

**TAMILNADU GENERATION & DISTRIBUTION
CORPORATION LIMITED**

2X800MW UPPUR TPP (BTG)

**TECHNICAL SPECIFICATION
FOR
*220V DC BATTERY CHARGER***

SPECIFICATION NO: PE-TS-425-508-E002, R0



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, UP (INDIA) – 201301**

	TECHNICAL SPECIFICATION FOR 220V DC BATTERY CHARGER	SPECIFICATION NO. PE-TS-425-508-E002	
		VOLUME II	
		SECTION I	
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COMPLIANCE CERTIFICATE

The bidder shall confirm compliance to the following by signing/ stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same
2. There are no deviation with respect to specification other than those furnished in the 'schedule of deviations'
3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ-Cum-Price schedule' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).

BIDDER'S STAMP & SIGNATURE



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SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

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1.0 SCOPE

- 1.1 This specification covers the design, manufacture, assembly, testing and inspection at vendor's/sub-vendor's works, packing and despatch to site, Supervision of commissioning & testing of 220V DC battery charger as described in the various sections of this specification. The equipment shall generally conform to IS. In this specification though erection and commissioning is not included in vendor's scope, the vendor shall still not be absolved of his responsibility of establishing the correctness of equipment at site.
- 1.2 Technical requirements of 220V DC BATTERY CHARGER are indicated in Data Sheet-A, Section-I & Section-II.
- 1.3 The stipulation of Data Sheet-A shall prevail in case of any conflict between the stipulations of Data Sheet-A & Section-II.
- 1.4 The stipulation of Section-I shall prevail in case of any conflict between the stipulations of Section-I & Section-II.
- 1.5 In case of any conflict between stipulations of the same section, Stringent of the two shall prevail.

2.0 BILL OF QUANTITIES

Quantity requirements shall be as per 'BOQ-cum-price schedule' as part of NIT.

3.0 SPECIFIC TECHNICAL REQUIREMENTS- SYSTEM CONCEPT

3.1 Main Plant 220V DC SYSTEM:

220V DC system shall be an ungrounded system comprising of two sets of batteries (2X100%) with 1X100% float cum-boost (FCB) charger for each set of battery and one sectionalised 1X100% DCDB and 1 No. common standby float cum boost charger for each unit. The 220V DC system is designed to cater the control, protection, interlocking, emergency lighting and emergency dc drives for main plant and associated station (excluding CHP & Switchyard). The load duty cycle and typical single line diagram for 220V battery and charger connections is enclosed as Annexure-II and Annexure-III respectively.

- 3.2 Each float cum boost charger will have a 'FLOAT/BOOST' selector switch for selection of battery charging mode. 'AUTO/MANUAL' selector switch for selection of battery charging control mode along with voltage/ current setter for FCB charger shall be provided. The float cum boost charger shall have provision for float equalising, and boost charging the battery through manual selection.
- 3.3 Under normal conditions, the 'FLOAT/BOOST' selector switch shall be in float mode. Float charging current of the battery shall be supplied by the FCB charger, which is continuously monitored. In case this current exceeds a certain value, the FCB charger can be switched

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over to 'BOOST' mode manually for charging at a higher rate only after load-isolating breaker is open. When the battery is fully charged, the FCB charger shall manually brought back to 'FLOAT' mode by closing the isolating breaker manually.

- 3.4 Under normal conditions, FCB charger will cater continuous loads and trickle charging current to batteries. In case of failure of AC, battery will meet the DC load requirement. After restoration of power, the FCB charger will supply the loads as well as trickle charge the battery. Under discharge condition, battery will be put to boost charge by FCB charger while FCB charger on other section will continue to supply DC loads. In boost mode, FCB chargers are suitable to charge the fully discharged battery (at end cell voltage of 1.85V) up to 2.75V/ cell in 10 hours.
- 3.5 Suitable electrical interlock shall be provided in the charger to ensure that boost charging can commence only after the relevant load isolating breaker in the DCDB is open. This ensures availability of both redundant feeders to the loads when any charger is isolated from the system for boost charging. However, in case of failure of any charger, the other charger shall feed both sections of DCDB and provide trickle charging to both sets of battery. One no. common standby battery charger shall form part of 220V DC system which shall take care of DC loads of each unit along with station loads. If both charger fails, standby float cum boost charger shall have to cut into the circuit by double pole double throw switch to take care function of charger.

4.0 OTHER TECHNICAL REQUIREMENTS

- 4.1 Chargers will be static, natural air cooled with Degree of Protection (DOP) IP-42, self regulating, silicon-controlled full wave rectifier, fully controlled, bridge configuration, auto and manual control type designed for single and parallel operation with battery and shall be provided with static automatic voltage regulator for a close voltage stability even when AC supply voltage and DC load fluctuates. Effective current (load) limiting feature and filters on both input and output to minimise harmonics shall be provided. Chargers designed for single and parallel operation with battery and shall be provided with following features:
- The charger output regulation shall be $\pm 1\%$ from no load to full load (0% load to 100% load) with an input power supply voltage & frequency variation on feeding System. (Voltage variation: -10% to 10%, frequency variation: +3% to -5% and Combined voltage and frequency variation: 10%).
 - The charger will be provided with automatic digital voltage regulation in float mode and automatic constant current regulation in boost mode.
 - Ripple content at rated continuous load will be limited to 1% rms with or without battery.
 - DC voltage setting adjustment of AVR for float charging will be $\pm 10\%$ of nominal voltage.
 - DC current adjustment for boost charging will be 50% to 100% of maximum boost charging current.
 - Current stabilization for constant current regulator for boost charging will be $\pm 2\%$.
 - The rectifier transformer shall have $\pm 2 \times 2.5\%$ taps on primary side.
 - Minimum permissible power factor at rated continuous load will be 0.8
 - Voltage stabilization for constant voltage regulation will be (a) $\pm 1\%$ of set DC voltage with + 10% variation in supply voltage (b) $\pm 5\%$ during transient.

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- j) One moving coil DC voltmeter and ammeter of size 96x96 mm of suitable range for each charger with necessary shunts for metering. Meters shall have 90 deg scale, antiglare glass, $\pm 1\%$ accuracy with zero adjuster on the front.
 - k) One moving coil centre zero ammeter, with shunt, size 96x96 mm to read discharge / charge current of the battery.
 - l) Each battery charger shall be provided with one (1) no. Voltage transducer and one (1) no. Current transducer for monitoring the DC output and as analog input to DCS. Each charger shall also be provided with "DC Voltage transducer" for monitoring the battery output Voltage and as analog input to DDCMIS. These transducers shall have twin-channel output of 4-20mA.
- 4.2 The rectifier shall utilize diodes / thyristors and heat sinks rated to carry 200% of the load Current continuously.
 - 4.3 The voltage at load terminal will not exceed the limits of +10% and -15% of nominal System voltage for 220V DC system.
 - 4.4 The 220V DC power cable between battery to DCDB and charger to DCDB will be single core copper cable (BHEL scope). The MCCB box shall be located near battery. The Main MCCB on battery and charger output shall also have alarm contact.
 - 4.5 The charger shall be designed to operate at an ambient air temperature of 50°C. It will be located indoor but in a hot, humid and tropical atmosphere.
 - 4.6 Suitable annunciation in DDCMIS shall be provided like charger trouble, battery on Boost mode etc. Further 4-20mA signals to DDCMIS shall be provided for important Parameters like charger O/P voltage, Charger O/P current and battery voltage. Charger panels shall also be provided with charger I/P & O/P Voltmeter & Ammeter, battery Voltmeter & Ammeter.
 - 4.7 The float-cum-boost charger will house load terminals, meters, annunciators and LED type indicating lamps.
 - 4.8 Meters shall be provided with necessary shunts for local and remote metering. The instruments shall be flush mounted type, dust proof, moisture resistant and should have easy accessible means for zero adjustment.
 - 4.9 For ungrounded DC system, suitable ground fault detection system shall be provided in the battery charger panel to detect the ground fault on either polarity for annunciation in the charger panel.
 - 4.10 The rectifier-transformers and chokes shall have Class-B insulation with temperature rise limited to class-A insulation value.
 - 4.11 The charger panels will have an enclosure DOP IP-42. The charger panels shall be painted as two coats of lead oxide primer followed by powder painting with final shade of RAL9002 for complete panel except end covers & RAL 5012 for end covers.

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5.0 ANNUNCIATION SYSTEM

5.0.1 Visual indications through indicating lamps/LEDs shall be provided in all Chargers for the following:

- i) A.C. supply failure
- ii) Rectifier fuse failure
- iii) Surge circuit fuse failure
- iv) Filter fuse failure
- v) Load limiter operated
- vi) Charger trip
- vii) Battery on Boost
- viii) DC output fuse failure
- ix) Positive grounded
- x) Negative grounded
- xi) Battery fully discharged
- xii) AC input under voltage
- xiii) DC under voltage
- xiv) DC over voltage
- xv) Charger earth fault
- xvi) Battery on Float

5.0.2 Potential free NO contacts of all above conditions shall be provided for following remote alarms in the Unit Control Panel:

- i) Battery on Boost
- ii) Charger trouble (this being a group alarm initiated by any of the faults other than 'Battery on Boost')

5.1 DIGITAL INDICATING INSTRUMENTS

5.1.1 Digital indicating instruments with built in communication port for remote data transfer shall be provided for all chargers. The instruments shall indicate DC current, DC voltage & AC voltage.

5.1.2 In addition to above, following metering provision shall be given for remote metering/recording at DCS.

- Battery Voltage
- DC Voltage and Current at FCBC (Isolated 4-20 mA signals)
- Charger tripped on fault
- AC supply – R, Y, B (Isolated 4-20 mA signals)
- Frequency (Isolated 4-20 mA signals)

5.2 Alarm signals for Charger Over Load, AC input supply failure, DC voltage Low, DC voltage High, DC system earth fault, DC Output MCCB, Discharge Resister connected etc. shall be considered for remote connection to DCS/EMS/SAS.

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5.3 Each charger panel shall be provided with the following meters/ indications:

- Indications
 - DC supply – Available
 - Charger in Float Mode
 - Charger in Equalising mode
 - Charger in Boost mode
- Meters
 - AC incoming current
 - DC Bus Voltmeter indicating - +ve to Earth, -ve to Earth and +ve to –ve with Selector switch.
 - Centre Zero Ammeter with Shunt to read Discharge/Charge current
 - Ammeter for Battery Trickle Charge current

6.0 DISCHARGE RESISTOR

Discharge resistor shall be provided for testing the Battery. The discharge resistor shall be adequately sized for charge – discharge cycle testing of different type & rating of batteries with necessary tapping. It shall be enclosed in sheet steel enclosure of at least 3 mm, having IP: 31 degree of protection. Resistor shall be of punched stainless steel. Temperature rise shall be limited to 150°C over ambient. The Discharge resistor shall be mounted on trolley with bi-directional wheels.

7.0 BATTERY MCCB BOX

For each Battery, MCCB box shall be provided for maintenance isolation and for short circuit protection. The MCCB box shall comprise MCCB sized for the Battery capacity. MCCB shall be designed to carry the rated in both direction of current flow and also shall protect against the short circuit in both the direction. It shall be enclosed in sheet steel enclosure of at least 2 mm, having IP: 54 degree of protection. The MCCB box shall be wall mounted type located in Battery room. MCCB shall be double pole type rated for DC. It shall be quick make, quick break, and independent manual type with trip free feature. It shall have the following:

- Short circuit release
- ON/OFF Trip position indicators
- Test trip push button
- Voltage rating shall be suitable for 220 volts DC.

8.0 All bus bars and bus connections shall be of high conductivity copper and adequately sized to limit the maximum temperature rise to 40 deg. C from ambient temp (50 deg. C) under rated load condition. The maximum allowable temperature rise shall be 55 deg. C from

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ambient temp (50 deg. C) at joints. All bus connections shall be silver-plated joined with two bolt connection with plain and spring washes and locknuts.

9.0 Bidder to furnish list of sub-vendor(s) for bought out items. Make of equipment / components shall be subject to BHEL/Customer approval after award of contract without any commercial implication.

10.0 For the purpose of design an ambient temperature of 50 deg.C and relative humidity of 85% shall be considered.

11.0 TESTS ON CHARGER

11.1 Following type tests on one sample of each rating of the equipment to be supplied shall be conducted:

- a. Complete physical examination
- b. Insulation resistance test
- c. High voltage test on power & control circuits except low voltage electronic circuit
- d. Ripple content test at no load, half and full load
- e. Automatic voltage regulation operation test at specified AC supply variations at no load, half and full load
- f. Load limiter operation test.
- g. Efficiency and power factor measurement.
Input and output surge withstand capacity test. Surge voltage as per ANSI-C37.90a shall be applied for a period of not less than 2 seconds at the following points of the charger operating at 50°C at full load:
 1. Across each AC input phases
 2. Across AC input line to ground
 3. Across DC output terminals
 4. Across each DC output terminal to ground
 The charger shall not exhibit any component damage and there shall be no deterioration in performance of the charger.
- h. Environmental Tests: Steady state performance tests (temperature rise test at full load & load limiter operation test) shall be carried out before & after the following tests.
- i. Soak test: The electronic modules shall be subject to continuous operation for a minimum period of 72 hours. During last 48 hours, the ambient temperature shall be maintained at 50°C. The 48 hour test period shall be divided into 4 equal 12 hour segments. The input voltage during each 12 hours shall be nominal voltage for 11 hours followed by 110% of nominal voltage for 30 minutes, followed by 90% of nominal voltage for 30 minutes.
- j. Degree of protection test
- k. Vibration Test of the electronic card rack / Panel

11.2 Temperature rise test shall be conducted on all chargers (refer BOQ cum price Schedule).

11.3 Following routine tests will be conducted on charger:

- Voltage regulation

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- Ripple content at different loads and noise measurement
- Insulation resistance test
- General operation
- Voltage/current stability test
- High voltage test
- Measurement of surface temperature of charger panel
- Current limiting features.
- Efficiency & PF measurement
- Short circuit test at full load and no load (for rectifier transformer)

- 11.4 Refer quality plan enclosed with this specification for detailed testing requirement. The Quality plan shall be subject to BHEL/ customer approval after award of contract without any commercial or delivery implication. Inspection shall be carried out as per BHEL/ customer approved Quality plan.
- 12.0 Bidder has to submit test certificates for their bought out items.
- 13.0 DELIVERY: Delivery of equipment shall be as per NIT.

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14.0 DRAWINGS & DOCUMENTS TO BE SUBMITTED

14.1 Documents required along with Technical offer

Signed and Stamped copies of following documents:-

- Out line drawings of charger, battery fuse box.
- Schedule of BOQ cum Price Schedule (Unpriced)
- Compliance certificate
- Schedule of deviations.

14.2 Documents required after award of LOI

Following documents/drawings shall be submitted after placement of order for BHEL & customer's approval:-

LIST OF STANDARD DELIVERABLES FOR DC BATTERY CHARGER			
SL. No.	DOCUMENT TITLE	DWG. / DOCUMENT No.	Submission Schedule
1	Data Sheet for Battery Charger	PE-V0-425-508-E101	Within two weeks of award of contract
2	General Arrangement drawing for Battery Charger	PE-V0-425-508-E102	
3	Schematic/ power circuit diagram for battery charger	PE-V0-425-508-E003	
4	Make of components for battery charger	PE-V0-425-508-E004	
5	Circuit diagram and ga of battery fuse box	PE-V0-425-508-E005	
6	Circuit diagram and ga of battery discharge panel	PE-V0-425-508-E006	
7	Operational write up for battery charger	PE-V0-425-508-E007	
8	Internal layout drawing for battery charger	PE-V0-425-508-E008	
9	Thyristor rating and fuse co-ordination calculation	PE-V0-425-508-E109	
10	Ac power consumption in float mode & boost mode	PE-V0-425-508-E010	
11	Calculation of transformer kva and rectifier for battery charger	PE-V0-425-508-E011	
12	Fault level calculation for battery charger	PE-V0-425-508-E012	
13	Filter Circuit Calculation for Battery charger	PE-V0-425-508-E113	
14	Field quality plan plan for battery charger	PE-V0-425-508-E014	
15	List of e & c spares for battery charger	PE-V0-425-508-E015	
16	List of o&m spares for battery charger	PE-V0-425-508-E016	



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17	List of mandatory spares for battery charger	PE-V0-425-508-E017	
18	Type test certificates for battery charger	PE-V0-425-508-E018	
19	O&m manual for battery charger	PE-V0-425-508-E019	
20	Termination Arrangement At Battery Charger Terminals	PE-V0-425-508-E120	
21	Quality Plan for Battery Charger	PE-V0-425-508-E901	

Note:-

1. Document indicated at clause no. 14.2 above, shall be submitted through document management system (DMS).

Tender Specification
Vol-IV: Battery & Battery Charger

SECTION 22: BATTERY & BATTERY CHARGER

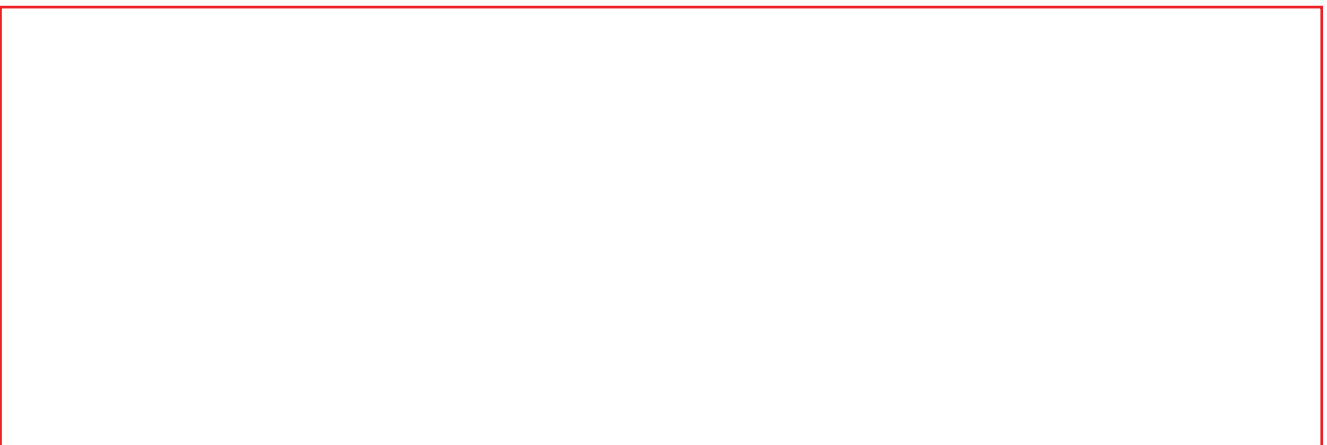
22.01.00 INTENT OF SPECIFICATION

- 22.01.01 This specification is intended to cover the design, manufacture, assembly, testing at manufacturer's works, supply and delivery, properly packed for transport to site of BATTERY AND BATTERY CHARGER complete with all accessories for efficient and trouble-free operation.
- 22.01.02 The scope of work shall also include the supervision of erection, testing, commissioning and putting into successful commercial operation of all equipment furnished under this specification.
- 22.01.03 In the event of any discrepancy with listed documents, the stipulation of this specification shall govern.

22.02.00 SCOPE OF SUPPLY

- 22.02.01 DC power supply is the most reliable source of power supply for control, protection, interlock and annunciation requirements of the power station during the normal running of the plant as well as for a safe shut down at the time of the total power supply failure. For arranging the DC supply for the above, the following shall be provided.
- 22.02.02 Two sets of 2x100% battery and Battery Charger for each unit and 1 No. Standby Battery charger shall form part of 220V DC system along with station loads. *Refer BOQ cum price Schedule*
- 22.02.03 Each set of battery and battery charger shall be supplied complete with fittings and accessories as per list furnished elsewhere in this specification. *Refer BOQ cum price Schedule*
- 22.02.04 One set of portable type battery discharge resistor Bank shall also be provided common for the above batteries. *Refer BOQ cum price Schedule*
- 22.02.05 Base channel frame, floor channel sill and kick plates for all floor- mounted charger panels, complete with holding down bolts and nuts.

22.03.00 CODES AND STANDARDS



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22.03.02 Battery Charger

Codes and Standards

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

IS:5	Colors for ready mix paints.
IS : 694	PVC Insulated Cable for working voltages upto and including 1100 V.
IS : 1248	Specification for Direct acting indicating analogue electrical measuring instruments.
IS : 3231	Electrical relays for power system protection.
IS : 3895	Mono-crystalline semi-conductor Rectifier Cells and Stacks
IS : 3842	Application guide for Electrical relays for AC System
IS : 4540	Mono crystalline semi-conductor Rectifier assemblies and equipment.
IS:6005	Code of practice for phosphating of Iron and Steel.
IS:6619	Safety Code for Semi-conductor Rectifier Equipment.
IS:6875	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages up to 1000 V AC or 1200 V DC.
IS : 9000	Basic environmental testing procedures for electronic and electrical items.



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IS:13703	Low voltage fuses for voltages not exceeding 1000 V AC or 1500 V DC.
IS:13947 Part-1	Degree of protection provided by enclosures for low voltage switch gear and control gear.
IS : 13947	Specification for low voltage switch gear and control gear
ANSI-C 37.90a	Guide for surge withstand capability tests
EEUA-45D	Performance requirements for electrical Alarm Annunciation System

22.03.03 Indian Electricity Rules

22.03.04 Indian Electricity Act.

22.04.00 DESIGN CRITERIA

22.04.01 The batteries and battery chargers shall constitute the D.C. power supply source for all loads of respective area.

22.04.04 The batteries and chargers shall be installed indoor in a clean but hot, humid and tropical atmosphere.

22.04.05 The battery and charger combinations shall be such as to ensure continuity of D.C. supply at load terminals without even momentary interruption.

22.04.06 For continuous operation at specified ratings, temperature rise of the various components of battery and charger shall be limited to the permissible values as stipulated in relevant standards.

22.04.07 Further the voltage at load terminals shall never exceed the limits of +10% and -15% of the nominal system voltage.



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- 22.04.13 The float cum boost charger shall be sized to carry the total DC continuous load and the trickle charging current of the battery plus full load current of largest DC motor and 25% margin. The output voltage of the float cum boost charger shall be adjustable between 230 -240 V. The charger shall also be capable of delivering the rated load even under the specified voltage and frequency variations. **Design margin is already considered in Charger rating mentioned in BOQ cum Price schedule.**
- 22.04.14 The float-cum-boost charger shall be sized to restore the fully discharged battery to full charge condition in ten (10 hours with 25% margin over maximum charging rate or to operate as a charger with duty requirement as mentioned in design criteria of charger above, whichever is greater.
- 22.04.15 The batteries & chargers shall be so designed that the maximum fault level on DCDB is limited to **50kA**
- 22.05.00 SYSTEM CONCEPT**
- 22.05.01 The battery charger shall be capable of providing the initial charging current as required for the battery.
- 22.05.02 The first float cum boost charger shall be normally ON in float mode, supplying the D.C. load current and at the same time trickle charging the battery. The characteristics shall be such that if load is high and exceeds the charger capacity, the excess load shall be supplied by the battery.
- 22.05.03 The second float-cum-boost charger shall be normally in stand-by(auto float/charge) mode and shall cut into the circuit automatically upon failure of the first float cum boost charger.
- i) To provide occasional equalising charge as required
 - ii) To take over the functions of float charger in case of its failure
 - iii) To boost charge the battery upto 2.75 Volts per cell.



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- iv) Necessary arrangement shall be provided so that connected DC load shall not be subjected to high voltage during equalizing or boost charging of battery.
- 22.05.04 The float-cum-boost charger shall also have provision for float, equalising, and boost charging the battery through manual selection.
- 22.05.05 On failure of station A.C. supply, float-cum-boost chargers shall go out of service and battery shall take over to supply emergency loads.
- 22.05.06 If charger fails, it shall be annunciated in the control room and standby float cum boost charger shall have to cut into the circuit automatically by double pole double throw switch to take over the function of charger.
- 22.05.07 Output of the chargers shall be controlled automatically as well as manually. AUTO/MANUAL selectro switch along with voltage/current setter shall be provided for this purpose.
- 22.05.08 Interlock shall be provided to ensure that the battery can be taken to boost mode only if the float cum boost charger is healthy and running. Interlock defeat arrangement shall also be provided for initial charging of battery.
- 22.05.09 For ungrounded DC system, suitable ground fault detection system with annunciation shall be provided in the battery charger panel to detect ground fault on either polarity.



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Vol-IV: Battery & Battery Charger



22.09.00 BATTERY CHARGER

- 22.09.01 The Battery Chargers as well as their automatic regulators shall be of static type. Battery chargers shall be capable of continuous operation at the respective rated load in Trickle mode i.e. Trickle charging the associated DC lead-acid Batteries while supplying the D.C. loads. The Batteries shall be Trickle charged at 2.25 Volts per cell. All chargers shall also be capable of Boost Charging the associated D.C. Battery at 2.3 to 2.7 Volts per cell at the desired rate. The Chargers shall be designed to operate, as mentioned above, at an ambient air temperature of 50°C.
- 22.09.02 Battery Chargers shall have a selector switch for selecting the battery charging mode i.e. whether Trickle or Boost charging.
- 22.09.03 All Battery Chargers shall be provided with facility for both automatic and manual control of output voltage and current. A selector switch shall be provided for selecting the mode of output voltage/current control, whether automatic or manual. Means shall be provided to avoid current/voltage surges of harmful magnitude/nature which may arise during changeover from Auto to Manual mode or vice-versa under normal operating condition.
- 22.09.04 Soft start feature shall be provided to build up the voltage to the set value slowly within fifteen seconds. The chargers shall have load limiters which shall cause, when the voltage control is in automatic mode, a gradual lowering of the output voltage when the DC load current exceeds the load limiter setting of the Charger. The load limiter characteristic shall be such that any sustained overload or short circuit in DC system shall neither damage the Charger nor shall it cause blowing of any of the charger fuses. The Charger shall not trip on overload or external short circuit. After clearance of fault, the Charger voltage shall build up automatically when working in automatic mode.
- 22.09.05 When on automatic control mode during Trickle charging, the Charger output voltage shall remain within +/-1% of the set value for AC input voltage variation of +/-10%, frequency variation of +3/-5%, a combined voltage and frequency (absolute sum) variation of 10% and a continuous DC load variation from zero to full load. Uniform and stepless adjustments of voltage setting (in both manual and automatic modes) shall be provided on the front of the Charger panel covering the entire Trickle charging output range specified & shall be capable of matching the float voltage correction recommendations(w.r.t. temperature) as suggested by the respective battery



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- manufacturer. Stepless adjustment of the load limiter setting shall also be possible from 80% to 100% of the rated output current for Trickle charging mode.
- 22.09.06 During Boost charging, the Battery Chargers shall operate on constant current mode (When automatic regulator is in service). It shall be possible to adjust the Boost charging current continuously over a range of 50 to 100% of the rated output current for Boost charging mode. The charger output voltage shall automatically go on rising, when it is operating on boost mode, as the battery charges up. For limiting the output voltage of the charger, a potentiometer shall be provided on the front of the panel, whereby it shall be possible to set the upper limit of this voltage anywhere in the output range specified for boost charging mode. All voltage and current setting potentiometers shall be vernier type.
- 22.09.07 Energising the Charger with fully charged battery connected plus 10% load shall not result in output voltage greater than 110% of the voltage setting. Time taken to stabilise, to within the specified limits as mentioned elsewhere, shall be less than fifteen seconds.
- 22.09.08 Momentary output voltage of the Charger, without the Battery connected shall be within 94% to 106% of the voltage setting during sudden load Change from 100% to 20% of full load or vice-versa. Output voltage shall return to, and remain, within the limits specified as mentioned elsewhere in less than 2 seconds after the above mentioned change.
- 22.09.09 The Charger manufacturer may offer an arrangement in which the voltage setting device for Trickle charging mode is also used as output voltage limit setting device for Boost charging mode, and the load limiter of the trickle charging mode is also used as Boost charging current setting device.
- 22.09.10 Suitable filter circuits shall be provided in all the Chargers to limit the ripple content (peak to peak) in the output voltage to 1% irrespective of the DC load, even when they are not connected to a battery.
- 22.09.11 The DC System shall be ungrounded and float with respect to the ground potential when healthy. An earth fault relay shall be provided in the DC distribution board for remote annunciation.
- 22.09.12 Digital Outputs shall be configured for connection to the DC health monitoring system for real-time charger status updation. Outputs like charger output current, output voltage, float/boost mode, etc may be configured.
- 22.09.13 A design margin of 10% shall be considered in selecting the rating of chargers. The Battery charger shall have efficiency of minimum 96%

22.09.13 Printed Circuits Boards (PCB)

PCB shall be made of glass epoxy of 1.6 mm thick, fire resistant, bonded with 99.8% pure copper foil, free of wrinkles, blisters, scratches and pinholes. The contact surface of the edge connectors of the PCBs shall be plated with hard gold to a minimum thickness of 5 microns. Component identification shall be printed on PCB by silk screen method. All PCBs shall be tropicalised and masked.



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22.09.14 Contactors

All Battery Chargers shall have an AC contactor on the input side. It shall be of air break type and suitable for continuous duty. The operating coil shall be rated for 415 Volts AC.

22.09.15 Thermal Overload Relay

A thermal overload relay incorporating a distinct single phasing protection (using differential movement of bimetal strips) shall also be provided for the AC input. The relay shall trip the above contactor.

22.09.16 Rectifier-Transformers and Chokes

The rectifier transformer and chokes shall be dry and air cooled (AN) type. The rating of the rectifier-transformers and chokes shall correspond to the rating of the associated rectifier assembly. The rectifier-transformers and chokes shall have class-B insulation with temperature rise limited to class-A insulation value.

22.09.17 Rectifier Assembly

The rectifier assembly shall be full wave bridge type and designed to meet the duty as required by the respective Charger. The rectifier cells shall be provided with their own heat dissipation arrangement with natural air cooling for up to 400A rating chargers. However, the rectifier cells shall be provided with their own heat dissipation arrangement alongwith forced air cooling for above 400A rating chargers and fan shall be temperature controlled with 100% standby redundancy. The rectifier shall utilise diodes/thyristors and heat sinks rated to carry 200% of the load current continuously and the temperature of the heat sink shall not be permitted to exceed 85°C absolute duly considering the maximum charger panel inside temperature. The Bidder shall submit calculations to show what maximum junction temperature shall be and what the heat sink temperature shall be when operating at 200% and 100% load current continuously duly considering the maximum surrounding air temperature for these devices inside the charger panel assuming air ambient temperature of 50°C outside the panel. Necessary surge protection devices and rectifier type fast acting fuses shall be provided in each arm of the rectifier connections.

22.10.00 DIGITAL INDICATING INSTRUMENTS

22.10.01 Digital indicating instruments with built in communication port for remote data transfer shall be provided for all chargers. The instruments shall indicate DC current, DC voltage & AC voltage and instrument shall be 96 x 96 mm², with display accuracy 0.5%, 4 digit-7 segment LED/LCD display and RS 485 Serial Bus port.

22.10.02 In addition to above, following metering provision shall be given for remote metering / recording at DCS.

- i) Battery Voltage
- ii) DC voltage of float & Boost charger
- iii) DC current of float & Boost charger



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- iv) DC load voltage (Isolated 4-20 mA signals)
 - v) DC load current (Isolated 4-20 mA signals)
 - vi) DC Voltage and Current at FCBC (Isolated 4-20 mA signals)
 - vii) Centre Zero Ammeter with Shunt to read Discharge/Charge current
 - viii) Ammeter for Battery Trickle Charge current
 - ix) DC Bus Voltmeter indicating - +ve to Earth, -ve to Earth and +ve to -ve with Selector switch.
 - x) Mandatory requirement for FCBC panel
 - xi) AC Supply – R,Y,B (Isolated 4-20 mA signals)
 - xii) DC supply – Available
 - xiii) Charger in Float Mode
 - xiv) Charger in Equalising mode
 - xv) Charger in Boost mode
 - xvi) Charger tripped on fault
 - xvii) DC Earth Fault
 - xviii) AC incoming current
 - i) Frequency (Isolated 4-20 mA signals)
 - ii) Suitabe soft link to be provided for interfacing with DCS.
 - iii) Alarm signals for Charger Over Load ,AC input supply failure, DC voltage Low, DC voltage High, DC system earth fault, DC output MCCB failure, Discharge Resister connected etc. shall be considered for remote connection to DCS/EMS/SAS

22.11.00

AIR BREAK SWITCHES

All Chargers shall have AC input and DC output MCCB 's MCCB shall be rated for 120% of the maximum continuous load. 'ON' & 'OFF' position of the MCCB shall be clearly indicated. The status of these switches shall be indicated at DDCMIS/EDMS for remote viewing.

MCCB shall be Triple pole type for incoming supply to Battery charger, Double Pole type for outgoing supply from Battery charger. It shall be quick make, quick break, and independent manual type with trip free feature. All MCCB shall have the following :

- Short circuit release
- ON/OFF Trip position indicators
- Test trip push button
- Voltage rating shall be suitable for 500 volts AC/DC.

BATTERY MCCB BOX

For each Battery, MCCB box shall be provided for maintenance isolation and for short circuit protection. The MCCB box shall comprise MCCB sized for the Battery capacity. MCCB be shall be designed to carry the rated in both direction of current flow and also shall protect against the short circuit in both the direction. It shall be enclosed in sheet steel enclosure of at least 2 mm, having IP: 54 degree of protection. The MCCB box shall be wall mounted type located in Battery room.

MCCB shall be double pole type rated for DC. It shall be quick make, quick break, and independent manual type with trip free feature. It shall have the following:

- Short circuit release
- ON/OFF Trip position indicators



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- Test trip push button
- Voltage rating shall be suitable for 220 volts DC.

22.12.00 CONTROL AND SELECTOR SWITCHES

Control and selector switches shall be of rotary stayput type with escutcheon plates showing the functions and positions. The switches shall be of sturdy construction and suitable for mounting on panel front. Switches with shrouding of live parts and sealing of contacts against dust ingress shall be preferred. The contact ratings shall be atleast the following:

- i) Make and carry continuously – 10 Amps.
- ii) Breaking current at 220 V DC – 0.5 Amp. (inductive)
- iii) Breaking current at 240 V AC – 5 Amp. At 0.3 p.f.

22.13.00 FUSES (Applicable for circuit other than clause no. 22.11.00)

Fuses shall be of HRC cartridge fuse link type. Fuses shall be mounted on fuse carriers which are mounted on fuse bases. Wherever it is not possible to mount fuses on fuse carriers, fuses shall be directly mounted on plug in type bases. In such cases one insulated fuse pulling handle shall be supplied for each charger. Kick-off fuses (trip fuses) with alarm contacts shall be provided for all D.C. fuses.

22.14.00 INDICATING LAMPS

Three (3) indicating lamps shall be provided to indicate A.C. supply availability. The indicating lamp shall be of panel mounting, filament type low wattage or LEDs and capable of clear status indication under the normal room illumination. The lamps shall be provided with series resistors (non-hygroscopic) preferably built in the lamp assembly and replaceable from front. The lamp covers shall be preferably screwed type, unbreakable and moulded from heat resistant material

22.15.00 DIODE (BLOCKING & VOLTAGE REGULATING)

Blocking diode shall be provided in the output circuit of each Charger to prevent current flow from the D.C. Battery into the Charger.

Voltage regulating diodes shall be provided to limit the voltage with in permissible limits during boost charging.

22.16.00 ANNUNCIATION SYSTEM

22.16.01 Visual indications through indicating lamps/LEDs or annunciation facia as per EEUA-45D shall be provided in all Chargers for the following:

- i) A.C. supply failure
- ii) Rectifier fuse failure
- iii) Surge circuit fuse failure
- iv) Filter fuse failure
- v) Load limiter operated
- vi) Charger trip



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- vii) Battery on Boost
 - viii) Battery on Trickle
 - ix) DC output fuse failure
 - x) Positive grounded
 - xi) Negative grounded
 - xii) Battery fully discharged
 - xiii) AC input under voltage
 - xiv) DC voltage low
 - xv) DC voltage high
 - xvi) DC system earth fault
- 22.16.02 Potential free NO contacts of all above conditions shall be provided for following remote alarms in the Unit Control Panel:
- i) Battery on Boost
 - ii) Charger trouble (this being a group alarm initiated by any of the faults otherthan 'Battery on Boost')
- 22.17.00 **NAME PLATES AND MARKING**
- The name plates shall be made of non-rusting metal/3 ply Lamicoid and shall have black back-ground with white engraved letters and secured by screws. These shall be provided near top edge on the front as well as on rear side of Charger. Name plates with full and clear inscriptions shall also be provided on and inside the panels for identification of the various equipments.
- 22.18.00 **CONSTRUCTION**
- 22.18.01 The Chargers shall be indoor, floor mounted, self supporting sheet metal enclosed cubicle type. The Bidder shall supply all necessary base frames, anchor bolts and hardware. The Charger shall be fabricated using cold rolled sheet steel shall not less than 1.6 mm and shall have folded type of construction. The panel frame shall be fabricated using cold rolled sheet steel of thickness not less than 2.0 mm. Removable undrilled gland plates of at least 3.0 mm sheet steel and lugs for all cables shall be supplied by the Bidder. The lugs for cables shall be made of electrolytic copper with tin coat. The Charger shall be tropicalised and vermin proof. Ventilation louvers shall be backed with fine brass wire mesh. All doors and covers shall be fitted with synthetic rubber gaskets. The Chargers shall have hinged double leaf doors provided on front and/or backside for adequate access to the Charger internals. All the Charger cubicle doors shall be properly earthed. The degree of protection of Charger enclosure shall be at least IP-42.
- 22.18.02 All indicating instruments, control & selector switches and indicating lamps shall be mounted on the front side of the Charger. Design of panels shall be based on the following dimensions.
- i) Overall height - Maximum 2350 mm
 - ii) Operating handles (highest and lowest positions reached by operator's hands), protective mechanical - Maximum 1800 mm
Minimum 350 mm



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indicators	
	iii) Doors and panel handles and locks - Maximum 1800 mm Minimum 300 mm
22.18.03	Electronic equipments shall be of modular design consisting of plug in modules in standard 19 inches metallic racks with metallic card guides. The cards should be provided with proper handles. Card to card wiring should be preferably through a mother board. Unplanned jumpering and track modifications are not permitted. Mechanical interlocks to prevent wrong insertion of cards should be provided. Each card shall have its junction and test points identified. Maintenance aids such as extension printed wiring boards and jumper leads shall be provided.
22.18.04	The layout of Charger components shall be such that their heat losses do not give rise to excessive temperature within the Charger panel surface. Location of the electronic modules shall be such that temperature rise of the location, in no case, shall exceed 10°C over ambient air temperature outside the Charger.
22.18.05	Each Charger panel shall be provided with an illuminating lamp and one 5 Amp. Socket. Switches and fuses shall be provided separately for each of the above.
22.18.06	Locking facilities shall be provided as following: i) For locking Trickle/Boost selector switch in the trickle position only. This would be used for having key mechanical interlock between Trickle/Boost selector switch and isolator in D.C. distribution board . The co-ordination & execution of this interlock shall be carried out by the Bidder. ii) The Charger enclosure door locking requirements shall be met by the application of padlocks. Padlocking arrangement shall allow ready insertion of the padlock shackle but shall not permit excessive movement of the locked parts with the padlock in position.
22.19.00	WIRING
22.19.01	Each Charger shall be furnished completely wired upto power cable lugs and terminal blocks ready for external connection. The power wiring shall be carried out with 1.1 KV grade PVC insulated cables conforming to IS:1554 (Part-I). The control wiring shall be of 1.1KV grade PVC insulated stranded copper conductors of 2.5 sq.mm. conforming to IS:694. Control wiring terminating at electronic cards shall not be less than 1.0 sq. mm. Control terminal shall be suitable for connecting two wires with 2.5 sq.mm. stranded copper conductors. All terminals shall be numbered for ease of connections and identification. At least 20% spare terminals shall be provided for circuits.
22.19.02	Power and control wiring within panels shall be kept separate. Any terminal or metal work which remains alive at greater than 415 V, when panel door is opened, shall be fully protected by shrouding.



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- 22.19.03 An air clearance of at least ten (10) mm shall be maintained throughout all circuits, except low voltage electronic circuits, right upto the terminal lugs. Whenever this clearance is not available, the live parts should be insulated or shrouded.

22.20.00 PAINTING

Treatment as per IS:6005. Two coats of lead oxide primer followed by powder painting with final shade of RAL9002 for complete panel except end covers & RAL 5012 for end covers.

**22.21.03 DISCHARGE RESISTOR**

Discharge resistor shall be provided for testing the Battery. The discharge resistor shall be adequately sized for charge – discharge cycle testing of different type & rating of batteries with necessary tapping. It shall be enclosed in sheet steel enclosure of atleast 3 mm, having IP: 31 degree of protection. Resistor shall be of punched stainless steel. Temperature rise shall be limited to 150 degree C over ambient. The Discharge resistor shall be mounted on trolley with bi-directional wheels.

- 22.21.03 Catalogue and Instruction manuals of battery and battery charger to be furnished.



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22.22.00 TESTS

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

22.22.05 General

- I) The Bidder shall carry out the following type tests on one sample of each rating of the equipment to be supplied under this contract.
- a) Complete physical examination
 - b) Temperature rise test at full load. (As considered in BOQ cum Price schedule)
 - c) Insulation resistance test.
 - d) High voltage (power frequency) test on power and control circuits except low voltage electronic circuits.
 - e) Ripple content test at
 - 1) No load
 - 2) Half load
 - 3) Full load
 - f) Automatic voltage regulator operation test at specified A.C. supply variations at
 - 1) No load
 - 2) Half load
 - 3) Full load
 - g) Load limiter operation test



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h) Efficiency and power factor measurement.

Input and output surge withstand capability test. Surge Voltage as per ANSI-C37.90a shall be applied for period not less than 2 sec. At the following points of the Charger operating at full load:

- 1) Across each A.C. input phase
- 2) Across AC input line to ground.
- 3) Across D.C. output terminals.
- 4) Across each D.C. output terminal to ground

The Charger shall not exhibit any component damage and there shall be no change in performance as per (g) and (h).

j) Environmental Tests

Steady state performance tests (f) and (g) shall be carried out before and after each of the following tests.

l) Soak Test

The electronic modules shall be subjected to continuous operation for a minimum period of 72 hours. During last 48 hours, the ambient temperature shall be maintained at 50 deg. C. The 48 hour test period shall be divided into four equal 12 hour segments. The input voltage during each 12 hours shall be nominal voltage for 11 hours followed by 110% of nominal voltage for 30 minutes, followed by 90% of nominal voltage for 30 minutes.

m) Degree of protection test.

All routine tests as per QA table and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price. Dynamic response test and Temperature rise test at full load shall be carried out on each charger before dispatch at manufacturer's works.

O) Vibration Test of the electronic card rack / Panel

II) Routine & Functional Test of Charger Panel

- Voltage regulation
- Ripple content at different loads and noise measurement
- Insulation resistance test
- General operation
- Voltage/current stability test
- High voltage test
- Measurement of surface temperature of charger panel
- Current limiting features.
- Efficiency & PF measurement

- Short circuit at full load
- Short circuit at No load



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22.27.00 DRAWINGS & DOCUMENTS

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

- Charger sizing calculation
- Technical data sheet
- General arrangement, layout drawing and section
- Charger room layout
- Schematic wiring diagram
- Drawing for MCCB box
- Drawing for discharge resistor
- Erection and commissioning procedures
- Operation and maintenance manual
- Battery Health Monitoring System
- Test reports
- Sub-vendor list
- Manufacturing quality plan
- Field quality plan



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2.0	BATTERY CHARGER	
		220 V DC
2.1	Charger	Per Unit 1x100% Float-cum-boost for each Battery & 1x100% Standby Float-cum-boost charger
2.2	Type	Solid-state, full wave, fully controlled, three phase bridge
2.2.1	Charger efficiency	$\geq 96 \%$
2.2.2	Ripple coefficient	$\leq .05\%$
2.3	Enclosure	Sheet steel enclosure, IP-42
2.4	A.C. Input	
a)	Supply	415 V, 3 phase, 50 Hz, 4 wire
b)	Voltage variation	$\pm 10\%$
c)	Frequency variation	$\pm 5\%$



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d)	Combined frequency and voltage variation	10% (absolute sum)	10% (absolute sum)
e)	Short circuit level	50kA r.m.s symmetrical	50kA r.m.s symmetrical
2.5	Performance Requirement		
a)	The output voltage of charger shall be regulated within $\pm 1\%$ of the set value for any load variation 0 to 100 % and A.C. input voltage and frequency variation as indicated above in 2.5.		
b)	The triple content in charger D.C output shall be limited to $\pm 1\%$ of the D.C output voltage, at nominal A.C voltage.		
2.6	Terminal Connection		
	A.C Input	AYWY cable of adequate size	
	D.C Output		
	To battery	1/C, copper cables of adequate size	
	To load	1/C, AYY copper cables of adequate size	



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DATASHEET-A

Sr. No.	PARAMETER	UNIT	VALUE
1.0	Power Supply & fault level details		
1.1	Rated AC voltage & variation	V, %	415 V, 3Ph, 3 Wire Systems, (-) 10% to (+) 10%
1.2	Frequency & variation	Hz, %	50 Hz, +3% to -5%
1.3	Rated DC voltage & variation	V, %	220 V, 187 V to 242V
1.4	Fault current of 415V system	kA	50 kA for 1 sec.
1.5	Fault current of DC system limited upto (max)	KA	The Charger shall be designed to restrict maximum fault level on DCDB limited to 50kA for 1 Sec.
1.6	Type/ Capacity of battery	MIN	Alternative-I: 4070 AH Lead-Acid Plante battery (Two parallel strings of 2035AH battery) Alternative-II: 3800 AH Lead-Acid Plante battery (Two parallel strings of 1900AH battery)
2.0	Charger current rating		
2.1	Float-cum-boost charger	A	Alternative-I: 720A Alternative-II: 560A
3.0	Type of cooling		Natural air cooled
4.0	Ripple content of charger		
4.1	RMS	%	± 1%
4.2	Peak to peak	%	
5.0	Degree of Protection (DOP)		
5.1	Rectifier transformer cubicle		IP-42
5.2	Control cubicle		IP-42
6.0	Constructional features		



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6.1	Panel sheet thickness/ material	mm	Charger shall be fabricated using cold rolled sheet steel not less than 1.6 mm. Panel frame shall be made of 2.0mm Cold rolled sheet steel
6.2	Paint shade		The charger panels shall be painted as two coats of lead oxide primer followed by powder painting with final shade of RAL9002 for complete panel except end covers & RAL 5012 for end covers
6.3	Cable gland plate thickness/ material	mm	Removable undrilled gland plates of atleast 3 mm sheet steel
6.4	Gasket thickness/ material	mm	3 mm / Neoprene
6.5	CABLE SIZES a) Cable size from Battery to MCCB Box b) Cable size from MCCB Box to DCDB c) Cable size from Charger to DCDB d) Cable Size For FCB Charger AC Incomer		a) 4X1CX400sq.mm(Cu) /Pole*(EPR insulated Fire survival cable) b) 4X1CX400sq.mm(Cu) /Pole*(EPR insulated Fire survival cable) c) 3X1CX400sq.mm(Cu) /Pole*(EPR insulated Fire survival cable) d) 2x1CX400sq.mm(Al)/ Ph
7.0	Type Tests		
7.1	Type tests to be conducted for this contract, despite availability of valid & acceptable test certificates	Yes/ No	YES, As per Section –I/ Quality plan.
8.0	EARTHING		
8.1	Grounding terminal size/ no. for each charger		75X10 MM./ 2 nos.



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8.2	Grounding terminal size/ no. for each fuse box		75X10 MM./ 2 nos.
8.3	Grounding terminal size/ no. for each discharge resistor		75X10 MM./ 2 nos.
9.0	Mandatory Spares		
9.1	Mandatory Spares to be quoted for this contract	Yes/ No	Yes
9.2	If yes, list of mandatory spares		Mentioned in BOQ cum Price Schedule
10	E & C Spares		
10.1	E & C Spares to be quoted for this contract	Yes/ No	Yes
10.2	If yes, list of E & C Spares		Mentioned in BOQ cum Price Schedule
11.0	Special tools & tackles		
11.1	Special tools & tackles to be quoted for this contract	Yes/ No	Yes
11.2	If yes, list of Special tools & tackles		Bidder to furnish the list.
12	Battery MCCB Box	MCCB Box as per Load Duty Cycle shall be provided. Minimum rating of Battery MCCB Box shall be as indicated in the BOQ cum price schedule.	
13	Discharge Resistor Panel	a) Portable type battery discharge resistor panels shall be supplied with shunt suitable for 10 hrs. Discharge rate (C10 rate) as per battery capacities indicated in the BOQ cum price schedule. b) It shall be enclosed in sheet steel enclosure of atleast 3 mm, having IP: 31 degree of protection. Resistor shall be of punched stainless steel. Temperature rise shall be limited to 150 degree C over ambient. The Discharge resistor shall be mounted on trolley with bi-directional wheels.	

Notes

1) BHEL will provide 3 PH-3 wire power Supply. Further distribution for single Phase shall be created by Bidder.

2) *Min cable size and Nos. indicated. Actual cable size and number of runs shall be informed during detailed engineering.



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DATASHEET-C

Sr. No.	PARAMETER	UNIT	VALUE
1.0	Manufacturer's Name		
2.0	Design ambient temperature		
3.0	Charger Rating & Type		
4.0	Charger rated output current:		
4.1	Trickle charging mode		
4.2	Boost charging mode		
5.0	Load limiter current setting range (Trickle mode)		
6.0	Automatic voltage regulator (Trickle mode)		
6.1	Type		
6.2	% Stabilization of the output DC voltage		
6.3	Voltage setting range		
6.4	Walk in time of Automatic Voltage Regulator		
6.5	Time taken to stabilize voltage for under shoot & overshoot		
7.0	Manual voltage regulator (Trickle mode)		
7.1	Type		
7.2	Voltage setting range		
8.0	Boost charging		
8.1	Current setting range		
8.2	Voltage limit setting range		
9.0	Rectifier assembly		
9.1	Type of semi-conductor material		
9.2	Rated direct current per cell (Average)		
9.3	SCR Rating Selected		
9.4	Heat sink for SCR		
9.5	Rated direct voltage		
9.6	Rated input voltage		
9.7	Type of connections of rectifier element		
9.8	Standard applicable		
9.9	Ripple content		



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Sr. No.	PARAMETER	UNIT	VALUE
10.0	Rectifier transformer		
10.1	Type		
10.2	Rated KVA & % impedance		
10.3	Input line winding connection in vector representation		
10.4	Cell winding connection in vector representation		
10.5	1 min. power frequency withstand voltage (kV)		
10.6	Standard applicable		
11.0	Charger full load Efficiency at nominal input & output voltage & current		
12.0	Power factor at nominal input & output voltage & current		
13.0	Instrument		
13.1	Manufacturer		
13.2	Type		
13.3	AC voltmeter range		
13.4	DC voltmeter range		
13.5	DC Ammeter range		
13.6	Dial size		
13.7	Accuracy class as per IS		
14.0	Contactor		
14.1	Manufacturer		
14.2	Type		
14.3	Rated voltage		
14.4	Rated current		
14.5	No. of power contact		
14.6	No. type and rating of Aux. Contacts		
14.7	Operating coil voltage		
14.8	Drop-out voltage		
15.0	Thermal over load relay		
15.1	Manufacturer		



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Sr. No.	PARAMETER	UNIT	VALUE
15.2	Tripping current range		
15.3	Whether single phasing protection provided		
15.4	Standard applicable		
16.0	Air - break switches (both DC & AC side)		
16.1	Manufacturer		
16.2	Type		
16.3	Rated voltage		
16.4	Rated current		
16.5	Type & material of contacts		
16.6	Standard applicable		
17.0	Output fuse		
17.1	Manufacturer		
17.2	Type		
17.3	Rupturing capacity (both AC & DC)		
17.4	Standard applicable		
18.0	Painting		
18.1	Paint shade		
18.2	Painting process		
19.0	Degree of Protection (DOP)		
19.1	Rectifier transformer cubicle		
19.2	Control cubicle		
20.0	Earthing busbar size & material		
21.0	Charger dimension: (approx.) [L x W x H]		
22.0	Sheet thickness (mm) / material		
23.0	Cable gland plate thickness		
24.0	Gasket material		
25.0	Charger weight (Kg.)		



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SECTION-II

STANDARD TECHNICAL REQUIREMENTS

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1.0 INTENT OF SPECIFICATION

The intent of specification is not to specify all details of design & construction of material. The material shall, however, conform in all aspects to high standard of design, engineering and workmanship and be capable of performing in continuous operation up to & after bidder's guarantee period in manner acceptable to purchaser who will interpret the drawings & specification and shall have power to reject any work or material which in his judgement is not in full accordance with this specification.

This specification covers the design, manufacture, assembly, testing, packing and despatch of Battery charger (Float/Boost) complete in all respects with all components, fittings and accessories for efficient and trouble-free operation. The charger shall be connected either with Ni-Cd or Lead-acid type battery. In this specification though erection & commissioning is not included in vendor's scope, the vendor shall still not absolved of his responsibility of establishing the correctness of equipment at site.

2.0 CODES & STANDARDS

- 2.1 The material shall comply with all currently applicable safety codes and statutory regulations of India as well as of the locality where the material is to be installed.
- 2.2 The design, material, construction, manufacture, inspection, testing and performance of 220V DC Battery Charger shall conform to the latest revision of relevant standards and codes of practices as per Annexure-I.
- 2.3 In case of conflict between the applicable reference standard and this specification, this specification shall govern.

3.0 SERVICES AND EQUIPMENT TO BE EXCLUDED

- A) Civil works like foundation and cable cellar, flooring of the battery charger room etc.
- B) Ventilation of battery and charger room.
- C) DCDB
- D) Power and control cables except internal wiring of the charger
- E) Erection of the equipment
- F) Battery

4.0 OPERATIONAL REQUIREMENTS

- 4.1 Under normal conditions, when the AC supply is healthy at the battery charger input terminals, the float charger shall feed the continuous DC loads, while the boost charger shall remain off. Over and above the continuous DC loads the float charger shall also supply the necessary charge to the battery, to keep the later in fully ready condition for being available

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during AC supply failure at charger terminals. Also some of the impulse loads of duration less than a minute for which the response of the charger is poor, shall be by the associated battery in the DC system. This impulse discharge, shall, however, be continuously replenished by the float charger, unless the discharge is of considerable magnitude, in the event of which the boost charger shall be deployed.

- 4.2 The float charger shall withstand momentary supply failure due to changeover on AC supply feeding bus and continue to operate on float mode satisfactorily on restoration of AC supply to charger.
- 4.3 The DC system shall be ungrounded and shall float with respect to be ground potential when healthy. An earth fault relay of approved type and make shall be provided for detection and annunciation of earth fault.
- 4.4 After the batteries are boost charged and operation is changed to float mode, the voltage impressed on the loads shall not exceed float charge voltage.
- 4.5 The charger shall be designed to operate at an ambient air temperature of 50°C. It will be located indoor but in a hot, humid and tropical atmosphere.
- 4.6 The voltage at load terminal will not exceed the limits of +10% and -15% of nominal system voltage for DC system.

5.0 BATTERY CHARGERS

- 5.1 The battery chargers shall be self regulating, natural air cooled, static type, composed of silicon controlled rectifiers (SCRs) connected in three phase full wave full control bridge circuit.
- 5.2 Each charger circuit shall be provided with its own AC input voltmeter with voltmeter selector switch, DC voltmeter & ammeter, battery DC output ammeter & voltmeter, battery charging current ammeter, control switches, rectifiers, Auto/ Manual voltage regulators, load load limiting device, etc. as required for the successful operation of the DC system.
- 5.3 The charger shall have auto voltage regulators to enable stepless, smooth and continuous voltage control. The chargers shall have the effective current limiting feature and smoothing filters on both input and output to minimise harmonics, radio frequency transients, electromagnetic transients, etc.
- 5.4 The battery chargers as well as their automatic regulators shall be of static type. The battery chargers shall be capable of continuous operation at the respective rated load in float charging mode i.e. trickle charging the associated DC batteries while supplying the DC loads.
- 5.5 The battery chargers shall have a selector switch for selecting the battery-charging mode i.e. float or boost charging.

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- 5.6 The battery chargers shall be provided with facility for both automatic and manual control of output voltage and current. The selector switch will select the mode of output voltage/current control, whether automatic or manual. Necessary provisions shall be provided to avoid current/voltage surges of harmful magnitude/nature, which may arise during changeover from auto to manual mode or vice versa under normal operating condition.
- 5.7 Soft start feature shall be provided to build up the voltage to the set value slowly within 15 seconds. The chargers shall have load limiters, which shall cause, when the voltage control is in automatic mode, a gradual lowering of the output voltage when the DC load current exceeds the load limiter setting of the charger. The load limiter characteristic shall be such that any sustained overload or short circuit in DC system shall not damage the charger nor shall it cause blowing of any of the charger fuses. The charger shall not trip on overload or external short circuit. After clearance of fault, the charger voltage shall build-up automatically when working in automatic mode.
- 5.8 When on automatic control mode during float charging, the charger output voltage shall remain within $\pm 1\%$ of the set value for AC input voltage variation of $\pm 10\%$, frequency variation of $+3\%$ to -5% , a combined voltage & frequency (absolute sum) variation of 10% and a continuous DC load variation from zero to full load. Uniform and stepless adjustment of voltage setting (in both auto/manual modes) shall be provided on the front of the charger panel covering the entire float charging output range specified. Stepless adjustment of the load limiter setting shall also be provided from 80% to 100% of the rated output current for float charging mode.
- 5.9 During boost charging, the battery chargers shall operate on constant current mode (when automatic regulator is in service). The boost charging current can be adjusted continuously over a range of 50% to 100% of the rated output current for boost charging mode. The charger output voltage shall automatically go on rising, when operating in boost mode, as the battery charges up. For limiting the output voltage of charger, a potentiometer shall be provided on the front of the panel, whereby it shall be possible to set the upper limit of this voltage anywhere in the output range specified for boost charging mode. All voltage and current setting potentiometers shall be vernier type.
- 5.10 Energising the charger with fully charged battery connected plus 10% load shall not result in output voltage greater than 110% of voltage setting. The time taken to stabilise within specified limits shall be less than 15 seconds.
- 5.11 In case of float-cum-boost charger, manufacturer shall offer an arrangement in which the voltage setting device for float charging mode is also used as output voltage limit setting device for boost charging mode, and the load limiter of the float charging mode is also used as boost charging current setting device.
- 5.12 Suitable filter circuits shall be provided in all the chargers to limit the ripple content (peak to peak) in the output voltage to 1% , irrespective of the DC load fluctuation even when they are not connected to a battery.

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- 5.13 The DC system shall be ungrounded and float with respect to ground potential when healthy. An earth fault relay shall be provided in DCDB for remote annunciation.

6.0 DESCRIPTION OF EQUIPMENT

6.1 Rectifier assembly

Rectifier assembly shall be full wave bridge type and designed to meet the duty as required by the respective charger. The rectifier cells shall be provided with their own heat dissipation arrangement with natural air-cooling. The rectifier shall utilise diodes / thyristors and heat sinks to carry 200% of the load current continuously and the temperature of the heat sink shall not be permitted to exceed 85°C absolute, duly considering the maximum charger panel inside temperature. The successful bidder shall furnish calculations to show what maximum junction temperature will be and what the heat sink temperature will be when operating at 200% and 100% load current continuously duly considering the maximum surrounding air temperature for these devices inside the charger panel at air ambient temperature of 50°C outside the panel. Necessary surge protection devices and rectifier type fast acting HRC fuses shall be provided in each arm of the rectifier connections.

6.2 Rectifier transformer and Chokes

The rectifier transformer & chokes shall be dry and air cooled (AN) type. The rating of the rectifier transformers & chokes shall correspond to the rating of the associated rectifier assembly. The rectifier transformers & chokes shall have class-F insulation with temperature rise limited to class-B insulation value.

6.3 Blocking Diode

Blocking Diode shall be provided in the output circuit of each charger to prevent current flow from the DC battery into the charger.

6.4 Voltage regulators

- 6.4.1 The float charger shall have both auto and manual voltage regulation arrangements. The voltage regulator shall have auto/manual option and be of static type. A selector switch for selection of the mode of voltage regulation shall be provided. AVR time constant shall not exceed 0.5.

- 6.4.2 The boost charger shall have auto/manual voltage regulation arrangement. The voltage adjustment shall be uniform and step less throughout the voltage variation range. The regulator shall be of static type. The boost charger shall be designed to charge the fully discharged battery to fully charged condition.

6.5 Printed Circuit Boards (PCB)

PCB shall be made of glass epoxy of 1.6 mm thick, fire resistant, bonded with 99.8% pure copper foil, free of wrinkles, blisters, scratches and pinholes. The contact surface of the edge connectors of PCBs shall be plated with hard gold to a minimum thickness of 5 microns. The

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The component identification shall be printed on PCB by Silk screen method. All PCBs shall shall be tropicalised and masked.

6.6 Control and Selector Switches

The control and selector switches shall be of rotary stayput type with escutcheon plates showing functions and positions. The switches shall be of sturdy construction and suitable for mounting on panel front. The switches shall have shrouded live parts and sealed contacts against dust ingress. Auto/normal switch shall be of lockable type in either position. The contact ratings shall be at least the following:

- Make and carry continuously 10A
- Breaking current at 220V DC 0.5A (inductive)
- Breaking current at 240V AC 5.0A at 0.3 p.f.

6.7 Indicating Lamps

To indicate AC supply availability, three indicating lamps shall be provided. The indicating lamp shall be suitable for panel mounting, cluster type LED and capable of clear status indication under normal room illumination. The lamp covers shall be preferably screw type, unbreakable and moulded from heat resistant material.

6.8 Instruments

For all chargers, DC ammeter, DC voltmeter and AC voltmeter shall be provided in 96 mm² size with 1.5 accuracy class conforming to IS-1248. The instruments shall be flush mounted type, dust proof, moisture resistant and have easy accessible means for zero adjustment.

6.9 Relays

The relays shall be enclosed in flush or semi flush dust tight cases finished with dull black enamel paint. Relays shall have self-contained test facilities and provisions for removing relay mechanism for inspection and maintenance.

6.10 Transducers

Transducers shall be panel-mounting type and suitable for operating temperatures from 0 to 55°C. Transducer output shall be used for remote display at DDCMIS/ ECP. Transducers shall be provided in charger panel for DC battery voltage, charger output voltage and charger output current. The transducer shall have the following features:

- Input/ output with galvanic isolation
- Auxiliary voltage – 220V DC
- 4-20 mA independent dual output
- Accuracy class 0.5 or better
- Short circuit and over current protection

6.11 Contactors

All battery chargers shall have an AC contactor on the input side. It shall be of air break type type and suitable for continuous duty. The operating coil shall be rated for 415 V.

6.12 Thermal overload relay

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A thermal overload relay with single phasing protection (using differential movement of bimetal strips) shall also be provided for the AC input, which will trip the contactor. The DC contactors shall be single/double pole air break type and suitable for continuous duty.

6.13 Air break switches

All chargers shall have AC input and DC output switches of air break, single throw, load break and fault make type. The contacts of the switches shall open and close with a snap action. The switches shall be rated for 120% of the maximum continuous load. The 'ON' and 'OFF' position of the switch shall be clearly indicated. The operating handle of the switches shall be fully insulated from circuit and shall be effectively earthed.

6.14 Fuses

Fuses shall be of HRC cartridge fuse link type. Fuses shall be mounted on fuse carriers, which are mounted on fuse base. Wherever, it is not possible to mount fuses on fuse carriers, fuses shall be directly mounted on plug-in type bases. In such cases one insulated fuse pulling handle shall be supplied for each charger. Kick-off fuses (trip fuses) with alarm contacts shall be provided for all DC fuses. The fuses shall be suitable for applicable fault level.

6.15 Variable Metallic Resistors

One set of variable metallic resistors and shunt suitable for carrying out discharge tests (5 hour discharge rate for Ni-Cd battery and 10 hour discharge rate for Lead Acid battery) on the batteries shall be supplied.

6.16 Battery fuse box

Battery fuse of adequate rating meeting the load duty cycle shall be supplied. Battery fuse box shall have suitable termination arrangement for terminating the cables informed during detailed engineering stage.

6.17 Panel Construction

The charger panels housing all the equipment shall be indoor, floor mounting, air natural cooled, self-supporting sheet metal enclosed cubicle type. The charger panel and its frame shall be fabricated from 2.0 mm cold rolled sheet steel and have folded type construction. The bidder shall also supply necessary base frames, anchor bolts and hardware. Removable undrilled gland plates of at least 3.0 mm thick sheet steel and lugs for all cables shall be provided. The lugs for cables shall be made of electrolytic tinned copper. The gland plate shall be of adequate size for accommodating requisite number of cable glands for power and control cables. The charger shall be tropicalised and vermin proof. Ventilation louvers shall be backed with fine brass wire mesh. All door and covers shall be fitted with synthetic rubber gaskets. The panels shall have hinged double leaf doors provided on front and backside for adequate access of charger terminals. All the charger cubicle doors shall be properly earthed. The panels shall comply with at least degree of protection IP-42. Incoming and outgoing cables shall enter from bottom. Suitable cable terminal board with copper cable lugs and double compression brass nickel-plated cable glands shall be provided in each panel for incoming and outgoing cables.



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- 6.18 Electronic equipments shall be of modular design consisting of plug-in modules in standard 19 inches metallic racks with metallic card guides. The card should be provided with proper handles. Card to card wiring shall be through mother board. Unplanned jumpering and track modifications shall not be allowed. Mechanical interlocks to prevent wrong insertion of cards shall be provided. Each card shall have its junction and test points identified. Maintenance aids such as extension printed wiring boards and jumper leads shall be provided.
- 6.19 The layout of charger components shall be such that their heat losses do not give rise to excessive temperature within the charger panel surface. Location of the electronic modules will be such that temperature rise of the location, in no case, shall exceed 10°C over ambient air temperature outside the charger.
- 6.20 All the charger panels shall be provided with an illuminating lamp, a 5 Amp socket and space heaters with thermostat. Toggle switches and fuses shall be provided separately for each of the above fittings. Space heaters "ON" indication shall be provided. Two separate grounding pads shall be provided for each panel.
- 6.21 Locking facility
Locking facility shall be provided as follows:

For locking float/boost selector switch in the float position only. This shall be used for having key mechanical interlock between float/boost selector switch and isolator in DCDB.

The charger enclosure door-locking requirement shall be met by the application of padlocks. Padlocking arrangement shall allow ready insertion of the padlock shackle but shall not permit excessive movement of the locked parts with the padlock in position.

- 6.22 Control wiring
Each panel shall be furnished completely factory wired upto power cable lugs and terminal blocks ready for external connections. The power wiring shall be carried out with 1.1kV grade, PVC insulated cables conforming to IS-1554 (Part-1). The control wiring shall be of 1.1kV grade, 1 core stranded copper wire with colour coded PVC insulation having identification ferrules at both terminal and device end for each wire. Wires shall conform to IS-694 and minimum size of the wire shall not be less than 2.5 mm². The control wiring terminating at electronic card shall not be less than 1.0 mm². The control terminal shall be suitable for connecting two wires with 2.5 mm² stranded copper conductors. All terminals shall be numbered for ease of connections and identification.

Power & control wiring within the panel shall be kept separate. Any terminal or metal work, which remains alive at greater than 415V, when panel door is opened, shall be fully protected by shrouding.

An air clearance of at least 10mm shall be maintained throughout all circuits, except low voltage electronic circuits, right upto the terminal lugs. Whenever this clearance is not available, the live parts shall be insulated or shrouded.

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6.23 Terminal Blocks

Terminal blocks for all the chargers shall meet the following requirements:

- Terminal block shall be 1.1kV grade, minimum 10A rated, one piece moulded complete with insulating barrier, clip on type terminals, washers, nuts and identification strip etc. It shall be similar to Klippon type RSF with insulating material of melamine or equivalent. Marking on terminal strips shall correspond to the terminal numbering on wiring diagrams. Terminal blocks for CT & VT secondary leads shall be provided with links to facilitate testing, isolation, star/delta and earthing. Terminal blocks for CT secondary shall have the short-circuiting facility.
- At least 20% spare terminals for external connections shall be provided on each panel and these spare terminals shall be uniformly distributed on all terminal blocks.
- There shall be minimum clearance of 250mm between the terminal blocks and the cable gland plate and 150mm between two rows of terminal blocks.

6.24 Cable Lugs

Heavy duty bolt-on termination tinned copper lugs of compression type shall be used in the switchgear for power cable termination. The supply of tinned copper cable lugs for power cables forms part of the supply of equipment. Cable lugs shall comply with IS-8309.

6.25 Cable Glands

The supply of cable glands forms part of the supply of equipment. Cable glands shall conform to BS-6121. Cable glands shall be of double compression type.

6.26 Panel Earthing

Charger panels shall have fully rated GI ground bus with two ground terminals, one at each end of the panel. Each ground terminal shall have two bolt drillings with GI bolts and nuts suitable for connection to purchaser's ground conductor.

7.0 ANNUNCIATION SYSTEM

7.1 Visual indication shall be provided to indicate the operating conditions of the charger by the means of indicating lamps/LED or annunciation facia windows as per EEUA-45D, arranged on the top of the charger panels for following faults:

- AC supply failure
- Rectifier fuse failure
- Surge circuit fuse failure
- Filter fuse failure
- Load limiter operated
- Charger trip/over loaded
- Battery on boost
- DC system earth fault
- Battery fuse blown
- DC system under voltage

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Potential free 'NO' contacts of all above conditions shall be provided for following remote alarms in the Unit Control Panel/ DDCMIS:

- k) Battery fuse fails
- l) Battery on boost
- m) Charger over load
- n) Charger trouble (this being a group alarm initiated by any of the faults of charger other than charger over load).

7.2 Suitable potential free contacts for remote indication of above abnormal conditions shall be provided. Multiplication relays, if required, shall be included in the panel. Indications for charger input supply healthy, charger in FLOAT mode and charger in BOOST mode shall be provided.

8.0 NAME PLATE AND MARKING

The name plates shall be made of non-rusting metal / 3 ply Lamicoid and shall have black back ground with white engraved letters and secured by screws. These shall be provided near top edge on the front as well as on rear side of charger. Name plates with full and clear inscriptions shall also be provided on and inside the panels for identification of the various equipments.

9.0 PAINTING

After fabrication, all surfaces shall be cleaned and pre-treated as per IS:6005. Two coats of lead oxide primer (anti-corrosive) shall be applied after the pre-treatment. Two coats of powder painting with shade no. RAL-7032 or paint shade approved by customer shall be applied for complete panel. Thickness of paint shall be min. 40-50 microns. Protecting peelable compound shall be provided on outside finished surface to protect the painted surface during transportation and site handling.

10.0 PERFORMANCE GUARANTEE

The bidder shall guarantee that chargers offered shall meet the ratings and performance requirements stipulated for various equipments covered in this specification. If the equipment fails to meet the requirement, the supplier shall replace it with appropriate equipment free of cost without affecting the schedule.

11.0 INSPECTION & TESTING

11.1 The bidder shall confirm compliance to Quality plan enclosed with Section-C of specification. The Quality plan shall be subject to BHEL/ customer approval after award of contract without any commercial or delivery implication. Inspection shall be carried out as per BHEL/ customer approved Quality plan.

11.2 All equipments to be supplied shall be of type-tested quality. The bidder shall furnish all type test reports for BHEL/ customer approval. The Type tests should have been carried out

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within last five years on the equipment similar to those proposed to be supplied under this contract and the tests should have been either conducted at an independent laboratory or should have been witnessed by a client/ government agency. In absence of such type tests reports or in case such reports are not found to be meeting the specification/ standards requirements, vendor shall conduct all such type tests without any commercial/ delivery implication to BHEL according to the relevant standards and reports shall be submitted to the owner for approval. (Type test charges as per clause 10.10 shall not be applicable in such such cases).

- 11.3 The details of Type Tests to be conducted shall be as per Section-I of specification.
- 11.4 The bidder shall furnish following Type Tests reports for each type & rating of battery charger:
- i) Temperature rise test at full load
 - ii) Temperature rise test for rectifier assembly at current specified in Data Sheet-A Section-C.
 - iii) Insulation resistance test
 - iv) High voltage (power frequency) test on power & control circuits except low voltage electronic circuit
 - v) Ripple content test at no load, half and full load
 - vi) Automatic voltage regulation operation test at specified AC supply variations at no load, half and full load
 - vii) Load limiter operation test
 - viii) Efficiency and power factor measurement
 - ix) Input and output surge withstand capacity test. Surge voltage as per ANSI-C37.90a shall be applied for a period of not less than 2 seconds at the following points of the charger operating at 50°C at full load:
 - a) Across each AC input phases
 - b) Across AC input line to ground
 - c) Across DC output terminals
 - d) Across each DC output terminal to ground

The charger shall not exhibit any component damage and there shall be no deterioration in performance of the charger.



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- x) Environmental Tests: Steady state performance tests (temperature rise test at full load & load limiter operation test) shall be carried out before & after the following tests.
 - a) Soak test: The electronic modules shall be subject to continuous operation for a minimum period of 72 hours. During last 48 hours, the ambient temperature shall be maintained at 50°C. The 48 hour test period shall be divided into 4 equal 12 hour segments. The input voltage during each 12 hours shall be nominal voltage for 11 hours followed by 110% of nominal voltage for 30 minutes, followed by 90% of nominal voltage for 30 minutes.
 - b) Degree of protection test
- xi) Complete physical examination

11.5 Rectifier transformers shall be subjected to following routine test:

- i) Temperature rise test
- ii) Insulation Resistance test
- iii) High voltage test (power frequency) test

11.6 Following routine tests are to be performed on all battery chargers:

- i) Complete physical examination
- ii) Temperature rise test at full load
- iii) Insulation resistance test
- iv) High voltage (power frequency) test
- v) Ripple content test at no load, half and full load
- vi) AVR operation test at specified AC supply variation at no load, half and full load
- vii) Load limiter operation test
- viii) Checking of proper operation of annunciation system
- ix) Dynamic response test
Overshoot / undershoot in output voltage of the charger corresponding to sudden change in load from 100% to 20% and from 20% to 100%.
- x) Burn in test shall be carried out on all electronic modules or panels with modules. During the test the panel / module shall be subjected to ambient temperature of

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50°C for 48 hours in energised condition. The temperature rise inside the cubicle shall not exceed 10°C during the test.

- xi) Degree of protection test
The charger shall be checked for gasket arrangement as per the drawings.

11.7 Following routine tests shall be carried out on annunciation system:

- i) Annunciation assembly and module shall be functionally tested as per EEUA-45D.
- ii) Burn in test as specified above in cl. No. 10.5 (x) above.

11.8 All material used for the construction of the equipment / items shall be new and shall be in accordance with the requirements of this specification. Materials utilised shall be those, which have established themselves for use in such applications.

11.9 All acceptance and routine tests as per relevant standards and specification, shall be carried out by the manufacturer. Charges for all these routine and acceptance tests for all the materials shall be deemed to be included in the bid price.

11.10 The bidder shall indicate cost of carrying out all the Type tests as specified in the specification. The charges for each of the Type tests shall be given separately in price schedule (Volume III) as optional. These prices will be applicable in case a type test is required to be conducted by purchaser despite availability of satisfactory type test report as per clause 10.2 above.

12.3 Instruction Manuals

Instruction manuals for the installation, operation and maintenance of battery charger, battery fuse and variable metallic resistor and shunt to be supplied at least two months before the date of despatch of equipment.

The installation and maintenance manual of battery charger, battery fuse and variable metallic resistor and shunt shall contain the following.

- A) General description giving type and rating of equipment.
- B) Technical data.
- C) Salient constructional details.
- D) Instruction to be followed on receipt at site.
- E) Erection procedures and checks (handling at site, erection, pre-commissioning).
- F) Commissioning procedures and site tests.
- G) Routine, periodic and preventive inspection and maintenance procedures.
- H) Safety rules.
- J) Possible faults, their causes and remedies.

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K) Catalogues, literature and drawings.

L) Outline dimension drawings showing constructional features, relevant cross sectional views and earthing details, operator oriented description of equipment and accessories.

M) Operating procedures, maintenance procedures & precautions to be taken during operation and maintenance work.

13.0 SPARES

13.1 Bidder to furnish the E & C spares as per BOQ cum Price Schedule.

13.2 Bidder to quote O&M spares for 3 years of normal operation as optional items.

14.0 TOOLS AND TACKLE

Tools & tackle, which are essential to facilitate assembly, adjustments, maintenance & dismantling of equipment shall be provided as part of equipment supplied. The above tools shall be supplied along with the initial consignment of equipment so as to be available prior to erection but may not be used for erection purposes.

15.0 AS-BUILT DRAWINGS

Though only supply of equipment is under bidder's scope, bidder may note that all as-built correction (as given by purchaser to vendor) shall have to be incorporated in the originals by the vendor and copies of the as-built corrected drawings / documents as per requirement shall be submitted by the vendor.

16.0 STATUTORY AND REGULATORY REQUIREMENTS

Statutory and regulatory requirements as per IE rule 1956 with amendment-3 rule 1986, rules Nos. 35, 42, 50 & 51 shall be adhered to.

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ANNEXURE-I

LIST OF APPLICABLE STANDARDS

- | | | |
|-----|--|----------|
| 1. | GUIDE FOR SURGE WITHSTAND CAPABILITY TESTS
37.90a | ANSI-C |
| 2. | COLOURS FOR READY MIX PAINTS | IS-5 |
| 3. | PVC INSULATED CABLE FOR WORKING VOLTAGE 1100V | IS-694 |
| 4. | INDICATING ANALOGUE ELECTRICAL MEASURING INSTRUMENTS | IS-1248 |
| 5. | DOP FOR LV SWITCHGEAR AND CONTROL GEAR
PART-1 | IS-13947 |
| 6. | SPECIFICATION FOR LV SWITCHGEAR AND CONTROL GEAR | IS-13947 |
| 7. | ELECTRICAL RELAYS FOR POWER SYSTEM PROTECTION | IS-3231 |
| 8. | APPLICATION GUIDE FOR ELECTRICAL RELAYS FOR AC SYSTEM | IS-3842 |
| 9. | MONO CRYSTALLINE SEMICONDUCTOR RECTIFIER CELLS & STACKS | IS-3895 |
| 10. | MONO CRYSTALLINE SEMICONDUCTOR RECTIFIER ASSEMBLIES &
EQUIPMENT | IS-4540 |
| 11. | CODE OF PRACTICE FOR PHOSPHATING OF IRON & STEEL | IS-6005 |
| 12. | SAFETY CODE FOR SEMICONDUCTOR RECTIFIER EQUIPMENT | IS-6619 |
| 13. | CONTROL SWITCHES (SWITCHING DEVICES FOR CONTROL AND
AUXILIARY CIRCUITS INCLUDING CONTACTOR RELAYS) FOR
VOLTAGE UPTO 1000V AC OR 1200V DC | IS-6875 |
| 14. | ENVIRONMENTAL TESTING FOR ELECTRONIC & ELECTRICAL ITEMS | IS-9000 |
| 15. | LV FUSE FOR VOLTAGES BELOW 1000V AC OR 1500V DC | IS-13703 |
| 16. | PERFORMANCE REQUIREMENT FOR ALARM ANNUNCIATION SYSTEM | EEUA-45D |
| 17. | POWER TRANSFORMERS | IS-2026 |
| 18. | INDIAN ELECTRICITY RULES & INDIAN ELECTRICITY ACTS | |

NOTE: Equipment complying to other internationally accepted standards such as IEC, BS, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the bidder shall clearly indicate the standards adopted, furnish a copy in English of the latest revision of the standards alongwith copy of all official amendments and revisions and shall clearly bring out the salient features for comparison.

ANNEXURE-II



TECHNICAL SPECIFICATION FOR 220V DC BATTERY CHARGER

SPECIFICATION NO. PE-TS-425-508-E002

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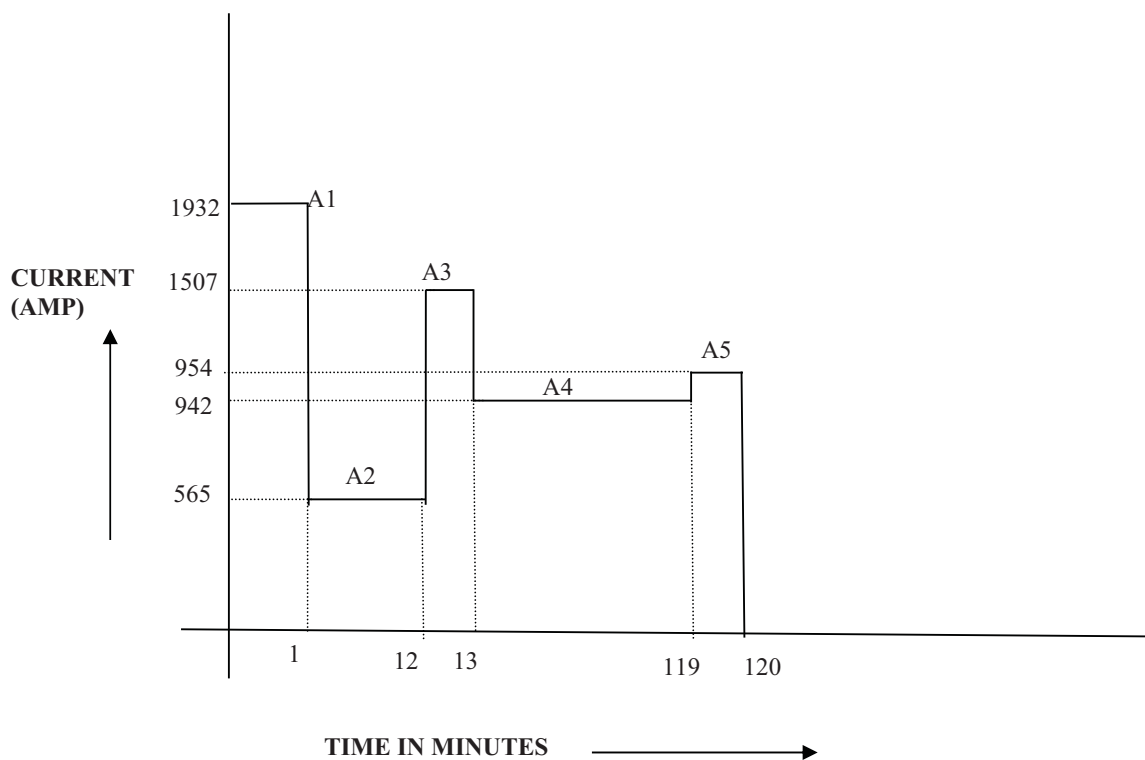
SECTION II

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LOAD DUTY CYCLE



FACTORS TO BE CONSIDERED FOR BATTERY SIZING:

- | | |
|----------------------------------|------------------|
| 1. AGEING FACTOR | : 1 |
| 2. MIN.ELECTROLYTIC TEMP. | : 5 °C |
| 3. END CELL VOLTAGE | : 1.85V PER CELL |
| 4. DESIGN MARGIN | : 15% |
| 5. TEMPERATURE CORRECTION FACTOR | : As per IEEE |
| 6. NO. OF CELLS | : 108 |



TECHNICAL SPECIFICATION FOR 220V DC BATTERY CHARGER

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VOLUME II

SECTION II

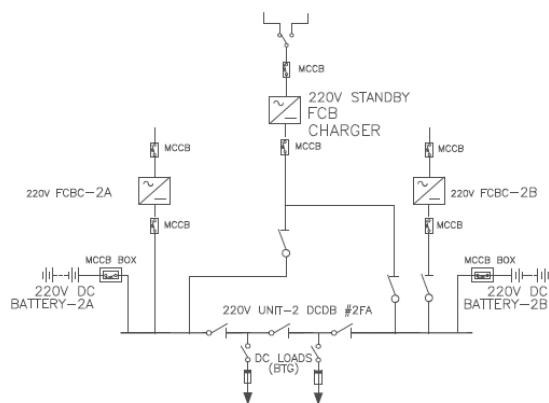
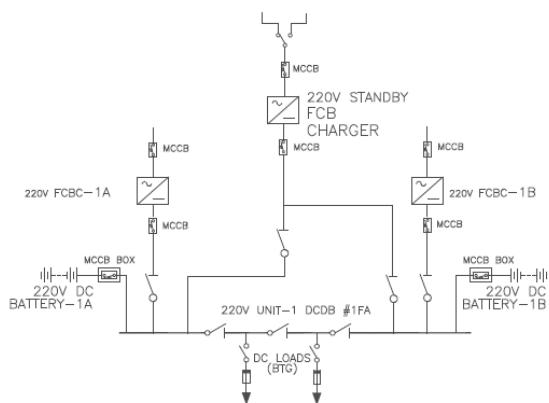
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ANNEXURE-III

ONE LINE DIAGRAM FOR 220 V DC SYSTEM



ITEM DESCRIPTION	VENDOR NAME	ADDRESS	PHONE
AC CONTACTORS	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadoria@siemens.com
AC CONTACTORS	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
AC CONTACTORS	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
AC CONTACTORS	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59
AC CONTACTORS	BCH	20/4, MATHURA ROAD, FARIDABAD, HARYANA-121006	0129-4293000
AC MCCB	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29
AC MCCB	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
AC MCCB	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadoria@siemens.com
AC MCCB	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
AC MCCB	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59
AC MCCB	CROMPTON GREAVES	RAIL TRANSPORTATION SYSTEMS,VANDANA BUILDING, 11, TOLSTOY MARG, TOLSTOY MARG, NEW DELHI, DL 110001	011 3041 6300
AIR CIRCUIT BREAKER	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59
AIR CIRCUIT BREAKER	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadoria@siemens.com
AIR CIRCUIT BREAKER	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
AIR CIRCUIT BREAKER	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
AIR CIRCUIT BREAKER	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29
AUXILIARY RELAYS	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	0129-2567580, 09871799449
AUXILIARY RELAYS	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000
AUXILIARY RELAYS	JYOTI LTD.	JYOTI LIMITED, E&CS DIVISION,3/15, BIDC, GORWA,VADODARA - 390 016, E-MAIL ID: ECS@JYOTI.COM	Ph. No.:+91-265-2281214 , Fax No.:+91-265-2281214
AUXILIARY RELAYS	OEN INDIA LTD	29/1479, VYTILLA, COCHIN - 682 019 KERALA, INDIA	Phone : +91 484 2301132, 2303709 Fax : +91 484 2302287, 2302221 sales@oenindia.com
AUXILIARY RELAYS	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadoria@siemens.com
BIMETAL RELAYS	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59
BIMETAL RELAYS	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
BIMETAL RELAYS	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadoria@siemens.com
BIMETAL RELAYS	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
CABLE GLANDS	ALLIED TRADERS & EXPORTERS	C-124 A, SECTOR-2, NOIDA -201 301, UTTAR PRADESH, INDIA	Mr. Vijay Mohan Sood +(91)-(120)-2525694 +(91)-(120)-3052594 +(91)-(11)-23287156 vijay_mohansood@yahoo.com

TECHNICAL SPECIFICATION FOR
220V DC BATTERY CHARGER
PE-TS-425-508-E002

ANNEXURE-IV
2 X 800 MW UPPUR TPS
SUB VENDOR LIST

ITEM DESCRIPTION	VENDOR NAME	ADDRESS	PHONE
CABLE GLANDS	ARUP ENGG & FOUNDRY WORKS	391/119, PRINCE ANWAR SHAH ROAD, CALCUTTA-700068	033 2473 0850
CABLE GLANDS	BALIGA LIGHTING EQPT.PVT.LTD.	63A, CP RAMASWAMY ROAD, ALWARPET, P.B.No 6910, CHENNAI-600018	44-24995505, 22680990-4
CABLE GLANDS	COMMET BRASS PRODUCTS	NUTAN CHEMICAL COMPOUND, WALBHAT ROAD, GOREGAON, MUMBAI-400063	91-022-26852961/62/63 comet@vsnl.net
CABLE GLANDS	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGAON (EAST). MUMBAI 400 063.	CEO : Mr. Jayantibhai S. Patel TEL: 022-32504770./022-29270876/ 022-29270878.
CABLE GLANDS	ELECTROMAC INDUSTRIES	27/28AF NEW EMPIRE IND.ESTT., R.KRISHNA MANDIR RD.JB NGR ,ANDHERI(E),MUMBAI-400059	91-22-28324829 / 66919034 devang@electromacglands.com
CABLE GLANDS	INCAB	HARE STREET,KOLKATA,WEST BENGAL-700001	91-33-2480161/62/63/64 Fax : 91-33-2485766
CABLE GLANDS	Sunil & Co.	Kolkata	
CABLE GLANDS	Quality Precision	Kolkata	
CABLE GLANDS	Standard Metal Industries	Mumbai	
CABLE LUGS	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGAON (EAST). MUMBAI 400 063.	CEO : Mr. Jayantibhai S. Patel TEL: 022-32504770./022-29270876/ 022-29270878.
CABLE LUGS	UNIVERSAL MACHINES LTD.	4,B.B.D.BAG (EAST) 90,STEPHEN HOUSE,5TH FLR CALCUTTA-700001	033 2282 2540
CABLE LUGS	3D	Umbergaon	
CABLE LUGS	Chetna	Nasik	
DC CONTACTORS	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
DC CONTACTORS	BHEL (BHOPAL)	HEAVY ELECTRICAL PLANT	
DC CONTACTORS	ELECTROMAC INDUSTRIES	27/28AF NEW EMPIRE IND.ESTT., R.KRISHNA MANDIR RD.JB NGR ,ANDHERI(E),MUMBAI-400059	91-22-28324829 / 66919034 devang@electromacglands.com
DC CONTACTORS	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59
DC CONTACTORS	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com
DC CONTACTORS	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
DC CONTACTORS	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
CONTROL SWITCHES/ SELECTOR SWITCH	KAYCEE	KAYCEE INDUSTRIES LTD., C/O-CMS COMPUTERS LTD., 35A, REAR BLDG., KILOKARI, NEW DELHI-110014	Rajiv Sharma-9312004687
CONTROL SWITCHES/ SELECTOR SWITCH	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
CONTROL SWITCHES/ SELECTOR SWITCH	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479000
CONTROL SWITCHES/ SELECTOR SWITCH	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
CONTROL SWITCHES/ SELECTOR SWITCH	M/s Shrenik & Co.	39A/3, PANCHRATNA INDUSTRIAL ESTATE, SARKHEJ-BAVLA ROAD, CHANGODAR, AHMEDABAD – 382 213	
CONTROL SWITCHES/ SELECTOR SWITCH	RECOM PVT. LTD.	M/S RECOM PVT. LTD., 16A , 2ND FLOOR A, WING RAJ INDUSTRIAL COMPLEX, MILITARY ROAD , MAROL ANDHERI (EAST),MUMBAI ,MAHARASHTRA STATE : 400059	Mr. Chandrashekar Kamath (MD) : 09820249503
CONTROL TRANSFORMER/ WINDING HEATING TRANSFORMER	AUTOMATIC ELECTRIC LTD.	96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482

ITEM DESCRIPTION	VENDOR NAME	ADDRESS	PHONE
CONTROL TRANSFORMER/ WINDING HEATING TRANSFORMER	INDCOIL	PLOT NO. A- 150/ 151, 23RD U ROAD, WAGLE ESTATE, THANE WEST, CST RD, FRIENDS COLONY, HALLOW PUL, KURLA WEST, MUMBAI, MAHARASHTRA 400070	Phone:022 2583 8305
CONTROL TRANSFORMER/ WINDING HEATING TRANSFORMER	KAPPA ELECTRICALS	KAPPA ELECTRICALS, KAPPA CONSOLIDATED PVT. LTD., 14, CART TRACK ROAD, MADUVANKARAI, CHENNAI - 600 042, INDIA.	PHONE: +91 - 44 - 22454709, 22454516, 22450794, 22450795 FAX: +91 - 44 - 22351662, 22451693 E MAIL: mira@kappaelectricals.com sales@kappaelectricals.com
CONTROL TRANSFORMER/ WINDING HEATING TRANSFORMER	LOGICSTAT	B-160, INDUSTRIAL AREA, C BLOCK RD, OKHLA I, OKHLA INDUSTRIAL AREA, NEW DELHI, DL 110020	011 2681 0032
CONTROL TRANSFORMER/ WINDING HEATING TRANSFORMER	PRECISE ELECTRICALS	47A-49A,CHAKALA ROAD ANDHERI(E),MUMBAI 99 MUMBAI, MAHARASHTRA, INDIA PIN-400 099	022-8323402 / 022-8216433
CONTROL TRANSFORMER/ WINDING HEATING TRANSFORMER	UNILEC ENGINEERS PVT. LTD.	PLOT NO: R-247, T.T.C. INDUSTRIAL AREA, M.I.D.C , RABALE, NAVI MUMBAI- 400 701 INDIA	+91-22- 27607787 / 27607927 +91-22- 27607997
LT- CURRENT TRANSFORMER	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER- B, PLOT NO. 78, SECTOR 18, GURGAON- 122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com
LT- CURRENT TRANSFORMER	AUTOMATIC ELECTRIC LTD.	96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482
LT- CURRENT TRANSFORMER	INDCOIL	PLOT NO. A- 150/ 151, 23RD U ROAD, WAGLE ESTATE, THANE WEST, CST RD, FRIENDS COLONY, HALLOW PUL, KURLA WEST, MUMBAI, MAHARASHTRA 400070	Phone:022 2583 8305
LT- CURRENT TRANSFORMER	KAPPA ELECTRICALS	KAPPA ELECTRICALS, KAPPA CONSOLIDATED PVT. LTD., SOUTHERN ELEKTRIS 14, CART TRACK ROAD, MADUVANKARAI, CHENNAI - 600 042, INDIA.	PHONE: +91 - 44 - 22454709, 22454516, 22450794, 22450795 FAX: +91 - 44 - 22351662, 22451693 E MAIL: mira@kappaelectricals.com sales@kappaelectricals.com
LT- CURRENT TRANSFORMER	PRAGATI ELECTRICALS	280/3,II POKHRAN RD	5341779,5427041
LT- CURRENT TRANSFORMER	PRECISE ELECTRICALS	47A-49A,CHAKALA ROAD ANDHERI(E),MUMBAI 99 MUMBAI, MAHARASHTRA, INDIA PIN-400 099	022-8323402 / 022-8216433
LT- CURRENT TRANSFORMER	SILKAANS ELECT.MFG.CO.PVT.LTD	PLOT NO: R-247, T.T.C. INDUSTRIAL AREA, M.I.D.C , RABALE, NAVI MUMBAI- 400 701 INDIA	+91-22- 27607787 / 27607927 +91-22- 27607997
LT- CURRENT TRANSFORMER	PRAYOG ELECTRICALS PVT. LTD.	GROUND FLOOR, THAKORE INDUSTRIAL COMPUND, STATION ROAD, VIDYA VIHAR (W), NATHANI ROAD , OPP. AMIBIKA TEMPLE,MUMBAI Mumbai - 400086, Maharashtra, India	91-22-25164288/25133146 Mr. P. U. PATWARDHAN (MANAGING DIRECTOR)
LT- CURRENT TRANSFORMER	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI- 110020	011-3088 7520-29
LT- POTENTIAL TRANSFORMER	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER- B, PLOT NO. 78, SECTOR 18, GURGAON- 122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com
LT- POTENTIAL TRANSFORMER	AUTOMATIC ELECTRIC LTD.	96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482
LT- POTENTIAL TRANSFORMER	INDCOIL	PLOT NO. A- 150/ 151, 23RD U ROAD, WAGLE ESTATE, THANE WEST, CST RD, FRIENDS COLONY, HALLOW PUL, KURLA WEST, MUMBAI, MAHARASHTRA 400070	Phone:022 2583 8305

ITEM DESCRIPTION	VENDOR NAME	ADDRESS	PHONE
LT- POTENTIAL TRANSFORMER	KAPPA ELECTRICALS	KAPPA ELECTRICALS, KAPPA CONSOLIDATED PVT. LTD., SOUTHERN ELECTRIKS 14, CART TRACK ROAD, MADUVANKARAI, CHENNAI - 600 042, INDIA.	PHONE: +91 - 44 - 22454709, 22454516, 22450794, 22450795 FAX: +91 - 44 - 22351662, 22451693 E-MAIL: mira@kappaelectricals.com sales@kappaelectricals.com
LT- POTENTIAL TRANSFORMER	PRAGATI ELECTRICALS	280/3,II POKHRAN RD	5341779,5427041
LT- POTENTIAL TRANSFORMER	PRECISE ELECTRICALS	47A-49A,CHAKALA ROAD ANDHERI(E),MUMBAI 99 MUMBAI, MAHARASHTRA, INDIA PIN-400 099	022-8323402 / 022-8216433
LT- POTENTIAL TRANSFORMER	SILKAANS ELECT.MFG.CO.PVT.LTD	PLOT NO: R-247, T.T.C. INDUSTRIAL AREA, M.I.D.C , RABALE, NAVI MUMBAI- 400 701 INDIA	+91-22- 27607787 / 27607927 +91-22- 27607997
LT- POTENTIAL TRANSFORMER	PRAYOG ELECTRICALS PVT. LTD.	GROUND FLOOR, THAKORE INDUSTRIAL COMPU, STATION ROAD, VIDYA VIHAR (W), NATHANI ROAD , OPP. AMIBIKA TEMPLE,MUMBAI Mumbai - 400086, Maharashtra, India	91-22-25164288/25133146 Mr. P. U. PATWARDHAN (MANAGING DIRECTOR)
DC SWITCH	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
DC SWITCH	KAYCEE	KAYCEE INDUSTRIES LTD., C/O-CMS COMPUTERS LTD., 35A, REAR BLDG., KILOKARI, NEW DELHI-110014	Rajiv Sharma-9312004687
DC SWITCH	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER- B, PLOT NO. 78, SECTOR 18, GURGAON- 122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com
HRC FUSES	INDO ASIAN	B-24, PHASE - II , NOIDA - 201305, U.P.	120-3042222
HRC FUSES	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
HRC FUSES	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI- 110015	011-41419554/59
HRC FUSES	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI- 110020	011-3088 7520-29
HRC FUSES	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER- B, PLOT NO. 78, SECTOR 18, GURGAON- 122015, INDIA	0124-2842000, 9873424331 ;amit.bhadauria@siemens.com
HRC FUSES	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA- 121003	0129-2567580, 09871799449
HRC FUSES	SPACEAGE SWITCHGEARS LTD.	68 & 13-A INDUSTRIAL DEVELOPMENT COLONY, MEHRAULI ROAD GURGAON, HARYANA-122001	0124-2302711, 4085091
HRC FUSES	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
HRC FUSES	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000
HRC FUSES	ESSEN DEINKI	FLAT NO. 502, SKYLINE HOUSE 85, NEHRU PLACE NEW DELHI	011-26217060
INTERPOSING RELAY	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA- 121003	0129-2567580, 09871799449
INTERPOSING RELAY	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000
INTERPOSING RELAY	JYOTI LTD.	JYOTI LIMITED, E&CS DIVISION,3/15, BIDC, GORWA,VADODARA - 390 016, E-MAIL ID: ECS@JYOTI.COM	Ph. No.:+91-265-2281214 , Fax No.:+91-265-2281214
INTERPOSING RELAY	OEN INDIA LTD	29/1479, VYTILLA, COCHIN - 682 019 KERALA, INDIA	Phone : +91 484 2301132, 2303709 Fax : +91 484 2302287, 2302221 sales@oenindia.com
INTERPOSING RELAY	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER- B, PLOT NO. 78, SECTOR 18, GURGAON- 122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com
INDICATING LAMPS	BCH	20/4, MATHURA ROAD, FARIDABAD, HARYANA- 121006	0129-4293000
INDICATING LAMPS	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI- 110020	6832259,6918834-37
INDICATING LAMPS	ESSEN DEINKI	FLAT NO. 502, SKYLINE HOUSE 85, NEHRU PLACE NEW DELHI	011-26217060
INDICATING LAMPS	VAISHNO(HOTLINE SWGR.& CONTROL)	G-19, SECTOR - 11, NOIDA - 201301, UTTAR PRADESH, INDIA	8377805157 9818338922

TECHNICAL SPECIFICATION FOR
220V DC BATTERY CHARGER
PE-TS-425-508-E002

ANNEXURE-IV
2 X 800 MW UPPUR TPS
SUB VENDOR LIST

ITEM DESCRIPTION	VENDOR NAME	ADDRESS	PHONE
INDICATING LAMPS	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	9818338922
INDICATING LAMPS	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com
INDICATING LAMPS	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
LIGHTING SWITCH , SOCKET & S/F UNIT	ELEXPRO ELECTRICALS PVT/ LTD.	C 1/27 & 37 GIDC KABILPORE NAVSARI-396424	02637-265140, Mr. Jssk kumar
LIGHTING SWITCH , SOCKET & S/F UNIT	ANCHOR KENWOOD ELECTRICAL	STEEL HOUSE, B WING, PLOT NO. 24, MAHAL INDUSTRIAL ESTATE, MAHAKALI CAVES ROAD, NEAR PAPER BOX, ANDHERI (E), MUMBAI, MAHARASHTRA.- 400093	022-30418888.
LIGHTING SWITCH , SOCKET & S/F UNIT	KAYCEE	KAYCEE INDUSTRIES LTD., C/O-CMS COMPUTERS LTD., 35A, REAR BLDG., KILOKARI, NEW DELHI-110014	Rajiv Sharma-9312004687
LIGHTING SWITCH , SOCKET & S/F UNIT	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59
LIGHTING SWITCH , SOCKET & S/F UNIT	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com
LIGHTING SWITCH , SOCKET & S/F UNIT	INDO ASIAN	B-24, PHASE - II , NOIDA - 201305, U.P.	120-3042222
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	ASIATIC	A-58 NARAINA IND. AREA, PHASE-I , NEW DELHI 110028	011 - 25796330, 25796617
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011 - 25793021
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	EVERGREEN ENGG. CO.	EVERGREEN ENGG COMPANY WORKS-5, PLOT NO. 9,10,11,12, SURVEY NO. 242, CHINCH PADA, VASAI EAST-401208	(0250) 6458250
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	TECKNIC CONTROLS	703, MADHAVA, BANDRA, KURLA COMPLEX, BANDRA EAST, MUMBAI, MAHARASHTRA 400051	022-42532507/00 022-24451648
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	EX-PROTECTA LIGHTING EQUIPMENT	305-306, GIDC ESTATE, VITHAL UDYOGNAGAR - 388121 DIST. ANAND, GUJARAT 388121 INDIA	02692-237823
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	BALIGA ELECTRICALS	63A,CP RAMASWAMY ROAD, PB NO 6910, CHENNAI-600018	44-24995505,22680990-4
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	ENPRO ENGG.	NO.995P, DIAMOND PLAZA, 2ND FLOOR, 12TH MAIN ROAD, ANNA NAGAR, CHENNAI-40	044 – 42611526 / 42170338 / 26262716 enproengg@enproengineering.com
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	STERLING SWGR CONTROL PVT.LTD.	P.O. BOX NO. 17023, SORAB HOUSE, 2ND FLOOR, 555, S.B. MARG, DADAR, MUMBAI - 400028, MAHARASHTRA, INDIA	91-22-24222297/24222298/24224236
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	ELEXPRO ELECTRICALS PVT/ LTD.	C 1/27 & 37 GIDC KABILPORE NAVSARI-396424	02637-265140, Mr. Jssk kumar
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	VAISHNO(HOTLINE SWGR & CONTROL)	G-19, SECTOR - 11, NOIDA - 201301, UTTAR PRADESH, INDIA	8377805157 9818338922
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	JASPER ENGINEERS PVT. LTD.	A-23, SECTOR - 8, NOIDA-201301	0120-4033520/533
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	KMG ATOZ SYSTEMS	C-49, SECTOR-81-NOIDA-201305	120-4207920, 08527897328
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	UNILEC ENGINEERS PVT. LTD.	BEHRAMPUR INDUSTRIAL AREA, BEGAMPUR KHATOLA ROAD, GURGAON-122001	0124-4030247,248, 4559700, 9911087173
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	BCH	20/4, MATHURA ROAD, FARIDABAD, HARYANA-121006	0129-4293000

ITEM DESCRIPTION	VENDOR NAME	ADDRESS	PHONE
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	CANDS	J/202, ANSA INDUSTRIAL ESTATE, SAKI VIHAR ROAD, SAKINAKA, ANDHERI (EAST), MUMBAI-72	022-28570858
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	TECKNIC CONTROLS	703, MADHAVA, BANDRA, KURLA COMPLEX, BANDRA EAST, MUMBAI, MAHARASHTRA 400051	022-42532507/00 022-24451648
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	UNITED ELECTRIC	97 UDYOG VIHAR PHASE-I, GURGAON 122015, HARYANA	124 4002970 72
LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	M/s Shrenik & Co.	39A/3, PANCHRATNA INDUSTRIAL ESTATE, SARKHEJ-BAVLA ROAD, CHANGODAR, AHMEDABAD – 382 213	
LOCAL PUSH BUTTON STATION (FLAME PROOF)			
MCB	MDS SWITCHGEAR LTD	314-317SHAH NAHAR ESTATE	011 - 25793021
MCB	INDO ASIAN	B-24, PHASE - II , NOIDA - 201305, U.P.	120-3042222
MCB	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
MCB	S&S POWER SWITCHGEAR LTD,	NEW NO. 67, OLD NO. 19, DR. RANGA ROAD, MYLAPORE, CHENNAI - 600004	044 - 24988056, 044 - 24988057, 044 - 24988058
PROTECTION - RELAYS (PNEUMATIC)	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com
PROTECTION - RELAYS (PNEUMATIC)	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
PROTECTION - RELAYS (PNEUMATIC)	GE-MULTILINE, GE INDIA INDUSTRIAL PVT. LTD.	NO. 90- B, ELECTRONICS CITY, HOSUR ROAD, BENGALURU - 560016, KARNATAKA	(080) 41314617, 9945478935
PROTECTION - RELAYS (PNEUMATIC)	SCHWEITZER ENGG. LAB (SEL)	406, BHIKAJI CAMA BHAVAN, BHIKAJI CAMA PLACE, BHIKAJI CAMA PLACE, MOHAMMADPUR, RK PURAM, NEW DELHI, DL 110066	011 4152 7899
PROTECTION - RELAYS (PNEUMATIC)	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29
PROTECTION - RELAYS (PNEUMATIC)	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000
PROTECTION - RELAYS (PNEUMATIC)	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	0129-2567580, 09871799449
PROTECTION - RELAYS (PNEUMATIC)	AVK-SEG & CONTROLS(I) LTD	C-60,NOIDA PHASE-II	6918834-37
TIMERS - ELECTRONIC	ESSEN DEINKI	FLAT NO. 502, SKYLINE HOUSE 85, NEHRU PLACE NEW DELHI	011-26217060
TRANSDUCERS	AUTOMATIC ELECTRIC LTD.	ADDRESS : 96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482
TRANSDUCERS	SOUTHERN TRANSDUCERS	INTERTECH B-83, FLATTED FACTORY COMPLEX, NEAR MODI MILLS, OKHLA, NEW DELHI-110020	Mr. Gurmohit Singh 011-41020365 / 9891402128
ENERGY METER (ANALOG)	BHEL (EDN)	MYSORE ROAD,BANGALORE-560026	080-26998500
ENERGY METER (ANALOG)	SIMCO ENGG. LTD	NO. 126, K ROAD, TIRUCHIRAPPALLI -620001, TAMIL NADU	Mr. Madaswamy Muthu +(91)-(431)-4046223 +(91)-(431)-4046210 +(91)-9786600915
ENERGY METER (ANALOG)	RISHABH INST.PVT LTD	RISHABH INSTRUMENTS PVT. LTD. F-31, MIDC, SATPUR NASHIK - 422007 MAHARASHTRA INDIA	marketing@rishabh.co.in 91-253 2202202/203 Fax: 91 253 2351064
ENERGY METER (ANALOG)	AUTOMATIC ELECTRIC LTD.	96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482
ENERGY METER (ANALOG)	CONZERVE SYSTEMS PVT. LTD.(SCHNEIDER)	87, 1ST FLOOR INDUSTRIAL DEVELOPMENT COLONY (IDC) MEHRAULI ROAD, UGURGAON 122001 HARYANA, INDIA.	4268899, 9910695701
ENERGY METER (DIGITAL)	CONZERVE SYSTEMS PVT. LTD.(SCHNEIDER)	87, 1ST FLOOR INDUSTRIAL DEVELOPMENT COLONY (IDC) MEHRAULI ROAD, UGURGAON 122001 HARYANA, INDIA.	4268899, 9910695701
AMMETER	AUTOMATIC ELECTRIC LTD.	96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482

TECHNICAL SPECIFICATION FOR
220V DC BATTERY CHARGER
PE-TS-425-508-E002

ANNEXURE-IV
2 X 800 MW UPPUR TPS
SUB VENDOR LIST

ITEM DESCRIPTION	VENDOR NAME	ADDRESS	PHONE
AMMETER	RISHABH INST.PVT LTD	RISHABH INSTRUMENTS PVT. LTD. F-31, MIDC, SATPUR NASHIK - 422007 MAHARASHTRA INDIA	marketing@rishabh.co.in 91-253 2202202/203 Fax: 91 253 2351064
VOLTMETER	AUTOMATIC ELECTRIC LTD.	96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482
VOLTMETER	RISHABH INST.PVT LTD	RISHABH INSTRUMENTS PVT. LTD. F-31, MIDC, SATPUR NASHIK - 422007 MAHARASHTRA INDIA	marketing@rishabh.co.in 91-253 2202202/203 Fax: 91 253 2351064
VOLTMETER	Yokogawa	Japan	
PROTECTION - RELAYS (NUMERICAL)	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER- B, PLOT NO. 78, SECTOR 18, GURGAON- 122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com
PROTECTION - RELAYS (NUMERICAL)	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
PROTECTION - RELAYS (NUMERICAL)	GE-MULTILINE, GE INDIA INDUSTRIAL PVT. LTD.	NO. 90- B, ELECTRONICS CITY, HOSUR ROAD, BENGALURU - 560016, KARNATAKA	(080) 41314617, 9945478935
PROTECTION - RELAYS (NUMERICAL)	SCHWEITZER ENGG. LAB (SEL)	406, BHIKAJI CAMA BHAVAN, BHIKAJI CAMA PLACE, BHIKAJI CAMA PLACE, MOHAMMADPUR, RK PURAM, NEW DELHI, DL 110066	011 4152 7899
THERMOSTAT	AUTOMATION INSTRUMENTATION	-	-
ISOLATING SWITCH	ABB/C&S/SCHNEIDER/L&T/ SIEMENS	-	-
PANEL SPACE HEATER	CONTROL & SWITCHGEAR/EQUIVALENT	-	-
FIXED TERMINALS	CONNECTWELL/ELEMEX/ESS EN/PHOENIX	-	-

Note: Make of equipment/ components is indicative. Make of equipment/ components shall be subject to customer approval after award of contract without any commercial or delivery implication.

 QUALITY PLAN			CUSTOMER : TANGEDCO		PROJECT TITLE : 2X800 MW UPPUR TPS		SPECIFICATION NO. : PE-TS-425-508-E002						
			BIDDER/ :		STANDARD QP NO. : PE-QP-999-508-E003, REV. 0		TECHNICAL SPECIFICATION FOR						
			VENDOR		ITEM : BATTERY CHARGER		220V DC BATTERY CHARGER						
			SHEET 1 OF 6				DOC. NO. :						
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	SYS-TEM CAT.	220V DC SYSTEM 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			
1.0 RAW MATERIAL													
1.1	M.S Sheet (CRCA)	1. Grade	Major	Chemical/Mechanical Physical	100% Sample/lot	MFR's drg	BHEL appd drg/data sheet	MFR's drg	TC	3	-	2	IR-INSPECTION RECORD
		2. Thickness & Finish	Major					BHEL appd drg/data sheet	IR	3	-	2	
1.2	Powder Paint	Shade	Major	Visual	Sample/lot	IS-5/(1994) SHADE CARD	BHEL appd drg/data sheet		-do-	3		2	
2.0 Major bought out items													
2.1	Power Switches, MCCB, Timer, Contactor & Relay	1) Type, Rating	Major	Visual	100%	BHEL appd drg/data sheet		BHEL appd drg/data sheet	TC/IR	3	-	2	
		2) Mechanical Operation/functional check	Major	Visual	100%	MFR's std.		MFR's std.	-do-	3	-	2	
2.2	MCB Push Buttons, HRC fuse, terminal blocks, control & selector switches, Semiconductor Fuses, Heaters, Thermostat, Lamps, Plug in socket	1) Type, Rating	Major	Visual	100%	BHEL appd drg/data sheet		BHEL appd drg/data sheet	COC	3	-	2	
		2) Continuity test	Major	Electrical	100%	MFR's std.		MFR's std.	-do-	3	-	2	
2.3	Rectifier bridge Element	1) Type, Rating	Major	Visual	100%	BHEL appd drg/data sheet		BHEL appd drg/data sheet	IR	3	-	2	
2.4	Digital Multi Function Meters	1) Type, Rating	Major	Visual	100%	BHEL appd drg/data sheet		BHEL appd drg/data sheet	IR	3	-	2	
		2) Calibration Certificate	Major	Calibration	100%	-do-		-do-	Calibration Certificate	-	-	2	
		3) Routine TC	Major	Electrical	100%	-do-		-do-	-do-	3	-	2	
2.5	PVC Insulated Electric Cable	1) Type, size	Major	Visual	100%	BHEL appd data sheet		BHEL appd data sheet	COC	3	-	2.1	All power cables to conform to IS 1554:Control wires to conform to IS 694
		2) I.R Test	Major	Electrical	Sample/lot	-do-		-do-	COC	3	-	2.1	
		3) H.V Test	Major	Electrical	Sample/lot	-do-		-do-	COC	3	-	2.1	
2.6	Transducer	1) Routine TC & calibration report	Major	Electrical	100%	IS 12784		IS 12784	Mfr TC	3	-	2.1	
		2) Type, Rating	Major	Visual	100%	-do-		-do-	-do-	3	-	2.1	
2.7	Current Transformer, Voltage Transformer, Dimmerstat Control Transformer	1) Routine Tests	Major	Electrical	100%	BHEL appd drg/Data sheet/ IS 2705		BHEL appd drg/Data sheet/ IS 2705	Mfr TC	3	-	2.1	
		1) Type, Rating	Major	Visual	100%	-do-		-do-	IR	3	-	2.1	
BHEL													
LEGEND : 1 - BHEL/ CUSTOMER			PARTICULARS		BIDDER/VENDOR								
			NAME										
			SIGNATURE										
2 - VENDOR			3 - SUB- VENDOR		P - PERFORM		W - WITNESS		BIDDER'S/VENDOR'S COMPANY SEAL				
DATE			V - VERIFICATION										

QUALITY PLAN		CUSTOMER : TANGEDCO		PROJECT TITLE : 2X800 MW UPPUR TPS		SPECIFICATION NO. : PE-TS-425-508-E002								
BIDDER/ : VENDOR		STANDARD QP NO. : PE-QP-999-508-E003, REV. 0		TECHNICAL SPECIFICATION FOR 220V/DC BATTERY CHARGER		DOC. NO. :								
SHEET 2 OF 6		ITEM : BATTERY CHARGER												
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	220V/DC SYSTEM TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS		
									P	W	V			
1	2	3	4	5	6	7	8	9	10			11		
2.8	Busbar	1) Dimensional checkup	Major	Physical	100%	BHEL appd drg/data sheet	BHEL appd drg/data sheet	IR	3	-		2,1		
		2) Conductivity test	Major	Electrical	Sample/lot	-do-	-do-	IR	3	-		2,1		
		3)Surface Finish	Major	Visual	100%	-do-	-do-	IR	2	-		2,1		
		4)Material Grade	Major	Verif. of TC	1/Lot	-do-	-do-	Mfr TC	2	-		2,1		
2.9	Annunciation facia (if applicable)	All routine test as per EEUA-45D	Major	Visual	100%	BHEL appd GA drg	BHEL appd GA drg	Mfr TC	2	-	1			
2.10	Visual Indications for charger status using LED/indicating lamps (if annunciation facia is not used)	Electronic card used for indication (refer Electronic card assembly & location at cl. No.3,4, for checks	Major	Visual	100%	BHEL appd GA drg	BHEL appd GA drg	Mfr TC	2	-	1			
2.11	Rectifier Transformer	1) Rating	Major	Visual	100%	BHEL appd Data sheet	BHEL appd Data sheet	IR	3	-	2,1			
		2) Dimensional check	Major	Physical	100%	MFR's drg.	MFR's drg.	-do-	3	-	2,1			
		a) Overall size	Major	Physical	100%	-do-	-do-	-do-	3	-	2,1			
		b) Mounting Details	Major	Physical	100%	-do-	-do-	-do-	3	-	2,1			
		3) Terminal Board	Major	Physical	100%	-do-	-do-	-do-	3	-	2,1			
		4) Polarity Test	Major	Electrical	100%	-do-	-do-	-do-	3	-	2,1			
		5) I/R Test	Major	Electrical	100%	-do-	-do-	-do-	3	-	2,1			
		6) Routine Tests												
		a)Voltage Ratio Test	Major	Electrical	100%	IEC 146	IEC 146	IR/ Mfr Tc	3	-	2,1			
		b) DC resistance Test	Major	Electrical	100%	-do-	-do-	-do-	3	-	2,1			
		c) No Load Test	Major	Electrical	100%	-do-	-do-	-do-	3	-	2,1			
		d) Measurement of iron losses	Major	Electrical	100%	-do-	-do-	-do-	3	-	2,1			
		e) Measurement of Cu. Losses	Major	Electrical	100%	-do-	-do-	-do-	3	-	2,1			
		f) High voltage test	Major	Electrical	100%	-do-	-do-	-do-	3	-	2,1			
		g) Induced high voltage test	Major	Electrical	100%	-do-	-do-	-do-	3	-	2,1			
		h) Heat run Test	Major	Electrical	100%	-do-	-do-	-do-	3	-	2,1			Temp. rise limited to class A insulation value
2.12	Chokte	1) Rating	Major	Physical	100%	BHEL appd Data sheet	BHEL appd Data sheet	IR	3	-	2,1			
		2) Dimensional check	Major	Physical	100%	MFR's drg.	MFR's drg.	-do-	3	-	2,1			
		a) Overall size	Major	Physical	100%	-do-	-do-	-do-	3	-	2,1			
		b) Mounting Details	Major	Physical	100%	-do-	-do-	-do-	3	-	2,1			
BHEL		PARTICULARS			BIDDER/VENDOR									
		NAME												
		SIGNATURE												
		DATE												

 QUALITY PLAN		CUSTOMER : TANGEDCO		PROJECT TITLE : 2X800 MW UPPUR TPS		SPECIFICATION NO. : PE-TS-425-508-E002			
SHEET 3 OF 6		BIDDER/ : VENDOR		STANDARD QP NO. : PE-QP-999-508-E003, REV. 0		TECHNICAL SPECIFICATION FOR 220V DC BATTERY CHARGER			
		SYSTEM CAT. : 220V DC SYSTEM		ITEM: BATTERY CHARGER		DOC. NO. : 			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	EXTENT OF CHECK	TYPE/ METHOD OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS
								P W V	
1	2	3	5	4	6	7	8	9	10 11
		3) Terminal Board/Bakelite plate or busbar	100%	Major	-do-	-do-	-do-	-do-	3 - 2,1
		4) Terminal rating	100%	Major	-do-	-do-	-do-	-do-	3 - 2,1
		5) Air gap Measurement	100%	Major	-do-	-do-	-do-	-do-	3 - 2,1
		6) Continuity test	100%	Major	-do-	-do-	-do-	-do-	3 - 2,1
		7) Insulation Resistance	100%	Major	Electrical	IEC 146	IEC 146	IR/ Mfr TC	3 - 2,1
		8) High voltage test	100%	Major	Electrical	-do-	-do-	-do-	3 - 2,1
		9) DC resistance Test	100%	Major	Electrical	-do-	-do-	-do-	3 - 2,1
		10) Heat run Test	100%	Major	Electrical	-do-	-do-	-do-	Temp. rise limited to class A insulation value
2.13	Printed Circuit Boards Insulating Materials (FRP,SMC,DMC,ETC.)	1. Electrical	Sample	CR	Elect. Test	Relevant IS, MFR's Std.	Relevant IS, MFR's Std.	Test Certificate	2 - 1
		2. Mech Props.	Sample	MA	Mech Test	-do-	-do-	-do-	2 - 1
		3. Tracking Index	Sample	MA	Elect. Test	-do-	-do-	-do-	3/2 - 1
	Paints	Shelf Life	100%	MA	Visual	as per Paints Manuf's. Spec.....	IR	IR	2 - -
	Gaskets(Syn. Rubber only)	1. Dimension	Sample	MA	Measurement	MFR's DRGS.	MFR's DRGS.	IR	2 - -
		2. Shore Hardness	-do-	MA	Test	MFR's DRGS.	MFR's DRGS.	IR	2 - -
		3. Ageing	-do-	MA	Test	IS-3400/BS-2752	IS-3400/BS-2752	INSPN Report	2 - -
3.0	In process Inspection								
3.1	Enclosure fabrication	1) Dimensional checks	100%	Major	Physical	MFR's Fabrication drg	MFR's Fabrication drg	IPR	2 - 1
		2) Diagonal (Skewness)	-do-	Major	Physical	-do-	-do-	-do-	2 - 1
		3) Straightness	-do-	Major	Physical	-do-	-do-	-do-	2 - 1
		4) Welded joints	-do-	Major	Visual	-do-	-do-	-do-	2 - 1
		5) Deburring & Finishing of welded joints	-do-	Major	Visual	-do-	-do-	-do-	2 - 1
BHEL		PARTICULARS	BIDDER/VENDOR						
		NAME							
		SIGNATURE							
		DATE							
LEGEND :	1 - BHEL/ CUSTOMER	2 - VENDOR	3 - SUB- VENDOR	P - PERFORM	W - WITNESS	BIDDER'S/VENDOR'S COMPANY SEAL			

		QUALITY PLAN		CUSTOMER : TANGEDCO		PROJECT TITLE : 2X600 MW UPPUR TPS		SPECIFICATION NO. : PE-TS-425-508-E002			
SHEET 4 OF 6		BIDDER/ : VENDOR		STANDARD QP NO. : PE-QP-999-508-E003, REV. 0		TECHNICAL SPECIFICATION FOR 220V DC BATTERY CHARGER					
SL NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	220V DC SYSTEM	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS	
				TYPE/METHOD OF CHECK					P	W	V
1	2	3	4	5	6	7	8	9	10		
3.2	Pre treatment of enclosure	1) Dimensional checks	Major	Physical	100%	IS 6005 / MFR's Std practice	IS 6005 / MFR's Std practice	IPIR	2	-	1
		2) Water rinsing	Major	Physical	-do-	-do-	-do-	-do-	2	-	1
		3) Derusting	Major	Physical	-do-	-do-	-do-	-do-	2	-	1
		4) Water rinsing	Major	Physical	-do-	-do-	-do-	-do-	2	-	1
		5) Phosphating	Major	Physical	-do-	-do-	-do-	-do-	2	-	1
		6) Water rinsing	Major	Physical	-do-	-do-	-do-	-do-	2	-	1
		7) Hot- Chromating	Major	Physical	-do-	-do-	-do-	-do-	2	-	1
		8) Sealing (If used)							2	-	1
3.3	Powder Coating	1) Shade, Thickness & Finish	Major	Cross Hatch	Random	IS 6005 / MFR's Std practice	IS 6005 / MFR's Std practice	-do-	2	-	1
		2) Adhesion check by cross hatch method	Major	Visual	100%	-do-	-do-	-do-	2	-	1
3.4	Electronic card assembly & location	1) Electronic cards fittings	Major	Cross Hatch	Random	Electronic cards shall be modular fitted in standard 19" metal racks with guides	Electronic cards shall be modular fitted in standard 19" metal racks with guides	-do-	2	-	1
		2) Mechanical interlock	Major	Visual	100%	To avoid wrong insertion of cards	No wrong insertion of cards possible	-do-	2	-	1
		3) Correctness of electronic components	Major	Visual	100%	MFR's drg	MFR's drg	-do-	2	-	1
		4) Jumpers/ track modification	Major	Visual	100%	No unplanned jumpers / track modification	No unplanned jumpers / track modification	-do-	2	-	1
		5) Finish of electronic cards	Major	Visual	100%	MFR's drg	No dry soldering	-do-	2	-	1
		6) Environmental check on cards to remove cards with infant mortal components	Major	Visual	100%	MFR's std	MFR's std	-do-	2	-	1
3.5	Assembly of components & modules	1) Transformer & choke	Major	Visual	100%	MFR's drg	MFR's drg	-do-	2	-	1
		2) Mounting of components such as switches, rectifiers, stack fuses, meter & contactor	Major	Visual	100%	-do-	-do-	-do-	2	-	1
		3) Minimum clearance between busbar	Major	Physical	100%	Relevant IS	Relevant IS	-do-	2	-	1
		4) Electronic cards location inside the panels	Major	Visual	100%	Approved drg.	Temp. rise of the location should not exceed 10°C over ambient during heat run	-do-	2	-	1
BHEL											
PARTICULARS											
NAME											
SIGNATURE											
DATE											
LEGEND : 1 - BHEL/ CUSTOMER 2 - VENDOR 3 - SUB- VENDOR P - PERFORM W - WITNESS V - VERIFICATION											
BIDDER'S/VENDOR'S COMPANY SEAL											

		CUSTOMER : TANGEDCO		PROJECT TITLE : 2X800 MW UPPUR TPS		SPECIFICATION NO. : PE-TS-425-508-E002				
QUALITY PLAN		BIDDER/ VENDOR SYSTEM		STANDARD QP NO. : PE-QP-999-508-E003, REV. 0		TECHNICAL SPECIFICATION FOR 220V DC BATTERY CHARGER				
		GAT.		ITEM : BATTERY CHARGER		DOC. NO. :				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS	
								P	W	V
3.6	Wiring	1. Bunching 2. Marking 3. Furling 4. Lugs crimping 5. Continuity 6. Identification labels	Visual Visual Visual Physical Electrical Visual	100% 100% 100% 100% 100% 100%	MFR's drg -do- -do- -do- -do- -do-	MFR's drg -do- -do- -do- -do- -do-	IPIR -do- -do- -do- -do- -do-	2 2 2 2 2 2	- - - - - -	1 1 1 1 1 1
3.7	Finishing of Equipment	1. Proper pasting of gasket 2. Earthing busbar	Visual Physical	100% 100%	-do- -do-	-do- -do-	-do- -do-	2 2	- -	1 1
4.0	Final Inspection									
4.1	Overall	1. Dimensional & sheet thickness	Major Physical	100%	BHEL appd drawing & Data sheet	BHEL appd drawing & Data sheet	IR	2	1	-
		2. Gen arr. & B.O.M	Major Visual	100%	-do-	-do-	-do-	2	1	-
		3. Aesthetic Look, Straightness,skewness,Door alignment,Labels etc.	Major Visual	100%	-do-	-do-	-do-	2	1	-
		4. Provision of lifting arrangement	Major Visual	100%	-do-	-do-	-do-	2	1	-
		5. Proper earthing	Major Visual	100%	-do-	-do-	-do-	2	1	-
		6. Gasketing (Check with 1mm wire)	Major Visual	100%	-do-	-do-	-do-	2	1	-
		7. Gland plate arrangement	Major Visual	100%	-do-	-do-	-do-	2	1	-
		8. Mounting arrangement	Major Visual	100%	-do-	-do-	-do-	2	1	-
		9. Wiring quality	Major Visual	100%	-do-	-do-	-do-	2	1	-
		10. Paint shade, Adhesion & thickness check	Major Visual	100%	IS-5(1994) SHADE CARD	-do-	-do-	2	1	-
		11. Door Functioning	Major Operation	100%	BHEL appd drawing & Data sheet	-do-	-do-	2	1	-
		12. Mounting & Proper Fixing of all components	Major Visual	100%	-do-	-do-	-do-	2	1	-
		13. Smooth operation of all Switches PUSH Buttons etc.	Major Operation	100%	-do-	-do-	-do-	2	1	-
		14. Alarm & Protection	CR Elect	100%	BHEL appd drawing & Data sheet & other Relv IS	BHEL appd drawing & Data sheet & other Relv IS	Test Report	2	1	-
BHEL										
PARTICULARS			BIDDER/VENDOR							
NAME										
SIGNATURE										
DATE										
1 - BHEL/ CUSTOMER			2 - VENDOR		3 - SUB-VENDOR		P - PERFORM		W - WITNESS	
LEGEND :			V - VERIFICATION							

[illegible]