2 X 660 MW SURATGARH STPS UNIT 7 & 8

VOLUME -IIB

TECHNICAL SPECIFICATION
FOR
SUMP PUMPS

Specification No.: PE-TS-392-172-N001 (REV. 0)

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA- 201 301

1.0 The tender document contains three (3) volumes. The bidder shall meet the requirements of all the three volumes.

1.1 Volume -I CONDITIONS OF CONTRACT

This consists of four parts as below:

Volume - I A : This part contains instructions to bidders for making bids to BHEL.

Volume - I B : This part contains general commercial conditions of the tender and include provision that vendor shall be responsible for the quality of item supplied by their sub-vendors.

Volume - I C : This part contains special conditions of contract.

Volume - I D : This part contains commercial conditions for erection and commissioning site work, as applicable.

1.2 Volume - TECHNICAL SPECIFICATIONS

Technical requirements are stipulated in Volume II which comprises of:

Volume - II A : General Technical Conditions

Volume - II B : Technical specification including drawings, if any

1.2.1 Volume - II B :

This volume is sub-divided into following sections:

Section - A : This section outlines the scope of enquiry.

Section - B : This section provides “Project Information”

Section - C : This section indicates technical requirements specific to the contract, not covered in Section-D.

Section - D : This section comprises of technical specifications of equipments complete with data sheet A, B & C.
Data sheet-A specifies data and other requirements pertaining to the equipment.
Data sheet - B specifies data to be filled by the bidder (Data Sheet B is contained in Volume - III)
Data sheet - C indicates data documents to be furnished after the award of contract as per agreed schedule by the vendor (as applicable).

1.2.2 Volume - III TECHNICAL SCHEDULES

This volume contains technical schedules and Data Sheets - B, which are to be duly filled by the bidder and the same shall be furnished with the technical bid.

2.0 The requirements mentioned in Section C/Data Sheets-A of Section-D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in thedescriptive portion in Section -D.

CONTENTS

SECTION - A

SCOPE OF ENQUIRY

1.00.00 **SCOPE**

This enquiry covers the design, manufacture, assembly, inspection and testing at manufacturer's and/or his sub-contractors works, proper packing, delivery of the item namely Sump Pumps complete with all accessories as per the requirements specified in this specification for 2X660 MW SURATGARH STPS UNIT 7 & 8as per Annexure-I.

2.00.00 **GENERAL TECHNICAL INSTRUCTIONS**

2.01.00 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship, and shall be capable of performing the required duties in a manner acceptable to Engineer/Owner, who will interpret the meaning of drawing and specifications and shall be entitled to reject any component or material, which in his judgement is not in full accordance herewith.

2.02.00 The omission of specific reference to any component/accessory necessary for the proper performance of Sump Pumps and drives shall not relieve the bidder of the responsibility of providing such facilities to complete the supply of Sump Pumps and drives at quoted prices.

2.03.00 BHEL's/Customer's representative shall be given access to the shop in which the equipments are being manufactured or tested and all test records shall be made available to him.

2.04.00 The equipments covered under this specification shall not be despatched unless the same have been finally inspected, accepted and shipping release issued by BHEL/customer.

2.05.00 In case of any deviation from this technical specification (Vol.IIB) and General Technical Conditions (Vol.IIA), the same shall be indicated in the schedule of deviations enclosed in Vol.III. In the absence of duly filled schedules it will be assumed that the bid strictly conforms to the specification.

2.06.00 Unpriced copy of the price bid shall be furnished alongwith the technical bid.

ANNEXURE-I

1. 2 X 660 MW SURATGARH STPS UNIT 7 & 8

Sl. No.	Description	Type of Pumps	Total Qty.
1.	Fixed Duty type Submersible pumps forCW Pit in TG Hall	Submersible type	4 Nos.for station
2.	Fixed Duty type Submersible pumps forPit in Rain Water collection tanks	Submersible type	4 Nos. for station
3.	Portable Type Submersible Pumps to be used for dewatering CW P/H Sump,Filtered water P/H, Raw water P/H & River Water Intake P/H	Submersible type	8 Nos. for station
4.	Portable Type Submersible Pumps to be used for dewatering Desilting chamber	Submersible type	2 Nos. for station
5.	Portable Type Submersible Pumps to be used for dewatering of various cable Trenches at various locations.	Submersible type	4 Nos. for station
6.	Portable Type Submersible Pumps to be used for dewatering of various sumps of the plant	Submersible type	8 Nos. for station
7.	Portable Type Submersible Pumps to be used for dewatering of various sumps of the plant	Submersible type	4 Nos. for station
8.	Portable Diesel Engine Driven Pumps to be used for dewatering of various sumps of the plant	-	2 Nos. for station

SECTION – B

PROJECT INFORMATION

1.0	Owner	Rajasthan Rajya Vidyut Utpadan Nigam Ltd., Jaipur
2.0	Consulting Engineer	TATA Consulting Engineers Ltd. 73/1, St. Marks Road, Bangalore – 560 001 Tel : 080 – 6622 6000 Fax : 080 – 22274874
3.0 4.0	Location of the plant Latitude and longitude	Prabat Nagar, Suratgarh Sriganganagar district, Rajasthan. Latitude : 29 deg. 10 min. N Longitude : 74 deg.01 min. E
5.0	Elevation above mean sea level	186 m (approximate)
6.0	**Climatic conditions**	
6.1	Temperatures : Monthly basis	
	Mean of daily max.	32.8 deg.C (in the month of May)
	Mean of daily min.	17.6 deg.C (in the month of Jan)
6.2	Temperatures : Annual basis	
	Mean of daily max.	32.3 deg.C
	Mean of daily min.	19.6 deg.C
	Highest temperature recorded	50 deg.C
	Lowest temperature recorded	(-) 2.8 deg.C
	Design Ambient Temperature for Electrical Equipment design	50 deg C
6.3	Relative humidity	Varies between 21% and 81%
6.4	Annual average rain fall	312 mm
6.5	Annual mean wind speed :	4 km / hr.
7.0	Wind load	

	Calculations for wind effect shall be in accordance with IS:875-1987(Part-3) taking into account the following:	
	a) Basic wind speed = 47 m/sec	
	b) Factor K1 = 1.07	
	c) Category of terrain = Category 2	
	d) K3 – as per IS 875	
8.0	Seismic data (As per IS: 1893 latest issue)	
	a) Zone	Zone II
	Designs & design coefficients shall be based on IS 1893:2002	
	Design condenser cooling water inlet temperature	33 Deg C
9.0	Auxiliary power supply:	
	Auxiliary electrical equipment to be supplied against this specification shall be suitable for operation on the following system:	
a)	For motors rated 160 kW and below.	415V AC, 3-phase, 3-wire effectively earthed.
b)	For motors rated above 160 kW and up to 1500 kW	6600V AC, 3-phase, 3-wire, 50 Hz, non-effectively earthed
c)	For motors rated above 1500kW	11000V AC, 3-phase, 3-wire, 50 Hz, non-effectively earthed
d)	For motor control centres	415V AC, 3-phase, 3/4-wire effectively earthed.
e)	DC motor starters, DC solenoids, DC alarm control and protection	220 V DC, 2-wire unearthed
f)	AC control & protective devices	110 V 1 phase, 50Hz, 2 wire AC supply. The single phase 110V AC supply shall be derived by VENDOR by providing 415V / 110 V Control transformers of adequate rating with MCCB / MCB on both the primary and secondary sides.
g)	Uninterrupted power supply	230 V, 1-phase, 50 Hz, 2-wire, AC

		supply (For all instrumentation and control system equipment and solenoid valves)

g) Lighting fixtures and space heaters — 240 V, 1 phase, 2 wire, 50Hz,solidly earthed system

h) Construction supply — 415 V, 3 phase, 4 wire, 50Hz AC supply with neutral lead solidly earthed.

i) The above voltages may vary as follows :

All devices shall be suitable for continuous operation over the entire range of voltage and frequency indicated below without any change in their performance.

AC supply	Voltage variation ± 10% Frequency variation ± 5% Combined voltage & frequency variation 10%
DC supply	Voltage variation +10% ,-15%
j) For instrument and control system of steam generator and steam turbine generator.	230 V ± 5% AC UPS, 1-phase, 50 Hz, 2-wire. The 24 V DC required for control system shall be generated from this UPS.

10.0 All the electrical equipment shall be designed for 50^{o} C reference ambient temperature.

ANNEXURE –1

RAW WATER ANALYSIS

Water samples are yet to be analysed in order to arrive at design quality. However, the following shall be considered for this enquiry

SL. NO.	Constituent	Unit	Value
1.	P^H	-	8.5
2.	Color and odor		
3.	Oil and grease	mg/l	DN
4.	BOD		3
5.	COD		20
6.	Suspended solids	mg/l	200
7.	Turbidity	NTU	200
8.	Calcium hardness as $CaCO_3$	mg/l	74
9.	Magnesium hardness as $CaCO_3$	mg/l	52
10.	Sodium as Na	mg/l	61
11.	Potassium as $CaCO_3$	mg/l	-
12.	Chloride as cl	mg/l	39
13.	Sulphate as So_4	mg/l	48
14.	Sulphide as S	Mg/l	-
15.	M- Alkalinity as $CaCO_3$	mg/l	140
16.	P-Alkalinity as $CaCO_3$	mg/l	Nil
17.	Nitrates as No_3	mg/l	17
18.	Nitrites as NO_2	mg/l	Nil
19.	Silica as SiO_2 – Dissolved	mg/l	15
20.	Silica as SiO_2 – Colloidal	mg/l	0.6
21.	Iron as CaCo3-dissolved	mg/l	0.5
22.	Iron as Fe-suspended	mg/l	0.1
23.	Total dissolved solids	mg/l	393

24.	Conductivity at 25^0C	μ-mho/cm	500
25.	Dissolved Oxygen as O_2	mg/l	5.0
26.	Carbon dioxide free	mg/l	5

1. The analysis given above shall be utilised for Bidding Purpose Only.

2. For design raw water analysis, the successful Contractor shall conduct physical & chemical tests to estimate the quality of raw water.

3. Should there be any change in the design raw water quality (based on physical & chemical tests, carried out by the successful contractor) from the analysis given above, the CONTRACTOR shall provide necessary alterations in the pre treatment & DM plant designs without any commercial implications.

CLARIFIED WATER ANALYSIS

SL. NO.	Constituent	Unit	Value
1.	pH	-	8.5
2.	Color and Odor		
3.	Oil and grease	mg/l	ND
4.	BOD		3
5.	COD		20
6.	Suspended solids	mg/l	<15
7.	Turbidity	NTU	<15
8.	Calcium hardness as CaCO3	mg/l	74
9.	Magnesium hardness as CaCO3	mg/l	52
10.	Sodium as Na	mg/l	61
11.	Potassium	mg/l	-
12.	Chloride as cl	mg/l	39
13.	Sulphate as So4	mg/l	48
14.	Sulphide	mg/l	-
15.	M- Alkalinity as CaCO3	mg/l	140
16.	P-Alkalinity as CaCO3	mg/l	Nil
17.	Nitrates as No3	mg/l	17
18.	Nitrite	mg/l	Nil
19.	Silica as SiO2 – Dissolved	mg/l	15
20.	Silica as SiO2 – Colloidal	mg/l	0.6
21.	Iron as Fe-dissolved	mg/l	0.5
22.	Iron as Fe-suspended	mg/l	0.1
23.	Total dissolved solids	mg/l	393
24.	Conductivity at 250C	-mho/cm	500
25.	Dissolved Oxygen as O2	mg/l	5.0
26.	Carbon dioxide free	mg/l	5

SECTION - C

SPECIFIC TECHNICAL REQUIREMENTS

SECTION C1: SPECIFIC REQUIREMENTS FOR SUMP PUMPS

SECTION C2: SPECIFIC REQUIREMENTS FOR ELECTRICAL EQUIPMENTS

SECTION C3: SPECIFIC REQUIREMENTS FOR C&I EQUIPMENTS

SECTION - C1

SPECIFIC TECHNICAL REQUIREMENTS FOR SUMP PUMPS

1.0 INTENT OF SPECIFICATION:

This specification is intended to cover the design, manufacture, inspection/ testing at manufacturer's works, properly packed for transportation/ delivery to site of following sump pumps and drives complete with accessories as specified and as required for

2X 660 MW SURATGARH STPS UNIT 7 & 8

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

The bidder shall include complete supplies for the project in his scope; part supplies offered for project shall disqualify the offer.

2.0 SCOPE OF SUPPLY:

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

2.2.0 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. (For motor Driven Pumps)

b) Diesel Engine drive with suitable interconnections (for Diesel Engine driven Pumps)

c) Self contained lubrication system.

d) Erection & commissioning spares, as required.

e) Supply of first fill of lubricants including second fill/ replenishment as necessary after commissioning and handing over of equipments.

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

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

a). For Fixed Submersible pumps

For each of these pumps a supply feeder upto starter cum control panel shall be made available by BHEL. The following to be included in pump bidder scope.

- One No. wall mounted local control panel for each set of two(2) Nos. of pumps per unit. The common LCP shall also house starter panel of 2 Nos. 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 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.
- MS piping complete with 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 MS pipe with pump discharge and connecting with discharge pipe works of purchaser shall be as per clause no. 2.2.4 below. The arrangement of Piping for Fixed Pumps has been indicated in Annexure II.
- 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.
- 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
- Pressure gauge at discharge of each pump with 3-way isolating root valve as per datasheet.
- 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 to 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.

  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. 2.2.5 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.

c) For **Portable trolley mounted Diesel Engine Driven**sump pumps:

The following to be included in pump bidder scope.

- Wheel trolley for carrying pump and drive unit

  The trolley shall be provided with "Hose Reeling Drums".

  The pump & diesel engine 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.

- Hose pipe at discharge 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. 2.2.5 below.
- Suction hose pipe along with foot valve.
- Delivery bends.
- Skirt base with suction strainer as applicable.
- Suitable handling attachments on the pump diesel engine assembly frame for moving from one place to another.

2.2.3 Rust inhibiter paint at Manufacturer's works.

2.2.4 Arrangement of connecting MS pipe with pump discharge & discharge pipe of purchaser.

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 MS pipe with flanged connection.

In case expander / reducer is required, flange connected with delivery bend shall be connected to reducer / expander. MS pipe shall be connected to reducer expander with flanged connection.

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

2.2.5 Arrangement of connecting hose with pump discharge & discharge pipe of purchaser.

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 pie 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.

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

2.2.7 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 alongwith the bid.

6.0 **OTHER REQUIREMENTS**:

6.1 In case of contradictions between Section-C, Section-D and Data Sheet-A, the prevailing document shall be in this order:

a) Data Sheet -A
b) Section - C
c) Section - D

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 Submersible pumps:**

Submersible Sump Pumps shall be controlled through a wall mounted starter cum control panel (in bidder's scope) for each set of Two (2) pumps.

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 canopy

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

Normally one pump will be running and the other an auto standby, however, in the event of very high level both pumps shall run.

(a) Start/stop facility.

(b) If any of the working sump pumps trips due to electric fault etc. the standby sump pump will come into operation automatically.

(c) Selector switch for main/standby selection.

(d) One number level switch (high level) provided in the sump shall start one number sump pump in the event of high water level in the sump.

(e) One number level switch (very high level) provided in the sump shall start second sump pump in the event of very high water level in the sump.

(f) One number level switch (low level) provided in the sump shall trip the running pumps in the event of very low water level in the sump.

(g) Sump pump status indication (ON/Off/Trip).

(h) Indication for failure of any sump pump.

(i) Indication for Low voltage, low level, high level and overload.

(j) Ammeter shall be provided in LCP if motor rating is 30 KW or above.

(k) Power and Control circuits shall be with MCCB.

(l) Alarm shall be annunciated in the event of low water level in the sump.

Important note: In order to make equal running of pumps, provision for duty standby selection of pumps shall be provided by bidder.

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 during contract stage.

11.0 It is mandatory for the bidder to submit alongwith 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 any thing 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 alongwith accessories for rated, performance duties, including the acoustical/ vibrational aspects for the stipulated limits specified elsewhere in the specification.

13.0 **DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE :**

After award of LOI, the successful bidder shall submit drawings/documents as per NIT.

14.0 The various Sections-C's & D's along with Data Sheets attached in this specification together with the specification for Sump Pumps shall be complied with by the bidders.

15.0 Bidder to submit all drawing/ documents in soft as well as hard copy as per NIT in the event of order.

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

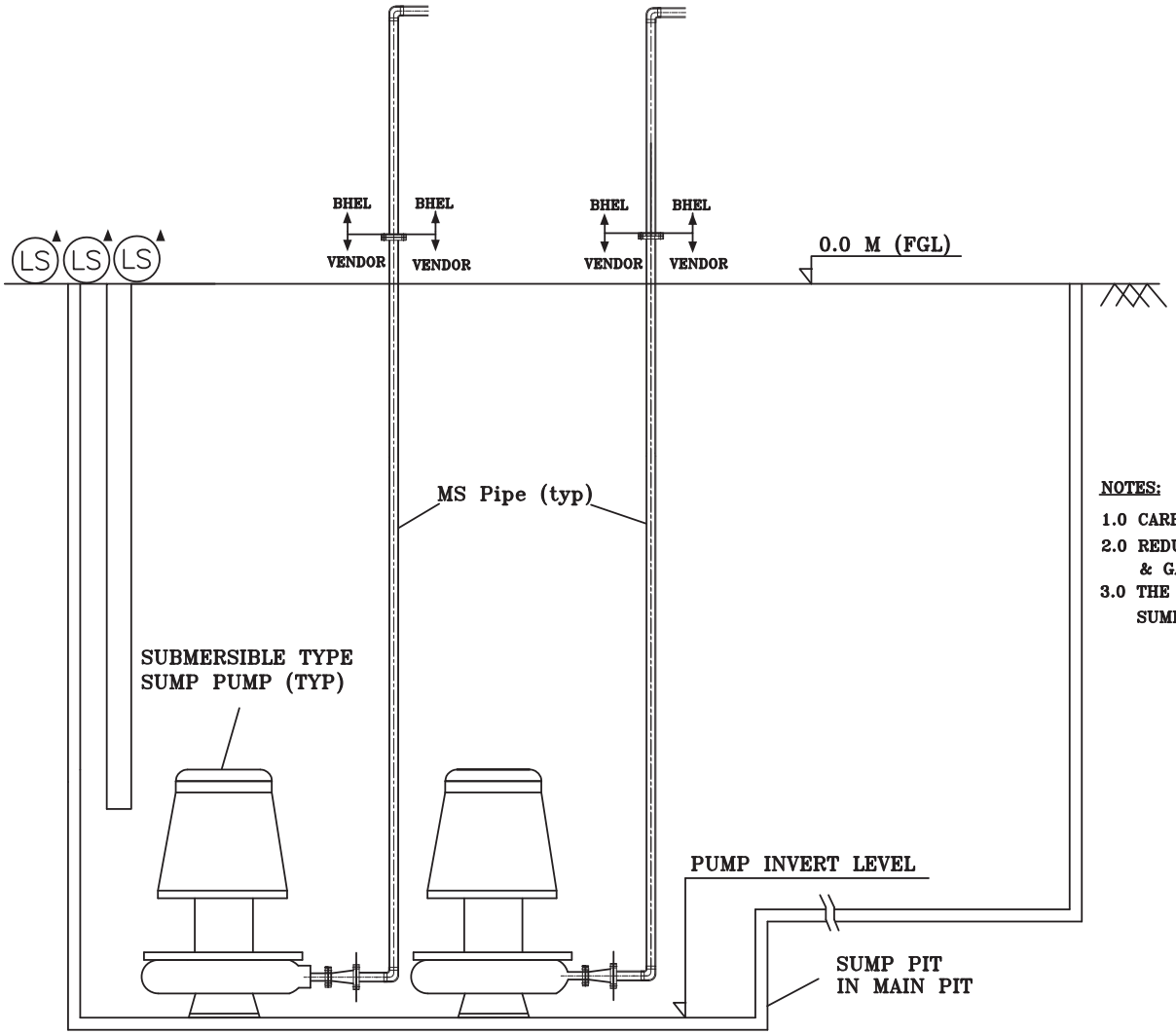
a) Compliance certificate duly signed and stamped (enclosed at Vol. III of specn.).

b) GA drawings of pumps and motors with following: (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).

c) Technical deviation schedule (if reqd.) (Enclosed at Vol. III of specn.).

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.

ANNEXURE II



NOTES:

1.0 CARBON STEEL PIPE AS PER IS 1239 HEAVY GRADE SHALL BE PROVIDED.

2.0 REDUCER/ EXPANDER ALONG WITH COUNTER FLANGES WITH BOLTS, NUTS & GASKET SHALL BE SUPPLIED BY PUMP MANUFATURER.

3.0 THE ARRANGEMENT SHOWN IS FOR FIX DUTY TYPE SUBMERSIBLE SUMP PUMPS.

SUMP PUMPS – SUBMERSIBLE TYPE
(PERMANENT DUTY TYPE)

For Pump Invert Levels, Kindly refer Datasheet A.

RRUVNL
TATA CONSULTING ENGINEERS LIMITED
2X660 MW SURATGARH STPS
FIXED SUMP PUMPS ARRANGEMENT
SKETCH NO. PE-DG-392-165-N501

SECTION – C2

SPECIFIC REQUIREMENTS FOR ELECTRICAL EQUIPMENTS

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

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

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

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

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

a) A copy of this sheet "Electrical equipment Specification for Sump/Misc Pumps" and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
b) List of Erection and Commissioning spares.
c) List of Erection & Maintenance tools & tackles.
d) Electrical load requirement

3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 List of enclosures :
a) Electrical Scope between BHEL and Vendor"
b) Standard Specification for Motors **(PE-SS-999-506-E101, VOL-IIB, SEC-D)**
c) Motors data sheet-A
d) Motors data sheet-B
e) Quality Plan (motors below 55kW & motors above 55kW)
f) Load data format.
g) Motor & cable customer specification
h) Conduit & pipe specification

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PROJECT: 2x660 MW SURATGARH TPS

PACKAGE: SUMP PUMP

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	LT MCC	BHEL	BHEL	DOL starters for motors and 415V supply feeders for the requirements like control panel will be provided by BHEL. The starters for motors shall be located in MCC. Vendor to furnish the load list. 415V MCC is 3ph, 3wire. Requirement of 415V AC (3ph, 4wire) OR 1-phase power requirement (for space heater/ lighting/ any other etc) shall be arranged/derived by vendor at their end.
2	Local push button station (for motors)	BHEL	BHEL	Located near the motor
3	Power cables, ordinary control cables and screened control cables between equipments supplied by vendor.	Vendor	Vendor	
4.	Power cables, ordinary control cables and screened control cables between equipments supplied by vendor & BHEL.	BHEL	BHEL	
5	Any special type of cable like compensating. Co-axial, prefab, MICC and fibre optical	Vendor	Vendor	
6	Cabling material (cable trays, accessories and cable tray-supporting system, conduits, M Boxes/J Boxes) for cabling between equipments supplied by vendor and BHEL.	BHEL	BHEL	Local cabling from nearby tray to equipment terminal shall be through conduits.
7	Conduits and conduit accessories for cabling between equipments by vendor	Vendor	Vendor	Cabling shall be through conduits. However, vendor can use the trunk routes available for laying of cables. Conduits shall be supplied by vendor and shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537. Makes of conduits shall be subject to customer/ BHEL approval at contract stage
8	Equipment earthing.	BHEL	BHEL	
9	Motors with Base frame and fixing hardware for motors.	Vendor	BHEL	1) Makes shall be subject to customer/BHEL approval at contract stage. 2) Motor shall comply the specification **Motors (PE-SS-999-506-E101, VOL-IIB, SEC-D)**
10	a) Input cable schedules b) Cable interconnection details. c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing (in excel format) for control cables for vendor-supplied equipment (soft copies in the BHEL cable schedule format) shall be furnished during detail engineering by vendor.
11	Equipment layout drawings.	Vendor	-	Layout details between vendor supplied equipment and installation drawings by vendor
12	Cable glands and lugs for equipment supplied by vendor	Vendor	BHEL	1. Double compression Ni-Cr plated brass glands. 2. Solder less crimping type heavy-duty tinned copper lugs for power cables. 3. Solder less crimping type heavy duty copper lugs for control cables.

Note- All QPs shall be subject to approval of BHEL/ Customer after award of contract.

	TITLE	SPECIFICATION NO.
	LV MOTORS	VOLUME II B
		SECTION D
	DATA SHEET-A	REV NO. 00 DATE 09/09/2013
		SHEET 1 OF 1

1.0	Design ambient temperature		:	50 ^{o}C
2.0	Maximum acceptable kW rating of LV motor		:	Upto 160KW
3.0	Installation (Indoors/ Outdoors)		:	As required
4.0	Degree Of Protection		:	IP55 - Outdoor IP54 – Indoor
5.0	Cooling		:	TEFC
6.0	Details of supply system			
	a)	Rated voltage (with variation)	:	415V $\pm$ 10%
	b)	Rated frequency (with variation)	:	50 Hz (Variation: +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 box	:	50 kA for 0.25 sec
	f)	LV System grounding	:	Solidly
7.0	Class of insulation		:	Class ‘F’, with temp rise limited to class B.
8.0	Minimum voltage for starting (As percentage of rated voltage)		:	85% of rated voltage
9.0	Power cables data		:	Shall be given during Detailed engg.
10.0	Earth Conductor Size & Material		:	Shall be given during Detailed engg.
11.0	Space heater supply **(30KW & ABOVE)**		:	240 V, 1Φ , 50 Hz
12.0	Rating up to which Single phase motor		:	Acceptable below 0.20 Kw
13.0	TYPE OF STARTER PROVIDED IN MCC		:	DOL
14.0	Locked rotor current			
	a)	Limit as percentage of FLC	:	See note.
	b)	Permissible tolerance, if any	:	-
15.0	Additional tests		:	As per QP
16.0	Flame-proof motor			
	a)	Enclosure suitable (As per IS:2148)	:	As per requirement
	b)	Classification of Hazardous area (As per IS: 5572 part-I)	:	As per requirement
	c)	Degree of protection	:	IP65
17.0	Makes		:	AS PER ANNUXURE-I
18.0	Terminal box		:	Suitable to rotate at 90 degrees

19.0 Paint shade : Shade 631 of IS-5

Note:
LT motors for continuous duty (S1) operation & S3 (intermittent periodic duty) with a cyclic duration factor of 80% or higher, shall be energy efficient class IE-3 in line with IS -12615-2011. The starting current shall be in line with IS: 12615-2011, subject to IS tolerance (refer clause 14.1 of IS 12615).

All LT motors shall be controlled as follows:
a) Up to 50kW: - MPCB + Contactor (MPCB shall be with adjustable S/C and O/L protection).
b) 50kW to 90kW shall have MCCB+ contactor+ bimetallic relay.
c) 90Kw to 160kW shall have ACB +motor protection relay (MPR).

1.0 AC & DC MOTORS

1.1. HT motors of rating above 1500kW shall be suitable for 11kV, 3 phase, 50Hz power supply. Motors above 160kW and up to 1500kW shall be suitable for 6.6kV, 3 phase, 50Hz. Motors rated 160kW and below shall be suitable for 415V, 3 phase, 50 Hz power supply.

1.2. All LT motors shall be energy efficient class – I in line with IS: 12615. However, the starting current shall be limited to 600% (inclusive of 20% tolerance) of full load current.

1.3. The motor rating shall be arrived at considering 15% margin over the duty point input or 10% over the maximum demand of the driven equipment, whichever is higher, considering highest system frequency. Motors shall be capable of starting and accelerating the load with the applicable method of starting without exceeding acceptable winding temperatures when supply voltage is 80% of the rated voltage for HT motors and 85% for LV motors. HT motors shall also be capable of satisfactory operation at full load at a supply voltage of 80% of the rated voltage for 5 min. commencing from hot condition. DC motors shall be suitable for the DC system voltage of 220V. Motor shall be capable of starting and accelerating the load with the applicable method of starting, without exceeding acceptable winding temperatures, when the supply voltage is in the range of 85% to 110% of rated motor voltage.

1.4. Motors shall be capable of running for one second if the supply voltage drops to 70% of the rated voltage. If such operation is envisaged for a period of one second, the pull out torque of the motor shall be at least 205% of full load torque.

1.5. Motors shall withstand for 1 second the voltage and torque stresses developed due to the vector difference between the motor residual voltage and the incoming supply voltage equal to 150% of the rated voltage during fast changeover of buses.

1.6. Locked rotor current of the HT motors rated 1500 kW and below shall be limited to 600% (inclusive of 20% tolerance) of the full load current of the motors and motor rated above 1500 kW shall be limited to 450% (inclusive of 20% tolerance) of full load current of the motor.

1.7. The locked rotor withstand time under hot condition at 110% rated voltage shall be more than the starting time at minimum permissible voltage specified above by at least three seconds or 15% of the accelerating time whichever is greater. Provision of speed switch shall be avoided to the extent possible.

These motors shall be designed to withstand at least 5% harmonics in the supply voltage.

1.8. The degree of protection for the motor enclosure (including terminal box) shall be IP-55 for outdoor. For single core cable termination, gland plates shall be of non-magnetic material. All motors located in hazardous area shall have flame proof enclosure.

1.9. All HT motors shall be provided with vibration pads for mounting vibration detectors. Vibration monitoring devices shall be provided on DE and NDE side in X &Y direction with remote DCS monitoring, alarms and tripping

1.10. Motors rated 1000kW and above shall be provided with differential protection. These motors shall be provided with star connected stator windings. The 3 nos. current transformers, one for each phase shall be mounted in a separate compartment in the neutral side terminal box. The three phases shall be connected to form the star point after they pass through the CTs. The CTs shall be of relay accuracy and the CT characteristics shall be compatible with the differential relay. The additional 3 nos. CTs of identical characteristics shall be provided in the 11kV/6.6 kV switchgear panel.

1.11. The terminal box of motor shall be of suitable size, suitable to terminate and maintain the cables easily. Terminal box shall be suitable to rotate at 90 degrees.

1.12. The ring oiling system shall be adequate for starting and continuous operation of the motor for at least one half hour without pressure oiling system in operation.

1.13. For 11kV & 6.6 kV motors, 6-nos. duplex RTD s for winding shall be provided for remote monitoring, alarm and tripping at DCS. Each bearing shall be provided with one duplex RTD for temperature remote monitoring, alarm and tripping at DCS. 6 nos. spare RTDs shall be provided for winding in HT motors.

1.14. The maximum double amplitude vibrations for motors shall be as per IS 12075.

1.15. Maximum noise level measured at a distance of 1.5 meter from the outer surface of the motor shall not exceed 85 db (A).

1.16. Cable boxes of all 11kV & 6.6 kV motors shall be Phase segregated & shall be provided with quick disconnecting type terminal connectors to facilitate easy disconnection and removal of the motors without requiring unsealing or otherwise disturbing the external cable connections and leaving the phase segregated terminal box intact. The terminal boxes shall have fault withstand capacity equal to at least rated short circuit level of system voltage for 0.25 sec. The terminal boxes shall be reversible to suit cable entry from top or bottom and suitable for termination of FRLS, XLPE armoured cables.

1.17. The star connection side terminal box should have sufficient capacity to accommodate CT's for differential protection for motor above 1000kW.

1.18. The insulation system for 11000 V AC & 6600 V AC motors shall withstand the negative or positive 0.3 / 3.0 microsecond wave (2.7 pu rated peak line to earth operating voltage) switching surges originating from non-effectively earthed power system. All 11000V AC & 6600 V AC motors shall have BIL and power frequency withstand voltage as per relevant standards.

1.19. Motor bearing shall be insulated wherever required.

1.20. All HT motors shall be with VPI insulation or better

1.21. All HT motors / LT motors 15 kW and above shall be provided with external greasing arrangement

1.22. CACW motor shall be provided with water leakage detector with remote alarms and tripping.

1.23. All HT motors / LT motors 30 kW and above shall be provided with space heaters using 240 V AC supply. However, for all the actuators, irrespective of its rating, space heaters shall be provided using 240V AC supply.

1.24. All motors below 15 kW shall be provided with sealed ZZ bearings

1.25. Each motor shall have two earthing terminals.

1.26. All motors for outdoor duty shall have detachable metal canopy.

1.27. HT motors shall be designed for operation as follows:

a) Upto 1000kW – Vacuum circuit breakers/SF6.

b) Above 1000kW-Vacuum circuit breakers/SF6.

c) All motors shall be suitable for DOL starting.

1.28. Separate terminal boxes to be provided for space heater, RTDs for windings/bearings, vibration monitors etc. All terminal boxes shall be provided with two earth studs for termination of protective earth conductor. Double compression type brass cable glands and crimping type copper lugs shall be provided for termination.

1.29. Provision shall be made at DCS to monitor, integrate running hours, nos. of starts and stop recording for all motors.

1.30. The terminals of all motors shall be suitable for terminating Aluminium conductor, XLPE insulated, armoured cables, the sizes of which will be intimated by the Purchaser.

2.0 ACTUATOR

2.1. GENERAL TECHNICAL REQUIREMENT

2.1.1. Actuator shall be weatherproof type with enclosure conforming to IP-64 degree of protection. It should be suitable for out-door use without the need for canopy. If the IP-68 degree of protection is required due to occasional submergence, the purchaser shall specify the depth and duration of such submergence.

2.1.2. The actuator shall be suitable for installation in any position without lubrication leakage or other operational difficulty.

2.1.3. All actuators shall be supplied with non integral starters for open & close. The main gearbox of the actuator shall be special grease filled.

2.1.4. Each actuator should have a hand wheel for emergency manual operation. Clockwise operation of hand wheel shall cause clockwise movement of the

output drive. The hand wheel shall be clearly marked with an arrow and the word CLOSE.

2.1.5. The hand wheel shall automatically disengage when the power to the motor is restored i.e. power drive shall have a preference over manual drive.

2.1.6. The manual effort should not exceed 400 N (push / pull). A top bevel gear set (side mounted hand wheel) shall be employed to reduce the manual effort.

2.1.7. Each actuator shall have a local mechanical position indicator. It should be suitable to indicate 0 - 100% position of the valve (continuous type).

2.1.8. In order to minimise the amount of spare parts required, parts and sub-assemblies limit / torque switches, limit switch counter gear assembly, torque switch drive assembly, mechanical position indicator assembly etc. individually interchangeable / replaceable throughout the models selected.

2.1.9. The actuator shall be painted with corrosion resistant epoxy resin paint. Paint shade shall be Grey (Shade 631) as per IS-5.

2.1.10. In order to prevent condensation, a space heater shall be provided in the switch compartment, suitable for continuous operation. Actuator mounting dimensions shall be according to ISO-5210. For rising stem applications, the design must allow the removal of actuator from the output drive without disturbing the function of valve.

2.2. LIMIT AND TORQUE SWITCHES

2.2.1. Independent torque and limit switches shall be provided in the actuator. A minimum of two position limit switches and two torque switches, one each for each direction of travel, having 4 NO + 4 NC potential free contacts, shall be supplied. If called for in the data sheet, two additional limit switches shall be provided for intermediate positions.

2.2.2. Torque switch dial shall be graduated directly in “kg-m” for easy setting to desired value within the range specified. Separate dials shall be provided for CLOSE and OPEN torque switches.

2.2.3. Two additional limit switches with 2NO + 2NC contacts, each adjustable at any intermediate position, shall be provided in the actuator.

2.2.4. The rating of both torque and limit switches shall be 240 V AC, 5 Amps. The switches shall individually be enclosed to a minimum of IP-64 protection class.

2.2.5. Torque and limit switches shall have only stainless steel flaps for better protection against environmental condition.

2.2.6. Limit switches shall be operated by gear driven cams, which are mechanically linked to the driving devices. The counter gear used for counting and tripping the limit switches shall be of metallic construction like brass etc. No plastic gearing shall be allowed.

2.2.7. To guarantee proper function under high ambient temperatures, torque and limit switch sensing shall be of mechanical type.

2.3. ELECTRIC DRIVE FOR ACTUATOR (MOTOR)

2.3.1. All motors shall be specifically designed for valve actuator operation, which is characterised by high starting torque, low stall torque & low inertia. All motors shall be high starting torque type to facilitate 'unseating' of valve.

2.3.2. Motor shall be suitable for power supply of 415 V, 3 ph, 50 Hz, AC.

2.3.3. Motor shall be squirrel cage induction type and shall generally conform to IS-325.

2.3.4. Motor shall have minimum class 'F' insulation with temperature rise restricted to class 'B' under the design ambient temperature.

2.3.5. Motor shall be of totally enclosed surface cooled (TESC) type with IP-67 protection class after mounting on actuator.

2.3.6. Motor shall have three thermostats connected in series, one in each phase of stator winding, for protection against overheating.

2.3.7. Motor shall be suitable for operation under voltage variation of + 10%, frequency variation of + 5% and combined voltage & frequency variation of 10% absolute.

2.3.8. Motor shall be suitable for direct on-line (DOL) starting and starter shall be non integral to the motor.

2.3.9. It should be possible to separate the motor from the lubricant filled gearing of the actuator allowing easy replacement of motor without loosing any lubricant regardless of mounting position.

2.3.10. Finsh shall be provided on the motor body to ensure better heat dissipation.

2.3.11. It shall be possible to change the output rpm of the actuator, if required, at the site at a later date, without hampering the mounting arrangement and loss of any lubricant.

2.4. CODES & STANDARDS

All the equipment specified herein shall comply with the requirements of the latest issue of the relevant National & International standards.

The design and materials used for the components shall also comply with the relevant National & International standards.

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

Electric motor operated actuators:IS 9334

Degrees of protection provided by enclosures at low:IS 2147
voltage switch gear and control gear

Flame Proof enclosure at electrical apparatus:IS 2148
Specification for three phase induction motors:IS 325

AC contactor for voltages not exceeding 1000 V:IS 2959

Degree of protection provided by enclosures for :IS 4691
Rotating electrical machinery

Specification for rotating electrical machines:IS 4722
For other code refer Section D28.

2.5. OTHER REQUIREMENTS OF ACTUATOR.

2.5.1. Common potential free contact shall be available to annunciate the fault condition to the remote control station or DCS.

2.5.2. The following individual relay / potential free contacts shall be provided for the remote indication:-

- Actuator OPEN.
- Actuator CLOSE
- Actuator fault feed-back

- Thermal overload relay shall be provided to trip the actuator in case of overload

2.6. The DC and AC actuator shall be provided with accessories viz., Torque limit switch, end of travel switch, adjustable limit switch, hand wheel motor, thermostat, etc. Complete actuator shall be tested at factory as per IS 9334. All actuators should have minimum 2 limit switches for each position, and should have position transmitters wherever required.

3.0 TESTS

3.1. All routine & acceptance tests as per relevant IS shall be conducted on motors. For all AC and DC motors of rating below 100kW, type test certificates shall be furnished. If the test reports are not found in order by Purchaser then these tests shall be conducted by the Vendor without any cost implication.

3.2. Type test shall be carried out on one no. of each type and rating of motor of rating 100kW and above, which shall be witnessed by Purchaser.

3.3. Efficiency and loss measurements shall be done for all LT motors as per relevant standard (Being energy efficient motors.) as routine test.

3.4. For 11000V AC & 6600V AC motors, in addition to all the tests specified above, polarisation index test shall be carried out as a routine test on each motor (the minimum value of polarisation index for all motors shall be 2 when determined according to IS: 7816).

3.5. Noise level measurement test shall be conducted on one motor of each type.

3.6. Vibration measurement shall be taken for each motor of 45kW & above.

3.7. Dielectric tests to establish the insulation withstand level of motors as indicated above shall be performed on a sample coil (identical to those to be used in the motor quoted for) for each type of motor. These tested sample coils shall not be used in the motors to be supplied.

4.0 For technical particulars refer datasheet-A.

1.0 CABLES

1.1 H T POWER CABLES

System cables shall be 11kV (UE) and 6.6 kV (UE) grade suitable for use in medium resistance earthed system, stranded & compacted aluminium conductor, extruded semi conducting screen over conductor, XLPE insulated, semi-conducting followed by copper tape screened, extruded PVC Type ST – 2 inner sheathed, aluminium/GS wire armoured, overall FRLS PVC outer sheathed, conforming to IS 7098 (Part II), IEC-502 for constructional details and tests.

1.2 L T POWER CABLES

LV Power Cables shall be 1100 V grade, single / multi core, stranded aluminium conductor, XLPE insulated, with PVC inner sheath, armoured and outer sheath made of FRLS PVC compound, generally conforming to IS 7098 (for XLPE). The cables used for DC system shall be of single core type. Minimum conductor cross section of power cables shall be 6-sq. mm for aluminium cables.

1.3 CONTROL CABLES

Control cables shall be 1100 V grade, multi core, minimum 1.5 sq. mm cross section, stranded copper conductor having minimum 7 strands, PVC insulated, PVC inner sheathed / galvanised steel wire armoured, overall FRLS PVC outer sheathed generally conforming to IS 1554 Part-I. In situations where accuracy of measurement or voltage drop in control circuit warrants, higher cross sections as required shall be used.

1.4 INSTRUMENTATION CABLES

The instrumentation cables shall be Annealed, tinned stranded copper conductor, 0.5 sq mm , twisted into pairs, overall screened (I1 type) for digital signals, individual and overall screened (for I2 type) for low level analog signals, individual triplet and overall screened (type I3), PVC insulated , inner PVC sheathed, GS wire armoured and overall sheathed with FRLS PVC. The insulation shall be strippable manually as well as by mechanical stripping devices without damage to the conductor.

1.5 TRAILING POWER AND CONTROL CABLES FOR MOBILE EQUIPMENT.

11 kV(UE) and 6.6 kV (UE) and 1100V-(E) grade power & control flexible trailing, annealed tinned copper conductor, EPR insulated, EPR inner sheathed, CSP outer sheathed and shall have conductor screen of rubber. Cables shall conform to IS requirements and any other applicable standards.

1.6 FIRE SURVIVAL CABLES

1.6.1 Power and control, single/multi, stranded copper conductor fire survival cables complying with IEC-60331 shall be provided for following systems as per CEA guidelines.

(a) DC emergency lube oil pumps

(b) DC seal oil pumps

(c) DC emergency lighting cables for main building

(d) Batteries to chargers and DC distribution boards

(e) Turbine lube oil pumps

(f) Jacking oil pumps

(g) Emergency turbine trip by pushbutton in control room

(h) Boiler Turbine: Generator inter trip which includes the interconnecting cables between:

- Boiler master fuel trip and turbine trip relays
- Generator trip relays and turbine trip relays
- Generator trip relays and 400kV breakers
- Generator trip relays and generator field breakers
- Generator trip relays and ST and UT breakers

1.6.2 FS cables shall have following properties:

(a) Excellent fire resistance characteristics

(b) Cables shall have features of nontoxic and low smoke generation

(c) Flame non-propogation property

(d) Ability to withstand burning & continue to function during and after fire

(e) Low smoke emission & low halogen property to maintain circuit integrity to essential services under severe fire condition.

1.6.3 Construction of FS cables

(a) Conductor- Copper stranded

(b) Fire proof layer- heat barrier based

(c) Insulation- elastomer rubber

(d) Fire proof layer- same as 2 above but optional – natural or synthetic, fibre or elastomer

(e) Filler- suitable filler optional

(f) Binder tape – two layers of glass fibre tape

(g) Inner sheath- HOFR FRLS elastomer (heat & oil flame retardant)

(h) Armouring/screening – suitable wire

(i) Over all sheath – HOFR FRLS

1.7 Cables for the fire detection and alarm system and communication system shall be as described else where.

2.0 CABLE PROPERTIES

2.1 All single core power cables shall have wire / strip armouring of aluminium, whereas multi core power cable shall have galvanised steel wire / strip armouring.

2.2 The sheath shall be resistant to water, UV radiation, fungus, termite and rodent attack.

2.3 The outer sheath of FRLS PVC compound shall meet the following performance requirements:

(a) The critical oxygen index value shall be minimum 29 when tested at 27$\pm$ 2^0C as per ASTM-D-2863-77 and the temperature index shall be minimum 250^0C at oxygen index value of 21 when tested as per ASTM-D-2863.

(b) The maximum acid gas generation as determined by titration method shall be less than 20% by weight when tested as per IEC-60754-1 (1994). Halogen acid content in outer sheath in FS cables shall not be more than 2%.

(c) Flammability

(i) Cables shall pass tests under fire condition as per IS-10810-Part-53.

(ii) Cables shall also pass tests as per IS-10810 Part-61 & Part-62. Category group shall be considered as Category 'A'.

(iii) Fire survival cables in addition to tests (i) and (ii) above shall pass tests as per IEC-331.

(d) The smoke generation under fire shall have maximum smoke density rating of 60% when tested as per ASTM-D-2843-77 (1977). Smoke density in FS cables shall not exceed 20%.

(e) The cables shall pass the ultraviolet tests as per DIN 53387.

(f) The cables shall pass the tests for Water absorption tests as per IS 10810.

2.4 The finished cable shall pass the flammability test as per IEC-322-1 (1993) and IEEE-383. In addition, it shall also pass flammability test as per Class F3 of Swedish Standard SS-424-1475 (1977).

2.5 In addition, cables for devices mounted on or near hot surfaces of Steam Generators, Turbine Generators, Main steam etc shall have heat resistance type outer sheath.

2.6 All LT cable shall have embossing at interval of 1 meter for owner name, size/ core type and length.

2.7 All cables shall be embossed with the name of RVUNL in addition to what is specified in the standards.

3.0 DESIGN CRITERIA FOR CABLE SIZING

3.1 POWER CABLES

Power cable sizes shall be selected on the following basis:

3.1.1 Power cables shall carry the full load current of the circuit continuously under site conditions considering the condition listed below:-

(a) Ambient design temperature 50 deg. C.

(b) Maximum allowable temperature under normal full load condition and under short circuit condition based on material selected (XLPE).

(c) Maximum short circuit fault current.

(d) Ambient temperature for underground cables, 50 deg. C.

(e) De-rating factors as per IS/IEC and manufacturer's standard catalogues.

3.1.2 Power cables shall withstand the fault current of the circuit for the duration not less than the maximum time taken by the primary protective system to isolate the fault. Fault clearing times for ties between two 6.6 kV switchgears shall be considered as 1 sec. Fault clearing times for ties between two 415V switchgears shall be considered as 0.5 sec.

3.1.3 For the cables to 415 V motors and feeders protected by fuses, the cross section shall be chosen according to the cut-off current of the fuse and its fusing time.

3.1.4 Voltage drop from transformer secondary to motor terminals during starting of motors will be limited to the following values:

(a) For HV motors (except MDBFP motor) – 15% of the rated voltage

(b) For MDBFP motors – 20% of the rated voltage

(c) For LV motors – 15% of the rated voltage.

3.1.5 Voltage drop in feeder cables shall be limited to 3% during full load running condition. Voltage drop from transformer secondary to motor terminals during full load running of motors shall be limited to 5 % of rated voltage.

3.1.6 For power supply to valve actuator motors, actuators of various isolating and regulating dampers and exhaust fans, 3 core 2.5 sq. mm stranded copper conductor cable may be used in view of ease of termination. These cables shall be in other respects similar to cables described in Clause 1.2 above.

3.1.7 Design Calculation for arriving at cable size shall be submitted for purchaser's approval.

3.1.8 DC System Cables:-

3.1.8.1 1100 V grade, single core cables as specified in LT power cables shall be used from batteries/ battery chargers to main DCDB, between main Distribution Board, from main Distribution Board to sub distribution board, main DC supply to various system cabinets/panels, Switchgears etc and for critical auxiliaries. Flexible cables with PVC insulation shall be used where termination of XLPE/PVC insulated cables is difficult.

3.1.8.2 Voltage drop in cables between battery to DCDB and battery charger to DCDB shall be limited to 2%. Voltage drop in cables between DCDB and loads shall be limited to 3%.

3.1.8.3 Design Calculation for arriving at cable size shall be submitted for purchaser's approval.

3.2 **CONTROL CABLES**

3.2.1 Current transformer leads shall be checked for the lead burden vis-a-vis the current transformer VA capacity. In case 2.5 sq. mm conductor impose unacceptably high burden on CTs, 4.0-sq. mm conductor shall be used. The conductor material shall be copper.

3.2.2 Voltage transformer leads shall be checked for voltage drop which shall be limited to within 1% for all cases other than tariff metering. For tariff metering the voltage drop shall be limited to 0.2%. In case the voltage drop with 2.5 sq. mm conductors exceed this value, higher conductor sizes shall be used.

3.3 INSTRUMENTATION CABLE

3.3.1	Element identification	:	As per IEC-60189-2
3.3.2	Core wrapping	:	By non-hygroscopic material by taping or by extrusion
3.3.3	Element screening	:	By copper tape of minimum 0.04mm thickness or by copper laminated plastic tape
3.3.4	Rip cord	:	Non-metallic rip cord under the core wrapping
3.3.5	Drain wire	:	A tinned copper drain wire of minimum 0.05 mm^2 cross section in contact with each screen of cabling element.

Cabling elements shall be any one of the following:

A 'Pair' of two insulated conductors twisted together designated by alphabet 'p' printed on a binding tape at 200 mm intervals.

A 'Triple' of three insulated conductors twisted together designated by alphabet 't', printed on a binding tape at 200 mm intervals.

Maximum length of lay in the finished cable shall be 120 mm.

3.3.6 Units

Cables shall be bunched together in units of twenty cabling elements or sub units of five or ten elements, stranded in concentric layers. The units or sub

units shall be designated by p1, p2, p3,. t1, t2, t3..,q1, q2, q3, .., or Q1, Q2, Q3 ..., etc. depending on the combination.

3.3.7 Overall screening and armouring

Cables shall have an overall screen made up of copper/aluminium tape of 0.04 mm thickness or copper/aluminium of 0.008 mm thickness laminated with plastic tape with a minimum overlap of 15%.A drain wire of tinned copper with minimum 0.5 mm^2 cross section shall be provided in continuous contact with the screen.

3.3.8 Inner and Outer Sheath

The inner and outer sheaths shall consist of black PVC compound.

3.3.9 Insulation Resistance

Minimum insulation resistance per km shall be 500 mega Ohm.

3.3.10 Mutual Capacitance

Mutual capacitance of any pair of conductors shall not exceed 120 nF/km.

3.3.11 Capacitance Unbalance

The capacitance unbalance between any two pairs shall not exceed 400 pF for 500 metre length of cable.The construction, performance and testing of cables except as mentioned above shall generally comply with the following standards :

IEC-60189 - Part-1 : Low frequency cables and wires with PVC insulation and sheath. General test and measuring methods

IEC-60189 - Part-2: (-do- Cables in pairs and triples).

4.0 CABLE TERMINATIONS

4.1 Cables shall be laid in trays /trenches/ conduits by the Bidder. Also joint markers shall be provided at each joint.

4.2 All 1100V termination for XLPE/PVC power cables and control cables shall be by Double compression weather proof type cable glands. Heavy duty, tinned, long barrel copper lugs shall be used for termination.

5.0 CABLE JOINTS

Cable joints shall be avoided to the extent possible. If joints are unavoidable due to circuit length, in excess of permissible maximum drum length, they shall be heat shrinkable types having a short circuit with stand capacity value as specified in clause 3.1.2 above. Lugs shall be heavy duty, tinned copper, long barrel type. All cable glands shall be double compression, weather proof.

6.0 POWER RECEPTACLES

GENERAL TECHNICAL REQUIREMENTS
OF
CONDUITS AND PIPES
SPECIFICATION NO. PES-507-27
REV 0

1.0 GENERAL

1.1 This specification covers the manufacture, inspection & testing at vendor's works and delivery to site of conduits, pipes and their fittings for electrical installation.

2.0 CODES AND STANDARDS

2.1 The material, constructional features and various processes involved in manufacture shall comply with currently applicable Indian Standards.

2.2 The following Indian Standards shall be applicable, in general. However if Data Sheet A specifies conformance to other international standards, the equivalent IEC/BS/other standards shall be considered.

a) IS:9537 (All Parts) Conduits for electrical installation.

b) IS:3480 Flexible steel conduits for electrical wiring.

c) IS:6946 Flexible non-metallic conduits for electrical installation.

d) IS:1239 Mild steel tubes, tubulars and other wrought steel fittings. (for size above 63mm dia of rigid conduits)

e) IS:2667 Fittings for rigid steel conduits for electrical wiring.

f) IS:3837 Accessories for rigid steel conduits for electrical wiring.

g) IS:3419 Fittings for rigid non-metallic conduits.

h) IS:6005 Code of practice for phostating iron & steel.

i) IS:2629 Recommended practice for hot dip galvanizing on iron and steel.

j) IS:4759 Specification for hot dip zinc coatings on structural steel and allied products.

k) IS:6745 Methods for determination of mass of zinc coating on zinc coated iron and steel articles.

3.0 DESIGN REQUIREMENTS AND CONSTRUCTIONAL FEATURES

The conduit and conduit accessories shall include conduit plugs & caps, gaskets and box cover etc in addition to any specific requirement given in Data Sheet A. The diameter of conduits and accessories shall be uniform throughout the length.

3.1 Rigid Conduits and Fittings

3.1.1 Rigid conduits shall generally conform to the requirements of IS:9537 (Part I & Part II). However conduits above 63mm diameter shall conform to the requirements of IS:1239. Unless specified otherwise in Data Sheet A, all conduits and pipes shall be of medium duty.

3.1.2 The rigid conduits shall be hot dip galvanized inside and outside. Weight of zinc shall be as per IS:4759. Conduits shall be thoroughly cleaned and pretreated, conforming to IS:6005.

3.1.3 Conduits shall be supplied in approximate length as specified below

a) Rigid Conduits 5 metres

b) Flexible Conduits 10 - 30 metres

3.1.4 Each end of conduit length shall be threaded. The ends of conduits shall be sealed with protective caps to prevent damage to threaded portions and entrance of moisture and foreign material.

3.1.5 The inside surface of all conduits shall be smooth and suitable for pulling insulated cables and wires without damage.

3.1.6 Conduit fittings shall be made out of tube or cast to the shape as to match with corresponding conduit sizes and meet their purpose without any special adjustment.

3.1.7 All fittings shall be screwed type and hot dip galvanized inside and outside.

3.2 Flexible Metallic Conduits and Fittings

3.2.1 Flexible metallic conduits shall generally conform to the requirements of IS:3480.

3.2.2 Flexible conduits shall be made of strip steel which shall be of cold rolled mild steel. The strip shall be of uniform width and thickness throughout.

3.2.3 The strip shall be electro galvanized to a minimum thickness of 25 microns as specified in IS:3480. The surface of the strip shall be thoroughly cleaned before application of protective coating. Pretreatment, before galvanization, shall conform to IS:6005.

3.2.4 The strip for making flexible conduit shall be wound tightly and so overlapped in subsequent helicals that no openings are seen in normal position.

3.2.5 Flexible conduits shall be lead coated for application in high temperature zones, if specifically mentioned in Data Sheet A.

3.2.6 The conduit shall have uniform diameter throughout its length. The internal surface of all conduits shall be smooth and suitable for pulling insulated cables and wires without damage.

3.3 PVC Conduits

3.3.1 PVC conduits shall generally conform to the requirements of IS:9537(Part I & Part III).

4.0 INSPECTION

4.1 The following stages of manufacture shall be stage inspected by Purchaser or his duly authorized representative.

4.1.1 Inspection of manufacturing processes such as shearing, punching, bending, welding, galvanizing etc.

4.1.2 Inspection of packing material and procedure.

4.1.3 Inspection of finished product.

4.2 The inspection will be carried out as per agreed quality plan.

5.0 TESTING

5.1 Rigid Conduits

a) Acceptance Tests - as per IS:9537 Part 1 & 2 upto 63mm OD
- as per IS:1239 above 63mm OD

i) Dimension checks

ii) Bending test (below 32mm OD)

iii) Compression test

b) Special Tests (as acceptance test) as applicable to galvanizing.

5.2 Flexible Steel Conduits

a) Acceptance Tests - as per IS:3480

i) Dimension checks

ii) Linear breaking test

iii) Test for flexibility

iv) Bend fracture test

v) crushing test

b) Special Tests (as acceptance test) as applicable to galvanizing.

5.3 PVC Conduits

a) Type Tests - as per IS : 9537 (Part 1 & 3)

i) Dimension checks

ii) Bending test

iii) Compression test

iv) Impact test

v) Collapse test

vi) Resistance test

vii) Resistance to burning

viii) Electrical Characteristics

b) Acceptance tests - as per IS:9537 (Part 1 & 3)

i) Dimension checks

ii) Bending test

iii) Compression test

iv) Collapse test

v) Resistance to burning

vi) Electrical characteristics

5.4 Sampling for the tests shall be done as per applicable standards mentioned above.

5.5 The testing shall be carried out as per agreed quality plan.

6.0 PACKING

6.1 The material shall be packed as per manufacturer's standard. Packing procedure shall be to the purchaser's approval.

7.0 DRAWING, DATA AND DOCUMENTS REQUIRED

7.1 The following information shall be furnished within two weeks of award of contract, for purchaser's approval.

a) Manufacturing drawings/details.

b) Recommended Field quality plan covering site handling, storing, laying etc.

c) Final quality plan.

7.3 The following information shall be furnished after testing and inspection

Type Test, routine test and special test certificates in bound volume in requisite number.

DATASHEET A

SPECIFIC TECHNICAL REQUIREMENTS

1.0	APPLICABLE STANDARDS:	IS:9537,IS: 1239, IS:3480
2.0	RIGID STEEL CONDUITS & STEEL PIPES	
a)	Material:	Cold rolled mild steel to IS:226
b)	Applicable standard	
	i) Upto 63mm OD:	IS:9537 Part I & II
	ii) Above 63mm OD:	IS:1239
c)	Surface treatment:	Hot dip galvanizing inside & outside as per IS:2629
d)	Wt. of zinc:	as per IS 4759
e)	Duty:	Medium
f)	Fittings:	Screw type as per IS:2667
3.0	FLEXIBLE CONDUITS:	
a)	Material:	Strip steel cold rolled and annealed
b)	Standard applicable:	IS: 3480
c)	Surface treatment:	Electro galvanized as per IS: 3480
d)	Whether lead coated:	YES
e)	Minimum thickness: of zinc coating	25 microns
4.0	PVC CONDUITS	
a)	Material:	PVC
b)	Applicable standard:	IS: 9537 (Part I & III)

SECTION – C3

SPECIFIC REQUIREMENTS FOR C&I EQUIPMENTS

C&I SPECIFICATION FOR SUMP PUMP

SPECIFIC TECHNICAL REQUIREMENT

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

1) SUMP PUMPS shall be operated from Relay based local control panel (bidder's scope).

2) Bidder to supply the field instrumentation as required.

3) The junction boxes required for termination of instruments are in bidder's scope.

4) Anti-vibration mountings and shock absorbers shall be provided for panel(s).

5) The cable used shall be 0.8 sq mm , F type cable for Analog signals and G type for Binary signals.

6) Regarding the supply scope of cables, please refer the in Electrical portion of the technical specification.

7) The specifications for instruments mentioned in the specification are minimum requirements. The detail specifications shall be finalized during detail engineering.

8) The make/model of various instruments/items/systems shall be subject to approval of owner/ purchaser during detailed engineering stage. 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.

9) All field instrument enclosures degree of protection shall be IP-65.

10) All the wetted parts of the instruments including the accessories like root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments as well as valves shall be of SS-316 material and same shall be in bidder's scope.

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

12) Every panel-mounted instrument, requiring power supply, shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a ground terminal and shall be suitably connected to panel grounding bus.

13) The LCP shall be fully wired. All the necessary cables, flexible conduits, junction boxes and accessories for the above purpose shall be included in bidder's scope. Double root valves shall be provided by bidder for all pressure tapping where the pressure exceeds 40 Kg / Cm2.

14) The applicable list of deliverables(refer Annexure- A) mentioned in the specification shall be furnished.

15) The contacts of equipment mounted instruments; sensors, switches etc. for external connection including spare contacts shall be wired out to suitably located junction boxes. The termination of wires/cables on both side of JB are in Bidder's scope.

16) The bidders shall specifically mention the deviation (if any) they would like to take on the C&I specification. In absence of only deviation it will be implied they follow the specification without deviation.

17) No deviation from vendor shall be entertained after placing of order.

18) SS Legend plates shall be provided on the panels, transmitter racks, instruments etc. for all items supplied to identify the equipment. Overall dimensions of the nameplates shall be decided by the text of legend, maintaining overall consistency and clarity and avoiding size variations.

19) The panels shall be upright; floor mounted, front open type with removable door and shall have ventilation with steel mesh. The outside colour of all local panels, Transmitter racks etc. shall be of light grey shade no. 631 of IS: 5, 1978 or equivalent international code. The inside colour of all these shall be brilliant white.

20) All outdoor field equipment shall be provided with epoxy painting.

21) All local panel indicating lamp/ indicating type Push button should be of cluster LED type only. All local panels shall be of double door type instead of double leaf type to avoid ingress of dust in dust prone areas.

22) Spring-loaded terminals shall be used for termination of instrumentation cables at field JBs and local panels.

23) All the switches, wherever provided shall be provided with 2nos. changeover contacts and both shall be wired up to the panel.

24) In case of any mismatch between local control panel technical specification and instrument specification, the later shall prevail.

ANNEXURE-A (LIST OF DELIVERABLES OF PEM - C&I DEPARTMENT)						
Sl.No.	**DRAWING NO.**	**DRAWING/DOCUMENT TITLE**	**CATEGORY**	**FROM**	**USER**	**REMARKS**
INSTRUMENTATION						
1	PE-V9-392-145-I901	INSTRUMENT DATA SHEETS	A	VENDOR	C&I	After Award of Contract
2	PE-V9-392-145-I902	INSTRUMENT SCHEDULE	I	VENDOR	C&I	After Award of Contract
3	PE-V9-392-145-I903	INSTRUMENT HOOK UP	A	VENDOR	C&I	After Award of Contract
4	PE-V9-392-145-I904	FIELD JB TERMINATIONS	I	VENDOR	C&I	After Award of Contract
5	PE-V9-392-145-I905	QUALITY PLANS (Transmitter, Switch & Guage)	A	VENDOR	C&I	Alongwith Bid
RELAY BASED LCP						
1	PE-V9-392-145-I951	LOCAL CONTROL PANEL DATA SHEET	A	VENDOR	C&I	Alongwith Bid
2	PE-V9-392-145-I952	PANEL EXTERNAL & INTERNAL GA DRAWING	A	VENDOR	C&I	After award of contract
3	PE-V9-392-145-I953	LIST OF HARDWIRED SIGNAL EXCHANGE WITH DDCMIS	A	VENDOR	C&I	**Not applicable**
4	PE-V9-392-145-I954	LOCAL CONTROL PANEL QUALITY PLAN	A	VENDOR	C&I	Alongwith Bid

1.0 SPECIFICATIONS FOR INSTRUMENTS TO BE SUPPLIED ARE AS FOLLOWS.

1.1 Pressure Indicators/DP indicators

Direct reading, pipe mounted Pressure gauges of die-cast aluminium body, with 6 inch(150mm) phenolic dial (white dial with black numerals), 316 SS/304 SS Bourdon tube for high pressure application and 316SS Diaphragm/bellow for low pressure applications, AISI 304 movements and micrometer type adjustable aluminium pointer an accuracy of +/-1.0% of span including accessories like siphons for steam services, snubbers for pump discharge applications and chemical diaphragm for corrosive and oil services and name plate, etc. Material of accessories shall be SS. IP65 or equivalent degree of protection for enclosure. Over range protection shall be 50% above maximum pressure. Armoured capillary of 10 M shall be provided as required. Process connection shall be ½"NPT (F).

1.2 Pressure Switches/DP Switches

Non indicating type, field mounted Pressure Switches of aluminium casing (epoxy coated), and 316 SS element and repeatability of +/-1% of span, including accessories like siphons for steam services, snubbers for pump discharge applications and chemical diaphragm for corrosive and oil services, name plate & mounting brackets. Material of accessories shall be SS. Auto reset micro switch with internal adjustment for set values with 2 SPDT contacts rated for 0.2 A at 220 V DC. IP 65 or equivalent degree of protection for enclosure. Over range protection 50% above maximum pressure. Scale for setting shall be provided. Piston actuated for high pressure applications and diaphragm/bellows for low pressure/vacuum. Process connection ½" NPT (F).

1.3 Pressure Transmitters/DP Transmitters/Flow transmitters(DP type/Level transmitters/DP type (SMART)

Micro-processor based 2 wire indicating type (LCD display), rack mounted with accuracy of +/-0.075% of span, external zero and span adjustment, self diagnostics, temperature sensor for compensation. Power supply 24 V DC; output signal of 4-20 mA DC. IP 65 or equivalent degree of protection. Aluminum housing with epoxy coating, Accessories like snubbers for pump discharge applications and chemical diaphragm. 10 m PVC covered SS armoured capillary for corrosive and oil services, three way manifold, nameplate etc. Material for accessories shall be SS. Turn down ration 30:1. Load impedance 700 ohm (min).Process connection-1/2"NPT (F). 2 valve manifold for absolute pressure, 3 valve manifold for gauge/vacuum and 5 valve manifold for DP/level/flow measurements. For HFO, LFO applications, SS capillary with ANSI RF flanged ends shall be provided.

than 5M ohms. Repeatability over full range shall be better than 0.02%. RTDs shall be ungrounded. RTD shall be supplied as an assembly complete with thermo wells meeting ANSI 19.3 (latest) requirements.

1.8 Level Gauges

Tubular type level gauges for low pressure upto 7 kg /sq.cm & reflex type for high pressure water & steam services & vacuum services with automatic ball check valves, illuminator (240 AC), pyrex/ tempered toughened borosilicate glass, mica shield, brass guard rods & brass holders. Body material: Forged carbon steel/304SS. Accuracy- +/- 2% with vertical scale.4 Material of accessories (name plate, etc.) shall be SS. Tubular glass OD shall be 5/8". Vent & drain valves shall be provided. Connection shall be screwed or flanged (ANSI class 150 RF).

1.9 Level Switches

External cage magnetic float operated level switches for tanks and vessels and top mounted level switches for sumps and underground tanks. The top mounted level switches shall be supplied with still tubes to suit the requirement. Micro switch with 2 SPDT contacts rated for 0.2 A, 220 V DC. Material of float & float chord shall be 316 SS & cage material shall be fabricated steel and the material of accessories shall be SS. IP65 or equivalent degree of protection for enclosure.

Accessories like name plate, drain valve for external case type level switches, mating flange, gaskets (asbestos), fasteners, bolts & nuts, etc. shall be supplied.

Conductivity type electronic Probe type level switches shall be supplied for Drain pots. The required pressure vessel assembly for mounting probes are included in the scope.

1.10 Level Transmitter

Ultrasonic type level transmitters top mounted with integral local LCD indicator, IP-65 protection; 2 wire type transmitter with 4-20mA output with HART protocol; Accuracy ±0.25%; Resolution 1mm; Repeatability ±0.1%; Linearity ±1%; Response time 150ms; Beam angle <12º; Auto false echo-suppression; Accessories like integral cable between sensor and transmitter unit with connectors on both side, gasket and cable gland, digital panel meter, name plate & metal tag; the material of accessories will be SS.

Radar type level transmitters top mounted with LCD indicator,IP-65 protection; 2 wire type transmitter with 4-20mA output with HART protocol; Accuracy ±1%; Resolution 1mm; Repeatability ±1 mm; Linearity ±0.01%; Beam angle <20º; Accessories like integral cable between sensor and transmitter unit with connectors on both side, gasket and cable gland, digital panel meter, name plate & metal tag; the material of accessories will be SS.

coloured LCD or fluorescent tube with user selectable span; programmability (selection of input & scan/storage rate) shall be through Front panel keyboard; the recorder shall have the capability of being drawn out from the front side of the housing for maintenance and shall have electrical connection of plug-in type; material of casing shall be die-cast aluminium with epoxy coating and with a non-glare shatter proof Glass; enclosure shall be IP32 The quantity of Hybrid recorders shall be 4 nos.

1.21 Pressure and Differential Pressure Transmitter Racks

Open type transmitter racks to mount all pressure, differential pressure and flow transmitters with vibration dampener: air supply lines and header shall be provided with bulk head fittings to receive impulse lines; Also provided with blow down/drain header. The material of accessories shall be SS. Drains shall be connected upto suitable Owner / Project Manager's drain header. The quantity shall be as required for the specified Pressure and Diff. Pressure transmitter.

1.22 Junction Boxes (JB)

All JBs shall be Galvanised. Wall/column mounted junction boxes having 32 (2x16) terminals and cable entry only at the bottom and sealed with fireproof compound; Screwed terminal type; IP 65 or equivalent degree of protection for enclosure. Separate terminal blocks shall be used for analog and digital signal and also for signals with different voltages. Removable gland plate shall be supplied. JB shall have single lockable door with gasket, able to open side ways, with common keys. Painting inside shall be glossy white & outside - IS-5 shade 631. Shield bus for screw connection shall be provided. Terminal size shall be suitable for 0.5 sq.mm to 2.5 sq.mm wire. Terminal blocks shall be vertical. JB shall have provision to add 10% additional terminals. Accessories like metal tag (SS), clamps, fixtures, bolts (SS), nuts (SS), gaskets (neoprene), lock & key, fireproof compound for sealing, etc. shall be supplied. The grouping of instruments in JBs is subject to Owner / Project Manager's approval. All the field Junction boxes shall have single doors and provision for locking. The doors shall not have screwed type of locking, but turnable hinge based. The JBs are subject to approval prior to manufacturing All JBs shall be provided with individual canopies to avoid ingress of water.
All the TBs used shall be 6.6polymide to withstand corrosion and the metallic portion shall be coated against rust / corrosion.

1.23 Programmable Logic controller (PLC)-Refer Cl.no. 9.0 & Table-15

1.24 Interposing Relays (IPR)

Electro magnetic type IPRs with plug-in type connections, suitable for channel/rail mounting in cabinets; coil rating 24V D.C; 2 set of silver plated Change over contacts rated for 0.2A 220 V DC. Freewheeling diode across relay coil (copper) and self reset type status indicator flag (electronic) shall be provided. All relays

hinged at one end to facilitate easy isolation shall be provided wherever necessary. All cabinets shall be provided with spare terminals for the spare inputs/outputs as specified else where in the specification.. The type of terminals for terminations from cabinets/panels shall match with the pre fabricated cables and pins supplied. The terminals for field cables shall be arranged in a logical order of equipment/system wise and shall be worked out by Bidder, subject to approval by Owner / Project Manager/ Consultant. Door shall have concealed type hinges and swing of 180 Degree & lockable. The doors shall be provided both on the front and rear. Channels, bolts & nuts shall be zinc plated and passivated. Two coats of premier paint and black colour paint shall be applied. Fluorescent lamp of 40W shall be provided and shall be operated by the door switches as well as by manual switches. The marshalling cabinets, the terminal blocks, the terminals and the electronic hardware if any, shall have identification numbers. Each cabinet shall be provided with one each 3 pin receptacles for 240 V AC, 1Ph, 50 c/s and receptacles for +24V DC. A system cabinet and associated cabinets shall be supplied on a skid to avoid outside interconnecting cables. Cabinet shall be delivered totally wired. Preparation of interconnection schedule (ICS) between marshalling cabinets & JBs/FTCs and JBs to Instruments is in Bidder scope. The format of Interconnection Cable Schedule (ICS) shall be submitted by the Bidder during detailed engineering stage for approval by Owner / Project Manager.

All cabinets shall have common key for the locks.

All the terminals shall have no screws and the cables shall be gripped by spring. Each terminal shall have LED indication with fuses to indicate and isolate earth faults.

1.27 Local Panels

1.27.1 Indoor/Outdoor located, free standing vertical type local panels with 2 mm thick sheet material of cold rolled steel; ant vibration pads of 15 mm thick; fluorescent lighting; Double doors with neoprene gaskets at every 1.5 m; blower & louvers in each section with brass mesh; fire proof compound (50 mm thick) for sealing cable entry (bottom); fire detector for each section; space heater with thermostatic control for each section (strip type). ~~IP-52 degree of protection for enclosure for outdoor and IP-32 for indoor.~~ Removable cover plates with locking facility shall be provided along the bottom of the front desk continuously to facilitate maintenance work. The length of each cover plate shall not exceed 1 m. Fluorescent lamp of 40 W shall be provided from one end of the panel to the other end at continuous length and shall be operated by the door switches as well as by manual switches. Nameplates shall be provided for all instruments/inserts with Tag. No. & short description of service engraved. These shall be phenolic overlays (1.6 mm thick), black background with white lettering & shall be fixed to the panel by stainless steel screws (counter sunk). Each section of the panels shall be provided with one each 3 pin receptacles for 240V AC, 1P, 50 c/s &. Panel shall be delivered totally wired. All instruments, inserts and annunciation windows shall be mounted & wiring connections at these hardware shall be terminated at site by Bidder.

Degree of protection shall be IP-65

1.27.2 All the Terminal Blocks shall be rust proof and corrosive resistant for outdoor mounted panels. Terminal Blocks housing material shall be 6.6 polyamide and metallic portion shall be coated against rust/corrosion.

1.27.3 In each Local Panel, a 24 V DC Voltmeter shall be provided to check the Field Interrogation voltage.

1.28 Vibration Monitoring And Analysis System

Refer TABLE-13.

1.29 230 V AC Distribution Board

The function of the 230V AC distribution is sub distribution of 230V AC power supply from UPS to all the utilities viz., system cabinets, HMI and peripherals. Redundant feeders shall be provided for each utility. The cabinets shall be free standing vertical cabinets, designed for indoor location. Material of construction shall be 2mm thick CRCA. Fluorescent lighting, fire detector and space heater shall be provided for each cabinet. Isolating switches and HRC cartridge fuses shall be provided for individual feeder isolation. Ammeter and voltmeter shall be provided for incoming feeders to the distribution boards.

Each terminal shall have LED indication with fuses to indicate and isolate earth faults.

1.30 Control Valves

1.30.1 Multistage, anti-cavitation, balanced, modulating, globe type, cage guided, single ported, diaphragm type of actuator with hand wheel, SMART positioner, air filter regulator, air lock device, solenoid valve as applicable, limit switches and position transmitters completely tubed with junction box. Smart positioner shall be suitable for accepting 4-20mADC signal. Pneumatic (PVC coated copper) tubing complete with accessories, fittings, If any up-gradation of the offered system is envisaged before completion of the job to meet the specified requirements, the same shall be incorporated in the system, with the approval of the OWNER without any additional cost. Positioner shall be provided with input/output/bypass gauges. Local position indicator & Non-contact type position transmitter with 2 wire, 4-20mA DC output. All limit switches/position transmitters, E/P converter signals etc., shall be wired out to external block of actuator and respective junction boxes.

1.30.2 Control valves shall be sized to have an opening of 15% at minimum flow condition and 85% at maximum flow condition. Noise level shall not exceed 85 dB at a distance of about 1.5 M from the valve. In case of predicted noise level above 85dBA, suitable low noise trim shall be provided. Noise reduction shall be achieved through an inherent Trim design and not through external means.

1.47 Cables

1.47.1 Individual pair shielded & overall shield twisted pair copper cables shall be used for analog signals & overall shielded cables shall be used for digital signals. All these cables shall be armoured. All the insulation including overall sheath shall be FRLS quality. The wire size shall be 0.5 sq.mm. Ferruling indicating terminal numbers on termination side shall be followed. Colour coding shall be approved by Owner / Project Manager. Only sleeve type ferruling with printed terminal numbers shall be used. Cross ferruling shall be adopted.

1.47.2 Instrumentation Cables

Instrumentation cables shall be 600VAC grade, stranded high conductivity annealed, tinned copper, twisted pair (with min. 20 twists for meter) extruded PVC insulated with overall and / or individual screening, extruded PVC inner sheathed, galvanized steel wire armoured, extruded outer sheathed with FRLS PVC compound. The conductor size shall be minimum 0.8 sq.mm. Triplex cables similar to instrumentation cables can be used for RTDs. Instrumentation cables carrying digital signals shall have overall screening along with drain wire and analogue signal carrying cables shall have each pair screening and overall screening along with each pair drain wire and overall drain wire. The Fire survival cable shall conform to IEC 331 standard.

1.47.3 Control Cables

Control cables shall be 1100V AC grade, multicore, minimum 1.5 sq.mm cross section, stranded copper conductor having 7 strands, PVC insulated, inner FRLS PVC sheathed of type ST-1, galvanized steel wire armoured and outer sheath made of FRLS PVC compound of type ST-1. In situations where accuracy of measurement or voltage drop in control circuit, warrant, higher cross sections as required shall be used. For all the CT & PT cables, minimum 2.5 sq.mm cables shall be used. Solenoid valve Power supply cables shall be minimum 2.5 sq.mm. The Fire survival cable shall conform to IEC 331 standard.

1.47.4 Compensating Cables

1.47.4.1 All Compensating cables shall be single or multicore cable (ANSI type KK) twisted and multiple shielded thermocouple extension compensating cable and shall be of Flame Retardant Low Smoke type (FRLS). All Compensating cable (Chromel - Alumel) of FRLS type shall conform to additional test to Prove the FRLS Characteristics as mentioned in the FRLS Instrument Cable specifications

1.47.4.2 Compensating Cable:

(a) Reference ANSI MC (96.1)

wiring, tinned copper conductor of 0.5 sq.mm cross section with seven strands twisted pair with 20 twists/meter. Insulation material shall be PVC, heat resistant with flame retarding properties with thickness not more than 0.5 sq.mm. Voltage grade shall be 1100V AC. Each prefabricated cable shall have a minimum of 5 cores as spares and these shall not be connected to end connectors.

1.48.3 Terminal Block (TB):

Cage clamp type , 600V V AC grade, vertically mounted, size of 0.5 sq.mm to 1.5 sq.mm for instrument wires and 100V AC 1.5 sq.mm to 2.5 sq.mm for control wires. Clearance between TBs shall be 150 mm and between TB and bottom plate shall be 250 mm, flame resistant, non-hygroscopic, decarbonised. Insulation between adjacent terminals or between terminals & framework shall be 2 KV RMS for 1 minute . Power supply and signal TB shall be separate. Signals shall be grouped in TBs in the same order as that in field junction box so as to provide neat cable layout and wiring. High voltage and low voltage signals shall be provided on separate TBs, which are mounted separately.

TBs housing material shall be 6.6 polyamide and metallic portion shall be coated against corrosion. There shall be no double decker terminals.

1.49 Electromatic Relief Valve (EMRV) Controller

Electronic/relay based type with pressure high & low switches. One no. for each EMRV. Man/Auto/Off selection with lamps for auto/manual positions shall be provided. IP65 or equivalent degree of protection for enclosure. Enclosure material will be epoxy coated die cast aluminum. Power supply will be 220 V DC & output signal will be 'pressure high' potential free contact for solenoid valve energisation. One no. solenoid valve (for each EMRV) of 220 V DC single coil with limit switches shall be supplied. Other features of solenoid valve shall be in line with that specified under 'Solenoid Valves' in this section. Terminals in terminal block of the controller & solenoid shall accept cable of 0.5 to 2.5 Sq.mm. Switch contact rating shall be boosted using relays.

1.50 Electronic display board

Electronic display board with Super bright red LED display for alphanumeric letters of size 9" x 7",gap between two lines 25mm,weather proof IP 65, with canopy. Power supply 240VAC. Seven lines of display as following:

i. Name of company
ii. Date and Day
iii. Stack emission parameters with units
iv. Ambient air quality parameters with units
v. Meteorological parameters
vi. Provision for additional line
vii. Provision for additional line

SECTION - D
STANDARD TECHNICAL SPECIFICATION

SECTION D1: STANDARD TECHNICAL SPECIFICATION FOR SUMP PUMP

SECTION D2: STANDARD TECHNICAL SPECIFICATION FOR ELECTRIC MOTOR

SECTION D3: STANDARD TECHNICAL SPECIFICATION FOR CONTROL PANEL, PR. GAUGE, LEVEL SWITCHES

SECTION - D1

STANDARD TECHNICAL SPECIFICATION FOR SUMP PUMPS

DATA SHEET- A

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 complete with all accessories as specified hereinafter.

1.02.00 The design, performance, major constructional features, materials of construction etc., of the Sump 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 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 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-C/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 sludge, 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 25mm.

3.01.02 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 which shall be furnished along with project enquiry and shall be portable type. Each pump set along with drives, control panel etc., and shall be mounted on a trolley for ease of transportation. These pumps shall be suitable for handling drainage water containing hard solid particles, sludge, and polluted liquid with expected particle size of 25mm.

3.01.02 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 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 25mm.

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 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).

5.00.00 GENERAL

5.01.00 Pumps as described in Section-C/Datasheet-A (furnished along with the project enquiry) shall be complete with their drives, couplings (if required) 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 at least 15% 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 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 (if required)., drive assembly etc. These pumps shall be trolley mounted portable type.

6.08.03 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 Fixed 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 (if required) between shafts shall be so designed that they become tight during pump operation.

6.08.07 Column Pipe for fixed type 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 (As required)

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 (If required)**

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 (if required).

ii) Shafts & shaft sleeves (if required).

iii) Couplings (if required).

iv) Bearings

v) Column pipes (if required).

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 (if required) be subject to D.P. & Ultrasonic test.

iii) Wearing rings (if required) 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 tolerances on Head; Discharge & Power shall be specified in HIS, USA.

ii) Performance tests are to be conducted to cover the entire range of operation of the pumps. These shall be carried out to span 130% of rated capacity upto pump shut-off condition. A minimum of five combinations of head & capacity are to be achieved during testing to establish the performance curves, including the design capacity point, shut-off point and the two extremities of the range of operation as specified in the annexures. After completion of performance test, all pumps shall be stripped down for inspection of internals.

iii) Tests shall be conducted with actual drive motors being furnished

iv) The Bidder shall submit in his proposal the facilities available at his works to conduct performance testing.

v) NPSH tests are to be conducted on one pump of each type at 3% head drop conditions, if specified in the pump Annexures.

vi) All rotating components of the pumps shall be subjected to static and dynamic balancing tests. The assembled rotor will be subjected to dynamic balancing tests.

vii) Mechanical run test shall be carried out on all pumps to determine the vibration levels, noise levels etc. This test shall be conducted at site also. However, test value at site shall be used for the acceptance of the equipment.

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

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

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

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

8.00.00 Drawings, data, curves and information

8.01.00 Following drawings, data and information for the equipments are required to be submitted by the bidder along with 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.

	2X660 MW SURATGARH STPS UNIT 7 & 8			**Specification No: PE-TS-392-172-N001**
	TECHNICAL SPECIFICATION FOR SUMP PUMPS			**Vol-IIB Section-D**
	DATA SHEET - A (SUMP PUMPS)			**Date - 07.07.14**
CL. NO.	**DESCRIPTION**	**UNIT**	**Group-A**	
			Fixed Duty type Submersible Sump	**Fixed Duty type Submersible Sump**
1.0.0	**GENERAL**			
1.1.0	Service /Location of Sump pumps		CW Pit in TG Building	Rain Water Harvesting
1.2.0	Equipment name		Sump Pump	Sump Pump
1.3.0	Pump type		Fixed Submersible sump pumps	Fixed Submersible sump pumps
1.4.0	Duty		Intermittent	Intermittent
1.5.0	Location		Indoor/ Outdoor	Indoor/ Outdoor
1.6.0	Maximum Ambient Temperature	°C	60	60
1.7.0	Drive		Motor Driven	Motor Driven
1.8.0	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	100	100
2.2.0	Total head at rated capacity	MWC	20	50
2.3.0	Total no.of pumps installed	Nos.	4	4
2.4.0	No. of pumps working / Standby	Nos.	(1 W+1 S) Per Unit	(2W + 2S) for Station
2.5.0	Parallel operation required		Yes	Yes
2.6.0	Pump RPM		1500 (Max.)	1500 (Max.)
2.9.0	Range of operation	%	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 5120/IS 8034
2.11.0	Max. particle size to be handled		35 mm	35 mm
3.0.0	**LIQUID DATA**			
3.1.0	Liquid handled		water with suspended particles	water with suspended particles
3.2.0	Specific gravity		1.1	1.1
3.3.0	Temperature (max.)	°C	60	60
4.0.0	**DESIGN AND CONSTRUCTION**			
	FEATURES			
4.1.0	Impeller type		Open, Non-clog type	Open, Non-clog type
4.2.0	Flange drilling standard		ANSI B 16.5	ANSI B 16.5
5.0.0	**MATERIAL OF CONSTRUCTION**			
5.1.0	Casing / Suction bell		CI,IS:210 Gr FG 260	CI,IS:210 Gr FG 260
5.2.0	Impeller		SS-316	SS-316
5.3.0	Impeller shaft		SS-410	SS-410
5.4.0	Wear ring (where applicable)		Austenitic cast iron	Austenitic cast iron
5.5.0	Shaft sleeve (where applicable)		SS-316/SS410	SS-316/SS410
5.6.0	Coulmn Pipe (where applicable)		-	-
5.7.0	Pump and motor coupling		-	-
5.8.0	Fasteners		SS 316	SS 316
5.9.0	Gland		C.I, IS-210, FG-260/ Equivalent	C.I, IS-210, FG-260/ Equivalent
	Gland Packing		Braided Graphite- free Teflon	Braided Graphite- free Teflon
5.10.0	Mechanical seal		As applicable	As applicable
5.11.0	Pump Lubrication		SELF/Oil/Grease	SELF/Oil/Grease
5.12.0	Pump line shaft lubrication		N/A	N/A
5.13.0	Strainer (Body / Mesh)		Body (CI IS FG260 FG 260)/ Mesh (SS 316)	Body (CI IS FG260 FG 260)/ 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
7.2.0	Elastomer cables for connecting pump with its panel length (M)		25M	25M
7.3.0	Relay based control panel with integral starter		Yes Wall mounted,common for two pumps with IP 65 protection	Yes Wall mounted,common for two pumps with IP 65 protection
7.4.0	Suction and Discharge pressure gauge with root valve / pump		Discharge pressure Guage with 3 way isolationg valve	Discharge pressure Guage with 3 way isolationg valve

	2X660 MW SURATGARH STPS UNIT 7 & 8			Specification No: PE-TS-392-172-N001
BHEL	TECHNICAL SPECIFICATION FOR SUMP PUMPS			Vol-IIB Section-D
	DATA SHEET - A (SUMP PUMPS)			Date - 07.07.14
CL. NO.	DESCRIPTION	UNIT	Group-A	
			Fixed Duty type Submersible Sump	Fixed Duty type Submersible Sump
7.5.0	Discharge hose/ Pipe			
	- Hose/ Pipe length per pump		Fixed MS Piping upto top of Pit (Carbon Steel as per IS 1239, Heave Grade)	Fixed MS Piping upto top of Pit (Carbon Steel as per IS 1239, Heave Grade)
	- Hose/Pipe dia		Min. 150 NB	Min. 150 NB
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		-	-
7.7.0	Chains		Yes(15M)	Yes, (15M)
7.8.0	Suction Strainers		Yes	Yes
7.9.0	Pump Stool		Yes	Yes
7.10.0	Wheel trolley required per pump		No	No
7.11.0	Level switches for		Top mounted displacer or capacitive type level switch subject to customer's approval	Top mounted displacer or capacitive type level switch subject to customer's approval
	- Very Low level		Yes, One level switch for two pumps installed in a pit	Yes, One level switch for two pumps installed in a pit
	- High level		Yes, One level switch for two pumps installed in a pit	Yes, One level switch for two pumps installed in a pit
	- Very high level		Yes, One level switch for two pumps installed in a pit	Yes, One level switch for two pumps installed in a pit
8.0.0	Levels for installation			
8.1	Pump/Motor Support Elevation		N/A	N/A
8.2	Pump Invert Level		-6.85 M w.r.t. Finished Ground Level	Approx.(-5.0) M to (-6.0) M w.r.t. Finished Ground Level
9.0.0	Pit Size		2 M X 1.5 M X 1 M	-
10.0.0	Special Requirements (Applicable Only for Diesel Engine Sump Pumps only)			
10.1.0	Suction Hose Pipe along with Foot Valve		N/A	N/A

	2X660 MW SURATGARH STPS UNIT 7 & 8			Specification No: PE-TS-392-172-N001
BHEL	TECHNICAL SPECIFICATION FOR SUMP PUMPS			Vol-IIB Section-D
	DATA SHEET - A (SUMP PUMPS)			Date - 07.07.14
CL. NO.	DESCRIPTION	UNIT	Group-B	
			Portable Submersible Sump Pumps	Portable Submersible Sump Pumps
1.0.0	**GENERAL**			
1.1.0	Service /Location of Sump pumps		For dewatering Various Pump Houses (CW P/H, River Water P/H, Raw Water P/H & Filtered Water P/H)	For dewatering Desilting Chambers
1.2.0	Equipment name		Sump Pump	Sump Pump
1.3.0	Pump type		Portable Submersible sump pumps	Portable Submersible sump pumps
1.4.0	Duty		Intermittent	Intermittent
1.5.0	Location		Indoor/ Outdoor	Indoor/ Outdoor
1.6.0	Maximum Ambient Temperature	°C	60	60
1.7.0	Drive		Motor Driven	Motor Driven
1.8.0	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	100	100
2.2.0	Total head at rated capacity	MWC	25	25
2.3.0	Total no.of pumps installed	Nos.	8	2
2.4.0	No. of pumps working / Standby	Nos.	-	-
2.5.0	Parallel operation required		-	-
2.6.0	Pump RPM		1500 (Max.)	1500 (Max.)
2.9.0	Range of operation	%	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 5120/IS 8034
2.11.0	Max. particle size to be handled		35 mm	35 mm
3.0.0	**LIQUID DATA**			
3.1.0	Liquid handled		water with suspended particles	water with suspended particles
3.2.0	Specific gravity		1.1	1.1
3.3.0	Temperature (max.)	°C	60	60
4.0.0	**DESIGN AND CONSTRUCTION**			
	FEATURES			
4.1.0	Impeller type		Open, Non-clog type	Open, Non-clog type
4.2.0	Flange drilling standard		ANSI B 16.5	ANSI B 16.5
5.0.0	**MATERIAL OF CONSTRUCTION**			
5.1.0	Casing / Suction bell		CI,IS:210 Gr FG 260	CI,IS:210 Gr FG 260
5.2.0	Impeller		SS-316	SS-316
5.3.0	Impeller shaft		SS-410	SS-410
5.4.0	Wear ring (where applicable)		Austenitic cast iron	Austenitic cast iron
5.5.0	Shaft sleeve (where applicable)		SS-316/SS410	SS-316/SS410
5.6.0	Coulmn Pipe (where applicable)		-	-
5.7.0	Pump and motor coupling		-	-
5.8.0	Fasteners		SS 316	SS 316
5.9.0	Gland		C.I, IS-210, FG-260/ Equivalent	C.I, IS-210, FG-260/ Equivalent
	Gland Packing		Braided Graphite- free Teflon	Braided Graphite- free Teflon
5.10.0	Mechanical seal		As applicable	As applicable
5.11.0	Pump Lubrication		SELF/Oil/Grease	SELF/Oil/Grease
5.12.0	Pump line shaft lubrication		N/A	N/A
5.13.0	Strainer (Body / Mesh)		Body (CI IS FG260 FG 260)/ Mesh (SS 316)	Body (CI IS FG260 FG 260)/ Mesh (SS 316)
Note :	**Bidder's may offer alternative materials, if they are**			
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
7.2.0	Elastomer cables for connecting pump with its panel length (M)		25M	25M
7.3.0	Relay based control panel with integral starter		Yes Trolley mounted for each sump pump with IP 65 protection	Yes Trolley mounted for each sump pump with IP 65 protection
7.4.0	Suction and Discharge pressure gauge with root valve / pump		-	-

	2X660 MW SURATGARH STPS UNIT 7 & 8			Specification No: PE-TS-392-172-N001
BHEL	TECHNICAL SPECIFICATION FOR SUMP PUMPS			Vol-IIB Section-D
	DATA SHEET - A (SUMP PUMPS)			Date - 07.07.14
CL. NO.	DESCRIPTION	UNIT	Group-B	
			Portable Submersible Sump Pumps	Portable Submersible Sump Pumps
7.5.0	Discharge hose/ Pipe			
	- Hose/ Pipe length per pump		30 M (Heavy duty rubberised canvas)	30 M (Heavy duty rubberised canvas)
	- Hose/Pipe dia		To suit pump discharge	To suit pump discharge
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		30 m	30 m
7.7.0	Chains		Yes(15M)	Yes, (15M)
7.8.0	Suction Strainers		Yes	Yes
7.9.0	Pump Stool		Yes	Yes
7.10.0	Wheel trolley required per pump		Yes	Yes
7.11.0	Level switches for		Float type level probe integral with pump	Float type level probe integral with pump
	- Very Low level		Yes	Yes
	- High level		NA	NA
	- Very high level		NA	NA
8.0.0	Levels for installation			
8.1	Pump/Motor Support Elevation		N/A	N/A
8.2	Pump Invert Level		N/A	N/A
9.0.0	Pit Size		-	-
10.0.0	Special Requirements (Applicable Only for Diesel Engine Sump Pumps only)			
10.1.0	Suction Hose Pipe along with Foot Valve		N/A	N/A

	2X660 MW SURATGARH STPS UNIT 7 & 8			Specification No: PE-TS-392-172-N001
	TECHNICAL SPECIFICATION FOR SUMP PUMPS			Vol-IIB Section-D
	DATA SHEET - A (SUMP PUMPS)			Date - 07.07.14
CL. NO.	DESCRIPTION	UNIT	Group-B	
			Portable Submersible Sump Pumps	Portable Submersible Sump Pumps
1.0.0	**GENERAL**			
1.1.0	Service /Location of Sump pumps		For dewatering various Cable Trenches	For various general purpose pits
1.2.0	Equipment name		Sump Pump	Sump Pump
1.3.0	Pump type		Portable Submersible sump pumps	Portable Submersible sump pumps
1.4.0	Duty		Intermittent	Intermittent
1.5.0	Location		Indoor/ Outdoor	Indoor/ Outdoor
1.6.0	Maximum Ambient Temperature	°C	60	60
1.7.0	Drive		Motor Driven	Motor Driven
1.8.0	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	10	100
2.2.0	Total head at rated capacity	MWC	15	25
2.3.0	Total no.of pumps installed	Nos.	4	8
2.4.0	No. of pumps working / Standby	Nos.	-	-
2.5.0	Parallel operation required		-	-
2.6.0	Pump RPM		1500 (Max.)	1500 (Max.)
2.9.0	Range of operation	%	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 5120/IS 8034
2.11.0	Max. particle size to be handled		35 mm	35 mm
3.0.0	**LIQUID DATA**			
3.1.0	Liquid handled		water with suspended particles	water with suspended particles
3.2.0	Specific gravity		1.1	1.1
3.3.0	Temperature (max.)	°C	60	60
4.0.0	**DESIGN AND CONSTRUCTION**			
	FEATURES			
4.1.0	Impeller type		Open, Non-clog type	Open, Non-clog type
4.2.0	Flange drilling standard		ANSI B 16.5	ANSI B 16.5
5.0.0	**MATERIAL OF CONSTRUCTION**			
5.1.0	Casing / Suction bell		CI,IS:210 Gr FG 260	CI,IS:210 Gr FG 260
5.2.0	Impeller		SS-316	SS-316
5.3.0	Impeller shaft		SS-410	SS-410
5.4.0	Wear ring (where applicable)		Austenitic cast iron	Austenitic cast iron
5.5.0	Shaft sleeve (where applicable)		SS-316/SS410	SS-316/SS410
5.6.0	Coulmn Pipe (where applicable)		-	-
5.7.0	Pump and motor coupling		-	-
5.8.0	Fasteners		SS 316	SS 316
5.9.0	Gland		C.I, IS-210, FG-260/ Equivalent	C.I, IS-210, FG-260/ Equivalent
	Gland Packing		Braided Graphite- free Teflon	Braided Graphite- free Teflon
5.10.0	Mechanical seal		As applicable	As applicable
5.11.0	Pump Lubrication		SELF/Oil/Grease	SELF/Oil/Grease
5.12.0	Pump line shaft lubrication		N/A	N/A
5.13.0	Strainer (Body / Mesh)		Body (CI IS FG260 FG 260)/ Mesh (SS 316)	Body (CI IS FG260 FG 260)/ Mesh (SS 316)
Note :	**Bidder's may offer alternative materials, if they are**			
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
7.2.0	Elastomer cables for connecting pump with its panel length (M)		25M	25M
7.3.0	Relay based control panel with integral starter		Yes Trolley mounted for each sump pump with IP 65 protection	Yes Trolley mounted for each sump pump with IP 65 protection
7.4.0	Suction and Discharge pressure gauge with root valve / pump		-	-

	2X660 MW SURATGARH STPS UNIT 7 & 8			Specification No: PE-TS-392-172-N001
BHEL	TECHNICAL SPECIFICATION FOR SUMP PUMPS			Vol-IIB Section-D
	DATA SHEET - A (SUMP PUMPS)			Date - 07.07.14
CL. NO.	DESCRIPTION	UNIT	Group-B	
			Portable Submersible Sump Pumps	Portable Submersible Sump Pumps
7.5.0	Discharge hose/ Pipe			
	- Hose/ Pipe length per pump		30 M (Heavy duty rubberised canvas)	30 M (Heavy duty rubberised canvas)
	- Hose/Pipe dia		To suit pump discharge	To suit pump discharge
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		30 m	30 m
7.7.0	Chains		Yes(15M)	Yes, (15M)
7.8.0	Suction Strainers		Yes	Yes
7.9.0	Pump Stool		Yes	Yes
7.10.0	Wheel trolley required per pump		Yes	Yes
7.11.0	Level switches for		Float type level probe integral with pump	Float type level probe integral with pump
	- Very Low level		Yes	Yes
	- High level		NA	NA
	- Very high level		NA	NA
8.0.0	Levels for installation			
8.1	Pump/Motor Support Elevation		N/A	N/A
8.2	Pump Invert Level		N/A	N/A
9.0.0	Pit Size		-	-
10.0.0	Special Requirements (Applicable Only for Diesel Engine Sump Pumps only)			
10.1.0	Suction Hose Pipe along with Foot Valve		N/A	N/A

	2X660 MW SURATGARH STPS UNIT 7 & 8			Specification No: PE-TS-392-172-N001
BHEL	TECHNICAL SPECIFICATION FOR SUMP PUMPS			Vol-IIB Section-D
	DATA SHEET - A (SUMP PUMPS)			Date - 07.07.14
CL. NO.	DESCRIPTION	UNIT	Group-B	
			Portable Submersible Sump Pumps	Portable Diesel Engine Driven Sump
1.0.0	**GENERAL**			
1.1.0	Service /Location of Sump pumps		For various general purpose pits	For various general purpose pits
1.2.0	Equipment name		Sump Pump	Sump Pump
1.3.0	Pump type		Portable Submersible sump pumps	Portable Diesel Engine Driven sump pumps
1.4.0	Duty		Intermittent	Intermittent
1.5.0	Location		Indoor/ Outdoor	Indoor/ Outdoor
1.6.0	Maximum Ambient Temperature	°C	60	60
1.7.0	Drive		Motor Driven	Diesel Engine Driven
1.8.0	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.	N.A.
2.0.0	**PUMP PARAMETERS**			
2.1.0	Design capacity	M3/hr	150	150
2.2.0	Total head at rated capacity	MWC	25	25
2.3.0	Total no.of pumps installed	Nos.	4	2
2.4.0	No. of pumps working / Standby	Nos.	-	-
2.5.0	Parallel operation required		-	-
2.6.0	Pump RPM		1500 (Max.)	1500 (Max.)
2.9.0	Range of operation	%	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 5120
2.11.0	Max. particle size to be handled		35 mm	35 mm
3.0.0	**LIQUID DATA**			
3.1.0	Liquid handled		water with suspended particles	water with suspended particles
3.2.0	Specific gravity		1.1	1.1
3.3.0	Temperature (max.)	°C	60	60
4.0.0	**DESIGN AND CONSTRUCTION**			
	FEATURES			
4.1.0	Impeller type		Open, Non-clog type	Open, Non-clog type
4.2.0	Flange drilling standard		ANSI B 16.5	ANSI B 16.5
5.0.0	**MATERIAL OF CONSTRUCTION**			
5.1.0	Casing / Suction bell		CI,IS:210 Gr FG 260	CI,IS:210 Gr FG 260
5.2.0	Impeller		SS-316	SS-316
5.3.0	Impeller shaft		SS-410	SS-410
5.4.0	Wear ring (where applicable)		Austenitic cast iron	Austenitic cast iron
5.5.0	Shaft sleeve (where applicable)		SS-316/SS410	SS-316/SS410
5.6.0	Coulmn Pipe (where applicable)		-	-
5.7.0	Pump and motor coupling		-	-
5.8.0	Fasteners		SS 316	SS 316
5.9.0	Gland		C.I, IS-210, FG-260/ Equivalent	C.I, IS-210, FG-260/ Equivalent
	Gland Packing		Braided Graphite- free Teflon	Braided Graphite- free Teflon
5.10.0	Mechanical seal		As applicable	As applicable
5.11.0	Pump Lubrication		SELF/Oil/Grease	SELF/Oil/Grease
5.12.0	Pump line shaft lubrication		N/A	N/A
5.13.0	Strainer (Body / Mesh)		Body (CI IS FG260 FG 260)/ Mesh (SS 316)	Body (CI IS FG260 FG 260)/ Mesh (SS 316)
Note :	**Bidder's may offer alternative materials, if they are**			
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
7.2.0	Elastomer cables for connecting pump with its panel length (M)		25M	NA
7.3.0	Relay based control panel with integral starter		Yes Trolley mounted for each sump pump with IP 65 protection	Not Applicable
7.4.0	Suction and Discharge pressure gauge with root valve / pump		-	-

CL. NO.	DESCRIPTION	UNIT	Group-B	
			Portable Submersible Sump Pumps	Portable Diesel Engine Driven Sump
7.5.0	Discharge hose/ Pipe			
	- Hose/ Pipe length per pump		30 M (Heavy duty rubberised canvas)	30 M (Heavy duty rubberised canvas)
	- Hose/Pipe dia		To suit pump discharge	To suit pump discharge
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		30 m	-
7.7.0	Chains		Yes(15M)	NA
7.8.0	Suction Strainers		Yes	Yes
7.9.0	Pump Stool		Yes	Yes
7.10.0	Wheel trolley required per pump		Yes	Yes
7.11.0	Level switches for		Float type level probe integral with pump	NA
	- Very Low level		Yes	NA
	- High level		NA	NA
	- Very high level		NA	NA
8.0.0	Levels for installation			
8.1	Pump/Motor Support Elevation		N/A	N/A
8.2	Pump Invert Level		N/A	N/A
9.0.0	Pit Size		-	-
10.0.0	Special Requirements (Applicable Only for Diesel Engine Sump Pumps only)			
10.1.0	Suction Hose Pipe along with Foot Valve		N/A	Yes (10 m per Pump)

MANUFACTURERS NAME & ADD

STANDARD QUALITY PLAN

ITEM : Submersible Pumps
Dt.: 31.05.2012 MODEL SUBMERSIBLE PUMPS

QP No: PE-QP-999-100-N005
REV No.: R01
DATE: 31.05.2012

PROJECT : -
END USER : CUSTOMER

MAIN SUPPLIER: BHEL, Noida

SR. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD		AGENCY			REMARKS
					M	B					M	B	N	
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	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	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	All batches	Appd. C S Drg.	APPROVED DRAWING/DATA SHEET	Corelated HT charts	√	P	V	V	
		IGC TEST	MA	CHEMICAL	1 SAMPLE/ HT BATCH		ASTM A 262	PRACTICE - "E"	TC	√	P	V	V	
1.3	Bars / forgings for pump and motor shafts	Physical/Chemical Properties	CR	Physical / Chemical Analysis	1/ Bar	1/ Bar	Appd. C S Drg.	APPROVED DRAWING/DATA SHEET	Mill TC or lab report	√	P	V	V	
		Dimensions	MA	Measurment	100%	100%	Manufacturers Drawing	Manufacturers Drawing	IR		P	V	V	
		Internal defects for 40 mm and above diameter	CR	UT	100%	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/ IS 1554, Length and Size	MA	Measurement	100%	100%	Approved Datasheet / IS 694/ IS 1554	Approved Datasheet / IS 694/ IS 1554	IR & TC	√	P	V	V	Compliance cert. To be submitted by Vendor.
1.5	Bearings	Make, Bearing No., Surface finish	MA	Visual Examination	100%	100%	Manufacturers Std	Manufacturers Std	IR		P	V	V	
2.0	**Inprocess Control**													
2.1	All Components	Visual Defects	MA	Visual	100%	100%	Manufacturers Drawing	No harmful defects	Log book / IR		P	V	V	
		Dimensions	MA	Measurement	100%	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%	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%	100%	Air testing at 0.5 Kg / cm^2 (gauge pressure)	No leakage	IR	√	P	V	V	
2.3	Casing & Impeller (M/C surfaces)	Surface Defects	CR	DPT	100%	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%	100%	ISO : 1940	ISO 1940 Gr. 6.3	IR	√	P	V	V	
2.5	Pump & Motor Shaft	Internal Defects	UT	DPT	100%	100%	ASTME:388	ASTME:388, REFER NOTE-1	IR	√	P	V	V	On machined surface only
		Surface Defects	CR	DPT	100%	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%	100%	Manufacturers Drawing	Manufacturers Drawing	Log book / IR		P	V	V	
3.2	Pump and Motor assembly	Completeness, correctness	MA	Visual Examination	100%	100%	Manufacturers Drawing	Manufacturers Drawing	IR		P	V	V	

ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION
** **M:** MANUFACTURER/SUB SUPPLIER
B: MAIN SUPPLIER OF PACKAGE, N : BHEL/NTPC/END CUSTOMER
P : PERFORM **W:** WITNESS **V** : VERIFICATION AS APPROPRIATE

BHEL DOC No.: PE-V8-XXX-172-N005

MANUFACTURER/ SUBCONTRACTOR	BHEL CONTRACTOR	NAME AND SIGN OF APPROVING AUTHORITY AND SEAL
SIGNATURE		

MANUFACTURERS NAME & ADD

STANDARD QUALITY PLAN

ITEM : Submersible Pumps
Dt.: 31.05.2012 MODEL SUBMERSIBLE PUMPS

QP No: PE-QP-999-100-N005
REV No.: R0
DATE: 31.05.2012

PROJECT : -
END USER : CUSTOMER

MAIN SUPPLIER: BHEL, Noida

SR. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	D*	AGENCY			REMARKS
											M	B	N	
1	2	3	4	5	6		7	8	9	D*	10			
4.0	**Final Inspection, Test, Packing, Despatch Control**				M	B								
4.1	Pump set (Pump+ Motor)	Q Vs Head, Q Vs Power Q Vs Efficiency Noise & Vibration	CR	Performance test	100%	1 Pump Per type	ENCLOSED TEST PROCEDURE	Tech. Spec., Appd. Data Sheet, Appd. Curves, HIS	Performance test record, Plotted Curves	√	P	W	V	Witnessing by BHEL pump per type
4.2	Routine Test on motor	HV, IR, Locked Rotor, No Load,Make,type,rating	CR	Electrical tests	100%	1 Pump Per type	IS 325	Approved Data Sheet	IR	√	P	W	V	Wdg resistance ** Degree of protection shall be IP 68 HV at 2.5 KV ac for 1 minutes
4.3	Strip down after Performance test	Undue wear, tear and breakages	CR	Visual examination of Casing & Impeller after stripping	1 / type	1 / type	Undue wer, tear and breakages	No undue wear, tear and breakages	IR	√	P	W	V	Witnessing one no. of each type
4.4	Complete Pump	Completeness, Correctness, Workmanship and finish, overall dimensions	MA	Visual examination	100%	100%	Approved G.A. drawing	Approved G.A. drawing	IR	√	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%	100%	Approved QP	Approved QP	IR	√	P	V	V	
4.6	Painting	Surface Preparation		Visual examination	100%	100%	Approved DataSheet		IR	√	P	V	V	Reports by Manufacturer
		Adhesion, Uniformity and thickness		Visual Measurement	100%	100%	As per Painting Schedule	As per Painting Schedule	IR	√	P	W	V	Reports by Manufacturer
4.7	Wooden Packing	Soundness, Aesthetic		Visual	100%	100%	Manufacturer's Standard	Manufacturer's Standard	IR		P			Compliance report by Vendor

Note : 1.For accessories and bought out items, Vendor will submit Compliance for review.
2. For UT test on shaft, acceptance criteria : 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 back wall 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 Vendor.
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.

	BHEL	** **M:** MANUFACTURER/SUB SUPPLIER	
MANUFACTURER/ SUBCONTRACTOR	CONTRACTOR	B: MAIN SUPPLIER OF PACKAGE, N : BHEL/NTPC/END CUSTOMER	
		P : PERFORM **W:** WITNESS **V :** VERIFICATION AS APPROPRIATE	
SIGNATURE		** **Motor IR to be checked before pump is tested and after pump is tested**	NAME AND SIGN OF APPROVING AUTHORITY AND SEAL

SECTION – D2

STANDARD TECHNICAL SPECIFICATION FOR ELECTRIC MOTOR

QUALITY PLAN FOR MOTORS

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.

	QUALITY PLAN	CUSTOMEI RRVUNL			PROJECT TITLE	2 X 660 MW SURATGARH TPS		SPECIFICATION : NUMBER :			
		BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION TITLE			
	SHEET 1 OF 2	SYSTEM			ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION			VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1		NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3

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

	QUALITY PLAN		CUSTOMEI RRVUNL			PROJECT TITLE 2 X 660 MW SURATGARH TPS			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

SECTION – D3

STANDARD TECHNICAL SPECIFICATION FOR CONTROL PANEL, PR. GAUGE, LEVEL SWITCH

1.0 SCOPE

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

2.0 CODES AND STANDARDS

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

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

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

3.0 TECHNICAL REQUIREMENTS

3.1 Panel Construction

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

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

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

3.1.4 The salient features of construction shall be:

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

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

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

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.

QUALITY PLAN

FORM NO. PEM-6666-0

	CHECK LIST FOR **PRESSURE / DIFFERENTIAL PRESSURE GAUGE** **(Mechanical Auxiliary Packages)**	SPECIFICATION NO.: VOLUME SECTION REV. NO. / DATE: SHEET 2 OF 2

Data Sheet No.: **PE-CL-999-145-I026-0**

SL NO	TESTS/CHECKS	QUANTM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS	AGENCY P	AGENCY W	AGENCY V	REMARKS
1.0	CHECK FOR						
	1.1 DIAL SIZE	100%		M	C	C	
	1.2 MODEL NO/TAG NO	100%		M	C	C	
	1.3 RANGE/SCALE	100%		M	C	C	
	1.4 END CONNECTION	100%		M	C	C	
	1.5 SWITCH CONTACT RATING & NOS	100%		M	C	C	
2.0	CALIBRATION						
	2.1 ACCURACY	100%		M	C	B	MFR TO CARRY OUT ROUTINE TEST ON 100%. WHEN MATL CORELATION ARE NOT AVAILABLE MFR'S COMPLIANCE TO BE PROVIDED
	2.2 REPEATABILITY (FOR SWITCH)	100%		M	C	B	
	2.3 SET POINT ADJUSTMENT FOR SWITCH	100%		M	C	C	
3.**0**	OVER PRESSURE & LEAK TEST	100%	APPROVED TECHINCAL REQUIREMENT/ DATA SHEET	M	C	C	
4.0	OPERATION OF PR. RELEIF DEVICE	ONE PER TYPE		M	C	C	
5.0	REVIEW OF T.C. FOR MATERIAL OF--						
	5.1 SENSOR	FOR LOT		-	-	B	
	5.2 MOVEMENT			-	-	B	
	5.3 PROCESS CONNECTION			-	-	B	
	5.4 HOUSING			-	-	B	
6.0	REVIEW OF T.C. FOR DEGREE OF PROTECTION	TYPE TEST		-	-	B	
7.0	REVIEW OF T.C. FOR CONTACT RATING OF SWITCH	ONE PER TYPE		-	-	B	
8.0	ACCESSORIES AS APPLICABLE	100%		M	C	C	

LEGEND:
M: MANUFACTURER/ SUB CONTRACTOR, C: CONTRACTOR/ NOMINATED INSP AGENCY, B: BHEL. P: PERFORM, W: WITNESS, V: VERIFICATION.

NOTE:
CONTRACTOR TO PROVIDE COMPLIANCE CERTIFICATE FOR TESTS/CHECKS VERIFIED BY CONTRACTOR AND SUBMIT THE SAME ALONGWITH TEST CERTIFICATES TO BE VERIFIED BY BHEL.

PEM :: C&I

STANDARD QUALITY PLAN FOR LEVEL GAUGES

QUALITY PLAN NO.:	**PE-QP-999-145-I028**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 01.11.2000
SHEET	1 OF 2

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $			Remarks
									P	W	V	
1.0	**Material / Components**											
1.1	Body, Cover, Interns, Flanges, Gaskets	1. Physical, Chemical Properties	MA	Physical, Chemical Test	One Sample from each lot	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Test Certificate	3/2	---	2,1#	# Compliance certificate to be verified.
		2. Workmanship, finish and dimensions	MA	Visual, Measurement	100%	Manufacturing standards / drgs.	Manufacturing standards / drgs.	Inspection Report / Log Book	3/2	---	2,1#	
1.2	Glass Tube	Strength, Transparency, dimensions	MA	Toughness & Thermal shock, Visual, Measurement	one sample from each lot	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Test Certificate/ Inspection Report	3	---	2,1#	
2.0	**Assembly**	1. Marking – Tag No., Model, Range	MA	Visual	100%	- do -	- do -	Inspection Report	2	1	---	
		2. Workmanship	MA	Visual	100%	- do -	- do -	- do -	2	1	---	
		3. Scale graduation	MA	Visual	100%	- do -	- do -	- do -	2	1	---	
		4. Glass Opaque painting	MA	Visual	100%	- do -	- do -	- do -	2	1	---	For Reflex type
		5. Dimensions and end connections	MA	Measurement	100%	- do -	- do -	- do -	2	1	---	
3.0	**Routine Test**	1. Calibration	CR	Measurement	100%	- do -	- do -	- do -	2	1**	1	**10% quantity with minimum of 1 piece / type & size
		2. Hydro Test	CR	Measurement	100%	- do -	No Leakage	- do -	2	1**	1	

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

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

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

PEM :: C&I

STANDARD QUALITY PLAN FOR LEVEL GAUGES

QUALITY PLAN NO.:	**PE-QP-999-145-I028**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 01.11.2000
SHEET	2 OF 2

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	
4.0	**Painting**	Shade & Finish	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report	2	1**	1	
5.0	**Packing**	Soundness	MA	Visual	100%	- do -	- do -	- do -	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 LEVEL SWITCHES

QUALITY PLAN NO.:	PE-QP-999-145-I033
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE:
SHEET	1 OF 4

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $			Remarks
									P	W	V	
1.0	**Material / Components**											
1.1	Non wetted parts	Physical, chemical properties	MA	Physical, chemical analysis	1/cast	Approved drg. / data sheet / BHEL Spec.	Relevant raw material std.	Test report	3/2	---	2,1#	# Compliance certificate to be verified.
1.2	**Float Assembly and wetted parts**	Physical for float only and chemical properties for all wetted parts including float assembly	MA	Physical, chemical analysis	1/batch	AISI:3.16/ BHEL spec/drg/approved data sheet	AISI:3.16/ BHEL spec/drg/approved data sheet/relevant material std.	Internal Inspection Report	3/2		2/1	
1.3	**Chamber**	Dimensions and leak tightness	MA	Measurement, visual,hyd test	100%	- do -	- do -	- do -	3/2	2	1	
1.4	Float	Leak Tightness	MA	Hyd Test	100%	- do -	No Leakage	Internal Inspection Report	3/2	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 LEVEL SWITCHES

QUALITY PLAN NO.:	PE-QP-999-145-I033
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE:
SHEET	2 OF 4

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $			Remarks
									P	W	V	
1.5	**Switch**	1. Make, type and rating	MA	Visual	100 %	BHEL/ Mtr Spec	BHEL/ Mtr Spec	Internal Inspection Report	3/2	---	2/1	
		2. Contact Continuity	CR	Electrical	100 %	- do -	- do -	To have continuity	3/2	---	2/1	
2.0	**Final Inspection**	1. Marking, Range,Model,Tag No ,Sl No.	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report	2	1	-	
2.1	Assembly	2. Correct assembly, workmanship and finish	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log book	2	1	-	
		3. Connection	MA	Visual & measurement	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report	2	1		
		4. Scale marking	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report	2	1		
		5. Cleanliness	MA	Visual	100%	Manufacturer standard	Free from scratches ,dirt etc	Log book	2	1		
		6. Overall dimensions	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report	2	1		

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PEM :: C&I

STANDARD QUALITY PLAN FOR LEVEL SWITCHES

QUALITY PLAN NO.:	PE-QP-999-145-I033
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE:
SHEET	3 OF 4

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	
2.2	**Routine test**	1. Overload	CR	Measurement	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	TEST REPORT	2	1	1	
		2. Repeatability	CR	Measurement	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	TEST REPORT	2	1	1	
		3. Set point adjustment	CR	Measurement	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	TEST REPORT	2	1	1	
		4. Differential	CR	Measurement	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	TEST REPORT	2	1	1	
		5. Contact rating	CR	Measurement	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection report	2	-	1	
		6. Insulation resistance and HV	CR	Electrical	100%	Manufacturer standard	Approved drg. / data sheet / BHEL Spec.	TEST REPORT	2	1	1	
2.3	**Type Test**	Weather proofness	CR	Measurement	Sample/ design	Approved drg. / data sheet / BHEL Spec.	IS:2147/NEMA-4	TEST REPORT	3/2		1	

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PEM :: C&I	STANDARD QUALITY PLAN FOR LEVEL SWITCHES	QUALITY PLAN NO.: PE-QP-999-145-I033
		VOLUME IIB
		SECTION D
		REV. NO. 00 DATE:
		SHEET 4 OF 4

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	
2.4	**Packing**	Soundness of packing	MA	Visual	100 %	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Log Book	3/2	2		

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STANDARD QUALITY PLAN FOR CONDUCTIVITY TYPE LEVEL SWITCHES

QUALITY PLAN NO.:	**PE-QP-999-145-I035**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 05.04.2013
SHEET	1 OF 3

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $			Remarks
									P	W	V	
1.0	**Raw Material/ Component**											
1.1	Wetted/Non Wetted Parts (Stand Pipe, Flanges etc.)	Physical, Chemical properties	MA	Physical, Chemical Analysis	1/ Cast	BHEL Spec/ Approved drg. / data sheet	Relevant material standard	Test Report	3/2	---	2,1*	*Relevant compliance certificate to be verified.
1.2	Switch	1.. Make, type and rating	MA	Visual	100%	BHEL / Mfr. spec.	BHEL / Mfr. spec.	Internal inspection report	3/2	---	2,1	
		2. Contact Continuity	CR	Electrical	100%	BHEL / Mfr. spec.	BHEL / Mfr. spec.	To have continuity	3/2	---	2,1	
2.0	**Final Inspection**											
2.1	Assembly	1. Marking: Range, Model, Tag No. Sl.No.	MA	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	1	---	
		2. Correct assembly, workmanship and finish	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	1	---	
		3. Connection	MA	Visual & Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	1	---	

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STANDARD QUALITY PLAN FOR CONDUCTIVITY TYPE LEVEL SWITCHES

QUALITY PLAN NO.:	**PE-QP-999-145-I035**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 05.04.2013
SHEET	2 OF 3

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	
		4. Scale Marking	MA	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	1	---	
		5. Cleanliness	MA	Visual	100%	Manufacturer standard	Free from scratches dirt etc.	Log Book	2	1	---	
		6. Overall Dimension	MA	Measurement	100%	BHEL Spec. / Approved drg.	BHEL Spec. / Approved drg.	Inspection Report	2	1	---	
2.2	Routine Test	1. Overload	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1❖	1	❖BHEL to witness 25% sample.
		2. Repeatability	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1❖	1	
		3. Set point adjustment	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1❖	1	
		4, Differential	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1❖	1	
		5. Pr. Test on Column/Stand Pipe	CR	Visual & Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1	1	1.5 Times of Design Pressure

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VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 05.04.2013
SHEET	3 OF 3

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	
		6. Contact Rating	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	---	1	Manufacturer compliance certificate to be verified.
		7. Insulation Resistance & HV	CR	Electrical	100%	Manufacturer standard	Manufacturer standard	Test Report	2	1❖	1	
2.3	Type Test	1. Weather proofness	CR	Measurement	1 sample / design	BHEL Spec. / Approved data sheet	IS : 2147 / NEMA-4	Test Report	3/2	---	1	Vendor to furnish test report
		2. Degree of Protection	CR	Measurement	1 sample / design	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	3/2	---	1	Vendor to furnish test report
3.0	**Packing**	Soundness of packing	MA	Visual	100%	BHEL Spec.	BHEL Spec.	Log Book	3/2	2	---	

NOTE:-

1) Manufacturer to ensure the welding procedure, welders qualification & NDT as per ASME for Design PR.>40 kg/cm2.
2) Type test reports for Dry heat, Damp heat, Vibration & Temp. Cycling, Burn in test of Electronic Units for 48 HRs/50 Deg C in Energised Condition to be furnished.
3) Type test should be conducted within last 5 years, Type test certificates older than 5 years shall not be accepted.

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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	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	---	---	

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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	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	---	---	

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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	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	

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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	

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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	5 OF 7

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

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STANDARD QUALITY PLAN FOR LOCAL CONTROL 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	
		10. Wiring Layout	MA	Visual	100%	BHEL approved drg.	BHEL approved drg.	Inspection Report	2	1	1	
		11. Wire Termination	MA	Pulling manually	Sample	-----	Firm termination	Inspection Report	2	1	1	
		12. Continuity	MA	Electrical	100%	-----	Continuity OK	Inspection Report	2	1	1	

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

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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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