

TANGEDCO
2X660 MW UDANGUDI STPP STG I

**TECHNICAL SPECIFICATION
FOR
SUMP PUMPS**

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



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



TITLE:
**TECHNICAL SPECIFICATION FOR RATE
CONTRACT OF SUMP PUMPS**

SPEC. NO.: **PE-TS-435-172-N001**

SECTION:

SUB-SECTION:

REV. NO. **0** DATE :05.10.19

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Notes:

1) 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.



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SECTION - I

SPECIFIC TECHNICAL REQUIREMENTS

SUB-SECTION IA - Specific Technical Requirements (Mech.)
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SUB-SECTION – IA

SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)



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1.0 SCOPE:

This enquiry covers the design, manufacture, assembly, inspection and testing at manufacturer's and/or his sub-contractors works, proper packing for delivery and mandatory spares complete with all accessories as per the requirements specified in this specification and any other services, etc. if called for in the succeeding sections of the specification.

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Evaluation of sump pumps as indicated in technical specification shall be as per NIT.

Note:

- a) The bidder shall include complete supplies for the project in his scope, part supplies offered for project shall disqualify the offer.
- b) Sump pumps details viz. quantity, Capacity, Head, Materials of construction, Mandatory spares and other particulars are detailed in Data Sheet-A at Section-ID of the specification.

2.0 SCOPE OF SUPPLY:

2.1.1 Scope of supply includes Pumps, motors with standard/special accessories which shall necessarily be the part of the pump bidder scope.

2.1.2 The pumps shall be complete with following standard/ special accessories- as applicable.

2.2.1 Standard accessories to be supplied with each pump.

- a) Electric motor drive with cable glands.
- b) Self-contained lubrication system.
- c) Erection & commissioning spares, as required.
- d) Supply of first fill of lubricants including second fill/ replenishment as necessary after commissioning and handing over of equipment.

2.2.2 Special accessories included in Bidder's scope of supply:

The following accessories besides those stipulated in Data Sheet-A shall be in bidder's scope.

a). For TYPE 1 (Fixed Vertical Type Sump Pumps)

The following to be included in pump bidder scope.

- Pump flange and Counter Flanges with Nuts, Bolts, Gaskets etc.
- Level Transmitters in Pit, Pressure Gauges and Pressure Transmitters at Pump Discharge Line shall be provided by Purchaser.
- Any other standard accessory required for safe and trouble free operation of Pumps to be provided by Bidder.

b). For TYPE 2 (Fixed Duty Submersible Sump Pumps):

The following to be included in pump bidder scope.

- One No. wall mounted local control panel for each set of two (2) Nos. of submersible sump pumps. The LCP shall also house starter panel of submersible sump pumps.



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For details of panels and control interlocks- refer Clause No. 7.1 in succeeding paras of this Section. Control system for projects shall be relay based.

- Submersible type power & control cable for each pump of lengths as per data sheet A of respective project with suitable connection arrangement to wall mounted starter cum control panel. Separate Cables shall be provided by Bidder for power and control purpose and these cables shall not be bunched together. Minimum size of power cables shall not be less than 2.5 mm square. Cable shall be flexible copper conductor PVC insulated, armored and overall hard grade PVC sheathed. In case where power and control cables are combined, the paired screened cable shall be provided.
- One (1) no. Delivery bend shall be provided with necessary Counter Flanges with Nuts, Bolts, Gaskets etc. with each pump.
- Two (2) nos. 30m long discharge hose(canvas) having female hose coupling at both ends & of size to suit pump discharge shall be provided for each pump. Arrangement of connecting hose with pump discharge and connecting with discharge pipe works of purchaser (if applicable) shall be as per clause no. 2.2.4 below.
- One (1) no. male type hose coupling, one end of which is suitable to couple with the discharge hose and the other end is flanged, matching with the above mentioned Delivery bend and connected therewith by necessary bolts, nuts & gaskets.
- One (1) no. 30 meters long submersible type power cable with a hermetically sealed (waterproof) cable gland for connection with the pump drive- motor.
- Skirt base with suction strainer as applicable.
- Suitable lugs and other attachments on the pump motor assembly frame for hoisting and lowering of the pump motor set from and to the sump with chain (Chain length: 15 M).
- One no. Wall Mounted Common Relay based control panel for each set of 2 Nos.(two) pumps with integral starter and other features as detailed in C&I Specification.
- 3 Nos. Level switches as per control interlock requirement as detailed in Clause No. 7.2 herein.
- Other accessories as mentioned in Datasheet-A.
- Any other standard accessory required for safe and trouble free operation of Pumps to be provided by Bidder.

c). For TYPE 3 (Portable trolley mounted Submersible type sump pumps):

For these pumps 63 amps. Welding socket shall be made available by BHEL for power supply. The following shall be included in pump bidder scope:

- Wheel trolley for carrying pump and drive unit along with starter cum control panel. Trolley shall have swiveling front wheel and have adequate fixing arrangement for pump motor set with a base frame along with all below accessories, for operation without any undue vibration and with facility for being handled by a single operator.

The trolley shall be provided with "Hose Reeling Drum" & "Cable Reeling Drum".

The pump motors set shall be suitably mounted on trolley with solid rubber type wheels, the trolley shall be of robust construction. The portable pump with its drives shall be secured to the trolley such that there is no unbalance when the trolley is



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moved from one location to another or when the pump is working. The number of wheel trolleys shall be one (1) per pump.

- One Trolley Mounted starter panel, having a plug socket as receptacle of the above mentioned power plug (item "d"), a 50-meter-long incoming power cable with switch/contacter and fuse, start- stop push buttons, red and green LED type indication lamps, over load relays, O/L reset push button, cable gland etc. Power Supply requirement to Starter Panels etc. shall be through 2P MCBs. The starter cum control panel shall be suitable for outdoor duty and to be provided with protection canopy.

Control system shall be relay based.

- Power cable connected to starter panel at one end and with plug compatible to 63 amp. Socket at the other end (Details shall be furnished during contract stage.) for connecting purchaser's power supply to starter panel.
- Hose pipe with hose nipple, flanges, nuts and bolts & matching counter-flange with nuts, bolts and gaskets for connecting with pump discharge at one end & discharge pipe works of purchaser at other end. Arrangement of connecting hose with pump discharge and connecting with discharge pipe works of purchaser shall be as per clause no. 2.2.13 below.
- One (1) no. Delivery bend shall be provided with necessary Counter Flanges with Nuts, Bolts, Gaskets etc.
- Two (2) nos. 30m long discharge hose(canvas) having female hose coupling at both ends & of size to suit pump discharge shall be provided for each pump.
- One (1) no. male type hose coupling, one end of which is suitable to couple with the discharge hose and the other end is flanged, matching with the above mentioned Delivery bend and connected therewith by necessary bolts, nuts & gaskets.
- One (1) no. 30 meters long submersible type power cable with a hermetically sealed (waterproof) cable gland for connection with the pump drive- motor.
- Skirt base with suction strainer as applicable.
- Suitable lugs and other attachments on the pump motor assembly frame for hoisting and lowering of the pump motor set from and to the sump with chain (Chain length: 15 M).
- Level switches as per control interlock requirement as detailed in Clause No. 7.2 herein.
- Other accessories as mentioned in Datasheet-A.
- Any other standard accessory required for safe and trouble free operation of Pumps to be provided by Bidder.

2.2.3 Rust inhibitor paint at Manufacturer's works.

2.2.4 Arrangement of connecting hose with pump discharge & discharge pipe of purchaser (if required).

One end of the discharge flange of the pump shall be connected to the delivery bend of suitable size.

Suitable sized expander/ reducer if required shall be connected with necessary flanges at both ends (bidder scope).

In case expander / reducer is not required, delivery bend shall be connected with hose nipple. Hose pipe shall be connected to hose nipple with necessary clamping arrangement.



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In case expander / reducer is required, flange connected with hose nipple shall be connected to reducer / expander. Hose pipe shall be connected to hose nipple with necessary clamping arrangement.

The other end of hose to be connected to pipe work of purchaser shall be provided with suitable flanged piece with counter flanges, nuts and bolts.

2.2.5 One set of special tools & tackles for maintenance of equipment for each project shall be in bidder's scope.

2.2.6 Bidder shall provide various drawings, data, calculations, test reports/ certificates operation & maintenance manuals including As Built drawings, etc. as specified and as necessary for the project.

3.0 Works excluded from Bidder's scope. The following/ services shall be provided by purchaser.

- a) Civil foundation
- b) Power supply

4.0 The pumps will be subjected to mechanical running at works and site by the purchaser. If the site performance is found not meeting the requirements including vibration and noise as specified, then the equipment shall be rectified or replaced by the vendor, at no extra cost to the purchaser.

5.0 High, reliability of the pumps is an essential requirement. It is therefore essential that the bidder chooses a standard proven model from the range of pumps manufactured. A comprehensive list of similar installations shall be submitted along with the bid.

6.0 OTHER REQUIREMENTS:

6.1 The submersible Sump pumps shall meet the technical requirements of Section-I as well as Section-II.

6.2 The Quality Plans enclosed in the specification are for bidder's guidance only. The bidder shall comply with these and other minimum requirements specified in the specification and shall furnish their own quality plan in the event of order based upon guidance given therein, for approval of BHEL/Customer as applicable to respective project.

7.0 Operational philosophy:

7.1 Controls for TYPE 1 (Fixed Duty Type Vertical Sump pumps):

Vertical Type Sump Pumps shall be controlled from Operator Work Station (OWS) in CCR through station DDCMIS, no local control panel is envisaged.

7.2 Controls for TYPE 2 (Fixed Duty Submersible pumps):

Submersible Sump Pumps shall be controlled through a Wall mounted starter cum control panel (in bidder's scope).

The local control panel shall be Relay based. The starter cum control panel shall be suitable for outdoor duty and to be provided with protection.

The following controls/interlocks shall be provided in the local control panel.



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- (a) Start/stop facility.
- (b) Selector switch for main/standby selection.
- (c) One number level switch (very high level) provided in the sump shall start second sump pump in the event of very high water level in the sump.
- (d) One number level switch (high level) provided in the sump shall start one number sump pump in the event of high water level in the sump.
- (e) One number level switch (low level) provided in the sump shall trip the running pumps in the event of low water level in the sump.
- (f) Sump pump status indication (ON/Off/Trip).
- (g) Indication for failure of any sump pump.
- (h) Indication for Low voltage, low level, high level, very high level and overload.
- (i) Ammeter shall be provided in LCP if motor rating is 30 KW or above.
- (j) Power and Control circuits shall be with MCCB.
- (k) Alarm shall be annunciated in the event of low water level in the sump.

Note: Level switches shall be top mounted displacer type.

7.3 Controls for TYPE 3 (Portable Submersible pumps):

Each submersible pump shall be provided with integral float type level switch mounted on pump frame for tripping the pump at low water level. The additional instruments/ interlocks required for pump - motor safety shall also be provided.

Each Portable type Sump pump shall be provided with starter panel as indicated above at S.No. 2.2.2 (c).

The start/ stop P.B. for pumps shall be provided in the panel being supplied by the bidder. Power and Control circuits shall be with MCCB. Any additional feature Specified in Data Sheet-A shall be provided.

- 8.0** No external water supply shall be available for the cooling/sealing of sump pumps. The portable type sump pumps shall be oil filled type.
- 9.0** The materials of construction for various components specified are the minimum requirements and materials of construction for other components not specified shall be similarly selected by the bidder for the intended duty.
- 10.0** The makes of various Bought-Out-Items of bidder shall be subject to Purchaser's approval.
- 11.0** It is mandatory for the bidder to submit along with the bid, the deviations if any whether major or minor in the schedule of deviations only. In the absence of deviations listed in the Schedule of Deviations, the offer shall be deemed to be in full conformity with the specification, notwithstanding anything else stated elsewhere in bidder's offer, data sheets etc. The bidder's deviations or implied/ indirect deviations in data sheets, etc. shall not be binding on the purchaser.



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12.0 The bidder shall guarantee the performance of pump- motor units along with accessories for rated, performance duties, including the acoustical/ vibrational aspects for the stipulated limits specified elsewhere in the specification.

NOTE: The discharge rate of sump pump is very much uncontrolled. As such pump should be capable to operate even under a condition of as low as 25% of specified total head.

13.0 DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE:

a. Delivery of Equipment shall be as per NIT.

b. The drawings to be submitted by bidder in event of award of contract:

- Technical Data Sheets of pump and motor
- GA drawings of pumps,
- Control philosophy & GA drawing of control panel.
- Quality Plan.
- O & M Manual.

c. Drawings submission schedule after the award of contract shall be as below:

PACKAGE	BHEL DRG NO	DRG TITLE	Drg Sch for Vendors
Sump Pumps/ Submersible pumps	Primary Documents:		
	PE-V8-435-172-N001	TDS AND PERFORMANCE CURVES OF SUMP PUMPS	R-0 within 21 days (for all except C&I Doc., for C&I Doc. 30 Days) from LOI/PO & subsequent revisions within 10 days of comments received from BHEL.
	PE-V8-435-172-N002	GENERAL ARRANGEMENT AND CROSS SECTIONAL - SUMP PUMPS	
	PE-V8-435-172-N003	TDS AND CURVES FOR MOTORS (IF APPLICABLE) OF SUMP PUMPS	
	PE-V8-435-172-N004	C&I Doc. -WRITE UP, WIRING DIAGRAM & GA OF CONTROL PANEL FOR SUMP PUMPS	
	PE-V8-435-172-N005	QP- SUMP PUMPS	
	Secondary Document:		Within 30 days from MDCC
	PE-V8-435-172-N006	O&M MANUAL-SUMP PUMPS	

14.0 Sub-Vendor List shall be furnished during detailed engineering. In case, Bidder offer makes other than the given list, the same shall be subject to approval of Customer/BHEL.

15.0 It is mandatory for the bidders to submit along with the bid the deviations if any whether major or minor in the schedule of deviations only. ***In the absence of deviations listed***



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in the schedule of deviations the offer shall be deemed to be in full conformity with the specification "non-withstanding" anything else stated elsewhere in bidder's offer, data sheets etc. The implied/ indirect deviations in data sheets etc. Shall not be binding on the purchaser.

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

- a) Compliance certificate duly signed and stamped.
- b) GA drawings of pumps with motors (shall be only for reference purpose, same shall not be reviewed/commented by purchaser at this stage and shall be subject to approval only during contract).

Apart from above no other drgs./docs./data sheets etc. are required to be submitted at bid stage and even if furnished shall not be taken cognizance of.

In case of any deviation from this technical specification, the same shall be indicated in the schedule of deviations as per Section-IIIC or NIT. In the absence of duly filled schedules it will be assumed that the bid strictly conforms to the specification.

17.0 Sump pumps/submersible pumps 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.

17.1 Preparation for Packing:

- After testing, operation, all fluids e.g. water etc., shall be completely drained from all 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 pumps shall be placed on a strong wooden base & bolted to the wooden base using the foundation holes for further transportation up to site.

17.2 Protection of parts:

- Pumps shall be packed in properly in high grade bubble plastic wrap for transportation, and long storage at site.
- Sump pumps 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



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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 sump pumps shall be closed properly by suitably covering to prevent foreign material entering in opened space.
- 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.

17.3 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.

17.4 Additional Dispatch Requirements

MDCC after final inspection shall be provided to vendor on the basis of following:-

- i) List of items packed in each box with description & quantity.
- ii) Photograph of each sump pump, control panel, hose pipe and each box in open & closed condition.
- iii) Bidder to include handling instructions in engineering drg/doc and packing to be done in such a way to avoid damage of items in transit and long storage at site and same shall be approved in contract stage by BHEL/Customer



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SUB-SECTION – IB

SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)

	TITLE: ELECTRICAL EQUIPMENT SPECIFICATION FOR SUMP PUMP 2 X 660 MW UDANGUDI STPP STAGE-I	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION: C
		REV NO. : 00 DATE: 03/10/2019
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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 Sump Pumps 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



TITLE:

**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
SUMP PUMP****2 X 660 MW UDANGUDI STPP STAGE-I**

SPECIFICATION NO.

VOLUME NO. : **II-B**SECTION: **C**REV NO. : **00** DATE: 03/10/2019SHEET: **OF**

- 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 copy of this sheet "Electrical Equipment Specification for Sump Pump package and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
 - 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**
- Electrical scope between BHEL & vendor
 - Technical specification – Specification for Electric Motors/Actuators
 - Standard Technical specification – LV Motors
 - Datasheets & quality plan for motors.
 - Load Data Format. (Annexure –II)
 - BHEL Cable listing format (Annexure –III)

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS) REV-0, DATE: 03.10.2019

PACKAGE : SUMP PUMPS

SCOPE OF VENDOR: SUPPLY

PROJECT : 2 X 660MW UDANGUDI STPP

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	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	
3	Any special type of cable like compensating, co-axial, prefab, MICC, fibre Optic cables etc.	Vendor	BHEL	
4	Cabling material (Cable trays, accessories ,cable tray supporting system, conduits etc.)	BHEL	BHEL	
5	Cable glands ,lugs, and bimetallic strip for equipment supplied by Vendor	Vendor	BHEL	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
6	Equipment grounding & Lightning protection	BHEL	BHEL	
7	Below grade grounding	BHEL	BHEL	
8	Motors along-with fixing accessories	Vendor	-	Makes shall be subject to customer/ BHEL approval at contract stage.

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 without any commercial implication.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.

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 : ($\pm$) 10%
- Voltage variation for HT motors : ($\pm$) 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 60034-15. The coil inter-turn insulation shall withstand steep front impulse withstand voltage as per IEC 60034-15.
- For HT motors, 12 nos. simplex or 6 nos. duplex RTDs (two per phase), each having D.C. resistance of 100 ohms at 0°C, 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 °C 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

DATA SHEET-A (For Motors)		
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	
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 requirement 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 & FOUNDRY 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



TITLE:
**TECHNICAL SPECIFICATION FOR RATE
CONTRACT OF SUMP PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-435-172-N001**

SECTION: **I**

SUB-SECTION: **IC**

REV. NO. **0** DATE **05.10.19**

SHEET **1** OF **1**

SUB-SECTION – IC

SPECIFIC TECHNICAL REQUIREMENTS (C &I)

	2x660 MW UDANGUDI STPP (UNIT#1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR SUMP PUMPS	

**TECHNICAL SPECIFICATION
(CONTROL AND INSTRUMENTATION)
FOR SUMP PUMPS**



	2x660 MW UDANGUDI STPP (UNIT#1&2)	DESG	SB
	JOB NO: 435	CHKD	PJ
REV. NO. 00	DATE: 04.10.2019	APPD	BS

SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR SUMP PUMPS FOR 2X660 MW UDANGUDI STPP

- 1.1 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.
- 1.2 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 Duplex stainless steel or better suitable for sea or saline water application.
 - 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.
- 1.3 Epoxy coated painting is required for all I & C equipment.
- 1.4 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.
- 1.5 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

SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR SUMP PUMPS FOR 2X660 MW UDANGUDI STPP

as per interpretation of Customer shall prevail without any commercial implication. No deviations shall be acceptable.

- 1.6 Drawings/Documents and data to be furnished after award of the contract as per deliverables list attached elsewhere in the specification.
- 1.7 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.
- 1.8 The local control cum starter panel in bidder's scope. Suitable canopy on top shall be provided for the panel.
- 1.9 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.
- 1.10 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.
- 1.11 Bidder to terminate all instrumentation and control elements in the control panel for further cabling to DDCMIS by BHEL.
- 1.12 All the transmitters and gauges shall have remote seal type having 15m capillary length minimum.

SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR SUMP PUMPS FOR 2X660 MW UDANGUDI STPP

- 1.13 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.
- 1.14 All primary instruments shall be with protection class of IP 65 or better.
- 1.15 Transmitter should not be mounted directly on the manifold, Manifold shall be non-integral and standalone type.
- 1.16 LVDT type instrument is not acceptable.
- 1.17 All limit switch shall be conforming to IEC-60947-5-1.
- 1.18 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.
- 1.19 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 window lamps for the system shall be driven through output modules of the control system.
- 1.20 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.
- 1.21 Signal/Electrical connection shall be screwed connection with double compression type Nickel-plated brass cable glands.
- 1.22 All the field instruments shall also be provided with SS tag nameplate.
- 1.23 Cable scope shall be referred in Electrical scope sheet attached in the Electrical portion of the specification.
- 1.24 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

SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR SUMP PUMPS FOR 2X660 MW UDANGUDI STPP

provided on the starter panel. Nos. shall be decided during detailed engineering.

- 1.25 Mandatory spare list shall be referred in 'List of mandatory spares' attached elsewhere in the specification and shall be supplied by bidder.
- 1.26 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.

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.

	2x660 MW UDANGUDI STPP (UNIT#1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR SUMP PUMPS	

LIST OF DOCUMENTS/DELIVERABLES

C&I DELIVERABLES LIST FOR SUMP PUMPS FOR 2X660 MW UDANGUDI PROJECT

Sl.No.	DRAWING NO.	DRAWING/DOCUMENT TITLE	CATEGORY
INSTRUMENTATION			
1	PE-V9-435-165-I901A	INSTRUMENT DATA SHEETS	A
2	PE-V9-435-165-I902A	BOQ	I
3	PE-V9-435-165-I903A	INSTRUMENT QP / CHECK LIST	A
RELAY BASED LCP			
1	PE-V9-435-165-I950A	LOCAL CONTROL PANEL DATA SHEET	A
2	PE-V9-435-165-I951A	WIRING DIAGRAM	A
3	PE-V9-435-165-I952A	PANEL EXTERNAL GA DRAWING (INCLUDING FOUNDATION DETAILS & FLOOR CUT-OUT)	A
4	PE-V9-435-165-I953A	PANEL INTERNAL GA DRAWING	A
5	PE-V9-435-165-I954A	PANEL FRONT VIEW DRAWING	A
6	PE-V9-435-165-I955A	LIST OF HARDWIRED SIGNAL EXCHANGE WITH DDCMIS	A
7	PE-V9-435-165-I956A	BILL OF MATERIAL	I
8	PE-V9-435-165-I957A	LOCAL CONTROL PANEL QUALITY PLAN	A
9	PE-V9-435-165-I958A	RELAY BASED PANEL O & M MANUAL	I

NOTES:

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

	2x660 MW UDANGUDI STPP (UNIT#1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR SUMP PUMPS	

**SPECIFICATION FOR LOCAL CONTROL
PANEL AND MEASURING INSTRUMENTS
(PRIMARY & SECONDARY)**



SPECIFICATION FOR LOCAL PANELS

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

VOLUME II B

SECTION D

REV. NO. 03

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1.0 SCOPE

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

2.0 CODES AND STANDARDS

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

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

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

3.0 TECHNICAL REQUIREMENTS

3.1 Panel Construction

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

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

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

3.1.4 The salient features of construction shall be:

Sheet material: Cold rolled sheet steel

Frame thickness: Not less than 3.0mm

Enclosure thickness: Not less than 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.**

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



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- 3.1.7 The class of protection shall be in accordance with IP-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



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

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

3.2 Hazardous Area Panel Requirement

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

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

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

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

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

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

3.3 Control & Monitoring devices

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

3.3.2 Alarm Annunciator System

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

3.3.3 Relays

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

3.3.4 Timers

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



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3.3.5 Control / Selector Switches

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

3.3.6 Push Buttons / Indicating Lights

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

RED	Motor OFF / Valve CLOSE	YELLOW	Alarm acknowledge	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 The bidder shall adopt suitable quality assurance program to ensure that the equipments offered will meet the specification requirements in full.

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



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

4.3.1 Routine Tests

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

4.3.2 Type Tests

1. Enclosure Class Test



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5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

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

5.2. Mandatory Spares

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

5.3. Recommended Spares

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

6.0 DRAWINGS AND DOCUMENTS

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

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

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

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

7.0 MARKING AND PACKING

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



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 |



DATA SHEET FOR LOCAL PANELS

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

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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

(As per requirement EDN)

ENCLOSURE SHEET THICKNESS

FRONT ☐ 2.0 mmOTHER ☐ 2.0 mmDOOR ☐ 1.6 mmHEIGHT ☐ 2365 mm for stand alone panels. ☐ OtherOTHER ☐ 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 3W ☐ 415V 3 PHASE 4W

NO. OF FEEDERS

☐ ONE

☐ TWO

STARTER WITH MCC

(CHECK WITH MAUX/ELEC)

☐ REQUIRED

☐ NOT REQUIRED

IPR POSITION

☐ MCC

☐ RELAY PANEL

CONTACT RATING OF RELAY

☐ 5 Amp, 230 V AC ☐ 0.25 Amp, 220V DC

CONTROL SUPPLY

☐ 110V AC

☐ 220V AC

☐ 220V DC

☐ Other.

(As per requirement)

ALARM ANNUNCIATOR WINDOW
(EXCLUDING SPARES)

____ NOS. (AS REQUIRED)

TEMP SCANNER

(IF REQUIRED -NO. OF CHANNELS TO BE
SPECIFIED UNDER SEC-C)
☐ REQUIRED

☐ NOT REQUIRED

PAINT TYPE

☐ EPOXY ENAMEL

☐ EPOXY POWDER COATED

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) .

FINISH (EXTERNAL)

☐ MATT

☐ GLOSSY

☐ SEMI GLOSSY

PANEL COLOUR (INTERNAL)

☐ WHITE

☐ CREAM

☐ OFF WHITE

FINISH (INTERNAL)

☐ MATT

☐ GLOSSY

☐ SEMI GLOSSY

CLASS OF PROTECTION

☐ IP-42 (FOR INDOOR SERVICE)

☐ IP-55 (FOR OUTDOOR SERVICE) ☐ ANY
OTHER

CONTROL HARDWARE

☐ RELAY BASED



DATA SHEET FOR LOCAL PANELS

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

VOLUME

SECTION

REV. NO. 02 DATE: 16.09.2013

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)

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 mASCOPE OF SUPERVISION FOR
ERECTION & COMMISSIONING☐ APPLICABLE ☐ NA

* TO BE CO-ORDINATED WITH PEM ELECTRICAL

PREPARED BY

CHECKED BY

APPROVED BY

NAME

AANCHAL CHOUDHARY

SACHIN SRIVASTAVA

MA MANSOORI

COMPANY SEAL

NAME:

DESIGNATION

SR.ENGR

DY.MNGR

D. GM

SIGNATURE

SIGNATURE:

DATE

16.09.2013

16.09.2013

16.09.2013

DATE:



DATA SHEET FOR LOCAL PANELS

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

VOLUME

SECTION

REV. NO. 02

DATE: 16.09.2013

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 EDN)
	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.)			



DATA SHEET FOR LOCAL PANELS

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

VOLUME

SECTION

REV. NO. 02

DATE: 16.09.2013

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		
NAME SIGNATURE DATE	PREPARED BY AANCHAL CHOUDHARY	CHECKED BY SACHIN SRIVASTYAVA	APPROVED BY MA MANSOORI
	16.09.2013	16.09.2013	16.09.2013
			COMPANY SEAL NAME: SIGNATURE: DATE:



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 °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 1/2" NPT.
d) 5-valve SS316 manifold constructed from barstock for differential pressure gauge. Process connection 1/2" 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



- 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

D. Level Switch

- 01. Type : External cage float operated. Magnetically coupled.
- 02. Float Material : AISI-316 stainless steel
- 03. Other wetted parts : AISI-316 stainless steel
- 04. External Cage : Carbon steel / Stainless steel as per process requirements, welded type / flanged construction. Cage pressure rating shall equal or exceed the rating of the main vessel.
- 05. External cage mounting : Side – Side with drain valve.
- 06. External cage connection : 25 NB socket weld to vessel or RF flanged.
- 07. Switch housing : Epoxy coated die-cast aluminum alloy with neoprene gasket conforming to IP-65. (Explosion proof for NEC Class-1, Division 1 area).
- 08. Type of switch Configuration : 2 SPDT (two nos.) Snap acting magnetically operated hermetically sealed.
- 09. Contact rating : 5A, 240V/AC, 0.5A, 220V DC
- 10. Accessories :
 - a) Counter flange, nuts & bolts, suitable gasket etc.
 - b) Steel globe type drain valve.
 - c) $\frac{3}{4}$ " ET cable gland
 - d) Stainless steel alpha-numeric engraved for service and tag.
- 11. Preferred feature : Switch operating point marked on cage
- 12. Temperature rating : As per application



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
Enclosure

: Flame proof/weather proof
: 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.

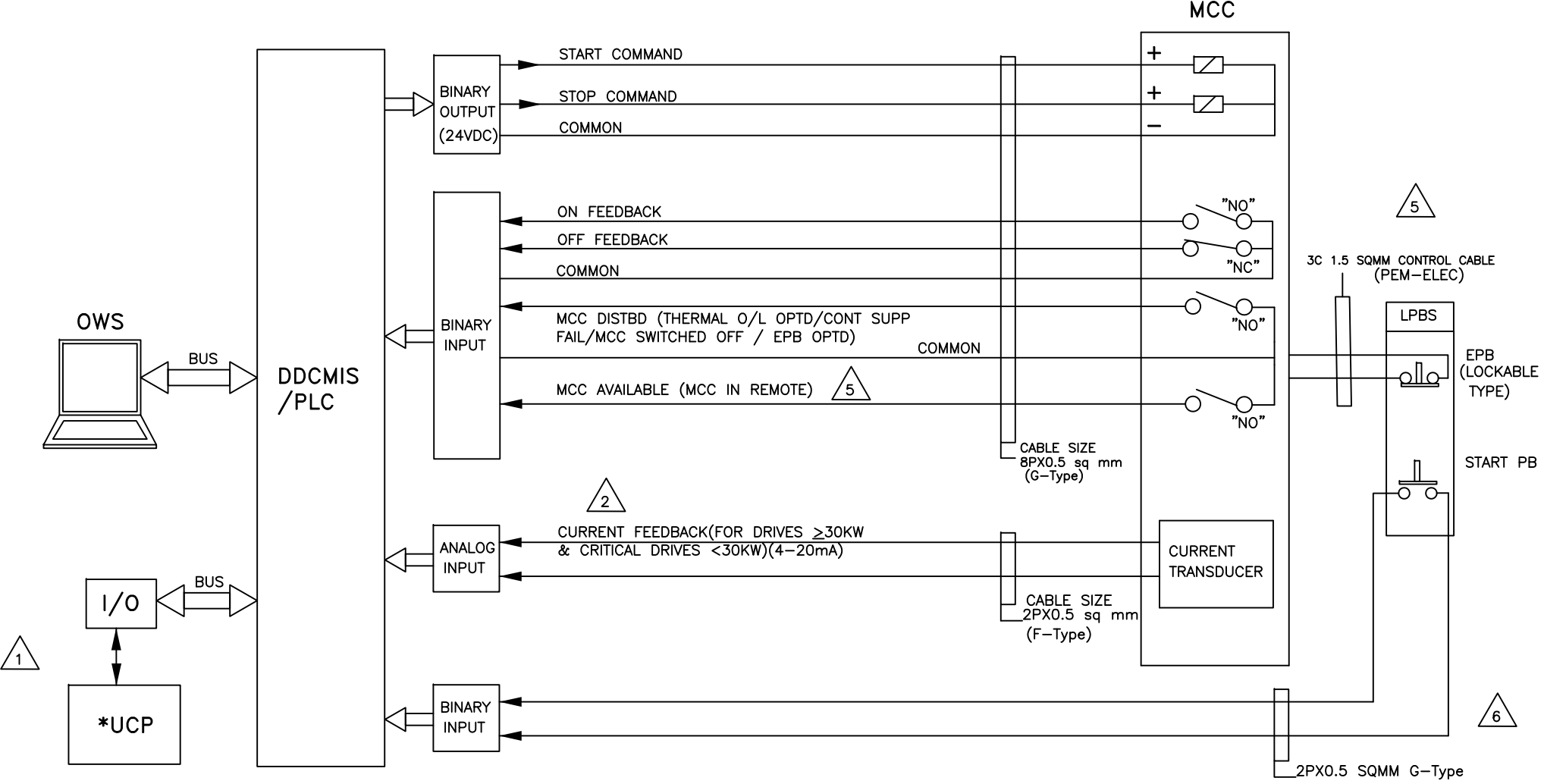
Suitable mounting clamps and other accessories shall be in scope of bidder.

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

	2x660 MW UDANGUDI STPP (UNIT#1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR SUMP PUMPS	
SIGNAL EXCHANGE BETWEEN DRIVES & DCS (DCP)		

DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE



* As Applicable

NOTE:

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



PROJECT: 2X660 MW TANGEDCO UDANGUDI
STAGE I STPP

TITLE DDCMIS INTERFACE FOR
UNIDIRECTIONAL LT DRIVE

DRG.NO. PE-DM-435-145-I002

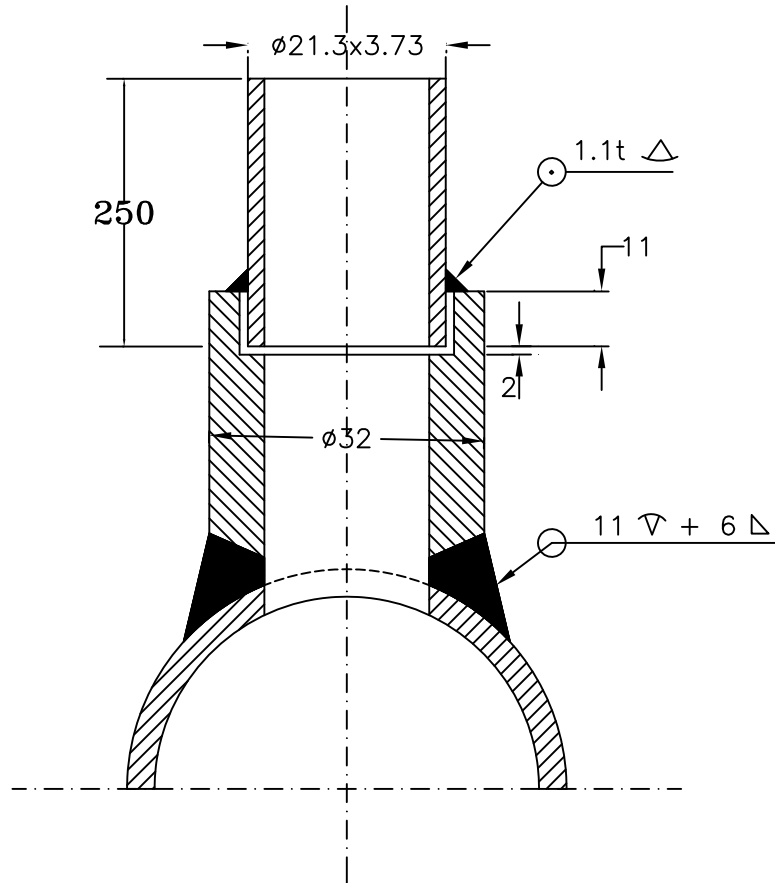
DATE 13.06.2019

REV.NO. 06

SHT 8 OF 11

	2x660 MW UDANGUDI STPP (UNIT#1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR SUMP PUMPS	

**INSTRUMENT STUB DETAILS &
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-435-145-1101
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 :-

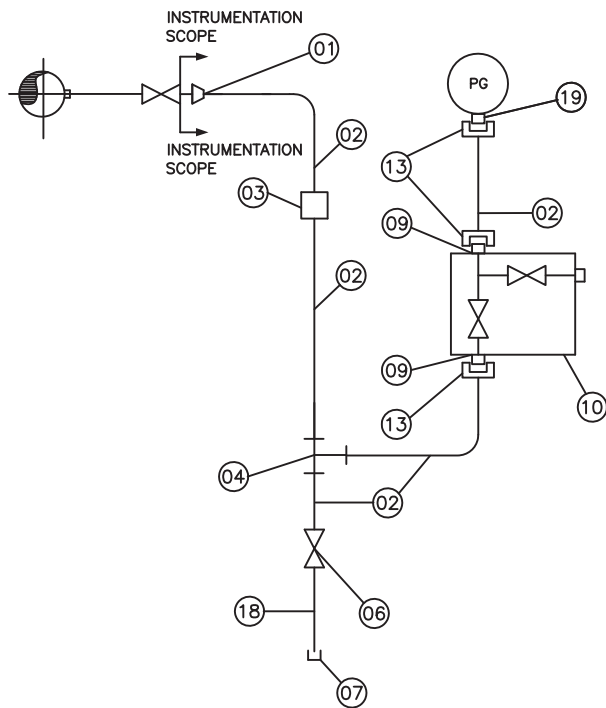
A/R - AS REQUIRED

NPTF - NATIONAL PIPE THREAD FEMALE

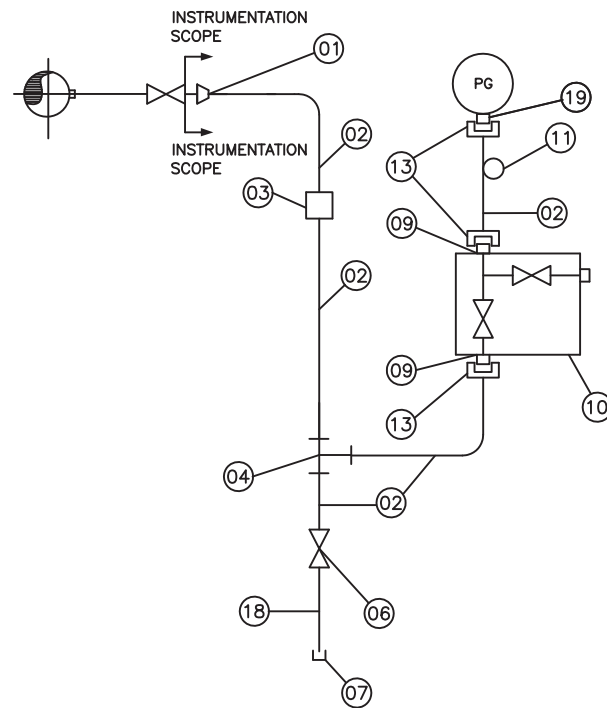
NPTM - NATIONAL PIPE THREAD MALE

SW - SOCKET WELD

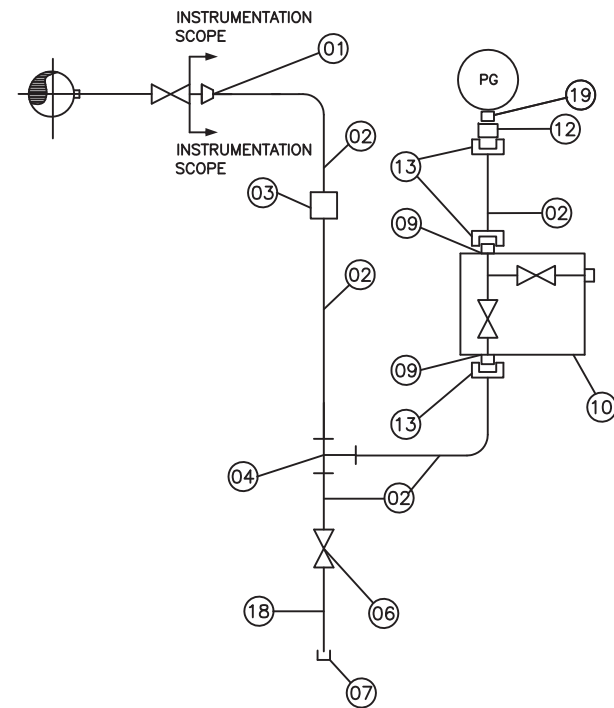
	TITLE :-			DRG. NO.	PE-DG-999-145-IXXX		
	INSTRUMENT INSTALLATION DIAGRAM			REV. NO.	00	DATE	05.11.13
	NOTES			SHT	2	OF	9



WATER SERVICE

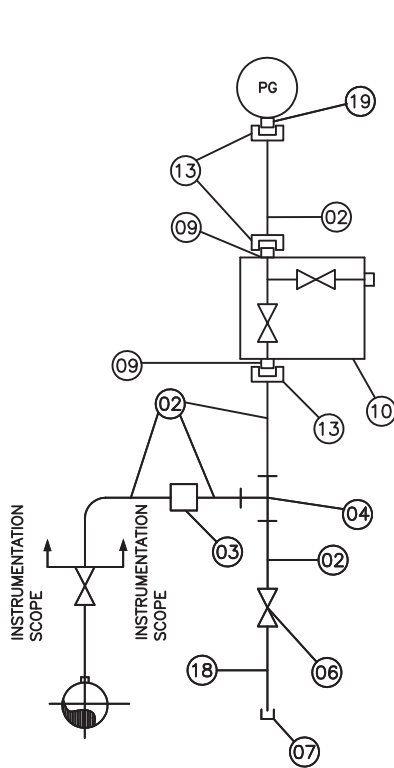


STEAM SERVICE

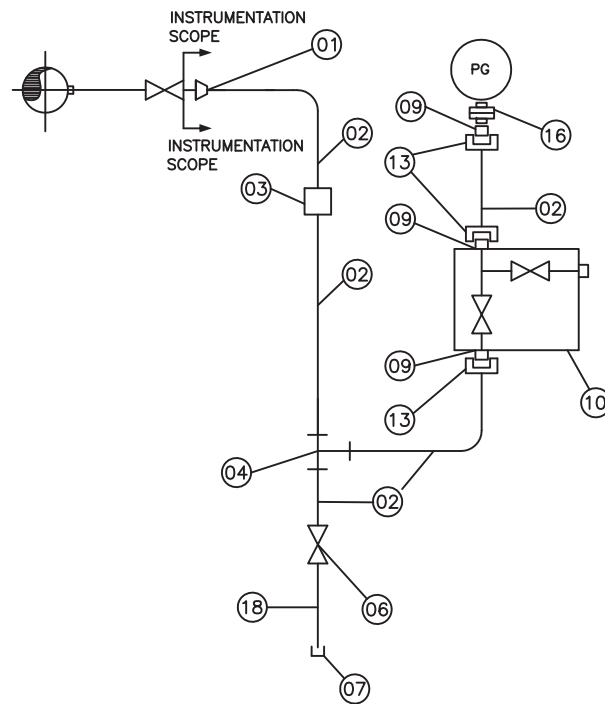


PULSATING SERVICE

	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



TITLE :-

INSTRUMENT INSTALLATION DIAGRAM

PRESSURE GAUGES

DRG. NO.

PE-DG-999-145-IXXX

REV. NO.

00 DATE 05.11.13

SHT

4 OF 9

	2x660 MW UDANGUDI STPP (UNIT#1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR SUMP PUMPS	
SUB VENDOR LIST		

PEM APPROVED SUB VENDOR LIST

SI No	Package Name	Supplier Name	Supplier Communication Address	Supplier Works 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.co m; bosepanda@vsnl.net	Works-1->Mr. Partha Bose 44, Saheed Hemanta Kumar Bose,Sarani, -Kolkata-WEST BENGAL India Phone- +91 33 2548 7220 FAX : +91 33 2548 0429, Pincode : 700074 Email : parthabosebpi@gmail.com 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	Works-1->Mr. Gautam Mukherjee Kusumba,Sonarpur Station Road,P.O. -Narendrapur, -Kolkata- WEST BENGAL INDIA Phone- 9836878855 FAX : 033-24342748 Pincode : 700103 Email : gkm_ani@hotmail.com
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	Works-1->NA NA -- Phone- FAX : Pincode : Email :
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.co m	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, -Kalol-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh.parmar@ashcroftindia.com
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	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 Å GIDC Å Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@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	Works-1->Shikha Hazra/ Shyamal Hazra 32, Industrial Suburb,Yeshwanthpur -BANGALORE- KARNATAKA INDIA Phone- 080- 23370300 FAX : 080-23379890 Pincode : 560022 Email : shikhahazra@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@forbesmar shall.com	Works-1->MR G.SRINIVASAN/MR ANUJ MALPANI PLOT NO:A-19/2 & T-4/2,I.DA. NACHARAM , - HYDERABAD-TELANGANA INDIA Phone- 09866550762 FAX : 040 27152193 Pincode : 560076 Email : gshrinivasan@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	Works-1->Gauge Bourdon India Pvt. Ltd., Plot No-4, 5, 6,Jawahar Co-operative Industrial Estate, - Kalamboli Taluka Panvel- MAHARASHTRA India Phone- 022- 27421095, FAX : 022-27421901, Pincode : 410209, Email : info@general-gauges.com
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	Works-1-> Others 26/2, G Type, Global Ind. Park Near Nahuli Railway Crossing, -Vapi-GUJARAT INDIA Phone- 9920576002 FAX : Pincode : 396105 Email : sales@nesstech.co.in, bkapadia@nesstech.co.in
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	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane - Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
12	LOCAL CONTROL PANELS	INDUSTRIAL CONTROLS & APPLIANCES PVT LTD	47, CHAKALA ROAD, ANDHERI(EAST), MUMBAI Phone- 28344494,28221532 Pincode : 400099 Email : indconapp@vsnl.com	
13	LOCAL CONTROL PANELS	PROCON INSTRUMENTATION PVT. LTD.	1H, SHAKTI TOWERS, 766, ANNA SALAI, CHENNAI Phone- 28266041,2824142 Pincode : 600022 Email : procond1@nda.vsnl.net.i n	
14	LOCAL CONTROL PANELS	C and S ELECTRIC LTD.	222, OKHLA INDUSTRIAL ESTATE, PHASE-II, NEW DELHI Phone- 9871799447 Pincode : 110020 Email : panel.marketing@cselect ric.co.in	
15	LOCAL CONTROL PANELS	PYROTECH ELECTRONICS PVT. LTD.	Unit-IV, A-193, M.I.A. Dadri, UDAIPUR Phone- 2492122,31,34 Pincode : 313003 Email : pyrotech@pyrotechindia. com	

16	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	Works-1->JIGNESH MAHENDRA AJMERA DENA BANK BLDG., SHREE NAGESHINDL. ESTATE,STATION ROAD, -MUMBAI-MAHARASHTRA INDIA Phone- 022 67973578 FAX : Pincode : 400 088 Email : ajmera@ajmera.net
17	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.ne t	
18	JUNCTION BOX	SUCHITRA INDUSTRIES	NO-2,OPP-27 AECS LAYOUT 2ND STG REJAMAHALVILAS EXTN 2ND STG BANGALORE Phone- Pincode : Email : suchitra.industriesblr@g mail.com	Works-1->B. Srinivas Suchitra Industries, Opp No 53, Muneshwara Black Devinagar, Lottagal hal - BANGALORE-KARNATAKA INDIA Phone- 080-23511247 FAX : Pincode : 560094 Email : suchitra_industries@yahoo.com
19	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	Works-1->Mr.Pulin Shah/ Mr. Kaloesh Parmar 39 A/3 ,Panchratna Industrial Est,Sarkhej-Bavla Road, Changodhar -Ahmedabad-GUJARAT INDIA Phone- 98250 80339 1 FAX : 079-26932424 Pincode : 382213 Email : sales@sumip.com
20	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	Works-1->Mr. Dineshbhai Zaveri CEO C-1/ 27&37, GIDC, Kabilpore, - Navsari-GUJARAT INDIA Phone- 02637-265140,265003 FAX : 02637- 265308 Pincode : 396424 Email : flexpro@flexproltd.com
21	LEVEL SWITCH- FLOAT TYPE	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com	
22	LEVEL SWITCH- FLOAT TYPE	D.K. INSTRUMENTS PVT.LTD.	N.SIKDAR/ SUMIT SIKDAR 76/2,SELIMPUR RD DHAKURIA Kolkata Phone- 033-2415-1310. Pincode : 700031 Email : dkinst@vsnl.net	

23	LEVEL SWITCH-FLOAT TYPE	V. AUTOMAT & INSTRUMENTS (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	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com
24	LEVEL SWITCH-FLOAT TYPE	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	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane - Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
25	LEVEL SWITCH-FLOAT TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com	
26	LEVEL SWITCH-FLOAT TYPE	GENERAL INSTRUMENTS CONSORTIUM	Mr. Amarendra Kulkarni 194/195, Gopi Tank Road, Off. Pandurang Naik Marg, Mahim Mumbai Phone- 9323195251 Pincode : 400016 Email : amarendra@general-gauges.com	
27	LEVEL SWITCH-FLOAT TYPE	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	Works-1->MR. MOHAN PADWAL 691/A/2,BIBWEWADI INDL ESTATE - PUNE-MAHARASHTRA INDIA Phone- 918600042374 FAX : 912024215670 Pincode : 411037 Email : wm@sbem.co.in
28	LEVEL SWITCH-FLOAT TYPE	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	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 À GIDC À Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com

29	LEVEL SWITCH-FLOAT TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
30	LEVEL SWITCH-FLOAT TYPE	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA -KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com



TITLE:
**TECHNICAL SPECIFICATION FOR RATE
CONTRACT OF SUMP PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-435-172-N001**

SECTION: **I**

SUB-SECTION: **ID**

REV. NO. **0** DATE **05.10.19**

SHEET **1** OF **1**

SUB-SECTION – ID

DATASHEET-A

 PROJECT: 2X660 MW UDANGUDI STPP STG I								Specification No: PE-TS-435-172-N002
TECHNICAL SPECIFICATION FOR SUMP PUMPS DATA SHEET - A								Section-ID
								Date-05.09.2019
CL. NO.	DESCRIPTION	UNIT	TYPE 1	TYPE 2	TYPE 3			
			Fixed Duty Vertical type Sump Pumps for Debris Discharge Pit	Fixed Duty Submersible Sump Pump for dewatering of CW Pit in TG Hall (Sea Water Application)	Portable Submersible Sump Pump for dewatering of CW Pump House/ Sea Water Intake Pump House/ Sea Water Outfall Pump House Sump (Sea Water Application)	Portable Submersible Sump Pump for dewatering of Various Plant Cable Trenches (Non-Sea Water Application)	Portable Submersible Sump Pump for dewatering of miscellaneous sumps/pits for general purpose including Desalinated Water Tank. (Non-Sea Water Application)	Portable Submersible Sump Pump for dewatering of miscellaneous sumps/pits for general purpose. (Sea Water Application)
1.0.0	GENERAL							
1.1.0	Service /Location of Sump pumps		Debris Filter Discharge Pit (2 Nos.)	CW Pit	CW Pump House/ Sea Water Intake Pump House/ Sea Water Outfall Pump House Sump	Various Plant Cable Trenches	Various sump pits in plant	Various sump pits in plant
1.2.0	Equipment name		Sump Pump	Sump Pump	Sump Pump	Sump Pump	Sump Pump	Sump Pump
1.3.0	Pump type		Fixed Duty type Vertical pumps	Fixed Duty Submersible sump pumps	Portable Submersible sump pumps	Portable Submersible sump pumps	Portable Submersible sump pumps	Portable Submersible sump pumps
1.4.0	Duty		Intermittent	Intermittent	Intermittent	Intermittent	Intermittent	Intermittent
1.5.0	Location		Outdoor	Indoor/ Outdoor	Indoor/ Outdoor	Indoor/ Outdoor	Indoor/ Outdoor	Indoor/ Outdoor
1.6.0	Maximum Ambient Temperature	°C	50	50	50	50	50	50
1.7.0	Drive		Motor Driven	Motor Driven	Motor Driven	Motor Driven	Motor Driven	Motor Driven
1.8.0	Motor Rating (For Motor Driven Pumps)		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 The discharge rate of sump pump is uncontrolled. As such pump should be capable to operate even under a condition of as low as 25% of specified total head.					
2.0.0	PUMP PARAMETERS							
2.1.0	Design capacity / Rated Flow	M3/hr	200	40	100	5	20	20
2.2.0	Total head at rated capacity	MWC	20	10 (Suitable for working in Range 2.5 to 12.5)	20 (Suitable for working in Range 5 to 25)	10 (Suitable for working in Range 2.5 to 12.5)	10 (Suitable for working in Range 2.5 to 12.5)	10 (Suitable for working in Range 2.5 to 12.5)
2.3.0	Total no.of pumps installed/required	Nos.	4	4	3	2	2	2
2.4.0	No. of pumps working / Standby	Nos.	1 Working + 1 Standby for each pit	1 Working + 1 Standby for each pit	-	-	-	-
2.5.0	Parallel operation required		YES	YES	-	-	-	-
2.6.0	Pump RPM		1500 (Max.)	1500 (Max.)	1500 (Max.)	1500 (Max.)	1500 (Max.)	1500 (Max.)
2.7.0	Range of operation	%	30 to 150 % of the rated flow	30 to 150 % of the rated flow	30 to 150 % of the rated flow	30 to 150 % of the rated flow	30 to 150 % of the rated flow	30 to 150 % of the rated flow
2.8.0	Pump design standard		IS 5120/IS 1710/IS 5600	IS 5120/IS 14220/IS 8034/IS 5600	IS 5120/IS 14220/IS 8034/IS 5600	IS 5120/IS 14220/IS 8034/IS 5600	IS 5120/IS 14220/IS 8034/IS 5600	IS 5120/IS 14220/IS 8034/IS 5600
2.9.0	Max. particle size to be handled	MM	30	30	30	30	30	30
2.10.0	Minimum Suction Lift	M	-	-	-	-	-	-
3.0.0	LIQUID DATA							
3.1.0	Liquid handled		Sea water with suspended particles	Sea/Saline Water with solid particles, cotton wastes, silica, mud/sludges, coal particles, ash particles etc.	Sea/Saline Water with solid particles, cotton wastes, silica, mud/sludges, coal particles, ash particles etc.	Water with solid particles, cotton wastes, silica, mud/sludges, coal particles, ash particles etc.	Water with solid particles, cotton wastes, silica, mud/sludges, coal particles, ash particles etc.	Sea/Saline Water with solid particles, cotton wastes, silica, mud/sludges, coal particles, ash particles etc.
3.2.0	Specific gravity		1.1	1.1	1.1	1.1	1.1	1.1
3.3.0	Temperature (max.)	°C	50	50	50	50	50	50
4.0.0	DESIGN AND CONSTRUCTION FEATURES							
4.1.0	Impeller type		Open/Semi-open, Non-clog type	Open/Semi-open, Non-clog type	Open/Semi-open, Non-clog type	Open/Semi-open, Non-clog type	Open/Semi-open, Non-clog type	Open/Semi-open, Non-clog type
4.2.0	Flange drilling standard		ANSI B 16.5	ANSI B 16.5	ANSI B 16.5	ANSI B 16.5	ANSI B 16.5	ANSI B 16.5
4.3.0	Motor Support Elevation	M	EL 0.3M	-	-	-	-	-
4.4.0	Sump Invert Level	M	EL (-)5.3M	-	-	-	-	-
4.5.0	Dimension of Sump Pit required in the pit to be dewatered (LXBXH)	MxMxM	-	-	-	-	-	-
5.0.0	MATERIAL OF CONSTRUCTION							
5.1.0	Casing / Suction bell		Duplex SS	Duplex SS	Duplex SS	2% Ni Cl to IS 210 Gr. FG 260	2% Ni Cl to IS 210 Gr. FG 260	Duplex SS
5.2.0	Impeller		Duplex SS	Duplex SS	Duplex SS	ASTM A 351 CF8M	ASTM A 351 CF8M	Duplex SS
5.3.0	Impeller shaft		Duplex SS	Duplex SS	Duplex SS	SS 316	SS 316	Duplex SS
5.4.0	Wear ring (where applicable)		Duplex SS	Duplex SS	Duplex SS	Austenitic cast iron	Austenitic cast iron	Duplex SS
5.5.0	Shaft sleeve (where applicable)		Duplex SS	Duplex SS	Duplex SS	SS-410	SS-410	Duplex SS
5.6.0	Column Pipe (where applicable)		Duplex SS	-	-	-	-	-
5.7.0	Pump and motor coupling		SS 316	-	-	-	-	-
5.8.0	Fasteners		Duplex SS for wetted fastners and SS 316L for other fastners	Duplex SS	Duplex SS	SS 316	SS 316	Duplex SS
5.9.0	Gland (Where applicable)		Duplex SS	Duplex SS	Duplex SS	C.I, IS-210, FG-260/ Equivalent	C.I, IS-210, FG-260/ Equivalent	Duplex SS
	Gland Packing (Where applicable)		Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)
5.10.0	Mechanical seal		As Applicable	As applicable	As applicable	As applicable	As applicable	As applicable
5.11.0	Pump Lubrication		Oil/Grease	SELF/Oil/Grease	SELF/Oil/Grease	SELF/Oil/Grease	SELF/Oil/Grease	SELF/Oil/Grease
5.12.0	Pump line shaft lubrication		Oil/Grease	N/A	N/A	N/A	N/A	N/A
5.13.0	Strainer (Body / Mesh)		Body:Duplex SS, Mesh: Duplex SS	Duplex SS	Duplex SS	Body (2.5% NiCl to IS 210 Gr. FG 260)/ Mesh (SS 316)	Body (2.5% NiCl to IS 210 Gr. FG 260)/ Mesh (SS 316)	Duplex SS
5.14.0	Line Shaft Bearing (Where Applicable)		Duplex SS	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
5.15.0	Line Shaft Coupling (Where Applicable)		Duplex SS	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
5.16.0	Base Plate		SS 316	-	-	-	-	-
Note : Bidder's may offer alternative materials, if they are superior to that specified above for the indicated service of the pump. MOC of all the parts coming in direct contact with Sea Water shall be Duplex SS.								
6.0.0	INSPECTION AND TESTING		As per approved quality plan by BHEL/ Customer					
7.0.0	SUPPLY OF ACCESSORIES AND SERVICE.							
7.1.0	Counter Flanges with Nuts,Bolts, Gaskets etc.		Yes	Yes	Yes	Yes	Yes	Yes



TITLE:
**TECHNICAL SPECIFICATION FOR RATE
CONTRACT OF SUMP PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-435-172-N001**

SECTION: **II**

SUB-SECTION: **IIA**

REV. NO. **0** DATE **05.10.19**

SHEET **1** OF **1**

SUB-SECTION - IIA

STANDARD TECHNICAL SPECIFICATION (MECHANICAL)

	TITLE :	SPECIFICATION NO.: PE-TS-999-172-N001	
	TECHNICAL SPECIFICATION FOR	SECTION: IIA	
	SUMP PUMPS	REV. NO. 0	DATE : 14.06.16
	STANDARD TECHNICAL REQUIREMENT	SHEET	OF

1.00.00 GENERAL

1.01.00 This specification covers the design, performance requirement, constructional features, material requirements, manufacture, inspection and testing at the manufacturer's and/or his sub-contractor's works and painting requirements for delivery of Sump Pump/submersible pumps complete with all accessories as specified hereinafter.

1.02.00 The design, performance, major constructional features, materials of construction etc., of the Sump Pumps/submersible pumps shall be guided by Data Sheet-A. The requirements of this specification shall also be taken care of.

2.00.00 Codes and Standards

2.01.00 The design, performance requirement, material requirements, manufacture, inspection and testing of the Sump Pumps shall generally comply with the requirements of all applicable Indian/British/American/DIN standards, in particular the following :

- IS 8034 : Technical requirements for submersible pump sets
- IS 5600 : Technical requirements for rotodynamic pumps for handling sewage and drainage.
- IS 1710 : Vertical turbine pumps for clear, cold and fresh water.
- IS 5120 : Technical requirements - Rotodynamic special purpose pumps
- IS 5600 : Sewage and drainage pumps
- IS 5639 : Pumps for handling chemical and corrosive mixed flow and axial flow pumps
- IS 9137 : Code for acceptance for centrifugal, mixed flow and axial flow pumps
- BS 5316 : Acceptance tests for centrifugal, mixed flow and axial flow pumps
- Hydraulic Institute Standards of USA
- API 610 : Centrifugal pumps general refinery services

2.02.00 In case of any contradiction between the above standards and this specification, the

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stipulations in this specification shall prevail and shall be binding on the bidder.

3.00.00 General Description

3.01.00 Sump pumps/submersible pumps specified hereinafter shall be used to dewater various sump pits in the power house and other plant area where gravity draining is not envisaged to ensure general housekeeping.

Type of Sump Pumps required under this specification are described in Section-ID/Data Sheet-A, the following requirements shall be taken care, as applicable.

3.01.01 Fixed Type Sump Pumps

Fixed type Sump pumps shall be electric motor driven permanently installed and shall be vertical wet pit bottom suction volute type and will handle drainage water, containing solid particles with sludges, polluted liquid etc. from the area where they are installed. These pumps will run continuously by the use of high and low level switches in the sump. Particle size expected in the water may be of the order of 30mm.

3.01.02 Fixed Duty Type Submersible Pumps

Fixed duty type submersible pumps shall be electric motor driven permanently installed and the motor shall be integral part of the pumps and the pump & motor shall be single unit i.e. monoblock type which be submerged in the water. Submersible pump will handle drainage water, containing solid particles with sludges, polluted liquid etc. from the area where they are installed. These pumps will run continuously by the use of high and low level switches in the sump. Particle size expected in the water may be of the order of 30mm.

3.01.03 Trolley Mounted portable sump pumps

These pumps shall be horizontal centrifugal, either electric motor driven or Diesel engine driven as specified in Data Sheet-A and shall be portable type. Each pump set alongwith drive, control panel etc., shall be mounted on a trolley for ease of transportation. These pumps shall be suitable for handling drainage water containing hard solid particles, sludge, polluted liquid with expected particle size of 30mm.

3.01.04 Trolley Mounted Vertical Submersible portable type pump

These pumps shall be vertical submersible portable type pump motor sets with suitable arrangement for carrying to any place and for lowering to and raising from various water reservoirs and pits. The pump motor set shall be monoblock type and shall be mounted on trolley and shall be suitable for handling water containing mud/sludge, solid particles, cotton waste, silica, ash particles, coal particles, polluted liquid etc. The particle size expected in water may be 30mm.

4.00.00 GENERAL PERFORMANCE REQUIREMENT

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4.01.00 The pumps shall be designed to have best efficiency at the specified duty point. The pump set shall be suitable for continuous operation at any point within the "Range of Operation".

4.02.00 Pumps shall have a continuously rising head capacity characteristics from the specified duty point towards shut off point, the maximum head being at shut off.

4.03.00 Permanently installed vertical sump pumps/submersible pumps, wherever specified, shall be suitable for parallel operation. The head vs capacity, the bhp capacity characteristics etc. shall match to ensure equal load sharing and trouble free operation throughout the range. Drive motor shall not be overloaded when pump discharge is more than rated.

4.04.00 The static head requirement of portable type sump pumps may have a considerably wide range of variation depending upon the depth of pit being dewatered. While the pump shall have adequate capacity at the maximum head, its drive shall be sufficiently rated to cater for any overloading during the pump operation at its minimum possible head, i.e. maximum discharge.

4.05.00 Pump with its drive unit shall run smooth without undue noise and vibration. Acceptable peak to peak vibration limits shall generally be guided by Hydraulic Institute Standards (latest edition)/as per applicable IS standard.

5.00.00 GENERAL

5.01.00 Pumps as described in Section-IA/ID (DataSheet-A) shall be complete with their drives, couplings and other accessories as also those needed to make the pump sets complete in all respect, for proper operation and maintenance.

6.00.00 DESIGN AND CONSTRUCTION

6.01.00 The design, construction testing and other details of the sump pumps and related accessories shall be in line with the stipulations and data in this section and as per data sheet-A.

6.02.00 Each sump pump shall be equipped and coupled with a drive motor with rating so selected as to have atleast 25% margin over the maximum power required by the pump, throughout its range of operation.

The discharge rate of sump pump is very much uncontrolled. As such pump should be capable to operate even under a condition of as low as 25% of specified total head.

6.03.00 All integral piping shall be as per IS-1239 of heavy grade (as suited for the maximum operating pressure) and shall be either galvanised or painted with approved rust inhibiting paint.

6.04.00 All valves shall be steel body type as per applicable IS/BA/ANSI standard, with pressure class compatible with the maximum working pressure.

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- 6.05.00 All hoses shall be of steel wire reinforced type. Pump suction hose shall be suitable for working under vacuum. Pump discharge hose shall be suitable to withstand the maximum pressure that it may be subject to in all working conditions, including hydrostatic testing of the sump pump discharge line.
- 6.06.00 Pump suction strainer (applicable only for Portable Horizontal Sump Pumps) shall have openings large enough just to permit the entry of solids having maximum size as stipulated in the specification.
- 6.07.00 Pressure gauges shall be of Bourdon type, with sealing diaphragm to prevent ingress of the work fluid. Selected range of pressure gauge shall be such that the entire range of working pressure covers about 1/3rd to 2/3rd to its range. Accuracy of measurement shall be within $\pm 1\%$ of scale range. The suction pressure gauge shall be compound type. Pressure gauge dial size shall be 100mm or more.
- 6.08.00 Pumps**
- 6.08.01 Fixed type Sump Pumps shall be wet pit type, vertical shaft, centrifugal, vertical submerged suction, non-clog volute type complete with enclosed shaft, discharge pipe, head assembly thrust bearing and drive assembly, cover plates etc.
- 6.08.02 Fixed duty type Submersible pumps shall be monoblock type in which electric motor shall be integral part of the pump and this monoblock of pump & motor set shall be submerged in the water. The pump shall be single stage and non-clog design.
- 6.08.03 Trolley mounted portable sump pumps shall be of horizontal shaft, single stage, end suction, radially split casing, centrifugal, non-clog design complete with common base plate, drive assembly etc. These pumps shall be trolley mounted portable type.
- 6.08.04 Vertical Submersible Portable type pumps shall be submersible pump motor type, single stage and non-clog design and shall be portable type.
- 6.08.04 Casing**
- a) Casing shall be so designed to allow free passage of specified maximum size of solid.
- b) Casing shall be designed to withstand the maximum shut off pressure developed by the pump.
- c) The casings shall be cast, free from blow holes, sand holes, other detrimental defects. The casing shall be complete with suction and discharge connections.
- d) For submersible type sump pumps adequate seal arrangement shall be made to keep leakage of liquid from casing to column assembly to minimum and adequate drain shall be provided in column assembly to permit escape of the leakage flow. The casing shall also include the bearing housing of the bottom pump shaft

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bearing.

- e) Trolley mounted portable sump pumps shall be provided with vent connections and drain connections with valves. These pumps shall be manually primed.

6.08.05 Impeller

- a) The impeller shall be non-clog type, cast in one piece and specially designed to pass large solids or unscreened liquids. The clearance between stationary and moving parts should be such as to allow sustained performance without excessive maintenance.
- b) Impellers of Fixed type sump pumps shall have provision for adjustment from an accessible location.

6.08.06 Pump shaft

- a) Shaft size selected shall be such that critical speed is at least 20% away from the operating speed and the runway speed.
- b) The shaft shall be ground and polished to final dimension and of ample size to withstand all stresses resulting from rotor weight, hydraulic loads and across the line starting. Shaft shall be provided with renewable sleeves particularly under stuffing boxes and other locations as recommended by pump manufacturers.
- c) The coupling between shafts shall be so designed that they become tight during pump operation.

6.08.07 Column Pipe for fixed type sump pumps (As applicable for vertical sump pumps)

The discharge pipe shaft assembly shall be flanged or screwed as per manufacturer's standard and standard length of each piece of column pipe shall be in conformity to the shaft piece lengths from consideration of easy handling.

6.08.08 Bearings

- a) Adequate nos. of properly designed bearings shall be furnished. Bearings for fixed type Sump Pumps shall be Oil lubricated and Bearings for trolley mounted Horizontal pumps shall be antifriction type and lubricated by oil/grease. All necessary grease gun, grease cup and tubing shall be included.
- b) Thrust bearing of adequate design shall be furnished for taking the entire pump thrust arising from all probable conditions of continuous operation through out its "range of operation" and also the shut off condition life of thrust bearing shall be 20,000 working hour minimum for the load corresponding to the duty point. The bearings shall be lubricated by grease or oil from a location conveniently accessible. Design shall be such that the lubricant can not contaminate the

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handling liquid.

6.08.09 Wearing Ring/Liner Plate

Renewable wearing rings/liner plates shall be provided either on impeller or on the casing or on both impeller and casing.

6.08.10 Stuffing Box

Stuffing box of Fixed type sump pumps shall be of mechanical packing type. Trolley mounted portable sump pumps shall have mechanical seal of reliable design.

6.08.11 Coupling

Pump and motor shall be connected with a suitable flexible coupling. Coupling shall be provided with coupling guard.

6.08.12 Fixed type sump pumps shall be provided with a suitable mounting plate. The mounting plate shall be adequately sized to accommodate the level switches, discharge pipe, oil cups etc. Trolley mounted portable sump pumps and drives shall be mounted on one base plate. Base plate shall be of rigid construction properly ribbed as needed. Suitable drain with valve, vent with valve and drain funnel shall be furnished by the Bidder.

The necessary supporting plate, mounting frame, base plate, etc., as required shall be supplied under this specification alongwith anchor bolts, foundation bolts, pipe, sleeves etc. Lifting lug, eye bolts etc., as required for the proper handling of each pump set shall be furnished.

6.08.13 Suction Bell

Fixed type sump pumps and vertical submersible portable type pumps shall be complete with adequately dimensioned suction bell to guide and streamline intake fluid.

7.00.00 INSPECTION AND TESTING

The contractor shall carry out the following minimum specific tests & inspections to ensure that the equipment furnished lies in strict conformance with the specification & in accordance with codes/standards and good engineering practice.

- a) Material identification and testing shall include but shall not be limited to the following components:
 - i) Impeller & wearing rings.

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- ii) Shafts & shaft sleeves.
 - iii) Couplings
 - iv) Bearings
 - v) Coloumn pipes
 - vi) Discharge head
- b) Tests shall also include but shall not be limited to the following :
- i) The entire surface of the impeller castings shall be subjected to D.P. test as per ASTM-E-165.
 - ii) Shaft shall be subject to D.P. & Ultrasonic test.
 - iii) Wearing rings shall be subject to D.P. test.
 - iv) Witnessing of NDT/review of NDT reports.
 - v) Static balance test for impeller & dynamic balance of complete rotating parts as per ISO-1940.
 - vi) Complete inspection of assembled pump
- c) Hydrostatic test shall be done for the following components (as minimum) at 150% of the shut-off pressure. Pressure shall be maintained for a period of not less than one (1) hour.
- i) Bowls/suction bells
 - ii) Column pipe
 - iii) Discharge head
 - iv) Any other applicable pressure parts.

	TITLE :	SPECIFICATION NO.: PE-TS-999-172-N001
	TECHNICAL SPECIFICATION FOR	SECTION: IIA
	SUMP PUMPS	REV. NO. 0 DATE : 14.06.16
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d) Performance tests at shop

- i) Each pump shall have to be tested to determine performance curves of the pumps. These tests are to be conducted in the presence of Owner's representative as per the requirements of the Standards of Hydraulic Institute of USA (ASME-Power Test Code PTC 8.2/BS-599) or any other equivalent standard but the tolerances on Head, Discharge & Power shall be specified in HIS, USA.
- ii) Performance tests are to be conducted to cover the entire range of operation of the pumps. These shall be carried out to span 130% of rated capacity upto pump shut-off condition. A minimum of five combinations of head & capacity are to be achieved during testing to establish the performance curves, including the design capacity point, shut-off point and the two extremities of the range of operation as specified in the annexures. After completion of performance test, all pumps shall be stripped down for inspection of internals.
- iii) Tests shall be conducted with actual drive motors being furnished
- iv) The Bidder shall submit in his proposal the facilities available at his works to conduct performance testing.
- v) NPSH tests are to be conducted on one pump of each type at 3% head drop conditions, if specified in the pump Annexures.
- vi) All rotating components of the pumps shall be subjected to static and dynamic balancing tests. The assembled rotor will be subjected to dynamic balancing tests.
- vii) Mechanical run test shall be carried out on all pumps to determine the vibration levels, noise levels etc. This test shall be conducted at site also. However, test value at site shall be used for the acceptance of the equipment.

7.01.00 The pump integral accessories like thrust bearing, pump motor coupling etc., shall be subject to tests as per manufacturer's standard.

7.02.00 Test on motors, control panels, starter panels, cables shall be conducted as per the requirement of this specification.

7.03.00 After erection at site, pumps shall be operated to prove satisfactory and trouble free performance.

7.04.00 A typical quality plan is enclosed for bidder's guidance, the bidder shall furnish detailed Quality Plan based on same for Purchaser's approval, in the event of order.

8.00.00 Drawings, data, curves and information

8.01.00 Following drawings, data and information for the equipments are required to be submitted by the bidder alongwith his formal proposal.

	TITLE :	SPECIFICATION NO.: PE-TS-999-172-N001	
	TECHNICAL SPECIFICATION FOR	SECTION: IIA	
	SUMP PUMPS	REV. NO. 0	DATE : 14.06.16
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- 8.01.01 General Arrangement drawings of the pumps showing various dimensions, suction and discharge locations.
- 8.01.02 Typical cross-section drawings of the pumps, seal rings, etc., and materials of construction for all items.
- 8.01.03 Characteristic curves of pumps showing effective head, pump input power, efficiency, submergence and NPSH, against capacity ranging from shut off condition to 150% of rated capacity.
- 8.01.04 Speed vs. torque curve of the pump corresponding to recommended mode of pump starting, super-imposed on speed vs. torque of the motor, corresponding to 80% and 100% rated voltage.
- 8.01.05 Diagram showing the type of lubrication system etc.
- 8.01.06 Completely filled up schedules enclosed under Vol.III of this specification.
- 8.01.07 GA drawing of Control Panel.
- 8.01.08 A write up describing clearly the procedure for installing the pump and also for overhauling the fixed type pumps. A procedure for lowering and raising the vertical submersible portable type pumps shall also be given.
- 8.02.00 Drawings, data, curves and information to be submitted by the successful tenderer after placement of order.
- 8.02.01 The drawings/data asked against clause nos.8.01.00 to 8.01.07 above shall also be furnished in a finalised form by the successful tenderer for the approval of the purchaser/his consultant. In addition following documents shall also be submitted for Purchaser's/consultant's approval.
- 8.02.02 Pump foundation details with static and dynamic loads.
- 8.02.03 Pump and drive sealing, bearing lubrication and cooling arrangement drawing.
- 8.02.04 Drive data
- 8.02.05 Reports on shop tests and test certificates.
- 8.02.06 All other drawings/documents and data as specified and deemed necessary.

 BHARAT HEAVY ELECTRICALS LIMITED		MANUFACTURERS NAME & ADD		MANUFACTURING QUALITY PLAN									
				ITEM :	Sump pumps/Submersible Pump		QP NO: PE-QP-999-100-N005		PROJECT :				
						REV-02		END CUSTOMER:					
						DATE: 14.06.16		CONTRACT No.:					
						PAGE 1 OF 2		MAIN SUPPLIER: BHEL, Noida					
SR. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
									M	B	C		
1	2	3	4	5	6	7	8	9	D*	10			
1.0 Raw Material and Bought out Control													
1.1a	Pump Casing	Physical Properties - Tensile Strength & Hardness / Chemical Composition	CR	Physical / Chemical Analysis	1 / Heat / Batch	Appd. C S Drg.	Approved drawing/Data sheet	Lab Report	√	P	V	V	
1.1b	Impeller	Physical Properties - Tensile Strength, Yield Strength & Elongation Chemical Composition	CR	Physical / Chemical Analysis	1 / Heat / Batch	Appd. C S Drg.	Approved drawing/Data sheet	Lab Report	√	P	V	V	
1.2	Heat treatment of Stainless Steel Castings	Heat Cycle	MA	Verification of HT chart	All Batches	Appd. C S Drg.	Approved drawing/Data sheet	Corelated HT charts	√	P	V	V	
1.3	Bars / forgings for pump and motor shafts	Physical/Chemical Properties	CR	Physical / Chemical Analysis	1 / Bar	Appd. C S Drg.	Approved drawing/Data sheet	Mill TC or lab report	√	P	V	V	
		Dimensions	MA	Measurment	100%	Manufacturers Drawing	Manufacturers Drawing	IR		P	V	V	
		Internal defects for 40 mm and above diameter	CR	UT	100%	ASTM A-388	Refer Note 1	IR	√	P	V	V	
1.4	Cable Type: PVC insulated, multicore, copper conductor	Routine TC and acceptance TC as per IS 694/Is1554, Length and size	MA	Measurement	100%	Approved Datasheet / IS 694/IS1554	Approved Datasheet / IS 694/IS1555	IR & TC	√	P	V	V	Compliance cert. To be submitted by Vendor
1.5	Bearings	Make, Bearing No., Surface finish	MA	Visual Examination	100%	Manufacturers Std	Manufacturers Std	IR		P	V		
2.0 Inprocess Control													
2.1	All Components	Visual Defects	MA	Visual	100%	Manufacturers Drawing	No harmful defects	Log book / IR		P	V	V	
		Dimensions	MA	Measurement	100%	Manufacturers Drawing	Manufacturers Drawing	Log book / IR		P	V	V	
2.2	Pump discharge casing	Leak tightness	CR	Hydro test (Duration 30 minutes min.)	100%	Refer Remark.	No leakage	IR	√	P	W	V	Test Pr.2 x duty pts. Pr. OR 1.5 x shut off whichever is higher
	Motor Housing	Leak tightness	CR	Air test (Duration 30 Minutes min)	100%	Air test at 0.5 kg/cm2 (guage pressure)	No leakage	IR	√	P	V	V	
2.3	Casing & Impeller (machined surfaces)	Surface Defects	CR	DPT	100%	ASTME:165	No Surface defect	IR	√	P	V	V	On machined surface only
2.4	Impeller	Static & Dynamic residual unbalance	CR	Static, Dynamic balancing	100%	ISO : 1940	ISO 1940 Gr. 6.3	IR	√	P	V	V	
2.5	Pump Motor Shaft	Internal Defects	CR	DPT	100%	ASTME:388	ASTME:388, Refer note 1	IR	√	P	V	V	On machined surface only
		Surface Defects	CR	DPT	100%	ASTME:165	No Surface defect	IR	√	P	V	V	On machined surface only
3.0 Sub-Assembly, Assembly Control													
3.1	Pump, Motor, Rotor	Eccentricity	MA	Measurement	100%	Manufacturers Drawing	Manufacturers Drawing	Log book / IR		P	V	V	
3.2	Pump and Motor assembly	Completeness, correctness	MA	Visual Examination	100%	Manufacturers Drawing	Manufacturers Drawing	IR		P	V	V	
				LEGEND: RECORDS IDENTIFIED WITH "TICK" () SHALL BE			BHEL DOC No.:PE : V8 - XXX - 100-N005						
				ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION			NAME AND SIGN OF APPROVING AUTHORITY AND SEAL						
		BHEL		** M: MANUFACTURER/SUB CONTRACTOR									
MANUFACTURER/		CONTRACTOR		B: BHEL, C:CUSTOMER (END USER)									
SUBCONTRACTOR				P : PERFORM W: WITNESS V : VERIFICATION AS APPROPRIATE									
SIGNATURE													
							ENGG DIV / QA & I						

 BHARAT HEAVY ELECTRICALS LIMITED		MANUFACTURERS NAME & ADD		MANUFACTURING QUALITY PLAN									
				ITEM :		Sump Pump/Submersible Pump		QP NO: PE-QP-999-100-N005		PROJECT :			
				REV-02				END CUSTOMER:					
				DATE: 14.06.16				CONTRACT No.:					
						PAGE 2 OF 2				MAIN SUPPLIER: BHEL, Noida			
SR. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	D*	AGENCY			REMARKS
										M	B	C	
1	2	3	4	5	6	7	8	9		10			
4.0	Final Inspection, Test, Packing, Despatch Control												
4.1	Pump set (Pump+ Motor)	Q Vs Head, Q Vs Power Q Vs Efficiency	CR	Performance test	100%	Tech. Spec., Appd. Data Sheet, Appd. Curves, HIS, Test procedure	Tech. Spec., Appd. Data Sheet, Appd. Curves, HIS	Performance test record, Plotted Curves	Ö	P	W	V	
4.2	Routine Test on motor	HV, IR, Locked Rotor, No Load, Make type, Rating	CR	Electrical tests	100%	IS 325	Approved Data Sheet	IR	Ö	P	V	V	Widing resistance ** Degree of protection shall be IP 68, HV at 2.5 KV AC for 1 Minute.
4.3	Strip down after Performance test	Undue wer, tear and breakages	CR	Visual examination of Casing & Impeller after stripping	100%	Undue wer, tear and breakages	No undue wear, tear and breakages	IR	Ö	P	W	V	Witnessing one no. of each type
4.4	Complete Pump	Completeness, Correctness, Workmanship and finish, overall dimensions	MA	Visual examination	100%	Approved G.A. drawing	Approved G.A. drawing	IR	Ö	P	V	V	Compliance report for accessories will be submitted.
4.5	Completion of all stages	Completion	MA	Verification of IR's TC's	100%	Approved QP	Approved QP	IR	Ö	P	V	V	
4.6	Painting	Surface Preparation		Visual examination	100%	Approved data sheet/Manufacturer standard		IR		P	V	V	Compliance report by Manufacturer
		Adhesion, Uniformity and thickness		Visual Measurement	100%	As per painting schedule/Manufacturer standard		IR		P	W	V	Compliance report by Manufacturer
4.7	Wooden Packing	Soundness, Aesthetic		Visual	100%	As per packing procedure		IR		P			Compliance report by Manufacturer
Note :													
1. For accessories and bought out items, Manufacturer will submit Compliance for review.													
2. For UT test on shaft, defect echo < 20 % full screen height when back wall echo set @ 100 % screen height. Reduction in back wall echo to be <20%. Defect height > 20 % of FSH is not acceptable, also loss in backwall echo>20 % not acceptable.													
3. IP 68 protection certificate for test conducted on similar motor shall be submitted for review													
4. Compliance for provision of thermic switch for over heating protection of winding, reverse rotation protection device shall be submitted by Manufacturer													
5. For control panel separate QAP is applicable.													
6. Before sending the documents for approval, supplier to ensure that "Reference documents" & "acceptance Norms" does contain data required for the Characteristic to be checked" as indicated in QP.													
				LEGEND: RECORDS IDENTIFIED WITH "NCK" () SHALL BE			BHEL DOC No.:PE : V8 - XXX - 100-N005						
				ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION			NAME AND SIGN OF APPROVING AUTHORITY AND SEAL						
		BHEL		** M: MANUFACTURER/SUB CONTRACTOR									
MANUFACTURER/		CONTRACTOR		B: BHEL, C:CUSTOMER (END USER)									
SUBCONTRACTOR		P : PERFORM W: WITNESS V : VERIFICATION AS APPROPRIATE											
SIGNATURE													
							ENGG DIV / QA & I						



TITLE:

**TECHNICAL SPECIFICATION FOR RATE
CONTRACT OF SUMP PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-435-172-N001**

SECTION: **II**

SUB-SECTION: **IIB**

REV. NO. **0** DATE **05.10.19**

SHEET **1** OF **1**

SUB-SECTION - IIB

STANDARD TECHNICAL SPECIFICATION (ELECTRICAL)



TITLE :
GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO. PE-SS-999-506-E101
VOLUME NO. : II-B
SECTION : D
REV NO. : 00 DATE : 29/08/2005
SHEET : 1 OF 1

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005
		SHEET : 1 OF 4

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.

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
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		SHEET : 2 OF 4
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 minimum 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: 4691 and 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.		

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		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005
		SHEET : 3 OF 4
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	

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
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		SHEET : 4 OF 4
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.		

	TITLE MOTORS DATA SHEET – C 2 x 660MW UDANGUDI STPP	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE 21.05.18
		SHEET 1 OF 2

S. No.	Description		Data to be filled by successful bidder
A.	General		
1	Manufacturer & country of origin		
2	Motor type		
3	Type of starting		
4	Name of the equipment driven by motor & Quantity		
5	Maximum Power requirement of driven equipment		
6	Rated speed of Driven Equipment		
7	Design ambient temperature		
B.	Design and Performance Data		
1	Frame size & type designation		
2	Type of duty		
3	Rated Voltage		
4	Permissible variation for		
5	a	Voltage	
6	b	Frequency	
7	c)	Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)		
9	Synchronous speed & Rated slip		
10	Minimum permissible starting voltage		
11	Starting time in sec with mechanism coupled		
12	a)	At rated voltage	
13	b)	At min starting voltage	
14	Locked rotor current as percentage of FLC (including IS tolerance)		
15	Torque		
	a)	Starting	
	b)	Maximum	
16	Permissible temp rise at rated output over ambient temp & method		
17	Noise level at 1.0 m (dB		
18	Amplitude of vibration		
19	Efficiency & P.F. at rated voltage & frequency		
	a)	At 100% load	
	c)	At 75% load	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTORS DATA SHEET – C 2 x 660MW UDANGUDI STPP	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE 21.05.18
		SHEET 2 OF 2

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
C.	Constructional Features	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level (kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
D.	Characteristic curves/ drawings (To be enclosed for motors of rating $\geq 55\text{KW}$)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

		QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :				
				BIDDER/ VENDOR :		TITLE		NUMBER :				
		SHEET 1 OF 2		SYSTEM		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01		SPECIFICATION TITLE				
				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
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	-	-	NOTE -1 & NOTE-3
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	-	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									

		QUALITY PLAN		CUSTOMER :		PROJECT			SPECIFICATION :			
				BIDDER/ :		TITLE			NUMBER :			
		SHEET 2 OF 2		VENDOR		NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION :			
		SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)			TITLE :			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
	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. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY	3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	
BHEL		PARTICULARS		BIDDER/VENDOR								
		NAME										
		SIGNATURE										
		DATE							BIDDER'S/VENDORS COMPANY SEAL			

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

		QUALITY PLAN		CUSTOMER :		PROJECT			SPECIFICATION :				
				BIDDER/		TITLE			NUMBER :				
				VENDOR		QUALITY PLAN			SPECIFICATION :				
SHEET 2 OF 9		SYSTEM		NUMBER PED-506-00-Q-007, REV-03			TITLE			SECTION			
ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		VOLUME III											
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
									P	W	V		
1	2	3	4	5	6	7	8	9	10			11	
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED	
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2		
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2		
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1		
1.6	SPACE HEATERS, CONNEC- TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	FOR DIA OF 55 MM & ABOVE	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2		
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2		
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2		
BHEL			PARTICULARS		BIDDER/VENDOR								
			NAME										
			SIGNATURE										
			DATE					BIDDER'S/VENDORS COMPANY SEAL					

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

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

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

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

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

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
		SHEET 8 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1\$	1	\$ NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1\$	1	\$ NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1\$	1	\$ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1\$	1	\$ NOTE - 2
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1\$	1	\$ NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1\$	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY \$ NOTE - 2
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			

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



TITLE:
**TECHNICAL SPECIFICATION FOR RATE
CONTRACT OF SUMP PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-435-172-N001**

SECTION: **II**

SUB-SECTION: **IIC**

REV. NO. **0** DATE **05.10.19**

SHEET **1** OF **1**

SUB-SECTION - IIC

STANDARD TECHNICAL SPECIFICATION (C &I)



STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: **PE-QP-999-145-I056**

VOLUME IIB

SECTION D

REV. NO. **01** DATE: **22-02-2008**

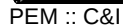
SHEET 1 OF 7

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

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

^s P - Agency Performing the Test.
W - Agency Witnessing the Test.
V - Agency Verifying the Test.

1 - BHEL
2 - Vendor
3 - Sub-vendor



STD QUALITY PLAN NO.: PE-OP-999-145-I056

IIB

D

01

DATE: 22-02-2008

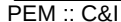
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- 1 - BHEL
- 2 - Vendor
- 3 - Sub-vendor



STD QUALITY PLAN NO.: PE-QP-999-145-I056

IIB

D

01

DATE: 22-02-2008

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7

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

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STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: **PE-QP-999-145-I056**

VOLUME IIB

SECTION D

REV. NO. **01** DATE: **22-02-2008**

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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			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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 PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL						STD QUALITY PLAN NO.: PE-QP-999-145-I056				
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								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 ^s			Remarks
									P	W	V	
10.	Panel Wiring	1. Wiring Layout	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		2. Wiring Termination (Crimped Lugs)	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		3. Ferrule numbers	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		4. Colour of wiring	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	1	
		5. Size of Conductor	MA	Measurement	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	1	
11.	Component Mounting	1. Correct components	MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---	
		2. Fixing	MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---	
12.	FINAL Final Inspection	1. Workmanship	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.
		2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components	MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		3. Components identification Marking / Name plates	MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	

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बी एच ई एल BHEL PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL						STD QUALITY PLAN NO.: PE-QP-999-145-I056					
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Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks	
									P	W	V		
		5. Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.	
		6. Door functioning	MA	Functional	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1		
		7. Paint Shade	CR	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1		
		8. Paint Thickness	CR	Measurement	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1		
		9. Workmanship of Gaskets	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1		
		10. Wiring Layout	MA	Visual	100%	BHEL approved drg.	BHEL approved drg.	Inspection Report	2	1	1		
		11. Wire Termination	MA	Pulling manually	Sample	-----	Firm termination	Inspection Report	2	1	1		
		12. Continuity	MA	Electrical	100%	-----	Continuity OK	Inspection Report	2	1	1		

LEGEND: * CR - Critical characteristics			\$	P - Agency Performing the Test.	1 - BHEL
MA - Major characteristics				W - Agency Witnessing the Test.	2 - Vendor
MI - Minor characteristics				V - Agency Verifying the Test.	3 - Sub-vendor



STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: PE-QP-999-145-I056	
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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks
									P	W	V	
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	Type Test Certificate	3	---	1	
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant IS.	BHEL approved spec., drg., BOM & relevant IS.	Test Report	2	1	1	
15	FUNCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		2. Instrument Calibration	CR	Electrical	10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		3. Temperature rise	CR	Electrical	100%	BHEL approved spec/drg. & relevant IS.	BHEL approved spec/drg & relevant IS.	Inspection Report	2	1	1	

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

CHECK LIST FOR FLOAT OPERATED LEVEL SWITCH

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	V	V	
	MODEL NO/TAG NO						
	TYPE						
	END CONNECTION						
2	ON/OFF DIFFL			P	W	V	
3	REPEATABILITY	SEE NOTE-5	---	P	W	V	
4	IR TEST			P	W	V	
5	HV TEST			P	V	V	
6	PR. TEST ON CHAMBER			P	V	V	
7	MATL. TC FOR CHAMBER & FLOAT	FOR LOT	---	V	V	V	
8	CONTACT CONFIG. & RATING FOR MICROSWITCH	FOR LOT	---	V	V	V	
9	TC FOR DEGREE OF PROTECTION	TYPE TEST	---	V	V	V	
10	MANUFACTURER TO ENSURE WELDING PROCEDURE, WELDERS & NDT AS PER ASME FOR PR >40 KG/CM2	SEE NOTE-1 BELOW	---	P	V	V	
11	CHECK FOR TEMP. SUITABILITY FOR MICROSWITCH AND LEAD WIRE		---	V	V	V	
12	ACCESSORIES AS APPLICABLE		APPROVED SPEC./ DATA SHEETS	V	V	V	

Legend :

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

Note :

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



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

CHECK LIST FOR PRESSURE & DP GAUGE

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

Legend :

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

Note :

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



TITLE:

**TECHNICAL SPECIFICATION FOR RATE
CONTRACT OF SUMP PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-435-172-N001**

SECTION: **III**

SUB-SECTION:

REV. NO. **0** DATE 05.10.19

SHEET **1** OF **1**

SECTION III

DOCUMENTS TO BE SUBMITTED BY BIDDER



TITLE:
**TECHNICAL SPECIFICATION FOR RATE
CONTRACT OF SUMP PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-435-172-N001**

SECTION: **III**

SUB-SECTION:

REV. NO. **0** DATE 05.10.19

SHEET **1** OF **1**

SECTION IIIA

COMPLIANCE CERTIFICATE

(TO BE SUBMITTED ALONG WITH BID)

	TITLE : TECHNICAL SPECIFICATION SUMP PUMPS 2X660 MW UDANGUDI STPP STG I	SPECIFICATION No. : PE-TS-435-172-N001, Rev-00
	COMPLIANCE CERTIFICATE	SECTION: IIIA
		Date: 05.09.19
		Sheet 1 of 1

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 & there are no exclusions/ deviations with regard to same.
- b) QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein.
- c) QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc.
- d) All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/ Customer approval.
- e) Bidder shall include the cost of Mandatory Spares, unless specified otherwise in Sec-IA of the specification or NIT.
Any mandatory spares stated as not applicable, shall have to be supplied without any cost implication to BHEL in the event they are found to be applicable during detail engineering stage.
- f) There are no other deviation with respect to specification other than those furnished in the 'Schedule of Deviations'.
- g) The offered materials should be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty. All materials shall be subject to approval in the event of order.
- h) Prices for recommended spares (if any) for 3 years operation shall be furnished separately & not included in the base price.
- i) The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL).
- j) All sub vendors shall be as per BHEL/ Customer approved list.
- k) Any special tools & tackles, if required, shall be in bidder's scope.
- l) All models offered have been supplied by bidder in the past and are meeting the experience qualifying criteria of BHEL/ Customer (viz. The submersible pumps shall be of proven design. The pump manufacturer should have manufactured and supplied at least One (1) no. of submersible pump set for continuous duty for similar application, of type and capacity as offered or higher and which has been in successful operation for at least one (1) year prior to the date of Techno-Commercial bid opening. The pump set shall be suitable for pumping raw water with high turbidity and soft solids/fibrous solids which are generally observed in contaminated rivers / canal water. Components of Identical pumps shall be interchangeable. Any deviation to these criteria shall be suitably highlighted in deviation schedule).
- m) All selected motor ratings have minimum margins as per Data sheet-A, section-1D of technical specification.
- n) Power & Control circuits shall be with MCCB.

We the undersigned hereby undertake to meet the compliance requirements as listed above on the conditions as elsewhere specified.

PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE

NAME	DESIGNATION	SIGNATURE	DATE	
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TITLE:

**TECHNICAL SPECIFICATION FOR RATE
CONTRACT OF SUMP PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-435-172-N001**

SECTION: **III**

SUB-SECTION:

REV. NO. **0** DATE 05.10.19

SHEET **1** OF **1**

SECTION IIIB

GA DRAWING OF SUMP PUMPS

(TO BE SUBMITTED ALONG WITH BID--FOR REF. ONLY)



TITLE:
**TECHNICAL SPECIFICATION FOR RATE
CONTRACT OF SUMP PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-435-172-N001**

SECTION: **III**

SUB-SECTION:

REV. NO. **0** DATE 05.10.19

SHEET **1** OF **1**

SECTION IIIC

**DEVIATION SCHEDULE
(AS PER NIT FORMAT)**

(TO BE SUBMITTED ALONG WITH BID)



TITLE:

**TECHNICAL SPECIFICATION FOR RATE
CONTRACT OF SUMP PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-435-172-N001**

SECTION: **III**

SUB-SECTION:

REV. NO. **0** DATE 05.10.19

SHEET **1** OF **1**

SECTION IIID

ELECTRICAL LOAD DATA FORMAT

CABLE SCHEDULE

MOTOR DATA SHEET-C

AND BLALANCE DOCUMENT AS PER CL. 13.0 OF SECTION-IA

(TO BE SUBMITTED BY SUCCESSFUL BIDDER AFTER AWARD OF CONTRACT)

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ANNEXURE III

[illegible]

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

(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

	TITLE	SPECIFICATION NO.
	MOTORS	VOLUME II B
	DATA SHEET – C	SECTION D
	2 x 660MW UDANGUDI STPP	REV NO. 00 DATE 21.05.18
		SHEET 1 OF 2

S. No.	Description		Data to be filled by successful bidder
A.	General		
1	Manufacturer & country of origin		
2	Motor type		
3	Type of starting		
4	Name of the equipment driven by motor & Quantity		
5	Maximum Power requirement of driven equipment		
6	Rated speed of Driven Equipment		
7	Design ambient temperature		
B.	Design and Performance Data		
1	Frame size & type designation		
2	Type of duty		
3	Rated Voltage		
4	Permissible variation for		
5	a	Voltage	
6	b	Frequency	
7	c)	Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)		
9	Synchronous speed & Rated slip		
10	Minimum permissible starting voltage		
11	Starting time in sec with mechanism coupled		
12	a) At rated voltage		
13	b) At min starting voltage		
14	Locked rotor current as percentage of FLC (including IS tolerance)		
15	Torque		
	a) Starting		
	b) Maximum		
16	Permissible temp rise at rated output over ambient temp & method		
17	Noise level at 1.0 m (dB		
18	Amplitude of vibration		
19	Efficiency & P.F. at rated voltage & frequency		
	a) At 100% load		
	c) At 75% load		

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTORS DATA SHEET – C 2 x 660MW UDANGUDI STPP	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE 21.05.18
		SHEET 2 OF 2

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
C.	Constructional Features	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level (kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
D.	Characteristic curves/ drawings (To be enclosed for motors of rating $\geq 55\text{KW}$)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

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