

**TAMILNADU GENERATION & DISTRIBUTION
CORPORATION LIMITED**

1X800MW NORTH CHENNAI STAGE III (BTG)

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

SPECIFICATION NO: PE-TS-423-508-E002, R0



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

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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.

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 (In lieu of the spare). 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 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.

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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 will 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 FCB charger, the standby FCB charger will take over automatically and feed in corresponding section of DCDB and provide trickle charging to associate battery. The operational philosophy/mechanism of DC SYSTEM shall be developed by vendor and decided during detailed engineering for approval of BHEL/Customer without any commercial implication to BHEL.

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 + 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 30% 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.
- One moving coil DC voltmeter and ammeter of size 96x96 mm of suitable range for each charger with necessary shunts for local and remote metering. Meters shall have 90 deg scale, antiglare glass, $\pm 1\%$ accuracy with zero adjuster on the front.
- One moving coil centre zero ammeter, with shunt, size 96x96 mm to read discharge / charge current of the battery.
- 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

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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. The output voltage of float charger shall be adjustable between 230V to 240V.
- 4.4 The 220V DC power cable between battery to DCDB and charger to DCDB will be single core copper cable (BHEL scope). The HRC fuse box shall be located near battery. The Main HRC fuse 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 charger panels will have an enclosure DOP IP-42. The charger panels shall be painted with grey shade (shade RAL-7032) with two coats of synthetic enamel paint.

5.0 ALARM, PROTECTION, METERING AND INDICATIONS

- 5.1 Fault indicating lamps for battery and chargers shall be provided on charger cubicle.
- 5.2 Each charger shall be provided with audio visual alarm annunciation arrangement, actuating devices, circuitry, legend and push buttons (accept, reject and test), and hooter for the following important alarms for various abnormal conditions. Also the initiating contacts shall be provided for remote alarm for each of the float cum boost chargers. The alarms shall be provided on the CRT in the control room.
 - AC supply failure
 - Charger overload

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- Battery on boost charge
- Battery on float charge
- Charger fail
- Battery earth fault
- DC output fuse blown
- DC system under voltage in boost mode
- DC system under voltage in float mode
- Load limiter operated
- DC system over voltage in float mode
- DC system over voltage in boost mode
- AC input fuse blown

For all above alarms, a group alarm for each charger “Battery charger Trouble” shall be provided on the DDCMIS/ Electrical control panel (ECP). Separate contacts shall be provided for “Battery earth fault” annunciation at remote.

Initiating contacts for all alarm points shall also have electrically separate spare set of contacts wired to the terminal block for future use. On occurrence of a fault, the corresponding window will light up and stay lighted until the fault is cleared and the reset button is pressed. In addition, any additional indication / alarms considered necessary during detailed engineering shall also be provided without any commercial implication. Each battery charger shall have minimum two (2) nos. spare annunciation channels and window facia.

Fault indicating lamps shall be provided on the charger cubicle and following initiating contacts shall be provided for remote alarm for each of the float and boost chargers. The alarms shall be provided on the DDCMIS:

- Main AC failure
- Charger AC input fuse blown
- Charger DC output fuse blown
- Charger U/V and current limit protection
- Charger Over voltage protection
- Charger Over current protection
- Charger Filter condenser fuse blown
- Charger Rectifier fuse blown
- Tap Contactor off
- DC Voltage
- Charger Current & Voltage
- DC System ground
- Battery on Boost
- Battery on Float

Following minimum indications shall be provided:

- DC supply healthy
- Control supply ON
- Charger power supply ON
- Charger DC output healthy
- Float charger ON

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- Float charger Fail
- Boost charger in operation
- Float cum boost charger in boost mode
- Float cum boost charger in float mode

5.3 Following protections are provided for batteries and chargers:

- Under voltage protection for DC system
- Over voltage protection for DC system
- Current limiting and AC under voltage protection for chargers
- Over current protection on DC side
- Fuse for short circuit protection of the battery
- Earth fault protection for DC system
- Fuse failure indication on DC side
- Reverse polarity protection for charger
- Tropical protection

5.4 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 limiting device, etc. as required for the successful operation of the DC system.

Each charger panel shall be provided with the following meters. Meters shall be 96 x 96 mm switchboard type, 90 deg scale, antiglare glass, ± 1 accuracy with zero adjuster on the front.

- AC input voltmeter with Voltmeter Selector switch
- AC input ammeter with Current Selector switch
- One (1) D.C. ammeter (for charger output, Range 0 – 150% of rated full Load charger output) .
- One (1) D. C. voltmeter (for charger output)
- One (1) D. C. voltmeter (for battery output voltage)
- One (1) D. C. ammeter for Battery charging/ discharging current (Centre zero type Ammeter)
- One (1) D.C. ammeter for monitoring trickle charging current.
- Shunts for local and remote metering.
- Voltage selectors switch to measure DC bus voltage between positive to earth, negative to earth and positive to negative.

5.5 Each Charger shall be equipped with LCD display, so the system or particular module operation parameters can be locally or remotely viewed / monitored. Following parameters to be displayed:

- Input AC voltage
- Input AC current
- Charging voltage
- Charging current
- Load voltage

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- Load current
- Battery voltage
- Battery current

5.6 Following minimum indications with cluster LEDs will be provided on each charger panel:

- Charger power supply ON (at all three phases)
- Charger D.C. output healthy
- Control supply ON
- Annunciation DC healthy
- FCB in boost mode
- FCB in float mode
- FCB in Equalising mode

5.7 The charger panels shall be provided with lamp, heater and receptacle circuits shall have individual ON-OFF switch fuse units/MCCB:

- Internal illumination lamp with door switch, the lamp shall be located in the ceiling and guarded with protective cage.
- Space heater with thermostat control.
- 5 pin 6A receptacle with plug.
- Individual switch fuse unit for lamp, heater and receptacle circuits
- Communication plug

6.0 DISCHARGE RESISTOR

Portable type battery discharge resistor panels shall be supplied with shunt suitable for 10 hrs. Discharge rate as per battery capacities indicated in the BOQ cum price schedule. Resistor Unit shall be an assembly consisting of copper-nickel alloy wire grid elements supported by stainless steel tie rods. The resistor bank shall have adequate trimming facility (coarse and fine) to maintain a constant current against falling voltage during discharge operation. An ammeter shall be provided on the unit to monitor discharge current of battery. The Discharge resistor panel terminal shall be made suitable for connection to the single string battery or batteries connected in parallel.

7.0 BATTERY FUSE BOX

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

Minimum rating of Battery Fuse Box shall be as indicated in the BOQ cum price schedule.

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 routine tests will be conducted on charger:

- Visual checks for dimensions and general arrangement
- Wiring checks
- Functional checks
- Voltage regulation for rated input supply for loads from 0-100% with $\pm 10\%$
- Input voltage variation
- Ripple measurement by oscilloscope at different loads
- Dielectric test
- Insulation test with 500V megger
- Load limiter test
- HV Test (2kV AC for 1 min excluding electronic controller)
- Efficiency & Power factor measurement

11.2 Following type tests will be conducted on one charger:

- Heat run test on current limiting value.

11.3 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-V0-423-508-E101	Within two weeks of award of contract
2	General Arrangement drawing for Battery Charger	PE-V0-423-508-E102	
3	Schematic/ power circuit diagram for battery charger	PE-V0-423-508-E003	
4	Make of components for battery charger	PE-V0-423-508-E004	
5	Circuit diagram and ga of battery fuse box	PE-V0-423-508-E005	
6	Circuit diagram and ga of battery discharge panel	PE-V0-423-508-E006	
7	Operational write up for battery charger	PE-V0-423-508-E007	
8	Internal layout drawing for battery charger	PE-V0-423-508-E008	
9	Thyristor rating and fuse co-ordination calculation	PE-V0-423-508-E109	
10	Ac power consumption in float mode & boost mode	PE-V0-423-508-E010	
11	Calculation of transformer kva and rectifier for battery charger	PE-V0-423-508-E011	
12	Fault level calculation for battery charger	PE-V0-423-508-E012	
13	Filter Circuit Calculation for Battery charger	PE-V0-423-508-E113	
14	Field quality plan plan for battery charger	PE-V0-423-508-E014	
15	List of e & c spares for battery charger	PE-V0-423-508-E015	
16	List of o&m spares for battery charger	PE-V0-423-508-E016	



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17	List of mandatory spares for battery charger	PE-V0-423-508-E017	
18	Type test certificates for battery charger	PE-V0-423-508-E018	
19	O&m manual for battery charger	PE-V0-423-508-E019	
20	Termination Arrangement At Battery Charger Terminals	PE-V0-423-508-E120	
21	Quality Plan for Battery Charger	PE-V0-423-508-E901	

Note:-

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



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EPC TENDER SPECIFICATION FOR BTG PACKAGE

I. Battery Charger

i. General



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- b) The charger shall be provided with automatic voltage regulation, current limiting circuitry, smoothing filter circuit and soft-start feature.
- c) Voltage control shall be stepless, smooth and continuous.
- d) The charger shall be self-protecting against all A.C. & D.C. transients and steady state abnormal currents and voltages.
- e) Charger A.C. input and D.C. output shall be electrically isolated from each other and also from panel ground.
- f) Isolation shall also be provided between power and control circuits.
- g) In case of chargers, both negative and positive isolations shall be achieved.
- h) Incomers for battery chargers shall be fed from two different sources or from two bus sections of same switchgear.

ii. Interlocks

Necessary interlock shall also be provided to avoid accidental boost mode operation when loads are connected to the bus.

iii. General Technical Requirement

- a) 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 Plant type Batteries while supplying the DC loads.
- b) Battery Chargers shall have a selector switch for selecting the battery charging mode i.e. whether Trickle or Boost charging.
- c) 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.
- d) Soft start features 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



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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.

- e) When on automatic control mode during Trickle charging, the Charger output voltage shall remain within $(\pm)1\%$ of the set DC value for AC input voltage variation of $(\pm)10\%$, frequency variation of $(+)-3$ to $(-)-5\%$, a combined voltage and frequency (absolute sum) variation of 10% and a continuous DC load variation from zero to full load. Uniform and step less 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. Step less adjustment of the load limiter setting shall also be possible from 80% to 100% of the rated output current for Trickle charging mode.
- f) 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.
- g) Energizing 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 stabilize, to within the specified limits as mentioned elsewhere shall be less than fifteen seconds.
- h) Momentary output voltage of the Charger, with 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.
- i) The Charger manufacturer may offer an arrangement in which the voltage setting device for Trickle charging mode is also used as output voltage limit



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setting device for Boost charging mode, and the load limiter of the trickle charging mode is also used as Boost charging current setting device.

- k) 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.
- l) Necessary separation walls for the UPS charger, panels and the batteries in battery room shall be provided.

iv. 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 500 Volts AC.

v. 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.



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vii. Instruments:

DC voltmeter, DC ammeter and AC voltmeter in 96 mm square shall be provided for all Chargers. The instruments shall be flush mounted type, dust proof and moisture resistant. The instruments shall have easily accessible means for zero adjustments. The instruments shall be of 1.5 accuracy class.

viii. 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. Switches shall be rated for 120% of the maximum continuous load. 'ON' and 'OFF' position of the switch shall be clearly indicated.

ix. Control and Selector switches:

Control and selector switches shall be of rotary stay-put 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 at least the following:

- a. Make and carry continuously – 10 Amps.



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b. Breaking current at 220 V DC – 0.5 Amp. (Inductive)

c. Breaking current at 240 V AC – 5 Amp at 0.3 p.f.

x. Annunciation System:

i. One (1) fifteen points alarm facia shall be provided on each charger panel, complete with proper actuating devices, circuitry and legends for the following:

- a. A.C. supply failure.
- b. D.C. voltage lows for Boost & float charger separately.
- c. D.C. voltage high for boost & float charger separately.
- d. D. C. System grounds
- e. Battery on Float
- f. Battery on boost
- g. Charger overload for boost charger separately
- h. DC output fuse blown for boost & float charger separately.
- i. Charger failure
- j. Two 2 nos. spare
- k. Load limiter operated
- l. Any other alarm point, if required for battery charger shall be provided.

Note: Initial contacts for alarm points shall have electrically separate spare set of contacts wired up to the terminal block for future use.

ii. The arrangement shall be such that on occurrence of a fault the corresponding window will light up and stays lighted until the fault is cleared and reset button is pressed.

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- iii. Each time a window lights up, a master relay will get energised to provide group alarm signals for Owner's remote panel.

xi. Following minimum indications shall be provided:

- a. DC supply healthy
- b. Control supply ON
- c. Charger power supply ON
- d. Charger DC output healthy
- e. Float charger ON
- f. Float charger Fail
- g. Boost charger in operation
- h. Float cum boost charger in boost mode
- i. Float cum boost charger in float mode

- xii. Fault indicating lamps shall be provided on the charger cubicle and following initiating contacts shall be provided for remote alarm for each of the float and boost chargers. The alarms shall be provided on the EDMS / DDCMIS:

- a. Main AC failure
- b. Charger AC input fuse blown
- c. Charger DC output fuse blown
- d. Charger U/V and current limit protection
- e. Charger Over voltage protection
- f. Charger Over current protection
- g. Charger Filter condenser fuse blown



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- h. Charger Rectifier fuse blown
- i. Tap Contactor off
- j. DC Voltage
- k. Charger Current & Voltage
- l. DC System ground
- m. Battery on Boost
- n. Battery on Float

xiii. Blocking Diode:

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

xiv. Construction:

- a. The charger shall comprise a continuous line up of free-standing, floor mounted sheet steel panels, with all access from the front.
- b. The panel shall conform to the degree of protection IP-42. The panels shall be manufactured from cold rolled sheet steel of minimum 2 mm thickness with doors and base frame of minimum 2.5 mm thick cold rolled sheet.
- c. Access doors shall be with concealed hinges and neoprene gaskets. Ventilating louvers shall be covered with fine wire mesh.
- d. All equipment within the panels shall be arranged in modular units and laid out with sufficient space for easy maintenance.
- e. Switches, meters, relays etc. shall be flush mounted on the front of the panels. Nameplates of approved size and type shall be provided for all circuits and devices.



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xv. Charger Equipment:

- a. All power diodes and control rectifiers shall be silicon type. Rectifier transformers shall be dry type, double wound, with copper conductor and class-B insulation. The maximum temperature of the class-B insulation shall be limited to that of class-A insulation.
- b. Blocking diodes shall be fully rated and redundant so that failure of a single diode shall not incapacitate the system in any way.
- c. Isolating switches shall be heavy duty, load break type, operated by an external handle with provision for padlocking in ON and OFF position.
- d. Changeover switch shall be 3 position, 4 pole, load break type with minimum 2 NO + 2 NC auxiliary contacts. The switch shall be installed in such a manner that the operating handle shall be accessible only after opening the front door.
- e. Contactors shall be air-break type. Thermal overload relays shall have in-built single phasing preventer.
- f. Fuses shall be HRC type and arranged for easy replacement. Semiconducting device fuses shall be fast-acting.
- g. Indicating Lamps shall be LED type.
- h. Meters shall be 96 x 96 mm switchboard type, 90 deg scale, antiglare glass, 1% accuracy with zero adjuster on the front.
- i. Rectifier transformer for float-cum-boost charger shall be provided with 2x2.5% taps on the primary side.

xvi. Controls:

The following manual controls shall be provided on the front of the panel:

- a. Selection of float, equalizing or boost charge.
- b. Voltage setters for setting the output of float/equalizing/boost charge. Setting shall be independent of each other so that setting of one voltage shall not require resetting other.
- c. Current limit setter.



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- d. Alarm window reset button.

xvii. Lamp/Space Heater/Receptacle:

- a. The charger panels shall be provided with:
 - i. Internal illumination lamp with door switch.
 - ii. Space heater with thermostat control.
 - iii. 3-pin 5A receptacle with plug.
- b. Lamp, heater and receptacle circuits shall have individual switch fuse units.

xviii. Wiring/Cabling:

- a. The panels shall be completely wired-up. All wiring shall be routed through wiring troughs. Wires shall be ferruled at both ends for identification.
- b. Panels shall have removable gland plates at the bottom for cable entry. All incoming/outgoing cables shall be terminated in suitable terminal blocks.
- c. Control terminal blocks shall be box-clamp type ELMEX 10 mm² or approved equal. 20% spare terminals shall be furnished.
- d. Wiring shall be done with 1100 V grade PVC armoured, multi strand FRLS cables. Minimum wire size shall be 2.5 mm² stranded copper conductor.

xix. 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 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 & marked.

xx. Grounding

- a. The charger panels shall have fully rated ground bus with two ground terminals, one at each end.
- b. Each terminal shall comprise two-bolt drilling with M10 G.I. bolts and nuts and shall be suitable for connecting to 50 x 6 mm G.S. flat.



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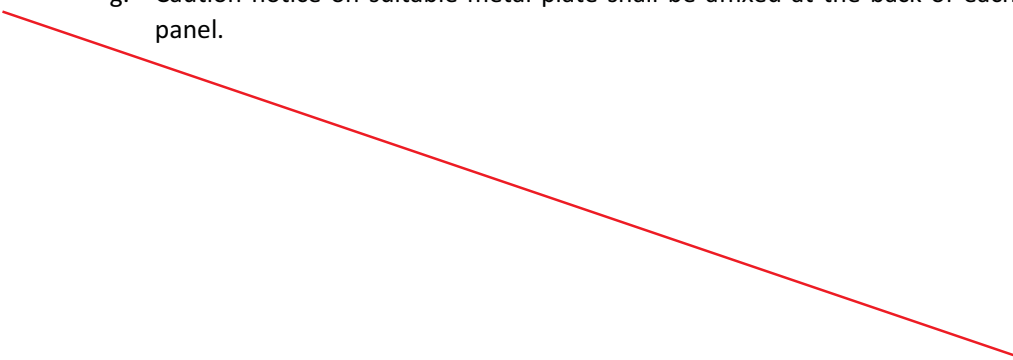
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xxi. Painting

The panels shall be finished in Siemens grey shade (shade RAL 7032) with two coats of synthetic enamel paint. The panels shall have a matt finish to prevent any glare from surface due to illumination.

Inside panels painting shall be as per shade RAL 7032.

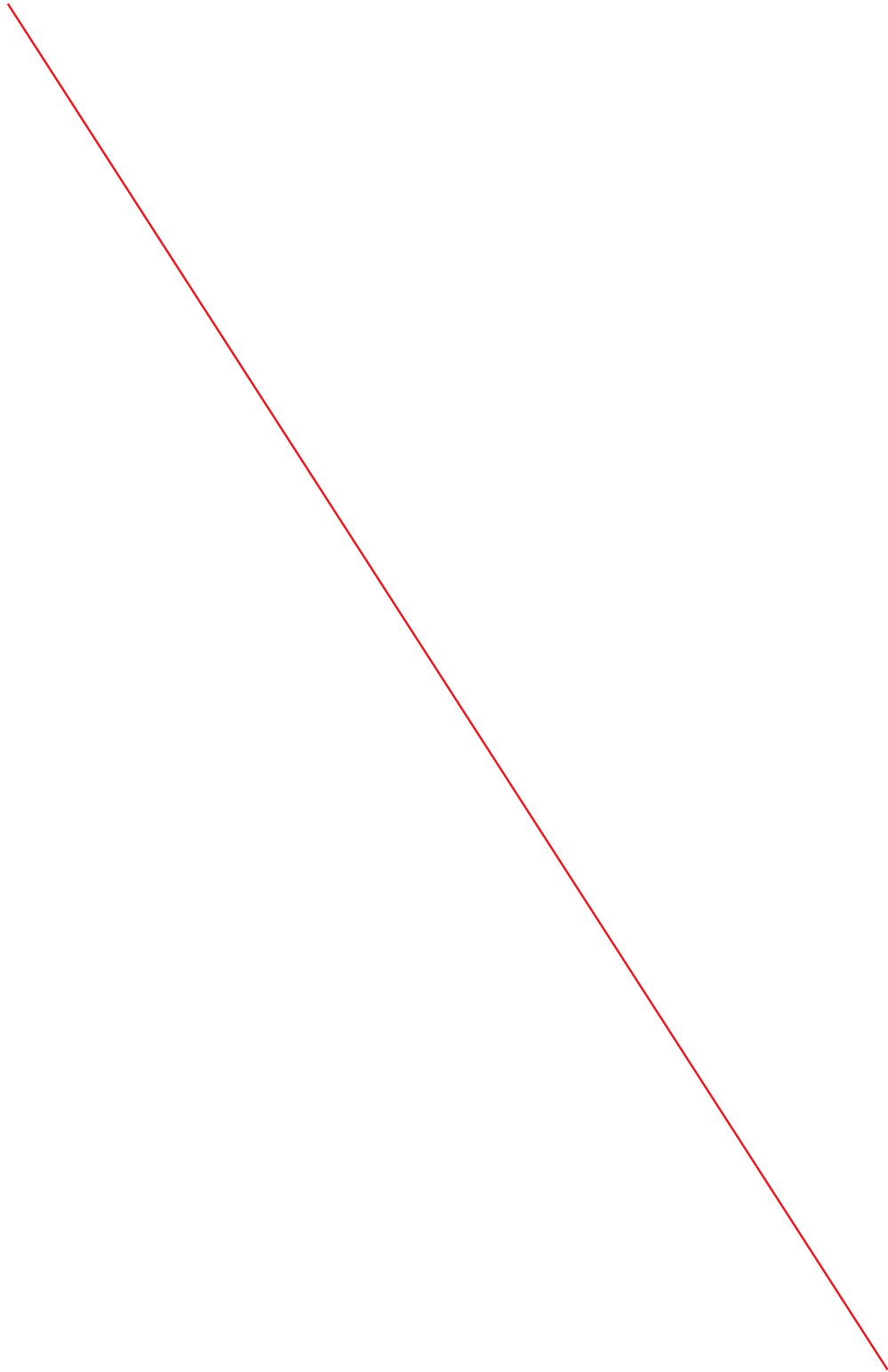
xxii. Name Plate

- a. Nameplates shall be provided for each panel and for each equipment/device mounted on it.
 - b. The material shall be anodized aluminium/lamicoid, 3 mm thick, with white letters on black background.
 - c. Nameplates shall be held by self-tapping screws. The size of nameplates shall be approximately 20 mm x 75 mm for equipment and 40 mm x 150 mm for panels.
 - d. Nameplates for panels shall be provided both on the front rear and also inside of the panels.
 - e. Control and meter selection switches shall have integral nameplates. Nameplates for all other devices shall be located below the respective devices both inside & outside of panel.
 - f. Instruments and devices mounted on the face of the panels shall also be identified on the rear with the instrument/ device number. The number may be painted on or adjacent to the instrument or device case.
 - g. Caution notice on suitable metal plate shall be affixed at the back of each panel.
- 



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All equipment and components thereof shall be subject to shop tests as per relevant IS standards.

b. Tests on battery charger.

Following tests shall be performed on each battery charger:

- i. Dielectric tests.
- ii. Voltage regulation check from 0 to 100% load with $\pm 10\%$ input voltage variation.
- iii. Ripple content measurement.
- iv. Heat run test on current limiting value.



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- v. D.C short circuit test to prove ability of current limit.
- vi. Measurement of transient overshoot/undershoot during switching ON/load throw-off.
- vii. Current limiter operation.
- viii. Dynamic response test - overshoot/ undershoot in output voltage of the charger as a result of sudden change in load from 100% to 20% and 20% to 100% shall be measured with the batteries connected and disconnected. Output voltage of the charger connected with battery shall be within 94% to 106% of the voltage setting in above conditions and shall return to, and remain, within the limits specified as mentioned elsewhere, in less than 2 seconds (as applicable).
- ix. Test for annunciation system
- c. Routine tests on component parts.
- d. Burning test for PCB's. Assembled PCB burning test at 70 Deg.C. for seventy-two (72) hours with loaded condition.
- e. Rapid temperature cycling tests at 70 Deg.C. and 0 Deg.C for thirty (30) minutes at each temperature for (five) 5 cycles.
- f. Routine and type test certificates for components like contactors, relays, instruments, SCR/PWM transistors, Diodes, Condenser, Potentiometer, semi-conductors, push buttons to be furnished for review whenever required.
- g. All routine tests as per applicable standards shall be conducted on the DC board. Copy of all type test certificates on identical boards issued by authorized test agency shall be furnished.

2. Test Certificates

- a. Certified reports of all the tests carried out at the works shall be furnished in six (6) copies for approval of Owner.
- b. The equipment shall be dispatched from works only after receipt of Owner's written approval of Test Report.

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- c. Type test certificate on any equipment, if so desired by the Owner, shall be furnished. Otherwise the equipment shall have to be type tested, free of charge, to prove the design.



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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	Option-I: 3860 AH Lead-Acid Plante battery (Two parallel strings of 1930AH battery) Option-II: 3600 AH Lead-Acid Plante battery (Two parallel strings of 1800AH battery)
2.0	Charger current rating		
2.1	Float-cum-boost charger	A	Option-I: 680A Option-II: 570A
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		
6.1	Panel sheet thickness/ material	mm	2.0mm Cold rolled sheet steel with doors and



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			base frame of min. 2.5mm thick Cold rolled sheet steel
6.2	Paint shade		Grey shade (shade RAL-7032) with two coats of synthetic enamel paint.
6.3	Cable gland plate thickness/ material	mm	3 mm / Non-magnetic material
6.4	Gasket thickness/ material	mm	3 mm / Neoprene
6.5	CABLE SIZES a) Cable size from Battery to Fuse Box b) Cable size from Fuse Box to DCDB c) Cable size from Charger to DCDB d) Cable Size For FCB Charger AC Incomer		a) 3X1CX400sq.mm(Cu) /Pole*(EPR insulated Fire survival cable) b) 3X1CX400sq.mm(Cu) /Pole*(EPR insulated Fire survival cable) c) 1X1CX400sq.mm(Cu) /Pole*(EPR insulated Fire survival cable) d) 1CX400sq.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. Heat Run test to be conducted on one chargers
8.0	EARTHING		
8.1	Grounding terminal size/ no. for each charger		50X6 MM./ 2 nos.
8.2	Grounding terminal size/ no. for each fuse box		50X6 MM./ 2 nos.
8.3	Grounding terminal size/ no. for each discharge resistor		50X6 MM./ 2 nos.
9.0	Mandatory Spares		
9.1	Mandatory Spares to be quoted for this contract	Yes/ No	Yes



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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 Fuse Box	Fuses as per Load Duty Cycle for both Positive and Negative Pole shall be provided. Also Construction shall be same as Charger Panel and Battery Fuse Box shall be wall-mounted type. Minimum rating of Battery Fuse 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) Cooling of discharge resistor shall be natural air cooled. c) Construction shall be same as Charger panel. Handle and wheel arrangement shall be provided for easy movement. d) Control - Using rotary switches for step control of current against falling voltage with ON-OFF facility.	

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.



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6.12 Thermal overload relay

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.



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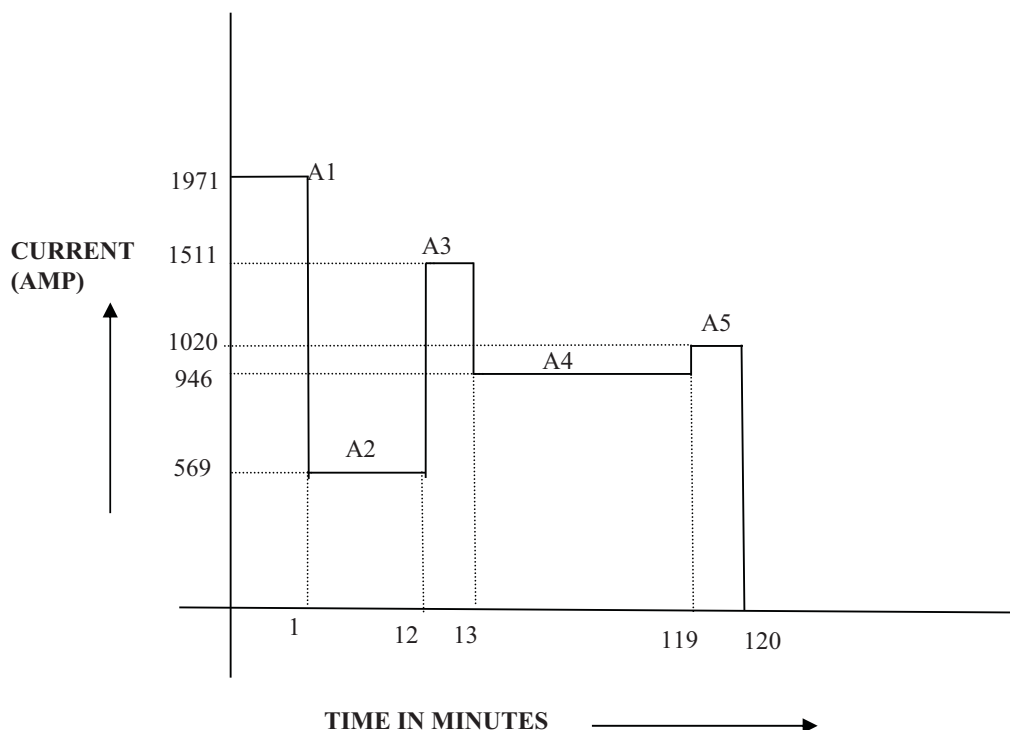
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ANNEXURE-II

LOAD DUTY CYCLE



FACTORS TO BE CONSIDERED FOR BATTERY SIZING:

- | | |
|----------------------------------|--------------------|
| 1. AGEING FACTOR | : 1 |
| 2. MIN.ELECTROLYTIC TEMP. | : 15 °C |
| 3. END CELL VOLTAGE | : 1.85V PER CELL |
| 4. DESIGN MARGIN | : 20% |
| 5. TEMPERATURE CORRECTION FACTOR | : As per IEEE 485* |
| 6. NO. OF CELLS | : 108 |

* Supporting calculation for temp correction factor as per IEEE 485 shall be furnished for batteries which are not designed at 25°C.



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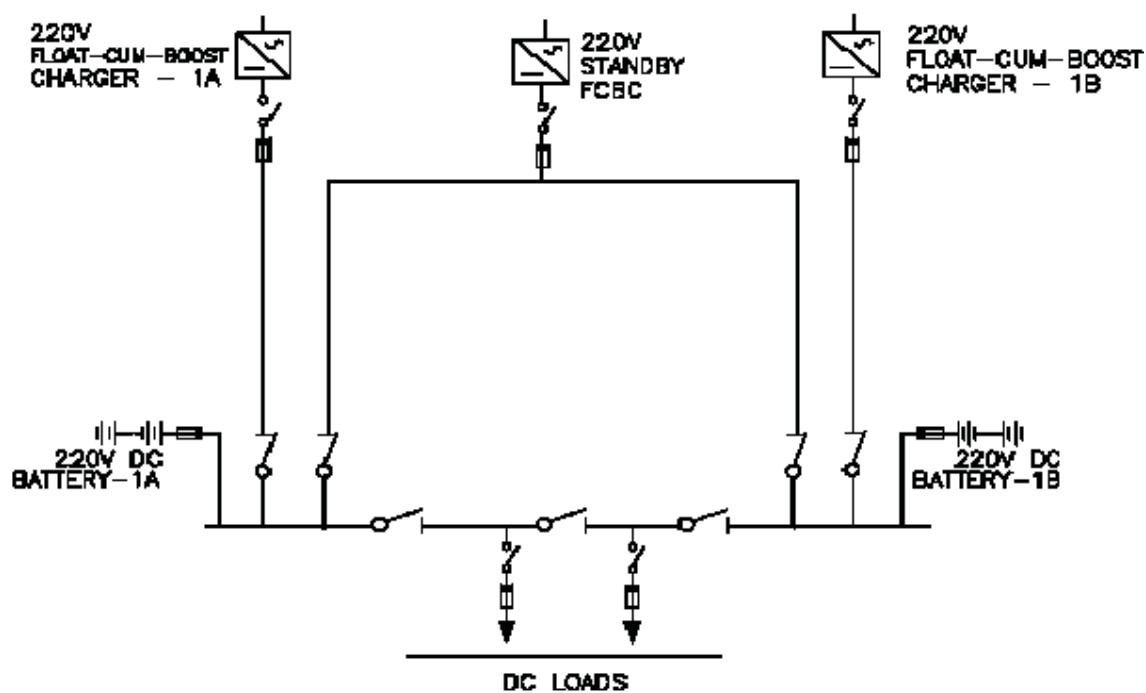
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ANNEXURE-III

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.bhadauria@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.bhadauria@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.bhadauria@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.bhadauria@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.bhadauria@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

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

TECHNICAL SPECIFICATION FOR
220V DC BATTERY CHARGER
PE-TS-423-508-E002

ANNEXURE-IV
1 X 800 MW NORTH CHENNAI TPS
SUB VENDOR LIST

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 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)
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

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.bhadoria@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.bhadoria@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

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 : 1X800 MW NORTH CHENNAI TPS		SPECIFICATION NO. : PE-TS-423-508-E002	
SHEET 1 OF 6				BIDDER/ : VENDOR		STANDARD QP NO. : PE-QP-999-508-E003, REV. 0		TECHNICAL SPECIFICATION FOR SPECIFICATION TTTL 220V DC BATTERY CHARGER	
COMPONENT/OPERATION		CHARACTERISTIC CHECK		SYSTEM CAT.		ITEM : BATTERY CHARGER		DOC. NO. :	
				TYPE/ METHOD OF CHECK		EXTENT OF CHECK		REFERENCE DOCUMENT	
SL. NO.						ACCEPTANCE NORM		FORMAT OF RECORD	
								AGENCY	
								P W V	
1		2		3		4		5	
								6	
								7	
								8	
								9	
								10	
								11	
1.0 RAW MATERIAL									
1.1		M.S Sheet (CRCA)		Major		Chemical/ Mechanical		100%	
				Major		Physical		Sample/lot	
				Major		Visual		Sample/lot	
1.2		Powder Paint		Major		Visual		Sample/lot	
2.0 Major bought out items									
2.1		Power Switches,MCCB, Timer, Contactor & Relay		Major		Visual		100%	
				Major		Visual		Sample/lot	
				Major		Visual		Sample/lot	
2.2		MCB,Push Buttons,HRC fuse,terminal blocks,control & selector switches,Semiconductor Fuses,Heaters,Thermostat,Lamps, Plug in socket		Major		Electrical		100%	
				Major		Visual		100%	
				Major		Visual		100%	
				Major		Visual		100%	
2.3		Rectifier bridge Element		Major		Visual		100%	
				Major		Visual		100%	
2.4		Digital Multi Function Meters		Major		Visual		100%	
				Major		Calibration Certificate		100%	
				Major		Electrical		100%	
2.5		PVC Insulated Electric Cable		Major		Visual		100%	
				Major		Electrical		Sample/lot	
				Major		Electrical		Sample/lot	
2.6		Transducer		Major		Electrical		100%	
				Major		Visual		100%	
				Major		Electrical		100%	
2.7		Current Transformer,Voltage Transformer, Dimmerstat Control Transformer		Major		Visual		100%	
				Major		Visual		100%	
BHEL									
PARTICULARS									
NAME									
SIGNATURE									
DATE									
LEGEND :		1 - BHEL/ CUSTOMER		2 - VENDOR		3 - SUB- VENDOR		P - PERFORM	
								W -WITNESS	
								V - VERIFICATION	
								BIDDERS/VENDOR'S COMPANY SEAL	

		CUSTOMER : TANGEDCO		PROJECT TITLE : 1X800 MW NORTH CHENNAI TPS		SPECIFICATION NO. : PE-TS-423-508-E002						
QUALITY PLAN		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												
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 Tap Voltages	Major	Electrical	100%	-do-	-do-	-do-	3	-	2,1	
		f) Measurement of Cu. Losses	Major	Electrical	100%	-do-	-do-	-do-	3	-	2,1	
		g) High voltage test	Major	Electrical	100%	-do-	-do-	-do-	3	-	2,1	
		h) Induced high voltage test	Major	Electrical	100%	-do-	-do-	-do-	3	-	2,1	
		i) Heat run Test	Major	Electrical	100%	-do-	-do-	-do-	3	-	2,1	Temp. rise limited to class A insulation value
2.12	Choke	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												
2 - VENDOR			3 - SUB- VENDOR			P - PERFORM			W - WITNESS			
1 - BHEL/ CUSTOMER			BIDDERS/VENDOR'S COMPANY SEAL									
LEGEND :			V - VERIFICATION									

		QUALITY PLAN		CUSTOMER : TANGEDCO		PROJECT TITLE : 1X800 MW NORTH CHENNAI TPS		SPECIFICATION NO. : PE-TS-423-508-E002			
SHEET 3 OF 6				BIDDER/ : VENDOR		STANDARD QP NO. : PE-QP-999-508-E003, REV. 0		TECHNICAL SPECIFICATION FOR 220V DC BATTERY CHARGER			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	SYSTEM 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	
			Major	Physical	100%	-do-	-do-	-do-	3	- 2,1	
		3) Terminal Board/Bakelite plate or busbar	Major	Physical	100%	-do-	-do-	-do-	3	- 2,1	
		4) Terminal rating	Major	Physical	100%	-do-	-do-	-do-	3	- 2,1	
		5) Air gap Measurement	Major	Physical	100%	-do-	-do-	-do-	3	- 2,1	
		6) Contuinity test	Major	Electrical	100%	-do-	-do-	-do-	3	- 2,1	
		7) Insulation Resistance	Major	Electrical	100%	IEC 146	IEC 146	IR/ Mfr TC	3	- 2,1	
		8) High voltage test	Major	Electrical	100%	-do-	-do-	-do-	3	- 2,1	
		9) DC resistance Test	Major	Electrical	100%	-do-	-do-	-do-	3	- 2,1	
		10) Heat run Test	Major	Electrical	100%	-do-	-do-	-do-	3	- 2,1	
										Temp. rise limited to class A insulation value	
2.13	Printed Circuit Boards Insulating Materials (FRP,SMC,DMC,ETC.)	1. Electrical	CR	Elect. Test	Sample	Relevant IS, MFR's Std.	Relevant IS, MFR's Std.	Test Certificate	2	- 1	
		2. Mech Props.	MA	Mech Test	Sample	-do-	-do-	-do-	2	- 1	
		3. Tracking Index	MA	Elect. Test	Sample	-do-	-do-	-do-	3/2	- 1	
	Paints	Shelf Life	MA	Visual	100%	as per Paints Manuf's. Spec.....		IR	2	- -	
	Gaskets(Syn. Rubber only)	1. Dimension	MA	Measurement	Sample	MFR's DRGS.	MFR's DRGS.	IR	2	- -	
		2. Shore Hardness	MA	Test	-do-	MFR's DRGS.	MFR's DRGS.	IR	2	- -	
		3. Ageing	MA	Test	-do-	IS-3400/BS-2752	IS-3400/BS-2752	INSPN Report	2	- -	
3.0	In process Inspection										
3.1	Enclosure fabrication	1) Dimensional checks	Major	Physical	100%	MFR's Fabrication drg	MFR's Fabrication drg	IPIR	2	- 1	
		2) Diagonal (Skewness)	Major	Physical	-do-	-do-	-do-	-do-	2	- 1	
		3) Straightness	Major	Physical	-do-	-do-	-do-	-do-	2	- 1	
		4) Welded joints	Major	Visual	-do-	-do-	-do-	-do-	2	- 1	
		5) Deburring & Finishing of welded joints	Major	Visual	-do-	-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		V - VERIFICATION	
										BIDDER'S/VENDOR'S COMPANY SEAL	

		QUALITY PLAN		CUSTOMER : TANGEDCO		PROJECT TITLE : 1X800 MW NORTH CHENNAI TPS		SPECIFICATION NO. : PE-TS-423-508-E002				
SHEET 4 OF 6				BIDDER/ : VENDOR SYSTEM		STANDARD QP NO. : PE-QP-999-508-E003, REV. 0		TECHNICAL SPECIFICATION FOR 220V/ DC BATTERY CHARGER				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	ITEM : BATTERY CHARGER REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS		
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
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)			-do-	-do-	-do-	-do-	2	-	1	
									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		BIDDER/VENDOR								
		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 : 1X800 MW NORTH CHENNAI TPS		SPECIFICATION NO. : PE-TS-423-508-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	Visual	100%	MFR's drg	MFR's drg	IPIR	2	-	1
		2. Marking	Visual	100%	-do-	-do-	-do-	2	-	1
		3. Furling	Visual	100%	-do-	-do-	-do-	2	-	1
		4. Lugs crimping	Physical	100%	-do-	-do-	-do-	2	-	1
		5. Continuity	Electrical	100%	-do-	-do-	-do-	2	-	1
		6. Identification labels	Visual	100%	-do-	-do-	-do-	2	-	1
3.7	Finishing of Equipment	1. Proper pasting of gasket	Visual	100%	-do-	-do-	-do-	2	-	1
		2. Earthing busbar	Physical	100%	-do-	-do-	-do-	2	-	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	Test Report	2	1	-
BHEL										
PARTICULARS										
NAME										
SIGNATURE										
DATE										
LEGEND :		1 - BHEL/ CUSTOMER	2 - VENDOR	3 - SUB-VENDOR	P - PERFORM	W - WITNESS	V - VERIFICATION			

QUALITY PLAN		CUSTOMER : TANGEDCO		PROJECT TITLE : 1X800 MW NORTH CHENNAI TPS		SPECIFICATION NO. : PE-TS-423-508-E002				
QUALITY PLAN		BIDDER/ : VENDOR		STANDARD QP NO. : PE-QP-999-508-E003, REV. 0		TECHNICAL SPECIFICATION FOR 220V DC BATTERY CHARGER				
		SYSTEM CAT.		ITEM : BATTERY CHARGER		DOC. NO. : DO. NO. :				
SL NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	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	
4.2	Electrical Testing	1) Burn in check at 50°C for 48 hrs in energized condition	Major	Electrical	100%	The panel / module shall be subjected to ambient temperature of 50°C for 48 hours in energised condition. The temperature rise inside the cubicle shall not exceed 10°C during the test.	The panel / module shall be subjected to ambient temperature of 50°C for 48 hours in energised condition. The temperature rise inside the cubicle shall not exceed 10°C during the test.	IR	2 - 1	Burn in test to be performed before offering for BHEL Inspection
		2) AVR operation test with input voltage variation of +/- 10%, frequency variation and combined voltage-frequency variation.	Major	Electrical	100%					
		a) No Load				variation within ±1%	variation within ±1%	-do-	2 1	-
		b) Half Load				variation within ±1%	variation within ±1%	-do-	2 1	-
		c) Full Load				variation within ±1%	variation within ±1%	-do-	2 1	-
		3) Ripple test	Major	Electrical	100%					
		a) No Load				variation within ±1%	variation within ±1%	-do-	2 1	-
		b) Half Load				variation within ±1%	variation within ±1%	-do-	2 1	-
		c) Full Load				variation within ±1%	variation within ±1%	-do-	2 1	-
		4) Logic simulation/interlocks/General Operation Test	Major	Electrical	100%					
		a) Trickle / boost mode selector switch operation	Major	Electrical	100%	Functional	Functional	-do-	2 1	-
		b) Auto/ manual selector switch operation	Major	Electrical	100%	Functional	Functional	-do-	2 1	-
		c) Soft start feature check	Major	Electrical	100%	Functional	Functional	-do-	2 1	-
		d) Uniform step-less trickle mode voltage adjustment in auto/ manual operation	Major	Electrical	100%	Functional	Functional	-do-	2 1	-
		e) Boost charge mode current adjustment from 50% to 100 % continuously	Major	Electrical	100%	Functional	Functional	-do-	2 1	-
		5) Control circuit & charger status indication test	Major	Electrical	100%	Functional	Functional	-do-	2 1	-
		6) Load Limiter Operation	Major	Electrical	100%	Voltage should not drop upto 100% load. Voltage should drop beyond 100% load	Voltage should not drop upto 100% load. Voltage should drop beyond 100% load	-do-	2 1	-
		7) Heat Run Test	Major	Electrical	1 sample	BHEL approved docs.	BHEL approved docs.	-do-	2 1	-
		8) Dynamic response test	Major	Electrical	100%	Overshoot / undershoot in output voltage of the charger corresponding to sudden change in load from 100% to 20% and from 20% to 100%.	Output Voltage should stabilise within 2 secs.	-do-	2 1	-

		9) Input AC current measurement test	Major	Electrical	100%	BHEL appd Data sheet	BHEL appd Data sheet	-do-	2	1	-
		10) Degree of protection Check for IP 4X	Major	Electrical	100%	IS -2147	BHEL appd Data sheet	-do-	2	1	-
		11) I.R Test	Major	Electrical	100%	IS -8623	IS -8623	-do-	2	1	-
		12) H.V Test	Major	Electrical	100%	Charger should be able to withstand 2.5kV for 1 min.	Charger should be able to withstand 2.5kV for 1 min.	-do-	2	1	-
		13) Efficiency and power factor measurement	Major	Electrical	100%	IS-4540	BHEL appd Data sheet	-do-	2	1	-
5	Battery Fuse Box	1) Dimensional check	Major	Physical	100%	BHEL appd G.A drg.	BHEL appd G.A drg.	-do-	2	1	-
		2) Fuse Rating	Major	Visual	100%	BHEL appd Data sheet	BHEL appd Data sheet	-do-	2	1	-
		3) I.R Test	Major	Electrical	100%	-do-	-do-	-do-	2	1	-
6	Discharge Resistor	1) Dimensional check	Major	Physical	100%	BHEL appd G.A drg.	BHEL appd G.A drg.	-do-	2	1	-
		2) Resistance rating	Major	Electrical	100%	BHEL appd Data sheet	BHEL appd Data sheet	-do-	2	1	-
		3) I.R Test	Major	Electrical	100%	-do-	-do-	-do-	2	1	-
5.0	CABLE LUGS & GLANDS	Visual	MA	-	100%	BHEL approved GA drg/ data sheet	BHEL approved GA drg/ data sheet	-do-	2	1	-
	BHEL						BIDDER/VENDOR				
			PARTICULARS								
			NAME								
			SIGNATURE								
			DATE								
LEGEND :				2 - VENDOR	3 - SUB- VENDOR	P - PERFORM	W -WITNESS	BIDDERS/VENDOR'S COMPANY SEAL			
1 - BHEL/ CUSTOMER								V - VERIFICATION			