

Annexure – Z(Revised)

TECHNICAL SPECIFICATION

SECTION- BATTERY, BATTERY CHARGER & DC DISTRIBUTION BOARD

2.0 GENERAL

2.1 All materials/components used in batteries and battery chargers shall be free from flaws and defects and shall conform to the relevant standards and good engineering practice.

2.2 All offered equipment shall also meet the technical requirement as specified in clause 24.0 of Section-GTR in addition to the requirements specified elsewhere in the technical specification.

2.3 DC system shall consist of 1 set of battery bank, 1 set of battery charger complete with DC distribution board for each of 220V & 48V systems respectively.

2.4 Bidder shall select number of cells, float and boost voltage to achieve the following system requirement.

System Voltage	Maximum voltage during float operation	Minimum voltage available when no charger working and battery fully discharged	Minimum number of cells
220 V	242 Volts	198 Volts	174
48 V	52.8 Volts	43.2 Volts	38

3.0 Battery

3.1 Type

DC Batteries shall be stationary Nickel – Cadmium type. The batteries shall be medium discharge performance type. For the purpose of design, an ambient temperature of 45 degree centigrade and relative humidity of 95% shall be considered. The 220 V DC system is unearh and 48 V DC system is +ve earth system.

DC batteries shall be suitable for standby duty. The batteries shall normally be permanently connected to the load in parallel with a charger and shall supply the load during emergency conditions when AC supplies are lost.

Batteries shall be suitable for a long life under continuous float operations and occasional discharges. The batteries shall be boost charged at about 1.54 to 1.7 volts per cell maximum and float charged at about 1.42 volts per cell. Batteries shall also be suitable for continuous operation for the maximum ambient temperature as specified elsewhere in the technical specification.

3.2 Container

Containers shall be made of polypropylene plastic material. Containers shall be robust, heat resistant, leak proof, non-absorbent, alkali resistant, non-bulging type and free from flaws such as wrinkles, cracks, blisters, pin holes etc. Electrolyte level lines shall be marked on container in case of translucent containers.

3.3 Vent Plugs

Vent plugs shall be provided in each cell. They shall be of anti-splash type, having more than one exit hole and shall allow the gases to escape freely but shall prevent acid from coming out. The design shall be such that the water loss due to evaporation is kept to minimum. In addition, the ventilator shall be easily removed for topping up the cells and of such dimensions that the syringe type hydrometer can be inserted into the vent to take electrolyte samples.

3.4 Plates

The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuations of load. The construction of plates shall conform to latest revisions of IS: 10918/ IEC as applicable. The separators shall maintain the electrical insulation between the plates and shall allow the electrolyte to flow freely. The positive and negative terminal posts shall be clearly marked.

3.5 Sediment Space

Sufficient sediment space shall be provided so that cells will not have to be cleaned out during normal life and prevent shorts within the cells.

3.6 Cell Insulator

Each cell shall be separately supported on PVC/porcelain/hard rubber insulators fixed on to the racks with adequate clearance between adjacent cells.

3.7 Electrolyte

The electrolyte shall be prepared from battery grade potassium hydroxide conforming to BS: 1069. The cells shall be shipped either in charged condition or in dry condition. Necessary electrolyte for make-up shall be supplied separately.

3.8 Manufacturer's Identification System

The following information shall be indelibly marked on outside of each cell:

- Manufacturer's name and trade mark
- Country and year of manufacture
- Manufacturer's type designation
- AH capacity at 5 hour discharge rate
- Serial Number

3.9 Connectors and Fasteners

Nickel coated copper connectors shall be provided for connecting up adjacent cells and rows. Bolts, nuts and washers shall be effectively nickel coated to prevent corrosion. The thickness of nickel coating of connectors should be not less than 0.02mm. All the terminals and cells inter-connectors shall be fully mutated shrouds. End take off connectors from positive and negative poles of the batteries shall be provided for end connections to the Power cables. More than one cable may be required to be connected to the battery terminals. Suitable arrangement for termination of multiple cables shall be provided so as to avoid extra load on battery terminals. The cable will be single core having stranded copper conductor and PVC insulation. All connectors and lugs shall be capable of continuously carrying the 30 Minute discharge current of the respective Batteries and through fault short current which the battery can produce and withstand for the period specified.

3.10 Battery Racks

Mild steel racks shall be provided for all Batteries. They shall be free standing type mounted on porcelain/hard rubber/PVC pad insulators. Batteries shall preferably be located in the single tier arrangement. However, batteries having a complete cell weight of lower than 50 kg could be

located in the double tier arrangement. The batteries racks and supports for cable termination shall be coated with three (3) coats of anti-alkali paint of approved shade. Name plates, resistant to alkali, for each cell shall be attached on to the necessary racks.

3.11 TESTS

3.11.1 Batteries shall conform to all type tests as per the latest issue of IS:10918/ IEC as applicable. The contractor shall submit for owner's approval the reports of all the type tests as listed in the technical specification.

4.0 BATTERY CHARGER FOR NICKEL-CADMIUM TYPE BATTERY

4.1 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 Nickel-Cadmium Batteries while supplying the DC loads. The Batteries shall be trickle charged at 1.4 to 1.42 Volts per cell. All chargers shall be capable of Boost charging the associated DC Battery at 1.53 to 1.7 Volts per cell at the desired rate. The Chargers shall be designed to operate, as mentioned above, at an ambient air temperature of 45 degree C.

4.2 Battery Chargers shall have a selector switch for selecting the battery charging mode i.e. whether trickle or Boost charging.

4.3 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.

4.4 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 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.

4.5 When on automatic control mode during Trickle charging, the charger output voltage shall remain within +1% of the set value for AC input voltage variation of +10% frequency variation of +3 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.

4.6 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.

4.7 Energizing the Charger with fully charged battery connected plus 10% feed 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.

4.8 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.

4.9 The Charger manufacturer may offer an arrangement in which the voltage setting device for Trickle charging mode is also used as output voltage limit setting device for Boost charging mode, and the load limiter of the trickle charging mode is also used as Boost charging current setting device.

4.10 Suitable filter circuits shall be provided in all the chargers to limit the ripple content (peak to peak) in the output voltage to 1% irrespective of the DC load, even when they are not connected to a battery.

4.11 The 230V 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. However, 48V system shall be +ve ground.

4.12 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 400 Volts AC.

4.13 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.

4.14 Rectifier-Transformers and Chokes

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

4.15 Rectifier Assembly

The rectifier assembly shall be full wave bridge type and designed to meet the duty as required by the respective Charger. The rectifier cells shall be provided with their own heat dissipation arrangement with natural air cooling. The rectifier shall utilize diodes/thyristors and heat sinks rated to carry 200% of the load current continuously and the temperature of the heat sink shall not be permitted to exceed 65 degree C absolute duly considering the maximum charger panel inside temperature. The Contractor shall submit 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 assuming air ambient temperature of 50 deg.C outside the panel. Necessary surge protection devices and rectifier type fast acting fuses shall be provided in each arm of the rectifier connectors.

4.16 Instruments

DC voltmeter, DC ammeter and AC voltmeter in 96mm 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.

4.17 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' & 'OFF' position of the switch shall be clearly indicated.

4.18 Control and Selector switches

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

- (a) Make and carry continuously – 10 Amps
- (b) Breaking current at 230V DC – 0.5 Amp. (Inductive)
- (c) Breaking current at 230V AC – 5 Amp, at 0.3 p.f.

4.19 Fuses

Fuses shall be of HRC cartridge fuse link type. Fuses shall be mounted on the fuse carriers which are mounted on fuse bases. Wherever it is not possible to mount fuses on fuse carriers, fuse 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.

4.20 Indicating Lamps

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

4.21 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.

4.22 Annunciation System

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

- (a) AC supply failure
- (b) Rectifier fuse failure
- (c) Surge circuit fuse failure
- (d) Filter fuse failure
- (e) Load limiter operated
- (f) Charger trip
- (g) Battery on Boost

Potential free NO contacts of all above conditions shall be provided for following remote alarms:

- (a) Battery on Boost

(b) Charger trouble (this being a group alarm initiated by any of the faults other than Battery on Boost.

4.23 Name Plates and Marking

The nameplates shall be made of non-rusting metal/3 ply Lamicaid and shall have black background 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.

4.24 Construction

The Chargers shall be indoor, floor mounted, self supporting sheet metal enclosed cubicle type. The Contractor shall supply all necessary base frames, anchor bolts and hardware. The Charger shall be fabricated using cold rolled sheet steel shall not less than 1.6mm and shall have folded type of construction. The panel frame shall be fabricated using cold rolled sheet steel of thickness not less than 2.0mm. Removable undrilled gland plates of atleast 3.0mm sheet steel and lugs for all cables shall be supplied by the Contractor. The lugs for cables shall be made of electrolytic copper with tin coat cable sizes shall be advised to the Contractor at a later date for provision of suitable lugs and gland plates. The Charger shall be tropicalised and vermin proof Ventilation louvers shall be backed with fine brass wire mesh. All doors and covers shall be fitted with synthetic rubber gaskets. The Chargers shall have hinged double leaf doors provided on front and/or backside for adequate access to the Charger internals. All the Charger cubicle doors shall be properly earthed. The degree of protection of Charger enclosure shall be atleast IP 42.

4.24.1 All indicating instruments, control & selector switches and indicating lamps shall be mounted on the front side of the Charger. Design of panels shall be based on the following dimensions:

1.	Overall height	Maximum 2350mm
2.	Operating handles –(highest& lowest positions reached by Operator's hands), protective Mechanical indicators	Maximum 1800mm Minimum 350mm
3.	Doors and panel handles and locks	Maximum 1800mm Minimum 300mm

4.24.2 Electronic equipments shall be of modular design consisting of plug in modules in standard 19 inches metallic racks with metallic card guides. The cards should be provided with proper handles. Card to card wiring should be preferably through a motherboard. Unplanned jumpering and track modifications are not permitted. Mechanical interlocks to prevent wrong insertion of cards should be provided. Each card shall have its junction and test points identified. Maintenance aids such as extension printed wiring boards and jumper leads shall be provided.

4.24.3 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, will exceed 10 deg.C over ambient air temperature outside the Charger.

4.24.4 Each Charger panel shall be provided with an illuminating lamp and one 5 Amp Socket Switches and fuses shall be provided separately for each of the above.

4.24.5 Locking facilities shall be provided as following :

(a) For locking Trickle/Boost selector switch in the trickle position only. This would be used for having key mechanical interlock between Trickle/Boost selector switch and isolator in D.C. distribution board.

(b) The Charger enclosure door locking requirements shall be met by the application of padlocks. Padlocking arrangement shall allow ready insertion of the padlock shackle but shall not permit excessive movement of the locked parts with the padlock in position.

4.25 Wiring

4.25.1 Each Charger shall be furnished completely wired upto power cable lugs and terminal blocks ready for external connection. The power wiring shall be carried out with 1.1kV grade PVC insulated cables conforming to IS:1554(Part-1). Control wiring terminating at electronic cards shall not be less than 1.0 sq.mm. Control terminal shall be suitable for connecting two wires with 2.5 sq.mm, stranded copper conductors. All terminals shall be numbered for ease of connections and identification. Atleast 20% spare terminals shall be provided for circuits.

4.25.2 Power and control wiring within panels 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.

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

4.26 TESTS

4.26.1 Battery chargers shall conform to all type tests as per relevant Indian Standard. Performance test on the Chargers as per Specification shall also be carried out on each Charger. Rectifier transformer shall conform to all type tests specified in IS: 4540 and short circuit test as per IS:2026. The report for the following type tests shall be submitted for compliance of specification requirements:

- a. Voltage regulation test
- b. Load limiter characteristics test
- c. Efficiency tests
- d. High voltage tests
- e. Temperature rise test
- f. Short circuit test at no load and full load at rated voltage for sustained shortcircuit.
- g. Degree of protection test
- h. Measurement of ripple by oscilloscope.

4.26.2 . At site the following tests shall be carried out by MOEP-2 :

- i) Insulation resistance test
- ii) Checking of proper annunciation system operation.

5.0 DC DISTRIBUTION BOARD:

5.1 TYPE

DC Distribution Board shall be of single front fixed type and as per IEC– 60947/IS:13947. DCDB may be offered as part of charger with segregation.

5.2 OPERATIONAL REQUIREMENTS

5.2.1 DP MCBs as outgoings.

5.2.2 Incomers for DC Distribution shall be double pole MCCB.

5.2.3 MCB shall conform to IEC - 898 and IS:8828.

5.2.4 Isolating switches shall have indoor interlocks and padlocking facility.

5.3 Panels

5.3.1 DBs shall have prominent engraved identification plates.

5.3.2 All non-current carrying metal work of DBs shall be effectively bonded to earth bus of galvanized steel, extending throughout the DBs.

5.3.3 It should be possible to carryout maintenance on a feeder with adjacent feeders alive.

5.4 Meters/instruments

All meters/instrument shall be flush mounted on front panel, at least 96 sw.mm, size with 90 deg. Linear scales and accuracy class of 2.0.

5.5 DESIGN AND CONSTRUCTIONAL FEATURES

5.5.1 DC Distribution boards(DBs) shall have following features:

5.5.1.1 DCDB shall be of metal enclosed, indoor, floor mounted and free standing type.

5.5.1.2 All frames and load bearing members shall be fabricated using mild steel structural sections or pressed & shaped cold rolled sheet steel of thickness not less than 2mm.

5.5.1.3 Frame shall be enclosed in cold rolled sheet steel of thickness not less than 1.6mm. Doors and covers shall also be of cold rolled sheet steel of thickness not less than 1.6mm. Stiffeners shall be provided whenever necessary. Removable gland plates of thickness 3mm (hot/cold rolled sheet steel) or 4mm (non-magnetic material) shall be provided for all panels.

5.5.1.4 All DBs shall be of dust and vermin proof. All cutouts shall have synthetic rubber gaskets.

5.5.1.5 The Degree of protection of DBs shall be IP52.

5.5.1.6 The DBs shall be designed to offer adequate level of safety to operating/maintenance personnel. Means shall be provided to prevent access to the live part to avoid accidents during service as well as maintenance period.

Bidder shall bring out the safety means provided to achieve above.

5.5.1.7 DBs shall be equipped with DC ammeter and DC voltmeter for the incomer.

5.5.2 Indicating lamps shall be cluster LED type.

5.5.3 DBs shall have bottom cable entry.

5.6 Cable Glands

Cable shall be terminated using double compression type cable glands. Cable glands shall confirm to BS:6121 and be of robust construction capable of clamping cable and cable armour (for armored cable) firmly without injury to the insulation. Cable glands shall be made of heavy

duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware also be made of brass with nickel chrome plating rubber components shall be of neoprene and of tested quality.

5.7 Cable Lugs/Ferrules

Cable lugs and ferrules shall be tinned copper conforming to IS:8309. The cable lugs shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments.

5.8 Wiring and Terminal Blocks

Wiring shall be carried out with 1100V grade wires of approved make. Crimping type lugs suitable for termination shall be used for end terminations. PVC sleeves shall be provided to cover terminals. Wires shall be heat resistant and stranded