

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

Specification No: PE-TS-RC-172-N001 (Rev-0)



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



TITLE:
**TECHNICAL SPECIFICATION FOR RATE
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SPEC. NO.: **PE-TS-RC-172-N001**

SECTION:

SUB-SECTION:

REV. NO. **0** DATE :24.04.17

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

CONTENTS

CONTENTS

SECTION

TITLE

I	Specific Technical Requirements
IA	Specific Technical Requirements (Mechanical)
IB	Specific Technical Requirements (Elec.)
IC	Specific Technical Requirements (C&I)
ID	Data Sheet – A
II	Standard Technical Specifications
IIA	Standard Technical Specifications (Mechanical)
IIB	Standard Technical Specifications (Elec.)
IIC	Standard Technical Specifications (C&I.)
III	Documents to be submitted by Bidder
IIIA	Compliance certificate (To be submitted along with bid)
IIIB	GA drawings of pumps with motors (To be submitted along with bid -for reference purpose only)
IIIC	Deviation schedule (To be submitted along with the Bid)
IIID	Balance documents as per cl. 13.0 of section IA (To be submitted by successful bidder after award of contract)



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

SPECIFIC TECHNICAL REQUIREMENTS

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

SECTION: I

SUB-SECTION:

REV. NO. **0** DATE 24.04.17

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

SECTION - I

SPECIFIC TECHNICAL REQUIREMENTS

SUB-SECTION IA - Specific Technical Requirements (Mech.)
SUB-SECTION IB - Specific Technical Requirements (Electrical)
SUB-SECTION IC - Specific Technical Requirements (C & I)
SUB-SECTION ID – Datasheet-A



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

SPECIFIC TECHNICAL REQUIREMENTS

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

SECTION: **I**

SUB-SECTION: **IA**

REV. NO. **0** DATE **24.04.17**

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

SUB-SECTION – IA

SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)



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

SPEC. NO.: PE-TS-RC-172-N001
SECTION: I
SUB SECTION: IA
REV. NO. 0 DATE 24.04.17
SHEET 1 OF 7

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.

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 & 3 (Portable Horizontal Centrifugal Sump Pumps)

The following to be included in pump bidder scope.

- Pump flange and Counter Flanges with Nuts, Bolts, Gaskets etc.



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

SPEC. NO.: **PE-TS-RC-172-N001**
SECTION: **I**
SUB SECTION: **IA**
REV. NO. **0** DATE **24.04.17**
SHEET **2** OF **7**

- One (1) no. 7.5 m long suction hose and One (1) no. 30m long discharge hose to be considered so that the sump pump can be discharged to the nearest surface drain. The size of discharge piping shall be to suit pump discharge. Either ends of each hose being provided with female hose coupling.
- One (1) no. 500 mm long straight pipe piece with both ends flanged, one end matching with the pump suction nozzle.
- Two (2) nos. male type hose couplings, one of which is suitable for coupling with the above mentioned 500 mm pipe piece on one side and the 7.5 m long suction hose on the other side, whereas the other is suitable for coupling with the pump discharge nozzle on one side and the 30 m long hose on the other side. The pump suction pipe-piece and discharge nozzle shall be of flanged type and shall be equipped with necessary bolts, nuts & gaskets.
- A foot valve (of Bidder's recommended size) with suction strainer, necessary coupling and matching piece/reducer (if necessary) to couple with the 7.5-meter-long suction hose end.
- A starter panel complete with incoming switch/contacter, fuse, overload relays, start-stop push button, O/L reset push button, cable gland, wiring terminals, red and green indication lamps (LED type) and also 50 metres length of flexible power cable with power plug at one end and arrangement to connect the other end with the starter panel. Power Supply requirement to Starter Panels etc. shall be through 2P MCBs. (For Motor Driven pumps Set only)
- A suitable trolley with swivelling front wheel and having adequate fixing arrangement for pump motor/diesel engine set with a baseframe along with all above accessories, for operation without any undue vibration and with facility for being handled by a single operator.
- Accessories as per data sheet.
- Noise level shall be less than 85 dB at 1 meter.
- Any other standard accessory required for safe and trouble free operation of Pumps to be provided by Bidder.

c). For TYPE 4, 5, 6, 7 & 8 (Portable Submersible Sump Pumps):

The following to be included in pump bidder scope.

- 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.
- 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 metres long submersible type power cable having a power plug at one end and a hermetically sealed (waterproof) cable gland for connection with the pump drive- motor at the other end.
- 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).



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

SPEC. NO.: **PE-TS-RC-172-N001**
SECTION: **I**
SUB SECTION: **IA**
REV. NO. **0** DATE **24.04.17**
SHEET **3** OF **7**

- One Trolley Mounted starter panel, having a plug socket as receptacle of the above mentioned power plug (item "d"), a 30 metre 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.
- A suitable trolley with swivelling front wheel and having adequate fixing arrangement for pump motor/diesel engine set with a baseframe along with all above accessories, for operation without any undue vibration and with facility for being handled by a single operator.
- Float Type Level switches as per control interlock requirement as detailed in Clause No. 7.2 herein.
- Any other standard accessory required for safe and trouble free operation of Pumps to be provided by Bidder.

d). For TYPE 9 & 10 (Fixed Duty Type Submersible sump pumps):

For each of these pumps a supply feeder up to starter cum control panel shall be made available by BHEL. 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. 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.
- 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 (if applicable) shall be as per clause no. 2.2.4 below.
- Delivery bend.
- 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.
- Accessories as per data sheet.
- Level switches as per control interlock requirement as detailed in Clause No. 7.1 herein. Each level switch shall be provided with accessories like Probe, Perforated enclosing MS pipe for probe a/w mounting flange, matching flange with fixing nuts and bolts
- Lifting chains.

e). For TYPE 11, 12, 13 (Portable trolley mounted Submersible type sump pumps):



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

SPEC. NO.: **PE-TS-RC-172-N001**
SECTION: **I**
SUB SECTION: **IA**
REV. NO. **0** DATE **24.04.17**
SHEET **4** OF **7**

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.

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

- One starter cum control panel for each pump complete with necessary auto selector switches, start/stop buttons, switch/contacter fuse, red & green indication lamp, over load relays, L/L reset push buttons, A/O/M switch, control transformer. The starter cum control panel shall be mounted on the wheel trolley. 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. Lengths are indicated in data sheet-A, Section-1D of technical specification.

Also power cable of suitable length between drive unit and starter panel shall be in bidder's scope.

- 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.
- Delivery bends.
- 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.
- Level switches as per control interlock requirement as detailed in Clause No. 7.2 herein.
- Lifting chains.

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.



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

SPEC. NO.: **PE-TS-RC-172-N001**
SECTION: **I**
SUB SECTION: **IA**
REV. NO. **0** DATE **24.04.17**
SHEET **5** OF **7**

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. In the event of any contradiction of Section-II with Section-I, the Section-I will prevail.

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 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 9 & 10 (Fixed Duty Type Submersible pumps):

Submersible Sump Pumps shall be controlled through a Stand mounted starter cum control panel (in bidder's scope) for each sump pump.

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.



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

SPEC. NO.: **PE-TS-RC-172-N001**
SECTION: **I**
SUB SECTION: **IA**
REV. NO. **0** DATE **24.04.17**
SHEET **6** OF **7**

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

- (a) Start/stop facility.
- (b) Selector switch for main/standby selection.
- (c) 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.
- (d) 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.
- (e) Sump pump status indication (ON/Off/Trip).
- (f) Indication for failure of any sump pump.
- (g) Indication for Low voltage, low level, high level and overload.
- (h) Ammeter shall be provided in LCP if motor rating is 30 KW or above.
- (i) Power and Control circuits shall be with MCCB.
- (j) 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 2 to 8, TYPE-11 to 13 (Portable Submersible pumps):

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

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

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.

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.



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

SPEC. NO.: **PE-TS-RC-172-N001**
 SECTION: **I**
 SUB SECTION: **IA**
 REV. NO. **0** DATE **24.04.17**
 SHEET **7** OF **7**

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-XXX-172-N001	TDS AND PERFORMACE CURVES OF SUMP PUMPS	R-0 within 20 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-XXX-172-N002	GENERAL ARRANGEMENT AND CROSS SECTIONAL - SUMP PUMPS	
	PE-V8-XXX-172-N003	TDS AND CURVES FOR MOTORS (IF APPLICABLE) OF SUMP PUMPS	
	PE-V8-XXX-172-N004	C&I Doc. -WRITE UP, WIRING DIAGRAM & GA OF CONTROL PANEL FOR SUMP PUMPS	
	PE-V8-XXX-172-N005	QP- SUMP PUMPS	
	Secondary Document:		Within 30 days from MDCC
	PE-V8-XXX-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 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.***



TITLE:
TECHNICAL SPECIFICATION FOR RATE
CONTRACT OF SUMP PUMPS
SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: PE-TS-RC-172-N001
SECTION: I
SUB SECTION: IA
REV. NO. 0 DATE 24.04.17
SHEET 8 OF 7

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 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



TITLE:
TECHNICAL SPECIFICATION FOR RATE
CONTRACT OF SUMP PUMPS
SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: PE-TS-RC-172-N001
SECTION: I
SUB SECTION: IA
REV. NO. 0 DATE 24.04.17
SHEET 9 OF 7

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



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

SPECIFIC TECHNICAL REQUIREMENTS

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

SECTION: **I**

SUB-SECTION: **IB**

REV. NO. **0** DATE **24.04.17**

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

SUB-SECTION – IB

SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)

Note: Specific electrical specification for Type-4 sump pumps are specified at two places i.e Sub-Section-1B (part-1) and Sub-Section-1B (part-2). However stringent of these two shall be followed.

	TECHNICAL SPECIFICATION FOR Sump Pumps (ELECTRICAL PORTION)	SPECIFICATION NO. SECTION-C REV 01 PAGE 1 OF 1
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SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER/ PURCHASER

- 1.1 Scope for supply, and erection & commissioning of various equipment forming part of electrical system for this package shall be as per Annexure-I to Section – C [Scope of Work (Electrical)].
- 1.2 Make of various equipment/ items in the scope of bidder shall be to approval of owner during detailed engineering stage without any commercial implications.
- 1.3 Bidder shall furnish all AC as well as DC loads required for the system at different voltage levels (eg. 415V AC, 240 V AC, 220 V DC etc.) of all types, such as motor feeders, supply feeders in PEM format along with the offer.
- 1.4 All electrical equipment shall be suitable for the power supplies, fault levels and climatic conditions indicated in project information enclosed with the specification.
- 1.5 All drawings, data sheets, Quality Plan, calculations, test reports, test certificates, etc. shall be submitted during detailed engineering stage as per formats enclosed. The same shall be subject to approval without any commercial implications.
- 2.0 **In case of any discrepancy between Customer specification and BHEL standard specification, Customer specification shall prevail.**

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/ quality assurance requirements stipulated. In line with this, the bidder as technical offer shall furnish two signed and stamped copies of the following:
 - a) A copy of this sheet “Electrical Equipment Specification for Ventilation System’ and sheet “Electrical Scope between BHEL and Vendor” with bidder’s signature and company stamp.
 - b) List of Erection and Commissioning spares.
 - c) List of Erection & Maintenance tools & tackles.
 - d) Electrical load requirement in the load data format.
- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 LIST OF ENCLOSURES

- 4.1 Electrical scope between BHEL & vendor (Annexure-I).
- 4.2 Electrical Section-C
- 4.3 Technical specification – Customer specification - Motors
- 4.4 BHEL standard specification for LT motors : PE-SS-999-506-E101 (Section-D)
- 4.5 Datasheets – A and C
- 4.6 Quality Plan for motors.
- 4.7 Load data format (Annexure-II).
- 4.8 Cable Schedule Format(Annexure-III)

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE : SUMP PUMPS

SCOPE OF VENDOR: SUPPLY

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL Vendor BHEL	BHEL BHEL BHEL	
5	Any special type of cable like compensating, co-axial, prefab, MICC, fibre Optic cables etc.	Vendor	BHEL	
6	Cabling material (Cable trays, accessories ,cable tray supporting system, conduits etc.)	BHEL	BHEL	
7	Cable glands ,lugs, and bimetallic strip for equipment supplied by Vendor	Vendor	BHEL	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
8	Equipment grounding & Lightning protection	BHEL	BHEL	
9	Below grade grounding	BHEL	BHEL	
10	Motors alongwith 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.

MOTOR DATA SHEET-A

SPECIFIC ELECTRICAL REQUIREMENT FOR Sump Pumps

SL.NO.	PARAMETERS	UNIT	
	MOTOR		
1	DESIGN AMBIENT TEMP	DEG. C	50
2	VOLTAGE SUPPLY AND VARIATION	VOLT	415V, $\pm 10\%$
3	FREQUENCY WITH VARIATION	Hz	50, +3% to -5%
4	COMBINED VOLTAGE & FREQUENCY VARIATION		10%
5	MAX ACCEPTABLE RATING OF MOTOR AT 415 V	KW	160 KW & below
6	SYSTEM FAULT LEVEL AND ITS DURATION	KA	50kA, 1sec
7	SUTABILITY OF TERMINAL BOX FOR FAULT LEVEL AND DURATION		50 KA, 0.25 sec
8	CLASS OF INSULATION & TEMP RISE LIMITED TO		Class-F and temp rise limited to Class-B
9	MIN. STARTING VOLTAGE		85%
10	MOTOR RATING FOR SINGLE PHASE SUPPLY		0.2 kW & Below
11	MAXIMUM LOCKED ROTOR CURRENT	% OF FLC	600% inclusive of IS tolerance.
12	ACCEPTABLE NOISE LEVEL	DB	As per IS 12065
13	TYPE OF STARTER PROVIDED IN MCC		DOL
14	DOP OF ENCLOSURE		IP-55 & IP-54 for outdoor & indoor resp.
15	SPACE HEATER REQUIREMENT	<30kW	30KW & ABOVE
16	PAINT SHADE		Siemens Grey (RAL 7032)
17	SPECIAL REQUIREMENT		-
18	ENERGY EFFICIENT		All LV MOTORS ABOVE 10 KW WITH S1 DUTY SHALL BE COMPULSORILY OF ENERGY EFFICIENT LEVEL IE3 AS PER IS 12615:2011

MOTORS

1.00.00 DESIGN CRITERIA

1.00.01 For the purpose of design of equipments /systems, an ambient temperature of 50 °C and relative humidity of 85% shall be considered. The equipment shall operate in a highly polluted environment.

1.00.02 Transient voltage dip on starting of the largest motor with DOL shall be limited to 20% of the nominal system voltage at the voltage terminals.

1.00.03 Rating

The motor rating shall be arrived at considering 15% margin over the duty point input or 10% over the maximum demand of the driven equipment, whichever is higher, considering highest system frequency.

All motors shall be continuously rated (S1 duty). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor.

Whenever the basis for motor ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.

1.00.04 Starting Voltage requirement for all motors (except mill motors):

1. 85 % of rated voltage for motors up to 1000 kW
2. 80 % of rated voltage for above 1000 kW and up to 4000 kW
3. 75 % of rated voltage for above 4000 kW

For Mill Motors:

1. 85 % of rated voltage for motors above 1000 kW
2. 90 % of rated voltage for motors up to 1000 kW

1.00.05 Canopy shall be provided for outdoor motors.

1.01.00 Contractor shall provide fully compatible electrical system, equipments, accessories and services.

1.02.00 All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.

1.03.00 Voltage and frequency variations:

Frequency: (+) 3% and (-) 5%

Voltage : **i. AC**

a. $\pm 6\%$ for 11 kV/3.3 kV

b. $\pm 10\%$ for 415 V

Combined 10 % (absolute sum)

ii. DC- +10% to -15% for 220 V DC

1.04.00 All LV motors above 10 kW with S1 duty shall be compulsorily of Energy efficient level IE 2 as per IS 12615: 2011.

1.05.00 The responsibility of coordination with electrical agencies and obtaining all necessary clearances shall be of the contractor.

1.06.00 Type

AC Motors:

(a.) Squirrel cage induction motor suitable for direct-on-line starting.

(b.) Crane duty motors shall be slip ring type induction motor

DC Motors

(a.) Shunt wound.

1.07.00 Temperature Rise

Air cooled motors

70°C by resistance method

Water cooled

80° C over inlet cooling water temperature mentioned elsewhere, by resistance method.

1.08.00 Degree of Protection

Degree of protection for various enclosures shall be as follows :

i) Indoor motors — IP 54

- | | | | |
|------|---|---|-------|
| ii) | Outdoor motors | – | IP 55 |
| iii) | CW motors (in case of screen
prot. Drip proof) | – | IP 23 |
| iv) | Cable box – indoor area | – | IP 54 |
| v) | Cable box – outdoor area | – | IP 55 |

2.00.00 CODES AND STANDARDS

2.01.00 All motors shall confirm to the latest editions including all applicable amendment of relevant IS, IEC and CBIP standards/Publications. In case any other standard is followed that ensures equal or better quality, may be accepted. However the English version of the Standard adopted shall be submitted.

2.02.00 Major Standards, which shall be followed, are listed below. Any other applicable Indian standards for any component part even if not covered in the list shall also be followed

- | | | | |
|-----|---|---|--|
| 1.) | Three phase induction motors | : | IS:325, IEC:60034 |
| 2.) | Single phase AC motors | : | IS:996, IEC:60034 |
| 3.) | Crane duty motors | : | IS:3177, IEC:60034 |
| 4.) | DC motors/generators | : | IS:4722 |
| 5.) | Degree of protection by
enclosures for rotating electrical
machines | : | IS: 4691
IS: 4728
IS: 6362
IS: 2253 |
| 6.) | Noise levels for rotating
electrical machines
Mechanical Vibrations for
rotating electrical machines | : | IS: 12065
IS: 12075 |

3.00.00 OPERATIONAL REQUIREMENTS

3.01.00 Starting Time

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

- 3.01.02 For motors with starting time more than 20 secs and up to 45 secs at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs more than starting time.
- 3.01.03 For motors with starting time more than 45 secs at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.
- 3.01.04 Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.
- 3.01.05 Motors shall be capable of restarting under full load after a momentary loss of voltage with the possibility of 150 % nominal voltage during fast bus transfer.
- 3.02.00 Torque Requirements
- 3.02.01 Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.
- 3.02.02 Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.

4.00.00 DESIGN AND CONSTRUCTIONAL FEATURES

- 4.00.01 Suitable single phase space heaters shall be provided on motors rated 30 kW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided.
- 4.00.02 All motors shall be suitable for direct on line starting through any type of breaker.
- L All motors shall be either totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). CW motors can be screen protected drip proof (SPDP) type. Motors located in hazardous areas shall have flame proof enclosures conforming to IS: 2148 as detailed below

- (a) Fuel oil area : Group - IIB
- (b) Hydrogen generation plant Group - IIC
area :

4.00.03 Winding and Insulation

- (a) Type : Non-hygroscopic, oil resistant, flame resistant

- (b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature
- (c) 11 kV / 3.3 kV AC motors : Class F: with winding temperature rise limited to class B. They shall withstand 1.2/50 micro sec switching surges of $4U+5$ KV (U=Line voltage in KV). The coil inter-turn insulation shall be suitable for 0.3/3 micro sec. surge of 32 KVp and 12 kVp for 11 kV and 3.3 kV system respectively followed by 1 min power frequency high voltage test of appropriate voltage on inter turn insulation.
- (d) 415V AC & 220V DC motors : Class 'F' with temperature rise limited to class 'B'

- 4.00.04 Motors rated above 1000 kW shall have insulated bearings to prevent flow of shaft currents.
 - 4.00.05 Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.
 - 4.00.06 Noise level and vibration shall be limited within the limits prescribed in IS: 12065 & IS: 12075 respectively. Motors shall withstand vibrations produced by driven equipment.
 - 4.00.07 In MV/HV 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. Each bearing shall be provided with dial type thermometer with adjustable alarm contact and resistance type temperature detector. All HV motors shall be provided with shaft grounding rings for bearing protection and earthing shaft current.
 - 4.00.08 MV/HV motors shall also be capable of satisfactory operation at full load at a supply voltage of 80% of the rated voltage and shall be capable of either two starts in quick succession with third start after 5 minutes in cold condition or two starts at 15 minutes intervals in hot condition, both cases with voltage and frequency variation within specified limits.
 - 4.00.09 Locked rotor current of the MV motors shall be limited to 600% (subject to IS tolerance) of the full load current of the motors and for HV motor shall be limited to 450% (inclusive of IS tolerance) of full load current of the motor.
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Locked rotor current of the LV motor shall not exceed 600% of full load current inclusive of IS tolerance.

- 4.00.10 MV Motors shall be provided with differential protection. These motors shall be provided with star connected stator windings. The 3 nos. current transformers, one for each phase shall be mounted in a separate compartment in the neutral side terminal box. The three phases shall be connected to form the star point after they pass through the CTs. These differential protection CTs shall be supplied loose by 11/ 3.3 kV switchgear manufacturer.
 - 4.00.11 Motor body shall be grounded at two earthing points on opposite sides with two separate and distinct grounding pads complete with tapped holes, GI bolts and washers.
 - 4.00.12 HV motors can be offered with either elastimould termination or dust tight phase separated double walled (metallic as well as insulated barrier) cable boxes. In case elastimould terminations are offered, then protective cover and trifurcating sleeves shall also be provided. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided in case of cable boxes.
 - 4.00.13 All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.
 - 4.00.14 The motors shall be suitable for bus transfer schemes provided on the 11 kV, 3.3 kV/415V systems without any injurious effect on its life.
 - 4.00.15 All motors below 15 kW shall be provided with sealed ZZ bearings.
 - 4.00.16 For motors rated 1000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.
 - 4.00.17 All motors shall be provided with an emergency stop push button near the motor as per the Indian Statutory regulations.
 - 4.00.18 The motor terminal box shall be suitable for withstanding the maximum system fault current for a duration of at least 0.25 seconds.
 - 4.00.19 Neutral in case of HV motors shall be kept accessible.
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- 4.00.20 Motors shall be designed to easy access for drilling holes through motor feed of mounting flange for installation of dowel pins after assembly of the motor and driven equipment.
- 4.00.21 Well spacious working platforms shall be provided around the motor area for carrying out maintenance & testing works. Platform shall be minimum of 300 mm below the level of motor base plate.
- 4.00.22 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.
- 4.00.23 For bearing temperature measurement, duplex RTDs shall be provided for each bearing and shall be wired up to the terminal box..
- 4.00.24 Lube oil pressure transmitters shall be provided to DCS for remote monitoring. Lube oil pressure very low trip to HV equipment shall be 2 out of 3 logic.
- 4.00.25 Capillary type temperature gauge cum switch shall be provided for DE / NDE of HV Motors
- 4.00.26 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.
- 4.00.27 Lifting Provisions**
- Motor weighing 25 kg or more shall be provided with eye bolt or other adequate provision for shifting. Electrical hoists shall be provided for motors above 1000 kgs for maintenance of the same.
- 4.00.28 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

4.00.30 Painting

Motor including fan shall be painted with corrosion proof paints of colour shade Siemens grey (RAL 7032).

4.00.31 Local Push Button Stations

The LPBS shall be installed near the motors to be controlled. Individual channel supports shall be used for each LPBS. These shall be installed as per approved erection detail drawing. LPBS for hazardous areas shall be CMRS certified and CCE approved.

All LPBS shall have necessary canopies. Wiring of LPBS shall be checked before giving control supply.

5.00.00 LIST OF TESTS TO BE CONDUCTED FOR HV, MV and LV MOTORS

5.01.00 TYPE TESTS

- (a) No load saturation and loss curves up to approximately 115% of rated voltage
 - (b) Momentary overload test
 - (c) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., core temp., coolant flow and its temperature shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.
 - (d) Surge withstand test on the sample coil after placing it in stator core at $(4U + 5 \text{ KV})$ and with at least five impulse of 1.2/50 micro sec. wave, for HV motors only, where U is the line to line voltage in kV.
 - (e) Surge-withstand test with 0.3/3 micro sec. wave on each type of 3.3/11 kV motor coils with at least five such impulses, followed by one minute power frequency high voltage test on turn to turn insulation, after cutting the coil and bringing out
-

the turns suitably. The power frequency test voltage shall be decided during detailed engineering.

- f) Dimensions (for motors covered by IS 1231:1974 and IS 2223:1983 only)
- g) Measurement of resistance of windings of stator and wound rotor.
- h) Reduced voltage running up test at no load (for squirrel cage motors up to 37kw only)
- i) Full load test to determine efficiency, power factor and slip.
- j) Insulation resistance test
- k) Test for vibration severity of motor
- l) Test for noise levels of motor
- m) Test for degree of protection by enclosure
- n) Temperature rise test at limiting values of voltage and frequency variations
- o) Over speed test

5.02.00 ROUTINE TESTS

The following shall constitute the routine tests.

- a) Insulation resistance test
- b) Measurement of resistance of windings of stator and wound rotor.
- c) No load test
- d) Locked rotor readings of voltage, current and power input at a suitable reduced voltage
- e) Reduced voltage running up test (for squirrel cage motor)
- f) Open circuit voltage ratio of stator and rotor windings (for slip ring motors); rotor;
- g) High voltage test

6.00.00 INSPECTION AND TESTING AT SITE

6.01.01 Insulation resistance of 415V motors shall be measured between the winding of the machine and its frame by means of a 500/1000V megger. A minimum value of 1 mega ohm for 415V motors shall be considered a safe value. In case of lower I.R. Value, the insulation value shall be brought up by any of the following methods as desired by the Site Engineer:

- (a.) Blowing hot air in case of big motors.
 - (b.) Putting the motor in electric oven in case of smaller motors.
 - (c.) Placing heaters or lamps around and inside in case of small motors after making suitable guarding and covering arrangements so as to conserve the heat.
-

6.01.02 Site Test

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

6.01.03 3.3 kV motors shall be tested for insulation by 500/1000V megger and its value should not be less than the safe minimum insulation of $\geq 20 \text{ M}\Omega$ resistance at 60 deg. C. In case the insulation is low, the following method of drying has to be adopted:

- a. By locking the motor so that it cannot rotate and then applying such a low voltage to the stator terminals that full load current flows in the stator, keeping the stator winding temperature below 90 deg. C. In this a close watch shall be kept for any possible overheating and I.R. Values vs. temperature shall be plotted and heating continued till I.R. Value becomes steady.
 - b. By blasting hot air from external source, Maximum temperature of winding while drying should be 70 deg. C to 80 deg. C. (Thermometer) or 90 deg. C. to 95 deg. C. by resistance method. Heating should be done slowly till steady temperature of winding is reached after 4 to 5 hours and for large machines after 10 hours. A record has to be kept for drying process, with half an hour readings and, after steady temperature is reached, at an interval of 2 hours. In case it is essential, the drying process can be supplemented by blower.
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	ELECTRICAL EQUIPMENT SPECIFICATION FOR SUMP PUMP	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION : C
		REV NO. : 00 DATE : 05.04.17
		SHEET : 1 OF 1

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

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Erection and Commissioning spares.
- e) Erection & Maintenance tools & tackles.
- f) Electrical load requirement for Sump Pump.
- g) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- h) 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
- i) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.

2.0 **EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:**
Refer “Electrical Scope between BHEL and Vendor”.

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

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

- a) A copy of this sheet ”Electrical equipment Specification for Sump Pump” and sheet “Electrical Scope between BHEL and Vendor” with bidder’s signature and company stamp.
- b) List of Erection and Commissioning spares.
- c) List of Erection & Maintenance tools & tackles.
- d) 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.

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE: SUMP PUMP

PROJECT:

<u>S.NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1.	415 V MCC	BHEL	BHEL	415 V AC (3 PHASE 3 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2.	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motors.
3.	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL Vendor BHEL	BHEL BHEL BHEL	
4.	Cabling material (cable trays, accessories, cable tray supporting system, Conduit and conduit accessories) for cabling between equipments supplied by vendor and BHEL.	BHEL	BHEL	
5.	Cable glands and lugs for equipments 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.	LT Motors with base plate and foundation hardware	Vendor	BHEL	Makes shall be subject to BHEL approval at contract stage.
9.	Mandatory spares	Vendor	-	Vendor to quote as per specification.
10.	Recommended O & M spares	Vendor	-	As per specification
11.	Any other equipment/material/service required for completeness of system but not specified above (to ensure trouble free and efficient operation of the system).	Vendor	BHEL	
12.	Electrical equipment GA drawing	Vendor	-	For necessary interface review.
13.	Any special type of cable like compensating. Co-axial, prefab, MICC and fibre optical	Vendor	BHEL	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
14.	Junction box for control & instrumentation cable	Vendor	Vendor	

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE: SUMP PUMP

15.	a) Input cable schedules (Control & screened control cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable (excluding power cables) in enclosed excel format shall be submitted by vendor during detailed engineering stage.
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Note- All QPs shall be subject to approval of BHEL/ Customer after award of contract.

NOTES:

1. Make of all electrical equipments/items supplied shall be reputed make & shall be subject to approval of BHEL after award of contract.
2. All QPs shall be subject to approval of BHEL after award of contract without any commercial implication.

SECTION – 14: AC & DC MOTORS

14.01.00 SCOPE

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

14.01.01 Site Conditions

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

14.01.02 Gases, Fumes & Dust Particles

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

14.01.03 Dust Particles

- i) Outdoor locations - Heavily dusty with abrasive dust and coal particles of size five (5) to hundred (100) microns present in atmosphere in large quantity.
- ii) Indoor Locations.
- iii) Coal conveyors - As for outdoor as per clause 14.01.3 (i) above.
- iv) Other locations - Lightly dusty with abrasive dust and coal particles of size five (5) to twenty (20) microns present in atmosphere.

14.01.04 Special Fumes

- i) Water treatment plant and acid cleaning room - Acid and alkali fumes present.
- ii) Fuel oil pumping areas & Hydrogen generation plant - Explosive fumes (flameproof motors required).
- iii) For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.

14.02.00 LOCATION OF MOTOR - As required

14.03.00 CODES STANDARDS

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

Code	Name of standard
IS : 325	Specification for three phase induction motor.
IS : 900	Code of Practice for installation and maintenance of induction motors
IS : 996	Single phase AC motors
IS : 1231	Dimensions of three-phase foot-mounted induction motors
IS : 1271	Thermal evaluation and classification of electrical insulation.
IS : 2223	Dimensions of flange mounted ac induction motors.
IS : 2254	Dimensions of vertical shaft motors for pumps
IS : 3043	Code of practice for earthing.
IS : 3177	Crane duty motors
IS : 4029	Guide for testing three phase induction motors.
IS : 4691	Degree of protection for enclosures of rotating electrical machinery.
IS : 4722	Specification for rotating electrical machinery.
IS : 4728	Terminal marking and direction of rotation for rotating electrical machinery.
IS : 4889	Methods of determination of efficiency of rotating electrical machines.
IS : 5571	Guide for selection of electrical equipment for hazardous areas.
IS : 6362	Designation of Method of Cooling of Rotating electrical machines.
IS : 8223	Dimensions and output ratings for foot mounted rotating electrical machines with frame numbers 355 to 1000.
IS : 8789	Values of performance characteristics for three phase induction motors.
IS : 12065	Noise level of motors.
IS : 12075	Measurement and evaluation of vibration of rotating electrical machines.
IS : 12615	Induction motors - Energy efficient, three-phase, squirrel cage – Specification
IS : 12802	Temperature rise measurement of rotating electrical machines.
IS : 12824	Temperature rise measurement of rotating electrical machines

IS : 12824	Type of duty and classes of rating assigned.
IS : 14222	Requirements and method of Impulse withstand test
IEC: 60034-1	Rotating electrical machines.
ISO : 1940-1	Mechanical vibration – Determination of permissible residual unbalance
NEMA, MG-1	Motors and Generators
DIN/IEC/IS	RTD
BS 5308 part II	RTD triad Cable

Equipment and material conforming to any other standard, which ensures equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be furnished during detail engineering.

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

14.04.00 TYPE

14.04.01 AC Motors:

- i) Squirrel cage induction motor suitable for direct-on-line starting.
- ii) Continuous duty LT motors rated above 0.37kW upto 200 KW Output rating (at 50 deg. C ambient temperature), shall be **Efficiency class-IE3**, conforming to IS 12615, or IEC:60034-30. However this is not applicable for geared motors (motors completely integrated with driven equipment) which are specifically designed to suit the driven equipment duty.
- iii) Crane duty motors shall be squirrel cage Induction motor of S4 duty and 40% CDF.

14.04.02 DC Motors shunt wound.

14.05.00 VOLTAGE (NOMINAL)

14.05.01 LV Motors

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

14.05.02 MV Motors

For motors above 200 kW upto and including 2000kW. Six point six (6.) kV.

14.05.03	HV Motors
	i) For motors above 2000kW - eleven (11) KV
	ii) All motors are to be designed for system grounding described in "System Particulars" under site information of the Driven Equipment Specification.
14.06.00	FREQUENCY (NOMINAL) - fifty (50) Hertz
14.07.00	NUMBER OF PHASES - Three (3)
14.08.00	SPEED - As required by the driven equipment
14.09.00	TYPE OF STARTING - Direct on-line
14.10.00	DUTY
14.10.01	Continuous motor rating shall be arrived at considering 15% margin over the duty point input or 10% over the maximum demand of the driven equipment, whichever is higher, considering highest system frequency and voltage variation. Crane motors shall be rated for S4 duty, 40% cyclic duration factor. If however, a higher margin is stipulated in the accompanying driven equipment specification, the higher stipulated margin shall prevail.
14.10.02	Motor rating shall be such that it is not overloaded at any operating point of driven equipment from zero to full load.
14.10.03	The break-away torque, pull-up torque and pull-out torque of the motors shall be properly co-ordinated with the requirements of driven equipment to ensure smooth and rapid starting and steady operation. The torque-speed characteristic of motor super imposed thereon on driven equipment torque-speed characteristics at 100%, 90%, 80% shall be furnished.
14.10.04	Maximum torque shall not be less than 205% of full load torque.
14.10.05	All HV & MV motors shall be provided with vibration pads for mounting vibration detectors.
14.10.06	All motors shall be designed to withstand hundred twenty (120) percent of rated speed without any mechanical damage for two (2) minutes.
14.10.07	Motors shall be designed to keep torsional and rotational natural frequencies of vibration of the motor and driven equipment atleast twenty five (25) percent above or below, preferably above the motor operating speed (to avoid resonance in vibration over the operating speed) range.
14.10.08	All LV motors rated 0.37kW and higher upto and including 200kW (LV Motors) with S1 duty shall be compulsorily be of energy efficiency level IE 3 as per IS 12615:2011.

14.10.09 HV & MV motors shall have full load efficiency of 95% minimum and rated full load power factor of 0.8 minimum. The required power factor shall be achieved without using external capacitor.

14.11.00 SUPPLY VARIATIONS Motors shall be capable of running continuously at full load under following variations in power supply.

14.11.01 Voltage (percent of nominal voltage) Plus minus ($\pm$) ten (10) for LT
Plus minus ($\pm$) Six (6) for MV & HT

14.11.02 Frequency (percent of minimal frequency)..... Plus Three 3 & minus (-) five (5)

14.11.03 Combined voltage & frequency (percent) Ten (10) (sum of absolute percentage value of voltage and frequency variation)

14.12.00 ABNORMAL CONDITIONS CAPABILITY

Motor shall have following capabilities as specified design ambient temperature:-

14.12.01 The motors shall also be capable of running up again after voltage collapse to about 40% for approximate duration of 0.5 sec. Subsequent rise in voltage to 70% and further to 80% and 100%, the total duration not exceeding 20 sec.

14.12.02 Pump motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with non-energized shaft rotating at 125% rated speed in reverse direction.

14.12.03 Low Voltage Running:-

Motor shall be capable of running satisfactorily at seventy five (75) percent nominal voltage for five (5) minutes.

14.12.04 Momentary Low Voltage Withstanding:

Motor, when running at full load, shall not stall when voltage drops down to seventy (70) percent nominal voltage for one (1) minute.

14.13.00 STARTING CAPABILITY

14.13.01 Low Voltage Starting

Motor shall be capable of starting and accelerating to full speed at full load (including loaded equipment e.g. mills and conveyors etc) at eighty (80) percent nominal voltage at motor terminals. Mill motors may be permitted to start with terminal voltage not below 90%.

14.13.02 Cold Motor Starting

Under specified voltage variations two (2) starts in quick succession and third start five (5) minutes thereafter, all with full load (including loaded equipment eg mills and conveyors etc) of driven equipment. No additional start shall be made till lapse of further thirty (30) minutes. (with initial temperature of the motor at ambient temperature)

14.13.03 Hot Motor Starting

Under specified voltage variations, one (1) immediate and two (2) fifteen (15) minutes interval starts all with full load (including loaded equipment e.g. mills and conveyors etc) of driven equipment. No additional start shall be made till lapse of further thirty (30) minutes. (with initial temperature of the motor at full load operating level)

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

14.13.05 Break-away Starting Current

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

- i) Motors upto 1000 KW 600% subject to IS Tolerance of plus 20%
- ii) Motors (above 1000 KW upto 3000 KW) 600%. Subject to 20% IS tolerance.
- iii) Motors above 3000 KW.....450%. Not subject to any positive tolerance.For energy efficient
- iv) LT motors, locked rotor current shall be as per IS: 12615.
- v) 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

14.14.06 Where variable voltage and variable frequency (VVFD) operation is envisaged through VVFD drives, motors shall be specially designed for such application.

14.14.00 STARTING VOLTAGE REQUIREMENT

14.14.01 All Motors (except Mill Motors)

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

14.14.02 For Mill Motors:

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

14.15.00 TORQUE REQUIREMENTS

14.15.01 Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10%. Motor full load torque.

14.15.02 Full out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty Motors.

14.16.00 STARTING TIME

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

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

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

14.16.04 At no stage, speed switch shall be provided to achieve requirements mentioned in Clause No. 14.16.01 to 14.16.03.

14.17.00 CLASS OF INSULATION

14.17.01 LV Motors Class F.

14.17.02 HV & MV Motors Class F

14.17.03 However temperature rise shall be restricted to limits corresponding to Class 'B' insulation for both MV, HV & LT motors. The temperature under abnormal running conditions shall be limited to 5°C above class 'B' limits.

14.17.04 The value of the polarization index for motors above 200kW should not be less than 2 when determined according to IS: 78114.0

14.17.05 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,

14.17.06 HT motors shall withstand 1.2/50 micro sec impulse Voltage wave of $4U+5$ kV (U =Line voltage in kV). The coil inter-turn insulation shall be as per IEC-60034 – Part 15 followed by 1 min power frequency high voltage test of appropriate voltage on inter turn insulation.

14.18.00 TEMPERATURE RISE UNDER NORMAL CONDITIONS

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- 14.18.01 Temperature rise over specified design ambient temperature when motor is running with full load at nominal supply voltage & frequency shall not exceed the values given below:

S.No.	Specified Design Ambient Temperature	Thermometer Method	Resistance Method
i)	50°C	60°C	70°C

- 14.18.02 For Water Cooled Motors, temperature rise of insulation should be limited to 80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method.

14.19.00 BUS TRANSFER WITHSTAND CAPABILITY

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

- 14.19.02 That motor shall be capable of withstanding heavy inrush transient current caused by such bus transfers without damage.
- 14.19.03 That the motor winding's shall be adequately braced to satisfactorily withstand mechanical stresses under these conditions.
- 14.19.04 The motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torques under these conditions.

14.20.00 TYPE OF ENCLOSURE

- 14.20.01 Outdoor Motors.....IP 55 (Additional canopy to be provided by Bidder).
- 14.20.02 Indoor Motors IP 55
- 14.20.03 IP-55 degree of protection shall be achieved without application of any compound, putty etc.

14.21.00 METHOD OF COOLING

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

14.23.00 MAXIMUM MECHANICAL VIBRATIONS

Vibration shall be limited within the limits prescribed in IS: 12075 / IEC 60034-14. Motors shall withstand vibrations produced by driven equipment. HV & MV motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads. Vibration pads with screwed holes along with vibration probes shall be provided at both DE and NDE.

14.24.00 NOISE LEVEL

14.24.01 Noise level for all the motors shall be limited to 85dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). at 1m from operating motor measured in accordance with IS: 10265.

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

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

TABLE – I

DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS

Motor MCR in KW	Minimum distance between centre of stud and gland plate in mm
UP to 3 KW	As per manufacturer's practice.
Above 3 KW - upto 7 KW	85
Above 7 KW - upto 13 KW	115
Above 13 KW - upto 24 KW	167
Above 24 KW - upto 37 KW	196
Above 37 KW - upto 55 KW	249
Above 55 KW - upto 90 KW	277
Above 90 KW - upto 125 KW	331
Above 125 KW-upto 200 KW	203

14.24.04 For HV & MV motors the distance between gland plate and the terminal studs shall not be less than 500 mm.

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

14.24.06 For motors rated 1000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.

14.25.00 WINDING & INSULATION

14.25.01 Type : Non-hygroscopic, oil resistant, flame resistant

14.25.02 11kV & 6.6 kV AC : Thermal class 155 (F) insulation and the motors temperature rise shall be limited to Class B. Winding material shall be of copper. The winding insulation process shall be total Vacuum Pressure Impregnated i.e resin poor method. The lightning Impulse & inter-turn insulation surge withstand level shall be as per IEC-60034 part-15

14.25.03 240VAC, 415V : Thermal Class(F)
AC & 220V
DC motors

14.26.00 DIRECTION OF ROTATION

14.26.01 As needed by driven equipment.

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

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

14.27.00 BEARINGS

14.27.01 Greased ball, roller and/or sleeve bearing shall be rated for minimum standard life of 40000 hours taking bearing and driven equipment loads into account. Loss of grease shall be scarce and it shall not creep along shaft into motor housing.

14.27.02 Bearing shall be effectively sealed against dust ingress and shall be pressure grease gun lubricated.

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| 14.27.03 | If the bearings are oil lubricated, a drain plug shall be provided for draining residual oil and oil level gauge shall be provided to show precisely oil level required under standstill and running conditions. |
| 14.27.04 | Unless otherwise approved, bearing lubricating system shall be such that no external forced oil or water is necessary to maintain required oil supply to keep bearing temperature within design limits. |
| 14.27.05 | For MV & HV motors rated 1000KW and above , the bearings shall be insulated wherever necessary to prevent damage to motor bearings from shaft current. |
| 14.27.06 | When pressure oiling is required for horizontal motors, bearings shall be sleeve type arranged for pressure oiling supplied from lubrication system of driven machine, with ring oiling for starting and emergency duty. Ring oiling system shall be adequate for starting and continuous operation of motor for at least half an hour, without pressure oiling system in operation. Oil sight flow gauges shall be provided to indicate oil flow through each bearing. |
| 14.27.07 | Lubricants shall be selected for prolonged storage and normal use of motors in tropical climate and shall contain corrosion and oxidation inhibitors. Greases shall have suitable bleeding characteristics to minimize setting. The selected lubricants shall be indigenously available. |
| 14.27.08 | Sleeve bearings for use with motors having flexible coupling with limited end play, shall have adequate axial end play to prevent transmission of thrust from driven equipment to motor bearings. |
| 14.27.09 | Bearings shall be of internationally reputed make subject to the approval of the Owner/Consulting Engineer. |
| 14.27.10 | Large motors shall preferably have spherically seated babitted, ring forced, feed lubricated, water-cooled bearings. If anti-friction bearings are provided, these shall be roller bearings rated for a minimum standard life of 30000 hours taking all bearing and driven equipment loads into account. |
| 14.28.00 | SHAFT EXTENSION Key slotted bare shaft extension of required length with key on driving end. |
| 14.29.00 | DRAIN HOLES Two (2) drain holes with plugs, one (1) on either end of motor at the bottom most point. |
| 14.30.00 | LIFTING DEVICES Motors shall be provided with eye-bolts, lugs or other means to facilitate safe lifting. |
| 14.31.00 | DOWEL PINS It shall be possible to drill holes vertically inclined through motor feet or mounting flange for installing dowel pins after assembling motor and driven equipment, before despatch (for completed driving + driven equipment assembly) or at site after erection (for separate supplies of above equipment). |
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- 14.32.00 **CENTERING SPIGOT**..... Flange mounted motor shall have centering spigot to match driven equipment socket.
- 14.33.00 **EASE OF MAINTENANCE**..... Motor shall be so constructed that it can be de-assembled and reassembled with ease.
- 14.34.00 **NAMEPLATES**..... Motor shall have nameplate(s) showing diagram of connections, all particulars as per IS: 325 and following additional information:-
- 14.34.01 In addition, an arrow block shall be screwed on to the body of motor on the non-driving end to indicate direction of rotation of motor.
- 14.34.02 Temperature rise under normal/abnormal conditions.
- 14.34.03 Type of bearing and recommended lubricants.
- 14.35.00 FINISH**
- 14.35.01 Motor shall have synthetic enamel paint shade as mentioned in Chapter 1.
- 14.35.02 All sharp edges and scales shall be removed from the surface, which shall then be thoroughly degreased, de-rusted and given two (2) coats of primer and two (2) coats of finish paint. It is preferred that a phosphate coat is given to motor prior to application of primer coat. Motors for water treatment plant shall have Zinc Chromate base with acid resistant Epilex 4 paint.
- 14.36.00 TERMINAL BOXES**
- 14.36.01 General
- i) Motors shall be provided with separate terminal boxes for main, space heaters, embedded temperature detectors, bearing temperature indicators and moisture detectors terminals, Neutral CT terminals. When it is not possible to provide LT motors with separate terminal box for space heater terminals, space heater terminals shall be adequately segregated from the main terminals in the single box. Terminal boxes shall be weatherproof and water-tight conforming to minimum IP-55 degree of protection with removable front cover for making connections. IP-55 degree of protection shall be achieved without application of compound. Space between and around terminals shall be adequate for easily connecting aluminium conductor cables. Terminal box arrangement shall be to the approval of the Owner /Consulting Engineer. All terminal boxes shall be suitable for proper termination cable to be finalized during detailed engineering.
- ii) The terminal boxes shall be complete with cable glands and termination accessories as required. Suitable non-magnetic material construction shall be adopted for terminal boxes where single core
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cables are to be terminated. All HV & MV motors shall be provided with phase segregated terminal box.

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

14.36.02 Main Terminal Box

- i) LV Motors Main terminal box shall be capable of being turned through 360 degrees in steps of 90 degrees.
- ii) MV & HV Motors shall be provided with two (2) terminal boxes for stator terminals. One (1) terminal box shall be for phase terminals while other one for forming star connection. For motors rated below 1000 KW should be interchangeable to facilitate cable routing.
- iii) Neutral terminal box for HV motors rated 1000 KW and above shall be suitable for mounting of three (3) Nos. wound/bar primary/ring type cast resin insulated current transformers for differential protection. These CTs shall be mounted in the motor neutral terminal box. Stator phase terminal box shall be phase segregated terminal box suitable for both top or bottom entry of cables (i.e. they should be capable of being turned through 180 Degrees). The terminal box shall be designed for termination of XLPE cables using heat shrinkable terminating Kit. Terminal leading shall be stud type or leading wire type.
- iv) Terminal Boxes shall be provided with cable end boxes having cable lugs and cable glands for cables.
- v) The terminal boxes shall be capable of withstanding at the terminals the system fault level (as indicated below) without rupture for a duration of atleast 0.25 seconds.
- vi) Phase to Phase/ Phase to Earth Air Clearance:-
- a) Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:-

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

- vii) Terminal Accessories.....Each terminal end shall be furnished with bimetallic washers, spring washers, nuts and crimp type aluminium (preferably tinned) lugs suitable for cables of sizes.

14.37.00 TYPE AND SIZE OF CABLES

14.37.01 Space Heaters

- i) For LV Motors: Two point five (2.5) mm², two (2) core copper conductor PVC insulated, armoured and FRLS PVC sheathed heavy duty 650/1100 V grade cable to IS: 1554 (Part-I).
- ii) For MV & HV Motors: Six (6) mm² two core aluminium conductor XLPE insulated armoured and FRLS PVC sheathed heavy duty 650/1100V grade cable to IS: 1554 (Part-I).
- iii) For Embedded Temperature Detectors two sets of six (6) Twisted triad 0.5 mm² ATC copper conductor armoured, shielded cable, 650/1100 V Grade IS: 1554 (Part-I). For bearing temperature, RTDS, two (2) sets of four (4) twisted triad 0.5 mm², ATC copper conductor armoured shielded 650/1100 V Grade, IS: 1554 (Part-I).
- iv) Bearing Temperature Indicators - For each indicator, 0.5 mm² six (6) tarnished triad ATC copper conductor, PVC insulated, shielded armoured and FRLS PVC sheathed heavy duty 650/1100 V grade cable as per IS: 1554 Part-I. Two (2) cables one (1) for each bearing temperature indicator.
- v) For Moisture Detectors.....As for space heaters as per Clause 14.041.1 (i) above.

14.37.02 For Main Terminals:-

- i) LT Motors
 - a) Three (3) core cablesStranded aluminium conductor, XLPE insulated, colour coded, laid up, FRLS PVC type ST2 sheathed, GI wire / strip armoured, FRLS PVC type-ST2 jacketed overall, 650 / 1100V grade, heavy-duty cables as per IS: 1554 (Part-I).
 - b) Single core cablesStranded aluminium conductor, XLPE insulated, hard drawn aluminium wire/ strip armoured FRLS PVC type ST2 jacketed overall, 1100V grade, heavy duty cable as per IS: 1554 (Part-I).
- ii) HV & MV Motors

Three (3) core cables stranded aluminium conductor, XLPE insulated, screened colour coded, laid up, FRLS PVC type ST2 sheathed, GI wire/strip armoured FRLS PVC type ST2 jacketed overall, 6.6 KV / 11 KV un earthed grade, heavy duty cables as per requirement for unearthed system as per IS: 7098 (Part-II).

14.38.00 GROUNDING

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| 14.38.01 | General..... Two (2) grounding terminals one (1) on either side at the bottom suitable for connecting mild steel/GI flat/GI wire grounding conductor, size of grounding conductor shall be decided during detailed engineering. |
| 14.38.02 | LV Motors.....At each earthing point, two (2) drilled and tapped holes with hexagonal head bolts, plain washers, spring washers and tinned lugs (for motors upto 5.5 KW) for size of conductor specified shall be provided. |
| 14.38.03 | HV & MV Motors.....Non-corrodible metallic grounding pad shall be welded or brazed at each earthing point. The size of grounding pad shall be 75x65x25 mm. Grounding pad shall have 40 mm apart two (2) drilled and tapped holes with hexagonal head bolts, plain washers and spring washers for size of conductor specified. In addition, one suitable earthing terminal shall be provided inside the stator phase terminal box for earthing metallic shield of XLPE cables. |

14.39.00 EMBEDDED TEMPERATURE DETECTORS

HV & MV motor shall be provided with four (4) Nos. simplex or two (2) Nos. duplex platinum resistance temperature detectors (RTDs) in each phase embedded in stator winding at locations where high temperatures are expected. In addition one (1) duplex type RTD shall be provided in each bearing. The RTDs shall be 3 wire duplex platinum resistance type having a value of 100 ohms at 0 Deg.C

14.40.00 BEARINGS TEMPERATURE INDICATORS

HV & MV motors shall be provided with dial type two (2) bearing temperature indicators and shall have two (2) sets of contacts, each set having 2 NO + 2 NC contacts rated for 5A at 240V AC and 0.5A at 220V DC. One set shall be set to operate at lower value to give alarm and other set at a higher value to trip the motor.

14.41.00 SPACE HEATERS

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| 14.41.01 | Valve / Damper actuator motors; and Motors 30 KW and above shall be provided with one (1) or two (2) space heaters suitable for 240V, 50 Hertz single phase AC supply and of adequate capacity to maintain motor internal temperature above dew point to prevent moisture condensation or deterioration of insulation during shut down. Heaters shall be mounted inside the motor in accessible locations so that their removal and replacement is simple. |
| 14.41.02 | The terminals of space heaters shall be brought out to a separate totally enclosed dust proof and weatherproof terminal box. |
| 14.41.03 | The space heater shall be wired to maintain the motor internal temperature above dew point when the motor is in idle condition. |

14.42.00 HOT AIR TEMPERATURE DETECTOR

If the motor is of CACA or CACW enclosure, dial type temperature indicator shall be provided (one each for hot and cold air temperature monitoring for CACA and CACW and one each for inlet and outlet water temperature monitoring for CACW). In addition one (1) duplex type RTD shall be provided in each enclosure for alarm and if trip is required for cooling air temperature, temperature switch shall be provided.

14.43.00 WATER FLOW INDICATOR

If the motor is of CACW enclosure a provision shall be made for visual indication of water flow and flow switch shall also be provided with alarm contacts. Thermometers shall be provided in water inlet and outlet circuits. In addition one (1) duplex type RTD shall be provided in each water inlet and outlet circuit

14.44.00 MOISTURE DETECTORS

Motors with type of cooling 1C 81W or 1C 91 W shall be provided with moisture detectors for raising alarm in the event of water tube failure.

14.45.00 BED PLATE

Whenever motor is supplied with driven equipment the Supplier shall ensure that bed plate suits both motor and driven equipment and is adequately braced to keep vibration and misalignment within allowable limits to the approval of driven equipment and motor manufacturers.

14.46.00 OTHER ACCESSORIES

Motor shall be supplied with all accessories and parts other than those, specified above which are necessary and/or useful for efficient operation.

14.47.00 TESTS

14.47.01 HV & MV Motors

i) Routine Tests

All equipment shall be completely assembled, wired, adjusted and all acceptance and routine tests as per the specification and relevant standards shall be carried out. These tests shall be carried out in presence of the Owner's representative, for which a minimum 7 days notice shall be given by the Bidder. Charges for these shall be deemed to be included in the equipment price.

ii) Type Tests

a) For each type & rating of HV & MV motors the Bidder shall submit for Owner's approval the reports of all the type tests as per relevant standards. These reports should be for the tests conducted on the equipment similar to those proposed to be

supplied under this contract and the test(s) should have been conducted at an independent laboratory. Period - With in 5 Years from the zero date.

- b) In case the Bidder is not able to submit report of the type test(s) conducted,, or in case the type test report(s) are not found to be meeting the specification requirements, the Bidder shall conduct all such tests under this contract free of cost to the Owner and submit the reports for approval, for which a minimum 7 days notice shall be given by the Bidder. Charges for these shall be deemed to be included in the equipment price

iii) List of minimum type tests to be conducted

The following Minimum type tests shall be conducted on each type and rating of HV & MV motor:-

- a) No load saturation and loss curves upto approximately 115% of rated voltage.
- b) Measurement of noise at no load.
- c) Momentary excess torque test.
- d) Full load test
- e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose. In case due to test bed limitations at the manufacturing works, mixed frequency method as per latest IEC 60034 is also acceptable.
- f) Lightning Impulse withstand test on the sample coil shall be as per IEC-60034, part-15
- g) Surge-withstand test on interturn insulation shall be as per clause no. 5.1.2 of IEC60034, part-15
- h) Degree of protection test for the enclosure followed by IR, HV and no load run test.
- i) Terminal box-fault level withstand test for each type of terminal box.
- j) All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

14.47.02 LT Motors

i) Routine Test

All equipment shall be completely assembled, wired, adjusted and routine tested as per relevant IS/IEC Standards at manufacturer's works in the presence of Consultant /Owner or his representative.

- ii) List of minimum tests for which reports have to be submitted

The following minimum type test reports shall be submitted for each type and rating of LT motor of above 30 KW only

- a) Measurement of resistance of windings of stator and wound rotor.
- b) No load test at rated voltage to determine input current power and speed.
- c) Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors)
- d) Full load test to determine efficiency power factor and slip.
- e) Temperature rise test.
- f) Momentary excess torque test.
- g) High voltage test.
- h) Test for vibration severity of motor.
- i) Test for noise levels of motor(Shall be limited as per clause No. 14.24.00 of this section)
- j) Test for degree of protection and
- k) Over speed test.
- l) Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1

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

14.48.00 INFORMATION WITH PROPOSAL

- 14.48.01 AC Motor Data Sheet.
- 14.48.02 Dimension Drawing/Foundation load details of motor and driven equipment.
- 14.48.03 Manufacturer's catalogue showing constructional details.

14.49.00 INFORMATION ON AWARD OF CONTRACT

- 14.49.01 Motor Data Sheet

Certified binding dimension drawing of motor complete with all accessories and fittings specifically showing terminal boxes, terminal spacing and sizes, earthing connections and sizes thereof, mounting details, lifting lugs, final foundation loads and dimensions with tolerances of centering spigot (where needed), shaft extension and key.
 - 14.49.02 Following characteristics curves:-
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- i) Torque-speed curves for motor at eighty (80), hundred (100) and hundred ten (110) percent rated voltage as well as torque-speed curve for driven equipment except for mill motor. For mill motor torque speed curve for motor at ninety (90) hundred (100) and hundred ten (110) percent rated voltage as well as torque-speed curve for driven equipment
 - ii) Current-speed curves at eight (80), hundred (100) and hundred ten (110) percent rated voltage except for mill motor. For mill motor current speed curve for motor at ninety (90) hundred (100) and hundred ten (110) percent rated voltage
 - iii) Current-time curves at eighty (80), hundred (100) and hundred ten (110) percent rated voltage except for mill motor. For mill motor current time curve for motor at ninety (90) hundred (100) and hundred ten (110) percent rated voltage.
 - iv) Thermal withstand curves for hot and cold at eighty (80), hundred (100) and hundred ten (110) percent rated voltage except for mill motor. For mill motor thermal withstand curve for motor at ninety (90) hundred (100) and hundred ten (110) percent rated voltage.
 - v) Efficiency, power factor, current and speed versus power output curves.
 - vi) Speed-time curves at eight (80), hundred (100) and hundred ten (110) percent rated voltage except for mill motor. For mill motor speed time curve for motor at ninety (90) hundred (100) and hundred ten (110) percent rated voltage.
 - vii) Negative phase sequence current withstand characteristics.

14.50.00 DC MOTOR

- 14.50.01 D.C. Motor provided for emergency service shall be shunt / compound would type. The starting current shall be as per manufacturer's standard.
- 14.50.02 Motor shall be sized for operation with fixed resistance starter for maximum reliability.
- 14.50.03 Starter panel complete with all accessories shall be included in the scope of supply.

14.51.00 DRAWINGS, DATA & MANUALS

- 14.51.01 Minimum Drawings, data & manuals for the motors to be submitted
 - i) Dimensional General Arrangement drawing
 - ii) Foundation Plan & Loading
 - iii) Cable end box details
 - iv) Space requirement for rotor removal
 - v) Thermal withstand curves hot & cold
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- vi) Starting and speed torque characteristics at 80% & 100% voltage except for mill motor. For mill motor Starting and speed torque characteristics at 90% & 100% voltage.
 - vii) Complete motor data
 - viii) Erection & Maintenance Manual
 - ix) Test reports
 - x) QAP
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DATASHEET

	Auxiliary power supply	
1.1	HV supply	
	11kV, 3Φ, 3W, 50 Hz non effectively earthed Earthed through resistance, limiting earth fault current to 400 Amps	Motors rated above 2000 kW
	Fault level	50 kA for 1 second
	HV Motors	shall be controlled through vacuum circuit breaker
	The cooling tubes of Motor	Shall be of Stainless Steel
1.2	MV supply	
	6.6kV, 3Φ, 3W, 50 Hz non effectively earthed. Earthed through resistance, limiting earth fault current to 400 Amps	Motors above 200kW upto and including 2000kW
	Fault level	40 kA for 1 second
	MV Motors	shall be controlled through vacuum circuit breaker
	The cooling tubes of Motor	Shall be of Stainless Steel
1.3	LV supply	
	415V, 3Φ, 3W, 50 Hz effectively earthed	Motors below and including 200kW
	Fault level	50kA for 1 second
	110V, 1Φ, 2W, 50 Hz effectively earthed	Lighting, space heating, AC control and protective devices
	LT motors rated up to 90 kW	shall be controlled through MPCB/ MCCB and contactor.
	LT motors rated more than 90 kW	Shall be controlled through air circuit breaker
1.4	DC supply	
	220V, 2W, unearthed	DC alarm, control and protective devices.
	Fault level	25 kA for 1 second
2	Range of variation	As indicated in the specification
2.1	AC supply	

	voltage	-----
	Frequency	-----
	Combined voltage & frequency	-----
2.2	DC supply	198 to 240 V
Note: During starting of largest motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance.		

SECTION – 18: LV POWER CABLES

18.01.00 SCOPE OF SUPPLY

- i) The LV Power cables shall be supplied, installed and commissioned in accordance with the following specification.
- ii) Other cables including special cables if any which are necessary as per proven engineering practice for satisfactory & trouble free operation of the entire cable system of the power plant shall also be within the scope of supply. These shall include all such cables for electrical integral with mechanical equipment systems and subsystems.

18.02.00 CODES & STANDARDS

- i) All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on zero date. In case of conflict between this specification and those (IS: codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:

IS:1554 (Part-I)	PVC insulated (heavy duty) electric cables for working voltage up to and including 1100 V.
IS: 2982	Copper conductor in insulated cables and cords.
IS : 3961	Recommended current ratings for cables
IS : 3975	Low carbon galvanized steel wires, formed wires and tapes for armouring of cables.
IS : 4905	Methods for random sampling.
IS : 5831	PVC insulation and sheath of electrical cables.
IS:7098 (Part - I)	Cross linked polyethylene insulated PVC sheathed cables for working voltages up to and including 1100V.
IS : 8130	Conductors for insulated electrical cables and flexible cords.
IS : 10418	Drums for electric cables.
IS : 10810	Methods of tests for cables.
IEC: 60	High voltage test techniques
IEC: 230	Impulse tests on cables and their accessories
IEC: 287	Calculation of the continuous current rating of the cables (100% load factor).
IEC: 288	Nominal cross sectional area and composition of conductor of insulated cables.
IEC-331	Fire resisting characteristics of electric cables
IEC: 502	Extruded solid dielectric insulated power cables for rated voltages from 1kV up to 30kV.
IEC: 540	The methods for insulations and sheath of electric cables and cords(elastomeric and thermoplastic compounds)
IEC-754 (Part-I)	Test on gases evolved during combustion of electric cables.
IEC -60332	Tests on Electric cables under fire conditions. Part-3 : Tests on bunched wires or cables (category -B)

IEEE-383	Standard for type test of Class IE Electric Cables.
ASTM-D -2843	Standard test method for density of smoke from the burning or decomposition of plastics.
ASTM-D-2863	Standard method for measuring the minimum oxygen concentration to support candle like combustion of plastics.
NES-715-1	Temperature index
SS-4241475 classF3	Swedish Chimney test
	SVENSK Standard SS-4241475 Class F3

- ii) BICC Hand Book For cables in fire regarding temperature index- chapter-6
- iii) Indian Electricity Rule.
- iv) Equipment and material conforming to any other standard, which ensures equal or better quality, may be accepted subject to approval of the Owner. In such case, copies of the English version of the standards adopted shall have to be submitted along with the bid.
- v) The electrical installation shall meet the requirements of Indian Electricity Rules as amended up to date and relevant IS Codes of Practice. In addition, other rules and regulations applicable to the work shall be followed.

18.03.00 DESIGN CRITERIA

- i) The cables shall be used for connection of power circuits of the system. Actual cable sizes shall be selected based on approved sizing calculations. Number of different sizes selected shall be kept to a minimum for optimization.
 - ii) Cables shall be generally laid on ladder type cable trays. For interplant connection cables shall be routed along overhead cable bridge.
 - iii) For continuous operation at specified rating, maximum conductor temperature shall be limited to the permissible value as per relevant standard and/or this specification.
 - iv) The insulation and sheath materials shall be resistant to oil, acid and alkali and shall be tough enough to withstand mechanical stresses during handling.
 - v) The inner and outer sheath shall have flame retardant low smoke (FRLS) characteristics or fire survival characteristics as the case may be, and shall meet the requirements of additional tests specified for the purpose.
 - vi) Core identification for multicore cable shall be provided by colour coding.
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- vii) Cables shall be so designed and manufactured that no damage occurs during handling, transit, storage, installation under any operative conditions which they may be subjected to.
 - viii) Maximum continuous operating temperature shall be 90 deg C under normal operation and 250 deg C under short circuit condition. The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS: 5831.
 - ix) Power cables shall be chosen taking into account the factors mentioned in Section-I.

18.04.00 SPECIFIC REQUIREMENTS / CONSTRUCTIONAL REQUIREMENTS

18.04.01 1.1KV Aluminium Conductor Power Cables

- i) 1100 volt, 90 Deg. C rating, heavy duty power cables with stranded aluminium conductor, extruded XLPE insulation, extruded PVC,FR-LS inner sheath, aluminium round wire armour for single core cables and galvanized steel strip /wire armour for three (3) core cables, and extruded PVC, FR-LS overall sheath. Cables shall be manufactured in conformity to IS-7098 part 1 - 1988, amended up to date and bearing ISI mark.
 - iii) Conductor

The cable conductor shall be made from standard Aluminum of grade H2 and Class 2 to form compact conductor having a resistance within the limits specified. All the cables of size 25mm² and above shall have sector shaped conductors.
 - iv) Insulation

The insulation shall be XLPE type. It shall be designed and manufactured for the specified system voltage. The manufacturing process shall ensure that insulation shall be free from voids. The insulation shall withstand mechanical and thermal stresses under steady state and transient operating conditions. The insulation of the cables shall be of high standard quality.
 - v) Inner Sheath
 - a) The laid up insulated cores of twin and multicore power cables shall be provided with an inner sheath of extruded FRLS PVC, compound conforming to Type ST2 of IS:5831. Single core power cables need not be provided with any inner sheath.
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- vi) Armour
 - a) For single core armoured cables, armouring shall be of aluminium wires/formed wires of H4 grade.
 - b) For multicore armoured cables, armouring shall be of galvanised steel strip /wire.
 - vii) Overall Sheath
 - a) Outer sheath shall be of extruded FRLS PVC compound conforming to type ST2 as per IS: 5831 & black in colour. In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall be applied with anti rodent and termite additives.

18.04.02

1.1KV Grade Copper Conductor Fire Survival Power Cables

- i) 1100 volt grade, 90 Deg. C rating, Power cables with stranded Copper conductor, heat resistance elastomeric insulation generally conforming to Type IE-2 of IS: 6380-1984, extruded Halogen free or very low Halogen elastomeric inner sheath, generally conforming to Type SE-3 of IS-6380-1984, round wire/strip armour and extruded outer sheath of elastomeric material generally conforming to Type SE-3 of IS: 6380-1984. The cables shall be generally manufactured in conformity to IS-9968 Part-1/1988. The cables can withstand 750 Deg. C temperature for three (3) hours.
 - ii) Conductor
 - a) Conductor shall be of stranded construction, consisting of high conductivity annealed plain copper wires conforming to Class-II of IS 8130.
 - b) A suitable heat barrier tape, preferably glass mica tape shall be provided over the conductor.
 - iii) Insulation
 - a) Cores of the cable shall be identified by colouring of insulation. Following colour scheme shall be adopted.
 - 1 core - Red, Black, Yellow or Blue
 - 2 core - Red & Black
 - 3 core - Red, Yellow & Blue
 - 4 core - Red, Yellow, Blue & Black
 - iv) Laying up of cores (For multi core cables only)
 - a) The core shall be suitably identified in accordance with IS: 9968 (Part-I).
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- b) The suitable fire retardant material fillers shall be used for filling in the interstices.
 - c) Two layers of plain glass fiber binder tape shall be applied over the laid up cores.
 - v) Inner Sheath
 - a) An inner sheath of extruded special low smoke and very low halogen content (acid gas generation shall be less than 2% by weight) elastomeric (HOFR) compound of black colour conforming to Type SE-3 of IS-6380/1984, amended up to date, shall be provided over the laid up cores. This shall be provided even for single core cables after providing two layers of plain glass fiber tape over the insulation.
 - vi) Armour
 - a) For Single core cables to be used in A.C system, the armouring over inner sheath shall consist of single layer of round copper wire.
 - b) For multi-core cables to be used in A.C. system and single/two core cables in D.C. System, the armouring over inner sheath shall consist of single layer of round galvanized steel wire.
 - vii) Outer Sheath
 - a) The extruded outer sheath shall be of special low smoke and very low Halogen content (Acid gas generation shall be less than 2% by weight) elastomeric HOFR compound comprising of synthetic rubber and shall generally conform to the type SE-3 of IS: 6380 latest revision.
 - b) Minimum value of 'Tensile Strength' and 'Percentage elongation at rupture' shall be 8 Newton/Sq. mm and 250% respectively.
 - c) The colour of outer sheath shall be black or any other colour agreed mutually between Owner and Supplier.

18.04.03

Flexible Trailing Cables

1100 V Grade flexible trailing cable shall be tinned copper of Class – 5 of IS – 8130, heat resistant electrometric compound based on EPR insulation, inner sheath of heat resistant electrometric compound PCP sheath, nylon cord reinforcement and heat resistant, oil resistant and flame retardant heavy duty electrometric compound FRLS CSP outer sheath.

18.05.00 GENERAL REQUIREMENTS**18.05.01 Drum Length & tolerance**

- i) Cable shall be supplied in wooden drums. The standard single length of each drum shall be minimum 500 metres for large size of cable minimum 1000 metre for smaller size of cables.
- ii) 1.1KV Copper Fire Survival Power cables shall be supplied in wooden drums. Each drum shall be minimum 500 metres single length of cable.
- iii) Allowable tolerance on individual drum length is (+) 5%.

18.05.02 Non-standard length

Contractor shall be required to obtain Owner's approval before packing the non standard length of cables on drums. Non-standard lengths shall not be less than half of the standard packing length in any case.

18.05.03 Cable identification

Cable identification shall be provided by embossing on every meter on the outer sheath the following:

- a) TANGEDCO
- b) Manufacturer's name or trademark
- c) Voltage grade
- d) Year of manufacture
- e) Type of insulation and sheath, e.g. XLPE /PVC FRLS, IE2/SE3 F.S. as applicable.
- f) No. of core and size of cables.
- g) Sequential length marking at an interval of 1m through out the length of the cable.
- h) ISI mark with C/ML Number
- i) Type of improved fire performance, e.g. FR/FR-LSH/FS.

18.05.04 Packing

- i) Cables shall be supplied in non-returnable drums. The drums shall be of heavy construction as per relevant IS. All wooden parts shall be manufactured from seasoned wood. All ferrous parts used shall be treated with suitable rust preventive finish or coating to avoid rusting during transit or storage. Wooden drums shall be treated by immersing in copper nitrate solution
 - ii) Cable shall be wound and packed on drums in such a manner that it shall be properly sealed and firmly secured to the drum. The ends of each length shall be sealed before shipment. Heat shrinkable cable seals shall be used for this purpose
 - iii) A label shall be securely attached to each end of the reel indicating the length, type, voltage grade, conductor size and number of core of the cable. A tag containing the same information shall be attached to the leading end of the cable inside. An arrow and necessary instructions
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shall be marked on the drum indicating the direction in which it should be rolled. Drum numbers are to be indicated on cable drums.

- iv) The cable drums should carry the following details in printed form (non returnable):-
- a) TANGEDCO & Manufacturer's name or trade make
 - b) Type of cable & voltage grade
 - c) Year of manufacture
 - d) Type of insulation / sheath e.g. XLPE /PVC FRLS, IE2/SE3 F.S. as applicable.
 - e) No. of core and size of cables
 - f) Cable code
 - g) Length of cable on drum
 - h) Direction of rotation, by arrow
 - i) Approx. gross mass.
 - j) ISI mark
 - i) IS/IEC number

18.06.00 TESTING PROCEDURE

18.06.01 Tests During Manufacture:-

During the manufacture of cables, manufacturer's standard tests shall be performed and record / test report shall be made available to Owner's representative during inspection / testing.

18.06.02 Type Tests:-

- i) Cables shall be type tested quality. For each type and rating of cables reports on all type tests as per relevant standards, and carried out with in last five years from the zero date shall be submitted.
- ii) These reports shall be for the tests conducted on the similar type of cables proposed to be supplied under this contract. These tests should have been conducted with in last 5 years from the zero date at an independent laboratory. If type test certificate are not available or in the case of type test report(s) are not found to be meeting the specification requirements, the same shall be conducted in the presence of the Owner free of cost.

18.07.00 SPECIAL TESTS ON PVC 'FR-LS' MATERIAL

- i) All the sizes of XLPE power cables of the 'FRLS' PVC sheathed type shall pass following special test requirements. Inner sheath wherever applicable shall also be of the 'FR-LS' type 'PVC' to meet these special tests:-
 - a) Oxygen/Temperature Index test on sheath material:-
 - b) This test shall be carried out as per American National Std. A STM-D-2863/77.
 - c) The minimum oxygen index shall be 29 at room temperature.
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- d) For determination of the temp.index, the oxygen index test shall be carried out at different temperature upto 250°C. However, the test shall be carried out by extra-polation method beyond temperature at which the material of sheath may start deformation. The minimum temperature index (i.e. the temperature at which the oxygen index is minimum 21) shall be 250°C generally as per BICC Hand Book Chapter-6.
 - ii) Acid gas emission test on sheath material:-

This test shall be carried out as per IEC Std. 754-1. The maximum acid gas emission shall be less than 20 by weight.
 - iii) Smoke density test on sheath material:-

This test shall be carried out as per American National Standard ASTM-D-2843/1977 and also as per UITP method (3M cube test on finished cable sample). The ASTM test method is compulsory. For passing this test, the requirement of light transmission shall be minimum 40% after the test.
 - iv) Flammability test on finished cable sample:-

This test shall be carried out as per the following method:
 - v) Swedish Std.SS:424-14-75 Class-F3. This test known as Swedish Chimney test is compulsory.
 - vi) IEEE std. 383-1974 – This test known as the vertical tray flame propagation test shall be conducted if insisted by Owner.
 - vii) IEC Std: 332-1. – The cable should meet the requirement of all the above standards.

18.08.00 ROUTINE TESTS

The following tests shall be carried out as Routine tests on each and every drum length of cable, as per IS 7098 (Part 2) / 1985:-

- a) High Voltage Test
- b) Conductor Resistance Test
- c) Partial discharge test (for screened cables) – on full drum length.

18.09.00 ACCEPTANCE TEST

- i) The following test shall be carried out as Acceptance Test in the presence of TANGEDCO Inspecting Engineer on samples taken from the delivery lot. One drum out of every 10 number of drums or less shall be selected at random sampling basis in each lot for the Acceptance Tests which shall be carried out at manufacturer's/supplier's cost:-
 - a) High Voltage Test
 - b) Conductor Resistance Test
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- c) Tensile / wrapping test.
 - d) Partial discharge test (In screened cables).
 - e) Insulation Resistance/Volume resistivity test
 - f) Measurement of thickness of insulation and sheath and other dimensions
 - g) Tensile strength & elongation at break for insulation & sheath.
 - h) Hot set test on XLPE insulation
 - i) Flammability test as per Swedish standard SS:424-15-75 Class-F-3 (Swedish Chimney test)
 - j) Acid gas generation test as per IEC-754-1.
 - k) Smoke density test as per ASTM-D-2843/1977
 - l) Oxygen index test as per ASTM-D 2863/1977
 - m) Temp. index test as per ASTM-2863/77
 - n) Test for Rodent and termite repulsion property

18.10.00 TEST WITNESS

Tests shall be performed in presence of Owner's representative. The Contractor shall give atleast fifteen (15) days advance notice of the date on which the tests are to be carried out.

18.11.00 TEST CERTIFICATES

- i) Certified reports of all the tests carried out at the works shall be furnished for approval of the Owner's representative.
- ii) Test reports shall be completed with all details and shall also contain IS/IEC specified limit values, wherever applicable, to facilitate review.
- iii) The cables shall be dispatched from works only after receipt of Owner's written approval of the test reports.

18.12.00 DRAWINGS, DATA AND MANUALS TO BE FURNISHED FOR APPROVAL

Bidder shall submit the following minimum drawings and documents for approval during detail engineering stage.

- Design basis report
 - Cable sizing calculation
 - General arrangement drawings
 - Technical data sheet
 - Test reports
 - Catalogues
 - Sub-vendor list
 - Manufacturing quality plan
 - Field quality plan
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DATA SHEET

1100 V grade, power cable conforming to following requirement and in line with IS-1554, IS-5831, IS-8130 & IS-3975.			
S.NO.	DESCRIPTION	:	SPECIFICATION
1	Conductor	:	Stranded and compacted plain aluminium of grade H2 and class 2/stranded, high conductivity annealed plain copper, generally conforming to IS:8130
2	Insulation	:	Extruded Cross linked Polyethylene (XLPE).
3	Inner Sheath	:	Extruded FRLS PVC compound conforming to type ST2 of IS: 5831 for multicore cable. Single core power cables need not be provided with any inner sheath.
4	Armour	:	Galvanised single round/ strip steel wire armour for twin and multicore cables. Non-magnetic hard drawn aluminum single round wire conforming to H4 grade for single core cables.
	Overall Sheath	:	Extruded FRLS PVC compound conforming to type ST2 of IS: 5831.

SECTION – 19: CONTROL CABLES

19.01.00 SCOPE OF SUPPLY

The cables shall be supplied, installed and commissioned in accordance with the following specification.

19.02.00 CODES & STANDARDS

- i) All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on zero date. In case of conflict between this specification and those (IS: codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:

IS:1554 (Part-I)	PVC insulated (heavy duty) electric cables for working voltage up to and including 1100 V.
IS: 2982	Copper conductor in insulated cables and cords.
IS : 3961	Recommended current ratings for cables
IS : 3975	Low carbon galvanized steel wires, formed wires and tapes for armouring of cables.
IS : 4905	Methods for random sampling.
IS : 5831	PVC insulation and sheath of electrical cables.
IS:7098 (Part - I)	Cross linked polyethylene insulated PVC sheathed cables for working voltages up to and including 1100V.
IS : 8130	Conductors for insulated electrical cables and flexible cords.
IS : 10418	Drums for electric cables.
IS : 10810	Methods of tests for cables.
IEC: 60	High voltage test techniques
IEC: 230	Impulse tests on cables and their accessories
IEC: 287	Calculation of the continuous current rating of the cables(100% load factor).
IEC: 288	Nominal cross sectional area and composition of conductor of insulated cables.
IEC-331	Fire resisting characteristics of electric cables
IEC: 502	Extruded solid dielectric insulated power cables for rated voltages from 1kV upto 30kV.
IEC: 540	The methods for insulations and sheath of electric cables and cords(elastomeric and thermoplastic compounds)
IEC-754 (Part-I)	Test on gases evolved during combustion of electric cables.
IEC -60332	Tests on Electric cables under fire conditions. Part-3 : Tests on bunched wires or cables (category -B)
IEEE-383	Standard for type test of Class IE Electric Cables.
ASTM-D -2843	Standard test method for density of smoke from the burning or decomposition of plastics.
ASTM-D-2863	Standard method for measuring the minimum oxygen concentration to support candle like

	combustion of plastics.
NES-715-1	Temperature index
SS-4241475 classF3	Swedish Chimney test
	SVENSK Standard SS-4241475 Class F3

- ii) BICC Hand Book For cables in fire regarding temperature index- chapter-6
- iii) Indian Electricity Rule.
- iv) Equipment and material conforming to any other standard, which ensures equal or better quality, may be accepted subject to approval of the Owner. In such case, copies of the English version of the standards adopted shall have to be submitted along with the bid.
- v) The electrical installation shall meet the requirements of Indian Electricity Rules as amended upto date and relevant IS Codes of Practice. In addition, other rules and regulations applicable to the work shall be followed.

19.03.00 DESIGN CRITERIA

- 19.03.01 The cables shall be used for connecting control circuits.
 - 19.03.02 Cables shall be generally laid on overhead cable trays/cable trays in cable trenches. For interplant connection cables routed along overhead cable bridge.
 - 19.03.03 Perforated type cable trays to be used for control cables. Only in cable risers ladder type cable trays can be used for control cables.
 - 19.03.04 For continuous operation at specified rating, maximum conductor temperature shall be limited to the permissible value as per relevant standard and/or this specification.
 - 19.03.05 The insulation and sheath materials shall be resistant to oil acid and alkali and shall be tough enough to withstand mechanical stresses during handling.
 - 19.03.06 The inner and outer sheath shall have flame retardant low smoke (FRLSH) characteristics or fire survival characteristics as the case may be, and shall meet the requirements of additional tests specified for the purpose.
 - 19.03.07 Conductor of control cables shall have plain annealed copper. The minimum size of control cable shall be of 1.5 sq.mm. For CT circuit minimum size shall be 4.0sq.mm copper. Control cables shall have 20% spare cores. For PT circuit minimum size shall be 2.5 sqmm
 - 19.03.08 Voltage transformer leads shall be checked for voltage drop which shall be limited to within 1% for all cases other than tariff metering. For tariff metering the voltage drop shall be limited to 0.2%. In case the voltage drop with 2.5 sq.mm copper conductor exceeds this value, higher conductor sizes shall be used.
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19.03.09 The cables shall be designed and manufactured in accordance with the best engineering practice and shall be such as has been proven to be suited for the intended purpose.

19.03.10 For fire survival control cable, the armouring over inner sheath shall consist of single layer of wire/round galvanized steel wire as per IS 975 amended upto date.

19.04.00 SPECIFIC REQUIREMENTS / CONSTRUCTIONAL REQUIREMENTS

19.04.01 1100 V Copper Conductor PVC FRLS Control Cables

1100 Volt grade, control cables with stranded copper conductors, PVC Insulation Type A, extruded FRLS PVC, of type ST1 Inner sheath, round wire/strip armour as specified elsewhere in the specification and extruded FRLSPVC, of type ST1 overall sheath. The cables shall be suitable for use in 1100V non-effectively earthed system. Control cable shall generally conform to IS 1554 latest and have ISI marked with C/ML Number. Armour shall be GS.

19.04.02 Conductor

Conductor shall be stranded, non-compacted & circular, high conductivity annealed, plain (untinned) copper conductor. Conductor shall be generally conforming to Class-II of IS 8130.

19.04.03 Insulation

The conductors shall be insulated with PVC compound conforming generally to type-A of IS:5831/1984 amended up to date ,except for the special properties / parameters, necessary at normal operation.

19.04.04 Inner Sheath

The laid up insulated cores of twin and multicore control cables shall be provided with an inner sheath of extruded FRLSPVC, compound conforming to Type ST1 of IS:5831/1984 amended up to date.

19.04.05 Armouring

For cables up to and inclusive 7 cores, galvanized round steel wire armour shall be provided. However, for control cables above 7 cores, galvanized steel strip armour shall be provided.

The armouring wire/strip shall generally conforming to IS: 3975 amended up to date.

19.04.06 Overall Sheath

A tough overall sheath of extruded FRLSPVC,Compound conforming to type ST1 of IS: 5831/1984 shall be provided over armour. The colour of outer

	sheath shall be black or any other natural colour (with prior approval of the Owner).
19.04.07	1100 V Copper Conductor Fire Survival Control Cables Fire survival cable shall be of copper conductor and comply with IEC-60331 (withstanding 750 degree C temperature for 3 hours). Also the halogen acid contents in outer sheath shall not be more than 2% when tested as per IEC-60754 and the smoke density in percent light absorption shall not exceed 20% when tested as per ASTM-D-2843. 1.1 kV earthed grade fire survival cables shall constitute the following: • Circular/shaped stranded and compacted annealed copper conductor • Elastomeric materials (XLPE, EPR, SR, or LSOH) insulated • Glass mica tapped • Extruded FRLS compound or LSOH material as inner sheath • Galvanised steel formed wire/strip • Extruded FRLS compound or LSOH material as inner sheath
19.04.08	Laying Up Of Cores (For Multi Core Cables Only) i) The core shall be suitably identified in accordance with IS: 9968 (Part-I). ii) The suitable fire retardant material fillers shall be used for filling in the interstices. iii) Two layers of plain glass fiber binder tape shall be applied over the laid up cores.
19.04.09	Inner Sheath An inner sheath of extruded special low smoke and very low halogen content (acid gas generation shall be less than 2% by weight) elastomeric (HOFR) compound of black colour or any other natural colour with prior approval from Owner conforming to Type SE-3 of IS-6380/1984, amended up to date, shall be provided over the laid up cores.
19.04.10	Armour The armouring over inner sheath shall consist of single layer of wire/round galvanized steel wire as per IS 3975 amended up to date.
19.04.11	Outer Sheath The outer sheath shall be of special low smoke and very low Halogen content (Acid gas generation shall be less than 2% by weight) elastomeric HOFR compound comprising of synthetic rubber and shall generally conform to the type SE-3 of IS: 6380 latest revision. The colour of outer sheath shall be black or any other natural colour agreed mutually between Owner.

19.05.00 GENERAL REQUIREMENTS

19.05.01 Drum Length & Tolerance

- i) The cable shall be supplied in wooden drums. Each drum shall be minimum 1000 meters single length of cable. For above cable drums, allowable tolerance on individual drum length is +/- 5%.
- ii) 1.1KV Copper Fire Survival control cables shall be supplied in wooden drums. Each drum shall be minimum 500 metres single length of cable. Allowable tolerance on individual drum length is +5%.

19.05.02 Non-standard length

Bidder shall be required to obtain Owner's approval before packing the non standard length of cables on drums. Non-standard lengths shall not be less than half of the standard packing length in any case.

19.05.03 Cable identification

- i) Cable identification shall be provided by embossing on every meter on the outer sheath the following:
 - a) TANGEDCO
 - b) Manufacturer's name or trademark
 - c) Voltage grade
 - d) Year of manufacture
 - e) Type of insulation and sheath, e.g. PVC/ FRLS, IE2/SE3/FS as applicable.
 - f) No. of core and size of cables.
 - g) Sequential length marking at an interval of 1m through out the length of the cable.
 - h) ISI marked with C/ML Number
- ii) Type of improved fire performance eg. FR/FR-LSH-FS

19.05.04 Packing

- i) Cables shall be supplied in non-returnable drums. The drums shall be of heavy construction as per relevant IS. All wooden parts shall be manufactured from seasoned wood. All ferrous parts used shall be treated with suitable rust preventive finish or coating to avoid rusting during transit or storage.
 - ii) Cable shall be wound and packed on drums in such a manner that it shall be properly sealed and firmly secured to the drum. The ends of each length shall be sealed before shipment.
 - iii) A label shall be securely attached to each end of the reel indicating the length, type, voltage grade, conductor size and number of core of the cable. A tag containing the same information shall be attached to the leading end of the cable inside. An arrow and necessary instructions
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shall be marked on the drum indicating the direction in which it should be rolled. Drum numbers shall be indicated on cable drums.

- iv) The cable drums should carry the following details in printed form (non returnable):-
- a) TANGEDCO & Manufacturer's name or trade make
 - b) Type of cable & voltage grade
 - c) Year of manufacture
 - d) Type of insulation / sheath e.g. PVC/ FRLS, IE2/SE3/FS. as applicable.
 - e) No. of core and size of cables.
 - f) Cable code.
 - g) Single length of cable on drum
 - h) Direction of rotation, by arrow
 - i) Approx. gross mass.
 - j) ISI mark.

19.06.00 TESTING PROCEDURE

19.06.01 1100 V Copper Conductor PVC FRLS Control Cables

i) Type Tests:-

Cables shall be type tested quality. For each type and rating of cables reports on all type tests as per relevant standards, and carried out with in last five years from the zero date shall be submitted.

- a) These reports shall be for the tests conducted on the similar type of cables proposed to be supplied under this contract. These tests should have been conducted at an independent laboratory. If type test certificate are not available or in the case of type test report(s) are not found to be meeting the specification requirements, the same shall be conducted in the presence of the Owner without cost implication.

ii) Special Tests On PVC 'FRLS' Material

All the sizes of 1.1 KV Grade PVC insulated, PVC Control cables of the FRLSH sheathed type shall pass these special test requirements. Inner sheath wherever applicable shall also be of the 'FRLSH' type 'PVC' to meet these special tests.

iii) Oxygen/Temperature Index Test On Sheath Material

- a) This test shall be carried out as per American National Std. ASTM-D-2863/77. The minimum oxygen index shall be 29 at room temperature.
- b) For determination of the temp index, the oxygen index test shall be carried out at different temperature upto 250°C. However, the test shall be carried out by extrapolation method beyond temperature at which the material of sheath may start deformation. The minimum temp. index (i.e. the temperature
-

at which the oxygen index is minimum 21) shall be 250°C generally as per BICC Hand Book Chapter-6.

iv) Acid Gas Emission Test On Sheath Material

This test shall be carried out as per IEC Std. 754-1. The maximum acid gas emission shall be less than 20% by weight.

v) Smoke Density Test On Sheath Material

- a) This test shall be carried out as per American National Standard ASTM-D-2843/1977 and also as per UITP method (3M cube test on finished cable sample). The ASTM test method is compulsory. For passing this test, the requirement of light transmission shall be minimum 40% after the test (Corresponding to 60 % smoke density).

vi) Flammability Test On Finished Cable Sample

- a) This test shall be carried out as per the following method:-
- i) Swedish Std.SS:424-14-75 Class-F3. (This test known as Swedish Chimney test is compulsory).
 - ii) IEEE std. 383-1974 – This test known as the vertical tray flame propagation test shall be conducted if insisted by Owner.
 - iii) IEC Std: 332-1. – The cable should meet the requirement of all the above standards.

vii) Routine Tests

- a) The following tests shall be carried out as Routine tests on each and every drum length of cable, as per IS: 1554 / IS: 8130/1984.
- 1) High Voltage Test.
 - 2) Conductor Resistance Test.

viii) Acceptance Test

- a) The following test shall be carried out as Acceptance Test in the presence of Owner's Inspecting Engineer on samples taken from the delivery lot. One drum out of every 10 number of drums or less shall be selected at random sampling basis for the Acceptance Tests.
- i) Tensile / wrapping test.
 - ii) High Voltage Test.
 - iii) Conductor Resistance Test
 - iv) Insulation Resistance/Volume resistivity test.
 - v) Measurement of thickness of insulation and sheath and other dimensions.
-

- 19.06.02 1100 V Copper Conductor Fire Survival Control Cables

These reports shall be for the tests conducted on the similar type of cables proposed to be supplied under this contract. These tests should have been conducted at an independent laboratory. If type test certificate are not available the same shall be conducted in the presence of the Owner.

1)	High Voltage Test	-	IS: 9968 (I)
2)	Conductor Resistance test	-	IS: 8130/1984

1)	Annealing Test	-	IS 9968 (I)
2)	High Voltage test (Water immersion Test)	-	IS 9968 (I)
3)	Conductor resistance test	-	IS8130/1984
4)	Insulation Resistance Test	-	IS6380/1984
5)	Measurements of thickness of Insulation and sheath and other Dimensions	-	IS: 9968(I)
6)	Tensile strength & elongation at	-	IS 6380/1984

	Break for sheath	
7)	Tensile strength and elongation at - -As per GTP break of sheath	IS 6380/1984
8)	Oxygen index test on inner & outer - 2863/77	ASTM-D-
	Sheath material at room temperature	Min.29 degC
9)	Temp. index test on inner & outer - material sheath	ASTM-D- 2863/77 Min 350 degC IEC-331
10)	Acid gas emission test on inner & sheath material	Acid gas shall be outer less than 2% generation IEC-754-1
11)	Smoke density test on inner & outer material	Max smoke sheath density shall not exceed 20% in percentage light Absorption. ASTM-D-2863/77
12)	Flammability test on finished cable Sample as per following method	
	a) Fire Survival Test	IEC -331
	b) Swedish Chimney Test	SS-424-14-75 Class-F3)

19.07.00 DRAWINGS, DATA AND MANUALS TO BE FURNISHED FOR APPROVAL

Bidder shall submit the following minimum drawings and documents for approval during detail engineering stage.

- Design basis report
 - Cable sizing calculation
 - General arrangement drawings
 - Technical data sheet
 - Test reports
 - Catalogues
 - Sub-vendor list
 - Manufacturing quality plan
 - Field quality plan
-

DATA SHEET

1100 V grade, PVC Control cable conforming to following requirement and in line with IS-1554, IS-8130, IS-5831 & IS-3975.

S.NO.	DESCRIPTION	:	SPECIFICATION
1	Conductor	:	Conductor shall be Stranded, non-compacted & circular, high conductivity annealed plain copper, generally conforming to IS:8130.. Conductor shall be generally conforming to Class-II of IS 8130.
2	Insulation	:	The conductors shall be insulated with PVC compound conforming generally to type-A of IS:5831/1984 amended up to date
3	Inner sheath	:	Extruded FRLS PVC compound conforming to type ST1 of IS: 5831 for multicore cables. Single core cables shall have no inner sheath
4	Armour	:	For cables up to and inclusive 7 cores, galvanized round steel wire armour shall be provided. However, for control cables above 7 cores, galvanized steel wire/strip armour shall be provided.
5	Overall sheath	:	Extruded FRLS PVC compound conforming to type ST1 of IS:5831



TITLE :
ELECTRICAL EQUIPMENT SPECIFICATION
FOR
SUMP PUMPS

SPECIFICATION NO.

VOLUME NO. : II-B

SECTION : I

REV NO. : 00 DATE : 01.03.2017

SHEET : 2 OF 3

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for SUMP PUMP (all AC & DC loads at different voltage levels like 415V AC, 240 V AC, 220 V DC etc).
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “ both end equipment in vendor’s scope”shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

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

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.
- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

	TITLE : ELECTRICAL EQUIPMENT SPECIFICATION FOR SUMP PUMPS	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION : I
		REV NO. : 00 DATE : 01.03.2017
		SHEET : 3 OF 3

4.0 List of enclosures :

- a) Electrical scope between BHEL & vendor (Annexure –I)
- b) Technical specification for motors.
- c) Datasheets & quality plan for motors.
- d) Electrical Load data format (Annexure –II)
- e) BHEL cable listing format (Annexure –III)
- f) Electrical mandatory spares (Annexure IV) not ordered as on date.

PACKAGE : SUMP PUMPS
SCOPE OF VENDOR: SUPPLY
PROJECT :

Annexure-I

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL Vendor BHEL	BHEL BHEL BHEL	
5	Any special type of cable like compensating, co-axial, prefab, MICC, fibre Optic cables etc.	Vendor	BHEL	
6	Cabling material (Cable trays, accessories ,cable tray supporting system, conduits etc.)	BHEL	BHEL	
7	Cable glands ,lugs, and bimetallic strip for equipment supplied by Vendor	Vendor	BHEL	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
8	Equipment grounding & Lightning protection	BHEL	BHEL	
9	Below grade grounding	BHEL	BHEL	
10	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.



1.0 This document covers the basic technical features of high tension (HT) and low tension (LT) squirrel cage induction AC motors employed for driving auxiliaries.

2.0 CODES AND STANDARDS

The motors shall generally conform to IS 325/IEC-60034. LT motors up to 160 kW with continuous duty (S1) shall be premium efficiency class IE3 conforming to IS-12615: 2011.

3.0 DESIGN REQUIREMENTS

3.1 General Requirements

The design ambient temperature shall be 50 deg C.

3.2 Supply system and rated voltage of motors

KW rating	Supply system	Rated voltage of motor
All motors of rating above 160 KW for CHP and above 200KW for remaining areas.	6.6 KV	6.6 KV
All motors of rating up to 160KW for CHP and up to 200KW for remaining areas.	415 V	415 V
Below 200W	240V	240V

3.2.1 Supply voltage & variations shall be as follows:-

Voltage variation (AC Supply) (+/-) 10%
Frequency variation (+) 5% to (-) 5%
Combined V & F variation 10% (sum of absolute values)

3.2.2 Motors shall be capable of running continuously at rated output for each of the conditions specified above.

3.3 Motor Rating

Motor ratings shall be adequate to meet the requirements of the drive equipment. Motors shall be continuously rated at the design ambient temperature of 50 degree C. Motor ratings shall have at least a 10% margin over the input power requirement of the driven equipment under entire operating range including voltage & frequency variation.

3.4 Starting Requirements

3.4.1 Motor shall start smoothly and rapidly. 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 motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage.

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



Minimum Starting Voltage requirement for motors as below:

1. 85 % of rated voltage for motor ratings below 110 kW.
2. 80 % of rated voltage for motor ratings form 110 kW to 200 kW.
3. 85 % of rated voltage for motor ratings form 201 kW to 1000 kW.
4. 80 % of rated voltage for motor ratings form 1001 kW to 4000 kW.
5. 75 % of rated voltage for motor ratings above 4000 kW.

2

3.4.3 The locked rotor current of the HT motors (except MDBFP motors for which locked rotor current shall be 450% FLC including IS tolerance) shall not exceed 600% of full load current excluding IS tolerance. For LT motors locked rotor current shall not exceed 720% of full load current including IS tolerance.

3.4.4 The following frequency of starts shall apply

- i) Three equally spaced starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature.
- ii) The motor shall be capable of two starts in succession with coasting to rest between starts and the motor initially at rated operating temperature.
- iii) Two hot starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.

3.4.5 Locked rotor withstand time of motors under hot condition at highest voltage limit shall be as follows:

- a) For motors with starting time up to 20 sec.
 - At least 2.5 sec. more than starting time.
- b) For motor with starting time above 20 secs and up to 45 secs.
 - At least 5.0 sec. more than starting time.
- c) For motors with starting time above 45 secs.
 - At least 10% more than starting time.

The starting time of the motor referred above is at minimum permissible voltage. For motors and in cases where the above requirements are not complied with, speed switches of approved make & type shall be provided to bypass the locked rotor protection for a pre-selected time during starting of motors. The speed switches shall have one NO & one NC contacts having maximum interrupting capacity of 5 Amps at 240V AC and 0.25 amps at 220 V DC.

2

3.4.6 Pump motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with non-energized shaft rotating at 125% rated speed in reverse direction.

3.5 Running Requirements

3.5.1 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.



3.5.2 Motor shall run continuously at rated output over the entire range of voltage and frequency variations as required for the driven equipment.

3.6 Stress during bus Transfer

3.6.1 Motors shall withstand the voltage 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.

3.6.2 Motor windings shall be adequately braced to satisfactorily withstand the mech. Stresses during above condition.

3.6.3 Motors shall be capable of withstanding heavy in-rush transient current caused by bus transfer without damage.

3.6.4 Motor and driven eqpt. Shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

3.7 Noise level

The maximum noise level for all motors shall be 85 dB (A) except MDBFP motor for which the maximum limit shall be 90dB (A).

3.8 Vibration

The maximum vibration for motors shall be in line with IS: 12075 / IEC 60034-14. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads. Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.

4.0 CONSTRUCTIONAL FEATURES

4.1 Degree of Protection

4.1.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction rain canopy (Rain canopy provided for the outdoor HT motors shall be removable type) shall be provided for outdoor motors.

4.1.2 The stator laminations shall made from suitable silicon steel/magnetic steel sheet varnished on both sides and pressed to form a rigid core.

4.1.3 The rotor shall be of rigid cage construction with die cast aluminium / copper alloy / copper bars firmly wedged in bar slots and brazed to the end rings. The rotor cage shall be designed to operate satisfactorily under respective starting and load duty cycle.

4.1.4 All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.



4.2 Enclosure and Cooling

- 4.2.1 Motors shall generally have totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) enclosures or Closed Air circuit Air (CACA) cooled type. However, motors rated 3000KW or above shall be Closed air circuit water cooled (CACW).
- 4.2.2 Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.
- 4.2.3 Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.

4.3 Class of Insulation

HT/LT motors shall have class F insulation. The temperature rise of all motors shall be limited to the limits applicable to Class 'B' insulation. In case of continuous operation at extreme voltage limits, 10deg C rise above the temperature limits specified in IS: 325 shall be permissible.

- 4.3.1 Windings shall be impregnated to make them non-hygroscopic, flame resistant and oil resistant. The lightning Impulse & inter-turn insulation surge withstand level shall be as per IEC-60034 part-15.

4.4 Bearings

- 4.4.1 Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application.
- 4.4.2 Horizontally mounted motors shall have grease lubricated ball/roller or sleeve bearings. For HT motors, the bearings shall be regreasable type and for LV motors, these bearings can be either sealed life lubricated type or regreasable type as per manufacturer's standard.
- 4.4.3 The vertical motors shall have a combined thrust and guide bearing on top and guide bearing at bottom. If the ball or roller bearings can take vertical thrust, thrust and guide bearing need not be provided.
- 4.4.4 After taking all motor driven equipment loads and thrust (if any) into account, the bearings shall be suitable for min. 40,000 working hours. Re-greasable bearings shall be provided with grease nipples and relief holes for on-line re-greasing and shall be suitable for 8000 working hours without changing of the grease.

- 4.4.5 The bearings of solidly coupled motors shall be of the same type as those of the driven equipment.

- 4.4.6 NDE side bearings shall be insulated as required to prevent shaft current and resultant bearing damage.

4.5 Terminals and Terminal Boxes

- 4.5.1 Motors of rating ≥ 90 kW shall be controlled by air circuit breaker with numerical protection. For all motors of rating up to 90kW shall be provided with MCCBs. The terminal box of motors shall be designed for the maximum fault current for a duration of at least 0.25 secs.



4.5.2 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.

4.5.3 For HT motors, the main terminal box shall be of phase-segregated type with clamping arrangement for the terminals.

4.5.4 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 V, W & U respectively.

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

4.5.6 Motor terminals and terminal leads shall be fully insulated with no bar live parts.

4.5.7 Separate terminal boxes shall be provided for space heaters and temp. Indicators. Detachable gland plates with double compression tinned brass glands shall be provided in terminal boxes.

4.5.8 Terminal box shall be capable of being turned 360 Deg. in steps of 90 Deg. However, in the case of rectangular type, Terminal Box shall be rotatable in steps of 180 Deg.

4.5.9 Cable glands and cable lugs as per selected cable sizes shall be provided in line with cable erection philosophy. For single core cable termination, gland plates shall be of non-magnetic material.

4.6 Grounding

Two separate earthing terminals suitable for connecting G.I. strip grounding conductor shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal. The cable terminal box shall have a separate grounding pad.

4.7 General

4.7.1 Motors provided for similar drives shall be interchangeable.

4.7.2 An arrow block shall be screwed on the body of the motors on the non-driving end to indicate the direction of rotation of the motors.

4.7.3 Motors for Fuel oil unloading and drain oil pumps located in hazardous areas shall be with flame-proof enclosures in accordance with IS 2148 / IEC 60079.

a) Fuel oil area: Group - IIB.

b) Hydrogen generation plant area: Group - IIC

5.0 ACCESSORIES



5.1 SPACE HEATERS

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

The leads from space heaters of each motor shall be brought out to a separate terminal Box. Space heaters shall be mounted inside the motor in accessible places so that their removal and replacement is simple.

5.2 RESISTANCE TEMPERATURE DETECTORS (RTDs)

5.2.1 HT motors stator windings shall be provided with 12 nos. Simplex / 6 nos duplex 3 wire Platinum RTDs with 100 ohms resistance at 0 deg C for remote monitoring of winding temperature. The leads from RTDs of each motor shall be brought out to a separate terminal Box.

5.2.2 For HT motors, each bearing shall be provided with 2 no. simplex / Duplex 3 wire Platinum RTDs with 100 ohms resistance at 0 deg C for remote monitoring of bearing temperature. The leads from these RTDs shall be brought out to a separate terminal Box or the terminal box same as for winding RTDs.

5.3 DIAL TYPE TEMP. INDICATORS

5.3.1 For HT motors, each bearing shall be provided with dial type thermometer with adjustable alarm contact and resistance type temperature detector. The indicators shall have 2 nos. NO contacts rated for 5A, 240 V AC and 0.5 A, 220 V DC for alarm/trip purpose.

5.4 Vibration monitoring pads

5.4.1 Vibration monitors shall be provided for all HT motors and shall be suitably connected to the DCS.

6.0 NAME PLATE

Motors shall have stainless steel name plate with all particulars as per IS: 325. In addition following information shall be indicated.

- a) Temperature rise in Deg. C under rated condition and method of measurement.
- b) Degree of protection.
- c) Bearing identification no. and recommended lubricant.
- d) Location of insulated bearings.

7.0 PAINTING

Motor including fan shall be painted with corrosion proof paints of colour shade blue (RAL 5012).

8.0 TESTING.

8.1 TYPE TESTS

8.1.1 For HT motors, type test reports for type test as listed below, conducted on equipment similar to those proposed to be supplied and carried out within last ten years shall be submitted. However, if such reports are not available, one motor of each type shall be subjected to type tests for free of cost.



LIST OF TESTS FOR HT MOTOR

- (a) No load saturation and loss curves up to approximately 115% of rated voltage.
- (b) Measurement of noise at no load.
- (c) Momentary excess torque test (subject to test bed constraint).
- (d) Full load test.
- (e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., core temp., coolant flow and its temp shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.
- (f) Degree of protection test for the enclosure followed by IR, HV and no load run test.
- (g) Terminal box-fault level withstand test for each type of terminal box of HT motors only.

8.1.2 For LT motors rated above 50 kW, type test reports for type test as listed below, conducted on equipment similar to those proposed to be supplied and carried out within last ten years shall be submitted. However, if such reports are not available, one motor of each type shall be subjected to type tests for free of cost.

LIST OF TESTS FOR LT MOTOR

1. Measurement of resistance of windings of stator and wound rotor.
2. No load test at rated voltage to determine input current power and speed
3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors)
4. Full load test to determine efficiency power factor and slip.
5. Temperature rise test.
6. Momentary excess torque test.
7. High voltage test.
8. Test for vibration severity of motor.
9. Test for noise levels of motor (Shall be limited as per clause no 7.06.00 of this section)
10. Test for degree of protection and
11. Over speed test.
12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148/ IEC 60079-1

8.2 ROUTINE TESTS

All motors shall be subjected to routine tests as per IS: 325/ IS: 12615 / specification.



TITLE

LV MOTORS**DATA SHEET-A**

SPECIFICATION NO.

VOLUME II B

SECTION D

REV. NO. DATE

SHEET 1 OF 2

ANNEXURE-III

- 1.0 Design ambient temperature : 50 °C
- 2.0 Maximum acceptable kW rating of LV motor : 200KW *
- 3.0 Installation (Indoors/ Outdoors) : As required
- 4.0 Details of supply system
- a) Rated voltage (with variation) : 415V $\pm$ 10%
 - b) Rated frequency (with variation) : 50 Hz + 5 % to - 5%
 - c) Combined voltage & freq. variation : 10% (sum of absolute values)
 - d) System fault level at rated voltage : 50 kA for 1 sec
 - e) Short time rating for terminal boxes
 - o 90 kW and above (Breaker Controlled) : 50 KA for 0.25 sec.
 - o Below 90 kW (Contactor Controlled) : 50 KA protected by HRC fuse
 - f) LV System grounding : Solidly
- 5.0 Class of insulation : Class 'F', with temp rise limited to class B.
- 6.0 Minimum voltage for starting (As percentage of rated voltage) : 85% for motor ratings below 110kW
80% for motor ratings from 110kW to 200kW.
- 7.0 Power cables data : Shall be given during detailed engg.
- 8.0 Earth Conductor Size & Material : Shall be given during detailed engg.
- 9.0 Space heater supply : 240 V, 1 ϕ , 50 Hz
- 10.0 Rating up to which Single phase motor : Acceptable below 0.2 kW
- 11.0 Locked rotor current
- a) Limit as percentage of FLC : 720% incl. of tolerance as per IS: 325
- 12.0 Flame-proof motor
- a) Enclosure suitable (As per IS: 2148) : Group – IIB for Fuel Oil area
Group – IIC for H2 Gen. plant area
 - b) Classification of Hazardous area (As per IS: 5572 part-I) : As per requirement
- 13.0 Makes : BHEL/ Customer approval
- 14.0 Paint shade : Blue (RAL 5012) – Corrosion proof
- 15.0 Degree Of protection for motor/ terminal box : As per IS 4691

*** LT motors of continuous duty shall be energy efficient IE3 class conforming to IS-12615**



TITLE

LV MOTORS**DATA SHEET-A**

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. DATE

SHEET 1 OF 2

16.0 TESTING**16.1 Type Tests**

For HT & LT Motors, type test reports for type tests as per IS: 325/ IS: 12615 conducted on equipment similar to those proposed to be supplied and carried out within last ten years shall be submitted. However, if such reports are not available, one motor of each type shall be subjected to type tests for free of cost.

16.2 Routine Tests

All motors shall be subjected to routine tests as per IS: 325/ IS: 12615 in the presence of customer or customer representative.

17.0 NAME PLATE

Motors shall have stainless steel name plate with all particulars as per IS: 325. In addition following information shall be indicated.

- a) Temperature rise in Deg. C under rated condition and method of measurement.
- b) Degree of protection.
- c) Bearing identification no. and recommended lubricant.
- d) Location of insulated bearings.



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

SPECIFIC TECHNICAL REQUIREMENTS

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

SECTION: **I**

SUB-SECTION: **IC**

REV. NO. **0** DATE **24.04.17**

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

SUB-SECTION – IC

SPECIFIC TECHNICAL REQUIREMENTS (C &I)

Note: Specific C&I specification for Type-4 sump pumps are specified at two places i.e Sub-Section-1C (part-1) and Sub-Section-1C (part-2). However stringent of these two shall be followed.

	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
Specific Technical Requirements (C&I): 1. All the instruments/drives shall be terminated on JB's/Panels in field. JB's/Panels shall be in Bidder's scope. 2. Bidder shall provide an unlimited warranty on all equipment and software for three years after the start of the warranty period, i.e. after satisfactory completion of initial operations. This warranty shall include repair, replacement or correction of identified software or hardware discrepancies at no cost to OWNER. 3. The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL. 4. All the instruments/equipment/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. 5. The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with. 6. Bidder shall also provide all the necessary instruments to the process requirement even if it is not specifically indicated in the given technical Specification document /drawings but required for completeness of the system. 7. All cables terminated in the terminal block, power distribution scheme instruments shall be ferruled. Ferruling shall be double cross ferruling (i.e.) so source and destination addresses shall be marked on both sides of the tube ferruling. 8. Bidder shall provide local panel for local start/ stop monitoring of auxiliaries and equipment as per requirement .The requirement shall be decided during detailed engineering. All local panel shall be NEMA 4X with canopy. 9. It is mandatory to use sensors/signals/measurements with 2 out of 3 logic for critical control & protection (Analog & Binary) application/service and		

	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
sensors with 1 out of 2 logic for all other control & interlock (Analog & Binary) application/service. 20. In the event of conflict between requirements of any two clauses or specification documents, the more stringent requirements shall apply. 10. Number of pairs to be selected for Screen /Control cable (Size : 0.5 mm2): a) F-Type: 2P/4P/8P/12P/24P b) G-Type: 4P/8P/12P		

3.03.17 LEVEL SWITCHES (LS)

Type/Construction	:	a) External float cage type with magnetic switch actuator for tanks and vessels. b) Electrode/Capacitance (for oil tanks) c) Displacer -Top mounted for all clean water sumps. d) Conductivity type for high Pressure and high temperature enclosed vessel like drain pot, HP heaters etc.
Materials		
- Body	:	Cast Carbon Steel/Die cast Aluminum suitable for specified pressure and temperature ratings
	:	For corrosive liquids suitable anti-corrosive coat/lining shall be provided.
- Float/Displacer	:	316 SS
- Wire rope	:	316 SS
Differential	:	± 12 mm minimum (Adjustable)
Contacts		
- Number	:	DPDT/2 SPDT
- Type	:	Snap action micro switch Auto reset with internal Adjustable
- Rating	:	5 Amp 240V AC 0.2 Amp 220V DC
Connection - Process	:	One (1) inch SCRD NPT Female Or One (1) inch ANSI Flanged Four(4) inch ANSI Flange for sump services.
Electrical	:	Suitable for Plug in type connection

Temperature/pressure rating :	As per service conditions
Accessories :	Counter flanges, still pipe of requisite length with anticorrosive coating for sump services.

Nuclear, capacitance, or ultrasonic type level switch for bulk material applications shall be provided.

3.03.17.01 Conductivity Type Level Switch

Type	:	Conductivity discrimination.
Mounting	:	Flanged – on standpipe.
Probe MOC	:	Stainless steel with high purity ceramic.
Probe rating	:	> Maximum design pressure of vessel.
Input	:	Four independent channel with selectable switching threshold for water conductivity.
Relay Output	:	Four isolated output relays for Hi, Lo, Hi-Hi, Lo-Lo.
Contact type & rating	:	2SPDT or 1 DPDT @ 5A 30V DC.
Faults Detection	:	Power Fail/Electrode Connection Open circuit/short circuit to ground, Ground failure. In built Fail Safe Logic.
Indicator	:	One Red LED for steam/ one Green LED for water/ Two no. LED one each for Process & system fault.
Power supply	:	Dual 240V AC, 50 Hz, 1Ph. From UPS
Enclosure	:	IP-65, corrosion resistant & wall mounting type.
Accessories	:	i. PTFE cable from probe to electronics unit. Electronic unit shall be separate. Head mounted electronic unit is not preferred. ii. Mounting accessories iii. standpipe iv. Washer & gasket
Test pressure	:	Two times rated pressure

3.03.17.02 Capacitance Type Level Switch

Type	:	Capacitance type
Probe	:	a) Rod or suspended electrode b) Rope type probes may be used only where required probe length is greater than 3 meters.
Probe Mounting	:	Stainless steel 1-1/2 ANSI RF Flange / ¾" NPT (M)
Material of construction	:	316 SS
Insulation	:	PTFE Part/Full as per service.

6.00.00 PANEL AND DESKS

6.01.00 GENERAL REQUIREMENTS

All DDCMIS/PLC/any other control system's electronic modules, power supply components, other control devices (except field mounted sensors/transmitters) and required for completeness of the system shall be housed in cabinets furnished by the Bidder. All equipment and dedicated cabinets required for termination, marshalling and proper interface within Bidder's system and also with other systems shall also be provided by the Bidder.

The cabinet mounted equipments shall be fully assembled, installed in mounting racks, wired and fully tested as per specification requirements and Owner approved drawings in the manufacturing works of a qualified manufacturer prior to shipment to the project site. The Bidder shall ensure that the cabinets are complete and ready for installation before dispatch from manufacturing works. The installation work at project site for these cabinets should only involve connections through multi pair cables from marshalling cabinets (wherever provided) to system cabinets and inter-cabinet/cabinet to UCD/UCP/BUP.

The Control cabinets shall house all types of modules / hardware to achieve all functions of Control System including signal conditioning modules, controller modules, I/O modules, communication controller modules, and all other requisite hardware for a complete system.

6.04.00

CONSTRUCTIONAL FEATURES OF PANELS, CONSOLES, CONTROL DESK, CUBICLES & ENCLOSURES

All panels, cubicles, consoles, SOV panels and enclosures furnished as per this specification shall be of free standing type and shall be constructed of specified gauge of steel plates. The panel sheet thickness shall be not less than 2 mm unless otherwise specified herein.

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

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

All panels shall be mounted on vibration dampers, which are secured to channels mounted on the floor. The channels shall be field welded to steel plates set into the concrete flooring. The steel plates shall be located such as to approximate the outline of panel bases. The exact mounting details shall be as approved by the owner during detailed engineering stage. All panels shall be provided with adequate ventilation and packaging density of components shall be restricted so as to limit the temperature rise

above ambient to 10°C under the worst conditions. All panels shall have auto on/off switch for internal lighting. All the power supply circuit for control panels shall be provided with auto changeover circuitry.

In each panel /cabinet, a 24 VDC Voltmeter digital type shall be provided to check the Field Interrogation voltage.

Exhaust Fans with louvers & filters shall be provided on door's (front & Rear) upper side to remove hot air in all consoles, control desk and panels.

Fire/Smoke detectors shall be provided inside the Control room mounted system/control cabinets.

UPS, 24 V DC & non UPS's Feeder failure/ healthy indication shall be provided in each cabinet & remote indication shall be hooked up to DDCMIS/ PLC/annunciation & suitably grouped.

All the panels shall be equipped with Anti vibration pad of min. 15 mm size. Cable gland plate thickness shall be 3 mm.

Doors shall be provided with neoprene/polyurethane gasket only.

All the cable entries shall be at the bottom of electronic cubicles/control panels.

Protection class of panels shall be as specified at Vol. V, chapter 2.

6.05.00 SURFACE PREPARATION AND PAINTING

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

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

Two spray coats of inhibitive epoxy primer – surface shall be applied to all exterior and interior surfaces, each coat of primer surfacer shall be of dry film thickness of 1.5 mil. A minimum of two spray coats of final finish colour (Catalysed epoxy finish) shall be applied to all surfaces of dry film thickness 2.0 mil. The finish colours for exterior and interior surfaces shall conform to the following shades:

- a) Exterior - RAL 7032/RAL 7035.
- b) Interior - Glossy white two coats/RAL 7035 with fire resistant paint

One uniform colour shade as finalized shall be applicable for complete plant.

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

6.06.00 PANEL WIRING

Interconnecting wiring shall be provided between all electrical devices mounted in the panels, and between the devices and terminal blocks if the devices are to be connected

to equipment outside the panels by cabling and through pre-fabricated plug in cables. All alarm contacts located within a panel shall be wired to terminal blocks. Thermocouple and other special circuits shall be field wires direct to instrument terminal blocks without the use of panel wiring.

All control and instrument wiring used within the panels shall conform to NEC and NEMA standards and shall be factory installed and tested at the works of a qualified manufacturer. All interior wiring shall be installed neatly and carefully, and shall be terminated at suitable terminal blocks. Sufficient clearance shall be provided for all control and instrumentation leads, and all incoming and outgoing leads shall be connected to terminal blocks suitably located for connecting external circuits.

All panel wiring shall have appropriate ferruling for clear identification. Interior wiring shall be so arranged that the external connections can be made with only one wire per terminal point. Any common connections shall be made internal side of the terminal blocks. Common connections shall be limited to two wires per terminal. Instrumentation cable shield wires shall be connected to separate terminal at the terminal block. Signal circuit shields shall be grounded separately.

All internal wiring (except low level instrument wiring) shall be National Electric Code Type SIS, Polymetric/Elastomeric insulated, tinned copper stranded conductor, switchboard wire, or owner approved equal.

Panel wiring shall have a flame resistant insulation with adequately sized 650/1100 V grade tinned copper stranded conductor based on current carrying capacities as etc forth by the National Electric Code.

Wire sizes shall be as specified herein and suitable for intended applications.

Wiring to door mounted devices shall be provided with (49 strand minimum) adequate loop lengths of hinge wire so that multiple door openings will not cause fatigue braking of the conductor.

Wiring shall be arranged to enable instruments or devices to be removed and/or serviced without unduly disturbing the wiring. No wire shall be routed cross the face or rear of any device in a manner, which will impede the opening of covers or obstruct access to leads, terminals or devices.

Panel wires shall be identified with wire number and each termination by means of Action craft products split sleeve or Borden Chemical Co. indelible tubing markers or owner approved equal. Corrections and modifications of all panel wiring shall be Bidder's sole responsibility. Any corrections/modifications required at site for successful commissioning shall be done by the Bidder without any additional costs. Terminal lugs furnished must be of the compression, insulated sleeve, half ring tongue type. Open-ended terminal lugs will not be accepted. Wires shall not be looped around the terminal screws or studs.

Wires shall not be tapped or spliced between terminal points.

Panels, cabinets, consoles/desks will be provided with removable, gasketed cable gland plates and cable glands, for all floor slots used for cable entrance. Split type grommets shall be used for prefab cables.

Internal wiring in factory prewired electronic systems cabinets may be installed according to the Bidder's standard as to wire size, insulation, and method of termination on internal equipment except that insulation for all wiring power supply wiring, and interconnecting cables between devices shall pass the following tests.

- a) Flammability test IEEE 383/1974
- b) When tested under UITPP test method or ASTM 2893/77 light transmittance of 80%
- c) When tested under IEC 754-1 maximum acid gas generation shall be 2% by weight
- d) Oxygen index not less than 30 as per ASTM D 2863.

All terminations for intra panel wiring inter panel cabling and connecting the Bidders panels, PB stations, control stations etc. shall be with cage clamp Screwed less connections. Soldered connections are not acceptable. All field side or external input connections shall also preferably of Cage clamp/Spring Clamp/ Screwed less connection.

Conductor Clamping shall also confirm to Standard IEC – 60947-1 & IEC-60947-7-1.

Identification of conductors may be done by insulation colour coding identified on drawings or by printed wiring lists. Terminal blocks for connection of external circuits in to factory prewired electronic system cabinets shall meet all the requirements as described elsewhere in the specification. For all multicore cables, the outer sheath shall satisfy the properties identified above. However, for panel wiring, the wiring insulation shall also satisfy the properties identified above. The internal wiring shall be done in coloured wiring.

6.06.01

Following Wire size shall be utilized for internal wiring:

- a. Current (4-20 mA) : 0.75 sq.mm
Low voltage signals :
(AI/AO & DI signals)
- b. DO signals, Ammeter/ : 1.5 sq.mm
voltmeter circuit,control
switches, indicator,recorder
- c. Internal Illumination : 2.5 sq.mm
- d. Size of Power supply cables shall be as below:-
 - i. 1 to 16 Amp. - 2.5 sq. mm
 - ii. 17 to 20 Amp. – 4 sq. mm
 - iii. 21 to 32 Amp. - 6 sq. mm
 - iv. 33 to 40 Amp. - 10 sq. mm.
 - v. 41 to 60 Amp. - 16 sq. mm
 - vi. Power earth - 4 sq. mm

6.07.00

INSTRUMENTS MOUNTING

6.07.01 Instruments and relays mounted on the panels shall be easily accessible for repair and replacement without disturbing other equipment their connected wiring. No special tools shall be needed for the purpose.

6.08.00 PANEL ILLUMINATION

Panels shall be provided with LED based illuminating lamps with door switch and six (6) point 6/16A, 240V AC universal type power sockets with switch for maintenance purposes. These switches shall be with quick make and break mechanism. 100 % spare LED lamps shall be provided with each panel, these are in additional to mandatory spares.

6.09.00 FUSE BLOCKS

Where fuse blocks rated 30 amp. 250 Volts are required by the specifications or the manufacturer's design, they shall be modular type with bakelite frame and reinforced retaining clips. Blocks shall be class H.2 pole, screw terminal fuse blocks. Blocks for other current and voltage ratings shall be similar in construction.

6.10.00 FUSES & MCB

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

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

6.11.00 MOULDED CASE CIRCUIT BREAKERS

Moulded case circuit breakers used in equipment covered under these specifications shall have not less than 5000 amp. Interrupting capacity at 220 Volts DC 10,000 Amp. Symmetrical interrupting capacity at 240 Volts AC. MCCB shall be provided at each main feeder line like ACDB & DCDB main feeders, PLC main feeder, control panels, UPS circuits etc.

6.12.00 GROUNDING

All panels and cabinets shall be provided with a continuous bare copper ground bus of minimum 6 mm x 25/50 mm cross section. The ground bus shall be bolted to the panel structure and effectively ground the entire structure. Each Ground bus shall have provision at each end for connection of ground leaks (6 mm x 50 mm GI Flats) by suitable bolting. All system cabinets shall be brought to a common system ground by the bidder. Electronic earthing resistance shall be < 0.5 ohms.

Each circuit requiring grounding shall be individually and directly connected to the panel ground bus by ring tongue type compression lugs. For electronic system cabinets the system ground bus shall be insulated from the cabinet enclosure and shall be separately

connected to the system ground. All system cabinets shall be brought to a common system ground by the bidder.

The Bidder shall furnish his recommendations regarding grounding requirements for all equipment/systems and shall specifically indicate the deviations if any from the above requirements as a part of his proposal.

6.13.00 TERMINAL BLOCKS

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

6.13.01 All outputs going to MCC/SWGR terminal blocks, shall be rated 600 volts minimum and shall have strap screw less terminals suitable for connection of wires with ring tongue type lugs. Standard terminal blocks shall be screw less cage clamps type. Terminal blocks shall be approximately sized for larger wire size of higher voltage insulated incoming conductors as necessary. All the TBs used shall be 6.6 polyimide to withstand corrosion and the metallic portion shall be coated against rust /corrosion. All metal parts should be non –ferrous in nature.

6.13.02 Terminal blocks shall be provided with white marking strips and re permitted by the safety codes and standards shall be without covers.

6.13.03 Fuses shall not be mounted on terminal blocks. Neither step type terminal blocks nor angle mounting of terminal blocks will be acceptable.

6.13.04 At least 20 per cent spare unused fully wired terminals shall be provided on each terminal block for circuit modifications and for termination of all conductors in a multi-conductor control cable with each panel, enclosure, cubicle, SOV Boxes etc.

6.14.00 NAME PLATES AND LABELS

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

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

Markings/Labels

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

2.06.00 PROTECTION, CLASS OF CABINETS / PANELS, ENCL.OSURES ETC.

- a) All panels, desks cabinets, consoles & enclosures furnished at least comply with the requirements of protection classes as indicated below.
 - 1. In-door Air-conditioned (A.C.) areas - IP32/42 (min.)
 - 2. In-door Non A.C. areas:
 - (a) Ventilated enclosures - IP42
 - (b) Non Ventilated. IP 54
 - 3. Out-door IP55 / IP65
(As per the requirement)
- b) Distribution boxes, junction boxes, cold junction compensation boxes, terminal boxes and all other field mounted equipment to be furnished as per this specification shall have weather protection conforming to IP 65.
- c) The design of panels, cabinets, enclosures and packaging density of components mounted therein shall be such that the temperature rise does not exceed 10 deg. C above the ambient under the worst conditions.
- d) The panels housing electronic hardware shall be provided with flame and smoke detectors by bidder.
- e) Enclosures for peripheral equipments like printers, etc. shall take care of noise and shall ensure minimum possible noise disturb to the working personnel.

2.06.01 Guards, barriers and access doors, covers of plates shall be marked to indicate the hazard, which may occur upon removal of such devices. Danger or caution signs shall be used to warn of specific hazards such as voltage or current. The marking shall be permanently affixed to the equipment.

2.07.00 System Documentation

QUALITY ASSURANCE AND TESTING AND GUARANTEES

14.01.00 GENERAL REQUIREMENT

- 14.01.01** All equipment furnished under this specification shall be subject to test by authorized quality assurance personnel of the Bidder, representatives of the Owner during manufacture, erection and on completion. Bidder's quality assurance personnel for these shop and site tests shall be identified in advance and shall be acceptable to the Owner. The approval of the Owner or passing of such inspection of tests will not, however, prejudice the right of the owner to reject the equipment if it does not comply with the specifications when erected or fails to give complete satisfaction in service.
- 14.01.02** The Bidder shall furnish details of shop and site tests proposed to be conducted by him at various stages to meet the specification requirements for each type of instrument/system along with his proposal. Bidder shall also furnish details of his proposed shop and site quality assurance organization for this contract
- 14.01.03** Bidder shall prepare a detailed shop and site 'Quality Assurance Programme' to meet the requirements of these specifications for Owner's approval. This document shall also contain the formats for reports and maintenance of test records specification of test equipment to be used for site tests.
- 14.01.04** All equipment and systems furnished under this specification shall be subjected to shop & site tests in accordance with the Quality Assurance Program approved by the Owner and shall be adequate to ensure full compliance with these specification, all applicable codes & standards and detailed engineering drawings and documents approved by the Owner.
- 14.01.05** The Bidder shall provide all required test equipment and simulation devices for performing all shop and site tests. All test equipment shall be of reputed make, required accuracy class and shall be recently calibrated. The record of calibration of test equipment shall be made available to the Owner on demand.
- 14.01.06** The cost of all tests as per the requirements of this specification and approved quality assurance programme shall be included in Bidder's lump sum price for this package and no extra price shall be payable by the Owner for conducting any test as per the intent and requirements of this specification.

14.01.07 All approval/Inspection are to be carried out by the Owner only.

14.02.00 SHOP TESTS

14.02.01 General Requirement

- 14.02.01.00 Shop tests shall include all tests to be carried out at Bidder's works at of this sub-bidder and at works where raw materials used for manufacture of equipment is produced.

14.02.01.01 Individual components, instruments and devices furnished in accordance with specification sheets, and I&C device list enclosed with these specifications shall be shop tested by manufacturer prior to shipment. The manufacturer shall conduct these tests for certifying compliance with published specifications for the equipment and provide test results to the Owner in writing. These tests and test certificates shall be in accordance with the agreed 'QA' programme for major systems/equipments. However, manufacturer's standard methods shall be followed if details of tests for any equipment are not covered under this agreed 'QA Programme'.

14.02.01.02 Whenever tested quality material is specified and wherever called upon by Indian Boilers Regulations or by the design code, the test pieces are to be prepared and tested to Owner's satisfaction.

14.02.01.03 In the event of Owner being furnished with certified particulars of tests, which have been carried out by the suppliers of material, the Owner may, at his discretion, dispense with these tests.

14.02.02 Material Tests

14.02.02.01 Whenever tested quality material specified and whenever called upon by Indian Boilers Regulations or by design code, the test pieces, are to be prepared and tested to Owner's satisfaction.

14.02.02.02 In the event of Owner being furnished with certified particulars of tests, which have been carried out by the suppliers of material, the Owner may, at his discretion, dispense with these tests.

14.02.03 Test at Manufacturer's Works

14.02.03.01 Works tests are to include electrical, mechanical performance and hydraulic tests in accordance with relevant IS, IBR or any other approved standard or any other tests called for by the Owner under these specifications to ensure that the equipment being supplied fulfills the requirements of these specifications. For equipments not covered by any IS or other approved standards, the tests to be carried out shall be in accordance with Bidders' quality assurance programme approved by the Owner.

14.02.03.02 Control systems, monitoring systems, control panels, instrument enclosures, and power supply systems shall be shop tested according to unique requirements specified in the applicable section of these specifications for each item and quality assurance program approved by the owner.

14.02.03.03 All shop tests shall be performed prior to shipment and the Owner shall be given the opportunity to witness these tests. The Bidder shall notify the Owner regarding readiness for shop test at least 10 days before the scheduled date if the tests to be conducted within Indian and at least 60 days before the schedule date if the test is to be conducted abroad.

14.02.04 Factory Tests

14.02.04.01 Automatic Control and Monitoring system (DDCMIS, PLC & any other microprocessor based control system) including alarm annunciation system furnished as per this specification shall be subject to shop and site tests as per the requirements of this specification, applicable codes and Owner approved Quantity Assurance Program so as to demonstrate to the Owner that the equipment furnished by the Bidder meets the intent and requirement of this specification. These tests shall include but shall not be limited to the tests indicated in the subsequent clauses.

	SPECIFIC TECHNICAL REQUIREMENTS (C&I) FOR SUMP PUMPS	
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SPECIFIC TECHNICAL REQUIREMENTS (C&I) WITH SCOPE OF SUPPLY:

- 1) The control of Sump pumps shall be realised in Relay based Control cum Starter Panel. Push buttons, alarms on LCP shall be supplied by vendor and shall be finalised during detailed engineering.
- 2) The Contractor shall provide complete Instrumentation for control, monitoring and operation of Sump pumps. The requirements given are to be read in conjunction with detailed Technical specification enclosed in the specification. Further in case of any discrepancy in the requirement within the same or different section, as noted by the bidder in the specification, the same will be brought to the notice of BHEL in the form of pre- bid clarification. In absence of any pre-bid clarification, the more stringent requirement as per interpretation of BHEL/customer shall prevail without any commercial implication.
- 3) The make/model of various instruments/items/systems shall be as per Customer approved vendor list. No commercial and delivery implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
- 4) Bidder to supply the field instrumentation, junction boxes as required.
- 5) The cable used shall be 0.5 mm², G type (2P/4P/8P/12P) for Binary signals and F type cable (2P/4P/8P/12P/20P) for Analog signals. For solenoid 2.5mm², 3-core cable shall be used (as shown in Drive controlled philosophy).
- 6) For cable scope refer to electrical scope between BHEL and vendor defined in electrical specification under Standard Electrical Scope Between BHEL and Vendor.
- 7) Items not specifically mentioned however required for the completeness of the system shall be supplied by vendor without any commercial/ time implication. Vendor shall be responsible for the completeness of the system in all respect.
- 8) Bidder to terminate all instrumentation and control elements in junction boxes.
- 9) Bidder to provide input/output list, drives list and termination details, recommended control logics / write-up etc., the list of documents to be submitted after award of contract is to be referred by bidder.
- 10) Bidder to perform tests of C&I items/instruments/systems as per Quality plans/type test attached in the specification. However, if any test not specified in the quality plan but specified in specification Tests for I&C equipment included elsewhere in specification will have to perform by Bidder without any cost implication.

	SPECIFIC TECHNICAL REQUIREMENTS (C&I) FOR SUMP PUMPS	
11) Instrument installation and accessories required for the same shall be in Bidder's scope and shall be submitted after award of contract. However, any instrument installation not covered in the same shall be subject to customer and BHEL approval during detailed engineering. The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold and all the other accessories required for mounting/ erection of these local instruments shall be provided by bidder, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments; sensors, switches etc. for external connection including spare contacts shall be wired out to suitably located junction boxes by bidder. 12) 415V AC Power supply shall be provided by BHEL at a single point, further distribution to various instruments/equipment of the system shall be in bidder scope. Bidder to include necessary power distribution board, changeover circuit in his scope. Any power supply other than the above, if required by any instrument/equipment has to be derived by the bidder from the above supply & all necessary hardware for the same shall be in bidder scope. Bidder to submit the power requirement along with the bid. 13) Local control panel required for operation shall be in bidder scope. 14) All the wetted parts of the instruments including accessories required for mounting/erection of these local instruments, for Sea water Plant or Sea Water services shall be Super duplex SS and same shall be in bidder's scope. 15) Redundancy of sensors shall be provided by bidder (i) Triple redundancy for all analog and binary inputs required for protection of system/drives. (ii) For all other control functions dual redundancy of the sensors shall be provided by the bidder. 16.) Level switches shall be separate for each setpoint. 17.) Panels for Permanent duty type pumps shall be constructed as specified in the panel specification. All panels (for Permanent duty and portable Pumps) Panel material, Painting Process/procedure & Painting material shall be suitable for sea water and saline conditions at site in line with national and international standards like ASTM, ISO etc. 18) Following INTERLOCKS (tentative) shall be realised in the LCP A.) Controls for Submersible Sump Pumps (For Permanent duty type)		

	SPECIFIC TECHNICAL REQUIREMENTS (C&I) FOR SUMP PUMPS	
Submersible Sump Pumps shall be controlled by a common Relay based Local control panel with IP 55 protection class for each set of two (2) numbers pumps in a pit. The LCP shall also house motor starter of sump pumps. The following controls/Interlocks shall be provided in the LCP. a) Start/ stop facility. b) If any of the working sump pump trips due to electric fault etc., the standby sump pump will come into operation automatically. c) Selector switch for main/standby selection. d) 1 No. (One) 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) 1 No. (One) 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. f) 1 No. (One) level switch (low level) provided in the sump shall trip all running sump pump in the event of low water level in the sump. g) Sump pump status indication (on/off/trip). B.) Controls/ Indications for Portable Submersible Pumps Portable Sump Pumps shall be controlled by trolley mounted Relay based Local Control panel. The LCP shall also house motor starter for the submersible sump pump. The local control panel height shall be as per pump manufacturers standard. The following controls/ interlocks shall be provided in the local control panel. a) Start / stop facility. b) Auto Stop Facility based on level very low switch feedback. c) Pump On/ off status in LCP. 19.) The minimum sheet thickness of Local panels shall be as follows. Side and top – not less than 1.6 mm. Door & mounting plate – 2.0 mm Base metal plate - 2.5 mm. Gland plate – 3 mm 20) Diaphragm seal shall be provided for pressure gauges.		

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	TECHNICAL SPECIFICATION (C&I) FOR SUMP PUMPS	
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SPECIFICATION FOR MEASURING INSTRUMENTS
(PRIMARY & SECONDARY) SWITCHES, GAUGES
AND LOCAL CONTROL PANELS



3.03.17 LEVEL SWITCHES (LS)

Type/Construction :

- c) Displacer -Top mounted for all clean water sumps.

Materials

- Body	:	Cast Carbon Steel/Die cast Aluminum suitable for specified pressure and temperature ratings
	:	For corrosive liquids suitable anti-corrosive coat/lining shall be provided.
- Float/Displacer	:	316 SS
- Wire rope	:	316 SS
Differential	:	± 12 mm minimum (Adjustable)
Contacts		
- Number	:	DPDT/2 SPDT
- Type	:	Snap action micro switch Auto reset with internal Adjustable
- Rating	:	5 Amp 240V AC 0.2 Amp 220V DC
Connection - Process	:	One (1) inch SCRD NPT Female Or One (1) inch ANSI Flanged Four(4) inch ANSI Flange for sump services.
Electrical	:	Suitable for Plug in type connection
Temperature/pressure rating:	:	As per service conditions.
Over Range Protection	:	150% of max. Design Pressure.
Accessories	:	Counter flanges, still pipe of requisite length with anticorrosive coating for sump services.

3.03.03 PRESSURE & ~~DIFFERENTIAL PRESSURE~~ GAUGES (PG & DPG)

Applicable standard	:	IS:3602-1966, IS/3624, ASME B 40.1
Type/Construction	:	
-760 mm to 1.0Kg/cm ²	:	Bellows/Diaphragm
-Above1.0Kg/cm ²	:	Bourdon Tube
- Suction side of pumps	:	Compound gauge
Materials		
- Bourdon tube	:	316 SS
- Bellows	:	316 SS
- Movement	:	316 SS
- Case	:	SS 316/ Die-cast aluminum with stoved enamel black finish. Epoxy coating shall be provided for corrosive atmosphere.
- Protective Diaphragm	:	Teflon
Dial size	:	150mm with toughened shatter proof glass. 300 mm with toughened shatter proof glass for frame mounted gauges.
Scale Details	:	Graduations in black lines on white dial, on white dial, 270 Deg. pointer deflection scale provided with

		glass cover. Smallest scale division shall be one (1) percent of full scale value or smaller. Pointer stop for all gauges.
Accuracy	:	± One (1) percent or better
Connection - Instrument Process	:	1/2 inch NPT Male Bottom
Mounting	:	Local / Frame mounted.
	:	1/2 inch NPT Male (Back entry) mounted on local gauge board.
Enclosure Class	:	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)
IBR Requirement	:	For high pressure service, Process tapping and root valves are as per IBR rules and regulations.

Accessories

- 3 way needle valve/manifolds	:	For all gauges depending upon service.
- Self cleaning type	:	Pump and compressor discharge lines
Pulsation dampener/snubber (S316)	:	
- Syphon	:	For all steam lines
- Protective separating seal	:	For fuel oil and corrosive liquid lines

Other particulars

- External Zero adjustment	:	For all gauges
- Safety device	:	
Ranges 5 to 20 Kg/cm ²	:	Rubber blow out disc with open front construction.
Ranges above 20 Kg/cm ²	:	Neoprene safety diaphragm at the back with solid front construction.
- Over range protection	:	One Fifty (150) percent of full scale

Other Requirements

:	Movement mechanism shall be glycerin filled for oil services & vibration prone area.
:	For Fuel oil & corrosive liquid lines diaphragm type sensors required. Armored capillary of 10 M for Fuel oil & Corrosive liquid service.
:	Contact type pressure gauges are not acceptable for interlock & protection.
:	For condensate storage tank and DM water storage tanks, the pressure

gauge in terms of 0-10000 mm wc or suitable range having **dial size of 300mm or bigger size** shall be provided.

3.03.41

Junction Boxes

Type of Enclosure	:	Flame proof/weather proof IP-65/Explosion Proof as per area classification. Design as per NEC-370 Article 18, 19 & 20.
Material	:	6 mm min. thick FRP with protective Coating 3 mm min. thickness Die cast aluminum for Flame proof/Explosion proof area.
Cable entry	:	Bottom or Side
Cable glands	:	Double compression type – Nickel plated brass 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.
Accessories	:	Suitable mounting clamps and other accessories shall be in scope of bidder. The brackets, bolts, nuts, screws, glands, lugs required for erection shall be of 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/Polyurethane thickness 6.0 mm. Silicon for High Temperature area.
Colour	:	In General same as provided for control panels, and for special services, To be decided during detailed engineering & subject to owner's approval.

3.03.43 Interposing Relays (IPR)

Electromagnetic type IPRs with modular design, plug-in type connections, suitable for channel/DIN rail mounting in cabinets; coil rating 24V DC; 2 set of silver plated cadmium free with change over contacts rated for DC1 Breaking capacity of 0.5A 110 V DC/ 0.15 A 220 VDC and AC1 Capacity of 8/10 A 240 V AC. Capacity shall be as system requirements. Freewheeling diode across copper relay coil and self reset type status non-polarized LED indicator for the Coil (electronic) and a flag indicator for the Contacts (mechanical) shall be provided. Manual forcing/override facility is required. The insulation test voltage of 1.2/50 μ s between the coil & contacts for relay shall not be less than 4 KV between adjacent contacts. The operating temperature of the Relay & Sockets shall be from -20 deg. C to 60 deg. C. The operating/release time of the relay shall not be more than 10/5 ms respectively.

The relay and DIN Rail sockets shall have the necessary approvals like UL/VDE and V0/V2 inflammability class in accordance with UL94", IEC60664/IEC60664A/DINVDE0110.

Facility to stimulate IPR manually shall be provided. The VA burden of relays shall be suitable to match the capacity of output modules. Interposing relay & sockets for mounting the interposing relay shall be of same make only and sockets shall have the plug in RC circuits/Varistors, required for EMI suppression.

4.05.08 RELAY BASED LOCAL CONTROL PANEL/DESK

Local control panel shall be of 2.5 mm steel construction, free standing type, totally enclosed dust and vermin proof with enclosure protection class of IP-55 as per IS: 13947 and colour shall be as per shade no. RAL 7032/7035. Panel shall be mounted on vibration dampers secured to steel frame on to the floor. Equipment and relays mounted on the panel shall be easily accessible. The panel shall be supplied completely wired upto terminal blocks for connecting external cables entering the panel from the bottom. Blank removable gland plate shall be provided with double compression type cable glands/conduits knockout along with the panel.

Terminal block shall be rated 600 volts minimum and shall have strap cage clamp type screw less terminals suitable for connection with 2x2.5 sq mm copper conductors on each side. Terminal block shall be provided with white marking strips. Fuses shall not be mounted on terminal blocks. At least 20 percent spare unused terminals fully wired shall be provided on terminal block.

Contactors, Relays, timers and other devices mounted on the panel shall have clearly visible identification marking. Separate contactors shall be provided for start & stop

command. Common contactor for start & stop command are not acceptable. All fuses shall be HRC semiconductor type of AC supply. HRC link & fuse shall be of removable type having 45 kA rupturing capacity (min) for protection of various circuits.

The panel shall be provided with a 50x6 mm tinned copper earthing strip running throughout the length of the panel at the bottom. Panel shall be provided with space heaters with isolating DPN MCB, and thermostats. LED based illuminating lamps, complete with door switches; and 1 no. 6 pin 5/15amps sockets with DPN MCB. Separate power supply feeder shall be provided for utilities.

Panel shall be provided with LED illuminating lamps with door switch and 6 point 5/15A, 240V AC socket with switch for maintenance purposes. Panel shall have removable lifting eye bolts for safe lifting from top during handling.

, control power supply shall be provided from dual non UPS single phase power supply feeders with dual transformers and with auto change over scheme, surge protection devices and Power/Volt/AM meter.

The panel shall be provided with push buttons, indicating lamps, annunciators, indicating instruments, interlock/ deinterlock switches etc., required for the complete system. General

Coloured Mimic with 6mm thickness sheet for respective plant lay out shall be provided as

20% spare relays of each type and rating shall be mounted and wired in relays control panel/Desk. All contacts of relays shall be terminated in terminal blocks of relay control panel/Desk, Additionally in the relay control panel/Desk, 20% spare terminal blocks shall be 'provided so that additional relays can be mounted and wired.

The annunciation system shall consist of panel mounted audio-visual windows of 50x75 mm provided with plug-in-type solid-state logic 16 nos. high intensity LEDs in parallel. EACH relay based control panel shall be provided with 30 nos min. facia windows. Initiating contacts may be either NO or NC; a jumper or switch shall be provided in each card to make it suitable for either type of contact. A set of acknowledge, reset and test push buttons shall be provided on the panel. All printed circuit boards shall be of epoxy fibre glass construction.

The sequence of annunciation shall be as follows:

Condition	Visual	Audible
Normal	OFF	OFF
Alarm	Flashing	ON
Acknowledge	Steady	OFF

Return to Normal:

a.	Before acknowledge	Flashing	ON
b.	After acknowledge	Steady	OFF

Reset:

a.	Alarm condition	No change	No change
b.	Return to normal	OFF	OFF

6.04.02 SURFACE PREPARATION AND PAINTING

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

Suitable filler shall be applied to all pits, blemishes and voids in the surfaces. The filler shall be sand blasted so that surfaces are level and flat, corners are smooth and even. Exposed raw metal edges shall be ground burr free. The entire panel surface shall be sand blasted to remove rust and scale and all other residue due to the fabrication operation. Oil grease and salts etc. shall be removed from the panels by the process like DI water by pressure spray method, one or more RoHS approved solvent cleaning methods. Alternatively 7/9 tank process shall be followed.

Two spray coats of inhibitive epoxy primer – surface shall be applied to all exterior and interior surfaces, each coat of primer surface shall be of dry film thickness of 1.5 mil. A minimum of two spray coats of final finish colour (Catalysed epoxy finish) shall be applied to all surfaces of dry film thickness 2.0 mil.

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

The final finished thickness of paint film on steel shall not be less than 65-75 micron for sheet thickness of 2 mm and 50 microns for sheet thickness of 1.6 mm.

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

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

- a) Exterior - RAL 7032/RAL 7035.
- b) Interior - Glossy white two coats/RAL 7035 with fire resistant paint

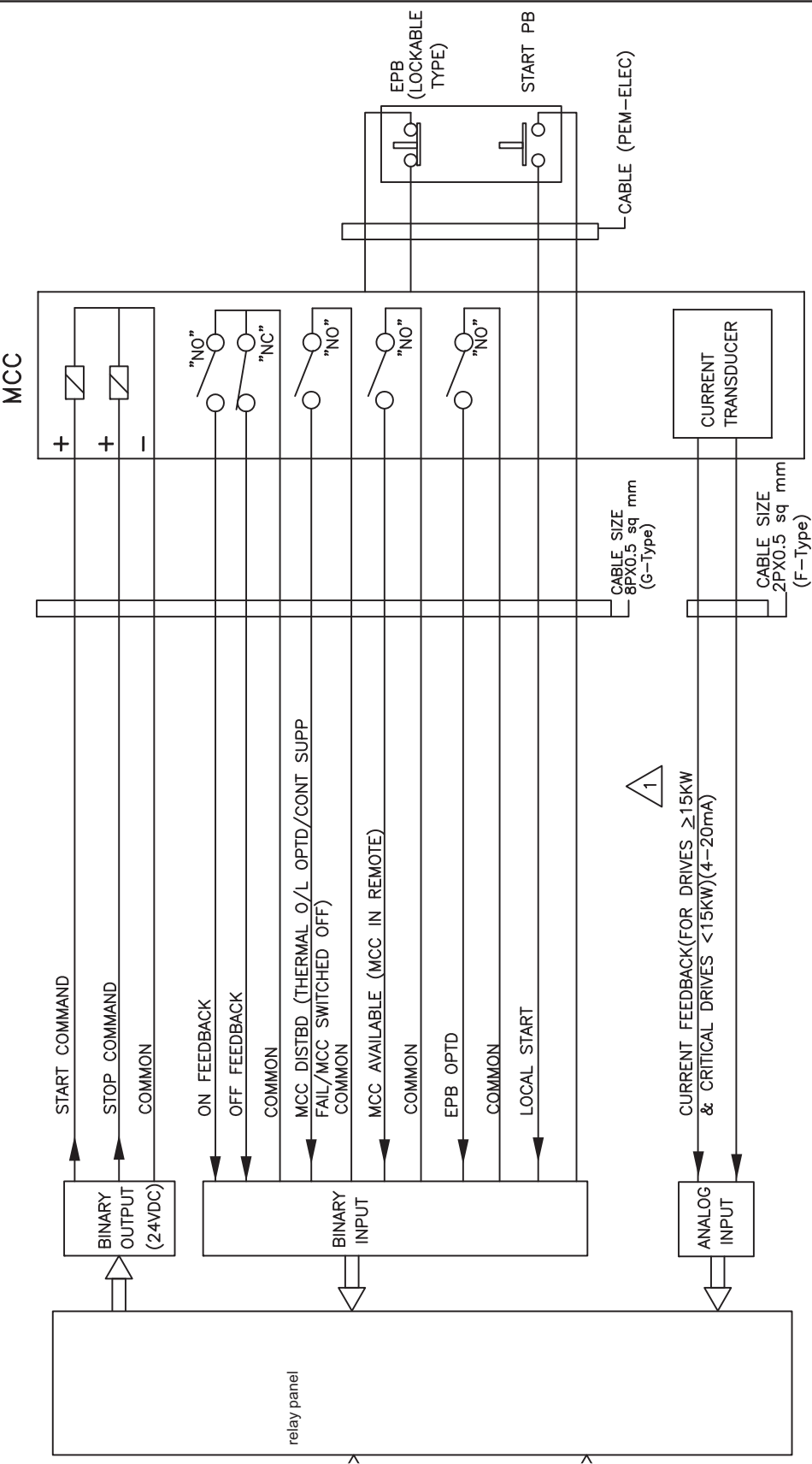
One uniform colour shade as finalized during detailed engineering shall be applicable for complete plant.

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

	TECHNICAL SPECIFICATION (C&I) FOR SUMP PUMPS	
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**SIGNL EXCHANGE BETWEEN DRIVES &
LCP (DCP)**

DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE



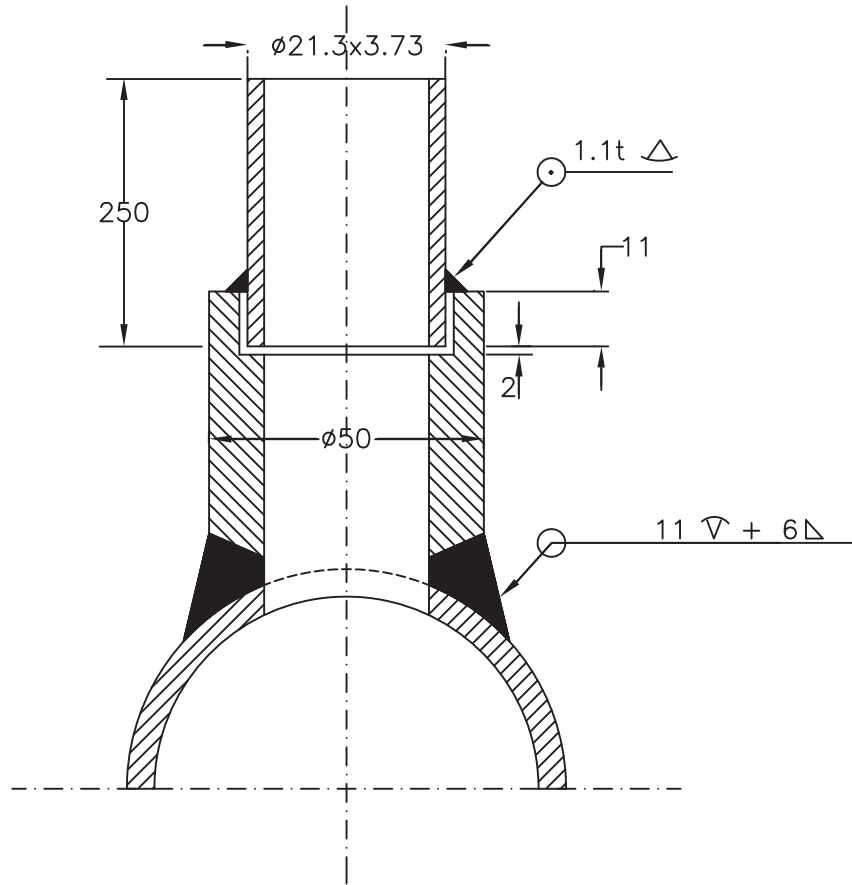
NOTE:

- 1) Redundancy of IO shall be as per specification requirement.
- 2) For LTUD, 4-20 mA Current Transducer shall be considered for all Lube Oil Pumps, Scanner Air Fans, Seal Air Fans.

* Wherever applicable



	TECHNICAL SPECIFICATION (C&I) FOR SUMP PUMPS	
INSTRUMENT STUB DETAILS		



NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHALL BE 250 MM.
3. 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. STUB LENGTH SHALL BE 64mm UPTO 200Nb, 45mm ABOVE 200Nb PIPE SIZE.
6. FOR PU COATED PIPE REFER SHEET No. 9



TITLE :
INSTRUMENT STUB DETAILS
FOR PRESSURE MEASUREMENT
 (SYSTEM PRESS <60Kg/Cm² & SYSTEM TEMP
 <425 DegC, CLASS 3000#)

DRG. NO.
PE-DG-425-145-I101
 REV. 00

SH. 04 OF 10 SHS.

13.02.04.21 **Calibration of Instruments**

The Bidder shall carry out the calibration of instruments as indicated below by submitting the test procedure and quality assurance plan for the Owner's approval. Bidder shall also prepare detailed checklist/calibration sheets for each of the systems/equipment clearly indicating the step-by-step procedures to be carried out for calibration pre commissioning, loop checking, powering and commissioning.

The calibration of all instruments shall be checked and calibration records prepared for the Owner's use. If the instruments require recalibration, Bidder shall recalibrate the instruments and revise the calibration records and submit to the Owner.

i TESTS TO BE PERFORMED FOR FIELD INSTRUMENTS

1.	Pressure Gauges
	Calibration Hydro test (1.5 times max. pr.)

11.	Level switches (Magnetic)
	Material test / Contact rating test / Hydro test / Calibration test.

21.	Junction Boxes
	Test for degree of protection / Material test
22.	Tests for terminal blocks
	Test for moulding for flame resistant, Non-hygroscopic and Decarbonised / Insulation test between terminals / Insulation between terminal block and frame.

30.	Interposing relay
	Functional test, temperature rise test, H.V test, Insulation test

37.	Local Panels : Visual inspection, wiring & continuity check, H.V. and I.R. tests on panels, checking of bill of materials, functional tests.
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13.02.05.4 TYPE TEST REQUIREMENTS FOR C&I SYSTEMS

S.No.	Item	Test requirement	Standard	Test to be specifically conducted	Owner's Approval required on Test Certificate
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3	Junction Box	Degree of Protection Test	IS - 13947	Yes	Yes
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12	Local gauges	Degree of protection test	IS 13947	No	No
13	Process actuated switches	Degree of protection test	IS 13947	No	No

16	LIE/LIR	Degree of protection test	IS 13947	YES	YES
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2.)New Sub-Vendor if proposed by Vendor during contract stage shall subject to BHEL/end user approval without commercial/delivery implication.

SLNO	Package Name	Vendor Name	Vendor Address
1	INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA-UTTAR PRADESH-INDIA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
2	INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI-MAHARASHTRA-INDIA Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
3	INSTRUMENT FITTINGS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai,-Maharashtra,-India, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,
4	INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	MD Hussain Shaikh/Shahanawaz Khan Gala No. 168, Loheki Chwal,216/ 218, Maulana Azad Rd. Nagpada Junction Mumbai-Maharashtra-INDIA Phone- 91-9324383121 Pincode : 400008 Email : shahanawaz.khan@perfectinstrumentation.com
5	INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	Mr. Jeetu Jain/Mr. Vinay Sosa Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway Laxmipura, Nandasan-Gujarat-INDIA Phone- 02764-267036/37 Pincode : 382705 Email : marketing@com-fit.com
6	INSTRUMENT FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI-DELHI-INDIA Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
7	INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	Mr.Sanjay Brahman/Mr.Shyam Vazirani 102, Vora Industrial Estate No.4 Navghar, Vasai Road (E) Dist.Thane, Mumbai-Maharashtra-INDIA Phone- +91-250-2392246 Pincode : 401210 Email : arya@aryaengg.com
8	INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	Mr. Abbas Bhola Potia Building No. 2, Office No. 3,292, Bellasis Road,Mumbai Central (East) Mumbai-Maharashtra-India Phone- 9920044113 Pincode : 400008 Email : ab@fluidfitengg.com
9	INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	S. Harichandran/P.S. Pandi B-11, Mugappair Industrial Estate, CHENNAI-Tamilnadu-INDIA Phone- 044 26252537 Pincode : 600037 Email : sales@hpvalvesindia.com
10	INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI-MAHARASHTRA-INDIA Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
11	INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI-MAHARASHTRA-INDIA Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
12	INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI-DELHI-INDIA Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
13	INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI-MAHARASHTRA-INDIA Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
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15	INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA-UTTAR PRADESH-INDIA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
16	INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI-MAHARASHTRA-INDIA Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
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19	JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Mr. Dineshbhai Zaveri C-1/ 27&37, GIDC, Kabilpore, Navsari-Gujarat-India Phone- 02637-265140,265003 Pincode : 396424 Email : flexpro@flexproltd.com
20	JUNCTION BOX	AJMERIA INDUSTRIAL & ENGINEERING WORKS	JIGNESH MAHENDRA AJMERIA DENA BANK BLDG.,SHREE NAGESH INDL. ESTATE,STATION ROAD, MUMBAI-MAHARASHTRA-INDIA Phone- 022 67973578 Pincode : 400 088 Email : ajmera@ajmera.net, jmajmera@yahoo.com
21	JUNCTION BOX	K.S.INSTRUMENTS PVT.LTD.	S Raghavan No. 72, 3rd Main, 1st Stage Industrial Suburb, Yeshwanthpur Bangalore-Karnataka-India Phone- 9880385770 Pincode : 560022 Email : sales1@ksinstruments.net
22	JUNCTION BOX	SUCHITRA INDUSTRIES	NO-2,OPP-27 AECS LAYOUT 2ND STG REJAMAHALVILAS EXTN 2ND STG BANGALORE -- Phone- Pincode : Email : suchitra.industriesblr@gmail.com
23	JUNCTION BOX	Shrenik & Company,	Mr. Mitesh Shah/Mr. Pulin Shah 39 A/3 ,Panchratna Industrial Estate, Sarkhej-Bavla Road Ahmedabad-Gujarat-India Phone- 9825024921 Pincode : 382213 Email : sales@pustron.com, pulin@sumip.com

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2.)New Sub-Vendor if proposed by Vendor during contract stage shall subject to BHEL/end user approval without commercial/delivery implication.

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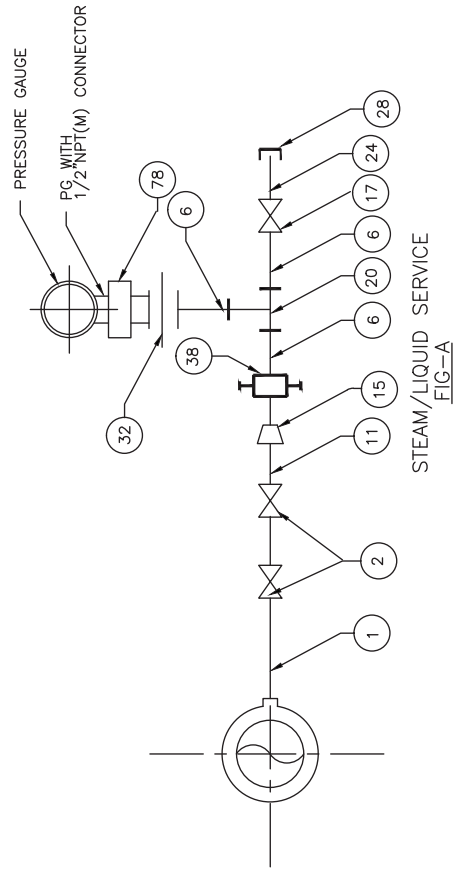
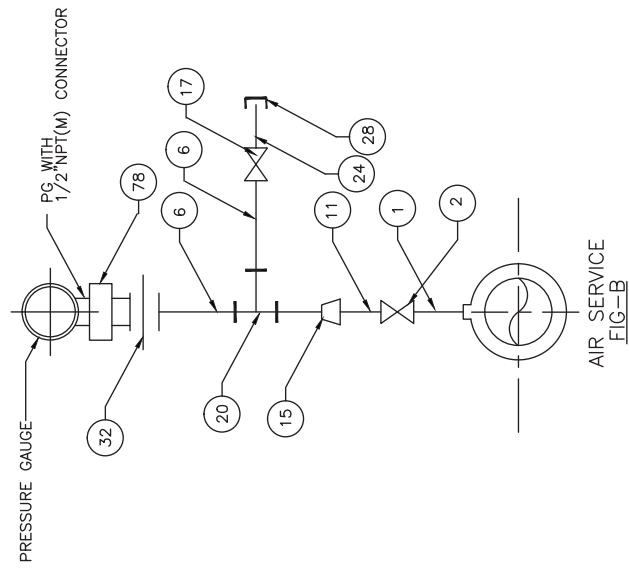
SLNO	Package Name	Vendor Name	Vendor Address
24	LEVEL SWITCH-FLOAT TYPE	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon-Haryana-India Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com
25	LEVEL SWITCH-FLOAT TYPE	D.K. INSTRUMENTS PVT.LTD.	N.SIKDAR/ SUMIT SIKDAR 76/2,SELIMPUR RD DHAKURIA Kolkata-West Bengal-India Phone- 033-2415-1310. Pincode : 700031 Email : dkinst@vsnl.net
26	LEVEL SWITCH-FLOAT TYPE	GENERAL INSTRUMENTS CONSORTIUM	Mr. Amarendra Kulkarni 194/195, Gopi Tank Road, Off. Pandurang Naik Marg, Mahim Mumbai-Maharashtra-India Phone- 9323195251 Pincode : 400016 Email : amarendra@general-gauges.com
27	LEVEL SWITCH-FLOAT TYPE	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA-KANSAS-USA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,
28	LEVEL SWITCH-FLOAT TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI-MAHARASHTRA-INDIA Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in
29	LEVEL SWITCH-FLOAT TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA-WEST BENGAL-INDIA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com
30	LEVEL SWITCH-FLOAT TYPE	Pune Techtrol Pvt. Ltd.	N.P.Khatany/Sudhakar Badiger S-18, MIDC Bhosari, Pune-Maharashtra-INDIA Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com
31	LEVEL SWITCH-FLOAT TYPE	SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE,-MAHARASHTRA-INDIA Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in
32	LEVEL SWITCH-FLOAT TYPE	V. AUTOMAT & INSTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDLAREA, PH-1 NEW DELHI-DELHI-INDIA Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com
33	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-Maharashtra-INDIA Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com
34	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-Maharashtra-INDIA Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com
35	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai,- Maharashtra,-India, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,
36	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA-WEST BENGAL-INDIA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net
37	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE-KARNATAKA- www.hgurusouth.com Phone- 080-23370300, Pincode : 560022 Email : info@hgurusouth.com
38	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-TELANGANA-INDIA Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com
39	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	BOSE PANDA INSTRUMENTS PVT.LTD.	Mr. Partha Bose 44, Saheed Hemanta Kumar Bose, Sarani, Kolkata-West Bengal-India Phone- +91 33 2548 7220 Pincode : 700074 Email : parthabosebpi@gmail.com; bosepanda@vsnl.net
40	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol-Gujarat,-INDIA Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com
41	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA-WEST BENGAL-INDIA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in

1.)The above Sub-Vendor list is tentative & reference only. However Sub-Vendor List is subject to BHEL/End user approval without any commercial /delivery implication.

2.)New Sub-Vendor if proposed by Vendor during contract stage shall subject to BHEL/end user approval without commercial/delivery implication.

	TECHNICAL SPECIFICATION (C&I) FOR SUMP PUMPS	

INSTRUMENT INSTALLATION DRAWING



1) All the wetted parts of the instruments including accessories required for mounting/erection of these local instruments, for Sea water Plant or Sea Water services shall be Super duplex SS and same shall be in bidder's scope.

78	1/2"NPT(F)X1/2"NPT(M)	SNUBBER/PULSATION DAMPER	1	1
59	1/2"SW, STRAIGHT PIPE CONNECTOR, CS/AS		—	—
38	3 WAY 2 VALVE MANIFOLD FOR BTG SS316 3 WAY GAUGE VALVE 1/2" NB SW FOR BOP SS316		1	—
37	6" COILED SYPHON SCH 80/160 1/2"NB CS/SS		—	—
32	1/2"NPS,3PIECE PIPE UNION WITH 1/2"NPT(F) SCREWED		1	1
28	1/2"NPT(F) CS CAP		1	1
24	1/2"NPS SCH—80/160X1/2"NPT(M)CS/AS NIPPLE		1	1
20	1/2"SW EQUAL TEE, CS/AS		1	1
17	1/2" SW CS/AS GLOBE VALVE		1	1
15	1" TO 1/2" SOCKET WELDED REDUCER		1	1
11	1" NPS SCH—80/160 CS/AS NIPPLE		1	1
6	1/2" NPS. SCH—80/160 CS/ AS PIPE		AS REOD.	
2	1/2"/3/4"/1" ROOT VALVE—SW GLOBE VALVE		2	1
1	1/2"/3/4"/1" CARBON/ALLOY STEEL NIPPLE OF MTL. SAME AS THAT OF MAIN PIPE(AS PER PROCESS REOD.)		AS REOD.	
TAG NO.	DESCRIPTION		A	B
			QTY.	

REFERENCE DRAWINGS.										NOTES										NOTICE										REVISIONS										APPROVED																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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	TECHNICAL SPECIFICATION (C&I) FOR SUMP PUMPS	
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**CABLE INTERCONNECTION AND
TERMINATION PHILOSOPHY**

8.04.04.4 INSTRUMENTATION CABLE INTERCONNECTION AND TERMINATION PHILOSOPHY

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

Application	Type of Termination		
FROM (A)	TO (B)	END A	END B
Valves/Dampers Drives (Integral Junction Box)	Marshalling/ Marshalling-cum Termination Cubicle/ Local group JB	Plug connector in	Post mount cage clamp type
Transmitters, Process Actuated switches mounted in LIE/LIR	Integral Junction Box of LIE/LIR	Plug connector in	Cage clamp (Rail mount type)
RTD heads	Local Junction Box	Plug Connector in	Cage clamp (Rail mount type)
Thermocouple	Local Junction Box	Plug Connector in	Cage clamp (Rail mount type)
Other Field mounted Instruments	Local JB/ Group JB	Plug Connector in	Cage clamp (Rail mount type)
RTD heads	Temperature transmitter	Plug Connector in	Screwed Cage Clamp Type
Thermocouple	Temperature Transmitter	Plug Connector in	Screwed Cage Clamp Type
Local Junction box, Temperature Transmitter, Int. Junction box of LIE/LIR/Group JB's.	Group JB	Cage clamp (Rail mount type)	Cage clamp (Rail mount type)
Local Junction box, Temperature Transmitter, Int. Junction box of LIE/LIR/Group JB/ MCC/SWGR	Marshalling/ Marshalling - cum Termination Cubicles.	Cage clamp (Rail mount type)	Cage clamp (Post mounted type)
Marshalling cubicle/Termination System Cabinets	Electronic system Cabinet	Cage clamp (Post mounted type)	Plug-in connector/other system as per Mfr's standard
Marshalling/ Termination System Cabinets	UCD mounted equipments	Cage clamp (Post)	Plug in Connector/ Cage

		mounted type)	clamp Type (rail mounted)
DDCMIS/PLC cabinets	OWS, Printer etc.	Plug connector in	Plug Connector in

Notes

1. For Analog signals, individual pair shielding & overall shielding & for Binary signals, only overall shielding of instrumentation cables (> 2 pair) shall be provided.
2. Signal and Electrical connection shall be screwed connection with double compression type Nickel-plated brass cable glands for Explosion proof area, Flame proof area and high vibration prone area.
3. All screwed connections shall be provided with double compression type Nickel-plated brass cable glands.
4. All spare contacts/terminals on relays, control switches, limit switches or similar devices, process switches, duplex RTDs & Duplex T/Cs shall be wired to accessible terminal blocks/JBs for future connections. All wiring leaving a junction box or enclosure shall leave from terminal blocks and not from other devices in the enclosure. Two (2) pair (individual & overall shielded) cables shall be provided for terminating the thermocouples, transmitters & switches i.e Analog & Binary signals to local JB's. Similarly four (4) pair (individual & overall shielded) cables shall be provided for terminating the Duplex (3 wire) RTD to local JB's.

Four (4) pair (individual & overall shielded) cables shall be provided for terminating the switches to local JB's, where both NC & NO contacts are used in DDCMIS/DCS/PLC.
5. Separate mutipaired cable shall be provided for each drive between MCC/SWGR and DDCMIS/PLC.
6. 10% spare pairs or min 1 pair cable (which ever is more) shall be provided with all type of cables.

SPECIFIC TECHNICAL REQUIREMENTS (C&I) WITH SCOPE OF SUPPLY:

- 1) The control of Sump pumps shall be realised in Relay based Control Panel. Push buttons, alarms on LCP shall be supplied by vendor and shall be finalised during detailed engineering.
- 2) The Contractor shall provide complete Instrumentation for control, monitoring and operation of Sump pumps. The requirements given are to be read in conjunction with detailed Technical specification enclosed in the specification. Further in case of any discrepancy in the requirement within the same or different section, as noted by the bidder in the specification, the same will be brought to the notice of BHEL in the form of pre- bid clarification. In absence of any pre-bid clarification, the more stringent requirement as per interpretation of BHEL/customer shall prevail without any commercial implication.
- 3) The make/model of various instruments/items/systems shall be as per Customer approved vendor list. No commercial and delivery implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
- 4) Bidder to supply the field instrumentation, junction boxes as required.
- 5) The cable used shall be 0.5 mm², G type (2P/4P/8P/12P) for Binary signals and F type cable (2P/4P/8P/12P/24P) for Analog signals. For solenoid 2.5mm², 3-core cable shall be used (as shown in Drive controlled philosophy).
- 6) For cable scope refer to electrical scope between BHEL and vendor defined in electrical specification under Standard Electrical Scope Between BHEL and Vendor.
- 7) Items not specifically mentioned however required for the completeness of the system shall be supplied by vendor without any commercial/ time implication. Vendor shall be responsible for the completeness of the system in all respect.
- 8) Bidder to terminate all instrumentation and control elements in junction boxes.
- 9) Bidder to provide input/output list, drives list and termination details, recommended control logics / write-up etc., the list of documents to be submitted after award of contract is to be referred by bidder.
- 10) Bidder to perform tests of C&I items/instruments/systems as per Quality plans/type test attached in the specification. However, if any test not specified in the quality plan but specified in specification Tests for I&C equipment included

elsewhere in specification will have to perform by Bidder without any cost implication.

- 11) Instrument installation and accessories required for the same shall be in Bidder's scope and shall be submitted after award of contract. However, any instrument installation not covered in the same shall be subject to customer and BHEL approval during detailed engineering. The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold and all the other accessories required for mounting/ erection of these local instruments shall be provided by bidder, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments; sensors, switches etc. for external connection including spare contacts shall be wired out to suitably located junction boxes by bidder.
- 12) 415V AC Power supply shall be provided by BHEL at a single point, further distribution to various instruments/equipment of the system shall be in bidder scope. Bidder to include necessary power distribution board, changeover circuit in his scope. Any power supply other than the above, if required by any instrument/equipment has to be derived by the bidder from the above supply & all necessary hardware for the same shall be in bidder scope. Bidder to submit the power requirement along with the bid.
- 13) Local control panel required for operation shall be in bidder scope.
- 14) All the wetted parts of the instruments including accessories required for mounting/erection of these local instruments shall be of SS-316 material and same shall be in bidder's scope.
- 15) Redundancy of sensors shall be provided by bidder
 - (i) Triple redundancy for all analog and binary inputs required for protection of system/drives.
 - (ii) For all other control functions dual redundancy of the sensors shall be provided by the bidder.

16.) Level switches shall be separate for each setpoint.

17) Following INTERLOCKS (tentative) shall be realised in the LCP

A.) Controls for Submersible Sump Pumps (For Permanent duty type)

Submersible Sump Pumps shall be controlled by a common Relay based Local control panel with IP 55 protection class for each set of two (2) numbers pumps in a pit. The LCP shall also house motor starter of sump pumps.

The following controls/Interlocks shall be provided in the LCP.

- a) Start/ stop facility.
- b) If any of the working sump pump trips due to electric fault etc., the standby sump pump will come into operation automatically.
- c) Selector switch for main/standby selection.
- d) 1 No. (One) 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) 1 No. (One) 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.
- f) 1 No. (One) level switch (low level) provided in the sump shall trip all running sump pump in the event of low water level in the sump.
- g) Sump pump status indication (on/off/trip).

B.) Controls/ Indications for Portable Submersible Pumps

Portable Sump Pumps shall be controlled by trolley mounted Relay based Local Control panel. The LCP shall also house motor starter for the submersible sump pump.

The local control panel shall be as per pump manufacturers standard.

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

- a) Start / stop facility.
- b) Auto Stop Facility based on level very low switch feedback.
- c) Pump On/ off status in LCP.

C.) PROCESS ACTUATED SWITCHES:

Repeatability	$\pm 0.5\%$ of full range
No. of contacts	2 No.+2NC. SPDT snap action dry contact
Rating of contacts	60 V DC, 6 VA (or more if required)
Elect. Connection	Plug in socket.
Set point	Provided over full range.
Dead band adjustment	Adjustment upto 10% at set points.
Enclosure	Weather and dust proof as per IP-55

PEM REGISTERED VENDOR

145-37000-A	LEVEL SWITCH-FLOAT TYPE	B077	BLISS ANAND PVT. LTD.	REGULAR	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon-Haryana-India Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com
145-37000-A	LEVEL SWITCH-FLOAT TYPE	D046	D.K. INSTRUMENTS PVT.LTD.	REGULAR	N.SIKDAR/ SUMIT SIKDAR 76/2,SELIMPUR RD DHAKURIA Kolkata-West Bengal-India Phone- 033-2415-1310. Pincode : 700031 Email : dkinst@vsnl.net
145-37000-A	LEVEL SWITCH-FLOAT TYPE	G060	GENERAL INSTRUMENTS CONSORTIUM	REGULAR	Mr. Amarendra Kulkarni 194/195, Gopi Tank Road, Off. Pandurang Naik Marg, Mahim Mumbai-Maharashtra-India Phone- 9323195251 Pincode : 400016 Email : amarendra@general-gauges.com
145-37000-A	LEVEL SWITCH-FLOAT TYPE	S010	SOR INC.	REGULAR	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA-KANSAS-USA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,
145-37000-A	LEVEL SWITCH-FLOAT TYPE	S008	SIGMA INSTRUMENTS CO.	REGULAR	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI-MAHARASHTRA-INDIA Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in
145-37000-A	LEVEL SWITCH-FLOAT TYPE	L005	LEVCON INSTRUMENTS PVT. LTD.	REGULAR	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA-WEST BENGAL-INDIA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com
145-37000-A	LEVEL SWITCH-FLOAT TYPE	P068	Pune Techtrol Pvt. Ltd.	REGULAR	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune-Maharashtra-INDIA Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com
145-37000-A	LEVEL SWITCH-FLOAT TYPE	S106	SBEM PVT. LTD.	REGULAR	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE,- MAHARASHTRA-INDIA Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in
145-37000-A	LEVEL SWITCH-FLOAT TYPE	V040	V. AUTOMAT & INSTRUMENTS (P) LTD.	REGULAR	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI-DELHI-INDIA Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com
145-37000-A	LEVEL SWITCH-FLOAT TYPE	W017	Baumer Technologies India Pvt. Ltd.	REGULAR	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI-Maharashtra-INDIA Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com

PEM REGISTERED VENDOR

Package Code	Package Name	Vendor Name	Vendor Address
145-24000-A	LOCAL CONTROL PANELS	PYROTECH ELECTRONICS PVT. LTD.	E-329, ROAD NO.12, MIA, UDAIPUR-RAJSTHAN-INDIA Phone- 2492122,31,34 Pincode : 313003 Email : pyrotech@pyrotechindia.com
145-24000-A	LOCAL CONTROL PANELS	PROCON INSTRUMENTATION PVT. LTD.	1H, SHAKTI TOWERS, 766, ANNA SALAI, CHENNAI-TAMIL NADU-INDIA Phone- 28266041,2824142 Pincode : 600022 Email : procond1@nda.vsnl.net.in
145-24000-A	LOCAL CONTROL PANELS	INDUSTRIAL CONTROLS & APPLIANCES PVT LTD	47, CHAKALA ROAD, ANDHERI(EAST), MUMBAI-MAHARASHTRA-INDIA Phone- 28344494,28221532 Pincode : 400099 Email : indconapp@vsnl.com
145-24000-A	LOCAL CONTROL PANELS	C and S ELECTRIC LTD.	222, OKHLA INDUSTRIAL ESTATE, PHASE-II, NEW DELHI-DELHI-INDIA Phone- 9871799447 Pincode : 110020 Email : panel.marketing@cselectric.co.in

Notes:-

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



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

SPECIFIC TECHNICAL REQUIREMENTS

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

SECTION: **I**

SUB-SECTION: **ID**

REV. NO. **0** DATE **24.04.17**

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

SUB-SECTION – ID

DATASHEET-A

		TECHNICAL SPECIFICATION FOR RATE CONTRACT OF SUMP PUMPS DATA SHEET - A									Specification No: PE-TS-RC-172-N001
											Section-ID
											Date-24.04.2017
CL. NO.	DESCRIPTION	UNIT	TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5	TYPE 6	TYPE 7	TYPE 8	TYPE 9
			Fixed Duty type Sump Pumps (Sea Water Application)	Motor Driven Pumps	Diesel Engine Driven Pumps	Portable Submersible Sump Pump	Portable Submersible Sump Pump (Sea Water Application)	Portable Submersible Sump Pump	Portable Submersible Sump Pump (Sea Water Application)	Portable Submersible Sump Pump (Sea Water Application)	Fixed Duty type Submersible Sump Pumps (Sea Water Application)
1.0.0	GENERAL										
2.3.0	Total no.of pumps required	Nos.	4	6	2	4	2	12	4	4	4
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	-	-	-	-	-	-	-	-
1.2.0	Equipment name		Sump Pump	Sump Pump	Sump Pump	Sump Pump	Sump Pump	Sump Pump	Sump Pump	Sump Pump	Sump Pump
1.3.0	Pump type		Fixed Duty type Vertical pump	Portable Horizontal Centrifugal Sump Pumps	Portable Horizontal Centrifugal Sump Pumps	Portable Submersible sump pumps	Portable Submersible sump pumps	Portable Submersible sump pumps	Portable Submersible sump pumps	Portable Submersible sump pumps	Fixed Duty type Submersible pump
1.4.0	Duty		Intermittent	Intermittent	Intermittent	Intermittent	Intermittent	Intermittent	Intermittent	Intermittent	Intermittent
1.5.0	Location		Outdoor	Indoor/ Outdoor	Indoor/ Outdoor	Indoor/ Outdoor	Indoor/ Outdoor	Indoor/ Outdoor	Indoor/ Outdoor	Indoor/ Outdoor	Indoor/ Outdoor
1.6.0	Maximum Ambient Temperature	°C	50	50	50	50	50	50	50	50	50
1.7.0	Drive		Motor Driven	Motor Driven	Diesel Engine Driven	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 25 % above the maximum load demand in the operating range. 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	20	20	20	20	50	20	100	20
2.2.0	Total head at rated capacity	MWC	30	15	15	10	10	20	15	20	15
2.6.0	Pump RPM		1500 (Max.)	1500 (Max.)	1500 (Max.)	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	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 5600	IS 5120/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	IS 5120/IS 14220/IS 8034/IS 5600
2.9.0	Max. particle size to be handled	MM	15	20	20	20	20	20	20	20	20
2.10.0	Minimum Suction Lift	M	-	6	6	-	-	-	-	-	-
3.0.0	LIQUID DATA										
3.1.0	Liquid handled		Sea water with suspended particles	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.	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.	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.
3.2.0	Specific gravity		1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
3.3.0	Temperature (max.)	°C	50	50	50	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	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	ANSI B 16.5	ANSI B 16.5	ANSI B 16.5
4.3.0	Pump/Motor Support Elevation	M	EL 0.0M	-	-	-	-	-	-	-	-
4.4.0	Sump/Pit Invert Level	M	EL (-)4.0M / EL (-)5.0M	-	-	-	-	-	-	-	-
4.5.0	Dimension of Sump Pit required in the pit to be dewatered (LXBXH)	MxMxM	2.0Mx2.0Mx1.0M	-	-	-	-	-	-	-	-
5.0.0	MATERIAL OF CONSTRUCTION										
5.1.0	Casing / Suction bell		Duplex SS (UNS 32205/31803)	2% NiCl to IS 210 Gr. FG 260	2% NiCl to IS 210 Gr. FG 260	2% NiCl to IS 210 Gr. FG 260	Duplex SS (UNS 32205/31803)	2% NiCl to IS 210 Gr. FG 260	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)
5.2.0	Impeller		Duplex SS (UNS 32205/31803)	ASTM A 351 CF8M	ASTM A 351 CF8M	ASTM A 351 CF8M	Duplex SS (UNS 32205/31803)	ASTM A 351 CF8M	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)
5.3.0	Impeller shaft		Duplex SS (UNS 32205/31803)	SS-410	SS-410	SS-410	Duplex SS (UNS 32205/31803)	SS-410	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)
5.4.0	Wear ring (where applicable)		Duplex SS (UNS 32205/31803)	Austenitic cast iron	Austenitic cast iron	Austenitic cast iron	Duplex SS (UNS 32205/31803)	Austenitic cast iron	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)
5.5.0	Shaft sleeve (where applicable)		Duplex SS (UNS 32205/31803)	SS-410	SS-410	SS-410	Duplex SS (UNS 32205/31803)	SS-410	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)
5.6.0	Coulmn Pipe (where applicable)		Duplex SS (UNS 32205/31803)	Not Applicable	Not Applicable	-	Duplex SS (UNS 32205/31803)	-	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)
5.7.0	Pump and motor coupling		Duplex SS (UNS 32205/31803)	-	-	SS 316	Duplex SS (UNS 32205/31803)	SS 316	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)
5.8.0	Fasteners		Duplex SS (UNS 32205/31803) for wetted fastnrs and SS 316L for other fastners	SS 316	SS 316	SS 316	Duplex SS (UNS 32205/31803)	SS 316	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)
5.9.0	Gland (Where applicable)		Duplex SS (UNS 32205/31803)	C.I, IS-210, FG-260/ Equivalent	C.I, IS-210, FG-260/ Equivalent	C.I, IS-210, FG-260/ Equivalent	Duplex SS (UNS 32205/31803)	C.I, IS-210, FG-260/ Equivalent	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)
	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)	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	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	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	N/A	N/A	N/A
5.13.0	Strainer (Body / Mesh)		Body:Duplex SS, Mesh: 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)	Body (2.5% NiCl to IS 210 Gr. FG 260)/ Mesh (SS 316)	Duplex SS (UNS 32205/31803)	Body (2.5% NiCl to IS 210 Gr. FG 260)/ Mesh (SS 316)	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)
5.14.0	Line Shaft Bearing (Where Applicable)		Duplex SS (UNS 32205/31803)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
5.15.0	Line Shaft Coupling (Where Applicable)		Duplex SS (UNS 32205/31803)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
5.16.0	Base Plate		SS 316L	CS as per IS 2062 (Epoxy Coated)	CS as per IS 2062 (Epoxy Coated)	-	-	-	-	-	-
Note : Bidder's may offer alternative materials, if they are superior to that specified above for the indicated service of the pump.											
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	Yes	Yes	Yes
7.2.0	Elastomer cables for connecting pump with its panel length (M)		Not Applicable	25M	Not Applicable	25M	25M	25M	25M	25M	25M
7.3.0	Relay based control panel with integral starter		Not Applicable	Starter panel for each sump pump with IP 65 protection	Not Applicable	Starter panel for each sump pump with IP 65 protection	Starter panel for each sump pump with IP 65 protection	Starter panel for each sump pump with IP 65 protection	Starter panel for each sump pump with IP 65 protection	Starter panel for each sump pump with IP 65 protection	Starter panel common for each set of two (2) Nos. sump pump with IP 65 protection
7.4.0	Suction and Discharge pressure gauge with root valve / pump		Not Applicable	-	-	-	-	-	-	-	-
7.5.0	Discharge hose										
	- Hose length per pump		Not Applicable	As per Section IA	As per Section IA	As per Section IA	As per Section IA	As per Section IA	As per Section IA	As per Section IA	As per Section IA
	- Hose dia		Not Applicable	Min. 65 NB or to suit pump discharge	Min. 65 NB or to suit pump discharge	Min. 65 NB or to suit pump discharge	Min. 65 NB or to suit pump discharge	Min. 100 NB or to suit pump discharge	Min. 65 NB or to suit pump discharge	Min. 65 NB or to suit pump discharge	Min. 65 NB or to suit pump discharge
	- No. of Hose pipe per pump			As per Section IA	As per Section IA	As per Section IA	As per Section IA	As per Section IA	As per Section IA	As per Section IA	As per Section IA
7.6.0	Orifice Plate and its arrangement at Pump Discharge (Refer Note A)		1 no. (suitable for 5MWC pressure drop)	1 no. (suitable for 5MWC pressure drop)	1 no. (suitable for 5MWC pressure drop)	1 no. (suitable for 5MWC pressure drop)	1 no. (suitable for 5MWC pressure drop)	1 no. (suitable for 5MWC pressure drop)	1 no. (suitable for 5MWC pressure drop)	1 no. (suitable for 5MWC pressure drop)	1 no. (suitable for 5MWC pressure drop)
7.7.0	Cables (*) for connecting the starter panel with the power supply source - Length (M) / pump (*)including plug matching with purchaser's 63 Amp welding socket		Not Applicable	50 m	Not Applicable	50 m	50 m	50 m	50 m	50 m	50 m
7.8.0	Chains (for pump lifting purpose)		Not Applicable	No	No	Yes(15M)	Yes(15M)	Yes(15M)	Yes(15M)	Yes(15M)	Yes(15M)
7.9.0	Suction Strainers		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7.10.0	Pump Stool		Yes, If required	Yes, If required	Yes, If required	Yes	Yes	Yes	Yes	Yes	Yes
7.11.0	Wheel trolley required per pump		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No

		TECHNICAL SPECIFICATION FOR RATE CONTRACT OF SUMP PUMPS DATA SHEET - A									Specification No: PE-TS-RC-172-N001
											Section-ID
											Date-24.04.2017
CL. NO.	DESCRIPTION	UNIT	TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5	TYPE 6	TYPE 7	TYPE 8	TYPE 9
			Fixed Duty type Sump Pumps (Sea Water Application)	Motor Driven Pumps	Diesel Engine Driven Pumps	Portable Submersible Sump Pump	Portable Submersible Sump Pump (Sea Water Application)	Portable Submersible Sump Pump	Portable Submersible Sump Pump (Sea Water Application)	Portable Submersible Sump Pump (Sea Water Application)	Fixed Duty type Submersible Sump Pumps (Sea Water Application)
7.12.0	Level switches for		Not Applicable	Not Applicable	Not Applicable	Float type level probe integral with pump	Float type level probe integral with pump (suitable for Sea Water Application)	Float type level probe integral with pump	Float type level probe integral with pump (suitable for Sea Water Application)	Float type level probe integral with pump (suitable for Sea Water Application)	Top mounted displacer type (suitable for Sea Water Application)
	- High level		-	-	-	-	-	-	-	-	Yes
	- Low level		-	-	-	-	-	-	-	-	Yes
	-Very high level		-	-	-						Yes
7.13.0	Flow regulating globe valve fitted at hose		Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
8.0.0	Special Requirements		Not Applicable								
	Male/female hose coupling with accessories for connecting two hose pipes		-	YES	YES	YES	YES	YES	YES	YES	YES
Note A: Orifice plate shall be installed in the discharge hose pipe. Suitable flanges/counterflanges with nut, bolts and gasket is to be provided by bidder.											
9.0.0	MANDATORY SPARES:										
9.1.0	415 V Motor										
9.1.1	Terminal plates	Nos.	10 Nos. each for small motors up to 30 KW & 4 Nos. each for more than 30 KW	10 Nos. each for small motors up to 30 KW & 4 Nos. each for more than 30 KW	NA	NA	NA	NA	NA	NA	NA
9.1.2	Motor of each type and rating	Nos.	1 No.	1 No.	NA	NA	NA	NA	NA	NA	NA
9.1.3	Bearings (DE and NDE) for each type and rating of motor	Set	4 Sets	4 Sets	NA	4 Sets	4 Sets	4 Sets	4 Sets	4 Sets	4 Sets
9.2.0	C&I Spares										
9.2.1	Each type of PBs used in the equipment/system.	Nos.	NA	20% of installed of each type	NA	20% of installed of each type	20% of installed of each type	20% of installed of each type	20% of installed of each type	20% of installed of each type	20% of installed of each type
9.2.2	Electrical Metering (voltmeter,ammeter on local control panel)	Nos.	NA	10 % of total no. of instruments for each type and Model or a minimum of one number for each model and type, whichever is more	NA	10 % of total no. of instruments for each type and Model or a minimum of one number for each model and type, whichever is more	10 % of total no. of instruments for each type and Model or a minimum of one number for each model and type, whichever is more	10 % of total no. of instruments for each type and Model or a minimum of one number for each model and type, whichever is more	10 % of total no. of instruments for each type and Model or a minimum of one number for each model and type, whichever is more	10 % of total no. of instruments for each type and Model or a minimum of one number for each model and type, whichever is more	10 % of total no. of instruments for each type and Model or a minimum of one number for each model and type, whichever is more
9.2.3	Level Switches	Nos.	NA	10% of total number of Instruments/transducers offered for each model and type for the project	NA	10% of total number of Instruments/transducers offered for each model and type for the project	10% of total number of Instruments/transducers offered for each model and type for the project	10% of total number of Instruments/transducers offered for each model and type for the project	10% of total number of Instruments/transducers offered for each model and type for the project	10% of total number of Instruments/transducers offered for each model and type for the project	10% of total number of Instruments/transducers offered for each model and type for the project
9.2.4	Pressure gauge	Nos.	NA	10% of total number of Instruments/transducers offered for each model and type for the project	NA	10% of total number of Instruments/transducers offered for each model and type for the project	10% of total number of Instruments/transducers offered for each model and type for the project	10% of total number of Instruments/transducers offered for each model and type for the project	10% of total number of Instruments/transducers offered for each model and type for the project	10% of total number of Instruments/transducers offered for each model and type for the project	10% of total number of Instruments/transducers offered for each model and type for the project
9.2.5	Hooters, Buzzers	Nos.	NA	Ten (10) percent or 2 no. (Whichever is more)	NA	Ten (10) percent or 2 no. (Whichever is more)	Ten (10) percent or 2 no. (Whichever is more)	Ten (10) percent or 2 no. (Whichever is more)	Ten (10) percent or 2 no. (Whichever is more)	Ten (10) percent or 2 no. (Whichever is more)	Ten (10) percent or 2 no. (Whichever is more)
	Relay based Control Panels				NA						
9.2.6	LEDs for indicating lights	Nos.	NA	100% of qty installed.	NA	100% of qty installed.	100% of qty installed.	100% of qty installed.	100% of qty installed.	100% of qty installed.	100% of qty installed.
9.2.7	Control circuit fuses	Nos.	NA	300% of installed of each type, current rating.	NA	300% of installed of each type, current rating.	300% of installed of each type, current rating.	300% of installed of each type, current rating.	300% of installed of each type, current rating.	300% of installed of each type, current rating.	300% of installed of each type, current rating.
9.2.8	MCB/MCCB	Nos.	NA	300% of installed of each type, current rating.	NA	300% of installed of each type, current rating.	300% of installed of each type, current rating.	300% of installed of each type, current rating.	300% of installed of each type, current rating.	300% of installed of each type, current rating.	300% of installed of each type, current rating.
9.2.9	Relays modules & contactors.	Nos.	NA	20% spare of qty Installed of each type &	NA	20% spare of qty Installed of each type &	20% spare of qty Installed of each type &	20% spare of qty Installed of each type &	20% spare of qty Installed of each type &	20% spare of qty Installed of each type &	20% spare of qty Installed of each type &
	Mandatory Spare Note: 1. Spares not applicable for the Package to be specifically quoted as "NOT APPLICABLE". 2. In case if such items of spares indicated as "not applicable" by bidder in its offer, are found applicable at a later date during execution of the project, such items of spares are to be supplied within the ordered cost of the mandatory spares. 3. In respect of quantity mentioned as 'Set' means the total quantity of all the components/items used in particular equipment unless otherwise specified.										

			Specification No: PE-TS-RC-172-N001			
TECHNICAL SPECIFICATION FOR RATE CONTRACT OF SUMP PUMPS			Section-ID			
DATA SHEET - A			Date-24.04.17			
CL. NO.	DESCRIPTION	UNIT	TYPE 10	TYPE 11	TYPE 12	TYPE 13
			Fixed Duty type Submersible Sump Pumps	Portable Submersible Sump Pumps	Portable Submersible Sump Pumps	Portable Submersible Sump Pumps
1.0.0	GENERAL					
2.3.0	Total no.of pumps installed/required	Nos.	2	2	3	3
2.4.0	No. of pumps working pumps	Nos.	1	-	-	-
2.5.0	Parallel operation required		Yes	NA	NA	NA
1.1.0	Service /Location of Sump pumps		CW Pit in TG Hall	CW pump house Sump	Various Cable trenches	Various general purpose pits
1.2.0	Equipment name		Submersible Sump Pump	Submersible Sump Pump	Submersible Sump Pump	Submersible Sump Pump
1.3.0	Pump type		Fixed Duty type Submersible pump	Potable type submersible pump	Potable type submersible pump	Potable type submersible pump
1.4.0	Duty		Intermittent	Intermittent	Intermittent	Intermittent
1.5.0	Location		Indoor/ Outdoor	Indoor/ Outdoor	Indoor/ Outdoor	Indoor/ Outdoor
1.6.0	Maximum Ambient Temperature	°C	50	50	50	50
1.7.0	Motor Rating		Motor rating shall be so selected as to have at least 25% margin over the maximum power required by the pump, throughout its entire range of operation.			
2.0.0	PUMP PARAMETERS					
2.1.0	Design capacity	M3/hr	40	100	10	40
2.2.0	Total head at rated capacity	MWC	12	15	10	10
2.6.0	Pump RPM		1500 (Max.)	1500 (Max.)	1500 (Max.)	1500 (Max.)
2.9.0	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
2.10.0	Pump design standard		IS 5120/IS 8034/IS 5600	IS 5120/IS 8034/IS 5600	IS 5120/IS 8034/IS 5600	IS 5120/IS 8034/IS 5600
2.11.0	Max. particle size to be handled	MM	30	30	30	30
3.0.0	LIQUID DATA					
3.1.0	Liquid handled		water with suspended particles & traces of oil	water with suspended particles	water with suspended particles	water with suspended particles
3.2.0	Specific gravity		1.1	1.1	1.1	1.1
3.3.0	Temperature (max.)	°C	50	50	50	50
4.0.0	DESIGN AND CONSTRUCTION					
	FEATURES					
4.1.0	Impeller type		Open, Non-clog type	Open, Non-clog type	Open, Non-clog type	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
5.0.0	MATERIAL OF CONSTRUCTION					
5.1.0	Casing / Suction bell		CI to IS 210 Gr. FG 260	CI to IS 210 Gr. FG 260	CI to IS 210 Gr. FG 260	CI to IS 210 Gr. FG 260
5.2.0	Impeller		SS 316	SS 316	SS 316	SS 316
5.3.0	Impeller shaft		SS 410	SS 410	SS 410	SS 410
5.4.0	Wear ring (where applicable)		Austenitic cast iron	Austenitic cast iron	Austenitic cast iron	Austenitic cast iron
5.5.0	Shaft sleeve (where applicable)		SS 316/SS 410	SS 316/SS 410	SS 316/SS 410	SS 316/SS 410
5.6.0	Coulmn Pipe (where applicable)		-	-	-	-
5.7.0	Pump and motor coupling		-	-	-	-
5.8.0	Fasteners		SS for fastners submerged in water and alloy steel for others.			
5.9.0	Gland (Where applicable)		2% Ni C.I, IS-210, FG-260/ Equivalent	2% Ni C.I, IS-210, FG-260/ Equivalent	2% Ni C.I, IS-210, FG-260/ Equivalent	2% Ni C.I, IS-210, FG-260/ Equivalent
	Gland Packing (Where applicable)		Braided Graphite- free Teflon/PTFE	Braided Graphite- free Teflon/PTFE	Braided Graphite- free Teflon/PTFE	Braided Graphite- free Teflon/PTFE
5.10.0	Mechanical seal		As Applicable	As Applicable	As Applicable	As Applicable
5.11.0	Pump Lubrication		SELF/Oil/Grease	SELF/Oil/Grease	SELF/Oil/Grease	SELF/Oil/Grease
5.12.0	Pump line shaft lubrication		NA	NA	NA	NA
5.13.0	Strainer (Body / Mesh)		Body: CI to IS-210, FG-260/IS 2062, Mesh: SS 316	Body: CI to IS-210, FG-260/IS 2062, Mesh: SS 316	Body: CI to IS-210, FG-260/IS 2062, Mesh: SS 316	Body: CI to IS-210, FG-260/IS 2062, Mesh: SS 316
Note :	Bidder's may offer alternative materials, if they are superior to that specified above for the indicated service of the pump.					
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
7.2.0	Elastomer cables for connecting pump with its panel length (M)		25M	25M	25M	25M

						Specification No: PE-TS-RC-172-N001
TECHNICAL SPECIFICATION FOR RATE CONTRACT OF SUMP PUMPS						Section-ID
DATA SHEET - A						Date-24.04.17
CL. NO.	DESCRIPTION	UNIT	TYPE 10	TYPE 11	TYPE 12	TYPE 13
			Fixed Duty type Submersible Sump Pumps	Portable Submersible Sump Pumps	Portable Submersible Sump Pumps	Portable Submersible Sump Pumps
7.3.0	Relay based control panel with integral starter		Starter panel common for each set of two (2) Nos. sump pump with IP 55 protection, Stand mounted	Yes Trolley mounted, with IP 55 protection	Yes Trolley mounted, with IP 55 protection	Yes Trolley mounted for each sump pump with IP 55 protection
7.4.0	Suction and Discharge pressure gauge with root valve / pump		NA	NA	NA	NA
7.5.0	Discharge hose					
	- Hose length per pump		30 M (wire braided flexible hose)	30 M (Heavy duty rubberised canvas)	30 M (Heavy duty rubberised canvas)	30 M (Heavy duty rubberised canvas)
	- Hose dia		80 MM	100 MM	50 MM	80 MM
7.6.0	Cables (*) for connecting the starter panel with the power supply source - Length (M) / pump (*)including plug matching with purchaser's 63 Amp welding socket		NA	25 M	25 M	25 M
7.7.0	Chains (for pump lifting purpose)		Yes(15M)	Yes, (15M)	Yes, (15M)	Yes, (15M)
7.8.0	Suction Strainers		Yes	Yes	Yes	Yes
7.9.0	Pump Stool		Yes	Yes	Yes	Yes
7.10.0	Wheel trolley required per pump		No	Yes	Yes	Yes
7.11.0	Level switches for		Top mounted displacer type subject to customer's approval			
	Very High level		Yes, One level switch installed in a pit	NA	NA	NA
	- High level		Yes, One level switch installed in a pit	NA	NA	NA
	- Low level		Yes, One level switch installed in a pit	Float type level probe integral with pump	Float type level probe integral with pump	Float type level probe integral with pump
8.0.0	Flow regulating globe valve fitted at hose pipe		NA	NA	NA	NA
8.1	Pump/Motor Support Elevation		NA	NA	NA	NA
8.2	Pump Invert Level (refer note 1)		NA	NA	NA	NA
9.0.0	Special Requirements		NA	NA	NA	NA
10.0.0	Pit Size		1MX0.8MX0.6M	1MX1MX1M	-	-
11	MANDATORY SPARES:		NA	NA	NA	NA



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

STANDARD TECHNICAL REQUIREMENTS

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

SECTION: **II**

SUB-SECTION: **IIA**

REV. NO. **0** DATE **24.04.17**

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

	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

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

	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

- 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.

	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

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

	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

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

	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

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.

	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

- 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
	STANDARD TECHNICAL REQUIREMENT	SHEET OF

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
	STANDARD TECHNICAL REQUIREMENT		SHEET OF

- 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.

		MANUFACTURERS NAME & ADD													
 BHARAT HEAVY ELECTRICALS LIMITED		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		
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	UT	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 ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION			BHEL DOC No.:PE : V8 - XXX - 100-N005								
		BHEL		** M: MANUFACTURER/SUB CONTRACTOR			NAME AND SIGN OF APPROVING AUTHORITY AND SEAL								
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 :	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

DATASHEET – C

Drawings / documents distribution schedule to be followed by successful bidder:

1.0 Within 2 weeks from the date of LOI, the successful bidder shall submit following drawings / documents.

1.1 Fully dimensioned outline general arrangement drawings of the pump and motor assembly. This drawing should include foundation base plate and sole plate details as applicable, civil foundation and anchor bolt details and loading data, points of connection of external piping and cables and mounting of devices furnished by the supplier.

1.2 Cross sectional drawing of the equipment showing the details of assembly of components and their material of construction with standard applicable codes.

1.3 Characteristic curves of pump showing the following:

- a) Flow Vs Head
- b) Flow Vs Power
- c) Flow Vs Efficiency
- d) Flow Vs NPSHR

1.4 Operation and maintenance manual

2.0 Within the stipulated time period as per vendor's drawings / documents schedule, the following shall be submitted but not later than one month before 1st dispatch.

- a) Drawings of components & details as deemed necessary.
- b) Instruction manual for erection, operation & maintenance.
- c) Storage instruction.

3.0 Before dispatch of the equipment the bidder shall furnish the following.

- a) Material test certificates.
- b) Shop test reports & certificates.

4.0 Distribution of drawings /documents for all projects:

The successful bidder, after the award of the contract shall furnish the drawings / documents as per the following distribution schedule

Sl. No.	Type of Document	No. of Hard Copies	No. of Soft Copies
1	Documents submitted for Approval	18 Nos.	2 Nos.
2	Final Distribution(Approved Documents)	18 Nos.	2 Nos.
3	O&M Manuals	18 Nos.	2 Nos.
4	As built drawings	18 Nos.	2 Nos.



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

STANDARD TECHNICAL REQUIREMENTS

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

SECTION: **II**

SUB-SECTION: **IIB**

REV. NO. **0** DATE **24.04.17**

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 machines
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
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005
		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.		

	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 : 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 bare 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
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005
		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 sh all be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters sh all 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 m aterials, com ponents and equipm ents c overed 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 m ore than 5 year shall be furnished. In the absence of these, ty pe tests shall have to be conducte d 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 equipm ent. In case motor is coupled with m echanical equipment by fluid coupling, the above cu rves shall be furnished with and without coupling.

iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.

MOTOR

TESTS/CHECKS	Visual	Dimensional	Make/Type/Rating /General Physical Inspection	Mech/Chem. Properties	NDT /DP/MP/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment
TEMS/COMPONENTS									
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y	Y				Y
Shaft	Y	Y	Y	Y	Y	Y			Y
Magnetic Material	Y	Y	Y	Y			Y		
Rotor Copper/Aluminium	Y	Y	Y	Y			Y		Y
Stator copper	Y	Y	Y	Y			Y		Y
SC Ring	Y	Y	Y	Y	Y		Y	Y	Y
Insulating Material	Y		Y	Y			Y		
Tubes, for Cooler	Y	Y	Y	Y	Y				Y
Sleeve Bearing	Y	Y	Y	Y	Y				Y
Stator/Rotor, Exciter Coils	Y	Y	Y				Y	Y	
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y	
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y			Y	Y
Wound stator	Y	Y					Y	Y	
Wound Exciter	Y	Y					Y	Y	
Rotor complete	Y	Y					Y		
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y		
Accessories, RTD, BTD, CT, Space heater, antifriction bearing, gaskets etc.	Y	Y	Y						
Complete Motor	Y	Y	Y						

Note: 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW.

2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard

3. Makes of major bought out items for HT motors will be subject to NSPCL approval.

Y1 = for HT Motor / Machines only.

MOTOR

ITEMS/COMPONENTS	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-325/IS-4722 /IS- 9283/IS 2148/IEC60034/IEC 60079-I	Vibration	Over speed	Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion
Plates for stator frame, end shield, spider etc.										
Shaft	Y		Y							
Magnetic Material										
Rotor Copper/Aluminium			Y							
Stator copper										
SC Ring			Y							
Insulating Material		Y								
Tubes for Cooler		Y								
Sleeve Bearing										
Stator/Rotor, Exciter Coils										
Castings, stator frame, terminal box and bearing housing etc.										
Fabrication & machining of stator, rotor, terminal box										
Wound stator										
Wound Exciter				Y	Y					
Rotor complete										
Exciter, Stator, Rotor, Terminal Box assembly										
Accessories, RTD, BTD, CT, , Space heater, antifriction bearing, gaskets etc.						Y	Y	Y	Y1	Y
Complete Motor										

Note: 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW.

2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard

3. Makes of major bought out items for HT motors will be subject to NSPCL approval. Y1 = for HT Motor / Machines only.

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

COMPREHENSIVE & UPDATED LIST OF MAIN VENDORS FOR BoIs PROCURED BY ELECTRICAL, C&I, MPL & MSE TO BE USED AS APPROVED SUB-VENDORS FOR BoP/ BoI PACKAGES						
S. No.	Deptt.	Package	PMD Vendor/ Sub Vendor	Vendor Address	Remarks	SUMP PUMP
1	Electrical	LV MOTORS (NON FLAME PROOF)	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	Sub vendor	YES
2	Electrical	LV MOTORS (NON FLAME PROOF)	BHARAT BIJLEE LTD.	BHARAT BIJLEE LIMITED, 1ST FLOOR, 7-B, RAJINDRA PARK, PUSA ROAD, NEW DELHI - 110 060.	Sub vendor	YES
3	Electrical	LV MOTORS (NON FLAME PROOF)	CROMPTON GREAVES	3RD FLOOR, EXPRESS BUILDING,9-10, BAHADUR SHAH ZAFAR MARG, NEAR ITO CROSSING,NEW DELHI-110002, INDIA	Sub vendor	YES
4	Electrical	LV MOTORS (NON FLAME PROOF)	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	Sub vendor	YES
5	Electrical	LV MOTORS (NON FLAME PROOF)	KIRLOSKAR ELECTRIC CO LTD.	P.O. BOX 5555 , MALLESWARAM WEST ,BANGALORE 560055	Sub vendor	YES
6	Electrical	LV MOTORS (NON FLAME PROOF)	LAXMI HYDRAULICS PVT. LTD	129/130, INDUSTRIAL ESTATE PATIL NAGAR, HOTGI ROAD SOLAPUR-413003, MAHARASHTRA	Sub vendor	YES
7	Electrical	LV MOTORS (NON FLAME PROOF)	MARATHON	MARATHON ELECTRIC INDIA PRIVATE LTD.SECTOR - 11, MODEL TOWN, FARIDABAD - 121006	Sub vendor	YES
8	Electrical	LV MOTORS (NON FLAME PROOF)	NGEF	POCKET NO.10, FLAT NO. 37 & 38, EXPANDABLE DDA FLATS, NASIRPUR DWARKA, PHASE-I NEW DELHI-110 045	Sub vendor	YES
9	Electrical	LV MOTORS (NON FLAME PROOF)	RAJINDRA ELECT INDUSTRIES	14 SHAH IND.ESTATE VEERA DESAI RD,ANDHERI(W) MUMBAI-400053	Sub vendor	YES
10	Electrical	LV MOTORS (NON FLAME PROOF)	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	Sub vendor	YES
11	Electrical	LV MOTORS (FLAME PROOF)	RAJINDRA ELECT INDUSTRIES	14 SHAH IND.ESTATE VEERA DESAI RD,ANDHERI(W) MUMBAI-400053	Sub vendor	YES
12	Electrical	LT XLPE POWER CABLE	APAR INDUSTRIES LTD.	Mr. Vijay Kumar Bajaj 12/13,Jyoti Wire House,23-A,Shah Ind Est Off. Veera Desai Road, Andheri (West). Mumbai-Maharashtra-India, Phone- 022-26740001 Pincode : 400053 Email : info.cable@apar.com	PMD	YES
13	Electrical	LT XLPE POWER CABLE	CORDS CABLE INDUSTRIES LTD.	MR. NAVEEN SAWHNEY B-1/A-26, MOHAN CO-OPERATIVE INDUSTRIAL ESTATE, MATHURA ROAD, NEW DELHI-DELHI-INDIA Phone-9818356799 Pincode : 110044 Email : sq@cordscable.com	PMD	YES

14	Electrical	LT XLPE POWER CABLE	CRYSTAL CABLE INDUSTRIES LTD.	Shri Vinod Kumar Gupta 32, GANESH CHANDRA AVENUE, KOLKATA-WEST BENGAL-INDIA Phone- 9339767435 Pincode : 700013 Email : cghosh@crystalcable.in	PMD	YES
15	Electrical	LT XLPE POWER CABLE	GEMSCAB INDUSTRIES LTD.	Sh. A. N. Pathak, (GM/Business Develop.) 40, Rajasthani Udyog Nagar, G.T. Karnal Road, NEW DELHI-Delhi-India Phone- 09212560974 Pincode : 110033, Email : sureshchandra@gemscab.com	PMD	YES
16	Electrical	LT XLPE POWER CABLE	Govind Cable Industries,	73/1, Cotton Street, Kolkata,-WB,-India, Phone- 9331055614, Pincode : 700007, Email : govindcable_kol@vsnl.net,	PMD	YES
17	Electrical	LT XLPE POWER CABLE	GUPTA POWER INFRASTRUCTURE LIMITED,	Mr. Gorav Atri,502, 5th Floor, K M Trade Tower,Radisson Blu Complex, Sector-14, Kaushambi Ghaziabad-Uttar Pradesh-India, Phone- 8130388991 Pincode : 201010 Email : gorav@guptapower.com,	PMD	YES
18	Electrical	LT XLPE POWER CABLE	HAVELLS INDIA LTD.	QIMAT RAI GUPTA QRG Towers, Plot 2D, Sector 126, Expressway NOIDA-U.P.-INDIA Phone- 95605 88484 Pincode : 201304 Email : marketing@havells.com	PMD	YES
19	Electrical	LT XLPE POWER CABLE	KEI INDUSTRIES LTD.	Mr. ANIL GUPTA D-90, OKHLA INDUSTRIAL AREA, PHASE-I, NEW DELHI-DELHI-INDIA Phone- 011-26818840 Pincode : 110020 Email : lalit.saxena@kei-ind.com	PMD	YES
20	Electrical	LT XLPE POWER CABLE	KEC INTERNATIONAL LIMITED	Mr. Radheshyam Singh CEAT MAHAL, 1ST FLOOR, 463, DR. ANNIE BESANT ROAD,WORLI, MUMBAI-MAHARASHTRA-INDIA Phone- 9930980158 Pincode : 400 030 Email : singhrb@kecrpg.com;yudhister@kecrpg.com	PMD	YES
21	Electrical	LT XLPE POWER CABLE	MANSFIELD CABLES COMPANY LTD.	Mr. J.P.S. Chadha B-41, Sector-6, Noida-U.P.-India Phone- 0120-2422275 Pincode : 201301 Email : sales@mansfieldcable.com	PMD	YES
22	Electrical	LT XLPE POWER CABLE	PARAMOUNT COMMUNICATIONS LTD.	C-125, Naraina Industrial Area, Phase-I, NEW DELHI-DELHI-INDIA Phone- 9958898025 Pincode : 110005 Email : jatan.singh@paramountcables.com	PMD	YES
23	Electrical	LT XLPE POWER CABLE	POLYCAB WIRES PVT. LTD.	HICO HOUSE, 1st FLOOR, 771, PANDIT SATWALEKAR MARG, MAHIM, MUMBAI-MAHARASHTRA-INDIA Phone- 011-29841697 Pincode : 400016 Email : lnsingh@polycab.com	PMD	YES
24	Electrical	LT XLPE POWER CABLE	RAVIN CABLES LIMITED	MR.PRAKASH LAKHKAR 30,AKRUTI TRADE CENTRE, 3RD FL, ROAD NO.7 , MIDC ,MAROL,ANDHERI (E) MUMBAI-MAHARASHTRA-INDIA Phone- 09324081733 Pincode : 400093 Email : surendra.rawat@ravingroup.com	PMD	YES
25	Electrical	LT XLPE POWER CABLE	SUYOG ELECTRICALS LTD.	Mr.Bimal Y.Desai/Mr. Haresh Hansoti 1, Madhuvan Apartment,24 Arunoday Society,Alkapuri VADODARA-GUJARAT-INDIA Phone- 9227192737 Pincode : 390 007 Email : suyog@seplcables.com	PMD	YES

26	Electrical	LT XLPE POWER CABLE	SPECIAL CABLES PVT. LTD.	MR. RAHUL KHANNA/MR. SANDEEP VERMA 6, COMMUNITY CENTRE, East of Kailash, opp. Sapna Cinema NEW DELHI-Delhi-INDIA Phone- 9310861167 Pincode : 110065 Email : sales@specialcables.co.in ;	PMD	YES
27	Electrical	LT XLPE POWER CABLE	SRIRAM CABLES PVT. LTD.	Anil Garg / Sunil Garg Flat No. 102, A 8A Rama Road, Adarsh Nagar Delhi-Delhi-India Phone- 011-27670005 Pincode : 110033 Email : contact@sriramcables.com	PMD	YES
28	Electrical	LT XLPE POWER CABLE	THERMO CABLES LTD.	MS.UMA GHURKA/N.SRINIVASA RAO 28, NAGARJUNA HILLS, PUNJAGUTTA HYDERABAD-TELANGANA-INDIA Phone- 9397803596 Pincode : 500082 Email : manoijagarwal@thermocables.com	PMD	YES
29	Electrical	LT XLPE POWER CABLE	TIRUPATI PLASTOMATICS PVT. LTD.	Mr. Ravi Gemini B-141 A, Road No. 9D V.K.I. Area Jaipur-Rajasthan-India Phone- 0141-2330305 Pincode : 302013 Email : ravi.gemini@yahoo.com	PMD	YES
30	Electrical	LT PVC CONTROL CABLE	Advance Cable Technologies (P) Ltd.	Mr. Siddharth Jain G-1, Sunrise Serenity, No.1,40 Ft.Road, M.R. Garden,Geddalahalli, Aswathnagar, Bangalore-Karnataka-India Phone- 9845326881 Pincode : 560094 Email : dbhat@advancecable.in	PMD	YES
31	Electrical	LT PVC CONTROL CABLE	APAR INDUSTRIES LTD.	Mr. Vijay Kumar Bajaj 12/13,Jyoti Wire House,23-A,Shah Ind Est Off. Veera Desai Road, Andheri (West). Mumbai-Maharashtra-India, Phone- 022-26740001 Pincode : 400053 Email : info.cable@apar.com	PMD	YES
32	Electrical	LT PVC CONTROL CABLE	CMI LTD.	Mr.Amit Jain/V.K.Gupta PLOT NO-71, SECTOR-6, FARIDABAD,-Haryana-INDIA Phone- 9958533005 Pincode : 110092 Email : p.aggarwal@cmilimited.in	PMD	YES
33	Electrical	LT PVC CONTROL CABLE	CORDS CABLE INDUSTRIES LTD.	MR. NAVEEN SAWHNEY B-1/A-26, MOHAN CO-OPERATIVE INDUSTRIAL ESTATE, MATHURA ROAD, NEW DELHI-DELHI-INDIA Phone- 9818356799 Pincode : 110044 Email : sg@cordscable.com	PMD	YES
34	Electrical	LT PVC CONTROL CABLE	CRYSTAL CABLE INDUSTRIES LTD.	Shri Vinod Kumar Gupta 32, GANESH CHANDRA AVENUE, KOLKATA-WEST BENGAL-INDIA Phone- 9339767435 Pincode : 700013 Email : cghosh@crystalcable.in	PMD	YES
35	Electrical	LT PVC CONTROL CABLE	DELTON CABLES LTD.	MR. V.K. GUPTA 4801, BHARAT RAM ROAD, 24, DARYA GANJ, NEW DELHI-DELHI-INDIA Phone- 9560866060 Pincode : 110002 Email : shashikumar@deltoncables.com	PMD	YES
36	Electrical	LT PVC CONTROL CABLE	ELKAY TELELINKS LTD.	Mr. Vinod Dubey K.C.HOUSE,5/66, PADAM SINGH ROAD, KAROL BAGH, NEW DELHI-DELHI-INDIA Phone- 9899789830 Pincode : 110005 Email : projects@elkaygroup.net	PMD	YES
37	Electrical	LT PVC CONTROL CABLE	GEMSCAB INDUSTRIES LTD.	Sh. A. N. Pathak, (GM/Business Develop.) 40, Rajasthani Udyog Nagar, G.T. Karnal Road, NEW DELHI-Delhi-India Phone- 09212560974 Pincode : 110033, Email : sureshchandra@gemscab.com	PMD	YES

38	Electrical	LT PVC CONTROL CABLE	GOVIND CABLE INDUSTRIES	Mr. D.K.Dutta 73/1, COTTON STREET, KOLKATTA-West Bengal-INDIA Phone- 9331055614 Pincode : 700007 Email : govindcable_kol@vsnl.net	PMD	YES
39	Electrical	LT PVC CONTROL CABLE	GUPTA POWER INFRASTRUCTURE LIMITED,	Mr. Gorav Atri,502, 5th Floor, K M Trade Tower,Radisson Blu Complex, Sector-14, Kaushambi Ghaziabad-Uttar Pradesh-India, Phone- 8130388991 Pincode : 201010 Email : gorav@guptapower.com,	PMD	YES
40	Electrical	LT PVC CONTROL CABLE	HAVELLS INDIA LTD.	QIMAT RAI GUPTA QRG Towers, Plot 2D, Sector 126, Expressway NOIDA-U.P.-INDIA Phone- 95605 88484 Pincode : 201304 Email : marketing@havells.com	PMD	YES
41	Electrical	LT PVC CONTROL CABLE	Incom Cables (P) Ltd.,	A-90, Naraina Indl. Area, Phase-I, New Delhi,-New Delhi,-India, Phone- 9958992525, Pincode : 110028, Email : vinaik@incomcables.com,	PMD	YES
42	Electrical	LT PVC CONTROL CABLE	KEI INDUSTRIES LTD.	Mr. ANIL GUPTA D-90, OKHLA INDUSTRIAL AREA, PHASE-I, NEW DELHI-DELHI-INDIA Phone- 011-26818840 Pincode : 110020 Email : lalit.saxena@kei-ind.com	PMD	YES
43	Electrical	LT PVC CONTROL CABLE	KEC INTERNATIONAL LIMITED	Mr. Radheshyam Singh CEAT MAHAL, 1ST FLOOR, 463, DR. ANNIE BESANT ROAD,WORLI, MUMBAI-MAHARASHTRA-INDIA Phone- 9930980158 Pincode : 400 030 Email : singhrb@kecrpg.com;yudhister@kecrpg.com	PMD	YES
44	Electrical	LT PVC CONTROL CABLE	MANSFIELD CABLES COMPANY LTD.	Mr. J.P.S. Chadha B-41, Sector-6, Noida-U.P.-India Phone- 0120-2422275 Pincode : 201301 Email : sales@mansfieldcable.com	PMD	YES
45	Electrical	LT PVC CONTROL CABLE	PARAMOUNT COMMUNICATIONS LTD.	C-125, Naraina Industrial Area, Phase-I, NEW DELHI-DELHI-INDIA Phone- 9958898025 Pincode : 110005 Email : jatan.singh@paramountcables.com	PMD	YES
46	Electrical	LT PVC CONTROL CABLE	POLYCAB WIRES PVT. LTD.	HICO HOUSE, 1st FLOOR, 771, PANDIT SATWALEKAR MARG, MAHIM, MUMBAI-MAHARASHTRA-INDIA Phone- 011-29841697 Pincode : 400016 Email : lnsingh@polycab.com	PMD	YES
47	Electrical	LT PVC CONTROL CABLE	RAVIN CABLES LIMITED	MR.PRAKASH LAKHKAR 30,AKRUTI TRADE CENTRE, 3RD FL, ROAD NO.7 , MIDC ,MAROL,ANDHERI (E) MUMBAI-MAHARASHTRA-INDIA Phone- 09324081733 Pincode : 400093 Email : surendra.rawat@ravingroup.com	PMD	YES
48	Electrical	LT PVC CONTROL CABLE	SUYOG ELECTRICALS LTD.	Mr.Bimal Y.Desai/Mr. Haresh Hansoti 1, Madhuvan Apartment,24 Arunoday Society,Alkapuri VADODARA-GUJARAT-INDIA Phone- 9227192737 Pincode : 390 007 Email : suyog@seplcables.com	PMD	YES
49	Electrical	LT PVC CONTROL CABLE	SPECIAL CABLES PVT. LTD.	MR. RAHUL KHANNA/MR. SANDEEP VERMA 6, COMMUNITY CENTRE, East of Kailash,opp.Sapna Cinema NEW DELHI-Delhi-INDIA Phone- 9310861167 Pincode : 110065 Email : sales@specialcables.co.in;	PMD	YES

50	Electrical	LT PVC CONTROL CABLE	SRIRAM CABLES PVT. LTD.	Anil Garg / Sunil Garg Flat No. 102, A 8A Rama Road, Adarsh Nagar Delhi-Delhi-India Phone- 011-27670005 Pincode : 110033 Email : contact@sriramcables.com	PMD	YES
51	Electrical	LT PVC CONTROL CABLE	Sam Cables & Conductors (P) Ltd.,	6th Km. Rudrapur-kichha Road, Post-Lalpur, Rudrapur, Distt. Udham Singh Nagar , Uttrakhand,-Uttrakhand,-India, Phone- 9837766444, Pincode : 263148, Email : manpreet@samcables.com ,	PMD	YES
52	Electrical	LT PVC CONTROL CABLE	SPM POWER & TELECOM PVT. LTD,	Plot No. A-28/1/12, Road No. 15, I.D.A., Nacharam, Hyderabad,-Telangana-India Phone- 040-65893830, Pincode : 500076, Email : info@spm cables.in ,	PMD	YES
53	Electrical	LT PVC CONTROL CABLE	THERMO CABLES LTD.	Ms.UMA GHURKA/N.SRINIVASA RAO 28, NAGARJUNA HILLS, PUNJAGUTTA HYDERABAD-TELANGANA-INDIA Phone- 9397803596 Pincode : 500082 Email : manoijagarwal@thermocables.com	PMD	YES
54	Electrical	LT PVC CONTROL CABLE	TIRUPATI PLASTOMATICS PVT. LTD.	Mr. Ravi Gemini B-141 A, Road No. 9D V.K.I. Area Jaipur-Rajasthan-India Phone- 0141-2330305 Pincode : 302013 Email : ravi.gemini@yahoo.com	PMD	YES
55	Electrical	LT PVC CONTROL CABLE	UNIVERSAL CABLES LTD.	MR. Y.S. LODHA/MR. AMITAVA ABOSE P.O. BIRLA VIKAS, SATNA SATNA-MADHYA PRADESH-INDIA Phone- +91 9584968066 Pincode : 485005 Email : amsingh@unistar.co.in	PMD	YES
56	Electrical	SCREENED CONTROL CABLES	Advance Cable Technologies (P) Ltd.	Mr. Siddharth Jain G-1, Sunrise Serenity, No.1,40 Ft.Road, M.R. Garden,Geddalahalli, Aswathnagar, Bangalore-Karnataka-India Phone- 9845326881 Pincode : 560094 Email : dbhat@advancecable.in	PMD	YES
57	Electrical	SCREENED CONTROL CABLES	CMI LTD.	Mr.Amit Jain/V.K.Gupta PLOT NO-71, SECTOR-6, FARIDABAD,-Haryana-INDIA Phone- 9958533005 Pincode : 110092 Email : p.aggarwal@cmilimited.in	PMD	YES
58	Electrical	SCREENED CONTROL CABLES	CORDS CABLE INDUSTRIES LTD.	MR. NAVEEN SAWHNEY B-1/A-26, MOHAN CO-OPERATIVE INDUSTRIAL ESTATE, MATHURA ROAD, NEW DELHI-DELHI-INDIA Phone- 9818356799 Pincode : 110044 Email : sg@cordscable.com	PMD	YES
59	Electrical	SCREENED CONTROL CABLES	DELTON CABLES LTD.	MR. V.K. GUPTA 4801, BHARAT RAM ROAD, 24, DARYA GANJ, NEW DELHI-DELHI-INDIA Phone- 9560866060 Pincode : 110002 Email : shashikumar@deltoncables.com	PMD	YES
60	Electrical	SCREENED CONTROL CABLES	ELKAY TELELINKS LTD.	Mr. Vinod Dubey K.C.HOUSE,5/66, PADAM SINGH ROAD, KAROL BAGH, NEW DELHI-DELHI-INDIA Phone- 9899789830 Pincode : 110005 Email : projects@elkaygroup.net	PMD	YES
61	Electrical	SCREENED CONTROL CABLES	GUPTA POWER INFRASTRUCTURE LIMITED,	Mr. Gorav Atri,502, 5th Floor, K M Trade Tower,Radisson Blu Complex, Sector-14, Kaushambi Ghaziabad-Uttar Pradesh-India, Phone- 8130388991 Pincode : 201010 Email : gorav@guptapower.com ,	PMD	YES

62	Electrical	SCREENED CONTROL CABLES	KEI INDUSTRIES LTD.	Mr. ANIL GUPTA D-90, OKHLA INDUSTRIAL AREA, PHASE-I, NEW DELHI-DELHI-INDIA Phone- 011-26818840 Pincode : 110020 Email : lalit.saxena@kei-ind.com	PMD	YES
63	Electrical	SCREENED CONTROL CABLES	MANSFIELD CABLES COMPANY LTD.	Mr. J.P.S. Chadha B-41, Sector-6, Noida-U.P.-India Phone- 0120-2422275 Pincode : 201301 Email : sales@mansfieldcable.com	PMD	YES
64	Electrical	SCREENED CONTROL CABLES	PARAMOUNT COMMUNICATIONS LTD.	C-125, Naraina Industrial Area, Phase-I, NEW DELHI-DELHI-INDIA Phone- 9958898025 Pincode : 110005 Email : jatan.singh@paramountcables.com	PMD	YES
65	Electrical	SCREENED CONTROL CABLES	POLYCAB WIRES PVT. LTD.	HICO HOUSE, 1st FLOOR, 771, PANDIT SATWALEKAR MARG, MAHIM, MUMBAI-MAHARASHTRA-INDIA Phone- 011-29841697 Pincode : 400016 Email : lnsingh@polycab.com	PMD	YES
66	Electrical	SCREENED CONTROL CABLES	SUYOG ELECTRICALS LTD.	Mr.Bimal Y.Desai/Mr. Haresh Hansoti 1, Madhuvan Apartment,24 Arunoday Society,Alkapuri VADODARA-GUJARAT-INDIA Phone- 9227192737 Pincode : 390 007 Email : suyog@seplcables.com	PMD	YES
67	Electrical	SCREENED CONTROL CABLES	SPECIAL CABLES PVT. LTD.	MR. RAHUL KHANNA/MR. SANDEEP VERMA 6, COMMUNITY CENTRE, East of Kailash,opp.Sapna Cinema NEW DELHI-Delhi-INDIA Phone- 9310861167 Pincode : 110065 Email : sales@specialcables.co.in;	PMD	YES
68	Electrical	SCREENED CONTROL CABLES	THERMO CABLES LTD.	Ms.UMA GHURKA/N.SRINIVASA RAO 28, NAGARJUNA HILLS, PUNJAGUTTA HYDERABAD-TELANGANA-INDIA Phone- 9397803596 Pincode : 500082 Email : manojagarwal@thermocables.com	PMD	YES
69	Electrical	SCREENED CONTROL CABLES	T C Communication Pvt. Ltd.	Mr. Ashok Bathwal 505, Vikas Deep, 18 Laxmi Nagar District Centre New Delhi-Delhi-India Phone- 9810002411 Pincode : 110092 Email : ashok@technocab.in	PMD	YES
70	Electrical	CABLE GLANDS	ALLIED TRADERS & EXPORTERS	C-124 A, SECTOR-2, NOIDA -201 301, UTTAR PRADESH, INDIA	Sub vendor	YES
71	Electrical	CABLE GLANDS	ARUP ENGG & FOUNDRY WORKS	391/119,PRINCE ANWAR SHAH ROAD, CALCUTTA-700068	Sub vendor	YES
72	Electrical	CABLE GLANDS	BALIGA LIGHTING EQPT.PVT.LTD.	63A,CP RAMASWAMY ROAD, ALWARPET,P.B.No 6910, CHENNAI-600018	Sub vendor	YES
73	Electrical	CABLE GLANDS	COMMET BRASS PRODUCTS	NUTAN CHEMICAL COMPOUND, WALBHAT ROAD, GOREGAON, MUMBAI-400063	Sub vendor	YES
74	Electrical	CABLE GLANDS	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGAON (EAST). MUMBAI 400 063.	Sub vendor	YES
75	Electrical	CABLE GLANDS	ELECTROMAC INDUSTRIES	27/28AF NEW EMPIRE IND.ESTT., R.KRISHNA MANDIR RD.JB NGR ,ANDHERI(E),MUMBAI-400059	Sub vendor	YES

76	Electrical	CABLE GLANDS	INCAB	HARE STREET,KOLKATA,WEST BENGAL-700001	Sub vendor	YES
77	Electrical	CABLE LUGS	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.	Sub vendor	YES
78	Electrical	CABLE LUGS	UNIVERSAL MACHINES LTD.	4,B.B.D.BAG (EAST) 90,STEPHEN HOUSE,5TH FLR CALCUTTA-700001	Sub vendor	YES
Note: No. of rows to be increased/ decreased based on the no. of entries for a particular package.						



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

STANDARD TECHNICAL REQUIREMENTS

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

SECTION: **II**

SUB-SECTION: **IIC**

REV. NO. **0** DATE **24.04.17**

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

SUB-SECTION - IIC

STANDARD TECHNICAL SPECIFICATION (C &I)



SPECIFICATION FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS -999- 145 -054A	
VOLUME	II B
SECTION	D
REV. NO. 03	DATE : 21.10.2016
SHEET	1 OF 6

1.0 SCOPE

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

2.0 CODES AND STANDARDS

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

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

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

3.0 TECHNICAL REQUIREMENTS

3.1 Panel Construction

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

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

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

3.1.4 The salient features of construction shall be:

Sheet material: Cold rolled sheet steel

Frame thickness: Not less than 3.0mm

Enclosure thickness: Not less than 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.



SPECIFICATION FOR LOCAL PANELS

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

VOLUME II B

SECTION D

REV. NO. 03

DATE : 21.10.2016

SHEET 2 OF 6

- 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



SPECIFICATION FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS -999- 145 -054A	
VOLUME	II B
SECTION	D
REV. NO. 03	DATE : 21.10.201
SHEET	3 OF 6

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.



SPECIFICATION FOR LOCAL PANELS

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

VOLUME II B

SECTION D

REV. NO. 03

DATE : 21.10.2016

SHEET 4 OF 6

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.



SPECIFICATION FOR LOCAL PANELS

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

VOLUME II B

SECTION D

REV. NO. 03

DATE : 21.10.2016

SHEET 5 OF 6

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



SPECIFICATION FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS -999- 145 -054A	
VOLUME	II B
SECTION	D
REV. NO. 03	DATE : 21.10.2016
SHEET	6 OF 6

5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

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

5.2. Mandatory Spares

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

5.3. Recommended Spares

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

6.0 DRAWINGS AND DOCUMENTS

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

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

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

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

7.0 MARKING AND PACKING

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

8.0 APPLICABLE DATA SHEET FORMS

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

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



DATA SHEET FOR LOCAL PANELS

SPECIFICATION NO.:	
VOLUME	
SECTION	
REV. NO. 00	DATE: 22.10.16
SHEET 1 OF	2

TAG No. Qty.....

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

Data Sheet A & B

DATA SHEET-A FOR LOCAL PANEL
(TO BE FILLED BY PURCHASER)

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

GENERAL	MANUFACTURER					
	CONSTRUCTION		☒ FOLDED ☐ WELDED (As per requirement EDN)			
	ENCLOSURE SHEET THICKNESS	FRONT	☒	As per specification		
		OTHER	☐			
		DOOR	☐			
HEIGHT		☒ (this shall be decided by BHEL during detailed engineering)				
		OTHER	☐ Load bearing sheet front shall have 3mm thickness			
TECHNICAL	INPUT POWER SUPPLY *		☐ 240V 50 Hz AC ☐ 220V DC ☒ 415V 3 PHASE (ANY OTHER POWER REQUIREMENT TO BE DERIVED FROM THIS SUPPLY ONLY)			
	NO. OF FEEDERS		☒ ONE ☐ TWO			
	STARTER WITH MCC		☐ REQUIRED ☐ NOT REQUIRED		STARTER IS IN BIDDERS SCOPE OF SUPPLY	
	IPR POSITION		☐ MCC ☒ RELAY PANEL			
	CONTACT RATING OF RELAY		☐ 5 Amp, 230 V AC ☐ 0.25 Amp, 220V DC			
	CONTROL SUPPLY		☐ 110V AC 240V AC ☐ 220V DC ☐ Other. (As per requirement)			
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)		REQUIRED as indicated in specification.			
	TEMP SCANNER (IF REQUIRED –NO. OF CHANNELS TO BE SPECIFIED UNDER SEC-C)		REQUIRED ☒ NOT REQUIRED			
	PAINT TYPE		as per specification cl. 4.05.08 for RELAY BASED LOCAL CONTROL PANEL/DESK			
	MIMIC (TYPE OF MIMIC- MATERAIL, THICKNESS TO BE SPECIFIED DURING DETAILED ENGG.)		☒ REQUIRED ☐ NOT REQUIRED			
	PANEL COLOUR (EXTERNAL)		as per specification cl. 4.05.08 for RELAY BASED LOCAL CONTROL PANEL/DESK			
	FINISH (EXTERNAL)		as per specification cl. 4.05.08 for RELAY BASED LOCAL CONTROL PANEL/DESK			
	PANEL COLOUR (INTERNAL)		as per specification cl. 4.05.08 for RELAY BASED LOCAL CONTROL PANEL/DESK			
	FINISH (INTERNAL)		as per specification cl. 4.05.08 for RELAY BASED LOCAL CONTROL PANEL/DESK			
	CLASS OF PROTECTION		☐ IP-42 (FOR INDOOR SERVICE) ☒ IP-55 (FOR OUTDOOR SERVICE) ☐ ANY OTHER			
	CONTROL HARDWARE		☒ RELAY BASED			
	FOUNDATION ARRANGEMENT		☒ FOUNDATION BOLTS ☐ ANCHOR FASTENERS			

	DATA SHEET FOR LOCAL PANELS			SPECIFICATION NO.:		
				VOLUME		
				SECTION		
				REV. NO.	00	DATE: 22.10.16
				SHEET	2 OF	2
TAG No. Qty.....			Data Sheet No.: PES-145A-DS1-0			
Data Sheet A & B						
DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)				DATA SHEET-B (TO BE FILLED-UP BY BIDDER)		
	WEIGHT OF PANEL (Kg.)		(Vendor to specify)			
	PANEL TYPE		☐ PRESSURISED ☐ UNPRESSURISED As per Requirement			
	CABLE GLAND		☒ DOUBLE COMPRESSION			
	AMMETER (TYPE OF INPUT)		1 Amp CT ☐ 4-20 mA		REQUIRED	
	SCOPE OF SUPERVISION FOR ERECTION & COMMISSIONING		APPLICABLE ☒ NA			
NAME DESIGNATION SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	COMPANY SEAL NAME: SIGNATURE: DATE:		



DATA SHEET FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS-392-145-054A

VOLUME

SECTION

REV. NO.

00

DATE: 17.01.2014

SHEET

2 OF

2

TAG No. Qty.....

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

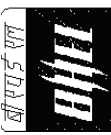
Data Sheet C

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

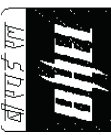
GENERAL	MANUFACTURER		
	CONSTRUCTION		☐ FOLDED ☐ WELDED (As per requirement EDN)
	ENCLOSURE SHEET THICKNESS	FRONT	
		OTHER	
		DOOR	
		HEIGHT	
	OTHER		
TECHNICAL	INPUT POWER SUPPLY		
	NO. OF FEEDERS		
	CONTACT RATING OF RELAY		
	TEMP SCANNER		
	CONTROL SUPPLY		
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)		
	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-392-145-054A	
				VOLUME	
				SECTION	
				REV. NO. 00	DATE: 17.01.2014
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		CHECKED BY		APPROVED BY
					COMPANY SEAL NAME: SIGNATURE: DATE:

**SPECIFICATION
FOR
QUALITY ASSURANCE
&
TESTING**

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-QP-999-145-1056							
 PEM :: C&I										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 \$			Remarks					
									P	W	V						
1.0	INCOMING Sheet Steel (CRCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample	IS:1079 IS:513	IS:1079 IS:513	Test Certificate	3	---	2						
		2. Bend Test	CR	Mech. test	Sample	IS:1079 IS:513	IS:1079 IS:513	Log Book	2	---	---						
		3. Surface finish	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---						
		4. Waviness	MA	Visual	100%	Factory Standard	No Waviness	Log Book	2	---	---						
		5. Thickness	MA	Measurement	100%	BHEL Spec.	BHEL Spec.	Log Book	2	---	---						
		6. Mill marking	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	1						
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	IS:2062	IS:2062	Log Book	2	---	---						
		2. Surface Defects	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---						
		3. Straightness	MA	Measurement	100%	Factory Std.	Factory Std.	Log Book	2	---	---						
		4. Mill marking	MA	Visual	100%	IS:2062	IS:2062	Log Book	2	---	1						
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---						
		2. IR and HV	MA	Electrical	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---						
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics													\$	P	- Agency Performing the Test.		
														W	- Agency Witnessing the Test.		
														V	- Agency Verifying the Test.		
															1	- BHEL	
															2	- Vendor	
															3	- Sub-vendor	

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-QP-999-145-1056				
 PEM :: C&I										VOLUME IIB		SECTION D		
										REV. NO. 01		DATE: 22-02-2008		
										SHEET 2		OF 7		
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks		
		3. Conductor a) Resistance b) Size c) Sheet colour	MA MA MA	Electrical Measurement Visual	100% 100% 100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---			
		4. Type / Routine Test Certificates	MA	Verification	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	3	---	2			
4.0	Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays Timers Space Heaters Thermostat Indicating meters etc.	1. Verification at make and Type	CR	Visual	Sample	BHEL Spec. and BOM	BHEL Spec. and BOM	Log Book	2	---	---	+ for relay & contactors only @ for all components except relays & contactors.		
		2. Verification of Test Certificates	CR	Scrutiny of Type / Routine T.Cs.	100%	Relevant IS	Relevant IS	Log Book	2	---	---			
		3. Operation / Functional check	CR	Electrical	Sample+ 100%@	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---			
		4. I.R.	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---			
		5. H.V.	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---			
		6. Calibration	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	1			
		7. Pick up / Drop off Voltage	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---			
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics										\$			P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.	1 - BHEL 2 - Vendor 3 - Sub-vendor

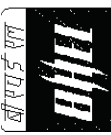
STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-QP-999-145-I056					
 PEM :: C&I										VOLUME		IIB			
										SECTION		D			
										REV. NO.		01			
										DATE:		22-02-2008			
										SHEET		3			
OF		7													
Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make 2. Surface defects 3. IR / HV on Terminal Blocks	MA MA MA	Visual Visual Electrical	Sample Sample Sample	BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue	Log Book Log Book Log Book	2 2 2	--- --- ---	--- --- ---				
6.0	IN PROCESS Blanking / Bending / Forming	1. Dimensions 2. Surface defects after bending	MI MA	Measurement Visual	100% 100%	Approved Mfr. drgs. Factory Standard	Approved Mfr. drgs. Factory Standard	Log Book Log Book	2 2	--- ---	--- ---				
7.0	Nibbling / Punching	1. Cutout Sizes 2. Deburring	MI MA	Measurement Visual	100% 100%	Approved Mfr. drgs. Approved Mfr. drgs.	Approved Mfr. drgs. Approved Mfr. drgs.	Log Book Log Book	2 2	--- ---	--- ---				
8.0	ASSEMBLY Frame Assembly & Sheet fixing	1. Dimensions 2. Alignment 3. Welding Quality 4. Surface defects	MA MA MA MA	Measurement Measurement Visual Visual	100% 100% 100% 100%	Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards	Log Book Log Book Log Book Log Book	2 2 2 2	--- --- --- ---	2 2 2 2				
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics										\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.				1 - BHEL 2 - Vendor 3 - Sub-vendor	

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-QP-999-145-I056					
 PEM :: C&I										VOLUME IIB		SECTION D			
										REV. NO. 01		DATE: 22-02-2008			
										SHEET 4		OF 7			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
									P	W	V				
9.0	Pre-treatment and Painting	1. Pretreatment Process 2. Process parameters like bath temp. concentration etc. 3. Dipping / Removal Time 4. Surface quality after every dip 5. Primer after phosphating 6. Putty Application & Rubbing after primer 7. Paint first coat 8. Putty Application and Rubbing after first coat of paint 9. Paint second coat	MA MA MA MA MA MA MA	Visual Measurement Measurement Visual Visual, Thickness Visual Visual, Thickness Visual Visual, Thickness, Scratch test Colour adhesion	100% Periodic 100% 100% 100% 100% 100% 100%	Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005	Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005	Log Book Log Book Log Book Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2 2 2 2	--- --- --- --- --- --- --- ---	1 1 1 1 1 1 1 1				
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics													1 - BHEL 2 - Vendor 3 - Sub-vendor		

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

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

1 - BHEL
 2 - Vendor
 3 - Sub-vendor

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-QP-999-145-I056					
 PEM :: C&I										VOLUME IIB		SECTION D			
										REV. NO. 01		DATE: 22-02-2008			
										SHEET 5		OF 7			
										Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check
									P	W	V				
10.	Panel Wiring	1. Wiring Layout 2. Wiring Termination (Crimped Lugs) 3. Ferrule numbers 4. Colour of wiring 5. Size of Conductor	MA MA MA MA MA	Visual Visual Visual Visual Measurement	100% 100% 100% 100% 100%	Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs.	Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs.	Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2	--- --- --- --- ---	--- --- --- 1 1				
11.	Component Mounting	1. Correct components 2. Fixing	MA MA	Visual Visual	100% 100%	Approved drgs., Specs. & BOM Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM Approved drgs., Specs. & BOM	Log Book Log Book	2 2	--- ---	--- ---				
12.	FINAL Final Inspection	1. Workmanship 2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components 3. Components identification Marking / Name plates	MA MA MA	Visual Visual Visual	100% 100% 100%	Factory Standard BHEL approved drg. / Spec. BHEL approved drg. / Spec.	Factory Standard BHEL approved drg. / Spec. BHEL approved drg. / Spec.	Inspection Report Inspection Report Inspection Report	2 2 2	1 1 1	1 1 1	At Random by BHEL, based on 100 % internal test reports by Mfr.			
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics										\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.				1 - BHEL 2 - Vendor 3 - Sub-vendor	

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

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 W - Agency Witnessing the Test.
 V - Agency Verifying the Test.

1 - BHEL
 2 - Vendor
 3 - Sub-vendor

प्रीतिका प्रीतिका PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL							STD QUALITY PLAN NO.: PE-QP-999-145-I056				
									VOLUME IIB				
									SECTION D				
									REV. NO. 01				
									DATE: 22-02-2008				
SHEET 6		OF 7											
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks	
									P	W	V		
		5. Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.	
		6. Door functioning	MA	Functional	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1		
		7. Paint Shade	CR	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1		
		8. Paint Thickness	CR	Measurement	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1		
		9. Workmanship of Gaskets	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1		
		10. Wiring Layout	MA	Visual	100%	BHEL approved drg.	BHEL approved drg.	Inspection Report	2	1	1		
		11. Wire Termination	MA	Pulling manually	Sample	-----	Firm termination	Inspection Report	2	1	1		
		12. Continuity	MA	Electrical	100%	-----	Continuity OK	Inspection Report	2	1	1		

LEGEND:

* CR

- Critical characteristics

MA

- Major characteristics

MI

- Minor characteristics

\$

P

- Agency Performing the Test.

W

- Agency Witnessing the Test.

V

- Agency Verifying the Test.

1

- BHEL

2

- Vendor

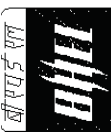
3

- Sub-vendor

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

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

1 - BHEL
2 - Vendor
3 - Sub-vendor

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

LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics				\$	P W V	- Agency Performing the Test. - Agency Witnessing the Test. - Agency Verifying the Test.	1 - BHEL 2 - Vendor 3 - Sub-vendor
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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	SEE NOTE-5	---	P	W	V	
3	REPEATABILITY			P	W	V	
4	IR TEST			P	W	V	
5	HV TEST			P	V	V	
6	PR. TEST ON CHAMBER	FOR LOT	---	P	V	V	
7	MATL. TC FOR CHAMBER & FLOAT	TYPE TEST	---	V	V	V	
8	CONTACT CONFIG. & RATING FOR MICROSWITCH	---	---	V	V	V	
9	TC FOR DEGREE OF PROTECTION	---	---	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	SEE NOTE-1 BELOW	---	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

CHECK LIST FOR TRANSMITTER

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

Legend :

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

Note :

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



STANDARD CHECK LIST FOR C&I INSTRUMENTS

CHECK LIST FOR PRESSURE & DP GAUGE

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

Legend :

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

Note :

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



STANDARD CHECK LIST FOR C&I INSTRUMENTS

CHECK LIST FOR PRESSURE SWITCH

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

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

Note :

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



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

STANDARD TECHNICAL REQUIREMENTS

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

SECTION: **III**

SUB-SECTION:

REV. NO. **0** DATE 24.04.17

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-RC-172-N001**

SECTION: **III**

SUB-SECTION:

REV. NO. **0** DATE 24.04.17

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

SECTION IIIA

COMPLIANCE CERTIFICATE

(TO BE SUBMITTED ALONG WITH BID)

	TITLE : TECHNICAL SPECIFICATION SUMP PUMPS COMPLIANCE CERTIFICATE	SPECIFICATION: PE-TS-RC-172-N001 NUMBER
		SECTION: IIIA
		Date: 24.04.17
		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. offered model is successfully operating in two separate stations for at least two years prior to submission of offer/bid. Any deviation to this 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	COMPANY SEAL
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TITLE:
**TECHNICAL SPECIFICATION FOR RATE
CONTRACT OF SUMP PUMPS**

STANDARD TECHNICAL REQUIREMENTS

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

SECTION: **III**

SUB-SECTION:

REV. NO. **0** DATE 24.04.17

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-RC-172-N001**

SECTION: **III**

SUB-SECTION:

REV. NO. **0** DATE 24.04.17

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-RC-172-N001**
SECTION: **III**
SUB-SECTION:
REV. NO. **0** DATE 24.04.17
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)

[illegible]

ANNEXURE III

[illegible]

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.	
		VOLUME	II B
		SECTION D	
		REV NO. 00 DATE 08/09/2010	
		SHEET	1 OF 7

LT MOTORS

A. GENERAL

1. Manufacturer & Country of origin.
(Shall be as per approved QA make)
2. Equipment driven by motor
3. Motor type
4. Quantity

B. DESIGN AND PERFORMANCE DATA

1. Frame size
2. Type of duty
3. Type of enclosure /Method of cooling/Degree of protection
4. Applicable standard to which motor generally conforms
5. Efficiency class as per IS 12615
6. (a) Whether motor is flame proof Yes/No
(b) If yes, the gas group to which it conforms as per IS:2148
7. Type of mounting
8. Direction of rotation as viewed from DE END__
9. Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)
10. Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)
11. Maximum continuous load demand of driven equipment in KW
12. Rated Voltage (volts)
13. Permissible variation of :

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.		
		VOLUME		II B
		SECTION D		
		REV NO.00 DATE 08/09/2010		
		SHEET	2	OF

- a. Voltage (Volts)
 - b. Frequency (Hz)
 - c. Combined voltage and frequency
14. Rated speed at rated voltage and frequency(RPM)
15. At rated Voltage and frequency:
 - a. Full load current
 - b. No load current
16. Power Factor at
 - a. 100% load
 - b. NO load
 - c. Starting.
17. Efficiency at rated voltage and frequency,
 - a. 100% load
 - b. 75% load
 - c. 50% load
18. Starting current (amps) at
 - a. 100 % voltage
 - b. 85% voltage
 - c. 80% voltage
19. Minimum permissible starting Voltage (Volts)
20. Starting time with minimum permissible voltage
 - a. Without driven equipment coupled
 - b. With driven equipment coupled

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.	
		VOLUME	II B
		SECTION D	
		REV NO.00 DATE 08/09/2010	
		SHEET	3 OF 7

21. Safe stall time with 100% and 110% of rated voltage
 - a. From hot condition
 - b. From cold condition
22. Torques :
 - a. Starting torque at min. permissible voltage(kg-mtr.)
 - b. Pull up torque at rated voltage.
 - c. Pull out torque
 - d. Min accelerating torque (kg.m) available
 - e. Rated torque (kg.m)
23. Stator winding resistance per phase (ohms at 20 Deg.C.)
24. GD^2 value of motors
25. No of permissible successive starts when motor is in hot condition
26. Locked Rotor KVA Input
27. Locked Rotor KVA/KW
28. Vibration limit :Velocity (mm/s)
29. Noise level limit (dBA)

C. CONSTRUCTIONAL FEATURES

1. Stator winding insulation
 - a. Class & Type
 - b. Winding Insulation Process
 - c. Tropicalised (Yes/No)

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.	
		VOLUME	II B
		SECTION D	
		REV NO. 00 DATE 08/09/2010	
		SHEET	4 OF 7

- d. Temperature rise over specified maximum ambient temperature of 50 deg C
 - e. Method of temperature measurement
 - f. Stator winding connection
2. Main Terminal Box
 - a. Type
 - b. Location (viewed from NDE side)
 - c. Entry of cables(bottom/side)
 - d. Recommended cable size (To be matched with cable size envisaged by owner)
 - e. Fault level (MVA), Fault level duration (sec)
 - f. Cable glands & lugs details (shall be suitable for power cable)
3. Type of DE/NDE Bearing
4. Motor Paint shade
5. Weight of
 - a. Motor stator (KG)
 - b. Motor Rotor (KG)
 - c. Total weight (KG)

D. List of accessories.

1. Space Heaters (Applicable for 30 KW & above motor)
(Nos./Power in watts/supply voltage)
2. Terminal Box for Space Heater (Yes/No)
3. Speed switch (Yes/No)
No of contacts and contact ratings of speed switch

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.	
		VOLUME	II B
		SECTION D	
		REV NO.00 DATE 08/09/2010	
		SHEET	5 OF 7

4. Insulation of bearing (Yes/No)

5. Noise reducer(Yes/No)

6. Grounding pads

i) No and size on motor body

ii) Nos on terminal Box

7. Vibration pads

i) Nos and size

ii) Location

8. Any other fitments

E. List of curves.

1. Torque speed characteristic of the motor

2. Thermal withstand characteristic

3. Starting. current Vs. Time

4. Starting. current Vs speed

5. P.F. and Effi. Vs Load

F. Additional Data to be filled for each rating of DC Motor

1. Rated armature voltage (Volt)

2. Rated field excitation (Amp)

3. Permissible % variation in voltage

4. Minimum Permissible Starting voltage (volt)

5. At rated voltage

i) Full load Armature current.(Amp)

ii) Full load Field current (Amp)

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.	
		VOLUME	II B
		SECTION D	
		REV NO.00 DATE 08/09/2010	
		SHEET	6 OF 7

- iii) No load Armature current (Amp)
6. Full load Field current (Amp)
7. No load Armature current (Amp)
8. Minimum permissible field current(Amp) to avoid overspeeding at
 - i) Maximum permissible voltage
 - ii) Rated voltage
 - iii) Minimum Permissible Voltage
9. Resistance (indicative Values) in ohm
 - i) Armature winding (Arm + IP + Series) at 25 deg.C
 - ii) Field Winding at 25 deg. C
10. Inductance (indicative values)
 - i) Armature winding
 - ii) Field winding
11. Value of trimmer resistance (ohm) to be connected in series with the shunt field to obtain rated speed at
 - i) 220 V DC
 - ii) 250 V DC
 - iii) 187 V DC
12. Value of the external resistance (ohm) required to be connected in series with armature during starting only
13. Technical data sheet for external resistance box
14. GA drawing of motor
15. Starting time calculation

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.	
		VOLUME	II B
		SECTION D	
		REV NO. 00 DATE 08/09/2010	
		SHEET	7 OF 7

16. Starter resistance design calculation
17. Electrical connection diagram of motor

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			