2X660 MW UDANGUDI STPP STG I
(TANGEDCO)

TECHNICAL SPECIFICATION
FOR
TRAVELLING BAND SCREENING SYSTEM
ALONG WITH
TRASH RACK WITH AUTOMATIC TRASH RACK CLEANING SYSTEM

Specification No. : PE-TS-435-172-N001 (REV. 00)

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

CONTENTS

This Technical Specification consists of three Sections:

Notes:

In case there is conflict in different clauses of specification, most stringent clause (as decided by BHEL / end customer) shall be followed, if no specific deviation is taken by bidder and accepted by BHEL during tender stage in that regard.

SECTION IA
SPECIFIC TECHNICAL REQUIREMENT
MECHANICAL SYSTEMS

1.00.0 **GENERAL**

The **Travelling Band Screens (TBS) along with TRASH RACK WITH AUTOMATIC TRASH RACK CLEANING SYSTEM** 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 End Customer Specification attached at Appendix 1 (if applicable) shall also be complied with.

Note: Wherever requirements (Including Quality Plan) for TBS are indicated in this specification, similar requirements shall be for Trash Rack with Automatic Trash Rack Cleaning System also (as applicable).

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 Seven (7) 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 1 No. Duplex Basket Strainer with other accessories as required to complete the equipment.

2.4 Each travelling band screen and Trash Rack 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 Seven (7) sets of Trash Racks (of clear opening 100 mm between bars) viz. independent set of Trash Rack for each inlet channel.

2.6 1 No. Common Automatic Mobile Trash Cleaning Mechanism shall be provided for Trash Racks along with associated instrumentation & electrical/Mechanical accessories for automatic operation.

2.7 Starter Panel (cum Switch Gear Panel) shall be as follows:

(i) One Common Starter Panel (cum Switch Gear Panel) for DCS based control system for TBS (7 sets) and Automatic Mobile Trash Cleaning Mechanism.

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.

2.8 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, Trash Rack, Automatic Trash Rack Cleaning Mechanism as required to make it a complete package.

2.9 2 Nos. Debris segregation and collection baskets and other details as per Datasheet-A.

2.10 Complete Pipe work, including interconnection/distribution piping, valves, flanges/counter flanges (including Counter Flange at Terminal Point) for pipes/valves, bends, fittings, distributors, nozzles and support installation materials for equipments/piping/valves etc. shall be in Bidder's scope.

2.11 Any other items not listed above but required to make Travelling Band Screening system along with Trash Rack with Automatic Cleaning Mechanism 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 & Trash Rack with Automatic Trash Rack Cleaning arrangement system-

a) Supervision during critical stages of Erection
b) Final installation checks before commissioning
c) Commissioning of Travelling Band Screen and its accessories & Trash Rack along with Automatic Trash Rack Cleaning arrangement system
d) Site Testing

Bidder to include suitable number of visits/mandays for above activities however minimum Eight site visits for four days each for above activities shall be included by bidder in their offer price.

3.00.00 EXCLUSIONS :

The following are excluded from the bidder's scope:

1. Stop log Gates at the inlet of each section
2. Gantry Crane
3. Civil works required for installation
4. Erection of Travelling Band Screen, Trash Rack, Automatic Trash Rack Cleaning Mechanism 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 Sea Water Intake Pump House and are intended to remove floating

matter coming from the source through the open sea. The water analysis is enclosed with Data Sheet-A.

Trash Rack (included in 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 Seven (7) streams as specified in Data Sheet-A.

Each stream shall be provided with an Independent Travelling Band Screen & Trash Racks. However, common Spray wash/Flushing pumps and Duplex Basket Strainers shall be provided for Seven (7) nos. Travelling Band Screens.

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

Trash Rack with Automatic Mobile Cleaning Mechanism System:-

4.05.00 Automatic Mobile scraper car and drive system shall be used to clean the debris from Trash Rack (with 100 MM spacing between bars) upstream of TBS in Sea Water Intake pump house sumps. Scraper car shall collect the debris from Trash Rack and discharge it into common debris discharge channel (Debris discharge channel is common for TBS and Scraper car).

4.06.00 Scraper car arrangement shall be automatic and debris removal system shall be common for all seven sumps.

4.07.00 Trash Rack (included in Bidder's scope) is tilted at an angle of 85 deg. or 90 deg. (to be decided during detailed engineering) (Refer Sketch-B of Sea Water Intake Pump house). Scraper car shall be accordingly designed by bidder.

4.08.00 One number semi gantry crane is available (BHEL –Provided) at Sea Water Intake pump house with capacity and hook level as per Datasheet-A. Any other lifting/handling arrangement/equipment shall be provided by bidder along with complete accessories.

4.09.00 Automatic scrapper car system shall be provided by bidder complete with all instrumentation, Mechanical equipment/accessories, Electrical equipment/accessories, nuts, bolts, sleeves, Drive, Motor, Embedments, Inserts, Installation materiel, clamps, other accessories to make it complete package along with TBS.

4.10.00 Operation control as applicable for regular operation of scraper car shall be provided by bidder. Same shall be subject to approval of BHEL /customer /consultant during detailed engineering without any commercial implication to BHEL.

4.11.00 Bidder may optimize space within the total length available for individual length requirement for Scraper car arrangement and TBS in Sea Water Intake pump house sumps.

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, Trash Rack with Automatic Mobile Cleaning arrangement system, Spray wash/flushing pumps, spray wash valves, Duplex Basket strainers and other auxiliaries shall be controlled and operated from standalone DDCMIS of Raw water pumps system located in Raw water 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 along with Automatic Scraper car arrangement system, spray wash pumps shall be realized in the DDCMIS.

b) Auto/Manual Selector Switch for

- Travelling Band Screens along with Automatic Scraper car arrangement system

- ❖ Spray wash pumps

c) Indication(Running/ Stopped)/alarms/annunciations/ for
- ❖ Travelling Band Screens along with Automatic Scraper car arrangement system
- ❖ Spray wash pumps
- ❖ Spray wash valves

d) Start/Stop facility for each TBS along with Automatic Scraper car arrangement system, spray wash pumps, spray wash valves, 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 along with Automatic Scraper car arrangement system.

g) Complete automatic shut-down of the system .

h) Selection of various modes of operation as described in succeding paras.

5.04.00 Differential Level Transmitter:

5.04.01 One No. Differential Level Transmitter shall be provided across each Travelling Band Screen and each Trash Rack and following minimum signals shall be derived:

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

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 Water Screens (TWS) shall be provided with following modes of operation from standalone DDCMIS of Sea Water Intake pumps system located in Sea water intake pump house control room only.

- 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 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 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 and discharge shall be provided with 'Open & Close' limit switches 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 permissive / interlocks shall be provided as follows:

a) Pumps start permissive:
   - Suction/ discharge Valves = "Open"
   - Pump Suction header pressure = "Adequate"
   - Differential level across Screen = "High / Very High"

b) Pumps tripping / stop interlocks :
   - Pump suction header pressure = "Very Low"
   - Differential level across TBS = "Normal"
   - Pump discharge pressure = "Very High"

Note: Alarm shall be annunciated for above conditions.

c) Status of following shall be indicated in LCP:
- Differential level across TBS
- Pump suction header pressure
- Pump discharge header pressure

d) Standby pump start permissive :
- Discharge header pressure = "Low with time delay"
- Working Pump = “Trips”

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 0.8 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.

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 along with Automatic Scraper car arrangement system 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:

The Travelling Band Screens, Trash Rack with Automatic Mobile Scraper car arrangement system 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 & Automatic Trash Rack Mobile Cleaning Mechanism 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 along with Automatic Scraper car arrangement system or its accessories, the supplier shall modify the TBS, Trash Rack with Automatic Trash Rack Mobile Cleaning Mechanism System 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-V9-435-172-N001	P&ID OF TWS SYSTEM	R-0 within 21 days from PO & subsequent revisions within 10 days of comments received from BHEL.
PE-V9-435-172-N002	GA OF TWS	
PE-V9-435-172-N003	CONTROL PHILOSOPHY & GA OF CONTROL PANEL- TWS	

PE-V9-435-172-N004	DETAILS OF DEBRIS SEGREGATION BASKET-TWS	
PE-V9-435-172-N007	DATASHEET FOR TWS	
PE-V9-435-172-N011	CIVIL DETAILS OF TWS	
PE-V9-435-172-N020	QP OF TWS	
PE-V9-435-172-N005	PIPING INSTALLATION DIAGRAM	R-0 within 21 days from approval of 'PID, Datasheet & GA of TWS' and subsequent revisions within 10 days of comments received from BHEL.
PE-V9-435-172-N006	GA OF STRAINER	
PE-V9-435-172-N008	DATASHEET OF STRAINER	R-0 within 30 days from approval of 'Datasheet of TWS' & subsequent revisions within 10 days of comments received from BHEL.
PE-V9-435-172-N009	DATASHEET OF VALVES	
PE-V9-435-172-N010	DATASHEET FOR PIPE, FITTING & FLANGES	
PE-V9-435-172-N019	DATASHEET FOR GEARED MOTOR OF TWS	
PE-V9-435-172-N012	DATASHEET FOR PRESSURE/DIFF. PRESSURE GAUGE	R-0 within 30 days from approval of 'PID & Datasheet of TWS' and subsequent revisions within 10 days of comments received from BHEL.
PE-V9-435-172-N013	DATASHEET FOR DIFF. LEVEL TRANSMITTER	
PE-V9-435-172-N014	DATASHEET FOR ELECTRICAL ACTUATOR	
PE-V9-435-172-N015	DATASHEET OF DIFF. PRE. INDICATOR SWITCH	
PE-V9-435-172-N016	WIRING DIAGRAM	R-0 within 30 days from approval of 'Control Philosophy' and subsequent revisions within 10 days of comments received from BHEL.
PE-V9-435-172-N017	DATASHEET OF STARTER PANEL (CUM SWITCHGEAR PANEL)	
PE-V9-435-172-N018	CABLE SCHEDULE	
PE-V9-435-172-N021	O&M MANUAL	Within 30 days from MDCC

Above mentioned drg/documents are applicable for TBS along with Trash Rack with Automatic Mobile Cleaning arrangement.

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.

ANNEXURE-1
PACKING PROCEDURE
(For TBS along with Trash Rack with Automatic Trash Rack Cleaning Mechanism)

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 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.

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM

SKETCH-A

NOTES:

1. DESIGN PRESSURE FOR INTAKE PIPING & OUTFALL PUMPING SYSTEM: = 6.0 KG/SQ.CM(g)
   DESIGN PRESSURE FOR CW MAKEUP PUMPING SYSTEM: = 3.0 KG/SQ.CM(g)
   DESIGN PRESSURE FOR DESALINATION PLANT SUPPLY PUMPING SYSTEM: = 5.0 KG/SQ.CM(g)
   DESIGN MECHANICAL TEMPERATURE: 50 DEG C.
2. SEA WATER INTAKE AND OUTFALL SYSTEM SHALL BE EXECUTED BY BHEL-PSSR AS A SEPARATE EPC PACKAGE.
3. FOR OTHER NOTES REFER SHEET 2 OF 2.

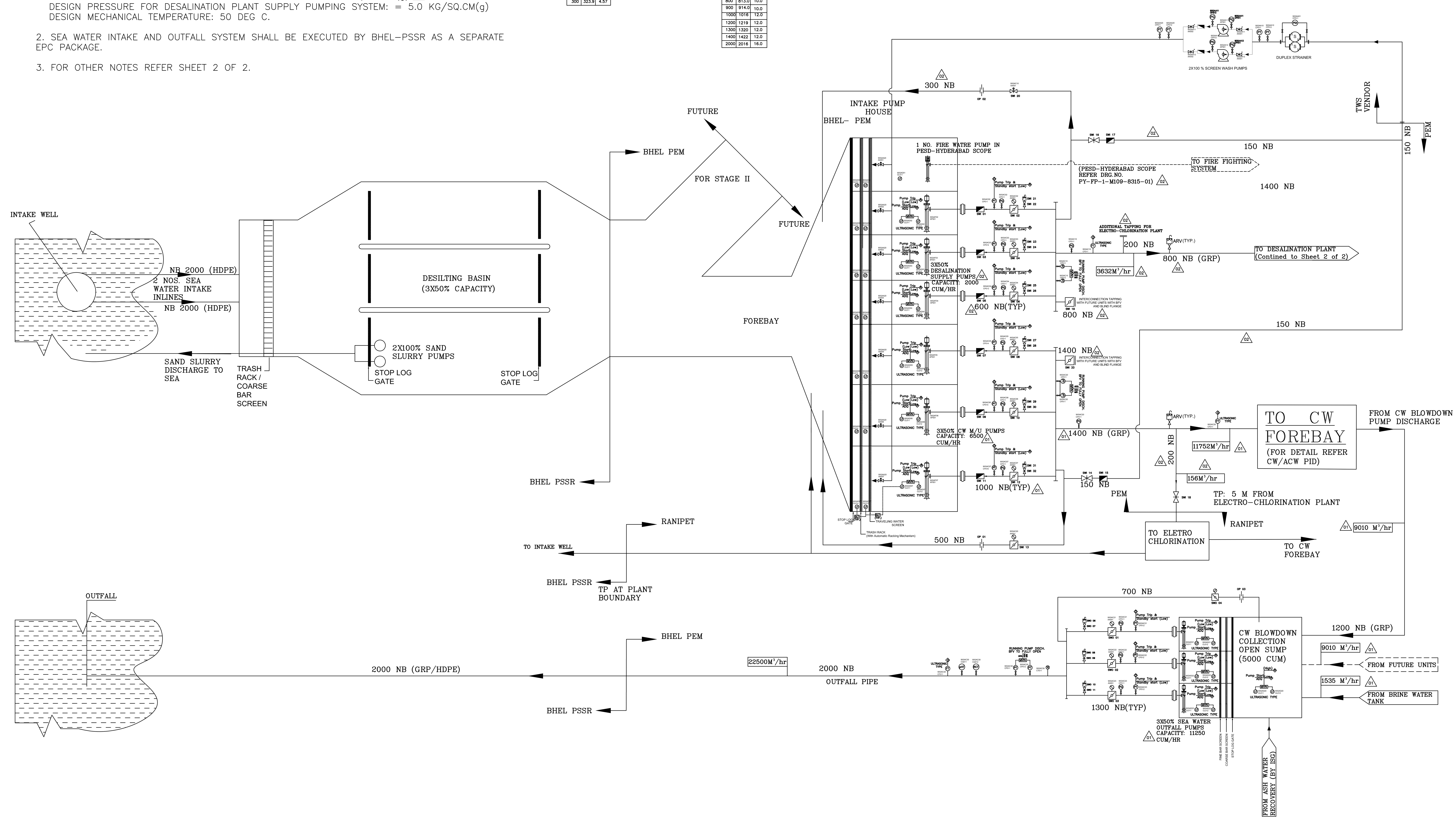
PIPE SIZES OF SS/DUPLEX SS PIPING (01)

NB	OD	THICK.
25	33.4	3.38
40	48.3	3.68
50	60.3	3.91
65	73.0	3.05
80	88.9	3.05
100	114.3	3.05
150	168.3	3.40
200	219.1	3.76
250	273.1	4.19
300	323.9	4.57

PIPE SIZES OF CS PIPING (01)

NB	OD	THICK.
15	21.8	3.25
25	34.2	4.05
40	48.8	4.00
50	60.8	4.50
80	89.5	4.85
100	115.0	5.40
150	166.5	5.40

NB	OD	THICK.
200	219.1	6.40
250	273.0	6.40
300	323.9	8.00
350	355.6	8.00
400	406.4	8.00
450	457.0	8.00
500	508.0	8.00
600	610.0	10.0
700	711.2	10.0
800	813.0	10.0
900	914.0	10.0
1000	1016	12.0
1200	1219	12.0
1300	1320	12.0
1400	1422	12.0
2000	2016	16.0



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COMPUTER FILE NAME:

PROJECT	2x660MW UDANGUDI STPP STAGE-I UDANGUDI, THOOTHUKUDI DISTRICT TAMILNADU
OWNER	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
OWNER'S CONSULTANT:-	TATA CONSULTING ENGINEERS LIMITED BENGALURU

JOB NO: 435
STATUS : CONTRACT
DISTRIBUTION

REV	DATE	ALTD	CHD	APPD
02	20.09.19	PA	AJ	AJ
01	24.5.19	PA	AJ	AJ

REV 02:
1. REVISED AS PER TCE letter TCE.11403A-ME-VDT-0145, dt.28.06.2019 & MOM dated 08.08.2019 and 13.09.2019
2. REVISION MARKED AS (02)

REV 01:
1. REVISED AS PER TCE letter TCE.11403A-ME-VDT-051, dt.14.05.2019
2. REVISION MARKED AS (01)

CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD, POWER SECTOR, PROJECT ENGINEERING MANAGEMENT, NOIDA

DEPT CODE		NAME	SIGN	DATE
N	DRN	PA	SD	27.07.18
	DESN	PA	SD	27.07.18
	CHD	AJ	SD	27.07.18
	APPD	AJ	SD	27.07.18

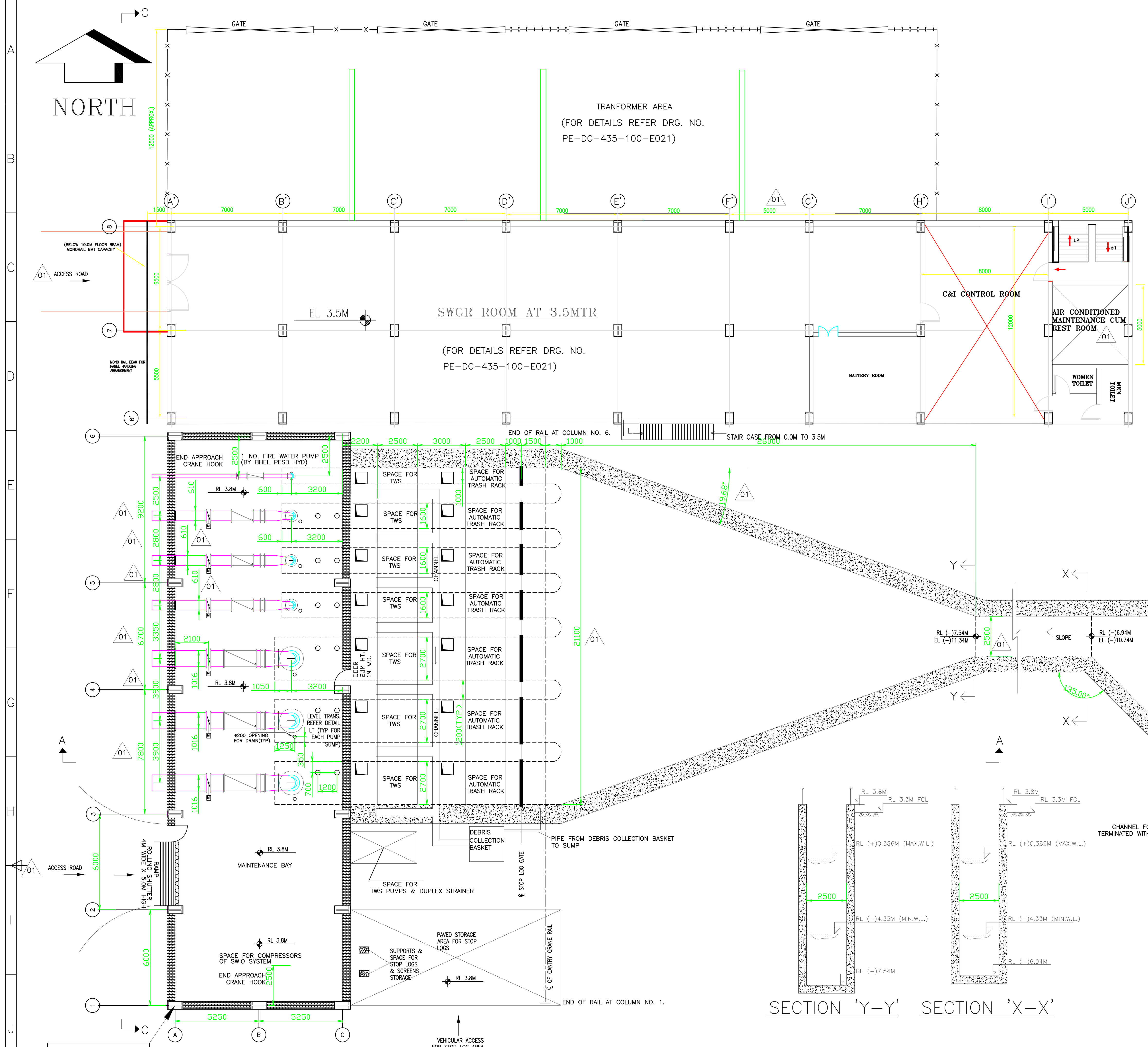
TITLE: P&ID-PLANT WATER SYSTEM

DRAWING NO. PE-DG-435-172-N001

SHEET 1 OF 2 REV 02

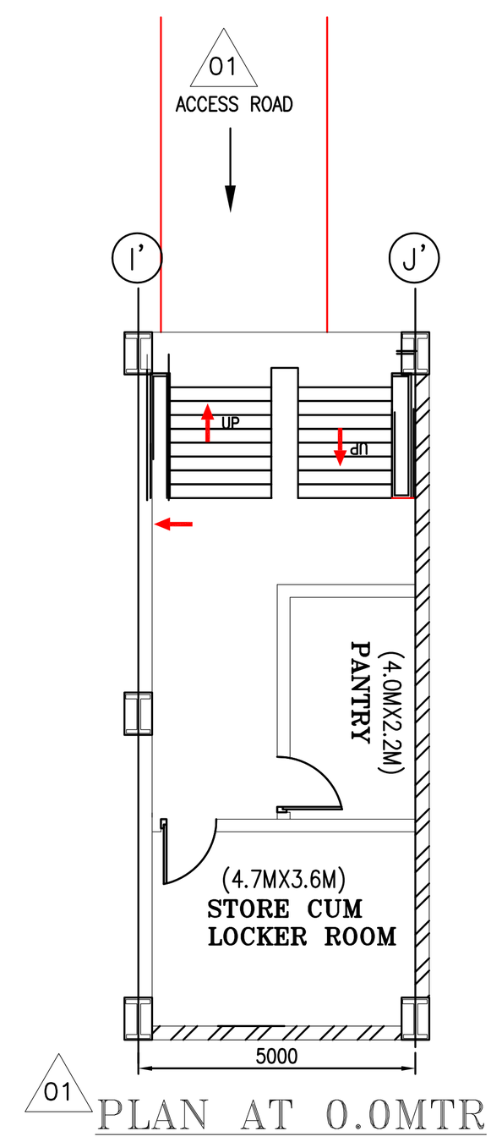
SIZE-A1

SKETCH-B



PLAN OF SWI PUMP HOUSE & FOREBAY

SCALE 1:160



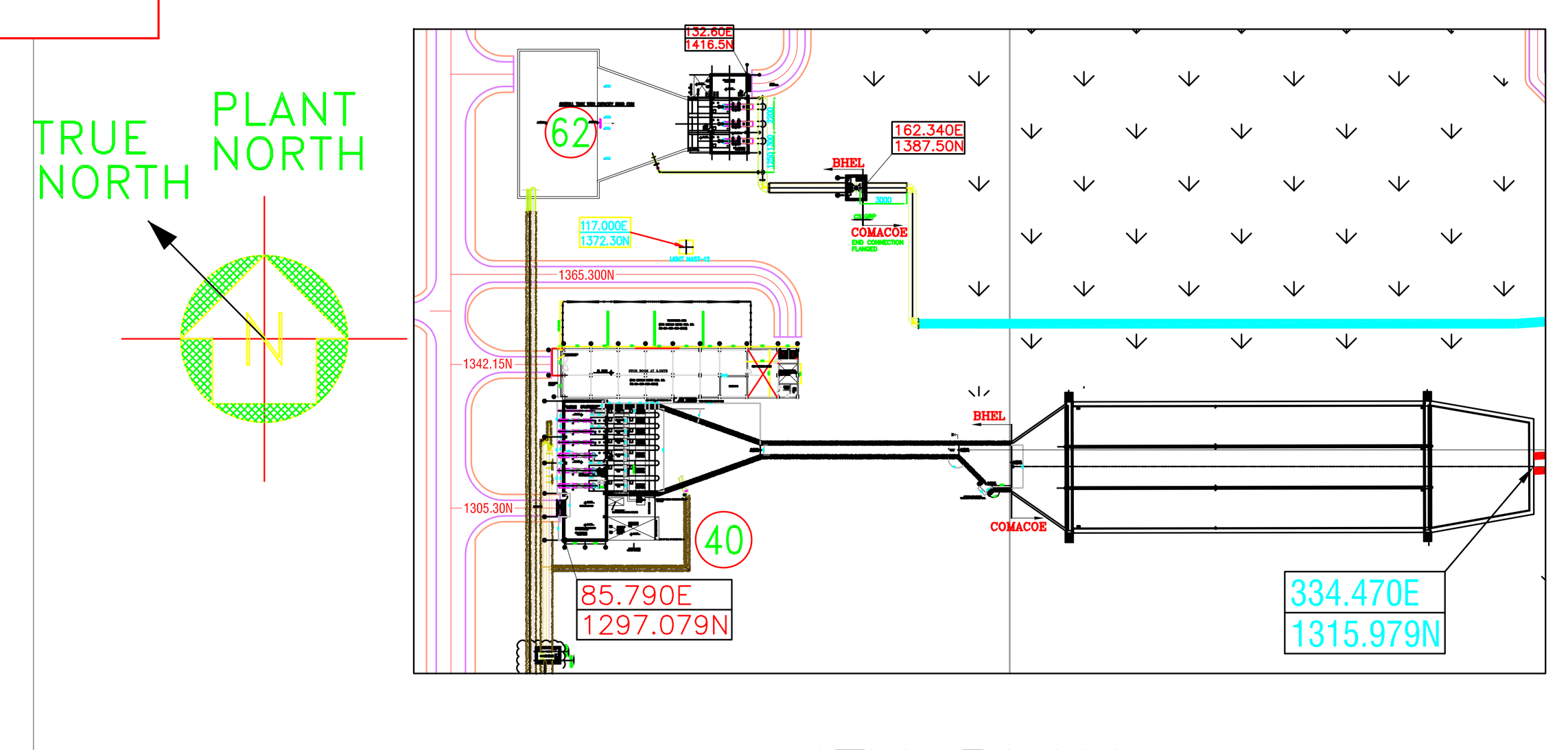
PLAN AT 0.0MTR

LEVELS CONSIDERED FOR DESIGNING

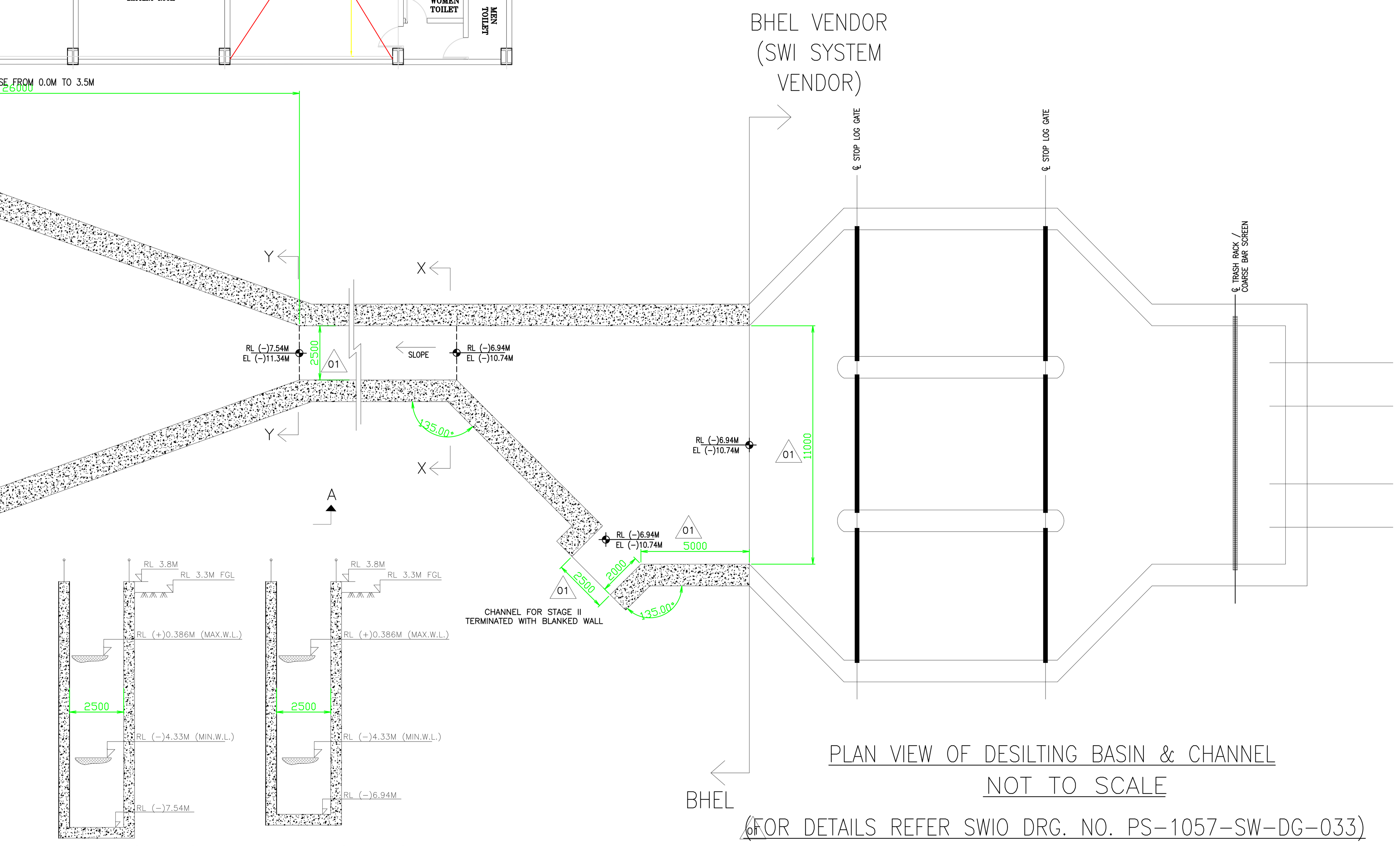
(AS PER INFORMATION FURNISHED BY TANGEDCO AS PER CL. 5.1.3, SEC 1.0, Vol II)

	ELEVATIONS W.R.T. CD	RL	EL. (M)
PLANT FGL	3.940	+3.300	(−)0.500
HIGHEST HIGH WATER LEVEL	1.026	+0.386	(−)3.414
MEAN SEA LEVEL	0.640	0.000	(−)3.800
LOWEST LOW WATER LEVEL	0.110	(−)0.530	(−)4.330

(Level differences shown: 2.914m, 0.386m, 0.530m, 0.916m, 3.300m, 0.530m)



KEY PLAN



PLAN VIEW OF DESILTING BASIN & CHANNEL

NOT TO SCALE

(FOR DETAILS REFER SWIO DRG. NO. PS-1057-SW-DG-033)

NOTES :

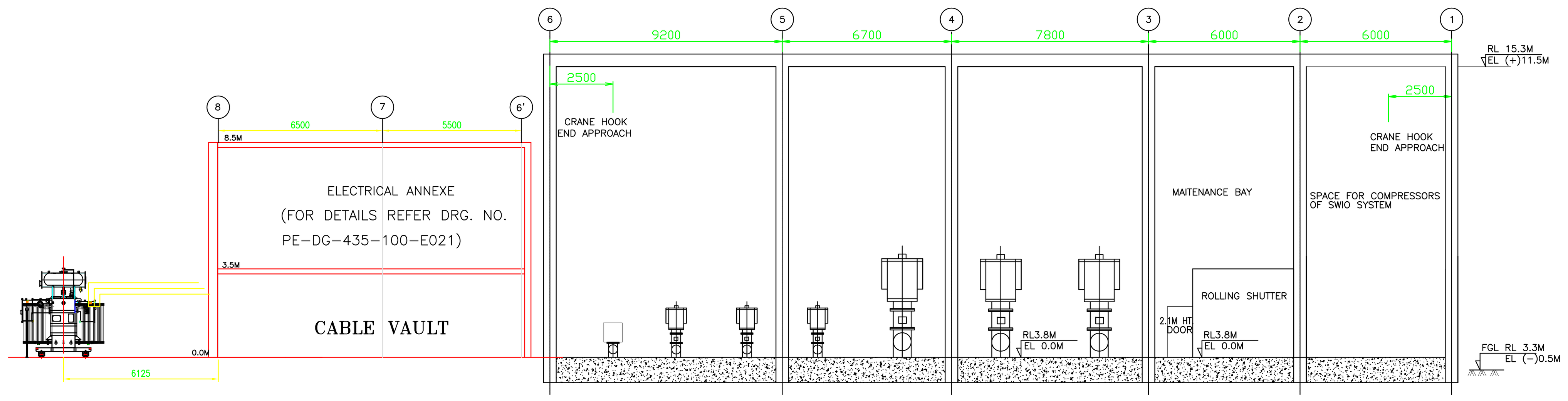
1. ALL DIMENSIONS ARE IN MM AND ALL ELEVATIONS ARE IN METRES UNLESS OTHERWISE STATED.
2. SS316L GATES (TOTAL 3 NOS. i.e. 1NO. FOR SWIP FOR CW MAKEUP, 1 NO. FOR SWIP FOR DESALINATION PLANT, & 1 NO. FOR FIRE WATER PUMP) & SS316L GUIDE TO BE FABRICATED AND SUPPLIED BY CIVIL CONTRACTOR.
3. 1 NO. TRASH RACK FOR EACH PUMP SUMP SHALL BE PROVIDED ALONG WITH 1 NO. COMMON AUTOMATIC MOBILE TRASH CLEANING MECHANISM BY BHEL-PEM TWS VENDOR.
4. SUMP MODEL STUDY SHALL BE CARRIED OUT BY BHEL PEM PUMP VENDOR FOR SEA WATER INTAKE SUMP & FOREBAY AND REQUISITE HYDRAULLIC ELEMENTS SHALL BE INCORPORATED IN CIVIL WORKS, IF REQUIRED, AS PER STUDIES.
5. OPENINGS, INSERTS ETC. REQUIRED FOR C&I ITEMS, PIPE/VALVE SUPPORTS ETC. SHALL BE AS PER RESPECTIVE INSTRUMENTS, PIPING LAYOUT ETC.
6. ACCESS TO ROOF FOR PUMP HOUSE SHALL BE PROVIDED BY CAGE LADDER.
7. STOP LOG GATE HEIGHT SHALL BE DESIGNED FOR SUMP OPENING HEIGHT AS SHOWN IN DRAWING.
8. TRASH RACK (COARSE BAR SCREEN) HEIGHT SHALL BE UP TO PUMP FLOOR LEVEL (RL 3.8M)
9. REFERENCE ENGINEERING DRAWINGS:
   a) PLANT WATER P&ID: PE-DG-435-172-N001
   b) GA OF PUMPS: PE-V6-435-100-N002
   c) ELECTRICAL EQUIPMENT LAYOUT & CABLING IN SEA WATER INTAKE P/H AREA: PE-DG-435-100-E021.
   d) P&ID OF ELECTRO CHLORINATION : 1-WT-040-01694
   e) GA DRAWING FOR SWI PH EOT CRANE: PE-V0-435-501-A105
   g) INTAKE PIPING OUTSIDE PUMP HOUSE: PE-DG-435-100-M049
10. VENTILATION DETAILS SHALL BE AS PER HVAC DOCUMENTS.
11. SERVICE & POTABLE WATER OVER HEAD TANK (1 CUM EACH) ON ROOF OF ELECTRICAL ANNEXE TO BE PROVIDED BY CIVIL CONTRACTOR.
12. CW MAKEUP PUMPS DETAILS

(i) No. OF PUMPS	3Nos. (2w+1S for Station)
(ii) TYPE	VERTICAL TURBINE
(iii) SPEED	1500 RPM (MAX.)
(iv) CAPACITY OF PUMPS	6500 m^3/hr
(v) HEAD (EX. PUMP INTERNAL LOSSES))	16.5M

13. DESALINATION PLANT SUPPLY PUMPS DETAILS

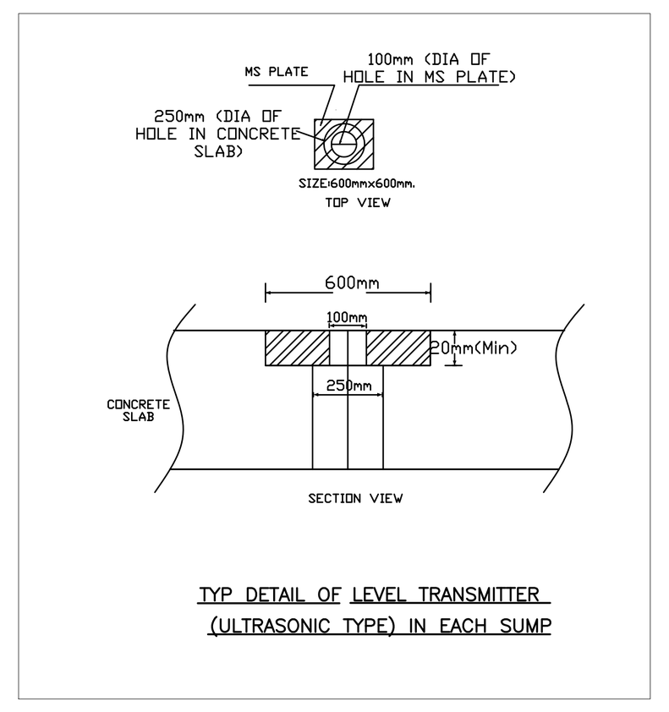
(i) No. OF PUMPS	3Nos. (2w+1S for Station)
(ii) TYPE	VERTICAL TURBINE
(iii) SPEED	1500 RPM (MAX.)
(iv) CAPACITY OF PUMPS	2000 m^3/hr
(v) HEAD (EX. PUMP INTERNAL LOSSES))	30.0M

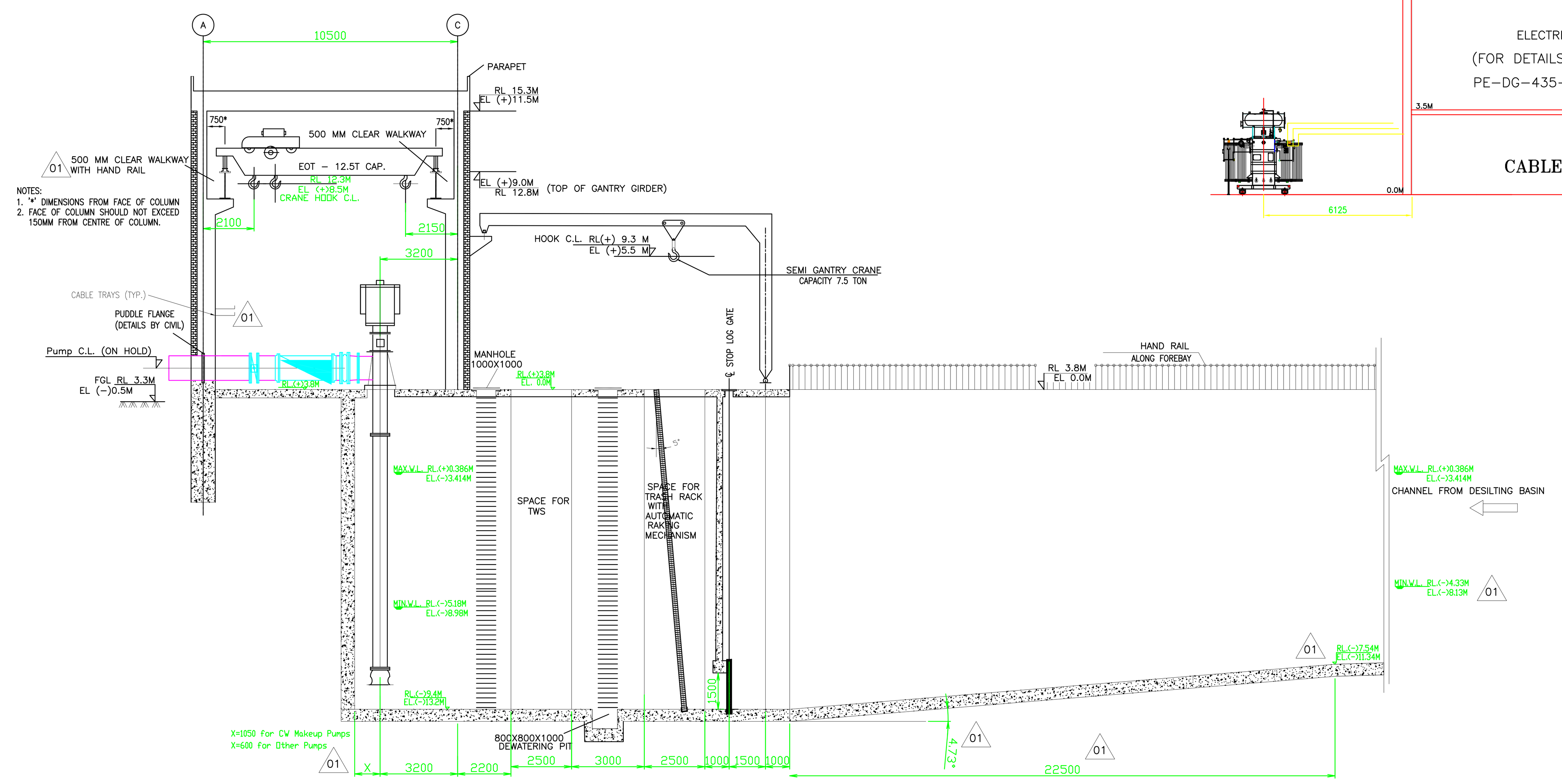
EL 0.00M CORRESPOND TO RL 3.8M, WHICH IS FFL OF TG BUILDING. ALL ELEVATIONS ARE MARKED WITH RESPECT TO THIS LEVEL.



VIEW -'C-C'

SCALE 1:160





SECTIONAL VIEW -'A-A'

SCALE 1:160

IMPORTANT NOTE:

THIS PUMP HOUSE IS BASED ON MINIMUM WATER LEVEL AS PER CALCULATION IN PLANT WATER EQUIPMENT SIZING (DOC. NO. PE-DC-435-172-N007) & PRESSURED DROP CALCULATION PROVIDED BY M/S COMACOE VIDE DOCUMENT NO. CM-190507-DBR-01.

PROJECT	2x660MW UDANGUDI STPP STG I
OWNER	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
CONSULTANT	TATA CONSULTING ENGINEERS LIMITED BENGALURU
JOB NO -	435
STATUS -	CONTRACT
	BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECTS ENGINEERING MANAGEMENT NEW DELHI
TITLE:	MECHANICAL GA OF SEA WATER INTAKE PUMP HOUSE
DRAWING NO.	PE-DG-435-172-N004
SHEET	01 OF 01
REV.	01

	NAME	SIGN	DATE
DRN	PA	SD	18.02.19
CHD	AJ	SD	18.02.19
APPD	AJ	SD	18.02.19

REV	DATE	ALTD	CHD	APPD
01	09.12.19	PA	AJ	AJ

01 REVISED AS PER CUSTOMER COMMENTS RECEIVED VIDE LTR. TCE.11403A-ME-VDT-0183, dt.16.07.2019

SECTION IB
SPECIFIC TECHNICAL REQUIREMENT
ELECTRICAL SYSTEMS

SPECIFIC TECHNICAL REQUIREMENTS:

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

The equipment and services to be provided by bidder under this specification shall be as detailed here below but shall not be limited to the following:

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 bidder without any extra charge shall provide the same.

c) Supply of mandatory spares as specified in the specifications of mechanical equipments.

d) Electrical load requirement for TWS package.

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 including GA drg, data sheet as per required format, quality plans, calculations, test reports, test certificates, operation and maintenance manuals, characteristic curves, wiring diagrams/schemes etc. shall be furnished as specified at contract stage. All documents shall be subject to customer / BHEL approval without any commercial implications to BHEL.

h) The sub-vendor list for various electrical items is subject to BHEL/Customer approval without any commercial implications.

i) Motors shall meet minimum requirement of Electric motor specification.

j) Purchaser will furnish data sheets to the vendor after award of contract. Vendor shall furnish filled in data sheets meeting the specification requirements.

k) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.

l) 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 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical / quality assurance requirements stipulated. In line with this, the bidder as technical offer shall furnish two signed and stamped copies of the following:

a) A copy of this sheet “Electrical Equipment Specification for TWS package and sheet “Electrical Scope between BHEL and Vendor” with bidder’s signature and company stamp.
b) Electrical load requirement.

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**

4.1 Electrical scope between BHEL & vendor
4.2 Technical specification – Specification for Electric Motors/Actuators
4.3 Standard Technical specification – LV Motors
4.4 Datasheets & quality plan for motors.
4.5 Load Data Format. (Annexure –II)
4.6 BHEL Cable listing format (Annexure –III)

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGES: TWS
SCOPE OF VENDOR: SUPPLY

PROJECT: 2 X 660MW UDANGUDI STPP

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC Starter cum control panel (if applicable)	BHEL Vendor	BHEL BHEL	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	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.
3	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.
4	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc.	Vendor	BHEL	Refer scope/ C&I portion of specification for scope of fibre Optical cables if used between PLC/ micro processor & DCS.
5	Cable trays, accessories & cable trays supporting system	BHEL	BHEL	
6	Cable glands and lugs for equipment supplied by Vendor	Vendor	BHEL	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty copper lugs for power & control cables.
7	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.
8	Lighting	BHEL	BHEL	
9	Equipment grounding & lightning protection	BHEL	BHEL	
10	Below grade grounding	BHEL	BHEL	

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGES: TWS
SCOPE OF VENDOR: SUPPLY

PROJECT: 2 X 660MW UDANGUDI STPP

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
11	LT Motors with base plate and foundation hardware	Vendor	BHEL	Makes shall be subject to customer/ BHEL approval at contract stage.
12	Mandatory spares	Vendor	-	Vendor to quote as per specification.
13	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
14	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	
15	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.
16	Equipment 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,
17	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 mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.

SECTION–3.16: MOTORS

1.0.0 INTENT OF SPECIFICATION

This section covers the technical requirements of HT motors, LT Motors and DC motors.

2.0.0 CODES AND STANDARDS

The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest edition (including amendments) of the following Indian Standards (IS), IEC publications and other codes except where modified and /or supplemented by this specification.

a)	IS: 325	Three phase induction motors
b)	IS: 12615	Energy efficient induction motors
c)	IS: 900	Code of practice for installation and maintenance of induction motors
d)	IS: 996	Single-phase AC induction motor for general purpose
e)	IS: 1231	Dimensions of three-phase foot-mounted induction motors
f)	IS: 2223	Dimensions of flange mounted AC induction motors
g)	IS: 4029	Guide for testing three-phase induction motors
h)	IS: 8789	Values of performance characteristics for three-phase induction motors
i)	IS: 13555	Guide for selection and application of 3-phase AC induction motors for different types of driven equipment
j)	IS: 5571	Guide for selection of electrical equipment for hazardous areas
k)	IS: 12065	Permissible limits of noise level for rotating electrical machines
l)	IS: 12075	Mechanical vibration of rotating electrical machines
m)	IS 60034-5	Degree of protection provided by Integral design of rotating electrical machines
n)	IS 60034-8	Terminal marking and direction of rotation
o)	IS 60079-1	Equipment protection by flame proof enclosure
p)	IS 60034-1	Rotating electrical machines.
q)	IS 60079	Explosive atmospheres
r)	IS/IEC 60529	Degrees of protection provided by enclosures (IP code)
s)	IEC 60034	Rotating electrical machines.
t)	IS 3177	Code of practice for Design, Manufacture, Erection and testing of Cranes and Hoists

3.0.0 TECHNICAL REQUIREMENTS

3.1.0 Design ambient temperature

Motors shall be suitable for an ambient temperature of 50 degree C and relative humidity of 95% and shall deliver the rated output without exceeding its guaranteed temperature limits.

3.2.0 Supply voltage

Motors rated up to and including 415 V are termed as LT motors and the motors rated higher than 415 V are termed as HT motors.

Motors shall be capable of delivering the rated output under following voltage and frequency variations without exceeding its guaranteed temperature limits.

- Frequency variation : (+) 3% and (-) 5%
- Voltage variation for LT motors : (±) 10%
- Voltage variation for HT motors : (±) 6%
- Combined variation of voltage and frequency : 10% (absolute sum)

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

3.3.0 System Parameters

Sl. No.	Description	11 kV and 6.6 kV System	LT System
1.	Voltage level	6.6 kV : Above 200 kW and upto 2000 kW 11 kV: Above 2000 kW	240 V : up to 0.2 kW 415 V: >0.2 kW and up to 200 kW.
2.	System earthing	Earthed through resistance, limiting earth fault current to 300 Amps	415 V system solidly grounded.
3.	Fault withstand rating of motor terminal box (Breaker operated)	50 kA for 0.2 sec for 11 kV and 31.5 kA for 0.2 sec for 6.6 kV	415 V system : 50/65 kA for 0.2 second

3.4.0 Type

AC Motors shall be squirrel cage induction type unless otherwise it is specified.

3.5.0 Duty

- All AC motors shall be squirrel cage three phase/single phase induction motors. All the motor shall be designed for bi-directional rotation.
- All the motors shall be rated for S1 duty for continuous operation. Motors of crane and hoist application shall be intermittent duty.
- DC motor shall generally be of shunt wound type rated for 220 V DC.
- Motors shall be suitable for installation in hot, humid and tropical atmosphere and polluted at places with coal ash and or fly ash.
- The motors shall be suitable for bus transfer schemes provided on the 11 kV/6.6 kV/415 V systems without any injurious effect on its life.

3.6.0 Design margin

Whenever the basis for motor rating are not specified in the corresponding mechanical specification section maximum continuous motor rating shall be atleast 10% above the maximum load derived of the driven equipment under entire operating range including voltage & frequency variation.

The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating; pull up, breakdown and full load torques are available for the intended service.

Service shall be considered as 1.0 only.

3.7.0 Method of Starting

- All the motors shall be suitable for direct on-line starting on full load. Where variable voltage and variable frequency (VVFD) operation is envisaged through VVFD drives, motors shall be specially designed for such application.
- LT motors rated up to 125 kW shall be controlled through MPCB/MCCB and contactor. LT motors rated more than 125 kW shall be controlled through air circuit breaker.
- HT Motors shall be controlled through vacuum circuit breaker.

3.8.0 Efficiency

All the duty motors shall be energy efficient type. For HT and LT motors, it shall be IE3 class as per IS 12615. For VFD controlled HT and LT motors, it shall be IE2 class as per IS 12615.

3.9.0 Temperature rise

- Winding Insulation shall be Class F.
- Temperature rise of air cooled motors shall not exceed 70°C over air temperature of 50°C by resistance method, while delivering its maximum rated output.
- Temperature rise of water cooled motors shall not exceed 80°C over inlet cooling water temperature by resistance method, while delivering its maximum rated output.

3.10.0 Starting voltage

a) Motors shall be capable of starting and accelerating the load at following starting voltage, with direct on-line starting, without exceeding specified winding temperatures.

- HT Motors (up to 1000 kW) : 85% of rated voltage
- HT Motors (> 1000 kW up to 4000 kW) : 80% of rated voltage
- HT Motors (> 4000 kW) : 75% of rated voltage
- LT motors : 80% of rated voltage

b) During fast changeover of power supply source, vector difference between the motor residual voltage and the incoming supply voltage shall be about 150% of the rated voltage and the motors shall withstand voltage stress and torque stress developed during that time, which may last for a period of one (1) second.

c) The motor shall be capable of operating at full load at a supply voltage of 75% of the rated voltage for 5 minutes.

3.11.0 No. of Starts

Continuous duty motors shall be suitable for the following starting requirements under the specified conditions of load, torque and inertia.

- No. of consecutive hot starts shall be 2 (with initial temperature of the motor at full load operating level).
- No. of consecutive cold starts shall be 3 (with initial temperature of the motor at ambient temperature).
- For conveyor motors, no. of consecutive hot starts shall be 3 (with initial temperature of the motor at full load operating level).

3.12.0 Starting current

- Locked rotor current of HT motors for applications other than listed below shall be limited to 600% of the full load current, and is subject to IS tolerance.
- For energy efficient LT motors, locked rotor current shall be as per IS: 12615.
- Locked rotor current of the VFD controlled AC motors shall be limited to 300% of the full load current, and is subject to IS tolerance.
- Locked rotor current of the BFP motors shall be limited to 450% of the full load current of the motor, and is subject to IS tolerance.

3.13.0 Locked rotor withstand time

- The locked rotor withstand time for HT motors under hot conditions at 110% rated voltage shall be more than the starting time at minimum permissible voltage specified above by atleast three seconds or 15% of the accelerating time whichever is greater. Provision of speed switch shall be avoided to the extent possible. In case the speed switch is required, it shall be indicated by the bidder in his offer
- For the LT motors having starting time up to 20 seconds at minimum permissible voltage, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 seconds more than the starting time.
- For the motors having starting time more than 20 seconds and up to 45 seconds at minimum permissible voltage, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 seconds more than the starting time.
- For motors having starting time more than 45 seconds at minimum permissible voltage, 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.
- Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.
- When a speed switch is mounted on the motor shaft, the same shall remain closed for speeds lower than 20% and open for speeds above 20% of the rated speed. The speed switch shall be capable of withstanding 120% over speed in either direction of rotation.

3.14.0 Torque Requirements

- Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.
- Pull out torque at rated voltage shall not be less than 205% of full load torque.
- Motors subjected to reverse rotation shall be designed to withstand the stresses encountered when starting with non-energized shaft rotating at 125% of rated speed in reverse direction.

3.15.0 Enclosure

a) Motors shall have IP 55 degree of protection.

b) For hazardous location, the enclosure of motors shall following have flame proof construction conforming to applicable standard.
   - Fuel oil area Group – IIB
   - Hydrogen generation plant area : Group – IIC)

3.16.0 Cooling

- LT motors shall be totally enclosed fan cooled (TEFC), type IC411. The cooling shall be effected by self-driven bi-directional centrifugal fan protected by fan cover.
- HT motors can be totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or closed air circuit air cooled (CACA-IC6A1A1) type.
- Motors rated >3000 kW can be closed air circuit water cooled (CACW).
- Motors with CACA/CACW heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate the following:

  -Hot and cold air temperatures of the closed air circuit for CACA motors.

  -Hot and cold, air and water temperatures for CACW motors.
- The Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10 A at 230 V AC.

3.17.0 Winding

- Winding shall be class F insulation with temperature limited to class B. Insulation shall be Non-hygroscopic, oil resistant, and flame resistant. Winding, fittings and hardware shall be corrosion resistant. Winding shall be tropicalized and suitably varnished, baked and treated for operating satisfactorily in humid and corrosive atmosphere.
- For the VFD operated drives, insulation shall be designed to take care of stresses due to high DV/DT. Motors shall be wound with dual coated winding wires and impregnated with VPI process. Further for such application, insulated bearings shall be provided to avoid circulating current caused by shaft induced voltages.
- Space heaters rated for 240 V AC, 50 Hz supply shall be provided for motors rated 30 kW and above to maintain windings in dry condition when motor is standstill.
- For HT motors, insulation shall be Vacuum Impregnated (VPI).
- HT motors shall withstand one minute power frequency voltage test or 1.2/50 micro sec lightning impulse Voltage wave of 4U+5 kV (U=Line voltage in kV) test on main insulation as per IEC 600034-15. The coil inter-turn insulation shall withstand steep front impulse withstand voltage as per IEC 600034-15.
- For HT motors, 12 nos. simplex or 6 nos. duplex RTDs (two per phase), each having D.C. resistance of 100 ohms at 0℃, embedded in the stator winding at locations where highest temperatures may be expected, shall be provided. The material of the ETD's shall be platinum.

3.18.0 Bearings

- Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application. Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.
- Sleeve bearings shall be split type, ring oiled with permanently aligned, close running shaft sleeves. Grease lubricated bearings shall be pre-lubricated and shall have provisions for in-service positive lubrication with grease nipple and relief holes. For sleeve bearings, the bearing housing shall be preferably in end shield itself.
- Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred. However, if anti-friction bearings can take vertical thrust, thrust and guide bearings are not required.

- Lubricant shall not deteriorate under all service conditions. The lubricants shall be limited to normally available types. For motors rated 30 kW and above re-lubrication facility shall be provided.
- For motor with forced lubrication, a shaft driven oil pump shall be provided along with an electrical auxiliary pump. Alternatively, two motor driven pumps may be provided, one working and one standby. All necessary auxiliaries and accessories shall be provided to complete the system. A pressure gauge and pressure switch for low oil pressure warning and to start the standby oil pump automatically shall also be provided. A motor driven jacking oil pump may be provided, for heavy shaft loads.
- Flow switches shall be provided for monitoring oil flow of forced lubrication bearings, if used. Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10 A at 230 V AC.
- For bearing temperature measurement, duplex RTDs shall be provided for each bearing and shall be wired up to the terminal box.
- Each bearing shall be provided with dial type thermometer.
- For all VFD operated motors shall have insulated bearings to prevent flow of shaft currents.
- For motors rated above 1000 KW having shaft length more than 1.5 M shall have insulated bearings to prevent flow of shaft currents.
- All the motors rated <15 kW shall be provided with sealed ZZ bearings.
- Lub oil pressure transmitters shall be provided to DCS for remote monitoring. Lub oil pressure very low trip to HT equipment shall be 2 out of 3 logic.

3.19.0 Terminal Boxes

- Separate terminal boxes of IP 55 degree of protection shall be provided for stator leads. For single core cables, gland plate shall be non-magnetic material. Terminal box of HT motors shall be capable of being turned 360° in steps of 180°. Terminal box of LT motors shall be capable of being turned 360° in steps of 90°. The terminal boxes shall be split type with removable cover with access to connections.
- Terminals for motors shall be stud type, thoroughly insulated from the frame. The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
- The terminal box shall be capable of withstanding maximum system fault current for 0.2 sec for all breaker operated motors and shall be provided with explosion vent.
- For contactor operated LT motors, the terminal box shall be capable of withstanding the fault current for 0.2 sec minimum and operating time of MPCB/MCCB.
- Removable gland plates of thickness not less than 2.5 mm sheet steel or 3 mm aluminium (for single core cables) shall be provided for cable boxes.
- Cable spreader box shall be provided for larger cable sizes.
- Cable boxes of HT motors shall be phase segregated type. The terminals of three phases shall be segregated by barriers of metal or fiber glass. For HT motors, cable box design shall be suitable for accommodating cable termination kits.
- Separate terminal box for space heaters shall be provided.
- A separate terminal box of IP 55 degree of protection shall be provided for temperature detectors.
- Motors rated >1000 kW shall be provided with neutral current transformers of PS class on each phase for differential protection in neutral side terminal box. The three phases shall be connected to form the star point after passing through the CTs. The CT details shall be

finalized during detail engineering. Neutral terminal box shall have IP 55 degree of protection.

- The secondary leads of CT shall be wired to separate auxiliary terminal box of IP 55 degree of protection
- All the accessory terminal boxes shall be located on the same side of the main (power) terminal box.
- For LT motors, terminal box shall be located on top, unless otherwise specified.

3.20.0 Earthing Terminals

The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer. The terminal box shall have a separate grounding terminal.

3.21.0 Noise and Vibration

- Motors shall be selected with low noise levels in accordance with IS 12065.
- The peak amplitude of the vibration shall also be within the specified limits of IS: 12075.
- All HT motors shall be provided with vibration pads for mounting vibration detectors.

3.22.0 Name Plates

Motor shall have stainless steel nameplate(s) showing diagram of connections, all particulars as per IS: 325 / IS: 12615 and shall also have 'BEE' marking.

In addition to the minimum information required by IEC/IS, the following information shall be shown on motor rating plate:

- Temperature rise in ºC under rated condition and method of measurement.
- Degree of protection.
- Bearing identification no. and recommended lubricant.
- Location of insulated bearings.

3.23.0 Canopy

Canopy shall be provided for all the motors located outdoor. For details, please refer Civil section.

4.0.0 DC MOTORS

DC motors shall be provided where specified/required. DC Motors shall be sized for operation with fixed resistance starting for reliability. DC motors shall be shunt wound type. Motors shall be capable of delivering the rated output at 220 V DC with (+) 10% and (-) 15% variations without exceeding its guaranteed temperature limits. 220 V DC system shall be unearthed. Starting current of the DC motors shall be limited to 200% of the full load current of the motor, and is subject to IS tolerance. DC Motors shall be similar to AC Motors with respect to other features like enclosure type, cooling and class of insulation.

5.0.0 INSTALLATION

Installation shall be carried out as per IS: 900.

6.0.0 PAINTING

Painting shall be carried out by an approved process. Pretreatment shall conform to applicable standard. The equipment shall be subject to a coat of red oxide primer paint. All inside and

outside surface shall be painted with epoxy based paint. The final thickness of paint film on steel shall not be less than 100 microns. Finish shade shall be 631 of IS: 5 (smoke grey).

7.0.0 TESTING AND INSPECTION

7.1.0 Equipment offered shall be of type tested and proven type. Type test certificates for test conducted earlier on similar rating shall be furnished for the motors rated 30 kW and above.

7.2.0 The following type tests shall be conducted on LT motors.

- Measurement of resistance of windings of stator and wound rotor.
- No load test at rated voltage to determine input current power and speed
- Full load test to determine efficiency power factor and slip.
- Temperature rise test.
- Momentary excess torque test.
- High voltage test.
- Test for vibration severity of motor.
- Test for noise levels of motor
- Test for degree of protection
- Over speed test.

7.3.0 The following additional type tests shall be conducted on HT motors.

- No load saturation and loss curves up to approximately 115% of rated voltage
- Measurement of noise at no load.
- Momentary excess torque test
- Full load test
- Temperature rise test at rated conditions.
- Lightning Impulse withstand test on the sample coil shall be as per IEC-60034, part-15
- Surge-withstand test on interturn insulation shall be as per clause no. 5.1.2 of IEC 60034, part-15
- Degree of protection test for the enclosure followed by IR, HV and no load run test.
- Terminal box-fault level withstand test for each type of terminal box.

7.4.0 The following routine tests shall be carried out for the motors as per applicable standards.

- IR of Winding before and after HV tests
- HV test on main winding space heater, RTD, BTD
- Resistance measurement
- No load run test Major Electrical
- Phase sequence and direction of rotation
- Vibration check Major Electrical
- Reduced voltage running test
- Locked rotor test at reduced voltage
- Record of RTD & BTD resistance at the end of no load test
- Test on space heater & RTD
- Visual Control of terminal box and verification of construction with respect to short tested terminal box

7.5.0 The following minimum tests/ checks shall be conducted at site. Any other tests/ checks as per the manufacturer's recommendation shall also be carried out

- Measurement of vibration.
- Measurement of insulation resistance and polarization index.
- Measurement of full load current.
- Test running of the motors, checking the temperature rise and identifying the hot spot etc.

8.0.0 DRAWINGS & DOCUMENTS

The following drawings and documents shall be submitted for approval during detail engineering stage.

- Motor sizing calculation
- Technical particulars
- General arrangement drawings
- Performance curves (Efficiency, power factor, starting current)
- Characteristic curves (Speed torque, Hot/cold with stand time, Negative sequence current)
- Terminal box details
- Test reports
- Sub-vendor list
- Manufacturing quality plan
- Field quality plan

SECTION–3.17: ELECTRICAL ACTUATORS

1.0.0 INTENT OF SPECIFICATION

This section covers the requirements of motor operated electrical actuators.

2.0.0 CODES AND STANDARDS

The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest edition (including amendments) of the applicable Indian Standards (IS), IEC publications and other codes except where modified and /or supplemented by this specification.

3.0.0 TECHNICAL REQUIREMENTS

3.1.0 Electric actuators shall be provided as specified in Mechanical and C&I section. It shall be equipped with 3 phase induction motor, rated for S2-15 minutes duty for ON/OFF valve and intermittent duty for inching duty

3.2.0 Motor shall be class F insulated with temperature rise limited to class B. Motor shall be of class H insulation with temperature limited to class B used for high pressure and high temperature valves.

3.3.0 Motor shall be surface cooled designed for enclosure protection class of IP 67. Motor shall be suitable for starting direct on-line.

3.4.0 For installation in potentially hazardous areas, the actuators shall have suitable explosion proof / flame proof type enclosure.

3.5.0 Actuators shall be suitable for operation at an ambient temperature of 50 degree C and relative humidity of 95%.

3.6.0 Maximum continuous motor rating shall be atleast 10% above the maximum load derived of the driven equipment under entire operating range including voltage & frequency variation.

3.7.0 Motors shall be capable of operating under following supply variations without exceeding its guaranteed temperature limits.

- Frequency variation : (+) 3% and (-) 5% of 50 Hz
- Voltage variation for LT motors : (±) 10% of 415 V
- Combined variation of voltage and frequency: 10% (absolute sum)

3.8.0 All actuators shall be of integral type. Duty cycle of actuators shall suit the system requirement. The actuators shall be capable of giving the required torque at the output shaft. The actuators shall be designed to take the full thrust.

3.9.0 Electrical Actuators of Inching type position transmitters of non contact type shall be interfaced to DCS.

3.10.0 Actuators shall be of totally enclosed weather proof and dust proof construction with NEMA-6/IP 65 enclosure and shall be suitable for outdoor application without the necessity for a canopy. The actuator shall be suitable for mounting directly on the valve. The actuator shall be capable of giving the required torque, rpm and thrust without the help of any spur gear arrangement. The actuator shall be suitable for mounting in any position. Actuators shall be provided with integral starters.

3.11.0 The actuator shall be complete with motor, reduction gears, change gears, terminal compartment, switch compartment with limit switches and torque switches, local position indicator, position transmitter for remote position indicator, thermistor, space heaters, cable glands, mechanical position indicator, hand wheel for manual operation, valve attachment etc.

3.12.0 Each actuator shall have a hand wheel fitted on it for emergency operation. The hand wheel shall be designed such that it is declutched automatically when the power supply to the motor is restored. The material of the hand wheel shall be either malleable iron or steel. The hand wheel shall have adequate clearance from housing for each gripping and operation. Actuators offered shall be with self-locking worm.

3.13.0 Two number adjustable torque switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts shall be provided. It is required to have calibration for the torque switches so that the switches can be easily set to any value desired.

3.14.0 Two numbers of position limit switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts shall be provided. Two auxiliary limit switches (one for open and one for close) with 2 NO and 2 NC potential free contacts shall also be provided. The limit switches shall be of independently adjustable type. Limit switches and actuating mechanism shall be rust proof suitable for damp atmospheres. Limit switch compartment shall be weather proof and spacious enough for easy setting. The limit switches shall be suitable for the following ratings, both 240 Volts AC, 10 A and 220 V DC, 0.5 Amps.

3.15.0 Each actuator shall have a space heater in the limit switch compartment suitable for 240 V AC 50 Hz single phase supply.

3.16.0 The wiring from the limit switches, torque switches etc. shall be brought out in a separate terminal box of adequate size, so as to easily terminate the control cables.

3.17.0 Actuators shall be supplied with 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..

3.18.0 A three position selector switch (marked as LOCAL-OFF-REMOTE) and push buttons OPEN-STOP-CLOSE (for local operation) with indication lamps for running OPEN and running CLOSE shall be provided.

3.19.0 The Remote command signal (OPEN-STOP-CLOSE) from DCS/Respective control system/Control panel shall be isolated from control electronics through opto-isolator.

3.20.0 The following individual sStatus annunciation LED's and fault annunciation LED's 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

3.21.0 The following individual fault annunciation LED's (Colour-Red) shall be provided locally. (Integral to Actuator)

- Torque switch OPEN
- Torque switch CLOSE
- Thermo switch trip
- Electronic overload relay trip
- Motor single phasing
- Common fault (Inclusive of any one or combination of above fault)

3.22.0 View port shall be provided on integral starter unit to monitor the above status annunciation and fault annunciation.

3.23.0 Electronic Overload relay shall be provided to trip actuator in case of overload.
Plug in connections/design shall be provided between:-

- Integral starter unit and basic actuator
- Between external customer connections and actuator.

3.24.0 OPEN-CLOSE indication /LED shall be provided for indication of full open/close position.

3.25.0 Automatic phase correction facility and potential free contact for annunciation of power failure shall be provided.

3.26.0 The following individual potential free relay contacts shall be provided in the actuator for remote annunciation to facilitate continuous monitoring of the actuator.

- Actuator (valve) running in OPEN direction.
- Actuator (valve) running in CLOSE direction.
- Actuator in remote mode.
- Actuator in local mode.
- Actuator power switched off /single phasing.
- Torque switch trip, thermo switch trip and overload relay trip

4.0.0 TESTING AND INSPECTION

Equipment offered shall be of type tested and proven type. Routine tests shall be carried out for all the equipment as per applicable standards. Copies of certified reports of all tests carried out at the works shall be furnished.

The following minimum tests/ checks shall be conducted at site. Any other tests/ checks as per the manufacturer's recommendation shall also be carried out.

- Measurement of insulation resistance.
- Measurement of full load current.
- Test running of the motors.

5.0.0 DRAWINGS & DOCUMENTS

The following drawings and documents shall be submitted for approval during detail engineering stage.

- Integral starter details
- Technical particulars of actuator
- Wiring diagram
- General arrangement drawings
- Test reports
- Manufacturing quality plan
- Field quality plan

DATA SHEET-A		
SL NO.	DESCRIPTION	**2X660 MW UDANGUDI SUPERCRITICAL STPP**
A	**General**	
1	Manufacturer & country of origin	
2	Motor type	Squirrel cage induction AC motors
3	Efficiency class	For all LT motors, it shall be IE3 class as per IS 12615 except for VFD controlled LT motors, it shall be IE2 class as per IS 12615
4	Type of starting	DOL
5	Maximum acceptable kW rating of LV motor	>0.2 kW and up to 200 kW. LT motors rated up to 125 kW shall be controlled through MPCB/MCCB and contactor. LT motors rated more than 125 kW shall be controlled through air circuit breaker.
6	Rating up to which Single phase motors permitted.	up to 0.2 Kw
7	Installation (Indoors/ Outdoors)	indoor/outdoor
8	Degree Of Protection	IP 55
9	Name of the equipment driven by motor & Quantity	
10	Maximum Power requirement of driven equipment	
11	Rated speed of Driven Equipment	As per system requirement
12	Design ambient temperature	50 deg C
B	**Design and Performance Data**	
1	Frame size & type designation	DURING DETAILED ENGINEERING
2	Type of duty	All the motors shall be rated for S1 duty for continuous operation. Motors of crane and hoist application shall be intermittent duty. The motors shall be suitable for bus transfer schemes provided on the 11 kV/6.6 kV/415 V systems without any injurious effect on its life.
3	Rated Voltage	240/415 V
4	Rated Frequency	50 Hz
5	System fault level at rated voltage	50 kA for 1 sec.
6	LV System grounding	solidly grounded
7	Permissible variation for	
a	Voltage	±10%
b	Frequency	+3% to -5%
c	Combined voltage & frequency	10%
8	Rated output at design ambient temp (by resistance method)	As per system requirement
9	Synchronous speed & Rated slip	As per system requirement
10	Minimum permissible starting voltage	80% of rated voltage During fast changeover of power supply source, vector difference between the motor residual voltage and the incoming supply voltage shall be about 150% of the rated voltage and the motors shall withstand voltage stress and torque stress developed during that time, which may last for a period of one (1) second. c) The motor shall be capable of operating at full load at a supply voltage of 75% of the rated voltage for 5 minutes.

11	TYPE OF STARTER PROVIDED IN MCC	DOL
12	Starting time in sec with mechanism coupled	
a	At rated voltage	As per manufacturers standard
b	At min starting voltage	
13	Locked rotor current as percentage of FLC (including IS tolerance)	For energy efficient LT motors, locked rotor current shall be as per IS: 12615. Locked rotor current of the VFD controlled AC motors shall be limited to 300% of the full load current, and is subject to IS tolerance
14	Torque	
a	Starting	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque. • Pull out torque at rated voltage shall not be less than 205% of full load torque. • Motors subjected to reverse rotation shall be designed to withstand the stresses encountered when starting with non-energized shaft rotating at 125% of rated speed in reverse direction.
b	Maximum	
15	Permissible temp rise at rated output over ambient temp & method	Winding shall be class F insulation with temperature limited to class B
16	Noise level at 1.0 m (dB)	Motors shall be selected with low noise levels in accordance with IS 12065.
17	Amplitude of vibration	The peak amplitude of the vibration shall also be within the specified limits of IS: 12075.
18	Efficiency & P.F. at rated voltage & frequency	
a	At 100% load	Premium efficiency (IE3) IS: 12615 .
b	At 75% load	
c	At starting	
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
4	Method of cooling	LT motors shall be totally enclosed fan cooled (TEFC), type IC411. The cooling shall be effected by self-driven bi-directional centrifugal fan protected by fan cover. The Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10 A at 230 V AC.
5	Class of insulation	All motors shall have class F insulation but limited to class B temperature rise
6	Main terminal box	

a	Type	Separate terminal boxes of IP 55 degree of protection shall be provided for stator leads. For single core cables, gland plate shall be non-magnetic material. Terminal box of LT motors shall be capable of being turned 360° in steps of 90°. The terminal boxes shall be split type with removable cover with access to connections.
b	Power Cable details (Conductor, size, armour/unarmour)	DURING DETAILED ENGINEERING
c	Cable Gland & lugs details (Size, type & material)	DURING DETAILED ENGINEERING The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer. The terminal box shall have a separate grounding terminal.
d	Permissible Fault level (kArms & duration in sec)	Fault withstand rating of motor terminal box (Breaker operated): 415 V system : 50/65 kA for 0.2 second
7	Earth Conductor Size & Material	DURING DETAILED ENGINEERING
8	Space heater details (30KW & ABOVE) (Voltage & watts)	Space heaters rated for 240 V AC, 50 Hz supply shall be provided for motors rated 30 kW'and above to maintain windings in dry condition when motor is standstill.
9	Flame proof motor details (if applicable)	For hazardous location: the enclosure of motors shall following have flame proof construction conforming to applicable standard. • Fuel oil area Group – IIB • Hydrogen generation plant area : Group – IIC)
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 manufacturers standard
10	Winding connection	As per system requirement
11	Kind of rotor winding	As per manufacturers standard

12	Kind of bearings	Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application. Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area. • Sleeve bearings shall be split type, ring oiled with permanently aligned, close running shaft sleeves. Grease lubricated bearings shall be pre-lubricated and shall have provisions for inservice positive lubrication with grease nipple and relief holes. For sleeve bearings, the bearing housing shall be preferably in end shield itself. • Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred. However, if anti-friction bearings can take vertical thrust, thrust and guide bearings are not required. • Lubricant shall not deteriorate under all service conditions. The lubricants shall be limited to normally available types. For motors rated 30 kW and above re-lubrication facility shall be provided. For bearing temperature measurement, duplex RTDs shall be provided for each bearing and shall be wired up to the terminal box. • Each bearing shall be provided with dial type thermometer. • For all VFD operated motors shall have insulated bearings to prevent flow of shaft currents. Lub oil pressure transmitters shall be provided to DCS for remote monitoring. Lub oil pressure very low trip to HT equipment shall be 2 out of 3 logic.
13	Direction of rotation when viewed from NDE	motor shall be bi-directional
14	Paint Shade & type	Painting shall be carried out by an approved process. Pretreatment shall conform to applicable standard. The equipment shall be subject to a coat of red oxide primer paint. All inside and outside surface shall be painted with epoxy based paint. The final thickness of paint film on steel shall not be less than 100 microns. Finish shade shall be 631 of IS: 5 (smoke grey).
15	Net weight of motor	
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)	
2	Torque speed characteristic	
3	Thermal withstand characteristic	
4	Current vs time	
5	Speed vs time	
E	**Tests on motors**	

NOTE:

1 Please write "As per manufacturers standard" where data is not defined in the project specification.

2 Please mention any project specific requirrement if any in the datasheet (Add extra row).

3 For details which is not applicable please write "NA"

SUB-VENDOR LIST FOR ELECTRICAL ITEMS

ITEM DESCRIPTION	SL NO.	VENDOR NAME
CABLE GLANDS	1	ALLIED TRADERS & EXPORTERS
	2	ARUP ENGG & FOUNDARY WORKS
	3	BALIGA LIGHTING EQPT.PVT.LTD.
	4	COMMET BRASS PRODUCTS
	5	DOWELLS
	6	ELECTROMAC INDUSTRIES
	7	INCAB
CABLE LUGS	1	DOWELLS
	2	UNIVERSAL MACHINES LTD.
LV MOTORS (NON FLAME PROOF)	1	ABB
	2	BHARAT BIJLEE LTD.
	3	CROMPTON GREAVES
	4	GE-POWER
	5	KIRLOSKAR ELECTRIC CO LTD.
	6	LAXMI HYDRAULICS PVT. LTD
	7	MARATHON
	8	NGEF
	9	RAJINDRA ELECT INDUSTRIES
	10	SIEMENS

SECTION IC
SPECIFIC TECHNICAL REQUIREMENT
CONTROL & INSTRUMENTATION SYSTEMS

	2x660 MW UDANGUDI STPP (UNIT#1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR TRAVELLING WATER SCREEN (TWS) SYSTEM	

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SPECIFIC TECHNICAL REQUIREMENTS (C&I)

SPECIFIC (C&I) TECHNICAL REQUIREMENTS
FOR
TRAVELLING WATER SCREEN (TWS) SYSTEM

1.1 The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. The Vendor list/ sub-vendor list shall be subject to BHEL / Customer approval during contract stage. No commercial implication in this regard shall be acceptable.

1.2 These requirements are to be read in conjunction with detailed Technical specification enclosed in the specification. In case of any conflict and repetition of clauses in the specification, the more stringent requirement as per interpretation of Customer shall prevail without any commercial implication. No deviations shall be acceptable.

1.3 Drawings/Documents and data to be furnished after award of the contract as per deliverables list attached elsewhere in the specification.

1.4 All local gauges as well as transmitters and sensors for parameters like pressure, temperature, flow etc. as required for the safe and efficient operation and maintenance under the scope of specification shall be provided. The necessary root valves, impulse piping, drain cock, gauge-zeroing cocks, valve manifolds, instrument racks and all the other accessories required for mounting / erection of these local instruments, transmitters and sensors shall be supplied by bidder even if not specifically asked for. Also the proposal shall include the necessary cables, flexible conduits, instrument racks, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg / Cm2.

1.5 All local gauges, transmitters and sensors shall be mounted on suitable enc losures, Instrument racks (LIR), etc. Same are in bidder's scope subject to Customer's approval.

1.6 Type of control system shall be DDCMIS (Station C&I) based, located in Central Control Room in BHEL scope. Field instrumentation for the package is in bidder's scope.

1.7 The local control cum starter panel in bidder's scope. Suitable canopy on top shall be provided for the panel.

1.8 Push buttons and indication lamps for Open/Close and Start/Stop of drives/equipment's shall be provided on the starter panel. Remote and local indication, indicating lamps / LED cluster for instruments/drives/equipment's status and critical alarms shall be provided on the starter panel. Nos. shall be decided during detailed engineering.

1.9 Colored MIMICS on the panel is to be provided as per system flow diagram. No. of facia on Starter panel shall be decided during detailed engineering.

1.10 Bidder to terminate all instrumentation and control elements in the control panel for further cabling to DDCMIS by BHEL.

1.11 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, Division 1 area & flame proof) and an anticorrosive paint shall be applied to the field mounted enclosures / instruments. All the field instruments shall also be provided with SS tag nameplate and double compression type Nickel-plated brass cable gland. Gaskets, Fasteners, Counter and mating flange shall also be included wherever required with the field instruments.

1.12 Sea or saline water media is applicable for the project. The minimum requirement for sea water or saline water media is as below:

a. Instruments shall be suitable for sea or saline water application. MOC of impulse tubing and impulse pipe shall be CPVC (3/8") Sch 80 or better, Industrial grade up to manifold. MOC of impulse tubing, fittings (from manifold to instrument) and manifold shall be Super Duplex stainless steel.
b. MOC of all wetted parts, fittings, sampling pipes, tubes, fittings, diaphragm and all types of erection hardware of instrument/drives/equipment, shall be Duplex stainless steel or better suitable for sea or saline water application.

1.13 Epoxy coated painting is required for all I & C equipment.

1.14 All valve actuator shall be provided with conventional actuators with integral starter for ON/OFF valves. Non-contact type electronic 2-wire position transmitters shall be provided for all inching type motorized valves and dampers. The detailed specification of actuator is given elsewhere in the specification.

1.15 Differential pressure indicators & Differential pressure Transmitters across strainers shall be provided with independent impulse & isolation valves. Remote & Local indication DP transmitters & gauges across strainer shall be provided.

1.16 All the transmitters and gauges shall have remote seal type having 15m capillary length minimum.

1.17 All the instruments/equipment's/electrical items shall be provided & designed with maximum star rating as available in line with energy conservation policies notified by BEE, GOI at the time of supply.

1.18 All primary instruments shall be with protection class of IP 65 or better.

1.19 Transmitter should not be mounted directly on the manifold, Manifold shall be non-integral and standalone type.

1.20 LVDT type instrument is not acceptable.

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

1.22 Each switching element including the limit and torque switches of valve actuators shall be provided with minimum two SPDT OR DPDT contacts each for close, open and adjustable.

1.23 All transmitters shall be smart and electronic type, microprocessor based and HART compatible. All instruments should be supplied with valid calibration and test certificates provided by OEM.

1.24 The system shall be provided with annunciation system. It shall be an integral part of the control system. All the field contact shall be acquired through control system. The annunciation sequence/ logic shall conform to ISA sequence ISA-2A. The window lamps for the system shall be driven through output modules of the control system.

1.25 For plug in type instruments, the plug & sockets shall be polarized to prevent wrong connections and have facility for secure coupling in plug-in position to prevent loose connections.

1.26 Signal/Electrical connection shall be screwed connection with double compression type Nickel-plated brass cable glands.

1.27 All the field instruments shall also be provided with SS tag nameplate.

1.28 Cable scope shall be referred in Electrical scope sheet attached in the Electrical portion of the specification.

1.29 Push buttons and indication lamps for Open/Close and Start/Stop of drives/equipment's shall be provided on the starter panel in Bidder's scope. Remote and local indication, indicating lamps / LED cluster for instruments/drives/equipment's status and critical alarms shall be provided on the starter panel. Nos. shall be decided during detailed engineering.

1.30 Mandatory spare list shall be referred in 'List of mandatory spares' attached elsewhere in the specification and shall be supplied by bidder.

1.31 Power Supply Requirement:
415 V, 3 phase AC power supply shall be provided by Customer for the local control cum starter panel at a single point. Further any electrical distribution shall be in bidder's scope. Any other voltage requirement to be arranged/derived by bidder by providing suitable control transformer. Starter panel in bidder's scope shall have provision for redundant feeder with fast automatic changeover.

1.32 Bidder to delegate /depute their persons/experts as per Customer's require ment.

1.33 Bidder must offer general tools and tackles and special calibration instrume nts required during start-up, trial run, operation and maintenance of the sys tem.

1.34 The technical requirements for instruments/ equipment's/panels mentioned in the specification are minimum requirements. Items not specifically mentioned and required for the completeness of the system shall be supplied by bidder.

1.35 Following Instruments/control functions shall be provided in addition to instruments provided as per process requirement

- Remote & Local indication DP transmitters & gauges across strainer.
- Auto start /stop of Cleaning devices for TWS at high & Low DP

2.0 **Requirements for flanged remote seal diaphragm:**

Maximum pressure rating: To meet 200 percent of process pressure,
Availability of seals: for both high and low pressure sides with capillary connection in case of differential pressure measurements.
Single Capillary connection for pressure transmitters.
Capillary length: 15.0 m
Fill fluid: Suitable oil
Process connection size: 1 inch
Flange size and Accessories: As per process requirement.
Flange pressure rating: Required Class (ANSI)
Process fluid temperature: 25°C to 60°C
Diaphragm and wetted part material: Suitable for sea water (Duplex SS or better)
Flushing option: To be made available with 1/4 inch (necessary drain and gasket suitable for sea water application to be provided).
Snubbers /Pulsation dampeners shall be used where the process media is unstable for measurement such as the discharge of a pump.

SCOPE MATRIX - TRAVELLING WATER SCREEN (TWS) SYSTEM		
S.No.	PROJECT	2X660 MW UDANGUDI STPP
1	SYSTEM APPLICABLE: TRAVELLING WATER SCREEN (TWS) SYSTEM	Y
2	SYSTEM CONFIGURATION: UNITISED OR COMMON OR AS APPLICABLE	COMMON
3	CONTROL SYSTEM	REFER NOTE-1 & 2
4	LOCATION OF CONTROL SYSTEM	
5	CONTROL SYSTEM SCOPE (BIDDER / BHEL / CUSTOMER)	
6	CONTROL FROM PB's ON STARTER PANEL	Y; REFER NOTE 3
7	ANNUNCIATION ON STARTER PANEL (Y/N) -- IF Y, MIN NO. OF HARDWIRED ALARMS / INDICATIONS	Y; REFER NOTE-4
8	MIMIC ON LCP (Y/N)	Y; REFER NOTE-5
9	ACTUATOR WITH INTEGRAL STARTER (Y/N)	Y
10	INSTRUMENTS	AS PER SECTION IA AND ID & PROCESS REQUIREMENT
11	SEA WATER APPLICATION	Y
12	DETAILED CUSTOMER SPECIFICATION	ATTACHED

NOTES:

1. Type of control system shall be DDCMIS (Station C&I) based, located in Central Control Room in BHEL scope. Field instrumentation, drives, equipments for the package are in bidder's scope.
2. Local control cum starter panel for TRAVELLING WATER SCREEN (TWS) SYSTEM is in bidder's scope of supply. Items not specifically mentioned and required for the completeness of the system shall be supplied by bidder.
3. Push buttons and indication lamps for open/close and Start/stop of drives/equipments for TRAVELLING WATER SCREEN (TWS) SYSTEM shall be provided on the starter panel. Remote and local indication,indicating lamps/LED cluster for instruments/drives/equipments status and critical alarms shall be provided on starter panel for TRAVELLING WATER SCREEN (TWS) SYSTEM. Nos. shall be decided during detailed engineering.
4. Number of facia shall be decided during detailed engineering.
5. Colored MIMICS on Local control cum starter panel to be provided as per system flow diagram of TRAVELLING WATER SCREEN (TWS) SYSTEM.

6	415 V, 3 phase AC power supply shall be provided by BHEL at a single point for the starter panel. Further any electrical distribution as required, shall be in bidder’s scope. Any other voltage requirement to be arranged/derived by bidder by providing suitable control transformer. Starter panel in bidder's scope shall have provision for redundant feeder with fast automatic changeover.
7	Bidder to terminate all instrumentation and control elements in the local control cum starter panel for further cabling to DDCMIS. Complete cable schedule (in BHEL excel format provided in electrical portion of the specification) and cable interconnection details from field to Local control cum Starter panel and ,Local control cum Starter panel to DDCMIS shall be provided by bidder.
8	Following documents shall be provided by bidder during detailed engineering for approval: a. Input/Output list, Drives list, b. Instrument datasheets and check lists/Quality plan, c. Panel external/internal GA drawing and termination details, d. Panel datasheet and QAP e. Recommended control logics / Control philosophy . f. Cable schedule (in BHEL excel format provided in electrical portion of the specification) & cable interconnection details from field to Local control cum Starter panel and, Local control cum starter panel to DDCMIS.
9	All the instruments along with necessary fittings, accessories and valve manifold etc., instrument rack and junction boxes, erection hardware shall be in bidder's scope of supply.
10	LIR (Instrument Rack) to be provided for mounting the instruments in the field.
11	Cable for local wiring, between field instruments to Starter panel shall be screened with 1.5 mm2 minimum and shall be in bidder's scope. Refer 'electrical scope sheet between BHEL and bidder' attached in electrical specification for cable scope.
12	Mandatory spare list shall be referred in 'List of mandatory spares' attached elsewhere in the specification and shall be supplied by bidder.
13	*Instruments, root valves, impulse pipe shall be suitable for sea water application having corrossion resistance where media is sea water. All the transmitters and gauges shall have remote seal type having 15m capillary length.
14	The Vendor list/ sub-vendor list shall be subject to BHEL/Customer approval during contract stage.
15	The specifications for instruments mentioned in the specification are minimum requirements. The detailed specifications shall be finalized during detail engineering.
16	No deviations with respect to technical specification shall be acceptable.

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LIST OF DOCUMENTS/DELIVERABLES

C&I DELIVERABLES LIST FOR TRAVELLING WATER SCREEN (TWS) SYSTEM FOR 2X660 MW UDANGUDI PROJECT			
Sl.No.	**DRAWING NO.**	**DRAWING/DOCUMENT TITLE**	**CATEGORY**
INSTRUMENTATION			
1	PE-V9-435-165-I901C	INSTRUMENT DATA SHEETS	A
2	PE-V9-435-165-I902C	BOQ	I
3	PE-V9-435-165-I903C	INSTRUMENT QP / CHECK LIST	A
LOCAL CONTROL CUM STARTER PANEL			
1	PE-V9-435-165-I950C	LOCAL CONTROL CUM STARTER PANEL DATA SHEET	A
2	PE-V9-435-165-I951C	WIRING DIAGRAM	A
3	PE-V9-435-165-I952C	PANEL EXTERNAL & INTERNAL GA DRAWING & TERMINATION DETAILS (INCLUDING FOUNDATION DETAILS & FLOOR CUT-OUT)	A
4	PE-V9-435-165-I953C	RECOMMENDED CONTROL LOGICS / CONTROL PHILOSOPHY	A
5	PE-V9-435-165-I954C	LIST OF HARDWIRED SIGNAL EXCHANGE WITH DDCMIS	A
6	PE-V9-435-165-I955C	BILL OF MATERIAL	I
7	PE-V9-435-165-I956C	LOCAL CONTROL PANEL QUALITY PLAN	A
8	PE-V9-435-165-I957C	INPUT/OUTPUT LIST; DRIVE LIST	I
9	PE-V9-435-165-I958C	RELAY BASED PANEL O & M MANUAL	I
10	PE-V9-435-165-I959C	Cable schedule & cable interconnection details from field to Local control cum Starter panel and, Local control cum starter panel to DDCMIS.	I

NOTES:

1) ANY OTHER DOCUMENT DECIDED DURING DETAILED ENGINEERING SHALL BE PROVIDED BY BIDDER WITHOUT ANY COM MERCIAL/TECHNICAL IMPLICATION.

2) CONTRACTOR TO SUBMIT REUSABLE DATABASE FORMATS IN BHEL/CUSTOMER APPROVED FORMATS LIKE MS EXCEL,MS ACCESS OF DOCUMENTS LIKE INSTRUMENT SCHEDULE, I/O LIST, DRIVE LIST,FIELD JB TERMINATIONS, CABLE SCHEDULE & I NTERCONNECTION, etc. SOFT COPY OF FORMATS SHALL BE PROVIDED TO SUCCESSFUL BIDDERS.

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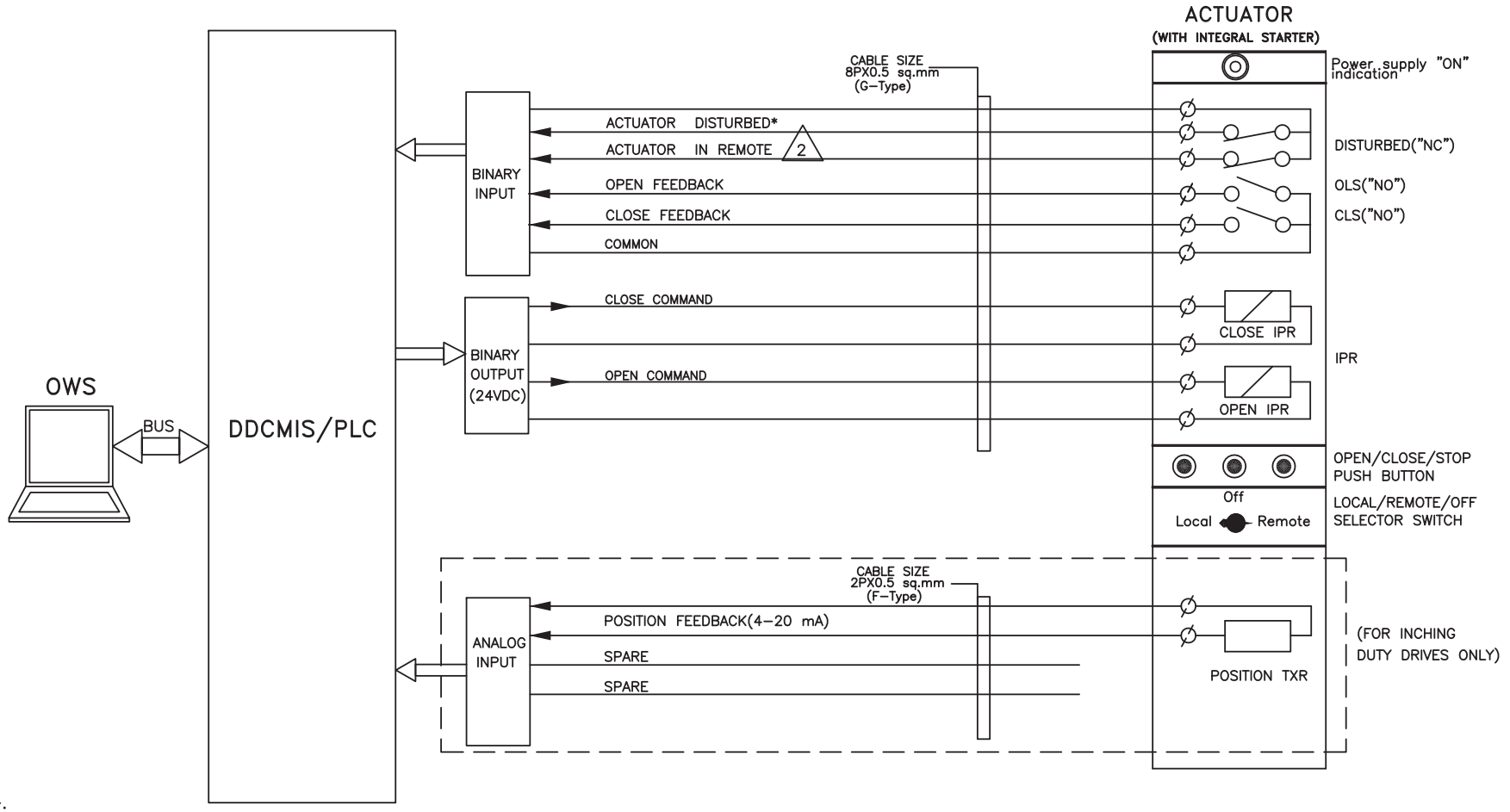
SIGNL EXCHANGE BETWEEN DRIVES & DCS (DCP)

DCS INTERFACE FOR BIDIRECTIONAL DRIVE(WITH INTEGRAL STARTER)



NOTE:

1) Position Feedback of Bidirectional Inching duty drives in vicinity may be grouped together in the field during cable engineering. Junction Boxes and Single Trunk cable of higher size may be used to connect.

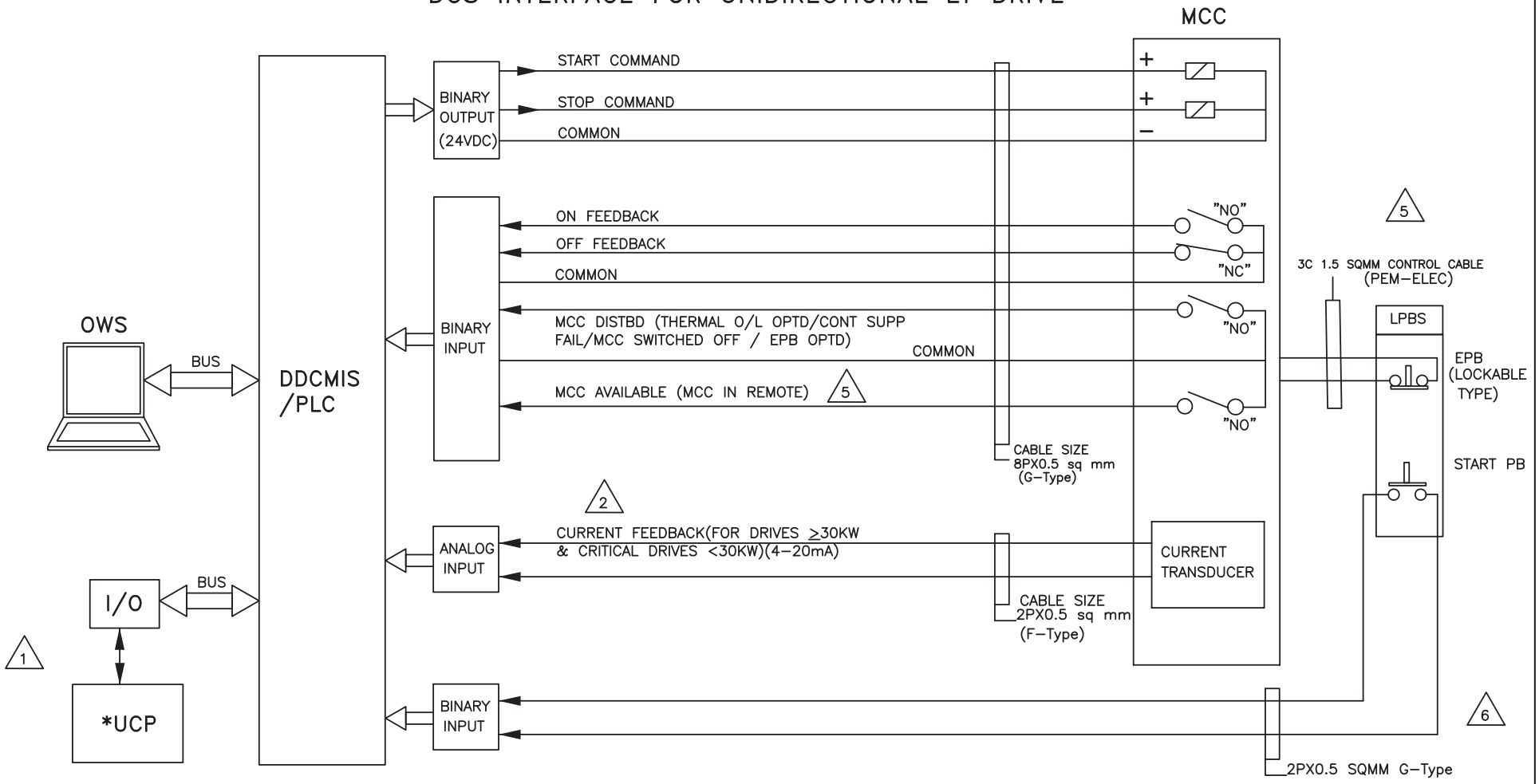
2) Redundancy of I/Os shall be as per contract specification requirement. 1

3) Two Nos of 9 pin plug in connectors, type connection shall be provided for interfacing with DDCMIS. 2

* DISTURBED= Loss of Power supply (1 Phase/3 Phase)/ Loss of control supply / Motor thermostat trip / Thermal over load / Local/Off/Remote Sel. switch in local or off mode / Torque open/close cut off / Stop PB optd.

BHEL	PROJECT: 2X660 MW TANGEDCO UDANGUDI STAGE I STPP	DRG.NO.	PE–DM–435–145–I002
		DATE	05.11.2019
	TITLE DDCMIS INTERFACE FOR BIDIRECTIONAL DRIVE	REV.NO.	07
		SHT	7 OF 11

DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE



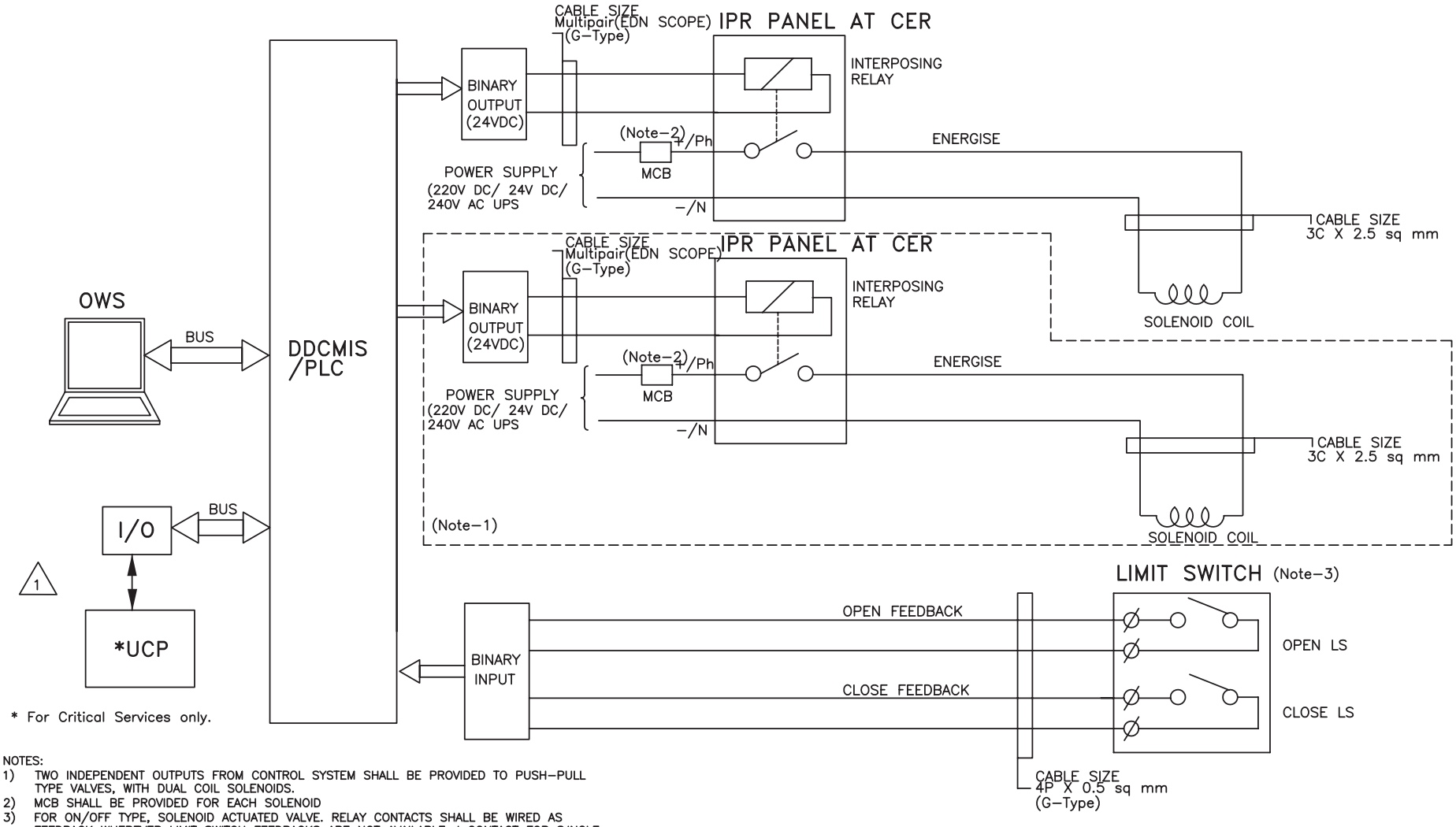
* As Applicable

NOTE:

1) Redundancy of I/Os shall be as per contract specification requirement.

BHEL	PROJECT: 2X660 MW TANGEDCO UDANGUDI STAGE I STPP	DRG.NO.	PE-DM-435-145-I002
		DATE	05.11.2019
	TITLE: DDCMIS INTERFACE FOR UNIDIRECTIONAL LT DRIVE	REV.NO.	07
		SHT	8 OF 11

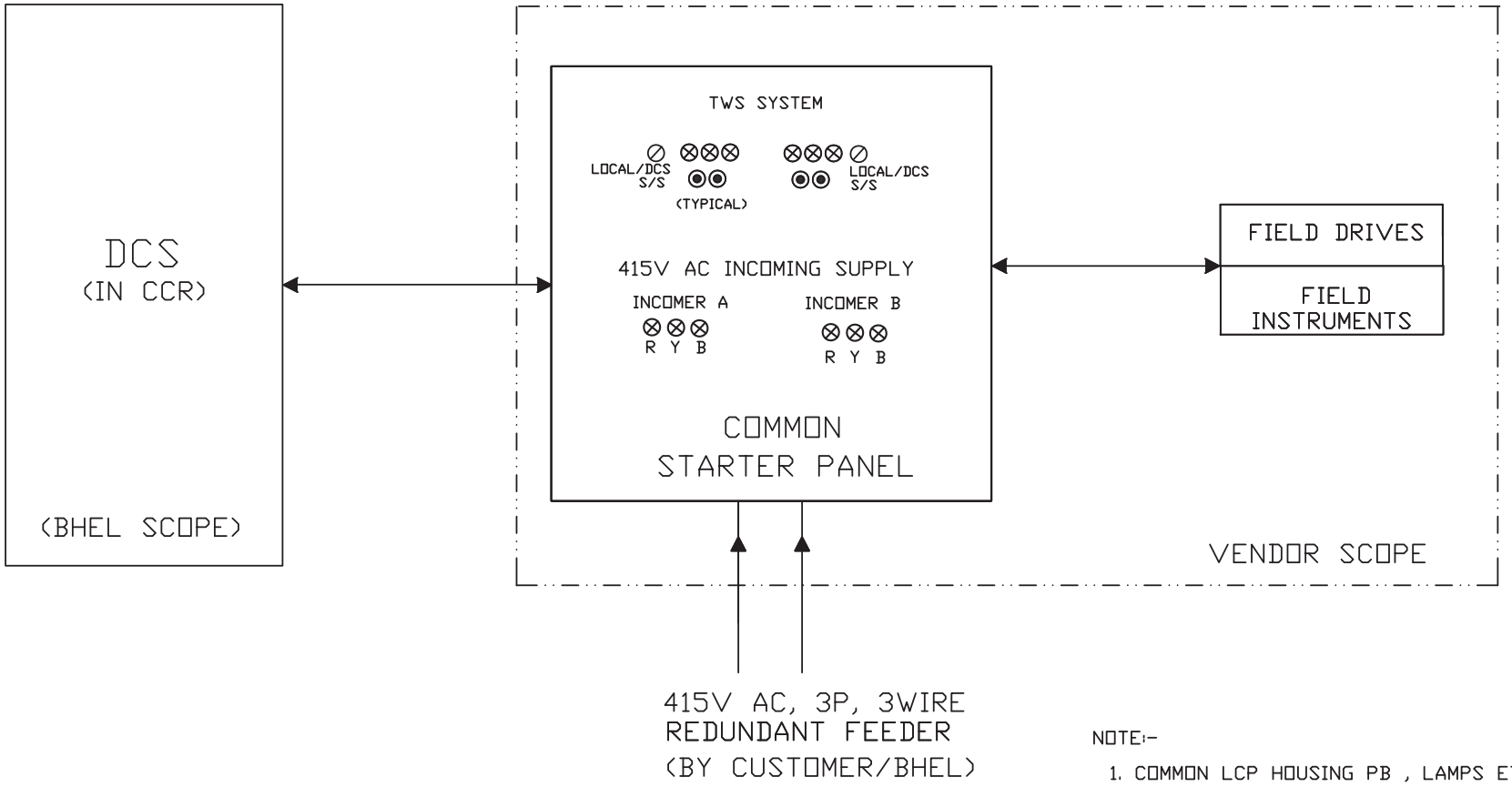
DCS INTERFACE FOR SOLENOID DRIVE
(220V DC/ 24V DC / 240V AC UPS)



NOTES:
1) TWO INDEPENDENT OUTPUTS FROM CONTROL SYSTEM SHALL BE PROVIDED TO PUSH–PULL TYPE VALVES, WITH DUAL COIL SOLENOIDS.
2) MCB SHALL BE PROVIDED FOR EACH SOLENOID
3) FOR ON/OFF TYPE, SOLENOID ACTUATED VALVE. RELAY CONTACTS SHALL BE WIRED AS FEEDBACK WHEREVER LIMIT SWITCH FEEDBACKS ARE NOT AVAILABLE. 1 CONTACT FOR SINGLE COIL & 2 CONTACT FOR DUAL COIL (OPEN LIMIT SWITCH & CLOSED LIMIT SWITCH.
4) BHEL WILL TAKE CARE OF DE–ENERGISE TO TRIP PHILOSOPHY FOR FAIL SAFE CONTROL SYSTEM (WHEREVER REQUIRED)
5) REDUNDANCY OF IO SHALL BE AS PER SPECIFICATION REQUIREMENT.
6) FEEDBACK OF SOLENOID DRIVES IN VICINITY MAY BE GROUPED TOGETHER IN THE FIELD USING JUNCTION BOXES & SINGLE TRUNK CABLE OF HIGHER SIZE MAY BE USED TO CONNECT TO THE DCS.

BHEL	PROJECT: 2X660 MW TANGEDCO UDANGUDI STAGE I STPP	DRG.NO.	PE–DM–435–145–I002
		DATE	05.11.2019
	TITLE: DDCMIS INTERFACE FOR SOLENOID DRIVE	REV.NO.	07
		SHT	9 OF 11

STANDARD BLOCK DIAGRAM FOR TWS PACKAGE WITH DCS



NOTE:-

1. COMMON LCP HOUSING PB , LAMPS ETC.

2. SIGNALS FOR FIELD INSTR. & FOR 'BID' DRIVES WITH INTEGRAL STARTER SHALL BE ROUTED TO DCS THROUGH STARTER PANEL.

DRG. NO. PE-DG-999-145-I275A(b)

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DATA SHEETS FOR MOTORISED VALVE ACTUATOR

BHEL	**SPECIFICATION FOR MOTORISED VALVE ACTUATOR**	SPECIFICATION NO.: PE-ID-435-145-I902
		VOLUME II B
		SECTION D
		REV. NO. 00 DATE: 28.08.2019
		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	2X660 MW UDANGUDI STPP
	OFFER REFERENCE	BIDDER TO SPECIFY
	* 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 0-55 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, IP:68
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. **FOR INCHING SERVICE - 150 STARTS/HR MINIMUM & FOR REGULATING SERVICE - 600 STARTS/HR MINIMUM.**
HANDWHEEL as per standard EN 12570:2000	* 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) (REFER NOTE NO. 6 & 7)	BIDDER TO SPECIFY
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT-INCLUSIVE OF **I.S.** TOLERANCE
	ACTUATOR APPLICABLE WIRING DIAGRAM	■ 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	☐ BLUE (RAL 5012) ■ SIMENS GRAY RAL 7030
	PAINT TYPE **(## Refer Notes)**	☐ ENAMEL ■ EPOXY CONFIRMING TO CORROSION CATEGORY C5-I
	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, 3PH, AC

Data Sheet A & B

	DATA SHEET-A (TO BE FILLED BY PURCHASER)		DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☐ 110 V	
	@ ENCLOSURE CLASS OF MOTOR	☐ IP 67 ☐ IP 68 ☐ 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 (THERMISTOR PTC)	
INTEGRAL STARTER	INTEGRAL STARTER	■ REQUIRED ☐ NOT REQUIRED	
	TYPE OF SWITCHING DEVICE	■ CONTACTORS ☐ THYRISTORS	
	TYPE	■ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)	
	IF SMART (REFER BELOW POINT a – h)		
	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 / CLOSE PB	■ REQUIRED ☐ NOT REQUIRED	
	STOP PB	■ REQUIRED ☐ NOT REQUIRED	
	INDICATING LAMPS	■ REQUIRED ☐ NOT REQUIRED	
	LOCAL REMOTE S/S	■ REQUIRED ☐ NOT REQUIRED	
	STATUS CONTACTS FOR MONITORING	■ REQUIRED ☐ NOT REQUIRED	
	INTEGRAL STARTER DISTURBED SIGNAL(Refer Note 14)	REQUIRED (O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, S/S IN LOCAL, TORQUE SWITCH OPTD. MID WAY,)	
	ACTION ON LOSS OF EXTERNAL ELECTRIC POWER	■STAYPUT ☐ FAIL SAFE	
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter) **DATASHEET & WIRING DIAGRAM OF ISOLATION DEVICE TO BE PROVIDED**	TYPE OF ISOLATING DEVICE	☐ INTERPOSING RELAY ■ OPTO COUPLER TO BE DECIDED DURING DETAILED ENGINEERING	
	QUANTITY	■ 2 NOs. ■ 3 NOs. (for inching type drive)	
	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 240V AC AND 0.5A 220V DC	
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE	
	ACCURACY	+3% OF SET VALUE	

Data Sheet A & B

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

LIMIT SWITCH (Not Applicable for Smart Actuator) **($$ Refer Notes)**	MFR & MODEL NO.	BIDDER TO SPECIFY					
	OPEN : INT : CLOSE	☐1 No ■2 Nos.	2 Nos. (ADJ.)	☐1 No. ■2Nos.			
	CONTACT TYPE	2 NO + 2 NC					
	RATING (AC / DC)	10A 240V AC AND 0.5A 220V DC					
	ACCURACY	2% OF SET VALUE					

POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty & other specific applications)	■ REQUIRED ☐ NOT REQUIRED	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	☐ ELECTRONIC (2 WIRE) R/I CONVERTER ■ ELECTRONIC (2 WIRE) CONTACTLESS	
	SUPPLY	■ 24V DC ☐	
	OUTPUT	■ 4-20mA	
	ACCURACY	± 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 @☐.....	
	@ EARTHING TERMINAL	REQUIRED	
	PLUG & SOCKET	■ REQUIRED ☐ NOT REQUIRED	
	NO. OF PINS REQUIRED(TO BE CHECKED AS PER SIGNALS IN DRIVE CONTROL PHILOSOPHY)		
	NOS. OF PLUG & SOCKET	☐ 1 Nos. ■ 2 NOS. ☐ OTHER (TO BE SPECIFIED INLINE WITH DRIVE CONTROL PHILOSOPHY)	
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:----------	
	@ SPACE HEATER CABLE GLAND	SIZE:----------	
	CONTROL CABLE GLANDS-1	QTY & SIZE: Cable gland suitable for 8Px0.5 sq mm	
	CONTROL CABLE GLANDS-2	QTY & SIZE: Cable gland suitable for 2Px0.5 sq mm	
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY	_____ Kg.

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR	SPECIFICATION NO.: PE-ID-435-145-I902
		VOLUME II B
		SECTION D
		REV. NO. 00 DATE: 28.08.2019
		SHEET 4 OF 4

Data Sheet A & B

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

NOTES:

1. **SCOPE**: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
2. **CODES & STANDARDS**: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATION STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:
   IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691, IS-4722, IEC 60947-5-1 AND EN 15714-3 :2010 OR LATEST VERSION.
3. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
4. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED.
5. 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.
6. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.
7. THE MOTOR SHALL BE CAPABLE OF STARTING AT 85 PERCENT OF RATED VOLTAGE RUNNING AT 80 PERCENT OF RATED VOLTAGE AT RATED TORQUE AND 85 PERCENT RATED VOLTAGE AT 33 PERCENT EXCESS RATED TORQUE FOR A PERIOD OF 5 MINUTES EACH.
8. IN ADDITION TO ABOVE REQUIREMENTS FOR LIMIT/TORQUE SWITCH, **MECHANICAL END STOP** WITH ACCURACY OF 2% SHALL BE SUPPLIED.
9. IT SHOULD BE POSSIBLE TO OPERATE THE ACTUATOR LOCALLY. LOCKABLE LOCAL/REMOTE SELECTION SHALL BE PROVIDED ON THE ACTUATOR.
10. LOCAL POSITION INDICATOR SHALL BE PROVIDED FOR 0 TO 100 % TRAVEL.
11. CONTROL WIRING SHALL BE SUITABLE VOLTAGE GRADE COPPER WIRE 1.5 SQ. MM.
12. ENDURANCE: RATED TORQUE RANGE SHOULD BE BASED ON ISO 5211, ISO5210.
13. TAG PLATE SHALL BE CONFIRMING TO STANDARD BS-15714.
14. INTEGRAL STARTER/ACTUATOR DISTURBED SIGNAL SHALL BE CHECKED AND INCLUDE AS PER DRIVE CONTROL PHILOSOPHY.
15. **** VALVES WITH 10 DEGREE/20DEGREE FEEDBACK REQUIREMENT FOR APPLICATIONS SUCH AS CW/ACW/PLANT WATER SYSTEM ETC SHALL BE CONSIDERED AS INCHING DUTY VALVES. ACCORDINGLY, POSITION FEED BACK TRANSMITTER, PLUG & SOCKET REQUIREMENT SHALL BE CONSIDERED.**

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

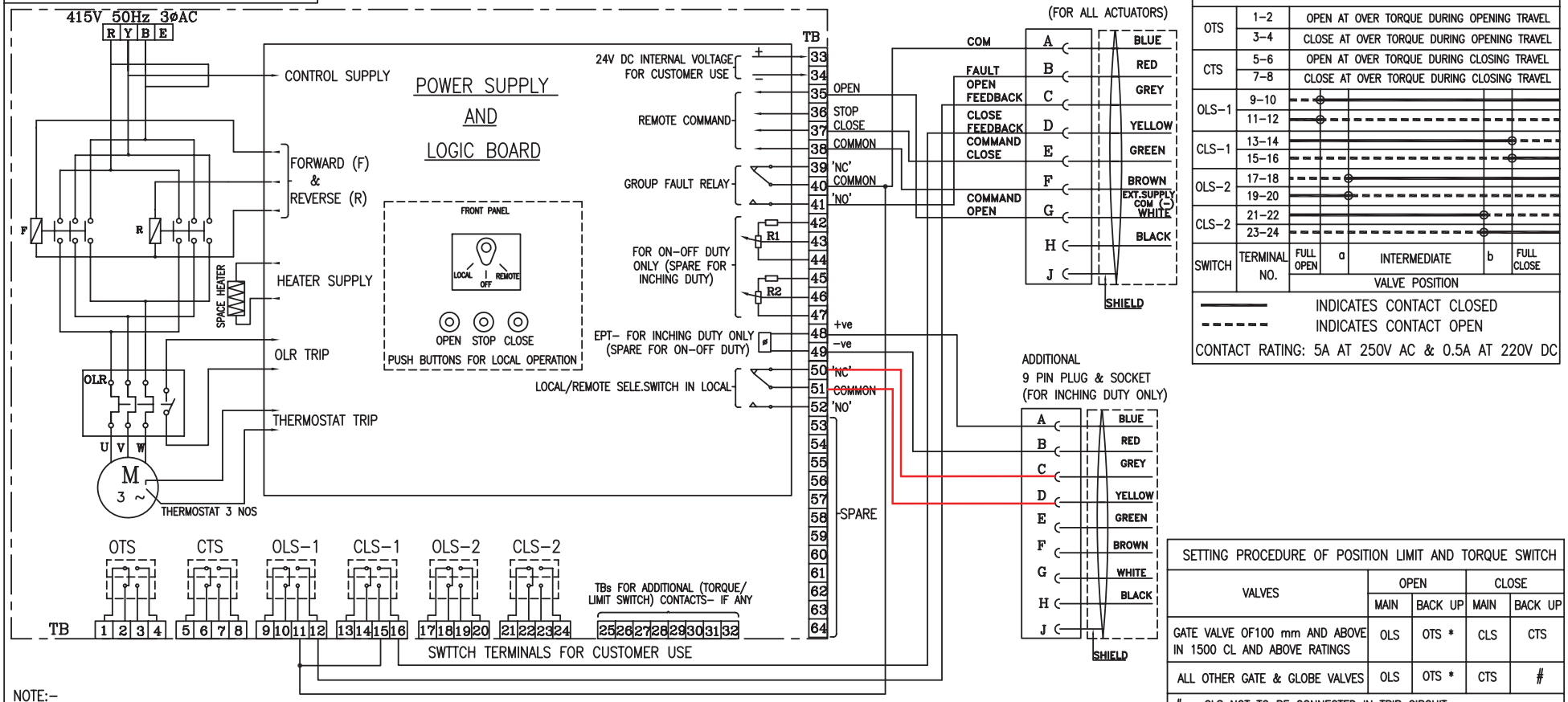
EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.

	PREPARED BY	CHECKED BY	APPROVED BY	VENDOR COMPANY SEAL
NAME	MADHAV GUPTA	VIPUL KUMAR VERMA	SHIVRAJ SINGH BANSALA	NAME
SIGNATURE				SIGNATURE
DATE	15.05.2019	15.05.2019	15.05.2019	DATE

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

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

DRAWING NO. 3-V-MISC-24283



CONTACT DEVELOPMENT DIAGRAM

OTS	1-2	OPEN AT OVER TORQUE DURING OPENING TRAVEL
	3-4	CLOSE AT OVER TORQUE DURING OPENING TRAVEL
CTS	5-6	OPEN AT OVER TORQUE DURING CLOSING TRAVEL
	7-8	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL
OLS-1	9-10	
	11-12	
CLS-1	13-14	
	15-16	
OLS-2	17-18	
	19-20	
CLS-2	21-22	
	23-24	

SWITCH TERMINAL NO. — FULL OPEN | a | INTERMEDIATE | b | FULL CLOSE — VALVE POSITION

INDICATES CONTACT CLOSED

INDICATES CONTACT OPEN

CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC

SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH

VALVES	OPEN		CLOSE	
	MAIN	BACK UP	MAIN	BACK UP
GATE VALVE OF100 mm AND ABOVE IN 1500 CL AND ABOVE RATINGS	OLS	OTS *	CLS	CTS
ALL OTHER GATE & GLOBE VALVES	OLS	OTS *	CTS	#

\# - CLS NOT TO BE CONNECTED IN TRIP CIRCUIT

* - BYPASS OTS FOR INITIAL 5% OF TRAVEL(FOR GATE VALVES ONLY)

NOTE:-

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

REV	DATE	ALTERED
		CHD & APPD

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS FOR NTPC PROJECTS (DRAWN FOR INTERMEDIATE POSITION OF VALVES)

BHARAT HEAVY ELECTRICALS LTD.,
UNIT: HIGH PRESSURE BOILER PLANT.
TIRUCHIRAPALLI-620014.
365-121

	NAME	SIGN	DATE	NO.OF VAR.
DRN	N.P.ESWAR	N.P	17.03.05	-
CHD	D.DINAKARAN	D.D	17.03.05	
APPD	K.ARUNACHALAM	K.A	17.03.05	

DEPT	SCALE	WEIGHT (KG).	REFERENCE INFORMATIONS	NO. OF ITEMS
VL	NTS	-		-
CODE -				

TITLE: WIRING DIAGRAM (TERMINAL PLAN) FOR ACTUATOR WITH INTEGRAL STARTER WITH PLUG & SOCKET FOR NTPC PROJECTS

CARD CODE: U 01

DRAWING NO.: 3-V-MISC-24283

REV: 0

Size A3

SECTION–3.17: ELECTRICAL ACTUATORS

1.0.0 INTENT OF SPECIFICATION

This section covers the requirements of motor operated electrical actuators.

2.0.0 CODES AND STANDARDS

The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest edition (including amendments) of the applicable Indian Standards (IS), IEC publications and other codes except where modified and /or supplemented by this specification.

3.0.0 TECHNICAL REQUIREMENTS

3.1.0 Electric actuators shall be provided as specified in Mechanical and C&I section. It shall be equipped with 3 phase induction motor, rated for S2-15 minutes duty for ON/OFF valve and intermittent duty for inching duty

3.2.0 Motor shall be class F insulated with temperature rise limited to class B. Motor shall be of class H insulation with temperature limited to class B used for high pressure and high temperature valves.

3.3.0 Motor shall be surface cooled designed for enclosure protection class of IP 67. Motor shall be suitable for starting direct on-line.

3.4.0 For installation in potentially hazardous areas, the actuators shall have suitable explosion proof / flame proof type enclosure.

3.5.0 Actuators shall be suitable for operation at an ambient temperature of 50 degree C and relative humidity of 95%.

3.6.0 Maximum continuous motor rating shall be atleast 10% above the maximum load derived of the driven equipment under entire operating range including voltage & frequency variation.

3.7.0 Motors shall be capable of operating under following supply variations without exceeding its guaranteed temperature limits.

- Frequency variation : (+) 3% and (-) 5% of 50 Hz
- Voltage variation for LT motors : (±) 10% of 415 V
- Combined variation of voltage and frequency: 10% (absolute sum)

3.8.0 All actuators shall be of integral type. Duty cycle of actuators shall suit the system requirement. The actuators shall be capable of giving the required torque at the output shaft. The actuators shall be designed to take the full thrust.

3.9.0 Electrical Actuators of Inching type position transmitters of non contact type shall be interfaced to DCS.

3.10.0 Actuators shall be of totally enclosed weather proof and dust proof construction with NEMA-6/IP 65 enclosure and shall be suitable for outdoor application without the necessity for a canopy. The actuator shall be suitable for mounting directly on the valve. The actuator shall be capable of giving the required torque, rpm and thrust without the help of any spur gear arrangement. The actuator shall be suitable for mounting in any position. Actuators shall be provided with integral starters.

3.11.0 The actuator shall be complete with motor, reduction gears, change gears, terminal compartment, switch compartment with limit switches and torque switches, local position indicator, position transmitter for remote position indicator, thermistor, space heaters, cable glands, mechanical position indicator, hand wheel for manual operation, valve attachment etc.

3.12.0 Each actuator shall have a hand wheel fitted on it for emergency operation. The hand wheel shall be designed such that it is declutched automatically when the power supply to the motor is restored. The material of the hand wheel shall be either malleable iron or steel. The hand wheel shall have adequate clearance from housing for each gripping and operation. Actuators offered shall be with self-locking worm.

3.13.0 Two number adjustable torque switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts shall be provided. It is required to have calibration for the torque switches so that the switches can be easily set to any value desired.

3.14.0 Two numbers of position limit switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts shall be provided. Two auxiliary limit switches (one for open and one for close) with 2 NO and 2 NC potential free contacts shall also be provided. The limit switches shall be of independently adjustable type. Limit switches and actuating mechanism shall be rust proof suitable for damp atmospheres. Limit switch compartment shall be weather proof and spacious enough for easy setting. The limit switches shall be suitable for the following ratings, both 240 Volts AC, 10 A and 220 V DC, 0.5 Amps.

3.15.0 Each actuator shall have a space heater in the limit switch compartment suitable for 240 V AC 50 Hz single phase supply.

3.16.0 The wiring from the limit switches, torque switches etc. shall be brought out in a separate terminal box of adequate size, so as to easily terminate the control cables.

3.17.0 Actuators shall be supplied with 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..

3.18.0 A three position selector switch (marked as LOCAL-OFF-REMOTE) and push buttons OPEN-STOP-CLOSE (for local operation) with indication lamps for running OPEN and running CLOSE shall be provided.

3.19.0 The Remote command signal (OPEN-STOP-CLOSE) from DCS/Respective control system/Control panel shall be isolated from control electronics through opto-isolator.

3.20.0 The following individual sStatus annunciation LED's and fault annunciation LED's 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

3.21.0 The following individual fault annunciation LED's (Colour-Red) shall be provided locally. (Integral to Actuator)

- Torque switch OPEN
- Torque switch CLOSE
- Thermo switch trip
- Electronic overload relay trip
- Motor single phasing
- Common fault (Inclusive of any one or combination of above fault)

3.22.0 View port shall be provided on integral starter unit to monitor the above status annunciation and fault annunciation.

3.23.0 Electronic Overload relay shall be provided to trip actuator in case of overload.
Plug in connections/design shall be provided between:-

- Integral starter unit and basic actuator
- Between external customer connections and actuator.

3.24.0 OPEN-CLOSE indication /LED shall be provided for indication of full open/close position.

3.25.0 Automatic phase correction facility and potential free contact for annunciation of power failure shall be provided.

3.26.0 The following individual potential free relay contacts shall be provided in the actuator for remote annunciation to facilitate continuous monitoring of the actuator.

- Actuator (valve) running in OPEN direction.
- Actuator (valve) running in CLOSE direction.
- Actuator in remote mode.
- Actuator in local mode.
- Actuator power switched off /single phasing.
- Torque switch trip, thermo switch trip and overload relay trip

4.0.0 TESTING AND INSPECTION

Equipment offered shall be of type tested and proven type. Routine tests shall be carried out for all the equipment as per applicable standards. Copies of certified reports of all tests carried out at the works shall be furnished.

The following minimum tests/ checks shall be conducted at site. Any other tests/ checks as per the manufacturer's recommendation shall also be carried out.

- Measurement of insulation resistance.
- Measurement of full load current.
- Test running of the motors.

5.0.0 DRAWINGS & DOCUMENTS

The following drawings and documents shall be submitted for approval during detail engineering stage.

- Integral starter details
- Technical particulars of actuator
- Wiring diagram
- General arrangement drawings
- Test reports
- Manufacturing quality plan
- Field quality plan

	2x660 MW UDANGUDI STPP (UNIT#1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR TRAVELLING WATER SCREEN (TWS) SYSTEM	

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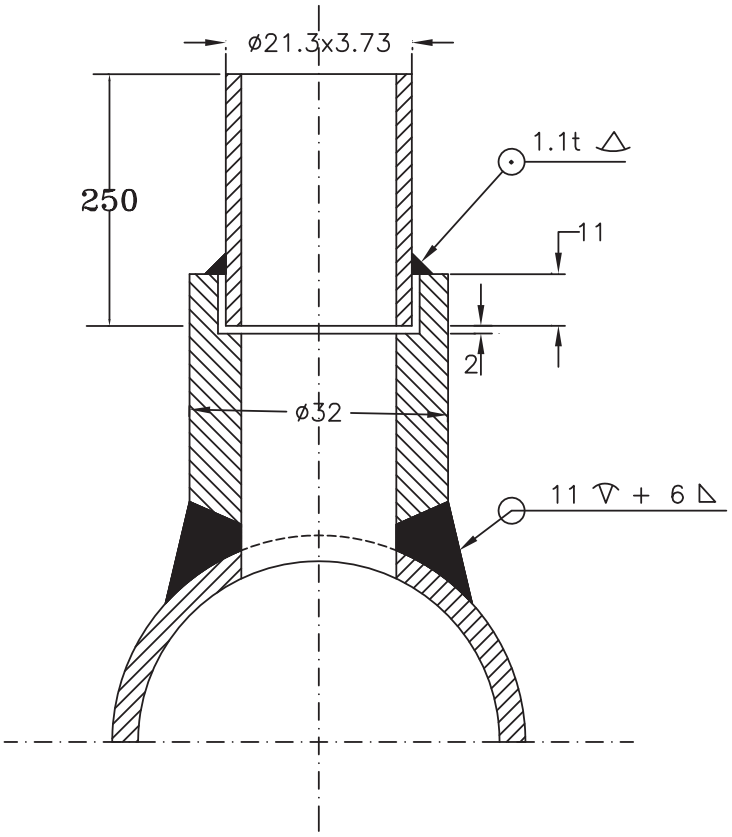
INSTRUMENT STUB & INSTALLATION DRAWING



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. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED
4. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY (1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES
5. FOR PU COATED PIPE REFER SHT NO–9.

TITLE :

INSTRUMENT STUB DETAILS FOR PRESSURE MEASUREMENT

(PRESS UPTO 40 Kg/cm2, TEMP<400 DEG C AND CLASS 3000#)

DRG. NO.
PE–DG–435–145–I101

REV. 01

SH. 4 OF 10

NOTES :–

1. IMPULSE PIPES SHALL BE OF SEAMLESS AND ANNEALED CONFORMING TO ANSI B36.10 IN LINE WITH THE MAIN PIPE MATERIAL.
2. PIPE FITTINGS SHALL BE OF FORGED MATERIAL CONFORMING TO ANSI B16.11–1991.
3. SNUBBER SHALL BE PROVIDED FOR PUMP DISCHARGE PRESS MEASUREMENTS.
4. IN CASE OF STEAM SERVICE SYPHON SHALL BE MADE BY BENDING THE TUBE OR PIPE.
5. VALVE MANIFOLDS & SNUBBER SHALL BE OF FORGED SS–316.
6. FOR SEA WATER APPLICATION SS316L FITTINGS TO BE PROVIDED.
7. 25NB x 15NB WELDED REDUCER SHALL BE USED FOR ROOT VALVE OF 25NB SIZE.
8. ROOT VALVES SHALL BE AS FOLLOWS:

   i) FOR PRESS <40 ATA & TEMP <425 DEG C, ONE(1) NO. 15Nb, ROOT VALVE OF SUITABLE CLASS SHALL BE USED.
   ii) FOR PRESS >40 ATA & TEMP <425 DEG C, TWO(2) NO. 15Nb, ROOT VALVE OF SUITABLE CLASS SHALL BE USED.
   iii) FOR PRESS >40 ATA & TEMP >425 DEG C, TWO(2) NO. 25Nb, ROOT VALVES OF SUITABLE CLASS SHALL BE USED.

9. HORIZONTAL PIPE RUNS SHOULD HAVE A SLOPE IN THE DIRECTION  SHOWN OF 1:20 AS MINIMUM.
10. FOR PRESSURISED STEAM & WATER SERVICE THE ASSOCIATED INSTRUMENT SHOULD BE MOUNTED BELOW THE TAPPING POINT. FOR VACUUM/AIR/GAS SERVICE, THE ASSOCIATED INSTRUMENT SHOULD BE MOUNTED ABOVE THE TAPPING POINT.
11. SEAMLESS PIPE/SEAMLESS TUBE/CAPILLARY LENGTH SHALL BE SUCH THAT THE GAUGES/TRANSMITTERS/SWITCHES ARE MOUNTED IN ACCESSIBLE AREA.

LEGEND :–

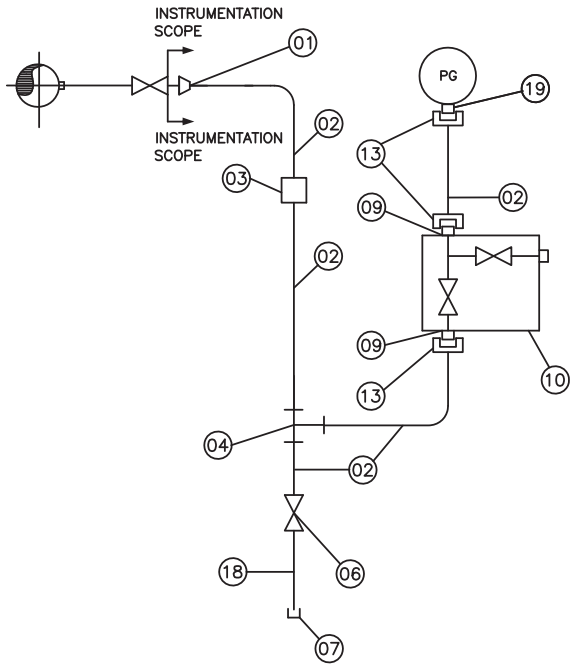
A/R – AS REQUIRED

NPTF – NATIONAL PIPE THREAD FEMALE

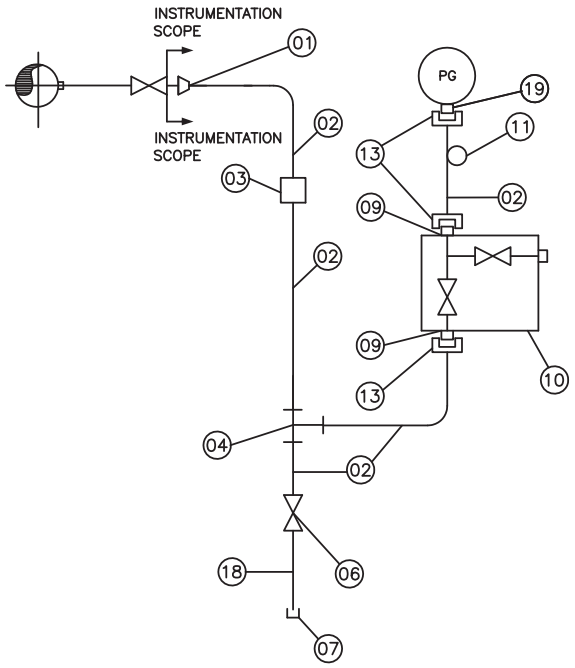
NPTM – NATIONAL PIPE THREAD MALE

SW – SOCKET WELD

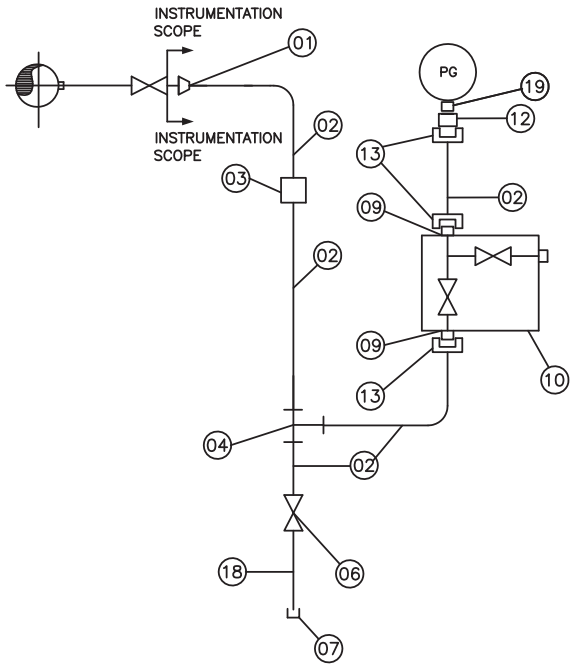
BHEL	TITLE :– INSTRUMENT INSTALLATION DIAGRAM NOTES	DRG. NO.	PE–DG–999–145–IXXX	
		REV. NO.	00	DATE 05.11.13
		SHT	2 OF 9	



WATER SERVICE

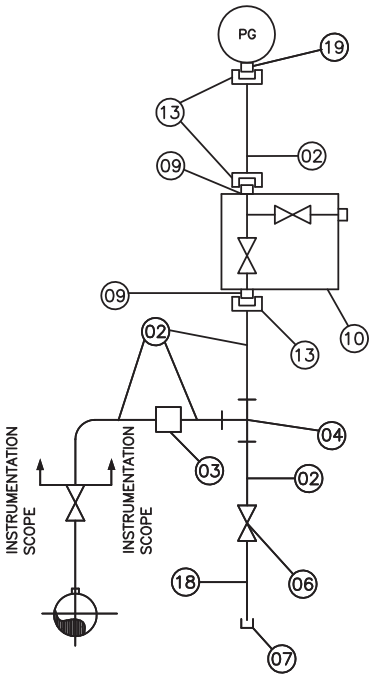


STEAM SERVICE

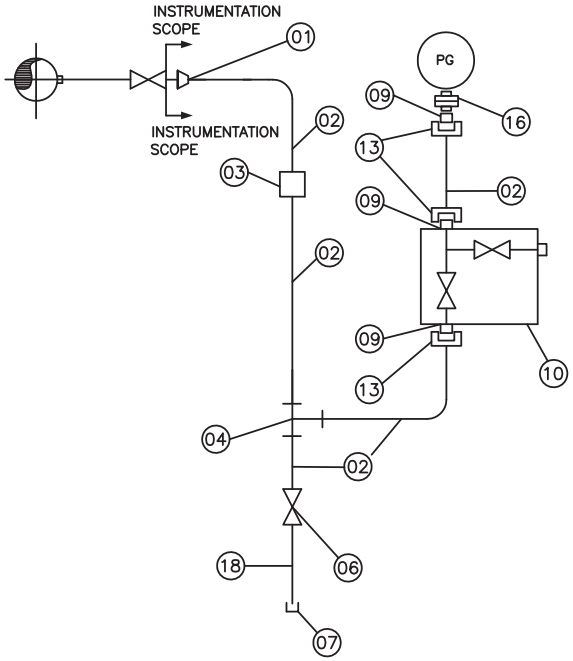


PULSATING SERVICE

BHEL	TITLE :- INSTRUMENT INSTALLATION DIAGRAM PRESSURE GAUGES	DRG. NO.	PE-DG-999-145-IXXX	
		REV. NO.	00	DATE 05.11.13
		SHT	3 OF 9	



AIR SERVICE



WITH CHEMICAL SEAL

(FOR VISCOUS NON–CORROSIVE FLUID ONLY)

ITEM NO	ITEM/DESCRIPTION	MATERIAL	SIZE	QTY				
				WATER	STEAM	PULSATING	AIR	CHEMICAL
01	REDUCER (IF APPLICABLE)	SAME AS MAIN PIPE	1" X 1/2"SW	01	01	01	00	01
02	SEAMLESS PIPE	SAME AS MAIN PIPE	1/2"	A/R	A/R	A/R	A/R	A/R
03	FORGED COUPLING	SAME AS MAIN PIPE	1/2" SW	A/R	A/R	A/R	A/R	A/R
04	FORGED TEE	SAME AS MAIN PIPE	1/2" SW	01	01	01	01	01
06	FORGED GLOBE VALVE	SAME AS MAIN PIPE	1/2" SW	01	01	01	01	01
07	CAP	SAME AS MAIN PIPE	1/2" NPTF	01	01	01	01	01
09	ADAPTER – M TO M	SS316	M20X1.5M X 1/2" NPTM	02	02	02	02	03
10	TWO VALVE 3 WAY MANIFOLD WITH VENT PLUG	SS316	1/2" NPTF	01	01	01	01	01
11	SYPHON	SS316	1/2" SW	00	01	00	00	00
12	SNUBBER	SS316	M20X1.5M X M20X1.5F	00	00	01	00	00
13	NUT & TAIL PIECE WITH ANNEALED COPPER/SS304 WASHER	SS316	NUT SIZE : M20 X 1.5 WITH 100MM TAIL	03	03	03	03	03
16	CHEMICAL SEAL	SS316	1/2" NPTF X 1/2" NPTF	00	00	00	00	01
18	NIPPLE	SAME AS MAIN PIPE	1/2" NPTM X 1/2" SW	01	01	01	01	01
19	ADAPTER – M TO F	SS316	M20X1.5M X 1/2" NPTF	01	01	01	01	00

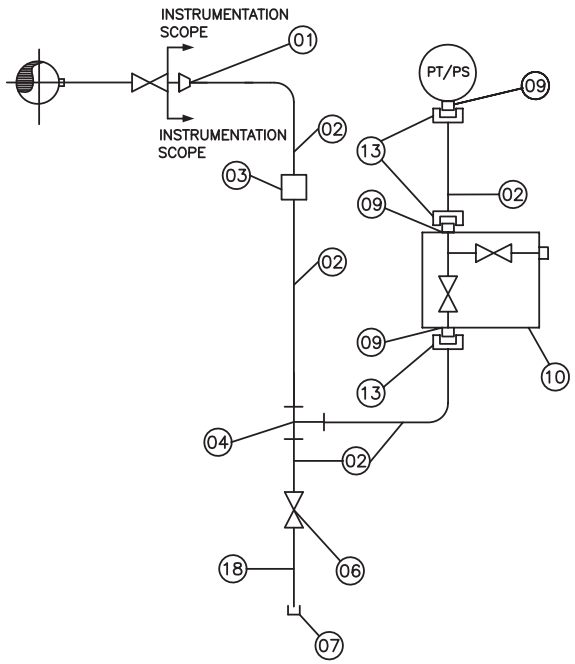
BHEL

TITLE :–

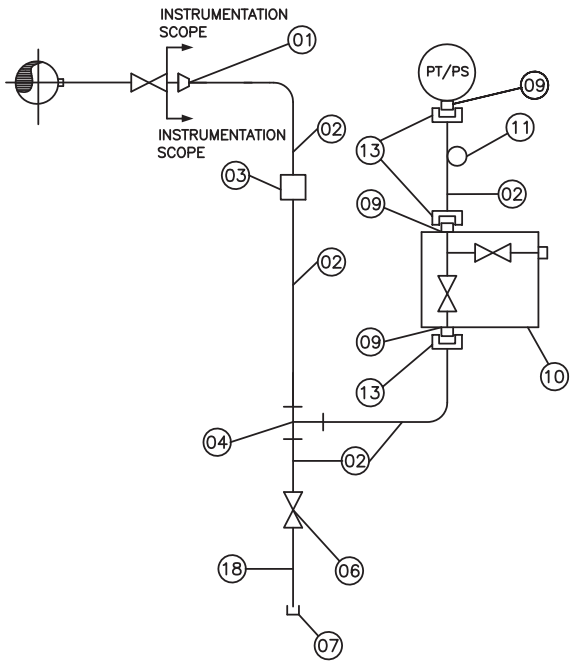
INSTRUMENT INSTALLATION DIAGRAM

PRESSURE GAUGES

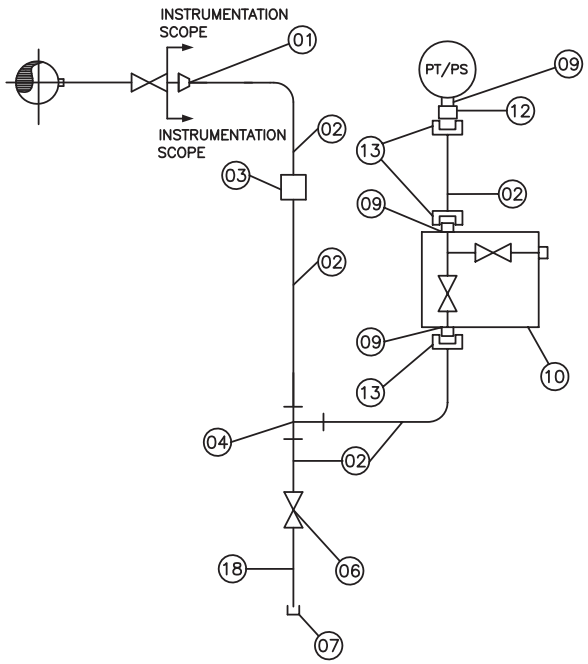
DRG. NO.	PE–DG–999–145–IXXX		
REV. NO.	00	DATE	05.11.13
SHT	4 OF 9		



WATER SERVICE

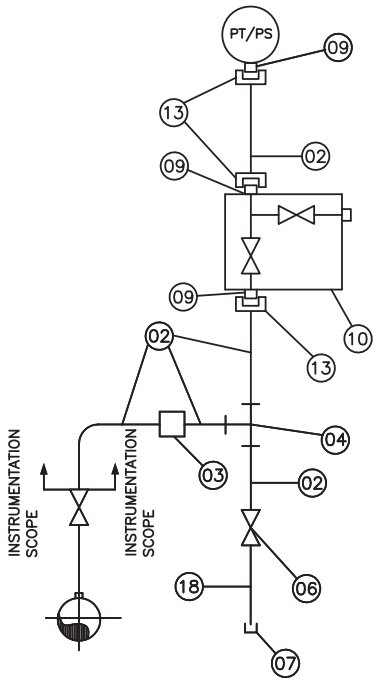


STEAM SERVICE



PULSATING SERVICE

BHEL	TITLE :- INSTRUMENT INSTALLATION DIAGRAM PRESSURE SWITCHES/TRANSMITTERS	DRG. NO.	PE-DG-999-145-IXXX	
		REV. NO.	00	DATE 05.11.13
		SHT	5 OF 9	



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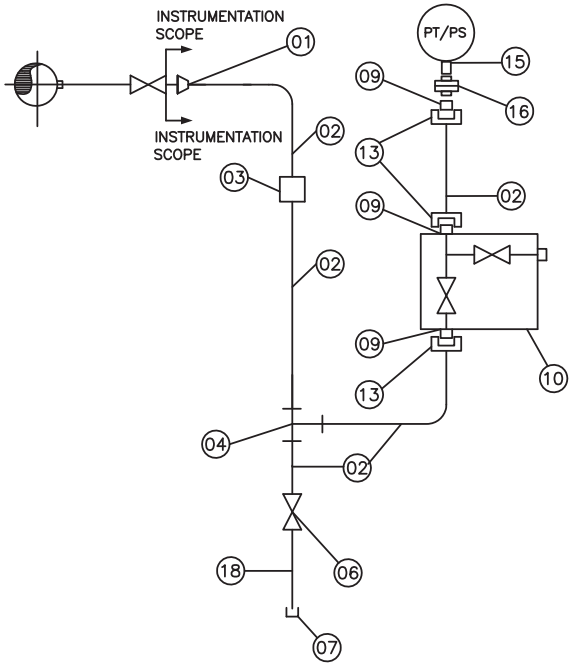


WITH CHEMICAL SEAL
(FOR VISCOUS NON–CORROSIVE FLUID ONLY)

ITEM NO	ITEM/DESCRIPTION	MATERIAL	SIZE	QTY				
				WATER	STEAM	PULSATING	AIR	CHEMICAL
01	REDUCER (IF APPLICABLE)	SAME AS MAIN PIPE	1" X 1/2"SW	01	01	01	00	01
02	SEAMLESS PIPE	SAME AS MAIN PIPE	1/2"	A/R	A/R	A/R	A/R	A/R
03	FORGED COUPLING	SAME AS MAIN PIPE	1/2" SW	A/R	A/R	A/R	A/R	A/R
04	FORGED TEE	SAME AS MAIN PIPE	1/2" SW	01	01	01	01	01
06	FORGED GLOBE VALVE	SAME AS MAIN PIPE	1/2" SW	01	01	01	01	01
07	CAP	SAME AS MAIN PIPE	1/2" NPTF	01	01	01	01	01
09	ADAPTOR – M TO M	SS316	M20X1.5M X 1/2" NPTM	03	03	03	03	03
10	TWO VALVE 3 WAY MANIFOLD WITH VENT PLUG	SS316	1/2" NPTF	01	01	01	01	01
11	SYPHON	CS	1/2" SW	00	01	00	00	00
12	SNUBBER	SS316	M20X1.5M X M20X1.5F	00	00	01	00	00
15	CONNECTOR – M TO M	SS316	1/2" NPTM X 1/2" NPTM	00	00	00	00	01
16	CHEMICAL SEAL	SS316	1/2" NPTF X 1/2" NPTF	00	00	00	00	01
13	NUT & TAIL PIECE WITH ANNEALED COPPER/SS304 WASHER	SS316	NUT SIZE : M20 X 1.5 WITH 100MM TAIL	03	03	03	03	03
18	NIPPLE	SAME AS MAIN PIPE	1/2" NPTM X 1/2" SW	01	01	01	01	01

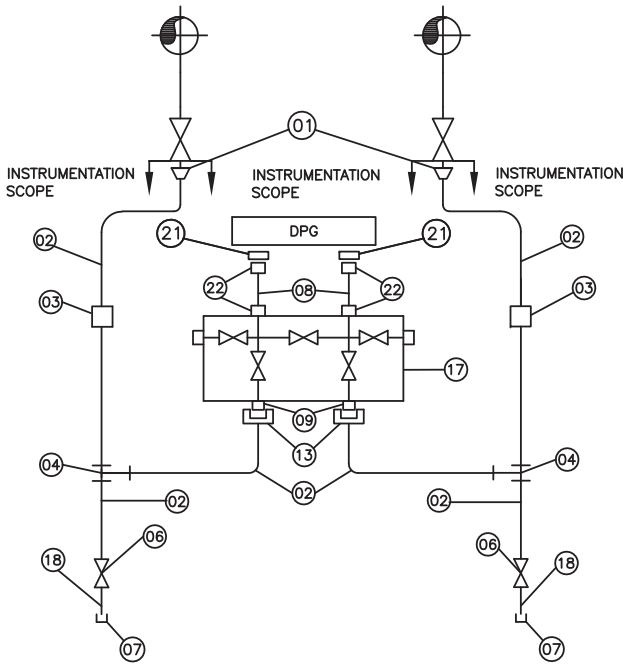
BHEL

TITLE :–

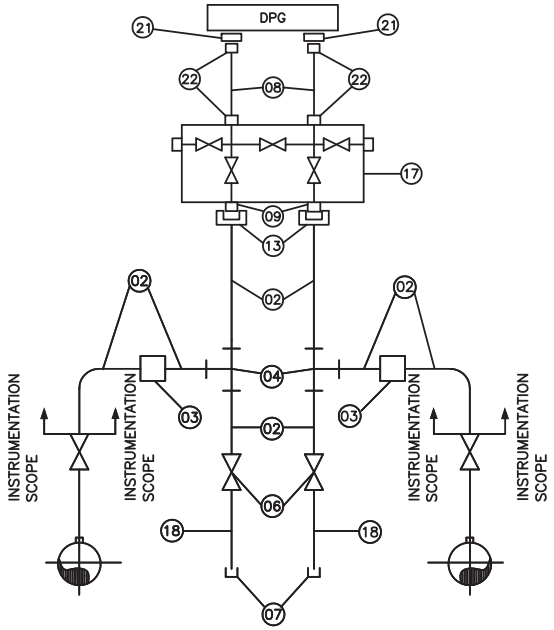
INSTRUMENT INSTALLATION DIAGRAM

PRESSURE SWITCHES/TRANSMITTERS

DRG. NO.	PE–DG–999–145–IXXX		
REV. NO.	00	DATE	05.11.13
SHT	6 OF 9		



WATER SERVICE



AIR SERVICE

ITEM NO	ITEM/DESCRIPTION	MATERIAL	SIZE	QTY	
				WATER	AIR
01	REDUCER (IF APPLICABLE)	SS316	1" X 1/2"SW	02	00
02	SEAMLESS PIPE	SAME AS MAIN PIPE	1/2"	A/R	A/R
03	FORGED COUPLING	SAME AS MAIN PIPE	1/2" SW	A/R	A/R
04	FORGED TEE	SAME AS MAIN PIPE	1/2" SW	02	02
06	FORGED GLOBE VALVE	SAME AS MAIN PIPE	1/2" SW	02	02
07	CAP	SAME AS MAIN PIPE	1/2" NPTF	02	02
08	SEAMLESS TUBE	SS316	1/2" OD	A/R	A/R
09	ADAPTOR – M TO M	SS316	M20X1.5M X 1/2" NPTM	02	02
17	FIVE VALVE MANIFOLD WITH DRAIN PLUG	SS316	1/2" NPTF	01	01
16	CHEMICAL SEAL	SS316	1/2" NPTF X 1/2" NPTF	00	00
13	NUT & TAIL PIECE WITH ANNEALED COPPER/SS304 WASHER	SS316	NUT SIZE : M20 X 1.5 WITH 100MM TAIL	02	02
18	NIPPLE	SAME AS MAIN PIPE	1/2" NPTM X 1/2" SW	02	02
22	TUBE FITTING DFDC	SS316	1/2" NPTM X 1/2"OD TUBE	04	04
21	CONNECTOR – F TO F	SS316	1/2" NPTF X 1/2" NPTF	02	02

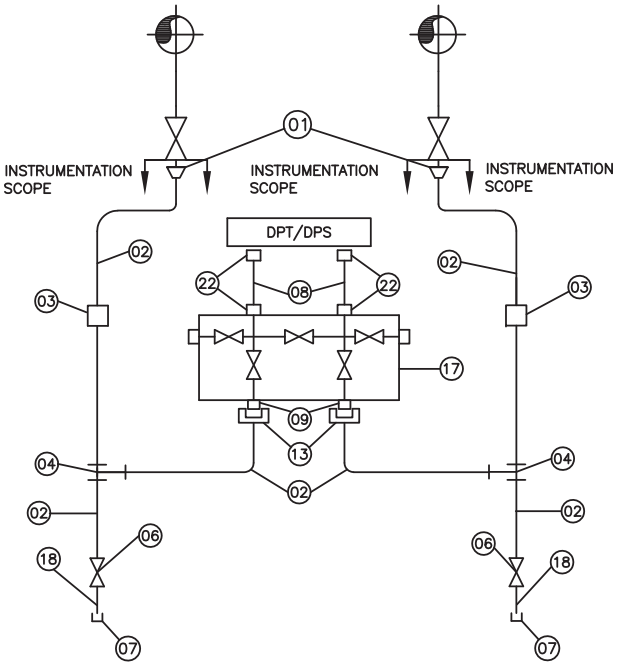
BHEL

TITLE :–

INSTRUMENT INSTALLATION DIAGRAM

DIFFERENTIAL PRESSURE GAUGES

DRG. NO.	PE–DG–999–145–IXXX		
REV. NO.	00	DATE	05.11.13
SHT	7 OF 9		



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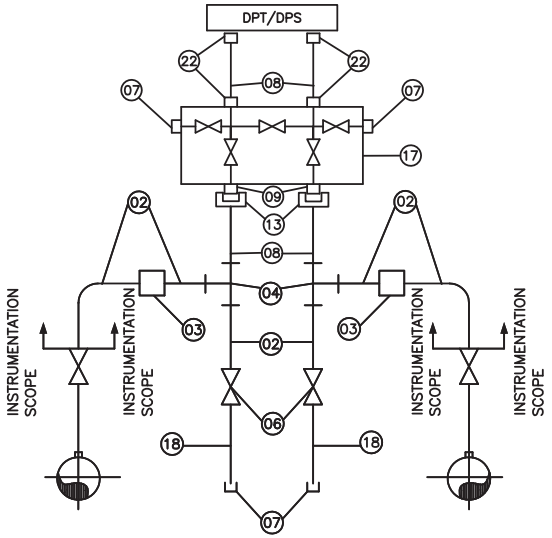


AIR SERVICE

ITEM NO	ITEM/DESCRIPTION	MATERIAL	SIZE	QTY	
				WATER	AIR
01	REDUCER (IF APPLICABLE)	SS316	1" X 1/2"SW	02	00
02	SEAMLESS PIPE	SAME AS MAIN PIPE	1/2"	A/R	A/R
03	FORGED COUPLING	SAME AS MAIN PIPE	1/2" SW	A/R	A/R
04	FORGED TEE	SS316	1/2" SW	02	02
06	FORGED GLOBE VALVE	SS316	1/2" SW	02	02
07	CAP	CS	1/2" NPTF	02	02
08	SEAMLESS TUBE	SS316	1/2" OD	A/R	A/R
09	ADAPTER – M TO M	SS316	M20X1.5M X 1/2" NPTM	02	02
17	FIVE VALVE MANIFOLD WITH DRAIN PLUG	SS316	1/2" NPTF	01	01
16	CHEMICAL SEAL	SS316	1/2" NPTF X 1/2" NPTF	00	00
15	CONNECTOR – M TO M	SS316	1/2" NPTM X 1/2" NPTM	00	00
13	NUT & TAIL PIECE WITH ANNEALED COPPER/SS304 WASHER	SS316	NUT SIZE : M20 X 1.5 WITH 100MM TAIL	02	02
18	NIPPLE	SAME AS MAIN PIPE	1/2" NPTM X 1/2" SW	02	02
21	CONNECTOR – F TO F	SS316	1/2" NPTF X 1/2" NPTF	00	00
22	TUBE FITTING DFDC	SS316	1/2" NPTM X 1/2"OD TUBE	04	04

BHEL

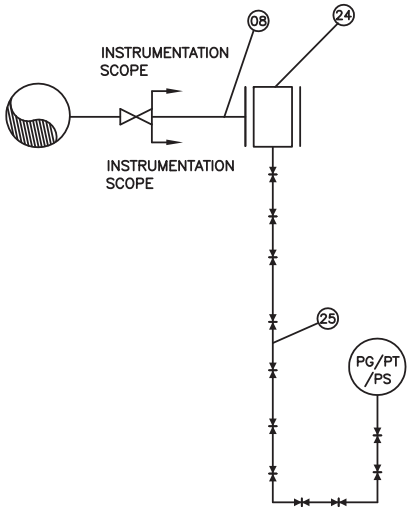
TITLE :–

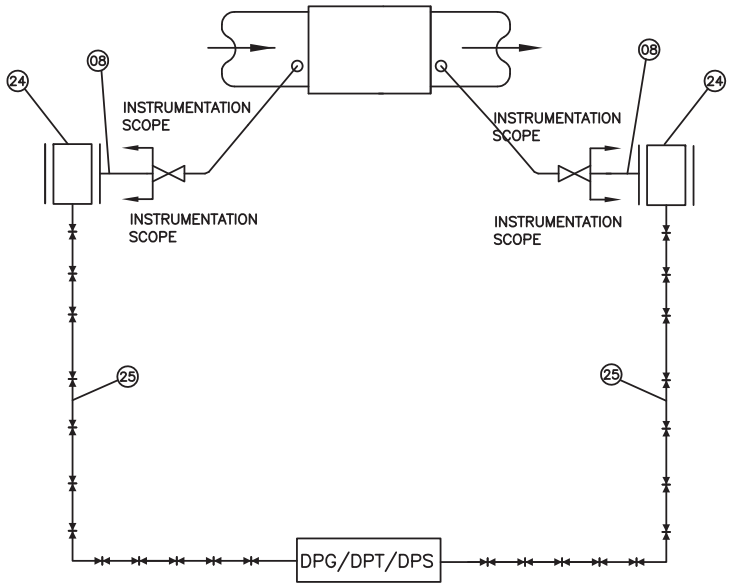
INSTRUMENT INSTALLATION DIAGRAM

DIFFERENTIAL PRESSURE SWITCHES/TRANSMITTERS

DRG. NO.	PE–DG–999–145–IXXX		
REV. NO.	00	DATE	05.11.13
SHT	8 OF 9		

ITEM NO	ITEM/DESCRIPTION	MATERIAL	SIZE	QTY	
				PG/PS/PT	DPG/DPS/DPT
24	FLANGE SUPPLIED WITH PG/PS PT/DPG/DPS/DPT TO SUIT 1/2" OR 1" NB PIPE	SAME AS MAIN PIPE	1/2" SW	01	02
08	SEAMLESS PIPE	SAME AS MAIN PIPE	1/2"	A/R	A/R
25	SS ARMORED CAPILLARY TUBE (MINIMUM 5M IN LENGTH)	SS316	–	A/R	A/R





BHEL	TITLE :– INSTRUMENT INSTALLATION DIAGRAM WITH CAPILLARY TUBES	DRG. NO.	PE–DG–999–145–IXXX	
		REV. NO.	00	DATE 05.11.13
		SHT	9 OF 9	

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SPECIFICATION FOR MEASURING INSTRUMENTS (PRIMARY & SECONDARY), TRANSMITTERS, SWITCHES, GAUGES ETC.

E. Pressure Gauge and Differential Pressure Gauge

01.	Type	:	Bourdon/Bellows/Diaphragm
02.	MOC Sensing & Socket	:	AISI-316 SS
03.	Movement Material	:	AISI-304 SS
04.	Case Material	:	Stainless steel casing bayonet type. Enclosure IP-65.
05.	Dial Size	:	Generally 150 mm (100 mm for SWAS gauges)
06.	Scale	:	Black lettering on white background in 270 Deg. arcs.
07.	Window	:	shatterproof toughened glass
08.	Range Selection	:	Normal process pressure – 50 ~ 70 % of range (approximately).
09.	Over-range Protection	:	125% of maximum range by internal stop. External stop at zero
10.	Adjustment	:	Micrometer screw for zero adjustment. Internal micrometer screw for range adjustment.
11.	Element Connection	:	Argon welding
12.	Process Connection	:	1/2" NPT (M) Bottom connection for local mounting, back connection for panel mounting.
13.	Performance	:	Accuracy of ± 1.0 % of span or better for Pressure gauge

			Accuracy of ± 1.6 % of span or better for Differential Pressure gauge
14.	Operating ambient Temperature	:	0 - 50 ^{O}C
15.	Safety Feature	:	Blow out disc. /diaphragm at the back
16.	Accessories	:	a) Snubbers and Glycerin filled for pulsating fluid applications and at pump discharge. b) Stainless steel 316 Diaphragm with Teflon coated seals for corrosive, viscous and solid-bearing or slurry type process fluids. c) 3-Way stainless steel Gauge cock for pressure gauges. Process connection ½" NPT. d) 5-valve SS316 manifold constructed from barstock for differential pressure gauge. Process connection ½" NPT. e) Union, nut & tail piece and other Installation accessories as required.
17.	Applicable standard	:	IS-3624 / 1996
18.	Electrical Contact rating	:	240V, 5A AC/ 220V, 0.5A DC (for gauges with alarm contact). Number of Contacts:2 SPDT
19.	Nameplate	:	Tag number, service engraved in stainless steel tag plate

B. Differential Pressure Transmitter

01.	Working Principle	:	Smart
02.	Type	:	2-Wire
03.	Output signal	:	Simultaneous transmission of digital and 4-20 mA DC signal isolated linear standard protocol -HART.
04.	Signal Processing Unit	:	Silicon solid-state electronic circuitry
05.	Measuring element	:	Capsule/Diaphragm
06.	Measuring element Material	:	AISI-316 (Stainless Steel)
07.	Static Pressure/ Overload Pressure	:	Maximum line (or static) pressure on either side without permanent deformation or loss of accuracy
08.	Turn-down ratio	:	100: 1 minimum
09.	Span and Zero	:	Locally adjustable, non-interacting
10.	Enclosure class	:	IP-65 (Explosion proof for NEC Class-1, Division 1 area)
11.	Zero suppression / Elevation	:	At least 100% of Span
12.	Output Indicator (Digital display)	:	LCD type in % and Engineering units
13.	Nameplate	:	Tag number and Service engraved in stainless steel tag plate
14.	Body	:	Forged Carbon Steel (SS for DM Water)
15.	Ambient temperature	:	0 - 85 ^{O} C
16.	Operating Voltage	:	18 - 36 Volts DC
17.	Load	:	750 Ohms at 24 Volts DC
18.	Performance:-		
	i) Accuracy	:	± 0.025 % of calibrated span or better
	ii) Repeatability	:	± 0.05 % of calibrated span or better
19.	Sealing/Isolation	:	6 meters SS armoured capillary with suitable fill fluid and flange remote seal diaphragm of SS 316 or suitable material as per application, for corrosive, viscous and dirty fluid application. Flange size and pressure rating as per application.
20.	Accessories	:	a) Universal mounting bracket suitable for 2" pipe and wall mounting. b) High tensile carbon steel U-bolts. c) Installation accessories as per relevant installation drawing. d) Syphons for steam and hot water services. l) ½" NPT 5-valve stainless steel manifold, constructed from SS316 bar stock. e) Companion flange with nuts, bolts and gaskets. f) Hand held configurator kit for diagnosis and calibration of Smart Transmitter. g) ¾" ET cable gland

h) Flushing facility at process end diaphragm.
i) Reverse polarity protection required.

Notes

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1) Differential pressure transmitters of the capacitance type, regardless of the applied service, shall be capable of withstanding a differential pressure equal to full process pressure on either side of the measurement element without damage or loss of calibration.

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2) Differential pressure transmitters will be supplied with integral mounted three valve manifolds for air service and 5 way valve manifold for steam & water service.

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3) Response time for pressure and differential pressure transmitter shall be 100 ms.

C. Ultrasonic Level Transmitter

01.	Type of Transmitter	:	Non contact Microprocessor based 2 wire type, HART protocol Compatible
02.	Output Signal	:	Galvanically isolated 4 – 20 mA DC along with superimposed digital signal (HART protocol)
03.	Sensor Accuracy	:	± 0.25% of calibrated span
04.	Sensor Repeatability	:	3 mm or better
05.	Power Supply	:	18 - 36V DC
06.	Temperature Compensation	:	To be provided within transducer
07.	Configuration	:	Sensor and electronic unit are separate. Electronic unit shall be possible to mount on the accessible location near the transducer. All cables, weather proof fittings for connection between transducer and electronic unit.
08.	Housing	:	IP 55 with durable corrosion resistant Epoxy coating
09.	Calibration	:	Through HART communicator
10.	Zero and Span adjustment	:	Continuous, Tamper proof, Remote as well as manual adjustability. Provision to calibrate the instrument without any level in the tank or sump etc.
11.	Sensor Material	:	Corrosion resistant to suit the individual application
12.	False signal tolerance	:	Facility to be provided. Shall have adjustable damping circuitry.
13.	Range	:	To be decided during detail Engg, with a facility to take care of frequency attenuation due to different obstructions (Surface, vapor)

14.	Display	:	Minimum 4 character display with integral key pad, access protected features.
15.	Diagnostics	:	Loss of echo alarm
16.	Load impedance	:	500 Ω minimum or as per vendor specification.
17.	Electrical connection	:	Plug and socket
18.	Accessories	:	Canopy for protection sunlight and rain Mounting hardware's and accessories shall be SS 316

VOLUME II

SUB-SECTION 4.21

C&I ERECTION

1.0.0 TECHNICAL REQUIREMENT

1.1.0 Panels

Panels and control desk shall be freestanding type and fabricated preferably from 2.5 mm thick cold rolled steel sheet. Angle iron framework shall use a minimum section of 50 × 50 × 6 mm angle. The finish shall include sand blasting, grinding, chemical cleaning, and surface finishing by suitable filter and two coats of high-grade lacquer with wet sanding between coats. Two coats of paint in panel color shall be given for non-glossy high stain finish. Panel face final color in general shall be RAL 7035. A final coat of paint shall be given at site.

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

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

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

Mounting heights

1. Annunciators (top row)
2. Miniature and subminiature instruments (next 3 rows)
3. Electric push buttons (last row)

Control room panels shall have IP protection of IP 32 if mounted in an air- conditioning room and IP-45 if mounted inside a room and IP-55 if mounted outside.

D. CONTROL BOARD

I. Control Desk / Console / Panel Construction

01.	Applicable for	:	Indoor Panel, Desk & console.
02.	Material of construction	:	Cold rolled steel sheet (Metal and plastic - Heat resistant, shrinkage free for mosaic tiles).
03.	Thickness of Sheet	:	a) 3.2 mm for faces supporting instruments / terminals. b) 2 mm for other sides and top.
04.	Construction	:	Welded throughout as per (metallic parts) approved National Standards.
05.	i) Corners	:	7 mm inner radius
	ii) Dimensional Tolerances	:	a) In height & length - 3 mm b) In height between adjacent sections - 2 mm. c) Total for a group - 6 mm
06.	Doors	:	Double, recessed, turned back edges
	i) Thickness of Sheet	:	2 mm
	ii) Hinges	:	Stainless steel
	iii) Door latches	:	Three point type
	iv) Door gaskets	:	Neoprene rubber on fixed frame to result dust proof / weatherproof enclosure.
	v) Opening of the doors	:	Outward
	vi) Louvers	:	With removable wire mesh to ensure dust and vermin proof.
07.	Color of interior	:	Glossy white
08.	Colour external	:	IS 5 No. 628 (Typical) [To be decided later]
09.	Protection of painting	:	Plastic peel coating
10.	Gland plates	:	Removable 4 mm thick (bottom)
11.	Cable entry	:	Bottom
12.	Hardware	:	a) Vibration dampeners b) Predrilled base channel ISMC - 100 or equivalent for all sides. c) Stainless steel buff- finished 2 mm thick kick plate for all sides. d) Stainless steel scratch strips along desk edges fixed with pan-head recessed screws. e) Rubber strips to ensure air tightness between kick plate and finished floor. f) Power supply points 5/15 A plug point with indication lamp 5 Nos.
13.	Enclosure Protection Class	:	IP-42 or as per environment condition.
14.	Earthing	:	4 per standards

1.8.0 Junction Boxes

Bidder shall supply junction boxes wherever required. These shall be of Industrial grade Fibre glass Reinforced Polyester (FRP) to weather proof, with cable entering on bottom and side entry shall be provided.

These boxes shall have terminals suitable for min 2.5 mm² cable termination (klip on) mounted on rails. 30% spare terminals shall be supplied in each junction box.

Junction box shall be provided with double compression glands.

Telephone socket shall be provided in junction boxes. Each junction box shall have a minimum of 20% or 2 nos., whichever is more, spare entry duly provided with plugs (weather proof/explosion proof, as applicable). Protection class shall be IP-65 minimum for JB and enclosures.

In general junction boxes shall be designed in accordance with NEC, Article 370, paragraphs 18, 19 and 20 or equivalent standards. Junction boxes for use in outdoor or damp locations shall be galvanized malleable iron or steel coated inside and outside. The enclosure shall conform to NEMA-4 with hinged door lockable type. Conduit and cable shall enter the lower portion of the box in such a manner that all terminals strips are above conduit entry points.

08. Junction Boxes

Type	:	Flame proof/weather proof
Enclosure	:	IP-65/Explosion/Flame Proof as per area classification.

Material	:	FRP with protective Coating
Cable entry	:	Bottom or Side
Cable glands	:	Double compression type – Nickel plated brass 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 cage clamp type spring loaded)
Grounding	:	Two terminals for body and shield ground
Door	:	Hinged, lockable type.

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 brass, 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 thickness 6.0 mm

FORM NO. PEM-6666-0

	2x660 MW UDANGUDI STPP	SPECIFICATION NO.: PE-TS-XXX-145-I100
		VOLUME
	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER	SECTION
		REV. NO. 00 / DATE: 12.10.2018
		SHEET 1 OF 2

TAG No. ……. Qty..... Data Sheet No.: **PES-145-01-DS1-0**

Data Sheet A & B

DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)

	MANUFACTURER		
	MODEL NUMBER		
TECHNICAL	TYPE	■ CAPACITANCE ■ SILICON RESONANCE TYPE	SMART TRANSMITTER OF ELECTRONIC TYPE, MICROPROCESSOR BASED, HART COMPATIBLE
	POWER SUPPLY	■ 24V DC NOMINAL	
	TRANSMITTER MEASUREMENT	■ PRESSURE ■ DIFF. PRESSURE	
	OUTPUT SIGNAL	■ 4 to 20 m Amp. DC	
	NO. OF WIRE	■ TWO	
	ACCURACY	■ ± 0.04% of span or better	
	LINEARITY, HYSTERISIS, DEAD BAND AND REPEATABILITY	■ ± 0.05 % of span or better	
	STABILITY	■ ± 0.1 % OF URL FOR 10 years	
	SENSITIVITY	■ ± 0.05% OF SPAN	
	MATERIAL	**THE MINIMUM REQUIREMENT FOR SEA WATER APPLICATION : ALL WETTED PARTS & DIAPHRAGM SHALL BE SUITABLE FOR SEA WATER (DUPLEX SS OR BETTER)**	
	A) BODY	■ 316 SS	
	B) ELEMENT	■ 316 SS	
	C) DIAPRAGM	■ 316 SS	
	C) SEAL	■ TEFLON	
	FLANGED REMOTE SEAL DIAPHRAGM	AS REQUIRED	
	CAPILLARY LENGTH	■ MINIMUM LENGTH OF 15 M REQUIRED	
	CONTINUOUSLY ADJUSTABLE SPAN AND ZERO ADJUSTMENT PROVIDED	■ YES, Locally adjustable, non-interacting ☐ NO	
	MOUNTING	☐ WALL/PIPE STAND ■ INSTRUMENT RACK	
	ENCLOSURE	☐ NEMA-4 ☐ NEMA-7 ■ IP-65 WITH CORROSION RESISTANCE EPOXY COATING	
	PAINT	■ EPOXY COATING FOR ALL C&I EQUIPMENT ■ Anticorrosive paint shall be applied to field mounted enclosures / instruments.	
	TURN DOWN RATIO	■ 100:1 in general	

FORM NO. PEM-6666-0

	2x660 MW UDANGUDI STPP **DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER**	SPECIFICATION NO.: PE-TS-XXX-145-I100 VOLUME SECTION REV. NO. 00 DATE: 12.10.2018 SHEET 2 OF 2

TAG No. ……. Qty..... Data Sheet No.: **PES-145-01-DS1-0**

Data Sheet A & B

DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER (TO BE FILLED BY PURCHASER)		DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
INSULATION RESISTANCE	TO BE SPECIFIED BY BIDDER	
OVER PRESSURE	■ 150% OF MAX. OPR. PRESS	
ZERO SUPPRESSION/ ELEVATION RANGE	■ At least 100% of Span	
INTEGRAL INDICATOR	■ YES, LCD indicator (5 digit) with scale of Engg. unit ☐ NO	
RESPONSE TIME	■ 150 msec.	
TRANSMITTER SHALL BE ABLE TO DRIVE LOAD IMPEDANCE OF 500 OHMS(min.) WITH DRIVE CAPABILITY OF 600OHMS NOMINAL	■ YES ☐ NO	
ELECTRICAL CONNECTION	■ PLUG & SOCKET TYPE	
PROCESS CONNECTION	■ I/2 " NPT (F)	
ZERO & SPAN DRIFT	■ ± 0.015 % PER DEG.C AT MAX. SPAN ■ ± 0.11 % PER DEG.C AT MIN. SPAN	
DIAGNOSTICS	■ SELF INDICATING FEATURE	
MANIFOLD		
a) PRESSURE MEASUREMENT	■ 2 WAY ■ MATERIAL: 316 SS	
B) DIFFERENTIAL PRESSURE MEASUREMENT	■ 5 WAY ■ MATERIAL: 316 SS	
CABLE ENTRY DETAIL	SUITABLE FOR DIA OF 17.5 mm	
NOTES: 1. TRANSMITTERS SHOULD NOT BE MOUNTED DIRECTLY ON MANIFOLD. MANIFOLD SHOULD BE NON-INTEGRAL AND STAND ALONE TYPE. 2. TRANSMITTERS TO BE EQUIPPED WITH MOUNTING BRACKETS. 3. ALL THE FIELD INSTRUMENTS SHALL BE PROVIDED WITH SS TAG NAME PLATE.		

	PREPARED BY	**CHECKED BY**	**APPROVED BY**	COMPANY SEAL
NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

FORM NO. PEM-6666-0

	2x660 MW UDANGUDI STPP	SPECIFICATION NO.: PE-TS-XXX-145-I100
		VOLUME
	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER	SECTION
		REV. NO. 00 / DATE: 12.10.2018
		SHEET 1 OF 2

TAG No. ……. Qty..... Data Sheet No.: **PES-145-01-DS2-0**

Data Sheet C

DATA SHEET-C FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER
(TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)

MANUFACTURER	
MODEL NUMBER	
TYPE	
POWER SUPPLY	
TRANSMITTER MEASUREMENT	
OUTPUT SIGNAL	
NO. OF WIRE	
ACCURACY	
LINEARITY, HYSTERISIS, DEAD BAND AND REPEATABILITY	
STABILITY	
SENSITIVITY	
MATERIAL	
A) BODY	
B) ELEMENT	
C) DIAPRAGM	
C) SEAL	
CONTINUOUSLY ADJUSTABLE SPAN AND ZERO ADJUSTMENT PROVIDED	
MOUNTING	
ENCLOSURE	
PAINT	
TURN DOWN RATIO	
INSULATION RESISTANCE	
OVER PRESSURE	
ZERO SUPPRESSION/ ELEVATION RANGE	

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	2x660 MW UDANGUDI STPP	SPECIFICATION NO.: PE-TS-XXX-145-I100
		VOLUME
	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER	SECTION
		REV. NO. 00 / DATE: 12.10.2018
		SHEET 2 OF 2

TAG No. ……. Qty..... Data Sheet No.: **PES-145-01-DS2-0**

Data Sheet C

DATA SHEET-C FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER
(TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)

INTEGRAL INDICATOR	
RESPONSE TIME	
TRANSMITTER SHALL BE ABLE TO DRIVE LOAD IMPEDANCE OF 500 OHMS(min.) WITH DRIVE CAPABILITY OF 600OHMS NOMINAL	
ELECTRICAL CONNECTION	
PROCESS CONNECTION	
ZERO & SPAN DRIFT	
DIAGNOSTICS	
MANIFOLD	
b) PRESSURE MEASUREMENT	
B) DIFFERENTIAL PRESSURE MEASUREMENT	
CABLE ENTRY DETAIL	

	PREPARED BY	CHECKED BY	APPROVED BY	COMPANY SEAL
NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

FORM NO. PEM-6666-0

BHEL	**2x660 MW UDANGUDI STPP** **DATA SHEET FOR** **PRESSURE / DIFFERENTIAL PRESSURE GAUGE**	SPECIFICATION NO.: PE-TS-435-145-I100 VOLUME SECTION REV. NO. 00 DATE: 12.10.2018 SHEET 1 OF 3

TAG No. ……. Qty..... Data Sheet No.: **PE-DC-999-145-I026**

Data Sheet A & B

DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
GENERAL	MANUFACTURER		
	MODEL NUMBER		
TECHNICAL	PRESSURE ELEMENT	☐ BOURDON ☐ DIAPHRAGM ☐ BELLOW	
	MATERIAL	**THE MINIMUM REQUIREMENT FOR SEA WATER APPLICATION : ALL WETTED PARTS & DIAPHRAGM SHALL BE SUITABLE FOR SEA WATER (DUPLEX SS OR BETTER)**	
	A) BELLOW	■ 316 SS	
	B) BOURDON TUBE	■ 316 SS	
	C) MOVEMENT	■ 316 SS	
	D) CASE ENCLOSURE	■ 316 SS	
	E) PROTECTIVE DIAPHRAGM	■ TEFLON COATED SEALS	
	ENCLOSURE	■ IP-65 OR BETTER	
	DIAL	SIZE: ☐ 100MM ■ 150MM WITH SHATTER PROOF GLASS COLOR: WHITE NUMERALS: BLACK SCALE: ■ LINEAR, 270 DEG ARC GRADUATED IN METRIC UNITS	
	CASE	COLOUR : BLACK	
	MOUNTING	■ LOCAL/FRAME MOUNTED ■ INSTRUMENT RACK	
	OVER RANGE PROTECTION	☐ 115% OF MAX. OF SCALE ■ 150% OF MAX. OF SCALE	
	CAPILLARY LENGTH	■ MINIMUM LENGTH OF 15 M REQUIRED	
	BLOW OUT DISC	■ REQUIRED WITH OPEN FRONT CONSTRUCTION OF SUITABLE MATERIAL	
	SWITCHING FACILITY (if applicable)	■ YES ☐ NO	
	TYPE	☐ MICRO SWITCH ☐ OTHER	
	NO. / TYPE OF CONTACTS	2 NOS. SPDT	
	CONTACT RATING	5A 230V AC, 0.25A 220V DC	
	SETTING RANGE RANGE SELECTION	FIELD ADJUSTABLE OVER FULL RANGE; COVERS 125% OF MAX. OF SCALE	
	REPEATABILITY	± 1% OF FSR	
	POWER SUPPLY	☐ 230V AC ☐ 110V AC	
	OVER RANGE TEST	TEST PR. FOR THE ASSEMBLY SHALL BE 1.5 TO THE MAX. DESIGN PRESSURE AT 38 DEG C.	
	ZERO/ SPAN ADJUSTMENT	■ MICROMETER SCREW EXTERNAL FOR ZERO ADJUSTMENT ■ MICROMETER SCREW INTERNAL FOR RANGE ADJUSTMENT	

FORM NO. PEM-6666-0

	2x660 MW UDANGUDI STPP	SPECIFICATION NO.: PE-TS-435-145-I100
		VOLUME
	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE	SECTION
		REV. NO. 00 / DATE: 12.10.2018
		SHEET 2 OF 3

TAG No. ……. Qty..... Data Sheet No.: **PE-DC-999-145-I026**

Data Sheet A & B

DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)

PERFORMANCE	ACCURACY	± 1% OR BETTER OF FULL SCALE DEFLECTION	
CONNECTION	PROCESS	½ " NPT (M)	
	LOCATION	☐ BACK ☐ BOTTOM	
ACCESSORIES	NAME PLATE / METAL TAG	SS	
	MOUNTING	☐ WALL ☐ PIPE – U CLAMPS & BOLTS ☐ PANEL / RACK TO BE DECIDED DURING DETAILED ENGG.	
		3 WAY NEEDLE VALVE / MANIFOLDS PROTECTIVE SEPARATING, CHEMICAL SEAL DIAPHRAGM – FOR CORROSIVE LIQUID LINES Union, nut & tail piece and other Installation accessories as required. 3-Way SS316 Gauge cock for pressure gauges	

NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

FORM NO. PEM-6666-0

	2x660 MW UDANGUDI STPP	SPECIFICATION NO.: PE-TS-435-145-I100
		VOLUME
	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE	SECTION
		REV. NO. 00 / DATE: 12.10.2018
		SHEET 1 OF 2

TAG No. ……. Qty..... Data Sheet No.: **PE-DC-999-145-I026**

Data Sheet C

DATA SHEET-C FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE
(TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)

GENERAL	MANUFACTURER	
	MODEL NUMBER	
TECHNICAL	PRESSURE ELEMENT	
	MATERIAL	
	ENCLOSURE	
	DIAL	
	CASE	
	ADJUSTMENT	
	MOUNTING	
	OVER RANGE PROTECTION	
	BLOW OUT DISC	
	SWITCHING FACILITY TYPE NO. / TYPE OF CONTACTS CONTACT RATING SETTING RANGE REPEATABILITY POWER SUPPLY	
PERFORMANCE	ACCURACY	
CONNECTION	PROCESS	
	LOCATION	
ACCESSORIES	NAME PLATE / METAL TAG	
	MOUNTING	
	OTHER	

NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

1.0 SCOPE

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

2.0 CODES AND STANDARDS

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

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

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

3.0 TECHNICAL REQUIREMENTS

3.1 Panel Construction

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

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

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

3.1.4 The salient features of construction shall be:

Sheet material: Cold rolled sheet steel
Frame thickness: Not less than 3.0mm
Enclosure thickness: Not less than 2.5 mm for load bearing sections (Mounted with instruments)
1.6 mm for doors and not less than 2.0 mm for others
Panel Height: Not less than 2365 mm (Refer data sheet-A (No. PES-145A-DS1-0)
Gland plate thickness: 3.0mm
Base channel: ISMC 100 with anti-vibration mounting & foundation bolts.

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

3.1.7 3.1.6 Suitable neoprene gasket shall be provided on all doors and removable covers. Suitable ventilation system along with louvers shall be provided at bottom and top of the doors covered with removable wire mesh.

3.1.7 The class of protection shall be in accordance with IP-42 unless otherwise specified in the data sheet – A (No. PES-145-54A-DS1-0).

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

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

3.1.10 All operable and indicating devices shall be mounted on the front of the panel while aux. Relays / timers MCBs etc. required for realization of control logics shall be mounted on a mounting plate inside the panel. Auxiliary relays and timers etc. shall be grouped according to the control function.

No operable or indicating devices shall be mounted below 750 mm and above 1800 mm (w.r.t. finished ground level). The devices shall be located in such a way so as to ensure easy access for operation / maintenance.

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

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

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

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

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

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

3.1.17 Local Panel shall be provided with main name plate of 150 mm x 40 mm size having inscription of 20 mm height. The individual devices on the panels shall be as provided with separate name plate with inscription of 3 mm height. The instrument / devices shall be provided with stick on label plates inside the panel. The material of the main and individual labels shall be three (3) ply 3 mm thick Traffolyte Sheet / 2 mm Anodised Aluminium Plate. The inscription shall be with white letters on black background on traffolyte sheet. The labels shall be fixed by self-tapping non-rusting screws.

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

3.2 Hazardous Area Panel Requirement

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

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

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

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

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

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

3.3 Control & Monitoring devices

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

3.3.2 Alarm Annunciator System

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

3.3.3 Relays

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

3.3.4 Timers

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

3.3.5 Control / Selector Switches

Switches shall be Rotary Cam type with minimum of 5 Amps AC & 2 Amp DC continuous current rating. Selector switches shall be stay put type while control switches shall be spring-return-to-neutral type. Contact configuration and rating shall be as per the control function requirement. The switches shall be

lockable type wherever specified. Each switch shall be provided with engraved plates indicating the switch position / functions.

3.3.6 Push Buttons / Indicating Lights

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

RED	Motor OFF / Valve CLOSE	YELLOW	Alarm acknowledge	Left Hand Side
GREEN	Motor ON / Valve OPEN	BLACK	Lamp test	Right Hand Side

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

GREEN	Motor OFF / Valve CLOSED condition	AMBER	Motor tripped	Left Hand Side
RED	Motor ON / Valve OPEN condition	WHITE	Normal / healthy	Right Hand Side

3.3.7 Ammeters

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

3.3.8 Miniature Circuit Breaker (MCB)

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

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

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

4.0 TESTING AND INSPECTION

4.1

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

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

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

4.3.1 Routine Tests

1. High Voltage (H.V.)
2. Insulation Resistance (I.R.)
3. Functional
4.

4.3.2 Type Tests

1. Enclosure Class Test

5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

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

5.2. Mandatory Spares

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

5.3. Recommended Spares

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

6.0 DRAWINGS AND DOCUMENTS

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

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

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

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

7.0 MARKING AND PACKING

7.1 Panel with all instruments / devices mounted on it shall be suitably packed & protected for the entire period of dispatch, storage and erection against impact, abrasion, corrosion, incidental damage due to vermin, sunlight, high temperature, rain moisture, humidity, dust, sea-water spray (where applicable) as well as rough handling and delays in Transit and storage in open.

8.0 APPLICABLE DATA SHEET FORMS

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

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

BHEL	**2x660 MW UDANGUDI STPP** **DATA SHEET FOR LOCAL PANELS**	SPECIFICATION NO.: PE-SS-999-145-054A VOLUME SECTION REV. NO. 00 DATE: 12.10.2018 SHEET 1 OF 3

TAG No. ……. Qty..... Data Sheet No.: **PES-145A-DS1-0**

Data Sheet A & B

			DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
GENERAL	MANUFACTURER			
	CONSTRUCTION		■ FOLDED ☐ WELDED	
	ENCLOSURE SHEET THICKNESS	FRONT	■ 3.0 mm	
		OTHER	■ 2.0 mm	
		DOOR	■ 2 mm	
		HEIGHT	■ 2365 mm for stand-alone panels (THIS SHALL BE DECIDED BY BHEL DURING DETAILED ENGG.)	
		OTHER	■ Load bearing sheet front shall have 3mm thickness	
TECHNICAL	INPUT POWER SUPPLY * (ANY OTHER POWER REQUIREMENT TO BE DERIVED FROM THIS SUPPLY ONLY)		☐ 240V 50 Hz AC ☐ 220V DC ■ 415V 3 PHASE Kindly refer Electrical scope sheet	
	NO. OF FEEDERS		☐ ONE ■ TWO	
	STARTER WITH MCC		■ REQUIRED ☐ NOT REQUIRED	
	IPR POSITION		☐ MCC ■ CONTROL PANEL	
	CONTACT RATING OF RELAY		■ 5 Amp, 230 V AC ■ 0.25 Amp, 220V DC	
	CONTROL SUPPLY		☐ 10V AC ☐ 220V AC ■ 220V DC ☐ Other. (As per requirement)	
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)		■ REQUIRED 10 nos. Actual no. shall be decided during detailed engg.	
	TEMP SCANNER (IF REQUIRED –NO. OF CHANNELS TO BE SPECIFIED UNDER SEC-C)		☐ REQUIRED ■ NOT REQUIRED	
	PAINT TYPE		■ EPOXY ENAMEL ☐ EPOXY POWDER COATED OR BETTER	
	MIMIC (TYPE OF MIMIC- MATERAIL, THICKNESS TO BE SPECIFIED DURING DETAILED ENGG.)		■ REQUIRED ☐ NOT REQUIRED	
	PANEL COLOUR (EXTERNAL)		☐ LIGHT GREY (Shade 631 IS-5) ☐ OPALINE GREEN (Shade 275) ☐ RAL 7032 SHALL BE DECIDED DURING DETAILED ENGINEERING	
	FINISH (EXTERNAL)		☐ MATT ☐ GLOSSY ☐ SEMI GLOSSY	
	PANEL COLOUR (INTERNAL)		☐ WHITE ☐ CREAM ☐ OFF WHITE SHALL BE DECIDED DURING DETAILED ENGINEERING	
	FINISH (INTERNAL)		☐ MATT ■ GLOSSY ☐ SEMI GLOSSY SHALL BE DECIDED DURING DETAILED ENGINEERING	

	2x660 MW UDANGUDI STPP	SPECIFICATION NO.: PE-SS-999-145-054A
		VOLUME
	DATA SHEET FOR LOCAL PANELS	SECTION
		REV. NO. 00 / DATE: 12.10.2018
		SHEET 2 OF 3

TAG No. ……. Qty..... Data Sheet No.: **PES-145A-DS1-0**

Data Sheet A & B

	DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)		DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
	CLASS OF PROTECTION	☐ IP-42 (FOR INDOOR SERVICE) ■ IP-55 (FOR OUTDOOR SERVICE) ☐ ANY OTHER	
	CONTROL HARDWARE	☐ RELAY BASED	
	FOUNDATION ARRANGEMENT	☐ FOUNDATION BOLTS ☐ ANCHOR FASTENERS	
	WEIGHT OF PANEL (Kg.)	……..(Vendor to specify)	
	PANEL TYPE	☐ PRESSURISED ■ UNPRESSURISED As per Requirement	
	CABLE GLAND	■ DOUBLE COMPRESSION	
	AMMETER (TYPE OF INPUT)	☐ 1 Amp CT ☐ 4-20 Ma NOT REQUIRED BELOW 30KW.	
	SCOPE OF SUPERVISION FOR ERECTION & COMMISSIONING	☐ APPLICABLE ☐ NA	

	PREPARED BY	**CHECKED BY**	**APPROVED BY**	COMPANY SEAL
NAME				NAME:
DESIGNATION				
SIGNATURE				SIGNATURE:
DATE				DATE:

BHEL	**2x660 MW UDANGUDI STPP** **DATA SHEET FOR LOCAL PANELS**	SPECIFICATION NO.: PE-SS-999-145-054A VOLUME SECTION REV. NO. 00 DATE: 12.10.2018 SHEET 3 OF 3

TAG No. ……. Qty..... Data Sheet No.: **PES-145A-DS1-0**

Data Sheet C

DATA SHEET-C FOR LOCAL PANEL
(TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)

GENERAL	MANUFACTURER			
	CONSTRUCTION		☐ FOLDED ☐ WELDED (As per requirement)	
	ENCLOSURE SHEET THICKNESS	FRONT		
		OTHER		
		DOOR		
		HEIGHT		
		OTHER		
TECHNICAL	INPUT POWER SUPPLY			
	NO. OF FEEDERS			
	CONTACT RATING OF RELAY			
	TEMP SCANNER			
	CONTROL SUPPLY			
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)			
	PAINT TYPE			
	PANEL COLOUR (EXTERNAL)			
	FINISH (EXTERNAL)			
	TYPE OF MIMIC MATERIAL OF MIMC THICKNESS OF MIMIC			
	PANEL COLOUR (INTERNAL)			
	FINISH (INTERNAL)			
	CLASS OF PROTECTION			
	CONTROL HARDWARE			
	FOUNDATION ARRANGEMENT			
	WEIGHT OF PANEL (Kg.)			

FORM NO. PEM-6666-0

	2x660 MW UDANGUDI STPP	SPECIFICATION NO.: PE-SS-999-145-054A
		VOLUME
	DATA SHEET FOR LOCAL PANELS	SECTION
		REV. NO. 00 / DATE: 12.10.2018
		SHEET 3 OF 3

TAG No. ……. Qty..... Data Sheet No.: **PES-145A-DS1-0**

Data Sheet C

DATA SHEET-C FOR LOCAL PANEL
(TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)

	PANEL TYPE		
	CABLE GLAND		
	AMMETER (TYPE OF INPUT)		
	SCOPE OF SUPERVISION		

	PREPARED BY	**CHECKED BY**	**APPROVED BY**	COMPANY SEAL
NAME				NAME:
SIGNATURE				SIGNATURE:
DATE				DATE:

	2x660 MW UDANGUDI STPP (UNIT#1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR TRAVELLING WATER SCREEN (TWS) SYSTEM	

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SUB VENDOR LIST

SUB VENDOR LIST (AS ON 14/11/2019)

Sl No	Package Name	Supplier Name	Supplier Communication Address
1	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	BOSE PANDA INSTRUMENTS PVT.LTD.	Mr. Partha Bose 44, Saheed Hemanta Kumar Bose, Sarani, Kolkata Phone- +91 33 2548 7220 Pincode : 700074 Email : parthabosebpi@gmail.com; bosepanda@vsnl.net
2	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in
3	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net
4	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com
5	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.- MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com
6	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode : 560022 Email : info@hgurusouth.com
7	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	FORBES MARSHALL (HYD) LTD.	MR SAILESH PATALAY/MR. M K SRINIVASAN PLOT NO.A-19/2, & T-4/2, IDA, NACHARAM, HYDERABAD Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com
8	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,
9	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Nesstech Instruments Private Limited	26/2, G Type, Global Industrial Park Near Nahuli Railway Crossing, Valvada Vapi Phone- 9920576002 Pincode : 396105 Email : sales@nesstech.co.in
10	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com
11	TRANSMITTERS	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com
12	TRANSMITTERS	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com
13	TRANSMITTERS	YOKOGAWA INDIA LIMITED,	PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, BANGALORE, Phone- 080-41586000, Pincode : Email : uday.shankar@in.yokogawa.com,
14	TRANSMITTERS	SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in
15	TRANSMITTERS	ABB INDIA LIMITED	MR. RAJIV GOVIL 14, MATHURA ROAD, FARIDABAD Phone- 09971085678 Pincode : 121003 Email : vipin.swami@in.abb.com
16	TRANSMITTERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,
17	TRANSMITTERS	Endress + Hauser (India) Pvt. Ltd.,	Mr. Prakash Vaghela 215-216, DLF Tower 'A', Jasola District Centre, New Delhi, Phone- 9717593001, Pincode : 110025, Email : prakash.vaghela@in.endress.com,
18	TRANSMITTERS	Moore Industries International Inc.	Leonard.W. Moore/ Matt Moren 16650 Schoenborn St. North Hills Phone- +1 818 830 5548 Pincode : 91343 Email : mmoren@miinet.com
19	TRANSMITTERS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,
20	TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL	Agents: Digital Electronic Ltd. 74/11 'C' Cross Road MIDC Andheri (East) MUMBAI Phone- 28208477 Pincode : 400093 Email : corp@delbby.rpgms.ems.vsnl.net.in
21	TRANSMITTERS	SIEMENS LIMITED	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com
22	TRANSMITTERS	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	Mr. Amit Paithankar/Vikram Raj Singh 206-210,BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI Phone- 9619121500 Pincode : 400051 Email : vikramraj.singh@emerson.com
23	TRANSMITTERS	Honeywell Automation India Limited	Mr. Ritwij Kulkarni 917, INTERNATIONAL TRADE TOWER, NEHRU PLACE, NEW DELHI Phone- 9890200584 Pincode : 110019 Email : rajesh.chaudhary@honeywell.com
24	TRANSMITTERS	NIVO CONTROLS PVT. LTD.	Mr. Praveen Toshniwal 104-115, Electronic Complex, Indore Phone- 0731-4081305 Pincode : 452010 Email : sales@nivocontrols.com
25	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	JIGNESH MAHENDRA AJMERA DENA BANK BLDG.,SHREE NAGESH INDL. ESTATE,STATION ROAD, MUMBAI Phone- 022 67973578 Pincode : 400 088 Email : ajmera@ajmera.net, jmajmera@yahoo.com
26	JUNCTION BOX	K.S.INSTRUMENTS PVT.LTD.	S Raghavan No. 72, 3rd Main, 1st Stage Industrial Suburb, Yeshwanthpur Bangalore Phone- 9880385770 Pincode : 560022 Email : sales1@ksinstruments.net
27	JUNCTION BOX	SUCHITRA INDUSTRIES	NO-2,OPP-27 AECS LAYOUT 2ND STG REJAMAHALVILAS EXTN 2ND STG BANGALORE Phone- Pincode : Email : suchitra.industriesblr@gmail.com
28	JUNCTION BOX	Shrenik & Company,	Mr. Mitesh Shah/Mr. Pulin Shah 39 A/3 ,Panchratna Industrial Estate, Sarkhej-Bavla Road Ahmedabad Phone- 9825024921 Pincode : 382213 Email : sales@pustron.com, pulin@sumip.com
29	JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Mr. Dineshbhai Zaveri C-1/ 27&37, GIDC, Kabilpore, Navsari Phone- 02637-265140,265003 Pincode : 396424 Email : flexpro@flexproltd.com
30	INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
31	INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
32	INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
33	INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
34	INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
35	INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
36	INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
37	INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
38	INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	S. Harichandran/P.S. Pandi B-11, Mugappair Industrial Estate, CHENNAI Phone- 044 26252537 Pincode : 600037 Email : sales@hpvalvesindia.com
39	INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	MD Hussain Shaikh/Shahanawaz Khan Gala No. 168, Loheki Chwal,216/ 218, Maulana Azad Rd. Nagpada Junction Mumbai Phone- 91-9324383121 Pincode : 400008 Email : shahanawaz.khan@perfectinstrumentation.com
40	INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	Mr.Sanjay Brahman/Mr.Shyam Vazirani 102, Vora Industrial Estate No.4 Navghar, Vasai Road (E) Dist.Thane, Mumbai Phone- +91-250-2392246 Pincode : 401210 Email : arya@aryaengg.com

41	INSTRUMENT FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
42	INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
43	INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	Mr. Jeetu Jain/Mr. Vinay Sosa Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway Laxmipura, Nandasan Phone- 02764-267036/37 Pincode : 382705 Email : marketing@com-fit.com
44	INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	Mr. Abbas Bhola Potia Building No. 2, Office No. 3,292, Bellasis Road,Mumbai Central (East) Mumbai Phone- 9920044113 Pincode : 400008 Email : ab@fluidfitengg.com
45	INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
46	INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
47	INSTRUMENT FITTINGS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@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.

SECTION ID
DATA SHEET – A

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM, TRASH RACK ALONG WITH AUTOMATIC TRASH RACK CLEANING MECHANISM SYSTEM				SPEC NO: PE-TS-435-172-N001
	TECHNICAL DATA SHEET- A				SECTION : ID
					REV.NO: 00
					DATE: 09/12/19
S.no.	**Description**	**Units**	**Data/Parameters**		
1	**General**				
1.1	Service / Application		**FOR CW MAKEUP PUMP SUMP**	**FOR DESALINATION PLANT SUPPLY PUMP SUMP**	**FOR FIRE WATER PUMP SUMP**
1.2	Nos. of Traveling Band screening systems sets required	Nos.	3 Nos. for station	3 Nos. for station	1 No. for station
1.3	Nos. of Trash Rack sets required	Nos.	3 Nos. for station	3 Nos. for station	1 No. for station
1.4	Nos. of Automatic scraper car arrangement system set required	Nos.	1 No. (common for all seven sumps of Sea Water Intake pump house)		
1.5	Nos. of Spray wash pumps common for all TBS	Nos.	2 Nos. (1 Working + 1 Standby) common for all TBS		
1.6	Liquid handled		Sea Water (Analysis attached)	Sea Water (Analysis attached)	Sea Water (Analysis attached)
1.7	Type of Travelling Band Screen		Inline Flow / Central Flow / Dual Flow	Inline Flow / Central Flow / Dual Flow	Inline Flow / Central Flow / Dual Flow
1.8	Hydraulic /Fluid coupling		Required	Required	Required
1.9	Manufacturer		By Bidder	By Bidder	By Bidder
1.10	Drive Mechanism Safety Devices		Required (Details :By Bidder)	Required (Details :By Bidder)	Required (Details :By Bidder)
2	**Site Data**				
2.1	FGL of the Site	m	RL 3.3 M	RL 3.3 M	RL 3.3 M
2.2	Elevation of the TBS & Trash Rack Operating Floor	m	RL 3.8 M	RL 3.8 M	RL 3.8 M
2.3	Invert level of the Sump at TBS & Trash Rack Inlet	m	RL (-) 9.4 M	RL (-) 9.4 M	RL (-) 9.4 M
2.4	Min. W.L. at upstream of Trash Rack	m	RL (-) 4.33 M	RL (-) 4.33 M	RL (-) 4.33 M
2.5	Max. W.L. at upstream of Trash Rack	m	RL 0.386 M	RL 0.386 M	RL 0.386 M
2.6	Maximum sump length & width for the Trash Rack & Automatic Cleaning System		2500 mm X 2700 mm	2500 mm X 1600 mm	2500 mm X 1000 mm
2.7	Maximum Chamber length (Excluding end walls) & width for the TBS		2500 mm X 2700 mm	2500 mm X 1600 mm	2500 mm X 1000 mm
2.8	Design Mechanical temperature	Deg. Cel.	50	50	50

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM, TRASH RACK ALONG WITH AUTOMATIC TRASH RACK CLEANING MECHANISM SYSTEM				SPEC NO: PE-TS-435-172-N001
	TECHNICAL DATA SHEET- A				SECTION : ID
					REV.NO: 00
					DATE: 09/12/19
S.no.	**Description**	**Units**	**Data/Parameters**		
2.9	Spray wash/Flushing water source		Pump Discharge in Intake Pump House at Downstream of TBS		
2.10	Pressure available at Tap off from discharge of purchaser's pump	mwc	10 to 25 MWC (g)		
2.11	Max. Limit on shut off head of purchasers pump	mwc	50 MWC (g)		
2.12	Location of TBS and Trash Rack along with Automatic Trash Rack Cleaning Mechanism		Outdoor	Outdoor	Outdoor
3	**Design Data**				
3.1	Flow rate per stream				
-	Design/Normal	cum/hr	6500	2000	410
-	Maximum	cum/hr	8450	2600	530
3.2	No. of Speed levels of TBS		By Bidder (Minimum 2)	By Bidder (Minimum 2)	By Bidder (Minimum 2)
3.3	Protection Mechanism for Differential level $\geq$ Design Differential		Required (Type Details: By Bidder)	Required (Type Details: By Bidder)	Required (Type Details: By Bidder)
3.4	Travelling Band Screen clear opeining	mm^2	10 mm X 10 mm	10 mm X 10 mm	10 mm X 10 mm
3.5	Screen wire mesh size (Diameter)	mm	2 (Minimum)	2 (Minimum)	2 (Minimum)
3.6	Clearance between bars of Trash Rack at upstream of TBS	mm	100	100	100
3.7	Maximum water velocity through screen at min. WL	m/sec	0.5	0.5	0.5
3.8	Design differential head each for Travelling Band screens & Trash Rack (Minimum)	MWC	1.5	1.5	1.5
3.9	Maximum head loss permitted across TBS (i.e. between inlet and outlet) in clean condition at Min WL	MWC	0.1	0.1	0.1
3.10	Screen backwashing/flushing start "ON" Slow speed head loss across TBS	MWC	0.2	0.2	0.2
3.11	Screen backwashing/flushing start at fast speed	MWC	0.35	0.35	0.35
3.12	Automatic Trash Rack Mechanism start for head loss in Trash Rack under Level Mode	MWC	0.1	0.1	0.1

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	TECHNICAL DATA SHEET- A		SECTION : ID
			REV.NO: 00
			DATE: 09/12/19

S.no.	Description	Units	Data/Parameters		
3.13	Corrosion Protection system		YES, with Sacrificial anode type Cathodic protection by Bidder. (Calculation for same to be furnished during contract stage for approval)		
3.14	Service Factor for Gear Box		2 (minimum)	2 (minimum)	2 (minimum)
3.15	The velocities for Calculating the inside diameters of pipes shall be limited to		At Pump Suction: 1.5 m/sec At Pump Discharge and Headers: 2.5 m/sec		
4	**Spray Wash/Flushing system**				
4.1	Spray wash/flushing water Piping		Common for all TBS		
	a) Material		• Pipe upto 50 NB: Duplex SS (AS PER SCH 40S) • Pipe above 50 NB and upto 300 NB: Duplex SS (AS PER SCH 10S)		
	b) O.D.Xthickness of Stub at Terminal Point	mmXmm	168.3 X 3.4		
4.2	Motor Rating of Spray Wash pump		Drive Motor shall be rated, at an ambient temp. of 50 Deg C, with a margin of at least 15 % over the shaft requirement at the duty condition 'or' 10 % above the maximum load demand in the operating range whichever is higher including voltage and frequency variation.		
5	**Duplex Basket Strainer**		Common for all TBS		
5.1	Screen perforation size	mm	2.0 mm (Max.) & less than spray Nozzle hole		
5.2	Free flow area in the Screen basket		Minimum 5 times of Pipe Inlet Area		
6	**Debris Segregation and collection baskets**				
6.1	Quantity	Nos.	2 (Common for all 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 (7.5 Ton capacity with crane hook level RL 9.3 M)		
6.5	Basket frame plate thickness	mm	Min. 6		
6.6	Wire Mesh size dia	mm	Min. 5		

S.no.	Description	Units	Data/Parameters		
6.7	Guide Ways				
6.7.1	Number (For each TBS)	Nos.	4	4	**4**
6.7.2	Type		Embedded in wall	Embedded in wall	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)	YES, with Sacrificial anode type Cathodic protection by Bidder. (Calculation for same to be furnished during contract stage for approval)	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	YES	YES
8	**Control and Instrumentation**				
8.1	Control Panel		N.A. (DDCMIS control). Only Starter cum Switchgear Panel to be provided by Bidder as per Section IC		
8.2	Differential Level Switch		N.A.		
8.3	Differential Level Transmitters		2 nos. i.e. 1 no. per stream for each TBS and Trash Rack respectively (Each DLT to be provided with 2 nos. Ultrasonic Level Transmitters)		
8.4	Pressure Transmitters				
8.4.1	Spray wash Suction Header		2 nos. Common for all the pumps		
8.4.2	Spray wash Discharge Header		2 nos . 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		
8.7	Differential Pressure Transmitters		1 no for Duplex Strainer		
8.8	Differential Pressure Gauge		1 no . For Duplex Basket Strainer		

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	TECHNICAL DATA SHEET- A				SECTION : ID
					REV.NO: 00
					DATE: 09/12/19
S.no.	**Description**	**Units**	**Data/Parameters**		
8.9	Limit Switches		1 No . Per suction & Discharge valve (OPEN/CLOSE) of TBS Spray wash pumps		
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	YES	YES
9.1.2	Automatic start-up intiated by timer.		YES	YES	YES
9.1.3	Manual mode of operation		YES	YES	YES
9.1.4	Provision for manual operation of the Travelling band shall be made in case of control system failure.		YES	YES	YES
9.2	Automatic Trash Rack cleaning Mechanism shall be designed for the following operation modes:				
9.2.1	Automatic start up initiated by High differential level		YES	YES	YES
9.2.2	Automatic start-up intiated by timer.		YES	YES	YES
9.2.3	Manual mode of operation		YES	YES	YES
9.2.4	Provision for manual operation shall be made in case of control system failure.		YES	YES	YES
10	**Spray wash/Flushing system/Duplex Basket Strainer**				
10.1	Spray wash pumps		Applicabe		
10.1.1	No. of Spray wash pumps	Nos.	2 Nos. (1 W + 1 S)		
10.2	No. of Duplex Basket Strainer	Nos.	1 No.		
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/Duplex Basket Strainer	Bar (g)	Refer Section IIA		
10.4.2	Test duration	Min	Refer Section IIA		
11.0	**Painting**				

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	TECHNICAL DATA SHEET- A				SECTION : ID
					REV.NO: 00
					DATE: 09/12/19
S.no.	**Description**	**Units**	**Data/Parameters**		
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 316L	SS 316L	SS 316L
12.2	Clamping Plates/Clamps		SS 316L	SS 316L	SS 316L
12.3	Basket frame and wire damping bars		SS 316L	SS 316L	SS 316L
12.4	Fasteners		SS 316L	SS 316L	SS 316L
12.5	Head Shaft		SS 316L	SS 316L	SS 316L
12.6	Foot Shaft (if applicable)		SS 316L	SS 316L	SS 316L
12.7	Head/Foot Sprockets		SS 316L	SS 316L	SS 316L
12.8	Carrying chain		SS 316L	SS 316L	SS 316L
12.9	Rubber Seals		As per Appendix-B of IS: 4622	As per Appendix-B of IS: 4622	As per Appendix-B of IS: 4622
12.10	**Carrying chain & rollers**				
12.10.1	Carrying Chain pins,&Bushing		Duplex SS for Pin SS 420 Hardened to at least 450 BHN for Bush or vice versa	Duplex SS for Pin SS 420 Hardened to at least 450 BHN for Bush or vice versa	Duplex SS for Pin SS 420 Hardened to at least 450 BHN for Bush or vice versa
12.10.2	Drive Chain type		Duplex Type of Approved Make	Duplex Type of Approved Make	Duplex Type of Approved Make
12.10.3	Drive chain pin/Bushing		Duplex SS for Pin SS 420 Hardened to at least 450 BHN for Bush or vice versa	Duplex SS for Pin SS 420 Hardened to at least 450 BHN for Bush or vice versa	Duplex SS for Pin SS 420 Hardened to at least 450 BHN for Bush or vice versa
12.10.4	Shaft bearing Bushing spherical roller		SS 316L	SS 316L	SS 316L
12.10.5	Sprocket		SS 316L	SS 316L	SS 316L
12.10.6	Torque tube		SS 316L	SS 316L	SS 316L
12.10.7	Main supporting frame		SS 316L	SS 316L	SS 316L

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM, TRASH RACK ALONG WITH AUTOMATIC TRASH RACK CLEANING MECHANISM SYSTEM				SPEC NO: PE-TS-435-172-N001
	TECHNICAL DATA SHEET- A				SECTION : ID
					REV.NO: 00
					DATE: 09/12/19
S.no.	**Description**	**Units**	**Data/Parameters**		
12.10.8	Screen chain side bars		SS 316L	SS 316L	SS 316L
12.10.9	Drive Chain guard		SS 316L	SS 316L	SS 316L
12.10.10	Baffle plate in boot section		SS 316L	SS 316L	SS 316L
12.10.11	Guide ways / Anchor		SS 316L	SS 316L	SS 316L
12.10.12	Splash housing and refuse chute		FRP / SS 316L	FRP / SS 316L	FRP / SS 316L
12.10.13	Basket frame		SS 316L	SS 316L	SS 316L
12.11	**Trash Rack with automatic raking mechanism**		SS 316L	SS 316L	SS 316L
12.12	**Pipe, Nozzles & Valves**				
12.12.1	Spray nozzle		Duplex SS	Duplex SS	Duplex SS
12.12.2	Pipe work				
12.12.2.1	Upto 50 NB		Duplex SS	Duplex SS	Duplex SS
12.12.2.2	above 50 NB		Duplex SS	Duplex SS	Duplex SS
12.12.3	Valve 350 NB and Below (Gate/Globe Valves only)				
12.12.3.1	Body, Bonnet & Trim		A 439 Gr. D2- NI RESIST/ Duplex SS	A 439 Gr. D2- NI RESIST/ Duplex SS	A 439 Gr. D2- NI RESIST/ Duplex SS
12.12.4	Check Valves				
12.12.4.1	Body & Bonnet		A 439 Gr. D2- NI RESIST/ Duplex SS	A 439 Gr. D2- NI RESIST/ Duplex SS	A 439 Gr. D2- NI RESIST/ Duplex SS
12.12.4.2	Seating surface &stem		Duplex SS	Duplex SS	Duplex SS
12.12.4.3	Disc		A 439 Gr. D2- NI RESIST/ Duplex SS	A 439 Gr. D2- NI RESIST/ Duplex SS	A 439 Gr. D2- NI RESIST/ Duplex SS
12.12.4.4	Hinge Pin		Duplex SS	Duplex SS	Duplex SS
12.13	**Spray Wash pump**				
12.13.1	Spray Wash pump Casing		Duplex SS		
12.13.2	Spray Wash pump impeller		Duplex SS		

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM, TRASH RACK ALONG WITH AUTOMATIC TRASH RACK CLEANING MECHANISM SYSTEM				SPEC NO: PE-TS-435-172-N001
	TECHNICAL DATA SHEET- A				SECTION : ID
					REV.NO: 00
					DATE: 09/12/19
S.no.	**Description**	**Units**	**Data/Parameters**		
12.13.3	Spray Wash pump Shaft		Duplex SS		
12.13.4	Material of Gland Packing /Mechnical Seal (If applicable)		AS PER MANUFACTURER PRACTICE		
12.14	**Debris Segregation and collection baskets**				
12.14.1	Frame		SS 316L		
12.14.2	Wire Mesh		SS 316L		
12.14.3	Flanges		SS 316L		
12.15	**Duplex Basket Strainer**				
12.15.1	Body		ASTM A216 Gr.WCB or equivalent (Internally Rubber Lined)		
12.15.2	Screen / All other internals		Duplex SS		
12.16	All Non-Wetted Fastners		SS 316L	SS 316L	SS 316L
12.17	All Wetted Fastners		Duplex SS	Duplex SS	Duplex SS
13.0	**MANDATORY SPARES**		AS PER ANNEXURE-A OF THIS DATASHEET	AS PER ANNEXURE-A OF THIS DATASHEET	AS PER ANNEXURE-A OF THIS DATASHEET
	NOTE: The material of construction of each component of the Travelling Band Screen & Trash Rack along with Automatic Cleaning Mechanism 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.				

2X660 MW UDANGUDI STPP STG I
Mandatory Spares List for TBS & TRASH RACK WITH AUTMATIC TRASH RACK CLEANING MECHANISM SYSTEM Package

MANDATORY SPARES – ANNEXURE A

S.No.	Spare Description	Unit	Quantity
1	**415 Volt Motor**		
1.1	Driving End & Non-Driving End Bearing	LOT	1 LOT (1 Set of each type=1 LOT)
1.2	Motor Terminal Block	LOT	1 LOT (10 Nos. for each type and rating of Motor = 1 LOT)
1.3	Motors of each type & rating	LOT	1 LOT (1 No. = 1 LOT)
2	Local Indicators like temperature gauges, pressure gauges, differential pressure gauges, flow gauges, flow meters etc.,	LOT	2 LOTS (10% or 2 no. of each make, model and type whichever is more.= 1 LOT)
3	**INSTRUMENTATION CABLE. INTERNAL WIRING AND ELECTRICAL FIELD**		
3.1	Pre fabricated cable of each type	LOT	2 LOTS (10% of installed quantity= 1 LOT)
3.2	Pre fabricated cable connector	LOT	2 LOTS (10% or 1 no.of each type and model, whichever is more. = 1 LOT)
3.3	Other cables	LOT	2 LOTS (5% of each type, pair and size of actual installed quantity = 1 LOT)
4	Electrical actuator, complete assembly, of each rating	LOT	1 LOT (2 Nos. = 1 LOT)

Notes for Mandatory Spares:

1	Spares not applicable for the Package to be specifically quoted as “NOT APPLICABLE”.
2	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.
3	Wherever % is indicated for the mandatory spares, the quantity shall be calculated for % of supply for one unit, 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.
4	In respect of quantity mentioned as 'Set' means the total quantity of all the components/items used in particular equipment unless otherwise specified.

TYPICAL SEA WATER ANALYSIS (FOR 2X660 MW UDANGUDI)

SAMPLE IDENTIFIED AS : SEA WATER

SAMPLING METHOD	N.A.
SAMPLE DESCRIPTION	SEA WATER
SAMPLE QTY.	20L
SAMPLE CODE	N.08+24,001,E-78+04,088/09.09.06
MARK	TOP LAYER
COLLECTED ON	09/09/2006
TEST START DATE	13/09/2006
TEST END DATE	27/09/2006

S.NO	Parameter	Protocol	Result
1	pH	ASTM D1292-99	7.98
2	Conductivity	ASTM D1125-99	53700µS/cm
3	Temperature	ASTM method	34°C
4	Turbidity	ASTM D1889-00	12.5 NTU
5	Salinity	ASTM method	35.5
6	Total Suspended Solids	ASTM D1888	6 mg/l
7	Total Organic Carbon	ASTM D4129-98	Less than 5 mg/l
8	Calcium as Ca	ASTM D511-98	400 mg/l
9	Magnesium as Mg	ASTM D511-98	1274 mg/l
10	Sodium as Na	ASTM D1428	12600 mg/l
11	Potassium as K	ASTM D1428	380 mg/l
12	Ammonia as NH3	ASTM D1426-98	BDL (DL : 0.01 mg/l)
13	Strontium as Sr	ASTM D5673-02	1.57 mg/l
14	Barium as Ba	ASTM D5673-02	BDL (DL : 0.41 mg/l)
15	Total Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
16	Dissolved Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
17	Total Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
18	Dissolved Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
19	Total iron as Fe	ASTM D1068-03	0.30 mg/l
20	Dissolved iron as Fe	ASTM D1068-03	0.16 mg/l
21	Chloride as Cl	ASTM D512-99	21088 mg/l
22	Sulfate as SO4	ASTM D516-02	3189 mg/l
23	Nitrate as NO3	ASTM 3867-99	0.87 mg/l
24	Nitrite as NO2	ASTM D3867-99	0.008 mg/l
25	Bicarbonate as HCO3	ASTM D1067-02	140 mg/l
26	Carbonates as CO3	ASTM D1067-02	NIL

27	Fluoride as F	ASTM D1179-99	1.4 mg/l
28	Boron as B	ASTM D3082-03	1.29 mg/l
29	Phosphate as PO4	ASTM D515-97	0.08 mg/l
30	Sulfide as H2S	ASTM D4658-03	BDL (DL : 0.01 mg/l)
31	Total Silica as SiO2	ASTM D859-00	0.31 mg/l
32	Dissolved Silica as SiO2	ASTM D859-00	0.18 mg/l
33	Dissolved Oxygen	ASTM D888-96	5.5 mg/l
34	BOD @ 27°C for 3 days.	ASTM method	10 mg/l
35	Phenols	ASTM D1783-01	BDL (DL : 0.001 mg/l)
36	COD	ASTM D1252-00	62 mg/l
37	Oil & Grease	ASTM D4281-01	Less than 1 mg/l
38	Zinc as Zn	ASTM D5673-02	BDL (DL : 0.003 mg/l)
39	Copper as Cu	ASTM D5673-02	BDL (DL : 0.006 mg/l)
40	Nickel as Ni	ASTM D5673-02	BDL (DL : 0.008 mg/l)
41	Cadmium as Cd	ASTM D5673-02	BDL (DL : 0.003 mg/l)
42	Lead as Pb	ASTM D5673-02	BDL (DL : 0.01 mg/l)
43	Mercury as Hg	ASTM D5673-02	BDL (DL : 0.001 mg/l)

NOTE: BDL: Below Detection Limit.
DL : Detection Limit

COC of 1.5 to be considered for MOC Selection

SECTION IIA
STANDARD TECHNICAL REQUIREMENT
FOR
MECHANICAL SYSTEMS

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 statures, 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-AEach 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.

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

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.

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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

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

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 through 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.

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.

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

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

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

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 :

a) Removal of oil, grease, dirt and swarf etc.
b) Removal of rust and scale etc.
c) 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

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

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 :-

a) Design and maximum flow rates.
b) Design and test pressures(wherever applicable)
c) Design temperature.
d) Empty and operating weights.

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

a) Service.
b) Design and test pressures.
c) Maximum flow and flow direction.
d) Size.
e) Engineer's Tag Number.

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

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

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

BHARAT HEAVY ELECTRICALS LIMITED

PROJECT | **PROJECT ENGINEERING MANAGEMENT**

VENDOR | **STANDARD QUALITY PLAN**

SECTION : **II A**
ITEM : **TRAVELLING BAND SCREEN**

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CATE-GORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
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.	MA	Visual, Measuremen Chemical analysis, Mech. Test	100%	ppvd. Data Sheet Drgs.	Appvd. Data Sheet / Drgs.	Mtrl. Test cert./ Lab. Report	3	3	2	For bar < 50 mm dia shall be MPI tested instead of UT Test certificates shall be submitted
		b) Ultrasonic test	MA	NDT	100%	ASTM A 388	ASTM A 388	Inspection report	3	3	2	Test certificates shall be submitted
		c) DPT on machined surface	MA	NDT	100%	ASME Sect V / ASTM E 165	ASME Sect VIII & No surface defect	Inspection report	3	3	2	Test certificates shall be submitted
1.2	Carrying chain side bars	a) Verification of Mill TC for mech. / chem. Props., dimensional check.	MA	Visual, Measurement Chemical analysis	100%	Appvd. Data Sheet /Drgs.	Appvd. Data Sheet /Drgs.	Mtrl. Test cert./ Lab. Report	3	3	2	Test certificates shall be submitted
		b) DPT on machined surface	MA	NDT	10%	ASTM E 165	No Surface Defects 100%	Inspection Report	3	3	2	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	MA	Visual	100%	SS : SA193 CS: IS 1364/ IS 1367	SS :SA193 Gr B8M CS: IS 1364/S 1367	Insp. Report	3	3	2	
		b.)Chemical properties	MA	Verification of MTC	1 per heat	SS : SA193 CS: IS 1364/S 1367	SS :SA193 Gr B8M CS: IS 1364/S 1367	Material Test Certificate	3	3	2	Test certificates shall be submitted
		c.)Physical properties	MA	Verification of MTC	1 per heat	SS : SA193 CS: IS 1364/S 1367	SS :SA193 Gr B8M CS: IS 1364/S 1367	Material Test Certificate	3	3	2	Test certificates shall be submitted
1.5	Rubber Seals	a.)Surface defects	MA	Visual	100%	No surface defect	No surface defect	Insp. Report	3	3	2	
		b.)Resistance to scratch	CR	Hardness	10% of the Lot	As per approved Drawing/Data Sheet	As per approved	Insp. Report	3	3	2	Test certificates shall be submitted
1.6	Screen wire mesh	a.) Visual, Dimension &	MA	Visual, Dimension	100% /	As per approved Drawing/Data Sheet	As per approved Drawing/Data Sheet	Insp. Report /	3	3	2	
		b.) Chemical composition	MA	and verification of MTC	1 / Lot	As per approved Drawing/Data Sheet	As per approved Drawing/Data Sheet	Material Test Certificate	3	3	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

SIGNATURE:

LEGENDS

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 P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		b.) Dimension	MA	Measurement	100%	As per approved Drawing/Data Sheet	As per approved Drawing/Data Sheet		3	3	2	Test certificates shall be submitted
1.8	Head Sprocket	a.) Surface defects,	MA	Visual	100%	As per approved Drawing/Data Sheet	As per spec./	Insp. Report	3	3	2	
		b.) Dimension	MA	Measurement	100%	Drawing	Drawing	Insp. Report	3	3	2	Test certificates shall be submitted
		c.) NDT	CR	Ultrasonic testing	100%	As per approved procedure	As per approved procedure	Test report				
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	Test report	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	3	3	2	Test certificates shall be submitted
		b.) Surface finish	MA	Visual	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet	Test report	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	3	3	2	Test certificates shall be submitted
		b.) Surface finish	MA	Visual	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet	Test report	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**											
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

SIGNATURE:

LEGENDS

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**

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
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	
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	All TBS will be offered for functional test
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	Compliance certificate/Inspection
	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

SIGNATURE:

LEGENDS

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

SECTION IIB
STANDARD TECHNICAL REQUIREMENT
FOR
ELECTRICAL SYSTEMS

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.: PE-SS-999-506-E101 Rev 00

1.0 INTENT OF SPECIFIATION

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer's work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

2.0 CODES AND STANDARDS

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

IS:325	Three phase Induction motors
IS : 900	Code of practice for installation and maintenance of induction motors
IS: 996	Single phase small AC and universal motors
IS: 4722	Rotating Electrical machines
IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines
IS: 4728	Terminal marking and direction of rotation rotating electrical machines
IS: 1231	Dimensions of three phase foot mounted induction motors
IS: 8789	Values of performance characteristics for three phase induction motors
IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
IS: 2148	Flame proof enclosures for electrical appliance
IS: 5571	Guide for selection of electrical equipment for hazardous areas
IS: 12824	Type of duty and classes of rating assigned
IS: 12802	Temperature rise measurement for rotating electrical machnines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechanical vibration of rotating electrical machines

In case of imported motors, motors as per IEC-34 shall also be acceptable.

3.0 DESIGN REQUIREMENTS

3.1 Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2 Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information
Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

3.3 Starting Requirements

3.3.1 Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

3.3.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.

The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.

3.3.3 The following frequency of starts shall apply

i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.

ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)

iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for mimimum 20,000 starts during the life time of the motor

3.4 **Running Requirements**

3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.

3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.

3.5 **Stress During bus Transfer**

3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.

3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.

3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.

4.0 **CONSTRUCTIONAL FEATURES**

4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy

4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.

Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled

4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.

4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.

4.5 Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.

4.6 In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.
In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.

4.7 **Terminals and Terminal Boxes**

4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.

Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".

4.7.2 unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.

4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively.

4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.

4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.

4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.

4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.

4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.

4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.

4.8 Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.

4.9 **General**

4.9.1 Motors provided for similar drives shall be interchangeable.

4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.

4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.

4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.

4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.

4.9.6 Name plate with all particulars as per IS: 325 shall be provided

4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.

5.0 INSPECTION AND TESTING

5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.

5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.

5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.

5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.

6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT

a) OGA drawing showing the position of terminal boxes, earthing connections etc.
b) Arrangement drawing of terminal boxes.
c) Characteristic curves:
(*To be given for motor above 55 kW unless otherwise specified in Data Sheet*).

i) Current vs. time at rated voltage and minimum starting voltage.
ii) Speed vs. time at rated voltage and minimum starting voltage.
iii) Torque vs. speed at rated voltage and minimum voltage.
For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.
iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.

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	

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 ≥ 55KW)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION TITLE			
	SHEET 1 OF 2		SYSTEM			ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**			**11**
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1		NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3

BHEL	**PARTICULARS**	**BIDDER/VENDOR**
	NAME	
	SIGNATURE	

	QUALITY PLAN	CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :					
		BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION : TITLE :					
	SHEET 2 OF 2	SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION		VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	**W**	**V**	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**			**11**
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	

NOTES:

1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON

2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.

Legends for Inspection agency

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

SECTION II C
STANDARD TECHNICAL SPECIFICATION
FOR
CONTROL & INSTRUMENTATION SYSTEMS

QUALITY PLANS FOR

1. LOCAL CONTROL CUM STARTER PANEL
2. INSTRUMENTS

PEM :: C&I

STANDARD QUALITY PLAN
FOR LOCAL CONTROL CUM STARTER PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 28.03.2017
SHEET	1 OF 7

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

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

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

1 - BHEL
2 - Vendor
3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN
FOR LOCAL CONTROL CUM STARTER PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 28.03.2017
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 $ P	Agency $ W	Agency $ V	Remarks
		3. Conductor a) Resistance b) Size c) Sheet colour	 MA MA MA	 Electrical Measurement Visual	 100% 100% 100%	 BHEL Spec. and IS:1554 or IS:694	 BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---	
		4. Type / Routine Test Certificates	MA	Verification	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	3	---	2	
4.0	Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays Timers Space Heaters Thermostat Indicating meters etc.	1. Verification at make and Type	CR	Visual	Sample	BHEL Spec. and BOM	BHEL Spec. and BOM	Log Book	2	---	---	
		2. Verification of Test Certificates	CR	Scrutiny of Type / Routine T.Cs.	100%	Relevant IS	Relevant IS	Log Book	2	---	---	
		3. Operation / Functional check	CR	Electrical	Sample+ 100%@	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---	+ for relay & contactors only
		4. I.R.	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---	@ for all components except relays & contactors.
		5. H.V.	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---	
		6. Calibration	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	1	
		7. Pick up / Drop off Voltage	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---	

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

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

1 - BHEL
2 - Vendor
3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN
FOR LOCAL CONTROL CUM STARTER PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 28.03.2017
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
									P	W	V	
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
		2. Surface defects	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
		3. IR / HV on Terminal Blocks	MA	Electrical	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
	IN PROCESS											
6.0	Blanking / Bending / Forming	1. Dimensions	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
		2. Surface defects after bending	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	---	
7.0	Nibbling / Punching	1. Cutout Sizes	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
		2. Deburring	MA	Visual	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
	ASSEMBLY											
8.0	Frame Assembly & Sheet fixing	1. Dimensions	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		2. Alignment	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		3. Welding Quality	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		4. Surface defects	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	

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

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

1 - BHEL
2 - Vendor
3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN
FOR LOCAL CONTROL CUM STARTER PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 28.03.2017
SHEET	4 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $			Remarks
									P	W	V	
9.0	Pre-treatment and Painting	1. Pretreatment Process	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		2. Process parameters like bath temp. concentration etc.	MA	Measurement	Periodic	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		3. Dipping / Removal Time	MA	Measurement	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		4. Surface quality after every dip	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		5. Primer after phosphating	MA	Visual, Thickness	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		6. Putty Application & Rubbing after primer	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		7. Paint first coat	MA	Visual, Thickness	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		8. Putty Application and Rubbing after first coat of paint	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		9. Paint second coat	MA	Visual, Thickness, Scratch test Colour adhesion	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	

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STANDARD QUALITY PLAN
FOR LOCAL CONTROL CUM STARTER PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 28.03.2017
SHEET	5 OF 7

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

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STANDARD QUALITY PLAN
FOR LOCAL CONTROL CUM STARTER PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 28.03.2017
SHEET	6 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $			Remarks
									P	W	V	
		5. Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	
		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	

At Random by BHEL, based on 100 % internal test reports by Mfr.

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PEM :: C&I

STANDARD QUALITY PLAN
FOR LOCAL CONTROL CUM STARTER PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 28.03.2017
SHEET	7 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $			Remarks
									P	W	V	
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	Type Test Certificate	3	---	1	
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant IS.	BHEL approved spec., drg., BOM & relevant IS.	Test Report	2	1	1	
15	FUCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		2. Instrument Calibratio	CR	Electrical	10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		3. Temperature rise	CR	Electrical	100%	BHEL approved spec/drg. & relevant IS.	BHEL approved spec/drg & relevant IS.	Inspection Report	2	1	1	

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QUALITY ASSURANCE FOR INSTRUMENTS

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 :

1. Quantum of check shall be as below :
   100 % - By Manufacturer
2. Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
3. When material corelation are not available manufacturer's compliance to be provided.
4. 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 :

1. Quantum of check shall be as below :
   100 % - By Manufacturer
2. Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
3. Manufacturer to carry out ROUTINE TEST on 100 %.
4. When material corelation is not available, MFR's compliance to be provided
5. 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 ANNUNCIATORS

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

Legend :

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Note :

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

SECTION III

(DOCUMENTS TO BE SUBMITTED BY BIDDER)

	TITLE : COMPLIANCE CERTIFICATE FOR TRAVELLING BAND SCREEN	SPEC. NO.	PE-TS- 435-172-N001 (REV-00)
	PROJECTS: 2X660 MW UDANGUDI STPP STG I	DATE:	09.12.2019
		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 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 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.

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 TECHNICAL DATA SHEET- B		SPEC NO: PE-TS-435-172-N001 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 Trash Rack at upstream of TBS	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	

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 Headin 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 opeining	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	

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	

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**		

S.no.	Description	Units	Data/Parameters
12.1	Travelling Band Screening sysetm is designed for the following operation modes:		
12.1.1	Automatic start up initiated by High differential level		
12.1.2	Automatic start-up intiated 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 fo drive mecahnism 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 TECHNICAL DATA SHEET- B		SPEC NO: PE-TS-435-172-N001 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	m2	
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 TECHNICAL DATA SHEET- B		SPEC NO: PE-TS-435-172-N001 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 (whever 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	Kgs	
	be handled including filled up debris segregation basket		
25.2	Recommended Gantry crane capacity	Kgs	
26.0	**Civil loadiing 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		

S.no.	Description	Units	Data/Parameters
27.2	Clamping Plates/Clamps		
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		

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	SPECIFICATION NO.
BHEL	**MOTOR** **DATA SHEET - C**	**VOLUME** II B **SECTION** D **REV NO. 00 DATE 29/08/2005** **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	

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 ≥ 55KW)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

LOAD TITLE	RATING (KW / A)		FULL LOAD CURRENT FLC(A)	UNIT (U)/STN. (S)	Nos.		VOLTAGE CODE*	FEEDER CODE*	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME> 5 SEC (Y)	LOCATION (Tag. No.)	RATING & FLC CHECKED FROM MOTOR/VALVE APPROVED DATASHEET (Y/N)	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.	KKS NO.
	NAME PALTE	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	20	21	22
NOTES: 1. COLUMN 1 TO 14 & 20 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)																					
2. ABBREVIATTIONS : * 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 (DC) : G =220V, H = 110 V, J = 48 V, K = +24V, L= -24V																					
: **FEEDER CODE (8) :- U = UNIDIRECTIONAL STARTER, B = BIDIRECTIONAL STARTER, S = SUPPLY FEEDER, D = SUPPLY FEEDER (CONTACTOR CONTROLLED)																					

BHEL	LOAD DATA (ELECTRICAL)		JOB NO.							ORIGINATING AGENCY			PEM (ELECTRICAL)	
			PROJECT TITLE							NAME			DATA FILLED UP ON	
			SYSTEM / S							SIGN.			DATA ENTERED ON	
			DEPTT. /SECTION							SHEET 1/2		REV. R0	DE'S SIGN. & DATE	

CABLE SCHEDULE FORMAT **ANNEXURE III**

UNITCABLENO	FROM	TO	PURPOSE	CABLE SCOPE (BHEL PEM/ VENDOR)	REMARKS	CABLESIZE	PATHCABLENO	TENTATIVE CABLE LENGTH

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

1. For the purpose of clarity, it may please be noted that the information given in regard to the cables to be routed through WinPath as per the system elaborated below is called "Cable List", while the term "Cable Schedule" applies to the cable list with routing information added after routing has been carried out.
2. The cable list shall be entered as an MS Excel file in the format as per enclosed template EXT_CAB_SCH_FORMAT.XLS. No blank lines, special characters, header, footer, lines, etc. shall be introduced in the file. No changes shall be made in the title line (first line) of the template.
3. The field properties shall be as under:
    a. UNITCABLENO: A/N, up to sixteen (16) characters; each cable shall have its own unique, unduplicated cable number. In case this rule is violated, the cable cannot be taken up for routing.
    b. FROM: A/N, up to sixty (60) characters; the "From" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
    c. TO: A/N, up to sixty (60) characters; the "To" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
    d. PURPOSE: A/N, up to sixty (60) characters; the purpose (i.e. power cable/ indication/ measurement, etc.) to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
    e. REMARKS: A/N, up to forty (40) characters; Any information pertinent to routing to be specified here (e.g., cable number of the cable redundant to the cable number being entered). Information in excess of 40 characters will be truncated after 40 characters.
    f. CABLESIZE: A/N, 7 characters exactly as per the codes indicated below shall be specified here. The program cannot route cables described in any other way/ format.
    g. PATHCABLENO: Field reserved for utilization by the program. User shall not enter any information here.
4. One list shall be prepared for each system/ equipment (i.e., separate and unique cable lists shall be prepared for each system).
5. The cables shall be described as per the scheme listed below:

A	NN	A	NNN
|	|	|	|
Cable Voltage Code (see B below)	No. of cores (e.g. 01,03,3H, 07)	Cable code (See C below)	Cable size (e.g. 035,185,2.5, 0.5)

(A) SYSTEM VOLTAGE CODES:
(ac) A = 11KV, B = 6.6KV, C = 3.3KV, D = 415V, E = 240V, F = 110V
(dc) G = 220V, H = 110V, J = 48V, K = +24V, L = -24V

(B) CABLE VOLTAGE CODES:
A = 11KV (Power cables)

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

B = 6.6KV (Power cables)
C = 3.3KV (Power cables)
D = 1.1KV (LV & DC system power & control cables)
E = 0.6KV (0.5 sq. mm. Control cables)

(C) CABLE CODES

PVC Copper

A = Armoured FRLS	B = Armoured Non-FRLS
C = unarmoured FRLS	D = Unarmoured Non-FRLS

PVC Aluminium

E = Armoured FRLS	F = Armoured Non-FRLS
G = unarmoured FRLS	H = Unarmoured Non-FRLS

XLPE Copper

J = Armoured FRLS	K = Armoured Non-FRLS
L = unarmoured FRLS	M = Unarmoured Non-FRLS

XLPE Aluminium

N = Armoured FRLS	P = Armoured Non-FRLS
Q = unarmoured FRLS	R = Unarmoured Non-FRLS

S = FIRE SURVIVAL CABLES
T = TOUGH RUBBER SHEATH
U = OVERALL SCREENED
V = PAIRED OVERALL SCREENED
W = PAIRED INDIVIDUAL SCREENED
Y = COMPENSATING CABLES
I = PRE-FABRICATED CABLES
Z = JELLY FILLED CABLES