



SECTION – 2.10

DC SYSTEM

1.0.0 INTRODUCTION

This section covers requirement of 110V DC system for 20MW/120MWh Vanadium Redox Flow Battery project in GIPCL complex.

2.0.0 SCOPE OF WORK

2.1.0 The scope of work shall include the following equipment.

- Two sets of 110V (Bank of 2.0 V cells), Lead acid SAN container tubular batteries (OPzS O = Ortsfest (stationary) Pz = PanZerplatte (tubular plate) S = Flüssig (flooded)) complete with electrolyte, FRP racks, consumables and all accessories.
- Two numbers 110 V DC – Float Chargers.
- Two numbers 110 V DC – Float Cum Boost Chargers
- Two number of enclosures (Sheet Metal) containing required MCCB's for cables to batteries and discharge resistors. Location of this enclosure shall be at battery room.
- Discharge resistor cubicle suitable for carrying out the discharge tests.
- Two numbers of DC with Tie arrangement as shown in the tender drawing.

2.2.0 Each 110 V DC system shall be sized to feed following equipment in the Substation.

- Control power requirements of Pooling Substation equipment and C&R panels
- Control power requirements 11kV switchgear of MCR and BESS Plant at B-Plot area..
- Control power requirements of LV system
- Power requirement of UPS / UPS's.
- Any other 110 V DC required for BESS Plant at B-Plot area.
- Communication system including FOTE panel

2.3.0 Conceptual Single line diagram for the 110 V DC system is shown in the enclosed tender drawing.

2.4.0 Motorized MCCBs specified / required for DC system as mentioned in this section may be substituted with DC contactors, provided that equivalent functionality is ensured, including short-circuit, overload protection, auxiliary contacts, indications and pushbuttons for ON / OFF operations. For detail specification of Cables, Glands, Lugs, terminal Blocks, painting etc. Bidder / sub vendor is requested to refer relevant section of this tender document.

3.0.0 CODES AND STANDARDS

The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest version of the relevant IS / IEC / IEEE standards including amendments, if any, except where modified and /or supplemented by this specification. Some of the applicable standards are listed below:

- | | |
|---------------|-------------------------------------------------------------------------------------------------------------------|
| a) IEEE: 485 | Recommended practice for sizing for large lead storage batteries for generating stations and substations. |
| b) IS : 14782 | Code of practice for maintenance and testing of large lead- acid batteries for generating systems and substations |
| c) IS : 266 | Specification for sulphuric acid. |
| d) IS : 1146 | Specification for rubber & plastic containers for lead acid storage batteries |
| e) IS : 1651 | Specification for stationery cells & batteries, lead acid type with tubular positive plates. |
| f) IS : 3116 | Sealing compound for lead acid batteries. |
| g) IS : 8320 | General requirements and methods of tests for lead acid storage batteries. |



h) IS : 6071 Specification for synthetic separators for lead acid batteries.

4.0.0 TECHNICAL REQUIREMENTS

4.1.0 General

4.1.1 Vendor shall carry out sizing calculations and provide required rating (Including future panels where only space provision mentioned) . After finalization of rating by calculations (including design margins), additional 15% margin shall be added to the final calculations.

4.1.2 The maximum voltage variation allowed at the load end shall be +10% to -15% at all operating conditions for both DC systems.

4.1.3 Short circuit withstand rating of the DCDB shall be as follows:

- 110V DCDB : 25 kA for 1 sec

4.1.4 The 110V DC system shall be unearthed. A DC earth monitoring system shall be provided for the 110V DC system and alarm shall be given on the occurrence of an earth fault.

4.1.5 110 V DC systems shall have a battery backup time of minimum of Ten (10) hours when AC supply to chargers fails.

4.1.6 The battery shall normally be permanently connected to the load in parallel with charger.

4.1.7 Each charger shall be fed from a dedicated feeder. Power supply to the chargers shall be derived from the Substation 415 V, 3-phase LT panel located in the MCR. Looping of feeders for FC and FCBC chargers shall not be permitted.

4.2.0 Battery charger

4.2.1 Battery charger shall be SMPS modular type. SMPS modules shall be hot swappable type.

4.2.2 Float modes of Float Charger + Float Cum Boost Charger shall be sized for the following:

- Continuous normal DC power requirement.
- Trickle charging of battery.

4.2.3 Boost mode of Float Cum Boost charger shall be sized to boost charge the fully discharged battery to its normal capacity in a period of 8 hours.

4.2.4 In case of mains failure to charger or charger failure, battery will supply the full load. After the restoration of supply, selected boost charger will boost charge the battery and the selected float charger will supply the DC load. On resumption of mains supply charger shall restart automatically if auto restart mode is selected.

4.2.5 A design margin of 10% will be considered in selecting the rating of chargers. Higher of the float charging rating and boost charging rating is considered for sizing the FCBC Charger.

4.2.6 SMPS Charger shall have following features:

- Pulse width modulation
- High frequency DC/AC converting
- Voltage stabilization tolerance: $\leq \pm 0.5\%$
- Current stabilization tolerance: $\leq \pm 0.5\%$
- Ripple coefficient: $\leq 0.05\%$
- Power factor: ≥ 0.92
- Efficiency: $\geq 92\%$
- Standby mode: N+2 module online
- MTBF: $\geq 100,000\text{h}$



- Remote control and monitoring functions with appropriate communication interfaces to enable seamless integration with SCADA / SAS / EnMS systems, including all necessary hardware, protocols, and configurations.
 - Modular Design
 - LCD Control Display Panel and HMI
 - Multi-Point Monitoring
 - Software Programmable (PLC Based)
 - AC Ripple < 0.5%
 - Dynamic Response <100 micro. sec.
 - THD < 5%
 - Enhance earth fault monitoring for ungrounded system
 - Tunable Output
 - Intelligent float boost & equalize charging
 - Temperature compensated charging
 - Calculating battery charge/ discharge capacity
 - Discharge calculation with K factor & temperature compensation
 - Total control on each charging module
 - Storing historic alarms
 - Ground fault identification for ungrounded system
 - Both positive & negative earth fault monitoring
- 4.2.7 The float charger will be normally ON, supplying the D.C. load and at the same time trickle charging the battery. FCBC shall be suitable for float charging as well as boost charging the battery. Each battery charger shall be capable of float charging the battery supplying the station normal DC load. Design shall be such that in case the load exceeds the charger capacity, the excess load current shall be supplied by the battery.
- 4.2.8 During float charging, the charger shall feed the respective bus section of DC Distribution board and as well as float charge its own batteries and shall maintain a DC voltage that will pass the minimum current through the cells to keep them charged without overcharging. In case of mains failure to charger or charger failure, battery will supply the full load. In case charger failure, the other charger shall feed both the bus section of DCDB and as well as float charge the battery. After restoration of AC supply, the fully / partly discharged battery shall be charged by boost charger and float charger continue to feed DC load.
- 4.2.9 During boost charging, the battery charger shall operate on constant voltage/ constant current mode (when automatic regulator is in service). It shall be possible to adjust the boost charging voltage/current continuously over a range of 50 to 100 % of the rated output voltage/current for boost charging mode. The charger output voltage shall automatically go on rising, when it is operating of 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.
- 4.2.10 When on automatic control mode during float charging, the charger output voltage shall remain within + / - 1% of the set value for AC input voltage variation of + / - 10%, frequency variation of + 3 / - 5%, a combined voltage and frequency (absolute sum) variation of 10 % and a continuous DC load variation from zero to full load. Uniform and 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 float charging output range specified.
- 4.2.11 For Interlocks and operational functionality reequipment bidder shall refer table given in the DC SLD .
- 4.2.12 All battery chargers shall be provided with facilities such as automatic voltage regulator (AVR) 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.

4.2.13 110 V DC system would be ungrounded and would float with respect to the ground potential when healthy.

4.2.14 Digital indicating meters (over and above parameters available on HMI / controller / remote monitoring) shall be provided on the front for DC system (chargers, DCDBs and to read the following.

- AC incoming voltage (3-Phase with VSS)
- AC incoming current (3-Phase with ASS)
- DC output voltage of chargers
- DC output current of chargers
- DC charge/discharge current of battery bank
- DC load voltage
- DC Bus Voltage
- DC load current
- DC leakage current
- Tie feeder DC voltmeters on Bus Side and outgoing side.
- Tie Feeder DC Current.

4.2.15 Remote monitoring of the following parameters shall be integrated with the SCADA/SAS/EnMS system. These parameters shall be acquired either through the DC system's communication interface or through installation of suitable transducers (4–20 mA, dual output) and potential-free contacts, as required.

Battery Charger

For each charger, either through the charger's communication interface or by installation of suitable transducers (4–20 mA, dual output)..

DCDB-1 & 2

DC load Voltages
DC load currents
DC Bus Voltages
Tie feeder current

Status Inputs

Off All MCCB's / MCB's and or contactors.
Battery Voltage High and Low

4.2.16 The following LED Status indications shall be provided as a minimum on the panel for each Charger.

- Battery status
- R, Y, B supply ON
- Float charger ON
- Boost charger ON

4.2.17 The following annunciations shall be provided as a minimum on the panel for each Charger.

- Charger overload
- Charger fail/trip
- DC output MCCB failure
- Positive grounded
- Negative grounded
- Battery fully discharged
- Battery on Boost.
- Battery Under voltage and over voltage
- Battery over current



- Battery MCCB Trip / OFF
- AC input supply failure
- AC MCCB Trip / OFF
- AC input under voltage
- AC input over voltage
- DC voltage low
- DC voltage high
- DC system earth fault for ungrounded system.
- SMPS module fail.
- Communication Error
- Any other required annunciation by purchaser / GIPCL during detail engineering.
- Annunciator shall have RS-485 communication and to be integrated with EMS or SCADA
- 4 Nos of spare annunciator window shall be provided for future use.

4.2.18 For remote SCADA indication/ Annunciation the following potential free contacts shall be provided for each Charger.

- DC system under voltage /over voltage
- Battery on Boost
- AC under voltage /AC Over voltage
- Charger fail
- DC earth fault
- Battery fully discharged
- AC Overload trip
- SMPS module fail
- Common charger trouble – 2 Nos of contact
- Any other required annunciation by purchaser during detail engineering.

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

- Short circuit release
- ON/OFF and Trip position indicators.
- On / Off and Trip position potential free contacts to be integrated HMI (Controller) & SAS
- Test trip push button
- Voltage rating shall be suitable for 110 volts AC/DC.

4.2.20 Control and selector switches shall be rotary or 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 provided.

4.2.21 The annunciation system shall have audio-visual arrangement and shall have LCD display. It shall also be provided with acknowledge, reset and test push buttons. On occurrence of fault, the corresponding LED lights up and stays in lighted condition until the fault is cleared and the reset push button is pressed.

4.2.22 Electronic equipment shall be of modular design consisting of plug in modules in standard 19 inches metallic racks with metallic card guides. 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.

4.2.23 The layout of charger components shall be such that their heat losses do not give rise to excessive temperature within the charger panel surface.



- 4.2.24 Chargers shall be metal enclosed, fixed type, suitable for indoor mounting on floor. Panel frame shall be fabricated using cold rolled sheet steel of thickness not less than 2.0 mm. The frames shall be enclosed by cold rolled sheet steel of thickness not less than 2.0 mm. At bottom removable gland plates (pre-drilled for cable entry) of at least 3 mm thick non-magnetic material shall be provided. All incoming and outgoing cables shall be terminated on suitable terminal blocks. Enclosure make shall be Rittal.
- 4.2.25 The charger panels shall be provided with an illuminating LED lamp, a 5 Amp socket and space heaters with thermostat. Toggle switches and MCBs shall be provided separately for each of the above fittings. 230V AC supply shall be brought from Station Service Board. Space heaters "ON" indication to be provided. Two separate grounding pads shall be provided for each panel suitable for connecting of 35x5 mm GI earthing strip.
- 4.2.26 The control wiring shall be 1.1 kV grade PVC insulated stranded copper conductors of minimum 1.5 sq. mm. Control wiring / termination at electronic cards shall not be less than 0.5 sq. mm. All terminals shall be numbered for case of connections and identification at least 20 % spare terminals shall be provided for circuits. Cable glands shall be of double compression type brass. Cable lugs shall be tinned copper. Size of external cables for connection to charger will be informed during detail engineering.

The panel shall be of sheet metal, enclosed, dust and vermin proof, conforming to IP 42 degree of protection. Battery charger shall be located in non-air conditioned room.

- 4.2.27 All Indoor equipment, panels and cabinets (Battery Chargers) shall be pre-treated as per IS 6005 before being factory-painted with epoxy based paint shade of paint shall be RAL 7035. The corrosivity grade specified in the tender shall be considered. Painting shall be carried out by approved process. Sufficient quantity of touch-up paint shall be furnished for application at site.

4.3.0 Discharge resistor and Battery MCCB & Discharge Test MCCB Panel/Enclosure located at Battery Room

A. Discharge resistor

- Discharge resistor shall be provided for individual battery banks (i.e. 2 Nos for each Battery banks) to carry out testing of the Battery and permanently connected to each bank with required MCCB.
- It shall consist of SS elements, voltmeter, ammeter with ampere selection switch (ASS) – fine & course based on battery discharge test requirements and rating.
- Ventilation of battery room shall be designed in view of heat dissipation of discharge resistor.
- The discharge resistor shall be adequately sized for charge - discharge cycle testing of different type & rating of batteries with necessary tapping. It shall be enclosed in sheet steel enclosure of at least 3 mm, having IP:31 degree of protection.
- Temperature rise shall be limited to 150 °C over 50 °C ambient.
- Additional spare SS elements of suitable quantity shall be provided.
- Discharge resistor enclosure paint shade shall be RAL 7035. The corrosivity grade specified in the tender shall be considered.
- Cable entry shall be from the bottom.

B. Battery MCCB & Discharge Test MCCB Panel/Enclosure located at Battery Room

- Battery is connected with charger by adequate capacity MCCB as shown in SLD. Also Battery Discharge test MCCB is provided in same enclosure. Panel/Enclosure with above two MCCB's shall be placed in battery room.
- Panel/Enclosure shall be wall mounted with wall clamps. Cable entry shall be from bottom. Removable gland plates (Pre-drilled) of suitable thickness shall be provided. Panel/Enclosure frame shall be fabricated using CRCA sheet steel of thickness not less than 2.0mm. The frames



shall be enclosed by CRCA sheet steel of thickness not less than 1.6mm. Suitable synthetic rubber gaskets shall be provided to make boards completely dust and vermin-proof with a degree of protection of IP55 for indoor installation. Panel shall be pre-treated as per IS 6005 before being factory-painted with epoxy based paint shade of paint shall be RAL 7035. The corrosivity grade specified in the tender shall be considered. Painting shall be carried out by approved process.

- MCCB shall be double pole type for battery outgoing and discharge test feeders. It shall be quick make, quick break, independent manual type with trip free feature. All MCCB shall have the following:
 - Short circuit release
 - ON/OFF and Trip position indicators.
 - On / Off and Trip position potential free contacts to be integrated to HMI (Controller) & SAS
 - Test trip push button
 - Suitable voltage rating for DC

4.4.0 Lead-acid tubular (OPzS) battery

- 4.4.1 Batteries shall be SAN container Lead-acid tubular (OPzS) type. (Type II, High discharge performance cell as per IS 1651)
- 4.4.2 Battery shall be sized considering ten (10) hour load cycle. Battery sizing and cell selection shall be based on IEEE. While estimating battery capacities the following shall be considered:
 - Maximum ambient temperatures & minimum site ambient temperatures
 - 10% design margin
 - An ageing factor of 1.25
 - 15% Future Load
- 4.4.3 The standard temperature used for stating cell capacity is 27deg C at a 10-hour discharge rate. The nominal voltage per cell shall be 2.0V. End voltage of cell shall be not less than 1.85V.
- 4.4.4 Battery racks / stands shall be of best quality FRP and single tier arrangement only. If required battery room size shall be increased to meet the requirement . Adequate space is available.
- 4.4.5 The electrolyte shall be prepared from battery grade sulphuric acid and distilled water.
- 4.4.6 Battery containers shall be made of transparent styrene acrylo nitrile (SAN) polymer. Containers shall be robust, heat resistance, fire retardant, leak proof, non-absorbent, acid/alkaline resistant, non-bulging type and free from flaws such as wrinkles, cracks, blisters, pin holes etc.
- 4.4.7 Batteries shall have thick plates designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuations of load. The tubular plate construction shall consist of high pressure cast lead alloy spines.
- 4.4.8 Transparent SAN containers shall have marked electrolyte level indicator on its body.
- 4.4.9 The separators shall maintain the electrical insulation between the plates and shall allow the electrolyte to flow freely. Separators should be suitable for continuous immersion in the electrolyte without distortion.
- 4.4.10 The cells shall be supported on FRP insulator fixed on to the rack with adequate clearance between adjacent cells.
- 4.4.11 The positive and negative terminals shall be clearly marked.



- 4.4.12 Vent plug shall be provided which shall be anti-splash type. It shall allow the gases to escape freely but prevent the acid spray from the battery.
- 4.4.13 Sufficient sediment space shall be provided beneath the plates to accommodate any plate deposit, which accumulates at the bottom of the cell over a reasonable life of battery without short circuiting the plates.
- 4.4.14 The following items shall be provided for the battery.
- Rack insulators
 - Cell insulators
 - Long/Short connectors
 - Inter row connectors (Insulated solid plated copper busbars)
 - Inter bank connectors (Insulated solid plated copper busbars)
 - Vent plug
 - Proper Battery take-off arrangements, and shall be finalized during detail engineering as per purchasers / GIPCL requirement.
 - Fasteners shall be supplied by Battery OEM
 - Cell number plates (On cells as well as on stand / rack)
- 4.4.15 Lead coated copper connectors shall be used for connectors. Bolts, nuts and washers shall be effectively lead coated to prevent corrosion. All the terminals and cells, interconnections shall be fully insulated or have insulation shrouds/covers. Connectors and all required hardware's shall be supplied by OEM of battery cell only.
- 4.4.16 The cell terminal posts shall be provided with connector bolts and nuts, effectively coated with lead to prevent corrosion.
- 4.4.17 End take off connections from positive and negative poles of batteries shall be made by single core cables having stranding class 4 copper conductors and shall be XLPE insulated. Necessary supports and lugs (Heavy duty long barrel copper lugs) for termination of these cables on batteries shall also be supplied. All connectors and lugs shall be capable of continuously carrying specified discharge current of the respective batteries and through fault short circuit current which the battery can produce and withstand for the period declared.
- 4.4.18 Lead-coated bent copper plate, tubular copper lugs, teakwood clamp, bolts, nuts, washers, etc. shall be furnished for connection of outgoing copper conductor cables.
- 4.4.19 FRP Racks / Stands shall be free standing type, mounted on porcelain insulators. Numbering tags for each cell shall be attached on to the racks as well as on the cells. The bottom tier of the stand shall not be less than 150 mm above the floor. Wherever racks are transported in dismantled conditions, suitable match markings shall be provided to facilitate easy assembly. It shall be noted by the Bidder that FRP stands are available in the market and are standardized by the Owner for all installations. Requests or deviations proposing alternative materials shall not be accepted during detail engineering.
- 4.4.20 Battery racks and other supporting/interconnecting accessories shall be as per layout arrangement to be approved by Owner during contract engineering stage.
- 4.4.21 Battery bank installation shall have minimum clearance of 1.2 meter between inter row and from all side (Walls, other battery bank etc.)
- 4.4.22 Following accessories shall be provided.
- Electronic Syringe type Hydrometer with temperature measurement and with built in memory suitable to measure up to 2 set of battery banks each of 60 cells.
 - Digital Multimeter with measuring probes.
 - Acid resistant funnel
 - Acid resistant jug.
 - Rubber apron and gloves



- Insulated Spanners- 2 sets.
- Wall mounted teak wood rack/ Acid resistance rubber insulated Steel rack for above items
- Lifting device for cell

4.5.0 DC Distribution Board (DCDB)

4.5.1 For feeding the 110 V DC loads, following DC switchboards shall be provided

- 110 V DC Distribution Board two bus with Tie

4.5.2 The DCDB shall be provided with suitably rated incomers, required quantity and type of outgoing feeders for the auxiliaries, control supplies to various panels/systems in accordance with the number of 110 V DC supplies. In addition, the following feeders shall be provided in each DCDB.

10% or minimum of two nos. feeders of each type whichever is higher shall be provided as spare in each bus section and rating. Any additional quantity required for increase/adjustment during detailed engineering stage shall also be duly considered.

4.5.3 The continuous current rating of the bus bars, incomers, ties for 110 V DCDB shall be the maximum DC load (excluding the momentary load) on the bus due to any operating condition, when unit system additionally feeds station system or vice-versa plus 20% margin rounded off to the next higher standard rating.

4.5.4 MCCB shall be double pole type for incoming and tie feeders. It shall be quick make, quick break, independent manual type with trip free feature. All MCCB shall have the following:

- Short circuit release
- ON/OFF and Trip position indicators.
- On / Off and Trip position potential free contacts to be integrated to HMI (Controller) & SAS
- Test trip push button
- Suitable voltage rating for DC
- Motorized MCCB shall be provided in accordance with the interlocking and operational philosophy requirements of the DC system.
- Motorized MCCB shall have remote operation form SCADA / SAS / EnMS system and local operation through dedicated pushbuttons.

4.5.5 DCDB shall be provided with +ve and -ve bus bars.

4.5.6 C Distribution boards (110V) shall be metal enclosed, fixed type with , compartmentalized construction. The distribution board frame shall be fabricated using CRCA sheet steel of thickness not less than 2.0mm. The frames shall be enclosed by CRCA sheet steel of thickness not less than 1.6mm. Each compartment may accommodate a maximum of two feeders, each with a rating up to 16 A. Feeders with ratings exceeding 16 A shall be provided in dedicated compartments.

4.5.7 Suitable synthetic rubber gaskets shall be provided to make boards completely dust and vermin-proof with a degree of protection of IP55 for indoor installation.

4.5.8 DBs shall have bottom entry for cables. Cable entry facilities shall be provided with removable gland plates (pre-drilled) of suitable thickness. All incoming and outgoing cables shall be terminated on suitable terminal blocks.

4.5.9 The incomer modules shall be MCCB controlled. Each incomer shall be provided with:

- Incoming Double Pole MCCB
- Battery Double pole MCCB



- 0.5 accuracy class Digital multifunction meter (Aux supply – 80 to 300V AC/DC, RMS 4 digit, , Communication interface as per system requirement RS485 port) on incomer and shall be integrated to SAS / SCADA / EnMS system.
- Earth fault relay.
- Under voltage relay with timer
- Indicating lamps for ON, OFF, EARTH FAULT, UNDER VOLTAGE conditions.
- Current and voltage transducers for remote indication.
- Necessary hardware and circuitry for fault alarm, lamp test and alarm rest.

4.5.10 Tie feeder shall have the following:

- Tie MCCB on both side
- Voltmeter to indicate voltages of both bus voltages shall be provided in the same compartment.
- Ammeter to indicate flow of current through tie feeder (one side)
- Transducer to indicate flow of current through bus coupler to SAS system (one side)

4.5.11 Outgoing feeders:

- These feeders shall be provided with suitably rated DP MCB and status & fault indicating lamps.
- The feeders rated 200 Amps and above shall be provided with a shunt and ammeter.

4.5.12 Following status, indications/alarms shall be provided in the SCADA/EMS/SAS for both DCDB's:

- Incomer, , ties - ON & OFF
- Incomer current
- Incomer alarm supply fail
- Bus under voltage
- Bus earth fault
- Bus voltage

4.5.13 All Indoor equipment, panels and cabinets DCDBs shall be pre-treated as per IS 6005 before being factory-painted with epoxy based paint shade of paint shall be RAL 7035. Corrosivity grade as shall be considered for indoor equipment. Painting shall be carried out by approved process. Sufficient quantity of touch-up paint shall be furnished for application at site.

4.5.14 20% spare TB (Control and Power) of each type for each terminal station shall be provided.

5.0.0 DRAWINGS, DATA AND MANUAL

5.1.0 To be Submitted After Award of Contract:

- Technical data sheet
- Dimensional general arrangement (GA) drawings for battery, battery chargers, DCDBs etc.
- Schematic and wiring diagram for chargers & DCDBs
- Sizing calculation for battery and charger with relevant assumptions and characteristic curves
- Sizing calculation for heat loss and ventilation requirement
- Dimensional GA drawing for battery, MCCB box and discharge resistor
- Drawings for battery rack & fixing arrangement
- Foundation plan and loading details



- Quality Plan
- Test certificates
- O&M manual

6.0.0 TESTS

- 6.1.0 The equipment offered shall be type tested and proven type. Type test certificates shall be furnished for approval. All routine and acceptance tests in accordance with the latest version of applicable standard shall be conducted.
- 6.2.0 Copies of certified reports of all type tests carried out on similar type and rating shall be furnished. In absence of such type tests certificates or in case such certificates are not found to be meeting the relevant standard requirements, vendor shall conduct all such tests according to relevant standards free of cost to Owner and reports shall be submitted to Owner for approval.
- 6.3.0 Sampling scheme and criteria for acceptance shall be as per IS.
- 6.4.0 Test reports shall be submitted for approval before the dispatch of batteries.

Acceptance test shall be conducted at Site on completion of installation and commissioning and immediately prior to putting the battery in service.