# TECHNICAL SPECIFICATION FOR 110V, 45A AUTO FLOAT-CUM-BOOST BATTERY CHARGER,110V, 150 AH BATTERY & DCDB

**SCOPE :**

This specification covers Design, Engineering, Manufacture, Assembly, Painting, Inspection, Testing at manufacturer's works, Delivery to site inclusive of packing & transportation, Testing and Commissioning assistance of Battery, Battery Charger & DCDB complete with all accessories.

1 set of three phase Battery charger for 110V, 150 AH Battery & DCDB in accordance with this specification, standards stated herein and Appendices enclosed herewith, shall comprise of the following:

a) Battery (Plante) complete with racks & accessories.
b) Dual Automatic Float cum Boost charger.
c) DCDB

- **TECHNICAL SPECIFICATION FOR BATTERY CHARGER**

**1. GENERAL REQUIREMENTS:**

The system requires a reliable and uninterrupted D.C. supply for supplying D.C. Power to emergency lights, closing and tripping coils of circuit breakers, relays etc. This will comply with all statues, regulations and safety codes.

**2. APPLICATION STANDARD**

Unless other wise specified, the equipment shall conform to latest applicable Indian standard of equivalent IS particular to the following standard

| | |
|---|---|
| IS:3895/1966 | Specification for the rectifier equipment |
| IS:2208 | Specification for HRC fuses. |
| IS:1248 | Indicating instrument. |
| IS:375/1963 | Specification for wiring |
| IS:4540/1968 | Mono crystalline semiconductor rectifier assemblies |
| IS:2026 | Transformers |
| IS:13947/1993 | Air Break Switch/Contactor |
| IS:5/1978 | Colour for ready mix paint |
| IS:5421/1981 | Printed circuit board |
| IS:8828/1993 | Miniature circuit breaker |
| IS:2147 | Degree of protection for cubicle |
| IS:6619 | Safety code for semiconductor rectifier equipment |
| IS 2959 | AC contactors for voltage not exceeding 1000 volt. |
| IS 6005 | Code of practice for phosphating of Iron & Steel |
| IS 5921 | Printed Circuit Board |

## 3. REQUIRED ELECTRICAL PARAMETERS :

3.1 AC input:

415 volts +10 % & -15%, 50 HZ +/- 3%, three phase four wire supply Input Power factor 0.8 minimum at rated load.

3.2 Charger system operation :

3.2.1. The Battery Charging Equipment shall be automatic dual float-cum-Boost type with facility to supply the DC continuous load of 30 Amp. During normal operation, the Battery is floated across the Battery charger at 118-126V (2.16 V / 2.3 V per cell) and should be compatible for battery as per specification and also supplies the Battery current 15 Amps. into batteries for higher voltage upto 130-152V (2.35 V / 2.75 V per cell). The charger shall provide extra voltage for Boost charging.

3.2.2 During boost charging, voltage across the battery terminal will go higher at the order of about 130-152 volts for which suitable automatic solid state transistorized dropping device shall be provided (maintain 110 V ± 10% across the terminal.

3.2.3 Battery Charging Equipment shall be fully automatic for Float and Boost charging facility with suitable indication on front of the panel by means of LED indication. For this, automatic solid state change over relay shall be provided. During AC mains fail, Battery supplies the load and gets discharged. The extent of discharge depends on the duration of power failure and the current drawn by load. When the mains are restored after power failure, Battery shall put on automatically on boost mode. During this time, load voltage shall be maintained by load regulator 110 V ± 10%. It should automatically switch over to trickle mode & when Battery voltage falls below 110 volts, the charger should automatically switchover to Boost mode. Soft start feature shall be provided in the system.

3.2.4 The battery charger shall have one Auto Bridge circuit. The Auto mode shall be so connected to the module that if necessary, it can be taken out for repair by simply disconnecting few links. Each arm of the bridge shall be provided with filter circuit as well as fuse protection in order to rectify the fault if any, at the earliest opportunity.

3.2.5 Automatic changeover of DC load requirement of substation to Battery in the event of Mains power failure should be without any break. i.e should be made without incorporating any relay in the output DC supply.

3.2.6 Automatic changeover of output to charger supply with restoration of incoming power supply and after meeting short time current requirement from battery.

3.2.7 Rating : 110 V DC output, 45 amp dual automatic float cum boost Battery charger.

a. Type : Thyristor controlled.

b. At Load terminal : During float charging or Boost charging, the load voltage shall be maintained 110 V ± 10%. For AC input voltage

variation of +10 & -15 % and load variation of 0 to 100 %. Also system shall provide 30 Amps continuous current and also momentary current of 100 Amps for one second.

c. At Battery terminal : Trickle charge voltage 118-126 volts (2.16 / 2.25 V per cell) at 400 mA maximum. Boost charge voltage 130-152 volts (2.23 V / 2.75 V per cell) at 15 Amps.

d. Ripple : The ripple content in the DC output of DC output of Battery Chrger shall be limited to 2% RMS.

e. Regulation – ± 2%

f. Efficiency : More than 70%

g. Method of cooling : Natural air with proper ventilating arrangement.

**4.0 DESCRIPTION :**

4.1 The charging equipment shall be housed in a free standing, floor mounted compartmentalized panels having separate compartments for float and float cum boost charging equipment, battery connection to DC bus, DC distribution equipment, including incoming feeders and outgoing feeders in different compartments. Panels shall have provision for bottom entry of cables with removable cable gland plate. (i.e. separate compartmentalized panels for each float charger, float cum boost charger and DC distribution).

4.2 The panel shall be of CRCA sheet steel construction and provided with concealed hinges. Adequate ventilating grills or louvers with fine brass wire mesh shall be provided. Thickness of sheet steel shall be at least 3.0 mm for load bearing members and 2.0 mm for other sides. Degree of protection provided by the enclosure to the internals of charger shall be IP-42 as specified in IS : 2147.

4.3 The instruments, switches and indicating lamps shall be flush mounted on the front panel.

4.4 Suitable neoprene rubber gaskets shall be provided all around doors and cover plates, between two shipping sections, two charger sections, two panel sections, for making charger construction dust and vermin proof.

4.5 All PCBs used in the charger shall be made of glass epoxy material. Electronic cards shall be plug in type and shall be mounted on standard racks. Rack shall have PCB guides which shall allow the insertion of PCBs smoothly without requiring force. Racks shall be mounted on hinged pivot to enable the rack to be turned for access to back side terminals. PCBs shall include status indicating LED lights and test connections in the front to facilitate fault diagnosis. PCBs shall be identified with proper permanent labels as per approved drawings.

4.6 Dimensions of the Charger : 1400 mm (W) X 700 mm (D) X 1800 mm (H)

4.7 Paint shade : Both exterior and Interior – RAL 7032

4.8 The panel must be naturally air cooled type designed for continuous operation in a ambient temp. 50°C. This shall be dust and vermin proof.

**5.0 COMPONENTS:**

5.1 The Battery charger shall comprise of following components but not limited to the same:

a) Double pole AC circuit breaker for AC incoming of the battery charger(MCB) with auxiliary potential free contact for indication to SCADA MCB ratings shall be for 3 KA rupturing capacity at 110 V DC..

b) Three phase, full wave half controlled SCR bridge of 100 A rating (Silicon controlled Rectifier) together with suitable heat sinks and RC suppression network to take care of momentary high load of 100 Amp. The bidder shall supply the characteristics of the rectifier used in the construction of the charger indicating the capacity of the rectifier to suit the temperature conditions. All the electronic components shall be of high MTBF or heavy duty type and liberally rated.

c. Automatic solid stage voltage / current controller for automatic control of voltage and current during float / boost charging the batteries complete with automatic control facility.

d. Auto mode selector switch (25 A rating) with Indication lamp/LED for respective position.

e. Float/Boost indicator lamps/LED.

f. Potentiometers to adjust DC output voltage and current in respective modes.

g. Battery charging current and voltage requirements are to be regulated by using voltage current feedback loops.

h. Smoothing (filter) circuit comprising of smoothing choke and filter condenser to reduce ripple content in the DC output of the Battery charger to 2% RMS.

i. DC moving coil Voltmeter of 0-110+0 V rating and 72 sqmm with selection switch and HRC fuse to measure voltage of charger / Battery and Load.

j. Solid state automatic load voltage regulator to maintain the load voltage of 110 V ± 10% (rating of the regulator shall be 30 A continuous and 100A for one second) during Float charging or Boost charging of the Batteries.

k. Double pole DC circuit breaker for Battery protection (MCB) with auxiliary potential free contact for indication to SCADA.

l. DC contactor to by-pass automatic load voltage regulator in the event of AC mains fails to allow the full battery across the load. There should not be any discontinuity of DC supply to the busbar during any transition period and battery power should be available for tripping circuit, if necessary, even during boost charging.

m. AC analog voltmeter 96x96 sqmm of rating 0 to 500 V.

n. Fuse fail indication lamp / LED for load and Battery fuses.

o. The indicating instruments shall be class 0.5 accuracy.

p. The following provisions conforming to relevant IS shall be made on the front panel:-

(i) Voltmeter to indicate battery/charger DC voltage (0-500V)

(ii) Voltmeter for Input AC supply voltage.

(iii) Ammeter to indicate Charge/Discharge current of battery (100-0-50 A)

(iv) Ammeter to indicate load DC current.

(v) Ammeter for earth leakage current of the charger & outgoing ckt. (load side) – ( 100 – 0 – 100 mA)

5.2 The Charger shall be provided with following LED of reputed make Indication:

(i) Supply of power--Green
(ii) Charger on --Green
(iii) Battery reverse polarity
(iv) Input power supply fail–Red
(vi) Output over/under voltage
(vii) Earth fault

5.3 Audio/Visual alarm to indicate:-

(i)AC input Power failure.
(ii) Charger Output failure.
(iii) Battery disconnection/failure.
(iv) DC under/Overvoltage.
(v) Condenser Fuse failure.
(vi) In case of failure of charger on fault, it should give buzzer as well as LED indication. However, the buzzer alarm should be provided for battery fuse fail, load fuse fail and charger trip due to over load indication with an accept and reset switch. The charger shall have provision for an alarm relay contact for remote Indication. Suitable terminals with identification label shall have to be provided.

5.4 Controlling arrangement for following functions shall be provided:-

a) Auto/Manual Selector Switch
b) Manual operation controlling device
c) Accept/Reset pushbutton
d) Voltmeter selector switch

5.5 Wiring: Charger cubicle shall be supplied completely wired upto terminal block for purchasers external connection using solder less crimping type copper lugs. All wiring shall be carried out with 1.1 KV grades PVC insulated multi-strand copper conductor of 2.5 Sqmm and shall be flame/vermin proof. All wiring shall be neatly bunched without affecting access to equipment/ components mounted within the cabinet. The Charger DC output circuit for Battery and load connection separately shall be wired with 6.00sq.mm PVC insulated cable.

Suitable two earthing terminal and outgoing terminal shall be supplied to connect the external supply cables.

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Control/Indication/Annunciation circuit shall be wired with suitable size of PVC insulated cable as per scheme requirement. Colour coded wires should be used to facilitate easy tracing, as under:-

. i. Single Phase A.C. Circuit:-
(a) Yellow for Phase
(b) Green for Earthing
(c) Blue for Neutral

ii. D.C. Circuit:-
(a) Red for Positive
(b) Black for Negative

iii. Control Wiring:-
(a) Gray for annunciation and other control circuits.
(b) Ferrules: Embossed/Engraved core identification ferrules, marked to correspond with the wiring diagram shall be fitted at both ends of each wire.
(c) Termination:

- The input, battery and load terminals shall be located in easy accessible positions. The terminals shall be properly labeled for easy identification of Input (Phase & Neutral), Battery (positive & negative), Load (Positive &negative) and Emergency Lamp (Positive & negative).
- The terminals shall be rated at 25 Amps or more depending on scheme requirement.
- The Input terminals shall be connected to a 3 core PVC insulated multi-stranded copper conductor cable (minimum 2mtr. length) with a 16 Amp 3 pin plug socket at the other end. The earth conductor of the cable shall be provided on the charger body.
- The charger shall incorporate terminals and fuse of 4 Amp rating for connecting wires from outside to bring emergency light in to battery circuit in the event of mains failure.
- All control cables should run through the bottom side of the Charger cubicle with proper gland arrangement.

**6. SPECIAL FEATURE :**

6.1 All printed circuits boards used in the battery charger shall be solder marked, glass, epoxy, FR 4 grade copper clad material having edge type gold plugging connectors conforming to latest IS / IEC specifications. All assembled PCB conforming coating on component side & epoxy varnish on the other side with suitable protective coating for protection against humidity and corrosion.

6.2 Transformer shall be with class B insulation having a continuous rating at least 125% of the rating of the charger. Reactance of the transformer shall be suitable to take care of regulation and surges. The power transformer rectifier unit of the battery charger shall be designed for adequate VA rating but in any case it should not be less than 800 VA and should be rated for 500 V at factor safety of 3. The heat dissipation and power control system should be designed with a factor of safety of 8. Rating of silicon diode should not be less than 100 A.

Please note that necessary documentary evidence, showing transformer rating of 700 VA along with test certificate from manufacturer. It bought out , shall be enclosed, for approval of the purchaser.

6.3 Following make of components shall be used in the Battery charging equipment or equivalent approved by WBSEDCL.

| | | |
|---|---|---|
| i) | Switches | Kaycee/Recom |
| ii) | Meters | AEL/IMP/USHA |
| iii) | Contacts/Relay | L&T/Siemens/ABB/C&S |
| iv) | MCB | MOS/ABB/Siemens/L&T |
| v) | HRC fuses | S&S/Bussman/Siemens/L&T |
| vi) | SCR | USHA/HIRECT/IR |
| vii) | Diode | USHA/KELTRON/IR |
| viii) | Lamps/LED | Essen/vaishna/Siemens/L&T/Emco |
| ix) | Filter condenser | Rescon/Elcon/Kendil |
| x) | Potentiometer | Pankaj |
| xi) | Voltmeter A.C. | IMP/AE/Rishav/Meco |

6.4 The charger cubicle will be indoor type with all associated and auxiliary equipments mounted therein.

6.5 All fuses shall be HRC cartridge types conforming to IS : 2208 mounted on plug type fuse bases.

6.6 Electrical indicating instruments shall be flush mounted on panel with only flanges projecting. Dial shall be white with black number and lettering.

6.7 Control & instrument switches shall be of rotary type.

6.8 Indicating lamps shall be LED type with low watt consumption. The LEDs shall be provided with series resisters.

6.9 Strip type space heaters of adequate capacity shall be provided inside cabinet to prevent moisture condensation.

6.10 All door mounted equipments as well as equipment mounted inside the cabinet shall be provided with individual labels with equipment designation engraved on aluminium / plastic plate (stickers are not acceptable).

6.11 POLARITYMARKING:-

The polarity marking of the terminals shall be marked for identification. The positive terminal may be identified by "P" or (+)sign and Red colour mark and the negative terminal may be identified by "N" or (-) and Blue colour. Terminal marking shall be permanent and non-deteriorating.

6.12 Terminals – Battery charger cabinet shall be provided with two separate suitable earthing terminals. Separate terminals shall be provided for connecting load & battery leads to the charger. All terminals shall be M12 size. Suitable copper lugs shall be provided by the bidder for use of the purchaser for connecting the load wiring. It would be the bidder's responsibility to prove the adequacy of the design by submitting all technical particulars and relevant graphs to show suitability of charger for supplying load on continuous basis.

6.13 The supplier of battery charger shall be fully coordinate with the supplier of battery in the event of the purchaser deciding not to place order for both equipments on the same supplier.

6.14 Method of cooling of the charger equipment shall be specified by the bidder.

6.15 Two earthing studs of MS 50 mm long & 12 mm dia shall be provided for external earth connections. These should be complete with plain washer, spring washer,

nuts etc. Earthing Bolts must be welded to prevent removal of the same from the box.

6.16 SCADA Compatibility

The Battery Charger shall be fully SCADA compatible. It shall have sufficient Nos. of potential free contacts & transducers (4-20mA output) for digital and analogue signals respectively. It shall also be possible to control various functionality of Battery Charger from SCADA system through hard wire connection.

Typical I/O requirement is tabulated here under.

| PARAMETERS | DIGITAL INPUTS | CONTROL OUTPUTS | ANALOGUE INPUTS (4-20mA) |
|---|---|---|---|
| AC mains fail | √ | | |
| Load Bus Over Voltage | √ | | |
| Load Bus Under Voltage | √ | | |
| Float Charger fail | √ | | |
| Earth Leakage | √ | | |
| Float Charger On | √ | √ | |
| Float Charger Off | √ | √ | |
| Float Charger on Auto mode | √ | | |
| Float Charger on Manual | √ | | |
| Boost Charger On | √ | √ | |
| Boost Charger Off | √ | √ | |
| Boost Charger On CV mode | √ | √ | |
| Boost Charger On CC mode | √ | √ | |
| Charger on local mode | √ | | |
| Charger on Remote mode | √ | | |
| Battery Voltage | | | √ |
| Boost Voltage | | | √ |
| Float Voltage | | | √ |
| Load Voltage | | | √ |
| Battery Current | | | √ |
| Boost Current | | | √ |
| Float Current | | | √ |
| Load Current | | | √ |
| Battery Room Temperature | | | √ |

6.17 PROTECTION AND ANNUNCIATION:

Following protection with alarm indicating lamps and alarm accept push button and lamp test push button shall be included in the scope of supply.

i) Load under voltage relay
ii) DC Earth leakage relay.
iii) Float charger failure
iv) AC mains failure
iv) DC over voltage relay for battery protection.

v) Boost charger failure.
vii) HV phase fail/phase sequence reversal protection.
viii) Semiconductor Fuse fail - Float
ix) Semiconductor Fuse fail - Boost

## 7.0 TESTS

7.1 Type Tests:-The bidder shall have to submit along with their Tender documents, as pre requisites, the complete Test reports of all tests including Type tests as stipulated in the relevant IS / IEC, carried out within 5 years from the date of tender, from CPRI / NABL accrediated / Govt. recognized Test house or Laboratory on the offered item, failing which their offer may not be technically accepted.

7.1.1 If the bidder fails to produce the said documents on the offered item during submission of tender, he/she will have to submit the said type test report after placement of order but before inspection of 1st lot of material at his own cost.

7.1.2 The following tests shall constitute the type tests as per IS: 3136-1965, IS:4540-1968 (latest amended) and IS 2026 (for short circuit test) :

a) DC voltage current test.
b) Automatic voltage regulator operation.
c) Efficiency test.
d) Ripple Voltage test.
e) High Voltage test.
f) Temperature rise test.
g) Degree of Protection test.
i) Short circuit test at No Load and full Load at rated voltage for sustained short circuit.

7.2 List of Routine Tests as follows:-

Physical checking of charger as per approved drawing.

- Insulation resistance test.
- High voltage test.
- Line regulation test at No Load and full load in test at load in Float/ boost mode.
- Full load ripple content measurement test at load terminals in float and boost mode
- Voltage regulation test at load terminal and Battery terminals in float and boost mode.
- DC short circuit test without blowing HRC fuses and without tripping MCBs at load terminal and also at Battery charger output terminals with observation of total current limit.

- Efficiency measurement test.
- Checking of automatic operation Float to Boost, Boost to float mode as per Battery condition.
- Checking of Battery voltage, load voltage and Load current Boost Mode at different charging current.
- Temperature rise test of complete charger at full load
- Checking of battery &Load Terminal voltage in manual Mode operation at different position of Manual Mode Selector Switch.
- Checking of automatic connection of Battery to load in case of "Mains Failure" or Charger Trip" conditions. Checking of Float voltage setting range and Boost current setting Range in Automatic Mode. Any other routine test shall be carried as per IS: 4540 on the complete battery Charging equipment.

**GUARANTEED TECHNICAL PARTICULARS FOR 110V, 45 A (30A+15A) BATTERY CHARGER SUITABLE FOR 110 V 150 AH LEAD ACID BATTERY**

| Sl. No. | Description | Particulars |
|---|---|---|
| 1 | Name of manufacturer | |
| 2 | Type of charger | |
| 3 | Indicate specification to which the offered charger conforms | |
| 4 | Rated Input supply voltage | |
| 5 | Rated Input current | |
| | Input Power Factor | |
| 6 | Output voltage with range of variation | |
| 7 | Output current range | |
| 8 | Output current<br>a)Max. Battery charging current<br>b) Max. continuous DC external load current<br>c)Max. continuous output current | |
| 9 | Output voltage Regulation<br>a)No load<br>b)Full load | |
| 10 | Ripple factor | |
| 11 | Efficiency | |
| 12 | Method of Cooling | |
| 13 | Painting details | |
| 14. | Whether separate terminals of M-12 size for connecting load and charger leads to the battery terminals has been provided. | |

| | | |
|---|---|---|
| 15 | Provision of LEDs for indication purpose | |
| 16 | Provision of Audio/Visual alarm | |
| 17 | Provision of labels for individual components | |
| 18 | Provision of ferrules | |
| 19 | Provision of separate terminals for connecting battery and load | |
| 20 | Provision of two separate Earthing terminals | |
| 21 | Weight of the complete charger | |
| 22 | Overall dimensions of battery charger | |
| 23 | Thickness of the sheet enclosure | |
| 24 | Make and rating of Miniature Circuit Breaker for AC Input supply | |
| 25 | Make & rating of main transformer | |
| 26 | Make and type of rectifiers CR | |
| 27 | Rating of rectifier SCR in Amps | |
| 28 | PIV value of rectifier diode | |
| 29 | Output in Amps of complete rectifier stack | |
| 30 | Make, Type & range of Voltmeter | |
| 31 | Expected service life of Charger | |
| 32 | Commitment for availability of spares during service life | |
| 33 | Applicable Standards | |
| 34 | List of accessories to be provided with the Charger | |
| 35 | Recommended particulars of matching Battery | |
| 36 | Technical particulars of different components including make, type and rating | |
| 37 | Description of operating principle of Auto/Manual float cum boost charger with functions of different components supported by drawing and block diagram | |

- **TECHNICAL SPECIFICATION FOR 110V, 150 AH LEAD ACID BATTERIES**

1. GENERAL REQUIREMENTS:

The system requires a reliable and uninterrupted D.C. supply for supplying D.C. Power to emergency lights, closing and tripping coils of circuit breakers, relays etc.

The chargeable batteries shall be Plante type. The end cell voltage after discharge shall be limited to 2.0 volts/cell. Batteries shall not require any water topping up and shall emit no corrosive fumes or gases under normal operating conditions.

The batteries shall be supplied along with the necessary mounting racks or sheet steel enclosure complete with the provision for clamping the cables. Battery racks shall be of steel frame with epoxy painted/ PVC lined.

2. REQUIRED PARAMETERS :

2.1 The terminals of the battery shall be suitable for receiving cable lugs.

2.2 The device shall be installed in indoor location to provide auxiliary DC Power Supply for following applications:

a) Emergency lighting
b) Circuit breaker/switchgear/protective relay operations
c) Equipment supervision indication
d) Audio visual annunciation

Under normal conditions, auxiliary DC Power Supply for continuous load will be met from Battery Charger and storage batteries should be kept under float or boost charging condition. But in case of Circuit Breaker/Switchgear/Protective Relay operation and/or in the event of failure of incoming power supply to Battery Charger, required auxiliary DC Power supply shall be met from Storage Batteries.

2.3 The standard ratings of batteries shall be 110 Volts DC, 150 AH mentioned.

2.4 The nominal voltage of a single cell shall not be less than 2 volts at the beginning of Charging. The FLOAT charging voltage per cell shall be within 2.15 volts to 2.3 volts. The BOOST charging voltage per cell shall be 2.35 V to 2.75 V. At the end of the charging, cell shall be floated easily around 2.25 volts without causing adverse corrosion or loss of water.

2.5 Range of charging current and final cell voltage

- Range of Float charging : 100 mA to 500 mA
- Starting current – 21 Amp,
- After discharging, final voltage shall not be less than 1.85 volts.
- Dimensions of each cell : 310 mm (L) X 195 mm (W) X 450 mm (H)
- Approx. weight of each cell (Dry Battery) : 41 KG.

3. DESCRIPTION :

3.1 The Electrolyte shall be of battery grade sulphuric acid.

3.2 Main Components of each cell

3.2.1 Positive & Negative Plates -

The positive plates of cell shall be constructed by heavy duty lead alloy grids type, the plates shall be corrosion resistant & shall have low self discharge properties

3.2.2 Plate Connections -

The plug of the plates of like polarity shall be connected to terminal post for external connections. Suitable plastic buffer, moulded bottom plate support shall be used for holding plates in proper position.

3.2.3 Separator -

The separators shall be constructed from highly micro-porous and rigid material of appropriate shape. Separators shall be inert chemically and shall prevent internal short circuit and shall ensure minimum internal resistance.

3.2.4 Terminal Posts -

The positive and negative terminal posts shall be clearly and indelibly marked for easy identification. The terminal posts shall be sealed properly with the lid by rubber grommets or other suitable device. The terminal posts shall have provision for inter- cell/outgoing cable connections.

3.2.5 Container -

Each cell shall be assembled in high grade, flame retardant polymer or moulded hard rubber container. The container shall be leak proof, non-absorbent, shock absorbing not liable to deformation within the range of working temperature and not affected by the acid. Electrolyte high-level and low-level lines shall be marked on at least two of the four sides of a cell and visible from the front of the completed assembly. A permanent airtight seal shall be provided between the cover & container to stop electrolyte &air leakage. The container shall be designed to withstand the pressure caused by charging & discharging characteristics of the battery.

3.2.6 Cell Lid -

Cell lid for covering cell container shall be made from high quality non-corrosive plastic, glass or ebonite complete with either suitable rubber gasket for closed type or bituminous sealing compound for sealed type of containers.

3.2.7 Vent Plug -

A vent plug of suitable design shall be provided on each cell lid. The vent plug shall have a micro-porous plastic alloy/ceramic filter which will prevent escape of acid fume/spreading of acid fume but will allow free exit of oxygen and hydrogen generated in the process of charging.

3.3 Other components of Battery

3.3.1 Cell pillars and connectors :

Cell Pillars and connectors shall be made from highly conductive material of lead allow having generous cross section ideally suited for high current duties. Bolts, nuts, washers etc. for connecting the cells and connectors shall be coated with anti-corrosive highly conductive material.

3.3.2 Battery Stand

The stand for supporting battery cells shall be provided. The stand for battery cell shall be of Mild Steel finished with at least three coats of anti-sulphuric paints of approved shade. The racks shall be free standing type. Suitable porcelain/plastic insulators shall be provided

between the stand and the battery room floor. Number plate to designate each cell of battery shall be provided and shall be attached on the rack. Provision shall be made for clamping outgoing cable on the rack. The cell shall be supported on the rack in suitable row and tier formation with adequate clearance between adjacent cells.

3.3.3 Polarity Marking

The polarity marking of the terminals shall be marked for identification. The positive terminal may be identified by "P" or (+) sign and red colour mark and the negative terminal may be identified by "N" or (-) and blue colour. Terminal marking shall be permanent and non-deteriorating.

4. TEST :

All tests shall be carried as per the relevant standard. Test shall comprise of Routine tests and Acceptance Tests.

4.1 Routine Test :

These are to be performed at manufacture's works and shall include the following test:-

- Verification of constructional requirement.
- Verification of marking.
- Verification of dimensions.
- Test for capacity.
- Test for voltage during discharge.
- Ampere hour and watt – hour efficiency test.
- Test for loss of capacity on storage.
- Endurance test.

4.2 Acceptance Test:

These tests shall be performed in presence of purchaser representative from the sample selected from the lot offered for supply.

- Verification of constructional requirement.
- Verification of marking.
- Verification of dimensions.
- Test for capacity.
- Test for voltage during discharge.
- Ampere hour and watt – hour efficiency test.

**GUARANTEED TECHNICAL PARTICULARS FOR 110V, 150 AH LEAD ACID CELL BATTERY**

| Sl No. | Particulars | Details | | |
|---|---|---|---|---|
| 1. | Name and Address of the Manufacturer | | | |
| 2. | Application standards | | | |
| 3. | Type & Designation as per standards | | | |
| 4. | Manufacturer's type and designation | | | |
| 5. | Capacity and voltage at 27 ◦C<br>a)At 10hrs. rate of discharge<br>b)At 5hrs. rate of discharge<br>c)At 3hrs. rate of discharge<br>d)At 1hrs. rate of discharge<br>e)At 1minute rate of discharge | AH | WH | FINAL VOLTAGE |
| 6. | Cell details<br><br>a) No. of cells per battery<br>b)No. of positive plates per cell<br>c)Total no. of plates per cell:<br>d)Type of positive plate:<br>e)Type of negative plate:<br>f)Surface area of plate in sq.mm:<br>g)Construction details and dimensions of<br>i) Positive plate<br>ii) Negative plate | | | |

| | | |
|---|---|---|
| | h) Rated current of each positive plate:<br>i) Construction details of separators including thickness, type and material<br>j) Container details:<br>i) Material of container<br>ii) Overall dimensions of container in mm<br>: Length<br>: Width<br>: Height<br>k)Overall dimension of cell in mm<br>(including Cell height)<br>l) Weight of each of cell in kg.<br>a) Without Acid<br>b)With acid<br>m)Clearance in mm between:<br>i) Top of plates and top of container<br>ii)Bottom of plates & bottom of container<br>iii) Edges of plates & inner surfaces of container<br>n)Cell Lid details:<br>i)Material<br>ii)Type<br>iii)Feature | |
| 7. | Electrolyte details:<br>i) Applicable standard of electrolyte | |
| | ii) Quantity of Electrolyte & Specific gravity at 27°C for first filling in each cell<br>iii) Quantity of Electrolyte required for 55 nos. Plante type lead acid cell plus 10% extra<br>iv) Specific gravity of electrolyte at 27°C with all cells fully charged<br>v)Specific gravity of electrolyte at the end of 10 hour of discharge rate | |
| 8. | Cell Pillars & Connectors:<br>i) Material<br>ii) Type<br>iii) Dimension details in mm<br>iv) Details of inter row inter tier connectors including bolts, nuts and washers. | |

| | | | |
|---|---|---|---|
| 9. | Battery Stand:<br>1) No. of racks per battery<br>2) No. of cells per rack<br>3)Formation of row and tier details<br>4)Material of stand<br>5) Particulars of anti-sulphuric paint to be provided<br>6) Type and no. of stand insulator to be provided | | |
| 10. | Nominal cell voltage in volts: | | |
| 11. | Recommended rate of first<br>Charging battery cells<br>1)Current in amps<br>2)Voltage in volts | Start | Finish |
| | 3) Total minimum input during<br>Initial charging in AH | | |
| 12. | Recommended float charge rate | | |
| 13. | Recommended float charge voltage Across the battery terminals | | |
| 14. | Recommended boost charge<br>voltage across the battery terminals | | |
| 15. | Guaranteed AH efficiency at 10hr. rate of discharge | | |
| 16. | Guaranteed WH efficiency at 10hr. rate of discharge | | |
| 17. | Internal Resistance of charged cell in milli ohm | | |
| 18. | Resistance of the charged battery<br>Including inter connect or between the cell in ohms | | |
| 19. | Short Circuit Current for dead<br>short circuit across the battery terminals when<br>1)Battery in floating mode<br>2)Battery in boost charge mode | | |
| 20. | Cell voltage characteristics curves during charging at 0.5, 1.0 and 1.5 times normal rate | | |
| 21. | Battery layout arrangement | | |
| 22. | List of accessories to be provided<br>With battery | | |

- **TECHNICAL SPECIFICATION FOR D.C. DISTRIBUTION BOARD**

1.0 STANDARDS:

Components mounted on the DCDB shall confirm to the latest revisions of the following standards:

| | | |
|---|---|---|
| A | IS:13947 | Degree of protection provided for enclosure for low voltage control gear and switchgear & MCCB |
| B | IS:13947/1993 Part-III Amended upto date | Switch ,Fuse, Disconnector unit |
| C | IS2705amendedupto date | CTs |
| D | IS 8828/1996amended | MCB |
| E | IS 1248 | Indicating instruments |
| F | IS375 | Wiring |
| G | IS:13703/1993 Part-I&II | HRC Fuses |

2.0GENERALTECHNICALPARTICULARS:

2.1 Rated Voltage:

Rated voltage for the Distribution Board and its constituent items like Switch, Fuse, Disconnector unit ,MCBs, busways etc. shall be single phase 2 wire D.C. 110 volts. The supply voltage may vary by ±10% of rated voltage. All the equipments used in the Board shall operates satisfactorily at this voltage variation.

2.2 General Requirements:

2.2.1 Each Distribution Board shall be free standing floor mounted having compact design. The Board shall be closed, dust protected, weather proof and shall be made vermin proof with a special type lining e.g. Neoprene gasket, around the edges of the doors. The distribution board shall comply degree of protection IP43. MCBs shall be operating vertically upward for ON/OFF operation. The entire distribution board shall have uniform finish and shall be sturdy. The distribution boards shall be of modular construction with provision for complete compartmentalisation of all feeders. It shall be free-standing, dead front type comprising dust-tight and vermin proof sheet steel cabinets suitable for indoor installation. The doors of cabinets shall be lockable. Handle shall be made o reputed make. The DB shall be provided with double door in front having 2 nos. hinges which should be suitable for movement of 120degree and 2no. knobs to be provided on the door corners. All instruments and control devices shall be mounted on the front of cabinets and fully wired to the terminal

blocks. All switches provided on the distribution board shall be on front side of the cabinets, operable from outside.

2.2.2 Distribution Board hall be made out of at least 2.0 mm thick cold rolled steel sheet, suitably reinforced to provide flat level surface. Size 1200(H)x1000(W)x450(D)mm. Gland plate shall be 3.0mm thick. No welds, rivets, hinges or bolts shall be visible from outside. The doors shall be fitted with double leaf neoprene rubber gaskets.

2.2.3 All cables shall enter and leave from bottom. Suitable cable terminal blocks with cable lugs shall be provided inside each cabinet for the incoming and outgoing cables. The terminals shall be serially numbered to facilitate installation and maintenance. Main busbars shall be accommodated in busbar chambers and cable alleys arranged by the inside. Compression type cable glands shall be provided to hold the cables to avoid any pressure or tension on the terminal block connections. The terminal blocks shall be easily accessible for inspection and checking. Panels hall have cable supports and metallic clips for supporting power and control cables for internal wiring of the panels.

2.2.4 DCDB should have 2 sets of Bus Bars in Two separate compartments to facilitate termination of Incomers from Battery and Chargers. One Change over switch should be provided to facilitate DC supply to outgoing load circuit in the event of failure of anyone of the battery/ Charger. The change over switch should be 2 way 2 position for changing over of both incomer individually.
Each Busbar shall consist of tinned electrolytic copper of cross-sectional area of a minimum of 25mmx3mm, suitable for carrying rated continuous current without temperature exceeding 85°C. The busbars shall be continuous throughout each section. The busbars shall have current rating to suit the requirements corresponding to the loads incident there on under the various operating conditions and shall withstand the applicable voltage and maximum short circuit stress. The busbars shall be insulated from supporting structure by means of durable non-hygroscopic, non-combustible and non-tracking polyester fibre glass material or porcelain. Busbars shall be encased separately in heat- shrunk sleeves of insulating material which shall be suitable for the operating temperature of busbar during normal service. The busbars joints shall be provided with removable thermosetting plastic shrouds.

The busbars shall be housed in totally separated enclosed busbar chambers. The incoming connections from the busbars to the various feeders shall be so designed as not to disturb cable connections and to ensure safety to the operating and maintenance personnel and to facilitate working outside any outgoing module without the need for switching off in-feed to the adjacent modules, as far as possible. The busbars shall be of high conductivity, adequate uniform cross-section and current density shall be there.
A cable alley preferably 230mm wide shall be provided in each vertical section for taking cables into the compartments.

2.2.5 All doors shall be provided with mechanical interlocking arrangements along with keys. The distribution board shall have no door on rear side.

2.2.6 Danger board (Caution Plate) shall be fitted suitably on inner door of the DB. Danger board shall be of 100x100mm size with details as per WBSEDCL standard format.

2.2.7 The DC boards shall be provided with the following equipments wherever applicable:

i. Single bus arrangement with provision for one set of +ve and –ve connected to Charger. Busbar shall consist of tinned electrolytic copper.
ii. Terminal arrangement with necessary equipment for connecting the incoming supply.
iii. Voltage and current measurement in the incomer feeder.
iv. Outgoing modules with switch/MCB units of adequate capacity for the outgoing feeders and 20% spare feeder units of each rating.
v. Necessary cable glands and terminal blocks.
vi. Adequate number of spare terminals on terminal blocks for receiving connections for external connections.
vii. The number of outgoing feeders from DC boards shall be such that each substation equipment is fed by separate feeder with 20% as spare.

2.2.8 The ventilating louvers should be covered from inside by a perforated sheet.

2.2.9 All sheet metal used for DB shall under goes even tank mechanical/ chemical cleaning process & painting shall be done using powder coating process. Colour of the Paint shall be RAL 7032 type.

3.0 MAJOR COMPONENTS:

3.1 Incoming cables for DCDB shall be terminated on terminal connectors provided at the bottom. Connection between incomer terminals and MCBs shall be with 50 sq. mm copper cable. Outgoing shall be connected with 35 sq.mm copper cable.
All MCBs, cable used in the DB shall be of reputed make and ISI marked.
DCDB should have 1 set of BusBar in a compartments to facilitate termination of Incomers from of Battery and Charger.

3.2 Incoming circuit:
Two double pole MCBs of 63 Amps capacity shall act as Incoming breaker of load bus. Changeover switchof63 Amps DP is to be provided.

3.3 Outgoing Circuits:

| Sr. No. | Feeder Rating | Cable size | Source-1 | Source-2 |
|---|---|---|---|---|
| 1. | Double pole DC MCB 32A, | 2core 16 sq. mm LT PVC cable | 04 nos. | 04 nos. |
| 2. | DP 16 A MCBs, | 2core 10 sq. mm LT PVC cable | 08 nos. | 08 nos. |

3.3.1 Total 24 Nos. outgoing circuits shall be provided.
MCBs shall comply following specifications as per IS8828/1996.

a)Rated current shall be 32A/16A as mentioned above.

b)Rated short circuit capacity shall be min.6KA at 0.8p.f. lag

c)Service short circuit capacity shall be 6KA as per table 15 of IS:8828/1996.

d)MCBs shall have fixed un adjustable time/current characteristics.

e) Under voltage release and shunt-trip release coils are not required. Only over load release and short circuit release shall be provided.

f)Tripping time shall be as per (clauseNo.8.6.1) table 6 of IS: 8828/1996.Tripping mechanism thermal magnetic type.

g) MCBs having precision moulded case and cover of flame retardant high strength thermo plastic material with high melting point, low water absorption, high dielectric strength and temperature with stand capacity shall be capable of carrying out given no. of operation cycles as per clause No. 9.11 of IS:8828/1996.

h) Limits of temperature rise shall be as per (clauseNo.9.8) table 5 of IS:8828/1996.

i) Standard range of instantaneous tripping shall be type 'B' as per (clauseNo.5.3.5) table 2of IS:8828/1996.

3.3.2 All MCB outgoing terminals shall be terminated on terminal connectors of 10 mm. stud type provided at the bottom.

3.3.3 The enclosure shall be provided with proper earthing

3.3.4 PVC cable glands of adequate size shall be provided for all incoming and outgoing cables.

3.3.5 The moving contacts of all poles of multi-pole circuit breaker shall be so mechanically coupled that all poles, except the switched neutral, if any, make and break substantially together. Whether operated manually or automatically even if an overload occurs on one protected pole only.
Both side terminal should be suitable for direct cabling as well as bus bar connection and should take wire upto cross-section area of 25 sq.mm.

Detailed specification is tabulated below:-

| | |
|---|---|
| Standard | IS:8828:96 & IEC:60898:2002 |
| Type/Series | B&C |
| Rated Current (DC) | 20A for SPN, 36A for DP |
| Rated Voltage (DC)Volt | 110 |
| Rated short circuit breaking capacity kA | 10 |
| Ambient temperature (degC) | -5 to+55 |
| Protection class | IP-20 |

3.3.6 Alarm Relays-

i. One Mains failure Alarm relay.
ii. One Earth Fault alarm relay
iii. One 110 Volt DC Bell to be operated by the Mains failure alarm relay.
iv. One 110 volt DC Buzzer to be operated by the earth fault alarm relay.

3.3.7 AC/DC Change Over Contacts

Emergency lighting circuit shall be provided such that the lights normally burn on AC 240Volts, 50 Hz but in case of failure of AC supply, these come upon DC

supply with the help of automatic changeover contactors and again changeover to AC supply with the restoration of AC supply. There shall be two number double pole ON/OFF switches with HRC fuses one each for AC and DC supply.

3.4 Indicating Instruments:

Principal requirements of indicating instruments are as follows:

3.4.1 D.C Ammeter:

Ammeter shall comply the following requirements

| | |
|---|---|
| Class of accuracy | 1.0 |
| Range | 0-75 Amps |
| Mounting | Flush type |
| Size | 96 x96mm |
| Type | Analog |

3.4.2 D.C Volt Meter:

Voltmeter shall comply the following requirements

| | |
|---|---|
| Class of accuracy | 1.0 |
| Mounting | Flush type |
| Size | 96x 96 mm |
| Range | 0-130volts |
| Type | DC moving coil |

3.4.3 Indicating Lamps:

Indicating lamps shall be panel mounting type 23 mm with rear terminal connections having low wattage LEDs cluster type. Lamps shall have translucent lamp covers to diffuse lights, coloured red for 'DCON' condition. The lamp cover shall be preferably of screw-on type, unbreakable and moulded from heat resisting fast coloured material. Conventional bulbs are not acceptable.

Necessary wiring shall be provided accordingly.

3.4.4 MARKING

Each compartment shall be provided with legible and indelibly marked/engraved nameplate. Nameplates shall be white with black engraved letters. On top of each module, nameplates with bold letters shall be provided for feeder designation. Each device shall also suitably marked for identification inside the panels. Name- plates with full and clear inscriptions shall be provided inside the panels for all isolating switches, links, fuse blocks, test blocks and cable terminals. Every switch shall be provided with a nameplate giving its function clearly. Switches shall also have clear inscriptions for each position indication e.g. 'ON''OFF' etc.

3.4.5 Earthing Arrangements:

Two nos. Earthing studs of galvanized M.S. 25X6mm shall be provided for external earth connections at the bottom. These should be complete with plain

washer, spring washer, nuts etc. Earthing Bolts must be welded to prevent removal of the same from the cabinet.

Flexible stranded copper connector (braided conductor) should be connected of copper equivalent 10 sq. mm. size between door and box enclosure. This flexible braided cable should be terminated using gland and proper size nut/bolts at both ends.

3.4.6 Mounting Clamps:

The DCDB box are to manufacture with suitable mounting arrangement on wall/steel support by means of 4nos.25X6mm size clamps having hole dia.14mm,fixed over the body.

3.4.7 Gland Plate:

The removable gland plate should be provided in the lower portion of the box to accommodate all brass glands (according to requirement) for incoming and outgoing cables.

3.4.8 Name Plate:

Aluminium sheet 2mm engraved with details should be provided duly refitted over front door.

a. DC Distribution Box
b. P.O No.
c. 'Property of WBSEDCL'

4.0 CONTROL WIRING

DCDB shall be furnished completely factory wired up to terminal blocks ready for external connections.

All wires shall consist of 1100V grade PVC insulated flexible trended copper wires with a cross-section of 2.5 sq. Mm suitable for switchboard wiring and complying with the requirement of relevant IS. Each wire shall be a ran identifying ferrule or tag at each end or connecting point.

Control cables for external connections shall consist of stranded copper wire with 4.0sq. Mm or higher cross-sectional areas and shall enter the bottom.

All inter connecting/outgoing control wiring shall terminate on stud type terminals on terminal blocks. The terminals shall be marked with identification numbers to facilitate connections.

The terminal blocks shall be made of moulded, non-inflammable, plastic material and arranged to provided maximum accessibility for inspection and maintenance. All terminal block shall have transparent plastic cover.

The terminals shall be made of hard brass and diameter of not less than 6mm.The studs shall be securely locked within the mounting base to prevent turning. The terminal blocks shall be provided with twenty(20) percent spare terminals. The terminals shall be suitable for connections through tinned copper crimped lugs.

Wiring shall be complete in all respect to ensure proper functioning of the control, protection and monitoring scheme.

Each wire shall be identified at both ends with permanent markers bearing wire numbers as per wiring diagram.

5.0 TYPE TEST CERTIFICATES:

MCBs & other components used in DCDB shall be fully type tested as per relevant IS and this specification.

All the Type Tests shall be carried out from laboratories which are accredited by the National Board of Testing and Calibration Laboratories (NABL) of Government of India such as CPRI Bangalore/Bhopal, ERDA Baroda, to prove that the MCBs & other components used in DCDB meet requirements of the specification.

**GUARANTEED TECHNICAL PARTICULARS OF DCDB**

| Sr. No. | Parameter Name | |
|---|---|---|
| 1. | Enclosure fabricated from M.S sheet of2.0 mm thickness | Y/N |
| 2. | All sheet metal work has undergone & tank chemical processing and powder coating | Y/N |
| 3. | Colour of enclosure from inside is white | Y/N |
| 4. | Colour of enclosure from outside is as per RAL 7032 | Y/N |
| 5. | Busbar is of electrolytic tinned copper of size 1.6 A/sq. mm with 200A rating and without joints. | Y/N |
| 6. | Make and type of switch Fuse Disconnector Unit | Y/N |
| 7. | No. of 1ph 36 ADP MCBs provided | Y/N |
| 8. | Make and type of 1Ph36 ADP MCBs | Y/N |
| 9. | No.of 1ph 16 ADPMCBs provided | Y/N |
| 10 | Make and type of 1Ph16 ADPMCBs | Y/N |
| 11 | All MCBs are type tested and having short circuit rating of Min. 6KAat0.7 pf lag | Y/N |
| 12 | Ammeter is having range of 0-75A And accuracy class 1.0 | Y/N |
| 13 | Make and type of Ammeter | Y/N |
| 14 | Voltmeter is having range of 0-130V And accuracy class 1.0 | Y/N |
| 15 | Make and type of voltmeter | Y/N |
| 16 | Indicating lamps are of LED type with 22.5 mm dia. | Y/N |
| 17 | Wiring between MCBs and terminal connectors is with specified stranded copper wire as per specification | Y/N |
| 18 | Terminal connectors are of bolted type provided as per specification | Y/N |
| 19 | Detachable gland plate is provided with knock out type arrangement for providing cable glands at the bottom | Y/N |
| 20 | Cable glands as per requirements provided separately | Y/N |