg/sq.cm through a bubbler sight glass. The boiler draft and vacuum piping shall be air tested by the same method as long signal tubing.

8.06.00 LOCAL INSTRUMENT ENCLOSURE AND RACKS

All transmitters, switches etc. in Boiler Turbine Generator measurements (except for all fuel oil applications) shall be suitably grouped together and mounted inside (i) Local instruments enclosures in case of open areas of the plant like boiler area, etc. and (ii) In local instrument racks in case of covered areas like Turbine/Generator area.

These local instrument enclosures and racks shall be furnished as per the actual requirements finalised during detailed engineering stage. The exact grouping of instruments in a particular instrument enclosure/instrument rack shall be as finalised during detailed Engineering stage subject to owner's approval. The GA of LIR should be similar to LIE except for front/rear doors and side panels. Vol. V, Part B, Chapter no. 6 shall also be referred for designing of LIE & LIR.

Sufficient spacing among adjacent transmitters shall be maintained to offer easy accessibility and operational convenience. The enclosure shall be designed with sizes to suit the grouping and to completely include all the hardware for hooking up the transmitters to the process on the basis of approved installation diagrams. A maximum of five (5) transmitters are envisaged to be grouped in one enclosure.

The internal layout shall be such that the impulse piping/ blow down lines are accessible from back side of the enclosure / rack and the transmitters etc. are accessible from front side for easy maintenance. Bulkheads, especially designed



to provide isolation from process line vibration shall be installed on instrument enclosures/racks to meet the process sensing line connection requirement.

Vibration dampeners shall be installed for each enclosure / rack. The Degree of Protection of LIE shall be IP-55.

The enclosure shall be constructed of 1.6 mm sheet plate and shall be of modular construction with one or more modules and two end assemblies bolted together to form an enclosure. Cable glands, Channel and frame shall be 3 mm thick. Double inter locking doors shall be provided. The doors shall be the three point locking type constructed of not less than 1.6 mm thick steel. Doors shall have concealed quick removal type pinned hinges and locking handles. Door locks shall accept the same key.

Neoprene/Polyurethane Gaskets shall be used between all mating sections to achieve protection class of IP-55.

The instrument racks shall be free standing type constructed of suitable 3 mm thick channel frame of steel and shall be provided with a canopy to protect the equipment mounted in racks from falling objects, water etc. The canopy shall not be less than 3 mm thick steel, and extended beyond the ends of the rack.

Bulk heads, especially designed to provide isolation from the process line vibration shall be provided. Exact fabrications details shall be as finalised during detailed Engineering stage. The junction box for LIE/LIR shall conform to IP -65 protection class.

Enclosures/Racks shall be reinforced as required to ensure true surface and to provide adequate support for instruments and equipment mounted therein. Centre posts or any member which would reduce access shall not be provided.

Each Transmitter enclosure housing instruments requiring purge air for continuous air purging, shall be provided with common purge air header, redundant air filters regulators of sufficient capacity , required pressure gauge, valves, fittings, SS tubing and individual purge meters for each purge line etc as required and indicated in instrument installation drawings enclosed herewith.

A 15 mm NB service air header shall be furnished in each instrument enclosure housing air and flue gas and coal mill instruments. The header shall be furnished complete with a pressure regulating valve, pressure gauge and quick disconnect connections. A hose for connecting each header to the draft instrument line four way valves shall be furnished. The hose shall be self storing nylon tubing having a burst pressure of 15 Kg/sq Cm the size of the hose shall be ½ " min. The service air header shall originate at a bulkhead penetration or fitting located on one of the bulkhead plates.

The bidder shall prepare the piping drawings and the general arrangement layout drawings for each of the enclosures and racks. The special attention shall be given in the piping layout to avoid air traps liquid filled piping or water pockets in piping intended to be dry. Drawings shall indicate the arrangement of all equipment, piping, valves and fittings within the enclosures/racks and shall be subject to owner's approval.



All liquid Filled Blow down lines, except those measuring vacuum shall be connected to a two inch header which is extended through one end of the enclosure and turned downward for directing the blow down into a drain. The material of the blow down header shall be carbon steel as per ASTM A 106 Gr C or as indicated in NIT's hookup drawings whichever is better.

The bidder shall submit to the owner with his proposal a copy of his welding procedure specification together with proof of his compliance with the latest applicable welding ANSI code. Prior to any welding being performed the bidder shall submit the qualifications of the craftsmen who will perform the work.

Bidder shall provide not more than three variants for LIE/LIR with respect to max. no. transmitters mounted in each LIE/LIR.

Each enclosure shall be provided with universal type 6/16 Amp. power receptacle, light fixture & LED lamps with wire guard and lighting switch etc. Lighting switches shall be door actuated & mounted inside the panel. Outlet box, switch box and device covers shall be of galvanized stamped steel. Light switches and power receptacles shall be installed inside the enclosure on the wall near the latch side of the enclosure door. Light fixtures shall be installed on the ceilings of the enclosures.

Power Supplies for miscellaneous devices shall be provided with 2P MCB located within the enclosures. MCB shall be mounted in Fuse blocks. Nameplates shall be furnished above the MCB blocks, identifying the devices being served.



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Technical Specifications for C&I Systems-Table-No. 8.1

S. No.	System/Line Description	Piping Class	Impulse Pipe material	Schedule (Size)	Materials for fitting/ valve body	Valve stem material	Rating of Piping Fitting	Pressure Class of valve
1	Main steam, Up stream & down stream of HP bypass and up stream of auxiliary steam pressure reducing valve, separator level.	A	ASTM-A335 Gr.P-91/22 (Note-2)	XXS (½ Inch)	Note-3	Note-3	9000lb	3000 SPL
2	BFP discharge/ superheater attemperator/spray to PRDS, Phosphate dosing, P/P discharge, BCW pumps.	B	ASTM-A106 Gr. C	160 (½ Inch)	Note-3	ASTM-A-182 Gr.F6a	6000lb	2500 SPL
3	Reheater attemperator	C	ASTM-A106 Gr. C	160 (½ Inch)	ASTM-A-105	ASTM-A-182 Gr.F6a	6000lb	1500 SPL
4	Hot. Reheat/Down stream of Aux.Steam pressure reducing valve upto desuperheater/flash tank drain manifold, HRH upstream & down stream of LP Bypass valve, HP heater level.	D	ASTM-A335 Gr.P-91/22 (Note-2)	160 (½ Inch)	ASTM-A182 Gr.F-22	Note-3	3000lb	2500 SPL
5	Cold reheat upto Tee-off for HP bypass.	E	ASTM-A335 Gr.P-22	80 (½ Inch)	ASTM-A182 Gr.F-22	ASTM-A-182 Gr.F6a	3000lb	800
6	Cold reheat down stream of Tee-off (HP Bypass)	F	ASTM-A106 Gr. C	80 (½ Inch)	ASTM-A105	ASTM-A-182 Gr.F6a	3000lb	800
7	BFP suction/condensate	G	ASTM-A106 Gr. C,	80 (½ Inch)	ASTM-A105	ASTM-A-182	3000lb	800

	system/Extraction to LPH/HPH and Extractions to BFPT, Deaerator, auxiliary steam, service air, instrument air, DMCW/ECW pumps, and other low pressure water services.		ASTM-A335 Gr.P-11/22			Gr.F6a		
8	Air/Flue gas outside furnace, coal-air mixture.	M	ASTM-A106 Gr.C	80 (3/4 Inch)	ASTM-A105	ASTM-A-182 Gr.F6a	3000lb	800
9	Air flue gas inside furnace	N	ASTM-A335 Gr.P-22	80 (3/4 Inch)	ASTM-A182 Gr.F-22	ASTM-A-182 Gr.F6a	3000lb	800
10.	Purge Air	O	ASTM-A106 Gr.C	80 (3/4 Inch)	ASTM-A105	SS316	3000lb	800
11.	DM Cooling water	P	ASTM-A312 TP 316	80/40 (1/2 Inch)	ASTM – A 182 F 316	SS316	3000lb	800
12.	CW & ACW	Q	ASTM-A106 Gr.C	80 (1/2 Inch)	ASTM-A105	SS316	3000lb	800

Note:-

- 1). Above requirements are minimum to be complied by bidder. Rating of piping / fittings / valves etc. is subjected to be approved by owner as per the final design pressure & temperature finalized during the detailed engineering, as per ANSI B 31.1.
- 2). In case temperature is more than 540 deg C, the material shall be P-91 only.
- 3). Material shall be compatible with that of the impulse pipe material and design parameter.
- 4). For DM Plant or DM water services, complete erection Hardware material shall be SS316 only.
- 5). Separator related impulse piping material shall be as per main process pipe/tank material.



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- e) Turbine lube oil pumps
- f) Jacking oil pumps
- g) Emergency turbine trip push buttons in control room.
- h) Boiler turbine: Generator inter-trip which includes the inter connecting cables between:-
- Boiler master fuel trip and turbine trip relays
 - Generator trip relays and turbine trip relays
 - Generator trip relays and 400 kV circuit breaker
 - Generator trip relays and generator field breaker
 - Generator trip relays and UAT breakers
- i) Fire alarm, annunciation and protection system.
- j) Any other system like safety critical circuit, trip protection circuit and for drives required for safe shut down operations of the plant.

9.03.00 INSTRUMENTATION CABLE INTERCONNECTION AND TERMINATION PHILOSOPHY

The cable interconnection philosophy to be adopted shall be such that extensive grouping of signals by large scale use of field mounted group Junction Boxes (JBs) at strategic locations is done and consequently cable with higher numbers of pairs are extensively used between field & Marshalling panels. The details of termination to be followed are mentioned in the given table below:-

Application		Type of Termination	
FROM (A)	TO (B)	END A	END B
Valves/Dampers Drives (Integral Junction Box)	Marshalling/ Marshalling- cum Termination Cubicle/ Local group JB	Plug in connector	Post mount cage clamp type
Transmitters, Process Actuated switches mounted in LIE/LIR	Integral Junction Box of LIE/LIR	Plug in connector	Cage clamp (Rail mount type)
RTD heads	Local Junction Box	Plug in Connector	Cage clamp (Rail mount type)
Thermocouple	Local Junction	Plug in Connector	Cage clamp (Rail

	Box		mount type)
Other Field mounted Instruments	Local JB/ Group JB	Plug in Connector	Cage clamp (Rail mount type)
RTD heads	Temperature transmitter	Plug in Connector	Screwed Cage Clamp Type
Thermocouple	Temperature Transmitter	Plug in Connector	Screwed Cage Clamp Type
Local Junction box, Temperature Transmitter, Int. Junction box of LIE/LIR/Group JB.	Group JB	Cage clamp (Rail mount type)	Cage clamp (Rail mount type)
Local Junction box, Temperature Transmitter, Int. Junction box of LIE/LIR/Group JB/ MCC/SWGR	Marshalling/ Marshalling – cum Termination Cubicles.	Cage clamp (Rail mount type)	Cage clamp (Post mounted type)
Marshalling cubicle/Termination Cabinets	Electronic system Cabinet	Cage clamp (Post mounted type)	Plug-in connector/other system as per Mfr's standard
Marshalling/ Termination System Cabinets	UCD mounted equipments	Cage clamp (Post mounted type)	Plug in Connector/ Cage clamp Type (rail mounted)
DDCMIS/PLC cabinets	OWS, Printer etc.	Plug in connector	Plug in Connector

Notes

1. For Analog signals, individual pair shielding & overall shielding & for Binary signals, only overall shielding of instrumentation cables shall be provided.
2. Signal and Electrical connection shall be screwed connection with double compression type Nickel-plated brass/SS316 cable glands for Explosion proof area, Flame proof area and high vibration prone area.
3. All screwed connections shall be provided with double compression type Nickel-plated brass/SS316 cable glands.

9.04.00 TERMINAL BLOCKS

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For all inputs to the system emanating from the field or other systems, the bidder shall furnish terminals suitable for correct size of field cables.

- 9.04.01** All outputs going to MCC/SWGR terminal blocks, shall be rated 600 volts minimum and shall have strap screw less terminals suitable for connection of wires with ring tongue type lugs. Standard terminal blocks shall be rail mounted screw less spring loaded cage clamps type.

The terminal blocks for DDCMIS/DCS/PLC input/output connections from/to SWGR/MCC, Actuators with Integral Starter (for Coupling relays and check back signals of 11 kV and 3.3 kV auxiliaries, LT drives/valves & dampers/solenoids, CT&VT, etc.) shall be provided with built in test and disconnect facilities complete with plug, slide clamp, test socket etc. The exact type of terminal blocks to be provided by the bidder and the technical details of the same including width etc. shall be subject to owner's approval.

Terminal blocks shall be approximately sized for larger wire size of higher voltage insulated incoming conductors as necessary. All the TBs used shall be high quality non-flammable insulating material of melamine suitable for working temperature of 105 deg C and 6.6 polyimide to withstand corrosion and the metallic portion shall be coated against rust /corrosion. All metal parts should be non –ferrous in nature.

- 9.04.02** All the Terminal blocks shall be provided complete with all required accessories including assembly rail, locking pin and section, end brackets, partions, small partions, test plug bolts and test plug (as specified above for SWGR connections) transparent covers, support brackets, distance sleeves, warning label, marking etc.

The marking on terminal strips shall correspond to the terminal numbering on wiring diagrams.

- 9.04.03** Fuses shall not be mounted on terminal blocks. Neither step type terminal blocks nor angle mounting of terminal blocks will be acceptable. The terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal blocks and between terminal blocks and junction box walls.

- 9.04.04** At least 20 per cent spare unused wired terminals shall be provided on each terminal block for circuit modifications and for termination of all conductors in a multi-conductor control cable with each panel, enclosure, cubicle, Junction Boxes, SOV Boxes, instrument racks/enclosures, termination/marshalling cabinets, etc.

All terminal blocks shall be numbered for identification and grouped according to the function. Engraved labels shall be provided on the terminal blocks.

For terminating each process actuated switches, drive actuators, control valves, thermocouples, RTD, etc. in local junction boxes etc. refer NIT's interfacing & wiring drawings.

- 9.04.05** For ensuring proper connections, Bidder shall provide suitable accessories, along with insulation sleeves. The exact connecting accessory shall be finalised as per application during detail engineering stage subject to owner's approval without any cost repurcussions.

9.05.00 INTERNAL PANELS/ SYSTEM CABINETS WIRING

- 9.05.01 Internal panel/cabinet wiring shall be of multi-stranded copper conductor with FRLS PVC insulation without shield and outer sheath meeting the requirements of VDE 0815.
- 9.05.02 All internal wires shall be provided with tag and identification nos. etched on tightly fitted ferrules at both ends. All wires directly connected to trip devices shall be distinguished by one additional red colour ferrule.
- 9.05.03 All external connection shall be made with one wire per termination point. Wires shall not be tapped or spliced between terminal points.
- 9.05.04 All floor slots of desk/panels/cabinets used for cable entrance shall be provided with removable gasketed gland plates and sealing material. Split type grommets shall be used for prefabricated cables.
- 9.05.05 All the special tools as may be required for solder less connections shall be provided by Bidder.
- 9.05.06 Wiring to door mounted devices shall be provided with (49 strand minimum) adequate loop lengths of hinge wire so that multiple door openings will not cause fatigue braking of the conductor.
- 9.05.07 Power supply wiring, and interconnecting cables between devices shall pass the following tests.
- Flammability test IEEE 383/1974
 - When tested under UITPP test method or ASTM 2893/77 light transmittance of 80%
 - When tested under IEC 754-1 maximum acid gas generation shall be 2% by weight
 - Oxygen index not less than 30 as per ASTM D 2863.

9.05.08 Following wire size shall be utilized for internal wiring:

- | | | | |
|------|---|--------------|-----------|
| a. | Current (4-20 mA)
Low voltage signals
(AI/AO & DI signals) | : | 0.5 sq.mm |
| b. | DO signals, Ammeter/
voltmeter circuit, control
switches, indicator, recorder | : | 0.5 sq.mm |
| c. | Internal Illumination | : | 2.5 sq.mm |
| d. | Size of Power supply cables shall be as below:- | | |
| | Load | Size | |
| i. | 1 to 16 Amp. | - 2.5 sq. mm | |
| ii. | 17 to 20 Amp. | - 4 sq. mm | |
| iii. | 21 to 32 Amp. | - 6 sq. mm | |



- | | | |
|-----|---------------|--------------|
| iv. | 33 to 40 Amp. | - 10 sq. mm. |
| v. | 41 to 60 Amp. | - 16 sq. mm |

9.06.00 **INSTRUMENTATION CABLE INSTALLATION & ROUTING**

9.06.01 Immediately prior to the installation of each cable or cable group, the raceway route to be followed shall be inspected and ascertained to be complete in installation and free of all materials detrimental to the cable or its placement. All cables assigned to a particular duct/conduit shall be grouped and pulled in simultaneously using cable grips and suitable lubricants. Cables removed from one duct/conduit shall not be reused without approval of Owner.

9.06.02 Cables shall be segregated as per IEEE Std.-422. In vertically stacked trays, the higher voltage cable shall be in higher position and instrumentation cable shall be in bottom tier of the tray stack. The distance between instrumentation cables and those of other system shall be as follows:

From 11 kV/6.6 kV/3.3 kV tray system	-	914 mm
From 415V tray system	-	610 mm
From control cable tray system	-	305 mm

9.06.03 Cables shall terminate in the enclosure through cable glands. All cable glands shall be properly gasketed. Sealing (to prevent ingress of dust entry and propagation of fire) shall be provided for all floor slots used for cable entrance. Double compression cable glands shall be provided.

9.06.04 The cables emanating from redundant equipment/devices shall be routed through different paths. The above segregation of cables & wiring for redundant equipments/devices shall be in accordance with IEEE-Std-422.

9.07.00 **CABLE LAYING AND ACCESSORIES**

- 1 Cables shall be laid strictly in line with cable schedule.
- 2 Identification tags for cables.

Indelible 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 20 m in cable trench/tray.
- 3 Cable tray numbering and marking.

To be provided at every 10m and at each end of cable way & branch connection.
- 4 Joints for less than 250 Meters run of cable shall not be permitted.
- 5 Buried cable protection



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INSTRUMENT CHECK LISTS

off, then the cost shall not be payable.

13.01.00 SPECIAL REQUIREMENT FOR SOLID STATE EQUIPMENTS/ SYSTEMS

13.01.01 The minimum type test reports, over and above the requirements of above clause, which are to be submitted for each of the major C&I systems shall be as indicated below:

i) Surge Withstand Capability (SWC) for Solid State Equipments/ Systems

All solid state systems/ equipments shall be able to withstand the electrical noise and surges as encountered in actual service conditions and inherent in a power plant. All the solid state systems/ equipments shall be provided with all required protections that needs the surge withstand capability as defined in ANSI 37.90.1/ IEEE-472. Hence, all front end cards which receive external signals like Analog input & output modules, Binary input & output modules etc. including power supply, data highway, data links shall be provided with protections that meets the surge withstand capability as defined in ANSI 37.90.1/ IEEE-472. Complete details of the features incorporated in electronics systems to meet this requirement, the relevant tests carried out, the test certificates etc. shall be submitted along with the proposal. As an alternative to above, suitable class of EN 61000-4-12 which is equivalent to ANSI 37.90.1/ IEEE-472 may also be adopted for SWC test.

ii) Dry Heat test as per IEC-68-2-2 or equivalent.

iii) Damp Heat test as per IEC-68-2-3 or equivalent.

iv) Vibration test as per IEC-68-2-6 or equivalent.

v) Electrostatic discharge tests as per EN 61000-4-2 or equivalent.

vi) Radio frequency immunity test as per EN 61000-4-6 or equivalent.

vii) Electromagnetic Field immunity as per EN 61000-4-3 or equivalent.

Test listed at item no. v, vi, vii, above are applicable for electronic cards only as defined under item (i) above.

13.02.00 TYPE TEST REQUIREMENT FOR C&I SYSTEMS

S.NO Col1	Item Col2	Test Requirement Col3	Standard Col4	Test to be specifically conducted Col5	UPRVUNL's Approval required on Test certificate Col6
1	Elect. Metering instruments	As per Standard (col4)	IS-1248	No	Yes
2	Transducers	As per	IEC-	No	Yes

		Standard (col4)	60688,IS12784		
3	Thermocouple	Degree Protection Test	IS-13947	No	No
4	RTD	As per Standard (col4)	IEC-60751	No	No
5	Electronic Transmitters	As per Standard (col4)	BS-6447/ IEC-60770	No	Yes
6	E/P converter	As per Standard (col4)	Mfr. standard	No	Yes
7	Dust emission monitor	Degree Protection Test	IS-13947	No	Yes
8	Instrumentation Cables Twisted & Shielded*				
	Conductor	Resistance	VDE-0815, IS: 10810	No	Yes
		Diameter test	IS-10810	No	Yes
		Tin Coating test (per sulphate)	IS-8130/84	No	Yes
	Insulation	Loss of mass	VDE 0472, IS:5831/1984	No	Yes
		Ageing in air ovens**	VDE 0472, IS:5831/1984	No	Yes
		Tensile strength and elongation test before and after ageing**	VDE 0472, IS:5831/1984	No	Yes
		Heat shock	VDE 0472, IS:5831/1984	No	Yes
		Hot deformation	VDE 0472	No	Yes
		Shrinkage	VDE 0472, IS:5831/1984	No	Yes
		Bleeding and Blooming	IS-10810, IS:5831/1984	No	Yes
		Cold bend test for PVC insulation.	IS:5831/1984		
		Insulation Resistance Test (Volume Resistivity method)	As per GTP		
	Inner sheath***	Loss of mass	VDE 0472, IS:5831/1984	No	Yes
		Heat shock	VDE 0472, IS:5831/1984	No	Yes
		Cold bend/cold impact test	VDE 0472, IS:5831/1984	No	Yes
		Hot deformation	VDE 0472	No	Yes
		Shrinkage	VDE 0472,	No	Yes

			IS:5831/1984		
	Outer sheath	Loss of mass	VDE 0472, IS:5831/1984	No	Yes
		Ageing in air ovens**	VDE 0472, IS:5831/1984	No	Yes
		Tensile strength and elongation test before and after ageing**	VDE 0472, IS:5831/1984	No	Yes
		Heat shock	VDE 0472, IS:5831/1984	No	Yes
		Hot deformation	VDE 0472	No	Yes
		Shrinkage	VDE 0472, IS:5831/1984	No	Yes
		Bleeding and Blooming	IS-10810, IS:5831/1984	No	Yes
		Colour fastness to water	IS-5831/1984	No	Yes
		Cold/bend cold impact test	VDE 0472, IS:5831/1984	No	Yes
		Oxygen index test	ASTMD-2863/77	No	Yes
		Smoke density test	ASTMD-2863, ASTM-D-2843/77	No	Yes
		Acid gas generation test	IEC-60754-1	No	Yes
	fillers				
		Oxygen index test	ASTMD-2863, IEC 60754-1	No	Yes
		Acid gas generation test	IEC-60754-1	No	Yes
	AL-MYLAR shield				
		Continuity Test	As per GTP	No	Yes
		Shield Thickness		No	Yes
		Overlap test		No	Yes
	Over all cable				
		Flammability Test	IEEE 383, IEEE-332 Part -3 (Category-B)	No	Yes
		Swedish chimney test	SEN 4241475	No	Yes
		Noise interference	IEEE Transactions	No	Yes
		Dimensional checks	IS 10810	No	Yes
		Cross talk	VDE-0472	No	Yes

		Mutual capacitance	VDE-0472	No	Yes
		HV test	VDE-0815, As per GTP	No	Yes
		Drain wire continuity	VDE 0472	No	Yes
	* 1.0 All cables to be supplied shall be of type tested quality. The Bidder shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last five years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.				
	2.0 In case the Bidder is not able to submit report of the type test(s) conducted within last five years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Bidder shall conduct all such tests either in an independent laboratory or at manufacturer's works in presence of Owner's representative under this contract free of cost to the Owner and submit the reports for approval.				
	** These tests shall be carried out as per VDE0207 Part 6 & ASTM-D-2116 for TEFLON insulated & outer sheathed cables				
	*** Applicable for armoured cables only				
9	DC Power Supply System (Applicable for each model and rating)				
	1)The Type Test reports for offered rectifier module and the controller module irrespective of the rectifier bank shall be acceptable				
		Surge Withstand capability (SWC)	ANSI 37.90.1 IEEE-472, EN61000-4-12	No	Yes
		Dry Heat Test	IEC-68-2-2 or equivalent	No	Yes
		Damp Heat test	IEC-68-2-3 or equivalent	No	Yes
		Vibration test	IEC-68-2-6 or equivalent	No	Yes
		Electrostatic discharge test	EN 61000-4-2 or equivalent	No	Yes
		Radio frequency immunity test	EN 61000-4-3 or equivalent	No	Yes
		Electromagnetic field immunity	EN 61000-4-3 or equivalent	No	Yes
		Degree of Protection	IS-13947 or equivalent	No	Yes
10	Battery##	As per stand	IS-10918	No	Yes

		col 4			
11	UPS (Applicable for each model and rating)				
	1) Type Test reports of same series of UPS with similar PCB's cards and controllers as the target UPS system shall be acceptable.				
	2) For Dry heat, Damp heat and vibration, the tests conducted on individual PCB's shall be acceptable.				
		Surge Withstand capability (SWC)	ANSI 37.90.1 IEEE-472, EN61000-4-12	No	Yes
		Dry Heat Test	IEC-68-2-2 or equivalent	No	Yes
		Damp Heat test	IEC-68-2-3 or equivalent	No	Yes
		Vibration test	IEC-68-2-6 or equivalent	No	Yes
		Electrostatic discharge test	EN 61000-4-2 or equivalent	No	Yes
		Radio frequency immunity test	EN 61000-4-3 or equivalent	No	Yes
		Electromagnetic field immunity	EN 61000-4-3 or equivalent	No	Yes
		Degree of Protection	IS-13947 or equivalent	No	Yes
		Fuse clearing capability	Approved procedure	No	Yes
		Short circuit current capability	IEC 60146-2	No	Yes
	Voltage stabilizers	Over Load Test	Approved procedure	No	Yes
		Temp rise test without redundant fans	Approved procedure	No	Yes
	LIE / LIR	Degree of protection Test	IS-13947	No	Yes
	Flue Gas Analysers	Degree of protection Test	IS-13947	No	Yes
	Master clock	Functional test	As per Approved procedure	No	Yes
	CJC Box	Degree of protection Test	IS-13947	No	Yes
	Junction Box	Degree of protection Test	IS-13947	No	Yes
	OPC data	OPC		No	Yes

	access server Data exchange server and Historical data access server	Compliance testing			(Self certification is also acceptable)
	Conductivity type level switch	Degree of protection Test	IS-2147	No	No
	Local Gauges	Degree of protection Test	IS-2147	No	No
	Process actuated switches	Degree of protection Test	IS-2147	No	No
	Control Valves	CV Test	ISA 75.02	No	Yes
	PLCs	As per standard (col4) and cl. No. 13.03.00 below.	IEC 1131	No	No
	Flow Nozzle orifice plate	Calibration	ASME PTC BS 1042	No	Yes
	## The bidder shall submit for Owners approval the reports of all the type test as per latest IS-10918 carried out within last five years from the date of Bid opening and the test(s) should have been either conducted at an independent laboratory or in presence / owners representative. The complete type test reports shall be for any rating of Battery in a particular group based on plate dimensions being manufactured by supplier. Note: Type Tests are to be conducted only for the items, which are being supplied as a part of this Package.				

13.03.00 TYPE TESTS for PLC

- 13.03.01 All equipments to be supplied shall be of type tested quality. The bidder shall submit for Owner's approval the reports of all the type testes as listed in this specification and carried out within last five years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.
- However if the bidder is not able to submit report of the type tests(s) conducted within last five years from the date of bid opening, or in case the type tests(s) are not found meeting the specification requirements, the Bidder shall conduct all such tests under this contract, at no additional cost to the owner either at third part lab or in presence of clients/owners representative and submit the reports for approval.
- 13.03.02 All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.



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

CHECK LIST FOR TRANSMITTER

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

Legend :

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

Note :

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



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

CHECK LIST FOR PRESSURE & DP GAUGE

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

Legend :

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

Note :

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



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

CHECK LIST FOR LEVEL GAUGE

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

Legend :

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

Note :

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



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

CHECK LIST FOR ANNUNCIATORS

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

Legend :

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

Note :

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



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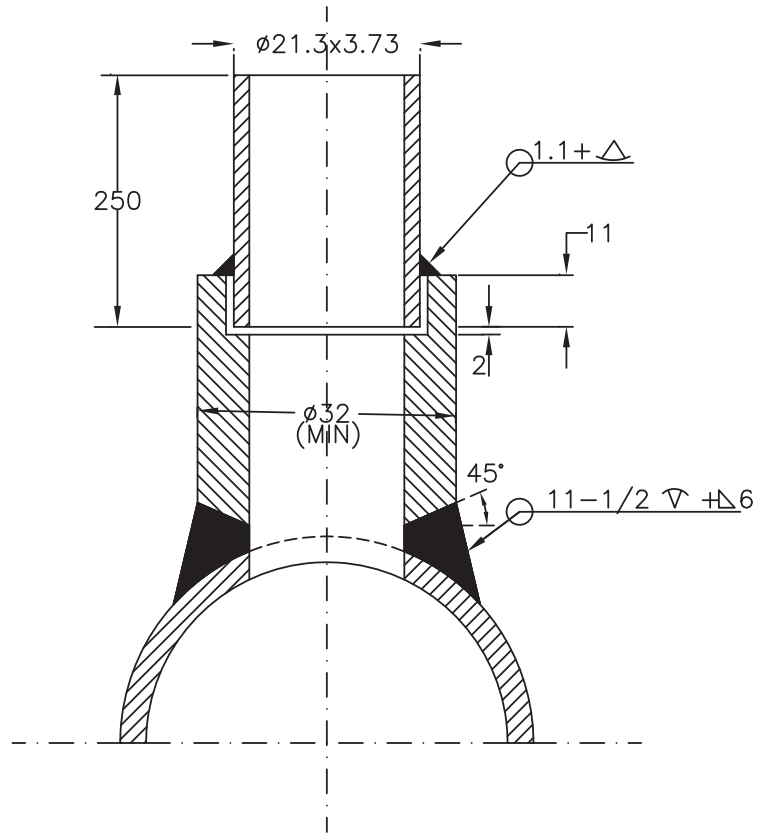
1X660MW PANKI TPS EXTN.

SECTION D

REV. NO. 00

DATE : 13.07.2018

INSTRUMENT STUB DETAILS



NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHALL BE 250 MM.
3. THE OTHER END OF THE NIPPLE SHALL BE SOCKET WELDED WITH 1/2" GLOBE VALVE OF MATERIAL AS PER ANSI B 31.1.
4. TWO ISOLATION VALVES ARE TO BE USED FOR PRESSURE EXCEEDING 40 Kg/Cm².
5. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
6. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY(1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES.
7. FOR PU COATED PIPE REFER SHT NO.7

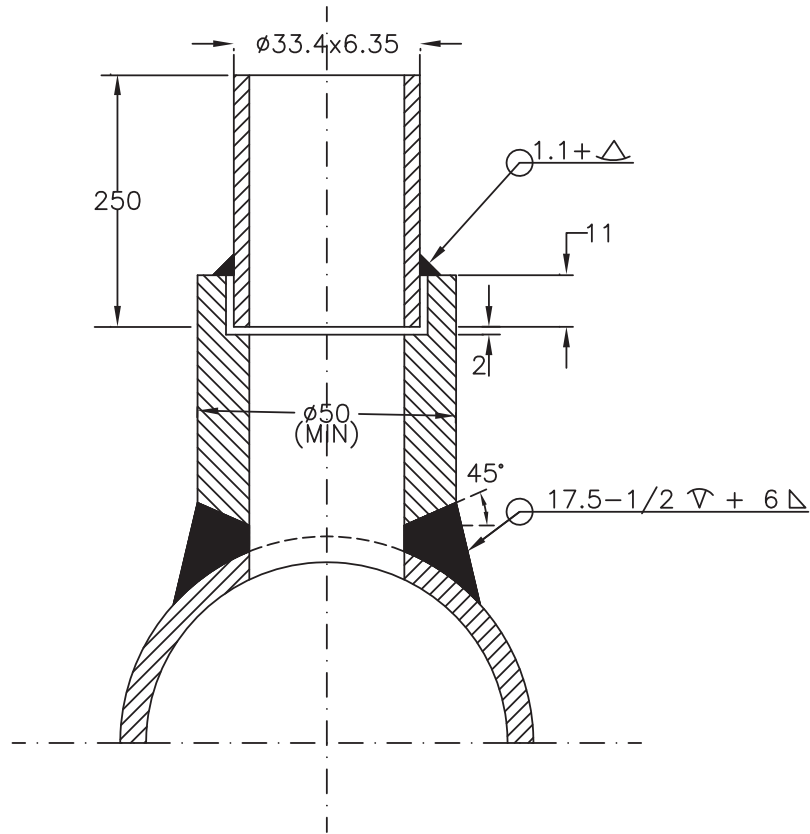


TITLE :

STD INSTRUMENT STUB
DETAILS
PRESSURE STUB

SYSTEM PRESS < 60Kg/Cm² & SYSTEM TEMP < 425 Deg C, Nb15 , CL3000

DRG. NO.
PE-DG-426-145-I101
REV. 00
SH. 02 OF 08



NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHALL BE 250 MM.
3. THE OTHER END OF THE NIPPLE SHALL BE SOCKET WELDED WITH 1" GLOBE VALVE OF MATERIAL AS PER ANSI B 31.1.
4. TWO ISOLATED VALVES ARE TO BE USED.
5. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
6. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY (1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES.

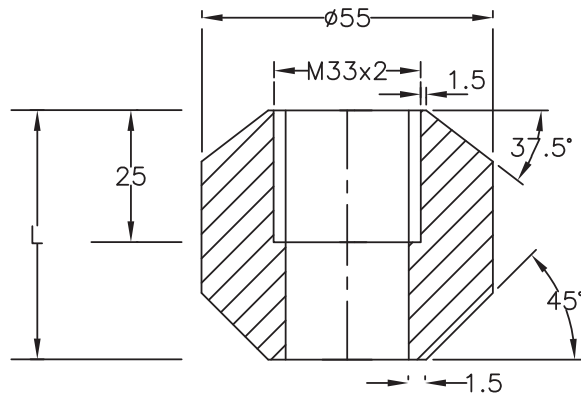


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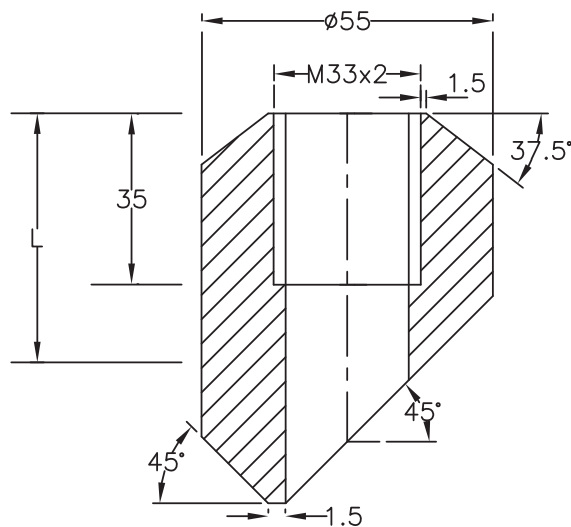
**STD INSTRUMENT STUB
DETAILS**
PRESSURE STUB

DRG. NO.
PE-DG-426-145-I101
REV. 00
SH. 03 OF 08

SYSTEM PRESS > 60Kg/Cm² & 425 Deg C < SYSTEM TEMP <= 500 Deg C , Nb25 , CL3000/6000



TEMPERATURE STUB FOR STRAIGHT IMMERSION



TEMPERATURE STUB FOR SLANT IMMERSION

NOTE :

1. MATERIAL OF THE BOSS SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED.
2. LENGTH OF THE STUB (L) SHALL BE 64/45 mm DEPENDING UPON PIPE SIZE, AS PER CORPORATE STD. AA 7326102.(FOR PIPE OD 88.9 mm TO 159 mm STUB HEIGHT SHALL BE=64mm & FOR PIPE OD ≥ 219.1 mm STUB HEIGHT SHALL BE=45mm)
3. STRAIGHT IMMERSION STUBS SHALL BE USED FOR PIPE OD'S 168.3 mm & ABOVE. THE STUB HEIGHT FOR PIPE OD 168.3 mm TO <219.1 mm SHALL BE 64 mm.
4. SLANT IMMERSION STUBS SHALL BE USED FOR PIPE OD'S 88.9 mm TO 159 mm.
5. FOR MAIN PIPE OD'S 88.9 mm & BELOW SUITABLE EXPANDER SHALL BE USED.
6. PLEASE REFER SHEET-6 FOR THERMOWELL INSTALLATION.
7. FOR PU COATED PIPE REFER SHT NO.8

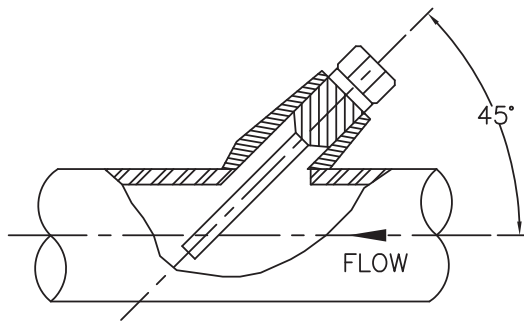
TITLE :



STD INSTRUMENT STUB
DETAILS

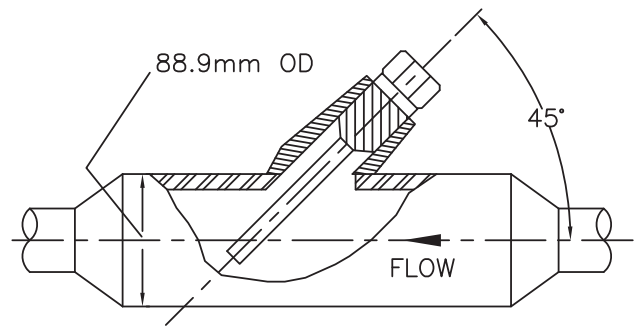
TEMPERATURE STUB

DRG. NO.
PE-DG-426-145-I101
REV. 00
SH. 05 OF 08



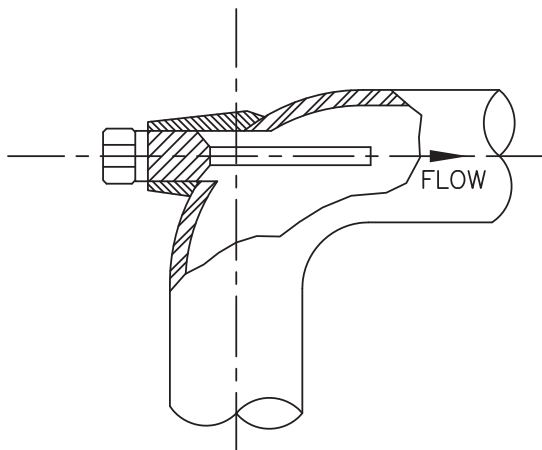
INSTALLATION TYPE-1

FOR MAIN PIPE OD 88.9mm to 159mm



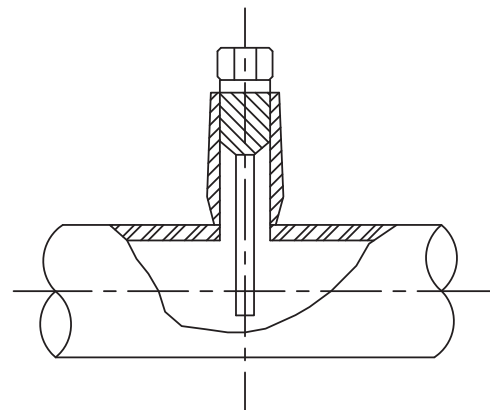
INSTALLATION TYPE-2

FOR MAIN PIPE OD BELOW 88.9mm



INSTALLATION TYPE-3

FOR MAIN PIPE OD 88.9mm & BELOW



INSTALLATION TYPE-4

FOR MAIN PIPE OD 168.3mm & ABOVE



TITLE :

STD INSTRUMENT STUB
DETAILS

THERMOWELL INSTALLATION

DRG. NO.
PE-DG-426-145-I101
REV 00
SH. 06 OF 08



Technical specification for
CONTROL & INSTRUMENTATION

1X660MW PANKI TPS EXTN.

SECTION D

REV. NO. 00

DATE : 13.07.2018

**LOCAL CONTROL PANEL
SPECIFICATION
&
QUALITY PLAN**

6.10.00 CONSTRUCTIONAL FEATURES OF LOCAL CONTROL PANELS, CONSOLES, CONTROL Desk, CUBICLES & ENCLOSURES

- i. All control panels, cubicles, consoles, SOV panels and enclosures provided anywhere for subject plant per this specification shall be of free standing type and shall be constructed of specified gauge of steel plates (CRCA). The minimum sheet thickness of panels shall be as follows unless otherwise specified herein.

Side and top – not less than 1.6 mm

Door – not less than 2.0 mm

Mounting plate – 2.5 mm

Base metal plate - 2.5 mm

Gland plate – 3 mm

- ii. The panels, consoles/desks shall be reinforced as required to ensure true surfaces and adequate support for instruments mounted thereon. All instrument cutouts, mounting studs, and support brackets shall be accurately located. All welds on the exposed panel surfaces shall be ground smooth. Finished panel surfaces shall be free from waves, bellies, or other imperfections. Unless specified, otherwise, panel doors shall be 4 points hinged and shall have turned back edges and additional bracing where required to ensure rigidity. Door hinges shall be of the concealed type. Door latches shall be of the three/four -point type to ensure tight closing. Door locks shall be furnished which will allow actuation of all locks by a single master key. All panels shall have removable lifting eyebolts for safe lifting from top during storage and installation handling.

Cabinet doors shall be hinged and shall have turned back edges and additional bracing where required ensuring rigidity. Hinges shall be of concealed type. Door latches shall be of three/four -point type to assure tight closing. Detachable lifting eyes or angles shall be furnished at the top of each separately shipped section and all necessary provisions shall be made to facilitate handling without damage. Front and rear doors shall be provided with locking arrangements with a master key for all cabinets. If width of a cabinet is equal or more than 800 mm, double doors shall be provided.

- iii. All panels shall be mounted on vibration dampers, which are secured to C-channels mounted on the floor. The channels shall be field welded to steel plates set into the concrete flooring. The steel plates shall be located such as to approximate the outline of panel bases. The exact mounting details shall be as approved by the owner during detailed engineering stage. All panels shall be provided with adequate ventilation and packaging density of components shall be restricted so as to limit the temperature rise above ambient to 10°C under the worst conditions. All panels shall have auto on/off switch for internal lighting. All the power supply circuit for control panels shall be provided with auto changeover circuitry.
- iv. In each panel /cabinet, a 24 VDC Voltmeter digital type shall be provided to check the Field Interrogation voltage.
- v. Exhaust Fans with louvers & filters shall be provided on upper side to remove hot air in all consoles and panels.
- vi. Fire & Smoke detectors shall be provided inside the Control room mounted system/control cabinets.
- vii. Feeder failure/ healthy indication shall be provided in each cabinet & remote indication shall be hooked up to DDCMIS/ PLC/annunciation & suitably grouped.
- viii. All the panels shall be equipped with Anti vibration pad of min. 15 mm size thickness. Cable gland plate thickness shall be 3 mm. C Channel height shall be min. 100 mm.
- ix. Doors shall be provided with neoprene/polyurethane gasket only. The front and rear doors shall be of full height .
- x. Protection class shall be as specified at Vol. V, Part B, chapter 1.
- xi. All the cable entries shall be at the bottom of electronic cubicles/control panels.
- xii. Control panels shall be provided with proper arrangement and hardware to terminate the inert gas required for fire protection.
- xiii. 25x6 mm copper ground bus to be provided for each panel/control desk.
- xiv. Terminal blocks shall be Rail mounted 650 V AC grade Terminal blocks (Screw less cage clamp type) with markers and 20% spare wired terminals of each type.
- xv. For Panels/cubicles internal wiring details, Bidder to refer Vol. V, Part B, Chapter 9.

6.11.00 TERMINATION/Marshalling CABINETS & Interposing Relay Panel

Marshalling/Termination cabinets for the control system shall be supplied for terminating all cables originating from the field, MCC/SWGR or any other source



of signal and for distributing the signals to different functional panels, MCC/SWGR and control cubicles.

Incoming cables from the field, MCC/SWGR or any other source of signal shall be terminated in suitable terminal blocks in logical sequence.

Prefabricated cables with plug in connectors at both ends shall be used for extending the signals to the functional panels. Matching plug sockets shall be provided in the termination cabinets for terminating the plugs.

Interposing relay panels for the system shall be supplied for mounting interposing relays & terminating all cables originating from the DO cards in case of solenoid valves, HW Annunciation windows and other required services etc. IPR panels shall be placed in CER and LCR.

Interposing relay shall be mounted in respective SWGR/MCC/integral starter required for commands signals of HT/LT unidirectional drives and bidirectional drives, breakers, isolators, bus couplers etc from DDCMIS/DCS/PLC or any control system.

Terminal blocks shall be located inside the cabinets on support wings fabricated of metal plates.

The plug socket shall be mounted on hinged plates to provide an access to the rear pins of the plugs.

General features of termination cabinets and accessories shall conform to the general design and construction specification of panels. Terminal blocks shall be Rail mounted 650 V AC grade Terminal blocks (Screw less cage clamp type) with markers and 20% spare wired terminals.

Wiring shall be 650V grade. PVC insulated FRLS stranded copper wire.

6.12.00 SURFACE PREPARATION AND PAINTING

All panel exterior steel surfaces shall be ground smooth, and painted as specified below:

Suitable filler shall be applied to all pits, blemishes and voids in the surfaces. The filler shall be sand blasted so that surfaces are level and flat, corners are smooth and even. Exposed raw metal edges shall be ground burr free. The entire panel surface shall be sand blasted to remove rust and scale and all other residue due to the fabrication operation. Oil grease and salts etc. shall be removed from the panels by one or more solvent cleaning methods. Alternatively 7 tank process shall be followed.

Two spray coats of inhibitive epoxy primer – surface shall be applied to all exterior and interior surfaces, each coat of primer surface shall be of dry film thickness of 1.5 mil. A minimum of two spray coats of final finish colour (Catalysed epoxy finish) shall be applied to all surfaces of dry film thickness 2.0 mil. The final finished thickness of paint film on steel shall not be less than 65-75 micron for sheet thickness of 2 mm and 50 microns for sheet thickness of 1.6



mm. As an alternative, single coat of anodic dip coat primer along with single textured powder coating with epoxy polyester meeting the thickness requirement is also acceptable.

The Bidder shall furnish sufficient touch-up paint for one complete finish coat on all exterior factory applied painted surface of each item of equipment.

The finish colours for exterior and interior surfaces shall conform to the following shades:

a) Exterior - RAL 7032/RAL 7035.

b) Interior - Glossy white two coats/RAL 7035 with fire resistant paint

One uniform colour shade as finalized by owner during detailed engineering shall be applicable for complete plant.

Paint films, which show sags, checks, blisters teardrops, fat edges or other painting imperfections, shall not be acceptable and if any such defects appear, they shall be repaired by and at the expenses of the Bidder.

6.13.00 PANEL ILLUMINATION

Panels shall be provided with LED based illuminating lamps with door switch and six (6) point 5/15A, 240V AC universal type power sockets with switch for maintenance purposes. These switches shall be with quick make and break mechanism. 100 % spare LED lamps shall be provided with each panel, these are in additional to mandatory spares.

6.14.00 Panel Cooling Fans (for ventilation of the DDCMIS/ PLC / DCS & other cabinets)

Filter Fan for electrical cabinets and enclosures to be used with 120 V or 230 V AC versions having very low acoustic noise and lower power consumption. The fans must have UL approval and should have air flow volume as per the cabinet requirement. Wherever required, the EMC filter fans may be used. Fans should have a life of 50,000 Hours at 40 Deg C. Fan Housing, cover should be of V0 material as per UL94. Filter mat should be compliant to EU3 according to DIN 24185 standard and have a filtering degree of 80 to 90 %. The Ambient temperature range °C should be -10 to +70 Deg C and Protection class should be IP 54. Filter Material shall be Synthetic fibre with progressive construction, temperature resistant to +100°C, self extinguishing, Class F1 as per DIN 53438 standard.

6.15.00 Panel Thermostat (for temperature control of the DDCMIS/PLC/DCS panel – to be connected to switch On/Off Fan/Heater)

The panel thermostat shall be DIN Rail Mounted with an inbuilt snap action thermostatic bimetal sensor and shall be connected in series with the load without any additional supply voltage. The panel thermostat shall be available in setting temperature range of -20 deg C to 40 deg C or 0 to 60 deg C with separate modules for NO or NC contact. The electrical life at rated load AC1 shall be 1 Lakh switching cycles and shall work at an ambient temperature of -45 to +80 deg C. With AgNi contact material for switching, the contact current carrying



capacity shall be 10 Amp at a rated voltage of 250 V AC with a dielectric strength between open contacts of 500 V AC and shall have UL approval.

6.16.00 FUSES & MCB

All fuses shall be fast acting semiconductor types for AC supply and compatible to the UPS fuses. For all DC Powered devices, similarly the fuses shall be fast acting compatible to DCDB fuse provisions. All the AC power supplies shall be provided with the protection of Fast acting semi conductor fuses & 2 P thermo magnetic type MCB. For all the DC power supply circuits, electronic type DC MCB shall be used only. Make of DC MCB shall be Siemens, Phoenix contacts, Murr, Weidmuller, or Lutze.

50 % spare fuses shall be provided with each panel, these are in additional to mandatory spares.

6.17.00 NAME PLATES AND LABELS

Name plates of adequate size shall be provided for each panel on front and rear of the panel. Instruments/other accessories mounted inside the panels shall have identification marking clearly visible from inside.

Devices to be mounted on the panels shall also be labeled on the panels shall also be labeled on the outside of the panel. Name plates shall be of polyamide sheets with black letters on white background. Name plates shall be attached to the boards by means of stainless steel panhead screws. Fuses provided for protection of various boxes shall be accessible for replacement. Fuse boxes shall be provided with circuit label and fuse rated current and voltage.

Markings/Labels

All markers/labels shall be made of halogen & silicon free polyamide material with inflammability class V2 as per UL 94, ensuring scratch proof printing with the use of environment friendly solvent free ink & latest BLUEMARK UV technology so as to comply the WIPE RESISTANCE according to DIN EN 61010-1/VDE 0411-1.

6.18.00 QUANTITIES

Refer Appendix-I to Part-A, Vol.-V of Technical Specifications. Quantities indicated are the minimum requirements, however each & every item shall be provided as per system requirements.

6.19.00 Design Criteria for Control Rooms:

The interiors of the each control Room shall be aesthetically designed with modern designs and technologies. The bidder shall have 2-D and 3-D software for designing the control room layouts. The bidder shall have thorough knowledge on Indian power plant control room requirements. Control rooms shall also be designed as per standard "ISO 11064 (1-7) - Ergonomic design of control centres".

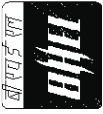
 PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-QP-999-145-1056				
												VOLUME		IIB		
												SECTION		D		
												REV. NO.		01		
												DATE:		22-02-2008		
												SHEET		1 OF 7		
Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks				
									P	W	V					
1.0	INCOMING Sheet Steel (CRCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample	Relevant standard	Relevant standard	Test Certificate	3	---	2					
		2. Bend Test	CR	Mech. test	Sample	Relevant standard	Relevant standard	Log Book	2	---	---					
		3. Surface finish	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---					
		4. Waviness	MA	Visual	100%	Factory Standard	No Waviness	Log Book	2	---	---					
		5. Thickness	MA	Measurement	100%	BHEL Spec.	BHEL Spec.	Log Book	2	---	---					
		6. Mill marking	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	1					
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	Relevant standard	Relevant standard	Log Book	2	---	---					
		2. Surface Defects	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---					
		3. Straightness	MA	Measurement	100%	Factory Std.	Factory Std.	Log Book	2	---	---					
		4. Mill marking	MA	Visual	100%	Relevant standard	Relevant standard	Log Book	2	---	1					
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	---	---					
		2. IR and HV	MA	Electrical	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	---	---					
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics													\$	P	- Agency Performing the Test.	1 - BHEL
													W	- Agency Witnessing the Test.	2 - Vendor	
													V	- Agency Verifying the Test.	3 - Sub-vendor	

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

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												VOLUME		IIB	
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												SHEET		3	OF 7
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$				Remarks		
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make 2. Surface defects 3. IR / HV on Terminal Blocks	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	---			
6.0	IN PROCESS Blanking / Bending / Forming	1. Dimensions 2. Surface defects after bending	MI	Measurement	100%	Approved Mfr. drgs. Factory Standard	Approved Mfr. drgs. Factory Standard	Log Book	2	---	---	---			
7.0	Nibbling / Punching	1. Cutout Sizes 2. Deburring	MA	Visual	100%	Approved Mfr. drgs. Approved Mfr. drgs.	Approved Mfr. drgs. Approved Mfr. drgs.	Log Book Log Book	2 2	---	---	---			
8.0	ASSEMBLY Frame Assembly & Sheet fixing	1. Dimensions 2. Alignment 3. Welding Quality 4. Surface defects	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	---	2			
			MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	---	2			
			MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	---	2			
			MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	---	2			

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Sl. No.		Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
										P	W	V	
9.0	Pre-treatment and Painting	1. Pretreatment Process 2. Process parameters like bath temp. concentration etc. 3. Dipping / Removal Time 4. Surface quality after every dip 5. Primer after phosphating 6. Putty Application & Rubbing after primer 7. Paint first coat 8. Putty Application and Rubbing after first coat of paint 9. Paint second coat	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	--	1		
			MA	Measurement	Periodic	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	--	1		
			MA	Measurement	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	--	1		
			MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	--	1		
			MA	Visual, Thickness	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	--	1		
			MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	--	1		
			MA	Visual, Thickness	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	--	1		
			MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	--	1		
			MA	Visual, Thickness, Scratch test Colour adhesion	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	--	1		

LEGEND:

* CR

- Critical characteristics

MA

- Major characteristics

MI

- Minor characteristics

\$

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

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Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks				
									P	W	V					
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IEC-60947, IEC-60079	BHEL approved spec., drg relevant IEC-60947, IEC-60079	Type Test Certificate	3	--	1					
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant standard	BHEL approved spec., drg., BOM & relevant standard	Test Report	2	1	1					
15	FUNCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1					
		2. Instrument Calibration	CR	Electrical	10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1					
		3. Temperature rise	CR	Electrical	100%	BHEL approved spec/drg. & relevant standard	BHEL approved spec/drg & relevant standard	Inspection Report	2	1	1					

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Technical specification for
CONTROL & INSTRUMENTATION

1X660MW PANKI TPS EXTN.

SECTION D

REV. NO. 00

DATE : 13.07.2018

APPLICABLE CABLE TYPES

Cable Sizes for 1X660MW TPS PANKI EXTN.	
Sl no.	Cable Type
G-TYPE	
1	2P X 0.5 sqmm
2	4P X 0.5 sq mm
3	8P X 0.5 sqmm
4	12P X 0.5 sqmm
F-TYPE	
1	4P X 0.5 sqmm
2	8P X 0.5 sqmm
3	12P X 0.5 sqmm
4	20P X 0.5 sqmm
CONTROL CABLE	
1	3C X 2.5 sqmm



Technical specification
for
1X660 MW TPS PANKI EXTN.

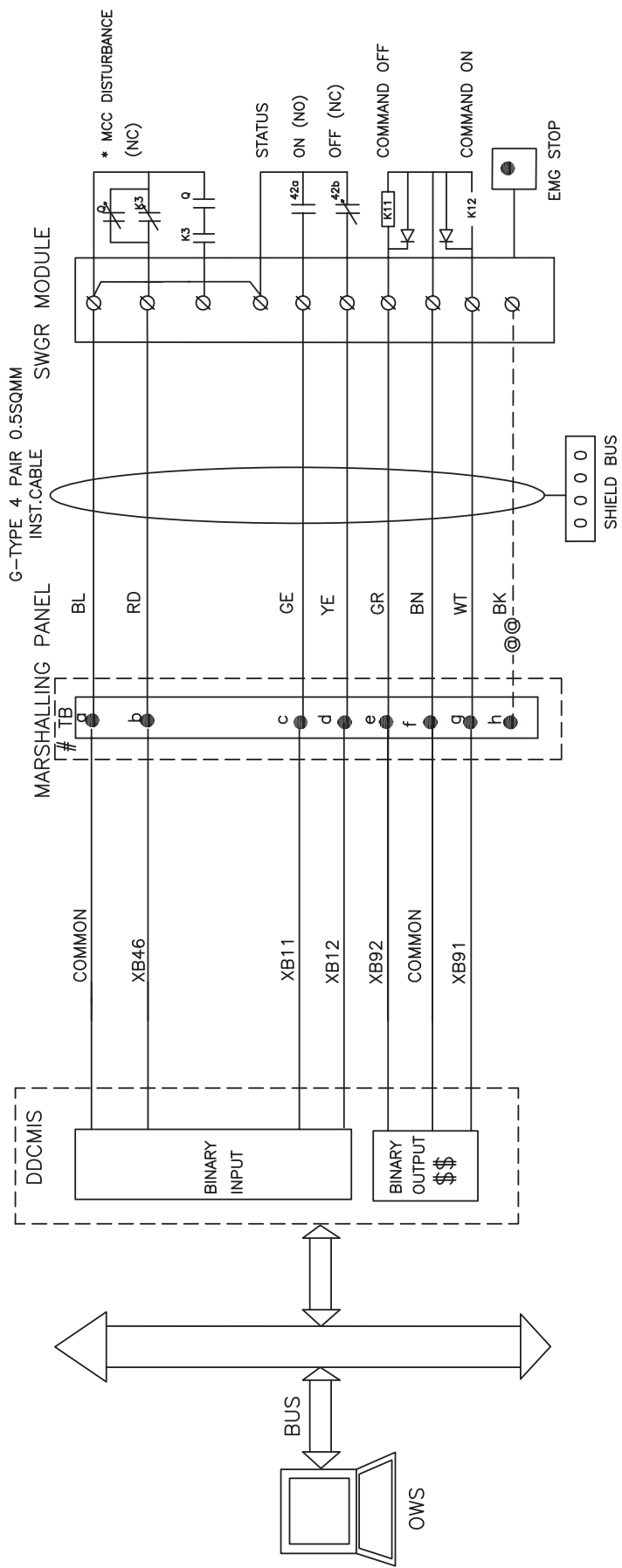
REV. NO.

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DATE : 04.04.2019

DRIVE CONTROL PHILOSOPHY

DDCMIS INTERFACE WITH LT MCC (LT)



NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE
NOTE:-2 # 8 LEVEL TERMINAL BLOCK
NOTE:-3 @@ INEACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION SEQUENTIALLY.
NOTE:-4 * MCC DISTURBED= THERMAL O/L OPT/CONT SUPP FAIL/EPB OPTD /DRIVE POWER SUPPLY OFF



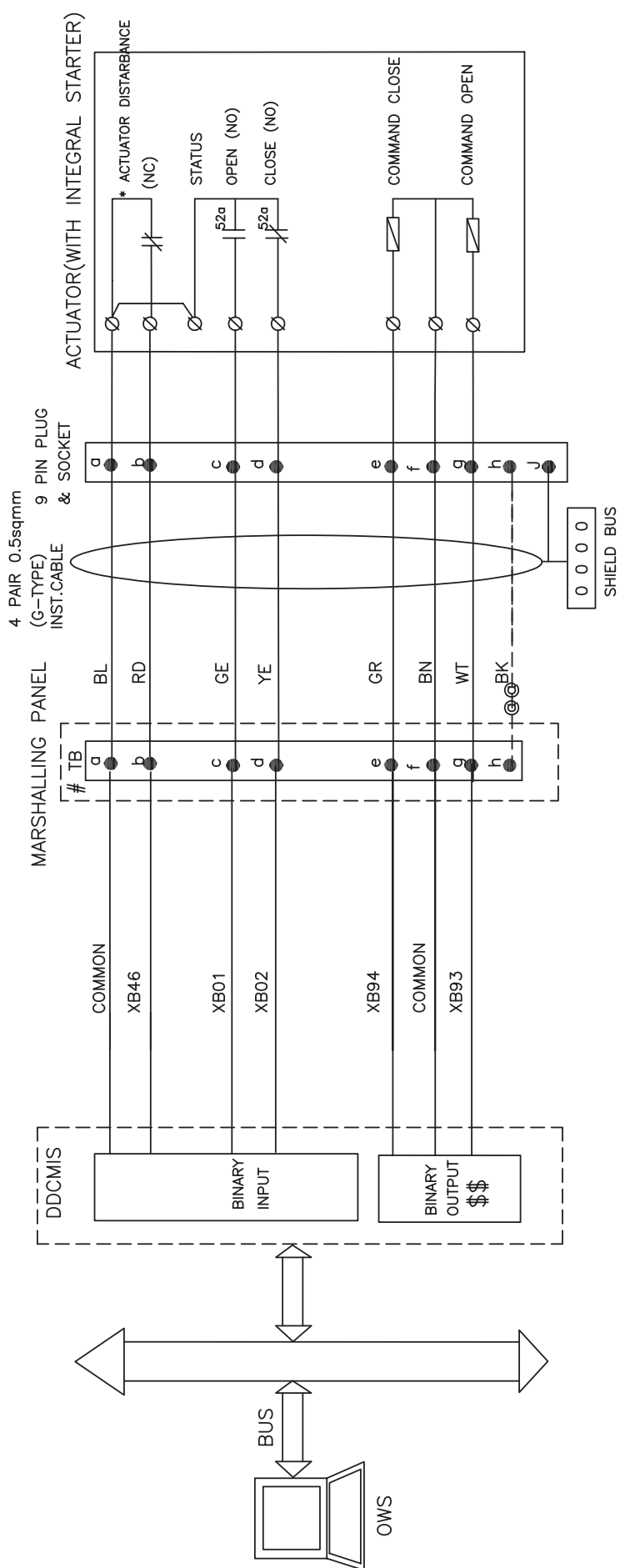
UP RAJYA VIDYUT UTPADAN NIGAM LTD
1 X 660 MW PANKI TPS

DDCMIS INTERFACE WITH LT MCC (LT)

DRG.NO. 9862-001-PE-405-PVL-B-152

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DDCMIS INTERFACE WITH BID/MOV/MOD



NOTE:-1 \$\$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE

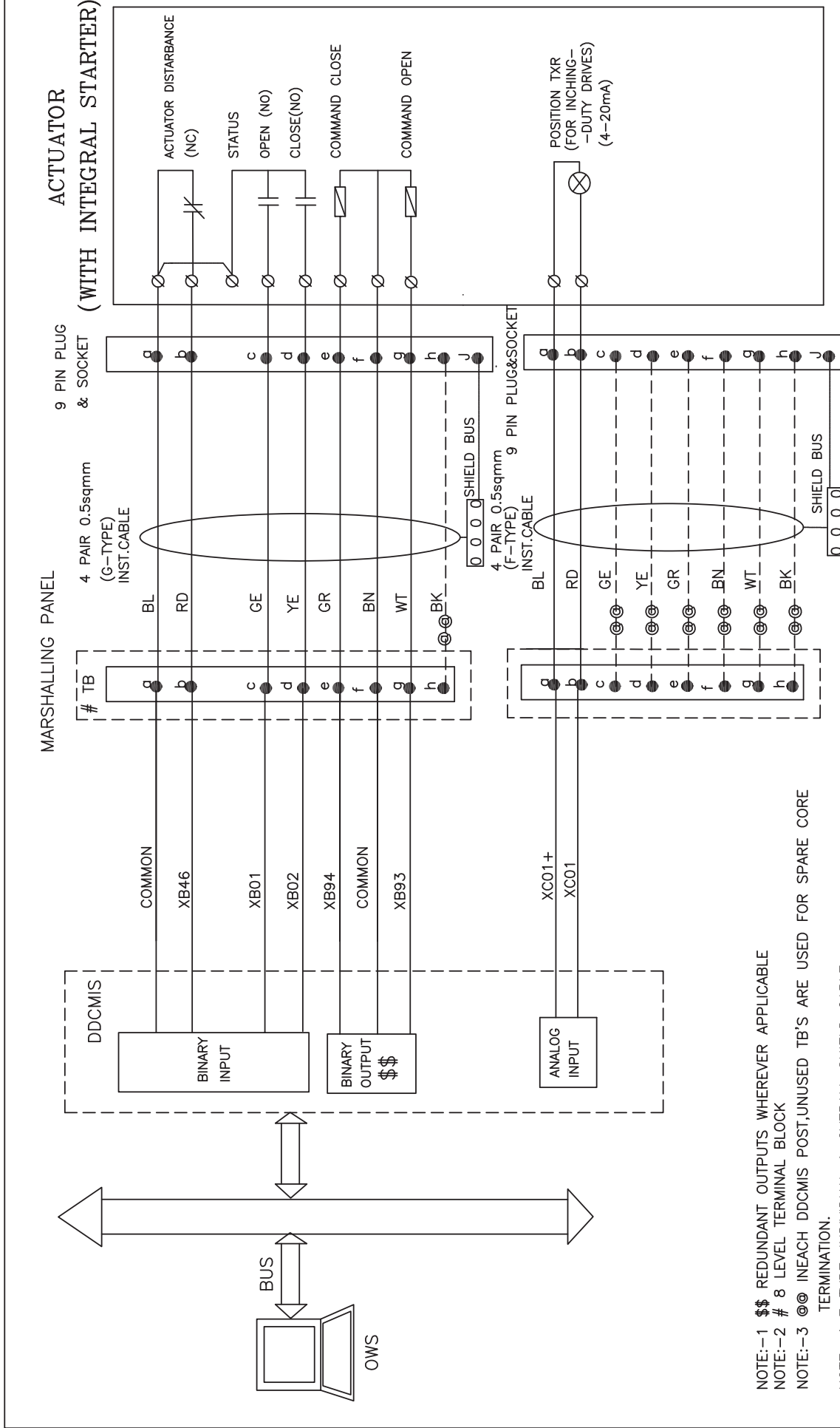
NOTE:-2 # 8 LEVEL TERMINAL BLOCK

NOTE:-3 @@ INEACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.

NOTE:-4 * DISTURBANCE=LOSS OF POWER SUPPLY(1PHASE/3PHASE)/LOSS OF CONTROL SUPPLY/MOTOR THERMOSTAT TRIP/THERMAL OVER LOAD/TORQUE SWITCH OPERATED, LOCAL/OFF/REMOTE SWITCH IN LOCAL/OFF POSITION

	UP RAJYA VIDYUT UTPADAN NIGAM LTD		DRG.NO.	9962-001-PE-405-PVI-B-152
	1 X 660 MW PANKI TPS		SHT	06 OF 26
	DDCMIS INTERFACE WITH BID			

DDCMIS INTERFACE WITH BIDI/MODI/MOVI



- NOTE:-1 \$\$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE
- NOTE:-2 # 8 LEVEL TERMINAL BLOCK
- NOTE:-3 @ @ @ IN EACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.
- NOTE:-4 F-TYPE: INDIVIDUAL & OVERALL SHIELD CABLE.
- NOTE:-5 *DISTURBANCE=LOSS OF POWER SUPPLY/LOSS OF CONTROL SUPPLY/
MOTOR THERMOSTAT TRIP/THERMAL OVERLOAD/TORQUE SWITCH OPTD/
LOCAL/OFF/REMOTE SWITCH IN LOCAL/OFF POSITION



UP RAJYA VIDYUT UTPADAN NIGAM LTD
1 X 660 MW PANKI TPS

DRG.NO. 9982-001-PE-405-PVI-B-152

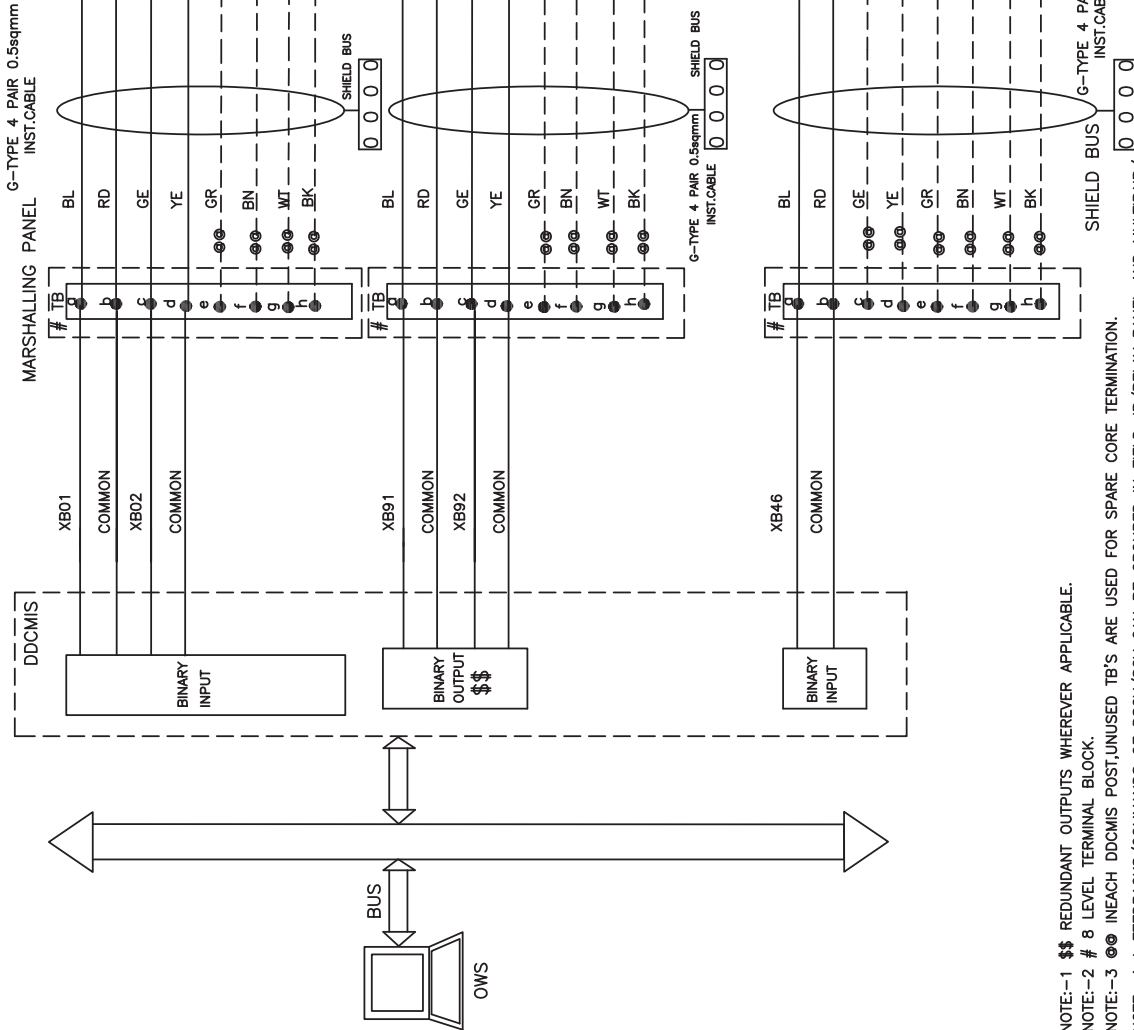
DDCMIS INTERFACE WITH BIDI

SHT

07 OF

34

DDCMIS INTERFACE WITH DUAL COIL SOLENOID (DSOV/L)



NOTE: -2 # 8 LEVEL TERMINAL BLOCK.

NOTE:-4 * FEEDBACKS/COMMANDS OF DSOV/SOV CAN BE GROUPED IN FIELD JB/RELAY PANEL AND MULTIPAIR/

NOTE:-5 FOR ON/OFF TYPE-SOLENOID ACTUATED CONTROL VALVE:

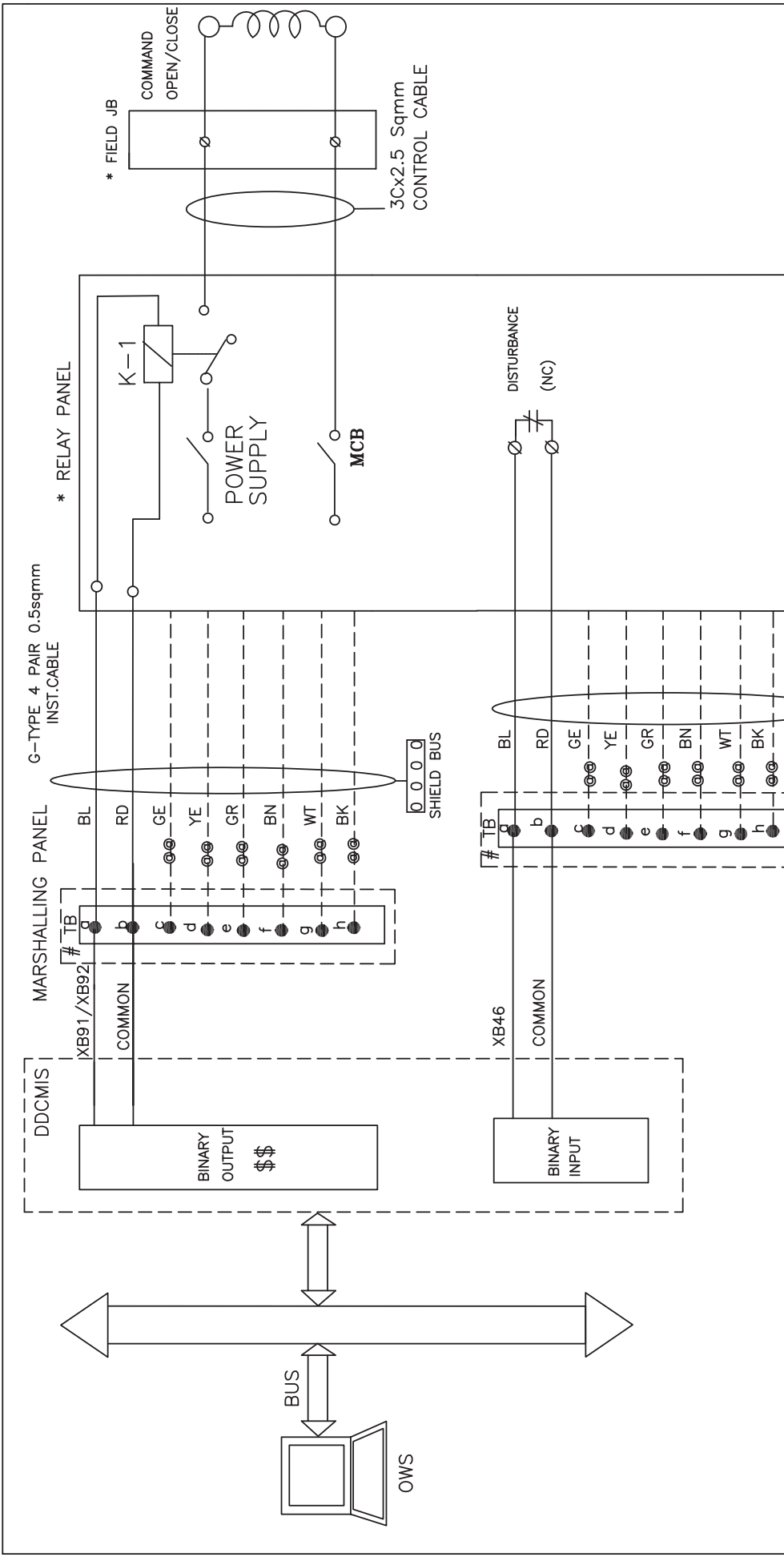
VALVES, WITH DUAL COIL SOLENOIDS.



DRG.NO. 9962-001-PE-405-PVI-B-152

10	OE	34
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DDCMIS INTERFACE WITH SOV/O/SOV/C(WITH OUT FEEDBACKS)



NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE.

NOTE:-2 # 8 LEVEL TERMINAL BLOCK.

NOTE:-3 @@ IN EACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.

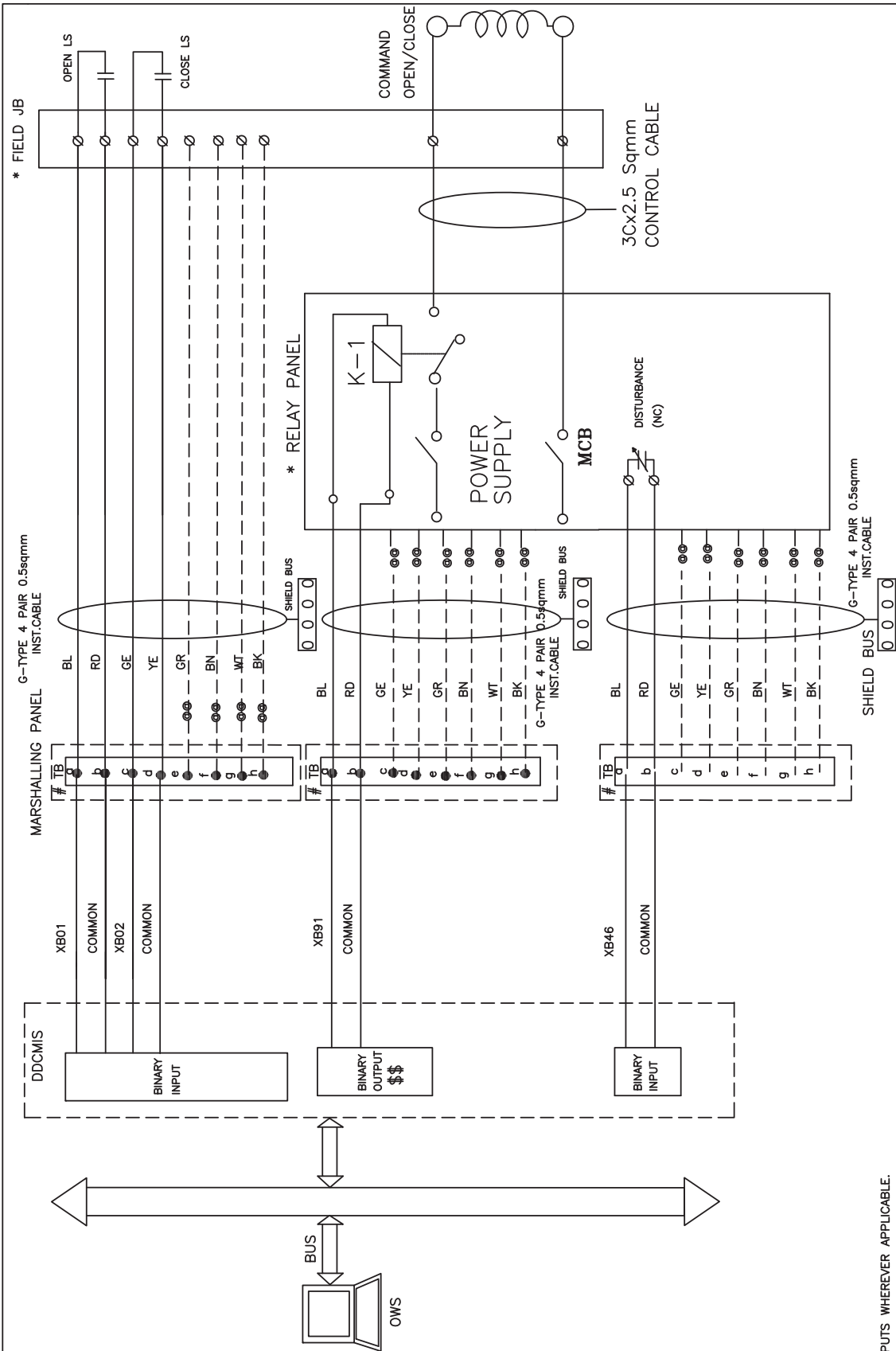
NOTE:-4 * FEEDBACKS/COMMANDS OF DSOV/SOV CAN BE GROUPED IN FIELD JB/RELAY PANEL AND MULTIPAIR/MULTICORE CABLE IS TO BE USED FOR GROUPED SIGNALS FROM FIELD JB/RELAYPANEL TO MARSHELING PANEL.

NOTE:-5 FOR ON/OFF TYPE,SOLENOID ACTUATED CONTROL VALVE.



UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS	DRG.NO. 9982-001-PE-405-PVI-B-152
DDCMIS INTERFACE WITH SOV/O/SOV/C(WITHOUT FEEDBACKS)	SHT 11 OF 34

DDCMIS INTERFACE WITH SOV/O/L(WITH FEED BACKS)

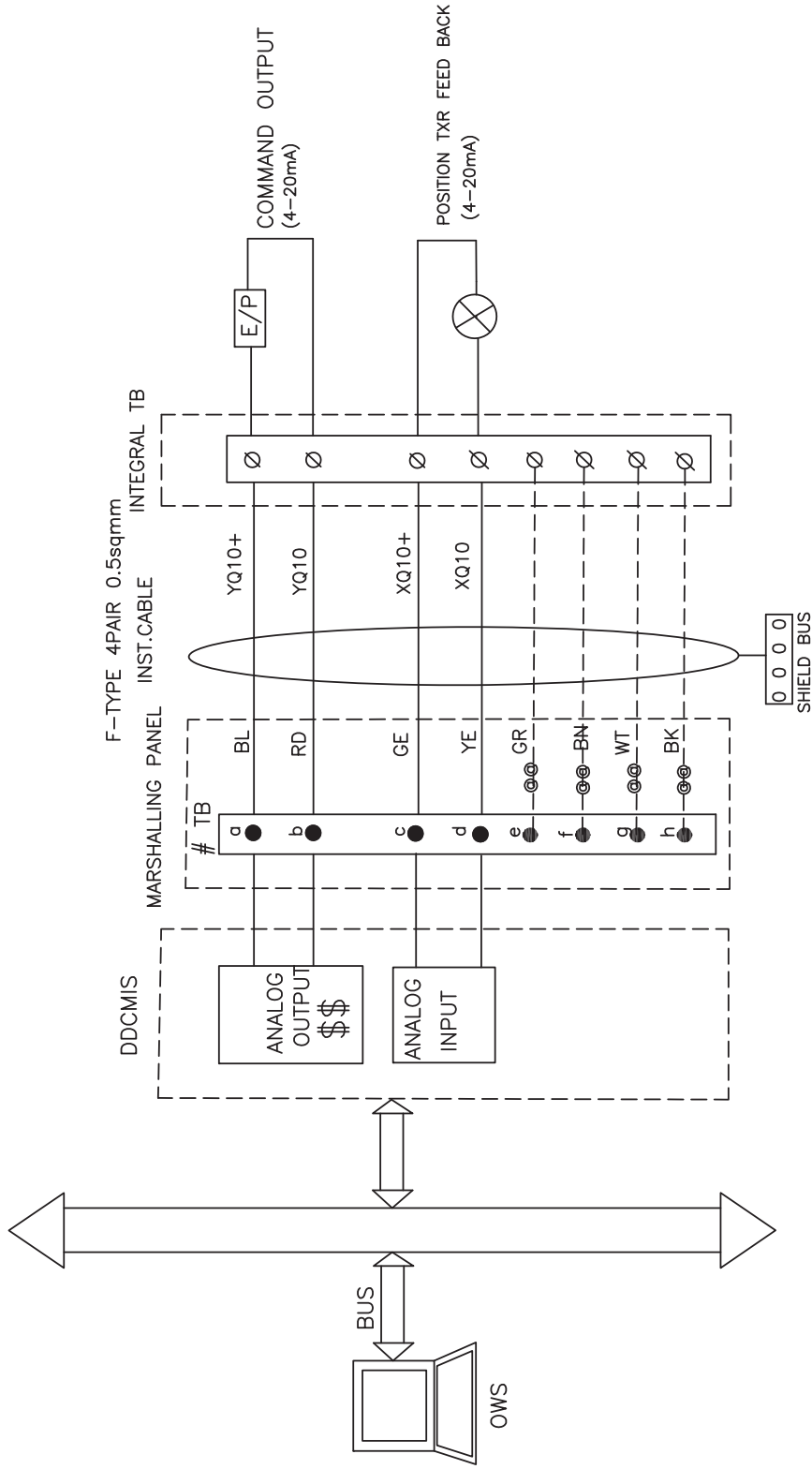


NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE.
NOTE:-2 # 8 LEVEL TERMINAL BLOCK.
NOTE:-3 ●● INEACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.
NOTE:-4 * FEEDBACKS/COMMANDS OF DSOV/SOV CAN BE GROUPED IN FIELD JB/RELAY PANEL AND MULTIPAIR/
MULTICORE CABLE IS TO BE USED FOR GROUPED SIGNALS FROM FIELD JB/RELAYPANEL TO MARSHALING PANEL.
NOTE:-5 FOR ON/OFF TYPE,SOLENOID ACTUATED CONTROL VALVE.



UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS	DRG.NO. 9982-001-PE-405-PVI-B-152
DDCMIS INTERFACE WITH SOV/O/L(WITH FEEDBACKS)	SHT 12 OF 34

INTERFACE FOR MODULATING DRIVES – CLCS



NOTE:--1 \$\$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE
NOTE:--2 # 8 LEVEL TERMINAL BLOCK
NOTE:--3 @ @ IN EACH DDCMIS POST, UNUSED TB's ARE USED FOR SPARE CORE TERMINATION.
NOTE:--4 F-TYPE: INDIVIDUAL & OVERALL SHIELD CABLE.

	UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS		DRG.NO. 9982-001-PE-405-PVI-B-152
	INTERFACE FOR MODULATING DRIVES – CLCS		SHT 14 OF 34

The diagram illustrates the DDCMIS (Digital Data Control and Monitoring Interface System) architecture. It shows the connection between a DDCMIS unit, a Marshalling Panel, and an Integral TB (Terminal Block).

DDCMIS Unit:

- ANALOG OUTPUT (\$\$):** Connected to the Marshalling Panel terminals BL and RD.
- ANALOG INPUT:** Connected to the Marshalling Panel terminals GE and YE.
- BINARY INPUT:** Connected to the Marshalling Panel terminals GR, BN, WT, and BK.

Marshalling Panel:

- Contains terminals for TBs (Terminal Blocks) labeled a through h.
- Wires are color-coded: BL (Blue), RD (Red), GE (Green), YE (Yellow), GR (Grey), BN (Brown), WT (White), and BK (Black).

Integral TB (Terminal Block):

- Contains various output modules: YQ10+, XQ10+, and XB46.
- Wires are connected to the Marshalling Panel terminals.
- Output modules include:
 - YQ10+:** Connected to BL and RD.
 - XQ10+:** Connected to GE and YE.
 - XB46:** Connected to GR, BN, WT, and BK.

Other Components:

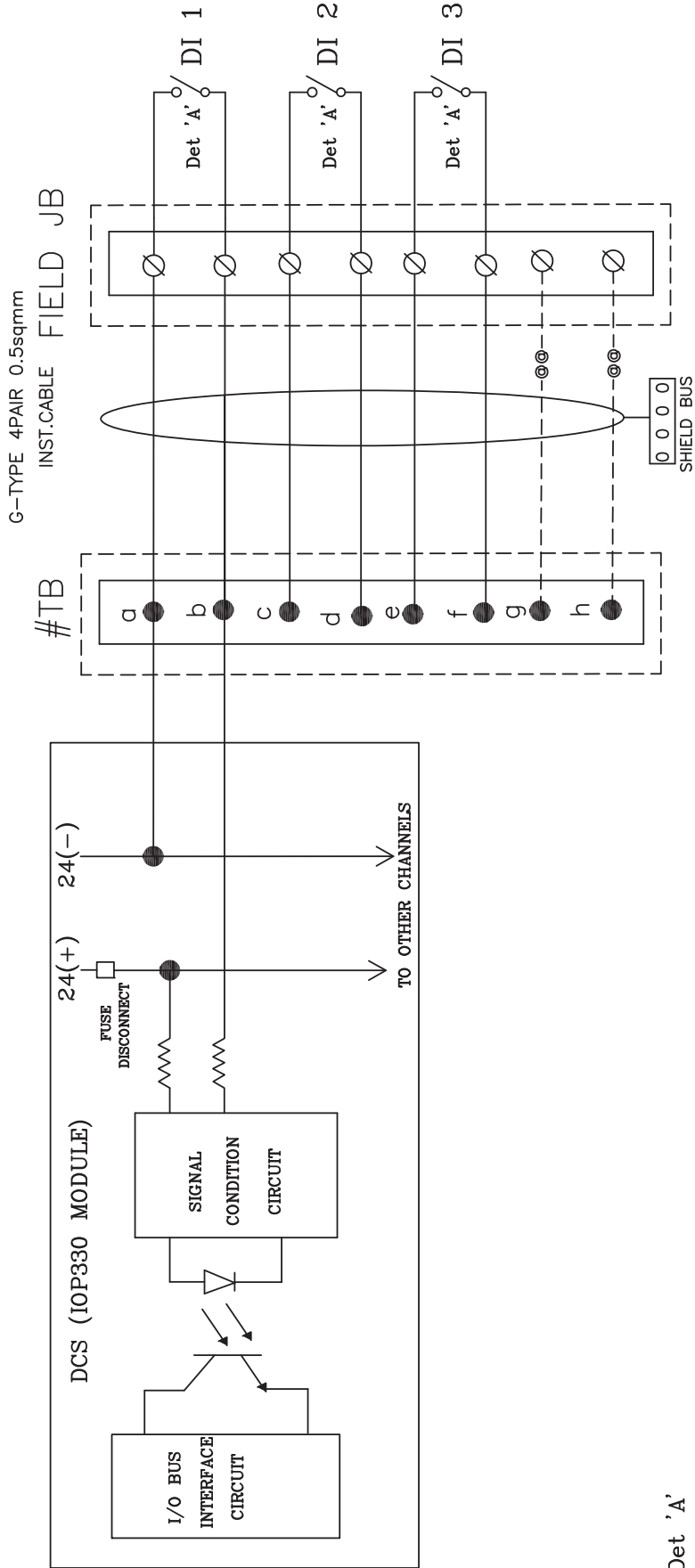
- COMMAND OUTPUT (4-20mA):** Connected to the YQ10+ module.
- POSITION TXR FEED BACK (4-20mA):** Connected to the XQ10+ module.
- ACTUATOR DISTURBANCE (NC):** Connected to the XB46 module.
- BUS:** Connects the DDCMIS unit to the OWS (Operator Work Station).

Notes:

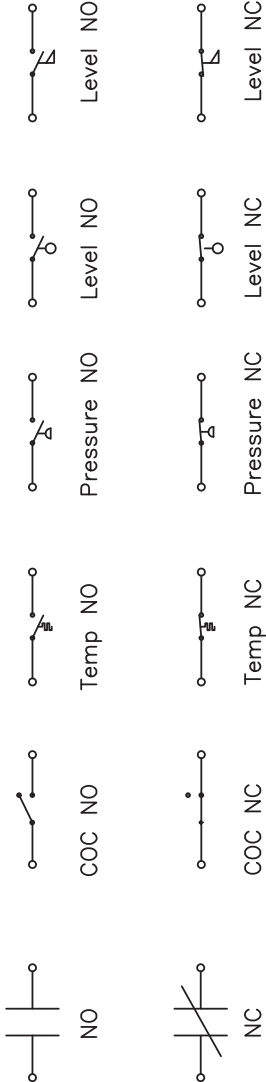
- NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE
- NOTE:-2 # 8 LEVEL TERMINAL BLOCK
- NOTE:-3 @@ IN EACH DDCMIS POST, UNUSED TB's ARE USED FOR SPARE CORE TERMINATION.

	UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS	DRG.NO.	9962-001-PG-405-PVI-B-152
	INTERFACE FOR MODULATING DRIVES - CLCS-M	SHT	15 OF 34

DDCMIS INTERFACE WITH DIGITAL INPUT SIGNAL



Det 'A'



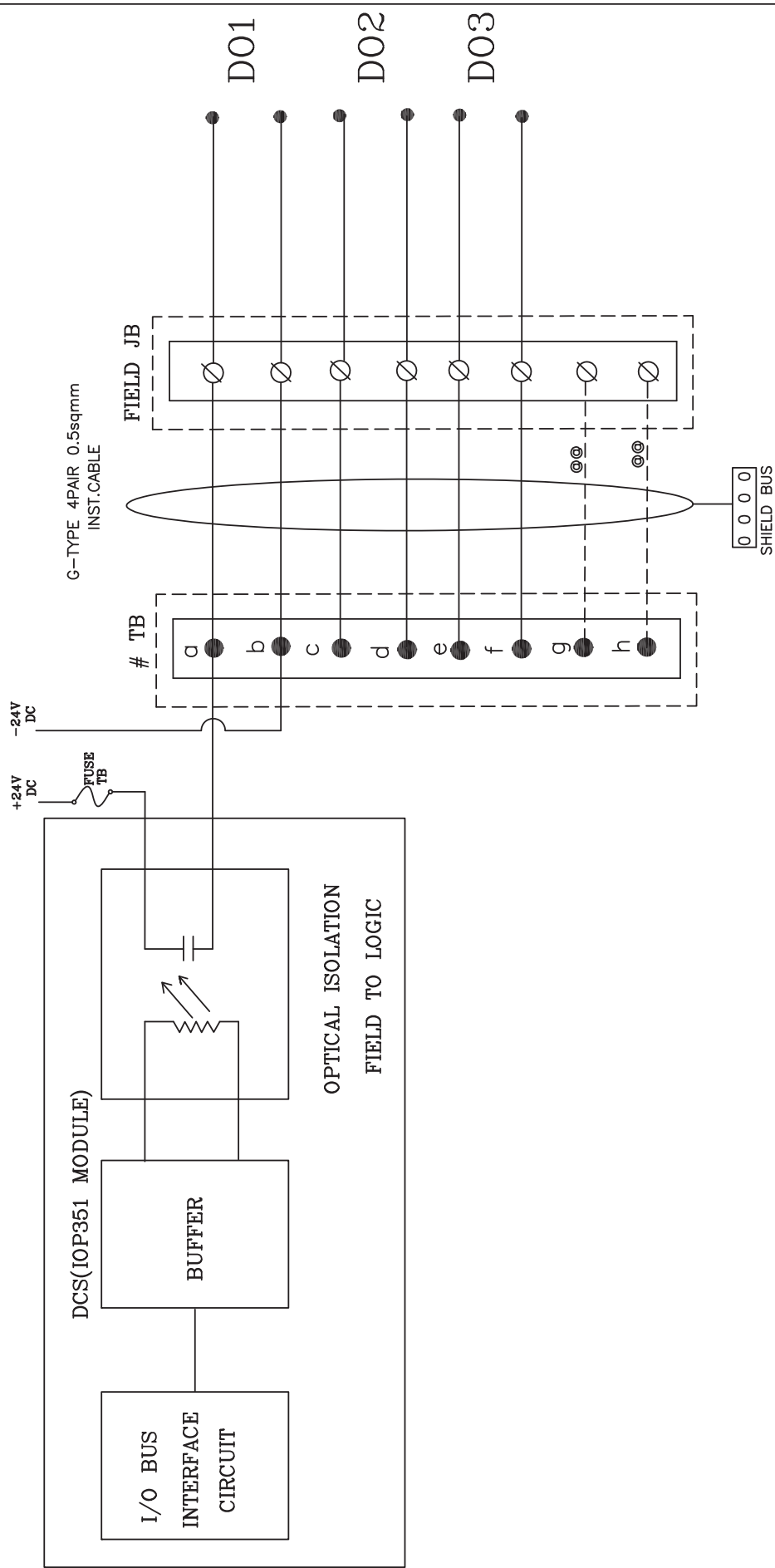
NOTE:-1 #8 LEVEL TERMINAL BLOCK.
NOTE:-2 @ @ IN EACH DDCMIS POST, UNUSED TB's ARE USED FOR SPARE CORE TERMINATION.



UP RAJYA VIDYUT UTPADAN NIGAM LTD
1 X 660 MW PANKI TPS
DDCMIS INTERFACE WITH DIGITAL INPUT SIGNAL

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DDCMIS INTERFACE WITH DIGITAL OUTPUT SIGNAL



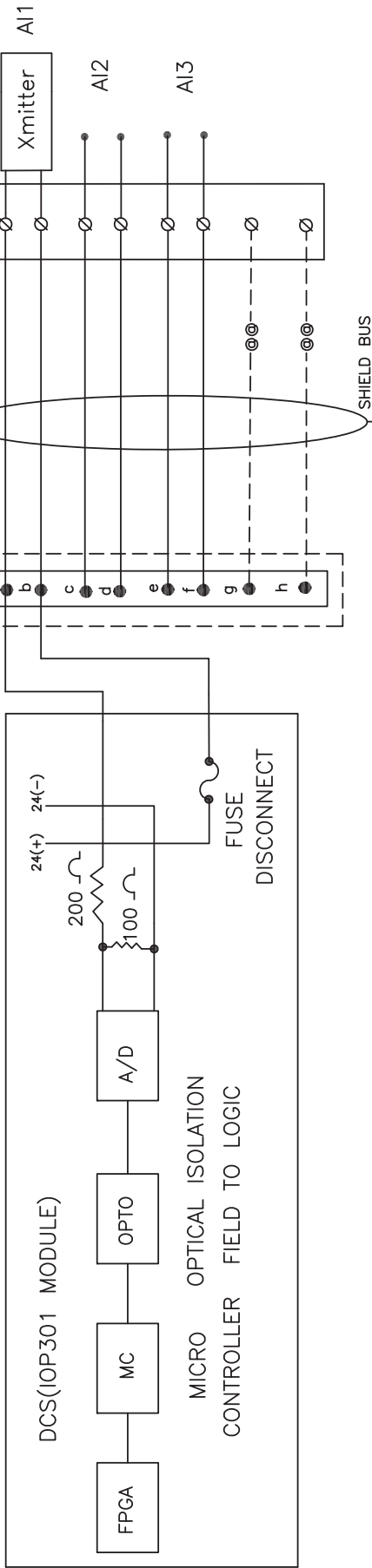
NOTE:-1 #8 LEVEL TERMINAL BLOCK.

NOTE:-2 @@ IN EACH DDCMIS POST, UNUSED TB's ARE USED FOR SPARE CORE TERMINATION.

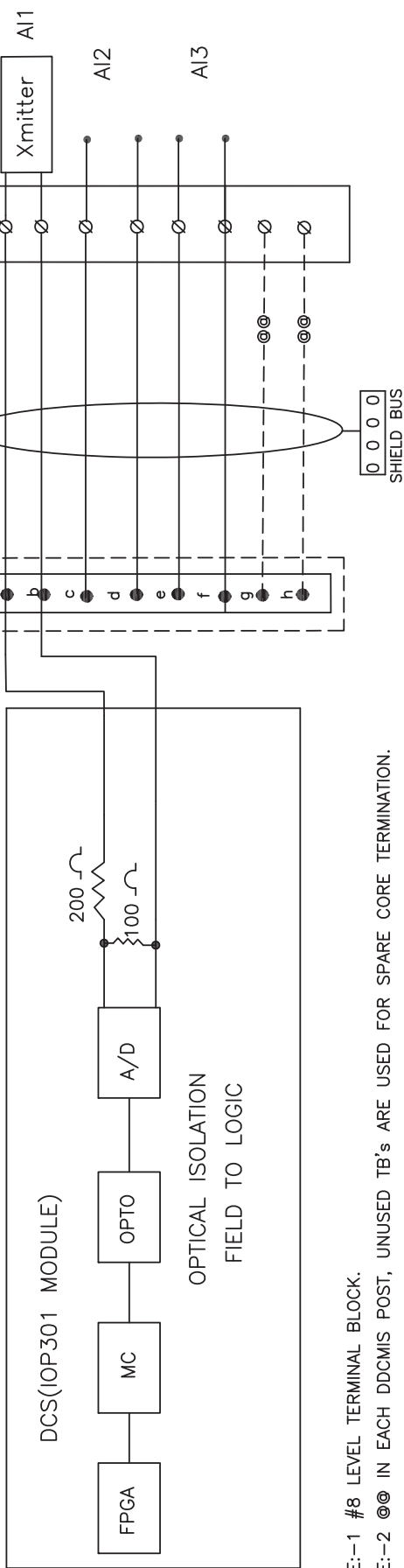
	UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS		DRG.NO.	9862-001-PE-405-PVL-B-152
	DDCMIS INTERFACE WITH DIGITAL OUTPUT SIGNAL		DATE	11.02.2019
			REV.NO.	01
		SHT	24	OF 34

DDCMIS INTERFACE WITH ANALOG INPUT SIGNAL

AI INTERFACE(4-20mA POWERED BY SYSTEM)



AI INTERFACE(4-20mA POWERED EXTERNALLY)



NOTE:-1 #8 LEVEL TERMINAL BLOCK.

NOTE:-2 @@ IN EACH DDCMIS POST, UNUSED TB's ARE USED FOR SPARE CORE TERMINATION.

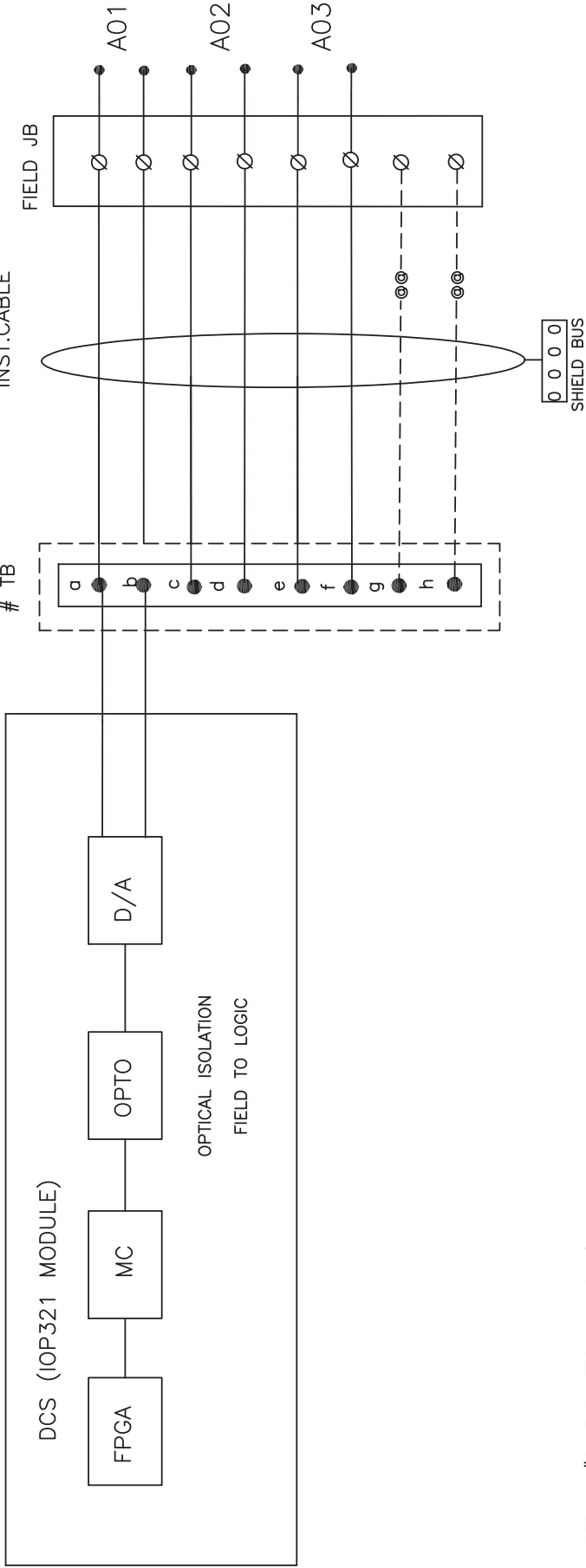
NOTE:-3 F-TYPE: INDIVIDUAL & OVERALL SHIELD CABLE.



UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS		DRG.NO.	9962-001-PE-405-PVI-B-152
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		REV.NO.	01
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DDCMIS INTERFACE WITH ANALOG OUTPUT SIGNAL

AO INTERFACE



NOTE: -1 #8 LEVEL TERMINAL BLOCK.

NOTE: -2 @@ IN EACH DDCMIS POST, UNUSED TB's ARE USED FOR SPARE CORE TERMINATION.

NOTE: -3 F-TYPE: INDIVIDUAL & OVERALL SHIELD CABLE.

	UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS		DRG.NO. 9982-001-PE-405-PVI-B-152
	DDCMIS INTERFACE WITH ANALOG OUTPUT SIGNAL		DATE 11.02.2019
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SUB VENDOR LIST		
Package Name	Vendor Name	Vendor Address
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	DRESSER INDUSTRIES INC.	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Barksdale GmbH, Germany	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	Works-1->C S Shankar 127, Sidco North Phase, Ambattur Estates, -CHENNAI-TAMIL NADU INDIA Phone- 8754491904 FAX : 044-26248849 Pincode : 600050 Email : cservice@switzerinstrument.com
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	PRECISION MASS PRODUCTS PVT. LTD.	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, -KaloI-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh.parmar@ashcroftindia.com
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS INDUSTRIES LIMITED	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	GENERAL INSTRUMENTS CONSORTIUM	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SOR INC.	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA -KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS (INDIA) LIMITED	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Kaustubha Udyog,	
PRESSURE GAUGE/ DIFF. PRESSURE GAUGE	H.GURU INDUSTRIES	Works-1->NA NA -- Phone- FAX : Pincode : Email :
PRESSURE GAUGE/ DIFF. PRESSURE GAUGE	BOSE PANDA INSTRUMENTS PVT.LTD.	Works-1->Mr. Partha Bose 44, Saheed Hemanta Kumar Bose,Sarani, -Kolkata-WEST BENGAL India Phone- +91 33 2548 7220 FAX : +91 33 2548 0429, Pincode : 700074 Email : parthabosebp@gmail.com
PRESSURE GAUGE/ DIFF. PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	bosepanda@vsnl.net Works-1->Mr. Gautam Mukherjee Kusumba,Sonarpur Station Road,P.O. -Narendrapur, -Kolkata-WEST BENGAL INDIA Phone- 9836878855 FAX : 033-24342748 Pincode : 700103 Email : gkm_ani@hotmail.com
PRESSURE GAUGE/ DIFF. PRESSURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, -KaloI-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh.parmar@ashcroftindia.com
PRESSURE GAUGE/ DIFF. PRESSURE GAUGE	Baumer Technologies India Pvt. Ltd.	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 A GIDC A Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
PRESSURE GAUGE/ DIFF. PRESSURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	Works-1->Shikha Hazra/ Shiyamal Hazra 32, Industrial Suburb,Yeshwanthpur -BANGALORE-KARNATAKA INDIA Phone- 080-23370300 FAX : 080-23379890 Pincode : 560022 Email : shikhaHazra@hgurusouth.com

PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	FORBES MARSHALL (HYD) LTD.	Works-1->MR G.SRINIVASAN/MR ANUJ MALPANI PLOT NO-A-19/2 & T-4/2,I.DA. NACHARAM , -HYDERABAD-TELANGANA INDIA Phone- 09866550762 FAX : 040 27152193 Pincode : 560076 Email : gsrinivasan@forbesmarshall.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	Works-1->Gauge Bourdon India Pvt. Ltd., Plot No-4, 5, 6,Jawahar Co-operative Industrial Estate, -Kalamboli Taluka Panvel-MAHARASHTRA INDIA Phone- 022-27421095, FAX : 022-27421901, Pincode : 410209, Email : info@general-gauges.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Nesstech Instruments Private Limited	Works-1-> Others 26/2, G Type, Global Ind. Park Near Nahuli Railway Crossing, -Vapi-GUJARAT INDIA Phone- 9920576002 FAX : Pincode : 396105 Email : sales@nesstech.co.in, bkapadia@nesstech.co.in
TRANSMITTERS	V. AUTOMAT & INSTRUMENTS (P) LTD.	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com
TRANSMITTERS	ABB LIMITED	
TRANSMITTERS	Pune Techtrol Pvt. Ltd.	
TRANSMITTERS	Moore Industries International Inc.	Works-1->Matt Moren/Gina Cruz 16650 Schoenborn St., North Hills -CALIFORNIA- USA Phone- +1 818 894 7111, ext FAX : +1 818 830 5588 Pincode : 91343 Email : gacruz@miinet.com
TRANSMITTERS	PANAM ENGINEERS	Works-1->Mr. Santosh Shukla Others R-628, TTC Industrial Area, MIDC Rabale, -Navi Mumbai-MAHARASHTRA INDIA Phone- 9821350761, FAX : 022-27695559, Pincode : 400701, Email : sales@panamengineers.com
TRANSMITTERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	Works-1-> Khasra No.: 218-230& 235, Industrial Estate,Makhupura, -Ajmer-RAJASTHAN INDIA Phone- 9887865856, FAX : 0145-2695174, Pincode : 305002, Email : rajeev.gupta@tipl.com
TRANSMITTERS	Endress + Hauser (India) Pvt. Ltd.,	Works-1-> M-171 to 173, MIDC, Waluj, -Aurangabad-MAHARASHTRA INDIA Phone- 9881000474, FAX : 0240-2555179, Pincode : 431136, Email : Narendra.Kulkarni@wetzer.endress.com
TRANSMITTERS	YOKOGAWA INDIA LIMITED,	Works-1-> PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, -BANGALORE-KARNATAKA INDIA Phone- 080-41586000, FAX : 080-28521442, Pincode : Email : uday.shankar@in.yokogawa.com
TRANSMITTERS	SBEM PVT. LTD.	Works-1->MR. MOHAN PADWAL 691/A/2,BIBWEWADI INDL ESTATE -PUNE-MAHARASHTRA INDIA Phone-918600042374 FAX : 912024215670 Pincode : 411037 Email : wmi@sbern.co.in
TRANSMITTERS	SIEMENS LIMITED	Works-1->Ankit Varshney Kalwa Works, Thane-Belapur Road, Thane, -MUMBAI-MAHARASHTRA INDIA Phone- FAX : Pincode : 400708 Email :
TRANSMITTERS	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	Works-1->Kalpesh Chandan/Hrishikesh Aghor Plot No. A 145/4 TTC IND AREA,MIDC, PAWANE, -NAVI MUMBAI-MAHARASHTRA INDIA Phone- 9619688001 FAX : 022-66736000 Pincode : 400 705 Email : kalpesh.chandan@emerson.com
TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL	
TRANSMITTERS	NIVO CONTROLS PVT. LTD.	Works-1->Mr. Praveen Toshniwal 104-115, Electronic Complex, -Indore-MADHYA PRADESH INDIA Phone-0731-4081305 FAX : 0731-255075 Pincode : 452010 Email : sales@nivocontrols.com

TRANSMITTERS	Honeywell Automation India Limited	Works-1->Mr.Kedar Tiliu 53, 54, 56 & 57,Hadapsar Industrial Estate -PUNE-MAHARASHTRA INDIA Phone- 9665034625 FAX : 020 66039905 Pincode : 411013 Email : kedar.tiliu@honeywell.com
JUNCTION BOX	Shrenik & Company,	Works-1->Mr.Pulin Shah/ Mr. Kaloesh Parmar 39 A/3 ,Panchratna Industrial Est,Sarkhej-Bavla Road, Changodhar -Ahmedabad-GUJARAT INDIA Phone- 98250 80339 1 FAX : 079-26932424 Pincode : 382213 Email : sales@sumip.com
JUNCTION BOX	SUCHITRA INDUSTRIES	Works-1->B. Srinivas Suchitra Industries, Opp No 53, Muneshwara Black Devinagar, Lottagal hal - BANGALORE-KARNATAKA INDIA Phone- 080-23511247 FAX : Pincode : 560094 Email : suchitra_industries@yahoo.com
JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Works-1->Mr. Dineshbhai Zaveri CEO C-1/ 27&37, GIDC, Kabilpore, -Navsari-GUJARAT INDIA Phone- 02637-265140,265003 FAX : 02637-265308 Pincode : 396424 Email : flexpro@flexproltd.com
JUNCTION BOX	K.S.INSTRUMENTS PVT.LTD.	
JUNCTION BOX	AJMERIA INDUSTRIAL & ENGINEERING WORKS	Works-1->JIGNESH MAHENDRA AJMERA DENA BANK BLDG., SHREE NAGESHINDL. ESTATE,STATION ROAD, -MUMBAI-MAHARASHTRA INDIA Phone- 022 67973578 FAX : Pincode : 400 088 Email : ajmeria@ajmeria.net
INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com
INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavla Indl.Co-op.Estate Ltd.Nagargaon, -Lonavla-MAHARASHTRA INDIA Phone- 9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-air.com
INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES	Works-1->ALEX BAPTIST/ K. SRINIVAS 7. SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com
INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	
INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com
INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavla Indl.Co-op.Estate Ltd.Nagargaon, -Lonavla-MAHARASHTRA INDIA Phone- 9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-air.com
INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES	Works-1->ALEX BAPTIST/ K. SRINIVAS 7. SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com
INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	
INSTRUMENT FITTINGS	AURA INCORPORATED	
INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	Works-1->Miss Sonal Pithadia/Miss Pavan Chavda Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway, Laxmipura -Nandasan-GUJARAT INDIA Phone- 8460848087 FAX : 2764-267036/37 Pincode : 382705 Email : domestic@com-fit.com
INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	Works-1->S. Harichandran/ P.S. Pandi B-11, Mugappair Industrial Estate, -CHENNAI-TAMIL NADU INDIA Phone- 044-26252537 FAX : 044-26252538 Pincode : 600037 Email : sales@hpvalvesindia.com

INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	
INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	Works-1->Shahanawaz Khan Vishweshwar Ind. Premises Co-op Soc. Ltd,F-18/19, Pradhikaran,Bhosadi MIDC -PUNE-MAHARASHTRA INDIA Phone- 020-30694134 FAX : 022-23013010 Pincode : 411026 Email : shahanawaz.khan@perfectinstrumentation.com
INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	Works-1->ALEX BAPTIST/ K. SRINIVAS 7, SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com
INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	Works-1->Mr. Abbas Bhola Unit No. 16, Supreme Industrial Estate,Kaman Bhiwandi Road,Devdal, -Vasai East-MAHARASHTRA India Phone- 9920044113 FAX : 07303178243 Pincode : 401208 Email : ab@fluidfitengg.com
INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com
INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavla Indi.Co-op.Estate Ltd,Nagargaon, -Lonavla-MAHARASHTRA INDIA Phone- 9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-air.com
INSTRUMENT FITTINGS	PANAM ENGINEERS	Works-1->Mr. Santosh Shukla Others R-628,TTC Industrial Area, MIDC Rabale, -Navi Mumbai-MAHARASHTRA India Phone- 9821350761, FAX : 022-27695559, Pincode : 400701, Email : sales@panamengineers.com

Note:-

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



**TITLE : TECHNICAL SPECIFICATION
FOR
TRAVELLING BAND SCREENING SYSTEM**

SPEC. NO. PE-TS-426-172-N001

SECTION : II B

REV. NO. 0

DATE : 04.06.2019

SECTION III

(DOCUMENTS TO BE SUBMITTED BY BIDDER)

	TITLE : COMPLIANCE CERTIFICATE FOR TRAVELLING BAND SCREEN		SPEC. NO.	PE-TS- 426-172-N001 (REV-0)
	PROJECTS: 1X660 MW PANKI TPS EXTENSION (UPRVUNL)		DATE:	04.06.2019
			SHEET	1 OF 2

COMPLIANCE CERTIFICATE

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

- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification and there are no exclusions with regard to same.
- b) There are no other deviations w.r.t. specification 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/Customer's Consultant approval and 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. Charges for 3rd party inspection (TUV/ equivalent) for imported components wherever required shall be included by bidder in the base price itself.
- d) Any drawing/ document/ data-sheet/ calculation/ Quality plan/ Instrumentation etc. if submitted along with the offer shall be considered for reference only, same shall be subject to BHEL / Customer/ Customer's Consultant approval in the event of order.
- e) The offered materials shall be either equivalent or superior to those specified in the specification.
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.
Prices for special tools & tackles, if any, shall also be included in the base price.
Recommended spares shall be quoted separately with price indicated separately.
- g) Charges for supervision during critical stages of erection, final installation checks before commissioning, commissioning of Travelling Band Screen and its accessories, Trial run and Site Testing shall be included by bidder in the base price itself.
- h) All sub - vendors shall be subject to BHEL/ Customer/Customer's Consultant approval in the event of order.
The guarantees of Equipments shall stand valid till the satisfactory completion of site demonstration testing & trial run its acceptance by BHEL/ Customer/Customer's Consultant.
- i) The offered Travelling Band Screens have been supplied by bidder in the past and are inline with Technical PQR indicated in NIT. Any deviation to this criteria shall be suitably highlighted in the deviation schedule.
- j) The orientation of piping shall be finalised during detailed Engg.

	TITLE : COMPLIANCE CERTIFICATE FOR TRAVELLING BAND SCREEN		SPEC. NO.	PE-TS- 426-172-N001 (REV-0)
	PROJECTS: 1X660 MW PANKI TPS EXTENSION (UPRVUNL)		DATE:	04.06.2019
			SHEET	2 OF 2

k) Electrical/ C&I :

- All motor ratings have been considered in line with Section -I.
- Supply of electrical viz. LT power cables, instrumentation and control cables, cable glands, lugs, cable trays etc. shall be as per specification. Their erection shall be done by BHEL.
- The junction boxes for termination of field instruments are included in bidder's scope. The instrumentation cable and cabling from instruments/ actuators to junction boxes is also included in bidder's scope.
- Valve actuators and controls shall be provided as specified in Data Sheet-A and Project specific requirements as specified in Sub-Section IB & Section IC.
- Alarms/ annunciations/ instruments shall be finalised during detailed engineering in the event of order which shall be subject to BHEL/ Customer/Customer's Consultant approval and shall be without any commercial implications to BHEL.

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM		SPEC NO: PE-TS-426-172-N001
	TECHNICAL DATA SHEET- B		SECTION : III
			REV.NO: 00
S.no.	Description	Units	Data/Parameters
1	General		
1.1	Nos. of Traveling Band screening systems sets required	Nos.	
1.2	Nos. of Spray wash pumps common for all TBS	Nos.	
1.3	Liquid handled		
1.4	Type of Travelling Band Screen		
1.5	No. of speed levels for the TBS		
1.6	Hydraulic /Fluid coupling		
1.7	Manufacturer		
1.8	Country of Origin		
1.9	Drive Mechanism Safety Devices		
2	Site Data		
2.1	FGL of the Site	m	
2.2	Elevation of the TBS Operating Floor	m	
2.3	Invert level of the Intake canal at TBS Inlet	m	
2.4	Min. W.L. at upstream of TBS	m	
2.5	Max. W.L. at upstream of TBS	m	
2.6	Clearance between bars of coarse bar screens at upstream of TBS(Not in Bidder scope)	mm	
2.7	Maximum Chamber length & width for the TBS		
2.8	Design Mechanical temperature	Deg. Cel.	
2.9	Spray wash/Flushing water source		
2.10	Pressure available at Tap off from discharge of purchaser's pump	mwc	
2.11	Max. Limit on shut off head of purchasers pump"	mwc	
3	Design Data		
3.1	Flow rate per stream		
-	Design/Normal	cum/hr	
-	Maximum	cum/hr	
3.2	Total Effective area at Min. water level	m ²	
3.3	Total Effective area at Max. water level	m ²	
3.4	No. of Speed levels of TBS		
3.5	Screen Wire Mesh Size (Diameter)	mm	

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM		SPEC NO: PE-TS-426-172-N001
	TECHNICAL DATA SHEET- B		SECTION : III
			REV.NO: 00
S.no.	Description	Units	Data/Parameters
3.6	Slow Rotating speed	rpm	
3.7	Fast rotating speed	rpm	
3.8	TBS Length	m	
3.9	TBS Width	m	
3.10	TBS Depth	m	
3.11	Protection Mechanism for Differential level $\geq$ Design Differential		
3.12	Type of protection mechanism		
3.13	Differential Head across TBS at Min. W.L		
	At Design flow		
	At Max Flow		
3.14	Differential Head in Clean Condition	MWC	
3.15	Differential Head in Choked Condition(Start of slow speed backwash/flushing)	MWC	
3.16	Differential Head in Choked Condition(Start of fast speed backwash/flushing)	MWC	
3.17	Water velocity through TBS at Mn. W.L at design flow and clean condition	m/sec	
3.18	Design pressure of Spray Wash system		
3.19	Travelling Band Screen clear opening	mm ²	
3.2	Maximum water velocity through screen at min. WL	m/sec	
3.21	Design differential head for Travelling Band screens	MWC	
3.22	Maximum head loss permitted across TBS (i.e. between inlet and outlet) in clean condition at Min WL	MWC	
3.23	Screen backwashing/flushing start "ON" Slow speed head loss across TBS	MWC	
3.24	Screen backwashing/flushing start at fast speed	MWC	
3.25	Corrosion Protection system		
3.26	Service Factor for Gear Box		
3.27	The velocities for Calculating the inside diameters shall be limited to		
4	Spray Wash/Flushing system		
4.1	Spray wash/flushing water terminal point pipe		
	a) Material		
	b) O.D.Xthickness	mmXmm	

**TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM****SPEC NO: PE-TS-426-172-N001****TECHNICAL DATA SHEET- B**

SECTION : III

REV.NO: 00

S.no.	Description	Units	Data/Parameters
4.2	Motor Rating of Spray Wash pump		
5	Self Cleaning Strainer		
5.1	Quantity		
5.2	Screen perforation size	mm	
5.3	Free flow area in the Screen basket		
6	Submersible sump pump		
6.1	Capacity	cum/hr	
6.2	Head	MWC	
7	Debris Segregation and collection baskets		
7.1	Quantity	Nos.	
7.2	Size(Preferable) - L x B x H	MxMxM	
7.3	Discharge mechanism for emptying the basket		
7.4	Type of arrangement for handling by Gantry crane provided		
7.5	Basket frame plate thickness	mm	
7.6	Wire Mesh size dia	mm	
7.7	Guide Ways		
7.7.1	Number	Nos.	
7.7.2	Type		
8	Guide ways section		
8.1	Frame work section size		
8.2	Whether provision for sacrificial anode provided for future		
8.3	Thickness of frame plates	mm	
8.4	Section for chain guide ways		
8.5	Plate thickness for chain guide ways	mm	
8.6	Fixing method of guide ways to be supplied		
9	Splash Housing & refuse trough		
9.1	Required Section of refuse trough (pl. provide dimensional sketch) along with required gradient		
10	Head Shaft & Sprocket		
10.1	Head shaft diameter	mm	
10.2	Foot shaft diameter	mm	

**TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM****SPEC NO: PE-TS-426-172-N001****TECHNICAL DATA SHEET- B**

SECTION : III

REV.NO: 00

S.no.	Description	Units	Data/Parameters
10.3	Connection details of Head sprocket with Head shaft (Keyed/Shrink fit/ others pl. specify)		
10.4	Connection details of Foot sprocket with FOOT shaft (Keyed/Shrink fit/ others pl. specify)		
10.5	Nos. of teeth on Head sprocket	Nos.	
10.6	Nos. of teeth on Foot Sprocket	Nos.	
10.7	Type of Sprocket teeth, whether insert are being used or not , or two teeth construction		
10.8	Centre distance between head shaft & foot shaft	mm	
10.9	Type of suport &Bearing for the Head shaft		
10.10	Type of support &Bearing for the foot shaft		
10.11	Max. power demand at Head shaft at Design differential head		
11	Control and Instrumentation		
11.1	Control Panel		
11.2	Differential Level Switch		
11.3	Differential Level Transmitters		
11.4	Pressure Transmitters		
11.4.1	Spray wash individual suction line		
11.4.2	Spray wash Suction Header		
11.4.3	Spray wash Discharge Header		
11.4.4	Spray wash individual discharge line		
11.5	Pressure Gauges		
11.5.1	Spray wash individual suction line		
11.5.2	Spray wash pump suction header		
11.5.3	Spray wash pump discharge header		
11.5.4	Spray wash individual discharge line		
11.6	Differential Pressure Very High Switch		
11.7	Differential Pressure Transmitters		
11.8	Differential Pressure Gauge		
11.9	Limit Switches		
12	Operation		

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM		SPEC NO: PE-TS-426-172-N001
	TECHNICAL DATA SHEET- B		SECTION : III
			REV.NO: 00
S.no.	Description	Units	Data/Parameters
12.1	Travelling Band Screening system is designed for the following operation modes:		
12.1.1	Automatic start up initiated by High differential level		
12.1.2	Automatic start-up initiated by timer.		
12.1.3	Manual mode of operation		
12.1.4	Provision for manual operation of the Travelling band is made in case of control system failure.		
13	TBS Drive motor		
13.1	Make & Rating		
13.2	Max. Power output of motor	KW	
13.3	Speed	rpm	
13.4	Coupling Type		
14	Reduction Gear Box		
14.1	Make		
14.2	Gear ratio/Speed ratio		
14.3	Type		
14.4	Duty Factor		
14.5	Drive mechanism		
14.5	Type of drive mechanism to transmit power from Gear Box to Head Shaft		
15	Carrying Roller Chain Mechanism		
15.1	Type of chain		
15.2	No. of chains per TBS	Nos.	
15.3	Type		
15.4	Chain pitch	mm	
15.5	Chain side bar size	mm	
15.6	Chain roller diameter	mm	
15.7	Chain Pin diameter	mm	
15.11	Chain Bushing diameter	mm	
15.12	Method of chain pin lubrication		
15.13	How weaving action of chain is prevented?		
15.14	Type & nos. of arrangement for adjusting chain tension per TBS		
16	Screening Elements		

**TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM****SPEC NO: PE-TS-426-172-N001****TECHNICAL DATA SHEET- B**

SECTION : III

REV.NO: 00

S.no.	Description	Units	Data/Parameters
16.1	Type of screening elements		
16.2	No. of screening Element rows per TBS	Nos.	
16.3	No. of Screening Element per row	Nos.	
16.4	Total no. of screening elements per TBS	Nos.	
16.5	Dimensions of Screening elements (LXB)	mmXmm	
16.6	Clearance between successive baskets	mm	
16.7	Wire mesh size Dia	mm	
16.8	Clearance between rotating screening elements and static components	mm	
16.9	Type of sealing and its material		
16.10	How trash bypassing is avoided?(give sketch w.r.t to basket sketch)		
17	Spray wash/Flushing system		
17.1	Spray wash pumps		
17.2	No. of Spray wash pumps	Nos.	
17.3	Type & make of pump		
17.4	Design flow	cum/hr	
17.5	Design TDH of pump	MWC	
17.6	Design pump speed	rpm	
17.7	Design pump efficiency	%	
17.8	Type of impeller		
17.9	Whether Inserts/embedments/packers for Spray wash pumps/distributors and nozzles being supplied.		
18.0	Spray Nozzles		
18.1	Nos. provided per TBS	Nos.	
18.2	Pitching of nozzles	Min	
18.3	Size of the nozzle	mm	
18.4	Spray Nozzle Effective envelope	m ²	
18.5	Max. Flow rate for each nozzle	cum/hr	
18.6	Spray Nozzle Effective envelope		
19.0	Drive motor for Spray wash/Flushing pump		
19.1	Type and make of motor		
19.2	Rating	KW	
19.3	Speed	rpm	

**TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM****SPEC NO: PE-TS-426-172-N001****TECHNICAL DATA SHEET- B**

SECTION : III

REV.NO: 00

S.no.	Description	Units	Data/Parameters
20.0	Motorised valves- Spray Wash header		
20.1	Nos. provided per TBS	Nos.	
20.2	Type & make of motor		
20.3	Motor rating	KW	
20.4	Whether supports (whenever necessary) complete with foundation plates, bolts,nuts,inserts etc. are included in the offer.		
21.0	Counter flanges:		
21.1	Counter flanges complete with gaskets, bolts and nuts etc. for all terminal points		
22.0	Tests		
22.1	Whether all the tests and inspections to be carried out at the shop are mentioned in the Quality plan submitted by bidder?		
23.0	Hydrostatic Test		
23.1	Hydrostatic test pressure for Spray wash/ flushing system/Self Cleaning Strainer	Bar (g)	
23.2	Test duration	Min	
24.0	Painting		
24.1	Surface preparation		
24.2	Primer coating thickness		
24.3	Finish coating thickness		
25.0	Weights:		
25.1	Weight of the heaviest equipment/assembly to be handled including filled up debris segregation basket	Kgs	
25.2	Recommended Gantry crane capacity	Kgs	
26.0	Civil loading Data		
26.1	Travelling Band Screen(per screen)		
26.2	Static load		
26.3	Dynamic load		
26.4	Spray wash/Back flushing pump (per pump)		
26.5	Static load		
26.6	Dyanamic load		
27.0	Materials of Construction		
27.1	Screen Wire mesh		
27.2	Clamping Plates/Clamps		

**TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM****SPEC NO: PE-TS-426-172-N001****TECHNICAL DATA SHEET- B**

SECTION : III

REV.NO: 00

S.no.	Description	Units	Data/Parameters
27.3	Basket frame and wire damping bars		
27.4	Fasteners		
27.5	Head Shaft		
27.6	Foot Shaft (if applicable)		
27.7	Head/Foot Sprockets		
27.8	Carrying chain		
27.9	Rubber Seals		
27.10	Carrying chain & rollers		
27.10.1	Carrying Chain pins,&Bushing		
27.10.2	Drive Chain type		
27.10.3	Drive chain pin/Bushing		
27.10.4	Shaft bearing Bushing spherical roller		
27.10.5	Sprocket		
27.10.6	Torque tube		
27.10.7	Main supporting frame		
27.10.8	Screen chain side bars		
27.10.9	Drive Chain guard		
27.10.10	Baffle plate in boot section		
27.10.11	Guide ways / Anchor		
27.10.12	Splash housing and refuse chute		
27.10.13	Basket frame		
27.11	Pipe & Nozzles		
27.11.1	Spray nozzle		
27.11.2	Pipe work		

**TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM****SPEC NO: PE-TS-426-172-N001****TECHNICAL DATA SHEET- B**

SECTION : III

REV.NO: 00

S.no.	Description	Units	Data/Parameters
27.11.2.1	Upto 50 NB		
27.11.2.2	above 50 NB		
27.12	Valves		
27.12.1	Valve 400 NB and above (Butterfly Valves only)		
27.12.1.1	Body & Disc		
27.12.1.2	Shaft		
27.12.1.3	Seal		
27.12.1.4	Sealing ,retatining segment& internals		
27.12.2	Valve 350 NB and Below (Gate/Globe Valves only)		
27.12.2.1	Body, Bonnet & Trim		
27.12.3	Check Valves		
27.12.3.1	Body & Bonnet		
27.12.3.2	Seating surface &stem		
27.12.3.3	Disc		
27.12.3.4	Hinge Pin		
27.13	Spray Wash pump		
27.13.1	Spray Wash pump Casing		
27.13.2	Spray Wash pump impeller		
27.13.3	Spray Wash pump Shaft		
27.13.4	Material of Gland Packing /Mechnical Seal (If applicable)		
27.14	Debris Segregation and collection baskets		
27.14.1	Frame		
27.14.2	Wire Mesh		
27.14.3	Flanges		
27.15	Self Cleaning Strainer		
27.15.1	Body		
27.15.2	Internals / Wetted Fastners		
27.16	All Non-Wetted Fastners		
27.17	All Wetted Fastners		

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE 12/06/2019
		SHEET 1 OF 2

S. No.	Description		Data to be filled by successful bidder
A.	General		
1	Manufacturer & country of origin		
2	Motor type		
3	Type of starting		
4	Name of the equipment driven by motor & Quantity		
5	Maximum Power requirement of driven equipment		
6	Rated speed of Driven Equipment		
7	Design ambient temperature		
B.	Design and Performance Data		
1	Frame size & type designation		
2	Type of duty		
3	Rated Voltage		
4	Permissible variation for		
5	a	Voltage	
6	b	Frequency	
7	c	Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)		
9	Synchronous speed & Rated slip		
10	Minimum permissible starting voltage		
11	Starting time in sec with mechanism coupled		
12	a) At rated voltage		
13	b) At min starting voltage		
14	Locked rotor current as percentage of FLC (including IS tolerance)		
15	Torque		
	a) Starting		
	b) Maximum		
16	Permissible temp rise at rated output over ambient temp & method		
17	Noise level at 1.0 m (dB)		
18	Amplitude of vibration		
19	Efficiency & P.F. at rated voltage & frequency		
	a) At 100% load		
	c) At 75% load		

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE 12/06/2019
		SHEET 2 OF 2

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
C.	Constructional Features	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level (kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
D.	Characteristic curves/ drawings (To be enclosed for motors of rating $\geq 55\text{KW}$)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOs				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

ANNEXURE-II

NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)/ CUSTOMER
2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V
: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTOR CONTROLLED)

LOAD DATA (ELECTRICAL)	JOB NO.	426	ORIGINATING AGENCY		PEM (ELECTRICAL)	
	PROJECT TITLE	1X660MW UPRVUNL PANKI TPS	NAME		DATA FILLED UP ON	
	SYSTEM	TRAVELLING WATER SCREEN	SIGN.		DATA ENTERED ON	
	DEPTT. / SECTION	MSE	SHEET 1 OF 2	REV. 00	DE'S SIGN. & DATE	

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		SIZE CODE	NOs													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)/ CUSTOMER 2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V : ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)																		
	LOAD DATA (ELECTRICAL)	JOB NO.		426		ORIGINATING AGENCY				PEM (ELECTRICAL)								
		PROJECT TITLE		1X660MW UPRVUNL PANKI TPS				NAME				DATA FILLED UP ON						
		SYSTEM		TRAVELLING WATER SCREEN				SIGN.				DATA ENTERED ON						
		DEPTT. / SECTION		MSE				SHEET 2 OF 2		REV. 00		DE'S SIGN. & DATE						

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