NTPC SAIL POWER COMPANY (P) LTD (NSPCL)

1X250 MW ROURKELA PP-II EXPANSION, NSPCL

TECHNICAL SPECIFICATION
FOR
SUMP PUMPS

Specification No. : PE-TS-427-172-N001 (Rev-01)

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

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SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

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 for following project:

1x250MW RORUKELA PP-II EXPANSION

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 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. Stand mounted local control panel common for two (2) sets of pump. 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.

b) For Portable trolley mounted Submersible type sump pumps:

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

- Wheel trolley for carrying pump and drive unit along with starter cum control panel.

  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/contactor 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. 2.2.4 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 inhibiter 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.

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 **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.

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.

7.2 Controls for **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.

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.

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:

SUMP PUMPS/SUB MERSIBLE PUMPS	**Primary Documents**		
	PE-V8-427-100-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-V8-427-100-N002	GENERAL ARRANGEMENT AND CROSS SECTIONAL - SUMP PUMPS	
	PE-V8-427-100-N003	TDS AND CURVES FOR MOTORS (IF APPLICABLE) OF SUMP PUMPS	
	PE-V8-427-100-N004	C&I Doc. -WRITE UP, WIRING DIAGRAM & GA OF CONTROL PANEL FOR SUMP PUMPS	
	PE-V8-427-100-N005	QP- SUMP PUMPS	
	Secondary Documents		
	PE-V8-427-100-N006	O&M MANUAL - SUMP PUMP	Within 30 days from MDCC

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.***

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 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

SUB-SECTION – IB

SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)

TECHNICAL SPECIFICATION

FOR

SUMP PUMP

(ELECTRICAL PORTION)

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.

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.

Annexure-I

PACKAGE : SUMP PUMPS
SCOPE OF VENDOR: SUPPLY
PROJECT :

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.

BASIC TECHNICAL FEATURES FOR HT / LT MOTORS

(FOR BHEL-PEM SCOPE PACKAGES)

REV.	DATE	ALTD	CHD	APPD
02	30.09.2016	BKR	ABA/SBH	SL

Revised in line with customer comments dated 21.09.2016

REV.	DATE	ALTD	CHD	APPD
01	13.09.2016	-SD-	-SD-	-SD-

Revised In line with customer comments dated 03.09.2016

CUSTOMER	NTPC-SAIL POWER COMPANY PVT.LTD.
CONSULTANT	MECON LIMITED
PROJECT	1X250 MW NSPCL ROURKELA TPP-III

427

CONTRACT

BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

DEPT CODE		NAME	SIGN	DATE
E	DRN	BKR	-SD-	24.08.2016
	DSGN	BKR	-SD-	24.08.2016
	CHD	ABA/SBH	-SD-	24.08.2016
	APPD	SL	-SD-	24.08.2016

TITLE: BASIC TECHNICAL FEATURES FOR HT / LT MOTORS (FOR BHEL-PEM SCOPE PACKAGES)

DRAWING NO. PE-DC-427-565-E003

SHEET 1 OF 8 REV. 02

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 of BHEL-PEM scope packages in 1 **x 250 MW ROURKELA POWER PROJECT.**

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.

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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.

2 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.

2 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.

2 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

2 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.

2 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.

2 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.

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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.

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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.

ANNEXURE-III

1.0	Design ambient temperature	:	50 ^{o}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¢, 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**

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.

SUB-SECTION – IC

SPECIFIC TECHNICAL REQUIREMENTS (C &I)

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 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 mm^2, G type (2P/4P/8P/12P) for Binary signals and F type cable (2P/4P/8P/12P/24P) for Analog signals. For solenoid 2.5mm^2, 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

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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.

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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.

	ROURKELA PP-II EXPANSION (1x250 MW)	
	TECHNICAL SPECIFICATION (C&I) FOR SUMP PUMPS	

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SPECIFICATION FOR MEASURING INSTRUMENTS (PRIMARY & SECONDARY) SWITCHES, AND LOCAL CONTROL PANELS

04.34.00 PROCESS ACTUATED SWITCHES

FEATURES	ESSENTIAL / MINIMUM REQUIREMENTS		
	Pressure/ Draft Switches/ DP Switches	Temperature switches	Level switches
Sensing Element	Piston actuated for high pressure and diaphragm or bellows for low pr./ vacuum	Vapor pressure sensing, liquid filled bellow type with SS bulb and capillary (10 m minimum)	~~Capacitance types~~, float type, ~~conductivity type~~, ~~RF type~~, ~~Ultrsonic type.~~
Material	316 SS	Bulb 316 SS/ capillary 304 SS	316 SS
End connection	½ inch NPT (F)	½ inch NPT (F)	Manufacturer standard
Over range proof pressure	150% of max. design pr.	-	150% of max. design pressure
Repeatability	± 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		
Accessories	Siphon, snubber, chemical seal, pulsation dampeners as required by process	Thermo well of 316 SS and packing glands	All mounting accessories
Mounting	Suitable for enclosure/ rack mounting or direct mounting	Suitable for rack mounting or direct mounting	-

SUB-SECTION – ID

DATASHEET-A

	PROJECT: 1X250 MW ROURKELA PP-II EXPANSION (NSPCL)					**Specification No: PE-TS-427-172-N001**
	TECHNICAL SPECIFICATION FOR SUMP PUMPS					**Section-ID**
	DATA SHEET - A					**Date-06.01.18**
CL. NO.	**DESCRIPTION**	**UNIT**	**Group-A**	**Group-B**	**Group-C**	**Group-D**
			Fixed Duty type Submersible Sump Pumps	**Portable Submersible Sump Pumps**	**Portable Submersible Sump Pumps**	**Portable Submersible Sump Pumps**
1.0.0	**GENERAL**					
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
2.3.0	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		NA	NA	NA	NA
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

	PROJECT: 1X250 MW ROURKELA PP-II EXPANSION (NSPCL)					**Specification No: PE-TS-427-172-N001**
	TECHNICAL SPECIFICATION FOR SUMP PUMPS					**Section-ID**
	DATA SHEET - A					**Date-06.01.18**
CL. NO.	**DESCRIPTION**	**UNIT**	**Group-A**	**Group-B**	**Group-C**	**Group-D**
			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		Yes Stand mounted with IP 55 protection common for two (2) sets of sump pump	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		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

SUB-SECTION - IIA

STANDARD TECHNICAL SPECIFICATION (MECHANICAL)

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 specifiation, the

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

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.

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 suctions 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 ± 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

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

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.

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.

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 tolerences 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.

8.01.01 General Arrangement drawings of the pumps showing various dimensions, suction and discharge locations.

8.01.02 Typical cross-section drawings of the pumps, seal rings, etc., and materials of construction for all items.

8.01.03 Characteristic curves of pumps showing effective head, pump input power, efficiency, submergence and NPSH, against capacity ranging from shut off condition to 150% of rated capacity.

8.01.04 Speed vs. torque curve of the pump corresponding to recommended mode of pump starting, super-imposed on speed vs. torque of the motor, corresponding to 80% and 100% rated voltage.

8.01.05 Diagram showing the type of lubrication system etc.

8.01.06 Completely filled up schedules enclosed under Vol.III of this specification.

8.01.07 GA drawing of Control Panel.

8.01.08 A write up describing clearly the procedure for installing the pump and also for overhauling the fixed type pumps. A procedure for lowering and raising the vertical submersible portable type pumps shall also be given.

8.02.00 Drawings, data, curves and information to be submitted by the successful tenderer after placement of order.

8.02.01 The drawings/data asked against clause nos.8.01.00 to 8.01.07 above shall also be furnished in a finalised form by the successful tenderer for the approval of the purchaser/his consultant. In addition following documents shall also be submitted for Purchaser's/consultant's approval.

8.02.02 Pump foundation details with static and dynamic loads.

8.02.03 Pump and drive sealing, bearing lubrication and cooling arrangement drawing.

8.02.04 Drive data

8.02.05 Reports on shop tests and test certificates.

8.02.06 All other drawings/documents and data as specified and deemed necessary.

BHARAT HEAVY ELECTRICALS LIMITED

MANUFACTURERS NAME & ADD

MANUFACTURING QUALITY PLAN

ITEM : Sump pumps/Submersible Pump | QP NO: PE-QP-999-100-N005 | REV-02 | DATE: 14.06.16 | PAGE 1 OF 2

PROJECT :
END CUSTOMER:
CONTRACT No.:
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 M	AGENCY B	AGENCY C	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	DPT	100%	ASTME:388	ASTME:388, Refer note 1	IR	√	P	V	V	On machined surface only
		Surface Defects	CR	DPT	100%	ASTME:165	No Surface defect	IR	√	P	V	V	On machined surface only
3.0	**Sub-Assembly, Assembly Control**												
3.1	Pump, Motor, Rotor	Eccentricity	MA	Measurement	100%	Manufacturers Drawing	Manufacturers Drawing	Log book / IR		P	V	V	
3.2	Pump and Motor assembly	Completeness, correctness	MA	Visual Examination	100%	Manufacturers Drawing	Manufacturers Drawing	IR		P	V	V	

LEGEND: RECORDS IDENTIFIED WITH "TICK" ( ) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION

** **M:** MANUFACTURER/SUB CONTRACTOR

B: BHEL, **C:**CUSTOMER (END USER)

P : PERFORM **W:** WITNESS **V :** VERIFICATION AS APPROPRIATE

BHEL DOC No.:PE : V8 - XXX - 100-N005

NAME AND SIGN OF APPROVING AUTHORITY AND SEAL

MANUFACTURER/ SUBCONTRACTOR — BHEL / CONTRACTOR

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 M	AGENCY B	AGENCY C	REMARKS
1	2	3	4	5	6	7	8	9	D*	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/Manufacurer standard		IR		P	V	V	Compliance report by Manufacurer
		Adhesion, Uniformity and thickness		Visual Measurement	100%	As per painting schedule/Manufacurer standard		IR		P	W	V	Compliance report by Manufacurer
4.7	Wooden Packing	Soundness, Aesthetic		Visual	100%	As per packing procedure		IR		P			Compliance report by Manufacurer

Note :

1. **For accessories and bought out items, Manufacurer 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 Manufacurer**
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	
		BHEL	**** M:** MANUFACTURER/SUB CONTRACTOR	
	MANUFACTURER/	CONTRACTOR	**B**: BHEL, **C:**CUSTOMER (END USER)	NAME AND SIGN OF APPROVING AUTHORITY AND SEAL
	SUBCONTRACTOR		**P :** PERFORM **W:** WITNESS **V :** VERIFICATION AS APPROPRIATE	
	SIGNATURE			

ENGG DIV / QA & I

SUB-SECTION - IIB

STANDARD TECHNICAL SPECIFICATION (ELECTRICAL)

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

1.0 INTENT OF SPECIFIATION

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

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

2.0 CODES AND STANDARDS

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

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

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

3.0 DESIGN REQUIREMENTS

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

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

3.3 Starting Requirements

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

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

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

3.3.3 The following frequency of starts shall apply

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

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

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

3.4 **Running Requirements**

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

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

3.5 **Stress During bus Transfer**

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

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

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

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

4.0 **CONSTRUCTIONAL FEATURES**

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

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

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

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

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

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

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

4.7 **Terminals and Terminal Boxes**

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

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

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

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

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

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

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

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

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

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

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

4.9 **General**

4.9.1 Motors provided for similar drives shall be interchangeable.

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

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

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

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

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

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

5.0 INSPECTION AND TESTING

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

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

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

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

6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT

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

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

E-48

MOTORS

QUALITY ASSURANCE

MOTOR

TESTS/CHECKS / TEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating /General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment
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.

QUALITY ASSURANCE

MOTOR

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

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

NOTES:

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

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

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

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

P. PERFORM
W. WITNESS
V. VERIFY

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

AS APPLICABLE

		SATARA/PUNE
		GRIP, FARIDABAD/HYDERABAD
		HERCULES HOIST, RAIGAD
		REVA INDUSTRIES, FARIDABAD
		ALPHA SERVICES, BHIWADI
		CENTURY CRANE, PALWAL

Elect. Aux.

Sl. No.	Item	SUB-SUPPLIERS PROPOSED
1.	HT MOTORS FOR ID FAN & BFP (SUB QR ITEM)	TECO, TAIWAN
		ASIR ROBICON, ITALY
		HYUDAI, KOREA
		BHEL, BHOPAL
		HYUDAI, KOREA
		WEG, BRAZIL
		WEG, HOSUR
		TMEIC, JAPAN
		SHANGHAI ELECTRIC, SHANGHAI
		CONVERTEAM, FRANCE
2.	OTHER HT MOTORS	VENDORS AT SR. NO 1 ARE ALSO ACCEPTABLE
		ABB, VADODARA
		CGL (D5 INSUSTRIAL AREA), MANDIDEEP
		MARATHON, KOLKATA
		IJLIN, KOREA
		LEZ, RUSSIA
		JYOTI, VADODARA
3.	LT MOTOR	ABB, FARIDABAD*/BANGALORE
		HYUDAI, KOREA
		WEG, BRAZIL
		JYOTI, VADODARA
		NGEF, BANGALORE
		HYOSUNG, KOREA
		SIEMENS, MUMBAI
		MARATHON, KOLKATA
		KEC, BANGALORE/HUBLI
		BHARAT BIJLEE, MUMBAI
		CGL, AHMEDNAGAR

		TIPM, JAPAN
		KAWAMATA, JAPAN
		ABB, SWEDEN
		TMEIC, JAPAN (NAGAS HAKI)
		ABB, SHANGHAI
4.	ELEVATOR	KONE, CHENNAI
		ECE, GHAZIABAD
		OTIS, MUMBAI
		OMEGA ELEVATORS, AHMEDABAD
		SAMIL ELECT. KOREA
		TECHNO INDUSTRIES, AHMEDABAD
5.	HVR TRANSFORMER	HIND RECTIFIER, MUMBAI
		ADOR POWERTRON, PUNE
6.	EC PANEL	HIND RECTIFIER, MUMBAI
		ADOR POWERTRON, PUNE
7.	INSULATOR (BUSHING, SUPPORT & SHAFT)	BHEL EPD, BANGALORE
		ZHANGJIAKOU XUANHUA XINDI, CHINA
8.	DISCONNECTING SWITCH	WINCRAFT, KOLKATA
		NATIONAL ENGINEERS, KOLKATA
9.	PANEL TYPE HOPPER HEATER	THERMON, USA
		HOTFOIL EHS, USA
		HTD, USA
		HTD HEAT TRAC E (I) PVT LTD., HYDERABAD
10.	TUBULAR HEATER	ESCORTS, FARIDABAD
11.	GEARED MOTOR	PBL, V V NAGAR
		PTL, AURANGABAD
		NAW,KOLKATA
		INTERNAL COMBUSTION, AURANGABAD

25.	GI PIPE	BIS LICENSEE
26.	STEEL CONDUIT/EXPOXY COATED CONDUIT	BIS LICENSEE
27.	LEAD COATED FLEXIBLE CONDUITS	M/S PLICA, GHAZIABAD
28.	JUNCTION BOXES/LINK BOXES TEST LINK BOX /ADAPTOR BOX	M/S POSITRONICS, VADODRA
		M/S PYROTECH, UDAIPUR
		M/S CONQUERENT CONTROL SYSTEM LTD, MANESAR
		M/S JAKSON, NOIDA
		M/S SWITCHING CIRCUIT, KOLKATA
		M/S SARVANA SWITCHGEAR, BANGALORE
		M/S AJMERA, MUBAI
29.	JUNCTION BOXES-FRP/THERMOSETTING PLASTIC/THERMO PLASTIC	SUMIP COMPOSITES, AHMEDABAD
		KEMROCK, VADODARA
		AJMERA, MUMBAI
		TRINITY TOUCH, PALWAL
30.	LT CABLE STRAINGHT THROGH JOINTING KIT	M/S RAYCHEM, MUMBAI
		M/S 3M ELECTRO & COMMUNICATION., PUNE
31.	HT CABLE TERMINATION KITS & STRAIGHT THROUGH JOINTING KIT	M/S 3M ELECTRO & COMMUNICATION., PUNE
		RAYCHEM, MUMBAI
32.	CABLE GLAND	M/S SUNIL & CO. KOLKATA
		M/S ARUP ENGG. KOLKATA
		M/S COMET, MUMBAI
		M/S QUALITY PRECISION, KOLKATA
		M/S STANDARD METAL, MUMBAI
		M/S BRACO, MUMBAI
33.	CABLE LUGS/FERRULES	M/S DEWELL, MUMBAI
		3D, UMBERGAON
		CHETNA, NASIK
34.	TUBULAR POLE	BIS LICENSEE AS PER IS 2713 WITH VALID CML NO.
35.	LIGHTING FIXTURES WITH ACCESSORIES (FILAMENT TYPE)	M/S CGL, MUMBAI
		M/S BAJAJ ELECTRICALS, MUMBAI
		M/S PHILIPS, NOIDA
		M/S WIPRO, MUMBAI
38.	LAMPS (FILAMENT TYPE)	M/S CROMPTON, MUMBAI
		M/S BAJAJ ELECTRICALS, MUMBAI
		M/S PHILIPS, NOIDA

		IEC, BHOPAL BIRLA NGK (INDIAN RAYON), HALOL WSI, CHENNAI SARAVANA GLOBAL ENERGY, CUDDALORE
8.	CLAMPS & CONNECTORS & WELDING SLEEVES	KLEMMEN ENGG, CHENNAI MILIND, MUMBAI EMTT, KOLKATA NOOTAN ENGG., MUMBAI ITPL, MUMBAI RASHTRIYA UDYOG, KOLKATA PEE VEE ENGG., BANGALORE MEGHA ENGG, CHENNAI
9.	ACDB/DCDB (Fixed Type)	
10.	INSULATOR HARDWARE, CONDUCTOR ACCESSORIES & EARTHWIRE ACCESSORIES	RASHTRA UDYOG, KOLKATA IAC, KOLKATA ITPL, MUMBAI EMTT, KOLKATA EMI, MUMBAI
11.	BMK'S/JB'S (ALL TYPES)/LIGHTING PANELS	
12.	DISC INSULATOR	IEC, BHOPAL BIRLA NGK (INDIAN RAYON), HALOL WSI, CHENNAI MODERN INSULATOR, ABU ROAD

PS- Mktg. Delhi

		BHEL, JHANSI
13.	GS FLAT/40MM DIA M.S.ROD/M.S EARTH RODS/U CLAMP/GI EARTH PIPE/GI PIPE /GI CONDUIT (INCLUDING BENDS)/PVC PIPES	MAIN CONTRACTOR APPROVED SOURCES
14.	ALUMINIUM TUBE	HINDALCO, RENUKUT INDALCO, ALUPURAM CENTURY EXTRUSIONS, KOLKATA JINDAL ALUMINUM TUBE, BANGALORE ALOM EXTRUSIONS, KOLKATA BALCO, KORBA SUDAL, NASIK
15.	CABLE TRAY, BENDS, COUPLER PLATES	
16.	ACSR CONDUCTOR	SMITHA, GHAZIABAD HINDUSTAN VIDYUT, FARIDABAD APAR INDUSTRIES, VADODARA/SILVASSA CABCON, HOWRAH HIRA CABLES, HIRAKUD SHARAVATHY CONDUCTORS, BANGALORE GALAXY TRANSMISSION, SANGLI
17.	GS EARTHWIRE/LIGHTING WIRE	MAIN CONTRACTOR APPROVED SOURCES
18.	CABLE GLANDS	
19.	1.1 KV GRADE POWER AND CONROL CABLES	
20.	CABLE LUGS	
21.	LIGHTING FIXTURES & LUMINARIES	
22.	LIGHTING POLE	BIS APPROVED VENDORS AS PER IS-2713*
23.	INDUSTRIAL RECEPTACLES	
24.	LEAKAGE CURRENT ANALYSER	ISA, ITALY

F	STATION HMI COMPUTER/OWS/EWS	IBM/ADVANTECH
G	LASER PRINTER	HP/CANON
H	DOT MATRIX PRINTER	TBSF/WIPRO/LIPI
I	LAN SWITCHES	CISCO/D-LINK/3-COM
J	FIBRE OPTIC CABLE	BIRLA ERICSSON, REVA FINOLEX, PUNE AKSH OPTIC FIBRE, BHIWARI
K	UPS FOR PC	DB/HIREL/3EL/APC, INDIA
L	LARGE VIDEO SCREEN	BARCO, GERMANY DELTA, CHINA
M	FURNITURE FOR HMI & PRINTER	MAIN CONTRACTOR APPROVED SOURCES
N	GATEWAY	DELL/IBM, USA
O	MODEMS	ALSTOM/NOMUS/ABB/BPL, INDIA
P	RELAY TEST KIT	OMICRON, USA/AUSTRALIA SCOPE T&M, PUNE
Q	TIME SYNCHRONISING EQPT.	SERTEL, MUMBAI SIEMENS, GERMANY HATHWAY, UK/USA HOPF, GERMANY ARBITER, USA
R	DISTURBANCE RECORDER	ABB, FINLAND ALSTOM, USA SIEMENS, GERMANY HATHWAY, UK
S	ETHERNET SWITCH	HIRSCHMANN, GERMANY GARETTCOM, USA RUGGEDCOM, CANADA
T	NUMERICAL RELAYS	ABB, FINLAND

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Sl. No.	Item	SUB-SUPPLIERS PROPOSED
1.	VVVFD PANEL (UP TO 690V)	ABB, BANGALORE
		SIEMENS, NASIK
		ROCKWELL/ALLEN BRADELY, SAHIBABAD
		SCHNEIDER, NASIK
		POWERTECH SWITCHGEAR, NARELA
		DANFOSS, CHENNAI
		L&T, MUMBAI
2.	LT TRANSFORMER (DRY TYPE). UP TO 2 MVA	VIJAY ELECTRICALS, HYDERABAD
		KEC, PUNE
		VLTAMP, SAVLI
		BHEL, JHANSI
3.	HT/LT EPR TRAILING CABLE	NICCO, SHYAMNAGAR
		UNIVERSAL CABLES, SATNA
		KEI, BHIWADI
4.	IN-LINE MAGNETIC SEPARATOR/SUSPENDED MAGNET	ELECTROMAG, MUMBAI
		MAGNETIC CORPORATION, BANGALORE
		ELECON EPC, SAVLI
		ELECTRO ZAVOD, KOLKATA
5.	METAL DETECTOR	ELECON EPC, SAVALI
		SIVA SYSTEMS, GOA
		ELECTROMAG, MUMBAI
		THERMO RAMSEY, AUSTRALIA
6.	ELECTROMAGNETIC (EM) BRAKE	ELECTROMAG, MUMBAI
		WITTON CRAMMER BROOK CROMPTON, UK
		STORM-CRAFT, MUMBAI
		BCH, FARIDABAD
7.	ELECTROHYDRO THRUSTER (EHT) BRAKE/EHT RAIL CLAMPS	PINTCH BUBNEZER, GERMANY
		ELECTROMAG, MUMBAI
		SIBRE, GERMANY
		RIMA SRL, ITALY
		WMI, MUMBAI
8.	ACTUATORS (WITHOUT INTEGRAL STARTER)	MMH, KOLKATA
		ONTINENTAL, FARIDABAD
		PREPEC, KOLKATA
		UNITED TECHNOMECH, MUMBAI
		LIMITORQUE,FARIDABAD

9.	GEARED MOTOR	PBL, VV NAGAR
		SEW EURODRIVE, GERMANY
		SIEMENS, GERMANY
		NAW, KOLKATA
		PREMTUM TRANSFORMISSION, AURANGABAD
		INTERNAL COMBUSTION, AURANGABAD
10.	BELT WEIGHER	KISTLER MORSE, HYDERABAD
		THERMO RAMSEY, AUSTRALIA
		ELECON EPC, SAVALI
		AVERY INDIA, BALLABHGARH
11.	WEIGH BRIDGE	AVERY INDIA, BALLABHGARH
		RICE LAKE, SRIPEREMBUDDUR
12.	PULL CORD SWITCHES/BELT SWAY SWITCHESUNDER BELT SWITCHES	JAYASHREE, PUNE
		KAKKU, BHILAI
		PROTO CONTROL, PUNE
		AG SYSTEM, MUMBAI
13.	ELECTRONIC SPEED SWITCHES, ZERO SPEED SWITCHES, TILT SWITCHES, MAGNETIC SWITCHES, PROXIMITY SWITCHES	PG ELECTRONICS, MUMBAI
		PROTO CONTROL, PUNE
		JAYASHREE, PUNE
14.	HEAVY DUTY LIMIT SWITCHES, SCREW CAM LIMIT SWITCH.	JAI BALAJEE, CHENNAI
		KAKKU, BHILAI
		JAYASHREE, PUNE
		BCH, FARIDABAD
		AG SYSTEM, MUMBAI
		ELEKTROMAG, MUMBAI
15.	PULL CORD/BELT SWAY SWITCH POSITION INDICATION SYSTEM	PARAMETRIC,PUNE
		JAYASHREE, PUNE
		PROTO CONTROL, PUNE
16.	CABLE REELING DRUM	ELECON, V V NAGAR
		ELEKTROMAG, VAPI
		BENGAL TECHNOCRATS, KOLKATA
		ELECTROZAVOD, KOLKATA
17.	TRAVELLING TRIPPER POSITION INDICATING SYSTEM	JAYASHREE, PUNE
18.	AIR HEATER	ESCORT, FARIDABAD

HT POWER CABLES , LT POWER CABLES,

Sl. No.	Item	SUB-SUPPLIERS PROPOSED
1.	HT CABLE UPTO 33KV (L-2 LEVEL VENDOR- **REFER NOTE-4)**	UNIVERSAL CABLE, LTD, SATNA
		TORRENT CABLE LTD, NADIAD
		POLYCAB WIRES PVT. LTD, DAMAN
		KEI INDUSTRIES, BHIWADI
		HAVELLS INDIA LTD, ALWAR
		FINOLEX, PUNE
		UNIFLEX, VALSAD
		NICCO, SHAMNAGAR KOLKATA
		INCAB, PUNE
		SRI RAM CABLES, BHIWADI
2.	I.I KV POWER CABLE (PVC & EXPE) (L-2 LEVEL VENDOR- **REFER NOTE-4)**	UNIVERSAL CABLE, LTD, SATNA
		NICCO, SHAMNAGAR KOLKATA
		TORRENT CABLE LTD, NADIAD
		INCAB, PUNE
		HINDUSTAN VIDYUT PRODUCTS LTD, FARIDABAD
		KEI INDUSTRIES, BHIWADI
		DELTON CABLE LTD., FARIDABAD
		PARAMOUNT CABLE, KHUSHKHERA
		POLYCAB WIRES PVT. LTD, DAMAN
		GEMSCABLES, BHIWADI
		HAVELLS INDIA LTD, ALWAR
		SHRI RAM CABLES, BHIWADI
		RAVIN CABLES, PUNE
		THERMOCABLES, HYDERABAD
		SBEE CABLES, BANGALORE
		SUYOG CABLES, VADODARA
		GUPTA POWER CABLES, BHUBANESWAR
		FINOLEX, PUNE
3.	1.I KV CONTROL CABLE (L-2 LEVEL VENDOR- **REFER NOTE-4)**	NICCO, SHAMNAGAR KOLKATA
		TORRENT CABLE LTD, NADIAD
		INCAB, PUNE
		POLYCAB WIRES PVT. LTD, DAMAN
		HINDUSTAN VIDYUT PRODUCTS LTD, FARIDABAD
		KEI INDUSTRIES, BHIWADI
		DELTON CABLE LTD., FARIDABAD

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		PARAMOUNT CABLE, KHUSHKHERA
		GEMSCABS INDUSTRIES, BHIWADI
		CORDS CABLES, BHIWADI
		SPM CABLES, BHIWADI
		ELKAY TELELINK, FARIDABAD
		HAVELLS INDIA LTD, ALWAR
		R.R.CABLE, SILVASA
		RAVIN CABLES, PUNE
		GUPTA POWER CABLES, BHUBANESWAR
		THERMOCABLES, HYDERABAD
		FINOLEX, PUNE
		SBEE CABLES, BANGALORE
		SUYOG CABLES, VADODARA
		SUYOG CABLES, VADODARA
		UNIVERSAL CABLES, SATNA
4.	FQP OF CABLE & ACCESSORIES	
5.	ERECTION AGENCY FOR THE SCOPE OF ERECTION	MAIN CONTRACTOR/MAIN CONTRACTOR APPROVED SOURCES

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 : sg@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, Ist 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 : manojagarwal@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,Geddalahhalli, 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, Ist 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@spmcables.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 : manojagarwal@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,Geddalahhalli, 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, Ist 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 & FOUNDARY 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, GOREGOAN (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.						

SUB-SECTION - IIC

STANDARD TECHNICAL SPECIFICATION (C &I)

2.2.0
SPECIFICATION FOR LCP

	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: For Permanent duty type pump (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.

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

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

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

3.1.10 All operable and indicating devices shall be mounted on the front of the panel while aux. Relays / timers MCBs etc. required for realization of control logics shall be mounted on a mounting plate inside the panel. Auxiliary relays and timers etc. shall be grouped according to the control function.
No operable or indicating devices shall be mounted below 750 mm and above 1800 mm (w.r.t. finished ground level). The devices shall be located in such a way so as to ensure easy access for operation / maintenance.

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

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

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

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

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

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

3.1.17 Local Panel shall be provided with main name plate of 150 mm x 40 mm size having inscription of 20 mm height. The individual devices on the panels shall be as provided with separate name plate with inscription of 3 mm height. The instrument / devices shall be provided with stick on label plates inside the panel. The material of the main and individual labels shall be three (3) ply 3 mm thick Traffolyte

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

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

3.2 Hazardous Area Panel Requirement

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

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

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

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

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

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

3.3 Control & Monitoring devices

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

3.3.2 Alarm Annunciator System

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

3.3.3 Relays

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

3.3.4 Timers

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

3.3.5 Control / Selector Switches

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

3.3.6 Push Buttons / Indicating Lights

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

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

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

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

3.3.7 Ammeters

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

3.3.8 Miniature Circuit Breaker (MCB)

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

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

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

4.0 TESTING AND INSPECTION

4.1 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.

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

5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

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

5.2. Mandatory Spares

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

5.3. Recommended Spares

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

6.0 DRAWINGS AND DOCUMENTS

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

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

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

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

7.0 MARKING AND PACKING

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

8.0 APPLICABLE DATA SHEET FORMS

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

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

FORM NO. PEM-6666-0

	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	■ 2.0 mm	
		OTHER	■ 2.0 mm	
		DOOR	■ 1.6 mm	
		HEIGHT	■ preferred height 2200 mm for permanent duty pumps(this shall be decided by BHEL during detailed engineering)	
		OTHER	☐ Load bearing sheet front shall have 3mm thickness	
TECHNICAL	INPUT POWER SUPPLY * (ANY OTHER POWER REQUIREMENT TO BE DERIVED FROM THIS SUPPLY ONLY)		☐ 240V 50 Hz AC ☐ 220V DC ■ 415V 3 PHASE	
	NO. OF FEEDERS		■ ONE ☐ TWO	
	STARTER WITH MCC		☐ REQUIRED ■ NOT REQUIRED	
	IPR POSITION		☐ MCC ■ RELAY PANEL	
	CONTACT RATING OF RELAY		☐ 5 Amp, 230 V AC 0.25 Amp, 220V DC	
	CONTROL SUPPLY		☐ 110V AC 240V AC ☐ 220V DC ☐ Other. (As per requirement)	
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)		AS REQUIRED.	
	TEMP SCANNER (IF REQUIRED –NO. OF CHANNELS TO BE SPECIFIED UNDER SEC-C)		■ REQUIRED ☐ NOT REQUIRED	
	PAINT TYPE		As per Clause 10.01.07 under specification for CONTROL PANELS AND DESK.	
	MIMIC (TYPE OF MIMIC- MATERAIL, THICKNESS TO BE SPECIFIED DURING DETAILED ENGG.)		■ REQUIRED ☐ NOT REQUIRED	
	PANEL COLOUR (EXTERNAL)		Front & Rear-RAL 9002; panel side RAL-5012.	
	FINISH (EXTERNAL)		☐ MATT ■ GLOSSY ☐ SEMI GLOSSY	
	PANEL COLOUR (INTERNAL)		– shall be same as external colour.	
	FINISH (INTERNAL)		☐ MATT ■ GLOSSY ☐ SEMI GLOSSY	
	CLASS OF PROTECTION		☐ IP-42 (FOR INDOOR SERVICE) ■ IP-55 (FOR OUTDOOR SERVICE) ☐ ANY OTHER	
	CONTROL HARDWARE		■ RELAY BASED	
	FOUNDATION ARRANGEMENT		■ FOUNDATION BOLTS ☐ ANCHOR FASTENERS	

FORM NO. PEM-6666-0

	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	
	SCOPE OF SUPERVISION FOR ERECTION & COMMISSIONING	■ APPLICABLE ☐ NA	

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

FORM NO. PEM-6666-0

	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.)			

FORM NO. PEM-6666-0

	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)

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

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

10.00.00 CONTROL PANELS AND DESK

10.01.00 General

10.01.07 Two spray coats of inhibitive epoxy primer-surface shall be applied to all exterior and interior surfaces. A minimum of 2 spray coats of final finish colour shall be applied to all surfaces. Exterior steel surface shall be sand blasted, ground smooth, filled, primed, sanded and smooth enamel painted to give a good finish subject to minimum paint thickness of 65-75 microns for sheet thickness of 3 mm and 50 microns for sheet thickness of 2 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 touch up paint shall be of the same type and colour as the factory applied paint and shall be carefully packed to avoid damage during shipment. Complete painting instructions shall be furnished.

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

Front & Rear-RAL 9002; End panel side- RAL 5012. Internal colour shall be same as external colour or brilliant white.

	ROURKELA PP-II EXPANSION (1x250 MW)	
	TECHNICAL SPECIFICATION (C&I) FOR SUMP PUMPS	

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LIST OF DOCUMENTS/DELIVERABLES

LIST OF DELIVERABLES OF PEM - C&I DEPARTMENT FOR SUMP PUMPS (ROURKELA PP-II EXPANSION (1x250 MW))							
		DOCUMENT NUMBER PE-GL-999-145-I100			SHEET 1 of 1		
Sl.No.	**DRAWING NO.**	**DRAWING/DOCUMENT TITLE**	**CATEGORY**	**CUSTOMER**	**FROM**	**USER**	**REMARKS**
		INSTRUMENTATION					
1	PE-V2-427-673-I901	INSTRUMENT DATA SHEETS	A	-	VENDOR	C&I	
2	PE-V2-427-673-I902	INSTRUMENT SCHEDULE	I	-	VENDOR	C&I	
3	PE-V2-427-673-I903	INSTRUMENT HOOK UP/INSTALLATION	A	-	VENDOR	C&I	
4	PE-V2-427-673-I904	FIELD JB TERMINATIONS	I	-	VENDOR	C&I	
5	PE-V2-427-673-I905	QUALITY PLANS	A	-	VENDOR	C&I	
		OTHER DOCUMENTS					
5	PE-V2-427-673-I955	I&C SYSTEM DESIGN BASIS REPORT INCORPORATING CONTROL PHILOSOPHY/OPERATION PHILOSOPHY/DESIGN PHILOSOPHY/REDUNDANCY PHILOSOPHY	A	-	VENDOR	C&I	
	Notes:						
		$$ - Approval by BHEL if Vendor BBU Item Approval by Customer if Customer BBU Item					

	ROURKELA PP-II EXPANSION (1x250 MW)	
	TECHNICAL SPECIFICATION (C&I) FOR SUMP PUMPS	

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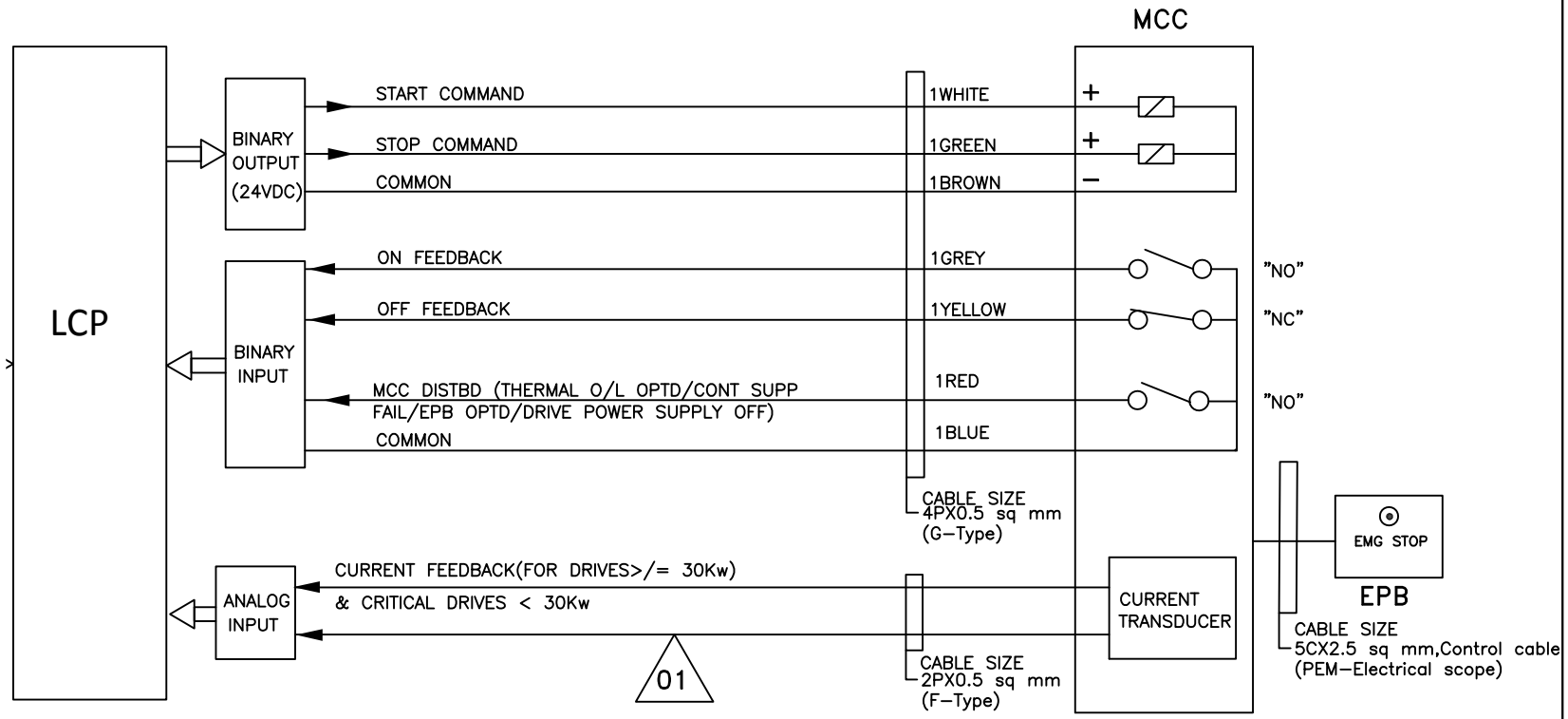
SIGNL EXCHANGE BETWEEN DRIVES & LCP (DCP)

DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE (CONTACTOR CONTROLLED) (LTUD)



BHEL	PROJECT: ROURKELA PP−II EXPANSION (1X250MW)	DRG.NO.	PE−DM−427−145−I002
		DATE	05.11.2016
	TITLE LCP ; INTERFACE FOR UNIDIRECTIONAL LT DRIVE	REV.NO.	02
		SHT	8 OF 14

	ROURKELA PP-II EXPANSION (1x250 MW)	
	TECHNICAL SPECIFICATION (C&I) FOR SUMP PUMPS	

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QUALITY ASSURANCE FOR INSTRUMENTS & LCP

TESTS / ITEMS	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Requirement as per standard (R)	WPS approval (A)	Non-destructive testing (R)	Calculation for accuracy (R)	Insulation Resistance (R)	IBR Certification as applicable (R)	Hydro test (R)	Material test certificate (A)
15. Cold junction compensation box	Y	Y	Y	Y					Y			
16. Orifice plate(BS-1042)	Y	Y	Y	Y *	Y	Y **	Y **			Y	Y **	Y
17. Flow nozzle(BS-1042)	Y	Y	Y	Y *	Y	Y	Y			Y	Y	Y
18. Impact head type element	Y	Y	Y					Y				Y
19. Level transmitter/float type switch	Y	Y	Y	Y					Y	Y	Y	Y
20. Flue Gas analyser	Y	Y	Y	Y								
21. Dust emission monitors	Y	Y	Y	Y								
*Calibration to be carried out on one flow element of each type and size if calibration carried out as type test same shall not be repeated.												
** If applicable												

R-Routine Test A- Acceptance Test Y – Test applicable

Note: 1) Detailed procedure of Environmental Stress Screening test shall be as per Quality Assurance Programme in General Technical Conditions

2) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.

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	1 OF 7

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

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

PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

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

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

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1 - BHEL 2 - Vendor 3 - Sub-vendor

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	3 OF 7

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

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

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

1 - BHEL
2 - Vendor
3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
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	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		2. Process parameters like bath temp. concentration etc.	MA	Measurement	Periodic	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		3. Dipping / Removal Time	MA	Measurement	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		4. Surface quality after every dip	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		5. Primer after phosphating	MA	Visual, Thickness	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		6. Putty Application & Rubbing after primer	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		7. Paint first coat	MA	Visual, Thickness	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		8. Putty Application and Rubbing after first coat of paint	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		9. Paint second coat	MA	Visual, Thickness, Scratch test Colour adhesion	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	

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

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

1 - BHEL
2 - Vendor
3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

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

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STANDARD QUALITY PLAN FOR LOCAL CONTROL 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	
		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	At Random by BHEL, based on 100 % internal test reports by Mfr.
		10. Wiring Layout	MA	Visual	100%	BHEL approved drg.	BHEL approved drg.	Inspection Report	2	1	1	
		11. Wire Termination	MA	Pulling manually	Sample	-----	Firm termination	Inspection Report	2	1	1	
		12. Continuity	MA	Electrical	100%	-----	Continuity OK	Inspection Report	2	1	1	

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

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	7 OF 7

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

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11.03.00 **TYPE TEST REQUIREMENT FOR C&I SYSTEMS**

Sl. No	Item	Test Requirement	Standard	Test To Be Specifically Conducted	NSPCL's Approval Req. On Test Certificate
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6

19	Junction Box	Degree Of protection test	IS-13947	No	Yes

Process actuated Switches	Degree of protection test	IS-2147	No	No

The Bidder shall submit for Owners approval the reports of all the type test as per latest IS-10918 carried out within last ten years from the date of Bid opening and the test(s) should have been either conducted at an independent laboratory or in presence / owners representative. The complete type test reports shall be for any rating of Battery in a particular group based on plate dimensions being manufactured by supplier.

Note:
Type Tests are to be conducted only for the items, which are being supplied as a part of this Package.

	ROURKELA PP-II EXPANSION (1x250 MW)	
	TECHNICAL SPECIFICATION (C&I) FOR SUMP PUMPS	

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SUB VENDOR LIST

		METPRESS, CALCUTTA
		HP VALVES AND FITTINGS, CHENNAI
		MAIN CONTRACTOR APPROVED SOURCES
35	ELECTRIC TO PNEUMATIC CONVERTER	IM NORGEN, INDIA
		FAIR CHILD, USA
		ABB, INDIA
36	CONDUITS LEAD COATED (FLEXIBLE)	PLLCA, GH\AZIABAD
37	INTELLIGENT BATTERY CHARGER 24 V DC & DCDB / BHMS	CHABBI ELECTRICALS, JALGAON
		ELTECH, GURGAON
		MASTECH, JALGAON
38	BATTERY HEALTH MONITORING SYSTEM	EMERSON, MUMBAI
		ELTCK SGS PVT LTD., GURUGAON
39	BATTERY (NI-CD)	AMCO SAFT, BANGALORE
		SAFT, FRANCE / SWEENEN
		HBL POWER, HYDERABAD
40	SOCKET WELD FITTINGS	MAIN CONTRACTOR APPROVED SOURCES
41	IMPULSE PIPE & TUBES	MAHARASHTRA SEAMLESS, RAIGARH
		SUMITOMO / KAWASAKI / NIPPON, JAPA
		TPS TECHNITUBE, GERMANY
		VELURIC &MANESSMANN, GERMANY
		BHEL, TRICHY
		TROUVAY AND CAUVIN, FRANCE
		ISMT, AHAMADNAGAR
		SANDVIK
42	COMPRESSION FITTINGS	HAMLET, ISRAIL
		PARKER, USA
		PRECISION, MUMBAI
		DK TECH, KOREA
		HY LOK, KOREA
		ASTECH MUMBAI
		HYDAIR (FLUID CONTROL), MUMBAI
		HP VALVES AND FITTINGS, CHENNAI

		YARWAY, USA
		LEVELSTATE, UK
56	LEVEL SWITCH - FLOAT / DISPLACER TYPE	RAMAN INSTRUMENTS, DELHI
		ENDRESS & HOUSER, AURANGABAD
		MAGNETROL, BELGIUM
		LEVCON, KOLKATA
		SBEM, PUNE
		CHEMTROLS SAMIL, MUMBAI
		NAKATIYA, JAPAN
		SIGMA INDUSTRIES, MUMBAI
		DK INSTRUMENT, KOLKATA
		PUNE TECHTROL, PUNE
		V AUTOMAT, NEW DELHI
		LEVEL STATE, UK
		GAUGES BOURDON (GIC), PANVEL
57	AIR FILTER REGULATOR	FAIR CHILD, USA
		SHAVO NORGEN, MUMBAI
		SMC PNEUMATICS, NOIDA
		EMERSON (ASCO), CHENNAI
		FESTO, BANGALORE
		PLAKA, CHENNAI
58	COPPER TUBING / BRASS CONNECTORS	MAIN SUPPLIER APPROVED SOURCES
59	COUPLING / INTERPOSING RELAYS	PARAMOUNT, BANGALORE
		OMRON
		OEN
		JYOTI, BARODA
		ELSTA, SWITZERLAND
60	SOLENOID VALVE	ROTEX, VADODRA
		AVCON, MUMBAI
		HERION, GERMANY
		IMI NORGEN, GERMANY
		JAFFERSON, ARGENTINA
		ASCO, CHENNAI/USA
		FESTO, BANGALORE
		SMC PNEUMATICS, NOIDA

66	TERMINAL BLCOK (CAGE & CLAMP TYPE)	WELDMULLER, GERMANY
		PHONIX, GERMANY / INDIA
		WAGO, GERMANY / INDIA
		ELMEX, VADODARA
67	FRP JUNCTION BOX	REFER ELECTRICAL LIST
68	PLC SYSTEM (IF APPLICABLE)	ABB
		SCHNEIDER, NASIK
		ROCKWELL, SAHIBABAD
		SIEMENS, NASIK
69	SMART POSITIONER	ABB
		MASOLENIEN
		SIEMENS
		SAMR
		YOKOGAWA
		EMERSON (FISHER RESEMOUNT)
		MESTO
70	ROTAMETER	IEPL, HYDERABAD
		TRACE, HYDERABAD
		PLACKA, CHENNAI
		EUREKA, PUNE
		SCIENTIFIC DEVICES, MUMBAI
		FLOW STAR, FARIDABAD
		TOKYO KEISO, JAPAN
71	SINGLE AND MULTI POINT TEMPERATURE RECORDER (MICROPROCESSOR BASED)	YOKOGAWA INDIA, BANGALORE
		CHINO CORPORATION, JAPAN
		EUROTHERM, UK
		YOKOGAWA, JAPAN
		ABB, UK/GERMANY
		FUJI, JAPAN
		HONEYWELL, USA / NETHERLAND
72	RESERVE ROTATION INDICATOR (RRI)	GE BENTLY, USA
		SHINKAWA, JAPAN
		PROTOCONTROL, PUNE
73	INSTRUMENT TUBE FITTINGS (AIR)	MAIN SUPPLIER APPROVED SOURCES

25.	GI PIPE	BIS LICENSEE
26.	STEEL CONDUIT/EXPOXY COATED CONDUIT	BIS LICENSEE
27.	LEAD COATED FLEXIBLE CONDUITS	M/S PLICA, GHAZIABAD
28.	JUNCTION BOXES/LINK BOXES TEST LINK BOX /ADAPTOR BOX	M/S POSITRONICS, VADODRA
		M/S PYROTECH, UDAIPUR
		M/S CONQUERENT CONTROL SYSTEM LTD, MANESAR
		M/S JAKSON, NOIDA
		M/S SWITCHING CIRCUIT, KOLKATA
		M/S SARVANA SWITCHGEAR, BANGALORE
		M/S AJMERA, MUBAI
29.	JUNCTION BOXES-FRP/THERMOSETTING PLASTIC/THERMO PLASTIC	SUMIP COMPOSITES, AHMEDABAD
		KEMROCK, VADODARA
		AJMERA, MUMBAI
		TRINITY TOUCH, PALWAL
30.	LT CABLE STRAINGHT THROGH JOINTING KIT	M/S RAYCHEM, MUMBAI
		M/S 3M ELECTRO & COMMUNICATION., PUNE
31.	HT CABLE TERMINATION KITS & STRAIGHT THROUGH JOINTING KIT	M/S 3M ELECTRO & COMMUNICATION., PUNE
		RAYCHEM, MUMBAI
32.	CABLE GLAND	M/S SUNIL & CO. KOLKATA
		M/S ARUP ENGG. KOLKATA
		M/S COMET, MUMBAI
		M/S QUALITY PRECISION, KOLKATA
		M/S STANDARD METAL, MUMBAI
		M/S BRACO, MUMBAI
33.	CABLE LUGS/FERRULES	M/S DEWELL, MUMBAI
		3D, UMBERGAON
		CHETNA, NASIK
34.	TUBULAR POLE	BIS LICENSEE AS PER IS 2713 WITH VALID CML NO.
35.	LIGHTING FIXTURES WITH ACCESSORIES (FILAMENT TYPE)	M/S CGL, MUMBAI
		M/S BAJAJ ELECTRICALS, MUMBAI
		M/S PHILIPS, NOIDA
		M/S WIPRO, MUMBAI
38.	LAMPS (FILAMENT TYPE)	M/S CROMPTON, MUMBAI
		M/S BAJAJ ELECTRICALS, MUMBAI
		M/S PHILIPS, NOIDA

SUB VENDOR LIST

SLNO	Package Name	Vendor Name	Vendor Address
1	FLOW ELEMENT - ORIFICE	DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD.	Mr. Yogish M. Kulkarni Plot # 23, Udyambag, Belgaum-karnataka-India Phone- 0831-4210386 Pincode : 590008 Email : yogish@dyna-fluid.com
2	FLOW ELEMENT - ORIFICE	Flow Star Engineering Pvt. Ltd.,	MR. KHALID AKHTAR/MR. TAPAN KUMAR JANA Plot No-7 F/2, Northern India Industrial 20/3, Mathura Road FARIDABAD-HARYANA-INDIA Phone- 9818176380 Pincode : 121005 Email : khalid@flowstar.co.ir
3	FLOW ELEMENT - ORIFICE	HYDROPNEUMATICS PVT. LTD.	Mr. DM Bichu G/B, Hill Crown Apts., College Road Mapusa-Goa-India Phone- 0832-2360364 Pincode : 403507 Email : ajayrc@hydropneumatics.co.in
4	FLOW ELEMENT - ORIFICE	INSTRUMENTATION LTD.	KANJIKODE WEST, PALALKKAD, PALAKKAD-KERALA-INDIA Phone- 2566127-130,2567128 Pincode : 678623 Email : icvldil@gmail.com;fa2@ilpgt.com
5	FLOW ELEMENT - ORIFICE	INSTRUMENTATION ENGINEERS PVT LTD	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, IDA, JEEDIMETLA HYDERABAD-TELANGANA-INDIA Phone- 9848407365 Pincode : 500055 Email : iedelhi@ieflowmeters.com
6	FLOW ELEMENT - ORIFICE	MICRO PRECISION PRODUCTS PVT. LTD.	K.P. CHANDHOK/ATUL CHANDHOK 4, LINK ROAD, FARIDABAD-HARYANA-INDIA Phone- 9810265688 Pincode : 121002 Email : pal@microa1.com
7	FLOW ELEMENT - ORIFICE	STAR-MECH CONTROLS (I) PVT.LTD.	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE-MAHARASHTRA-INDIA Phone- 02026970450 Pincode : 411028 Email : marketing@starmech.net
8	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
9	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
10	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,
11	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
12	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
13	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
14	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
15	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
16	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
17	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
18	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
19	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
20	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
21	INSTRUMENTS PIPE 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
22	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
23	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
24	INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI-MAHARASHTRA-INDIA Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
25	INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI-DELHI-INDIA Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com

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.

26	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	JIGNESH MAHENDRA AJMERA 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
27	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
28	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
29	JUNCTION BOX	SUCHITRA INDUSTRIES	NO-2,OPP-27 AECS LAYOUT 2ND STG REJAMAHALVILAS EXTN 2ND STG BANGALORE -- Phone- Pincode : Email : suchitra.industriesblr@gmail.com
30	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
31	LEVEL GAUGE	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
32	LEVEL GAUGE	TOSHNIWAL BROTHERS PVT.LTD.	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER-RAJASTHAN-INDIA Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com
33	LEVEL GAUGE	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
34	LEVEL SWITCH-CAPACITANCE TYPE	Flow Star Engineering Pvt. Ltd.,	MR. KHALID AKHTAR/MR. TAPAN KUMAR JANA Plot No-7 F/2, Northern India Industrial 20/3, Mathura Road FARIDABAD-HARYANA-INDIA Phone- 9818176380 Pincode : 121005 Email : khalid@flowstar.co.ir
35	LEVEL SWITCH-CAPACITANCE 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
36	LEVEL SWITCH-CAPACITANCE TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.	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
37	LEVEL SWITCH-CAPACITANCE 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
38	LEVEL SWITCH-CAPACITANCE TYPE	Sapcon Instrument Pvt Ltd.	131, PALSHIKAR COLONY Contact Person- Mr. Ashwin (9826080207) INDORE-MP-INDIA Phone- +91-731-4085751, Pincode : 452004 Email : sales@sapconinstruments.com
39	LEVEL SWITCH-CAPACITANCE 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
40	LEVEL SWITCH-CAPACITANCE 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,
41	LEVEL SWITCH-CAPACITANCE 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
42	LEVEL SWITCH-CAPACITANCE TYPE	NIVO CONTROLS PVT. LTD.	MR.PRAVEEN TOSHNIWAL/MR. NITIN TAMHANE 104-115, ELECTRONIC COMPLEX, INDORE-MAHARASHTRA-INDIA Phone- 07314081300 Pincode : 452010 Email : sales@nivocontrols.com
43	LEVEL SWITCH-CAPACITANCE TYPE	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune-Maharashtra-INDIA Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com
44	LEVEL SWITCH-CONDUTIVITY 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
45	LEVEL SWITCH-CONDUTIVITY 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,
46	LEVEL SWITCH-CONDUTIVITY 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
47	LEVEL SWITCH-CONDUTIVITY TYPE	RAMAN INSTRUMENTS PVT.LTD.	Mr. N R Shenoy/Mr G B Vijh 8, First Floor.Plot : 160A Bait-Ush-Sharaf, 29th Road,Bandra(W) MUMBAI-Maharashtra-India Phone- 09892331381 Pincode : 400050 Email : ramanbpl@vsnl.com
48	LEVEL SWITCH-CONDUTIVITY TYPE	Sapcon Instrument Pvt Ltd.	131, PALSHIKAR COLONY Contact Person- Mr. Ashwin (9826080207) INDORE-MP-INDIA Phone- +91-731-4085751, Pincode : 452004 Email : sales@sapconinstruments.com
49	LEVEL SWITCH-CONDUTIVITY TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.	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
50	LEVEL SWITCH-CONDUTIVITY 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
51	LEVEL SWITCH-CONDUTIVITY TYPE	HI-TECH SYSTEMS & SERVICES LTD.	Mr. Vikash Agrawal/Mr. Tarun Debnath 119, PARK STREET , KOLKATA-West Bengal-India Phone- 033-22290045 Pincode : 700016 Email :

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.

52	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
53	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
54	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
55	LEVEL SWITCH-FLOAT TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.	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
56	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
57	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.ir
58	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
59	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,
60	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
61	LEVEL SWITCH-FLOAT TYPE	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune-Maharashtra-INDIA Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com
62	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
63	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
64	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
65	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
66	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,
67	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
68	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
69	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
70	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS INDUSTRIES LIMITED	B-20-21, INDUSTRIAL AREA, MEERUT ROAD, GHAZIABAD-UP-INDIA Phone- 0120-2712016 Pincode : Email : mktg@indfos.com
71	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	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
72	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	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
73	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	DRESSER INDUSTRIES INC.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol-Gujarat-India Phone- 02764-233682 Pincode : 382729 Email : Nishit.patel@ashcroftindia.com
74	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS (INDIA) LIMITED	MR.L.C.VENKATRANGAN/MR.B.KANNAN New No.17, II Floor, Adwave Towers, Dr.Sevalia Shivaji Salai, T.Nagar Chennai-TamilNadu-INDIA Phone- +91 44 24353407 Pincode : 600017 Email : delhi@indfos.com
75	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Barksdale GmbH, Germany	Michael Weileder Dorn Assenheimer, Strasse 27 Reichelsheim--Germany Phone- +91-9999107840 Pincode : D-61203 Email : msingh@barksdale.de
76	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Kaustubha Udyog,	S.No. 36/1/1, Sinhgad Road, Vadgaon Khurd, Near Lokmat Press, Pune,-Maharashtra,-India, Phone- 020-24393577, Pincode : Email : pressure@vsnl.com,
77	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	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,
78	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	B Kannan/V S Jayaprakash 9, SOUTH BOAG ROAD, II FLOOR, PB NO-1423, T.NAGAR, CHENNAI-TAMIL NADU-INDIA Phone- 044-24340999 / 24344 Pincode : 600017 Email : marketing@switzerinstrument.com

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.

	ROURKELA PP-II EXPANSION (1x250 MW)	
	TECHNICAL SPECIFICATION (C&I) FOR SUMP PUMPS	

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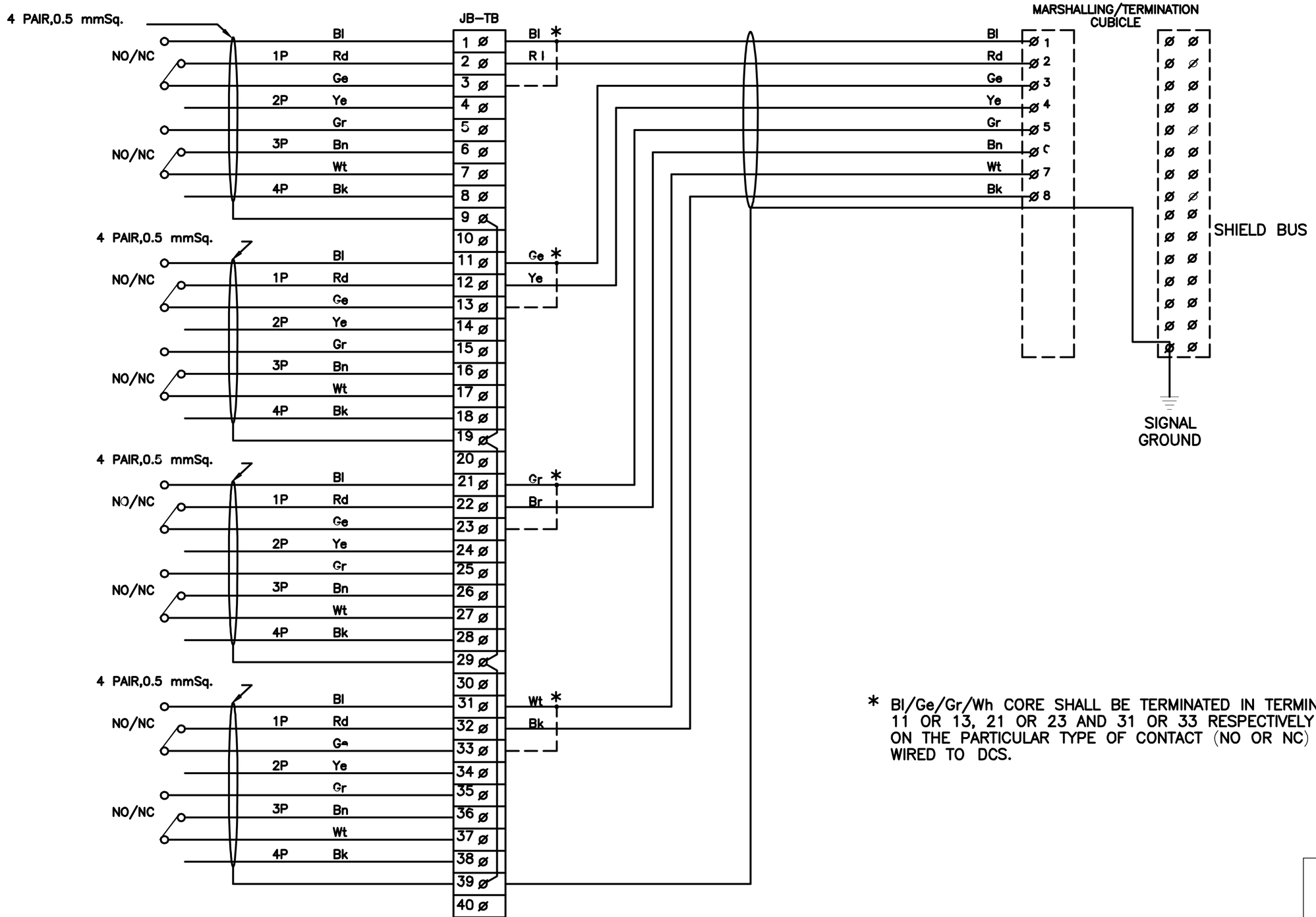
CABLE INTERCONNECTION AND TERMINATION PHILOSOPHY



* Bl/Ge/Gr/Wh CORE SHALL BE TERMINATED IN TERMINAL 1 OR 3, 11 OR 13, 21 OR 23 AND 31 OR 33 RESPECTIVELY DEPENDING ON THE PARTICULAR TYPE OF CONTACT (NO OR NC) IS TO BE WIRED TO DCS.

FOR TENDER PURPOSE ONLY

NSPCL DRG. NO. : 0000–999–PEI–A–020

NTPC SAIL POWER COMPANY (P) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV.No.	DATE	ZONE	DESCRIPTION	BY	VERIFIED
			REVISIONS		

REFERENCES — DRG. No.

SECTION	PP & EE
LOCATION	RANCHI
DESIGNED	SKD
DRAWN	SATISH
CHECKED AND VERIFIED	SKD
APPROVED	
SIG.	
DATE:	

PROJECT– 1 X 250 MW POWER PROJECT AT ROURKELA

INTERFACING OF FIELD INSTRUMENTS
SWITCH TERMINATION DETAILS NO/NC

SCALE – NTS | SHEET 1 OF 1 | REV 0

DRG.No.MEC/TS/11/E5/G24F/C&I/025

07.00.09 FIELD MOUNTED LOCAL JUNCTION BOXES

(i)	No. of ways	12/24/36/48/64/72/96/128 with 20% spares terminals.
(ii)	Material and Thickness	4mm thick Fiberglass Reinforced Polyester (FRP).
(iii)	Type	Screwed at all four corners for door. Door gasket shall be of synthetic rubber.
(iv)	Mounting clamps and accessories	Suitable for mounting on walls, columns, structures etc. The brackets, bolts, nuts, screws, glands required for erection shall be of SS, included in Bidders scope of supply.
(v)	Type of terminal blocks	Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm^2. A M6 earthing stud shall be provided.
(vi)	Protection Class	IP: 55 minimum for indoor & IP-65 minimum for outdoor applications.
(vii)	Grounding	To be provided.
(viii)	Color	RAL 7305.

At least 20% spare unused terminals shall be provided everywhere including local junction boxes,

SECTION III

DOCUMENTS TO BE SUBMITTED BY BIDDER

SECTION IIIA

COMPLIANCE CERTIFICATE

(TO BE SUBMITTED ALONG WITH BID)

	TITLE :	SPECIFICATION: PE-TS-427-172-N001 NUMBER
	TECHNICAL SPECIFICATION SUMP PUMPS	SECTION: IIIA
	COMPLIANCE CERTIFICATE	Date: 03.04.17
		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

SECTION IIIB

GA DRAWING OF SUMP PUMPS

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

SECTION IIIC

DEVIATION SCHEDULE
(AS PER NIT FORMAT)

(TO BE SUBMITTED ALONG WITH BID)

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)

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.	VERIFICATION FROM MOTOR DATASHEET (Y/N)	KKS NO
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOs						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

ANNEXURE-II

NOTES:
1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)/ CUSTOMER
2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V
: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

	LOAD DATA (ELECTRICAL)	JOB NO.	427	ORIGINATING AGENCY		PEM (ELECTRICAL)
		PROJECT TITLE	1 x 250MW ROURKELA POWER PROJECT	NAME		DATA FILLED UP ON
		SYSTEM	SUMP PUMP	SIGN.		DATA ENTERED ON
		DEPTT. / SECTION	MSE	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE

CABLE SCHEDULE FORMAT

ANNEXURE III

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

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

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