# West Bengal State Electricity Distribution Co. Ltd.

## TECHNICAL SPECIFICATIONS

## FOR

## D. C. DISTRIBUTION BOARD

## (FOR 33 KV SUB STATIONS)

## 1.0 SCOPE:

This specification covers the design, manufacturing, testing at works and supply of Indoor type D.C. Distribution Boards for protection system of the 33 kV substation. The system shall be DC, 30 V.

## 2.0 SERVICE CONDITIONS:

Equipment to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions.

| | | |
|---|---|---|
| 2.1 | Maximum ambient temperature (Degree C) | 50 |
| 2.2 | Maximum temperature in shade (Degree C) | 45 |
| 2.3 | Minimum temperature of Air in shade (Degree C) | 3.5 |
| 2.4 | Relative Humidity (Percent) | 10-100 |
| 2.5 | Maximum annual rain fall (mm) | 1450 |
| 2.6 | Maximum wind pressure (Kg/ sq.mm) | 150 |
| 2.7 | Maximum altitude above mean sea level (metre) | 1000 |
| 2.8 | Isokeraunic level (Days per year) | 50 |
| 2.9 | Seismic level (Horizontal Acceleration) | 0.3g |
| 2.10 | Moderately Hot and Humid tropical climate conducive to rust and fungus growth | - |

## 3.0 STANDARDS:

3.1 Components mounted on the ACDB 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 5 | Painting |
| C | IS: 13947/1993 Part-III amended up to date | Switch Fuse Disconnector unit |
| D | IS 2705 amended up to date | CTs |
| E | IS 8828/1996 amended upto date | MCB |
| F | IS 1248 | Indicating instruments |
| G | IS 375 | Wiring |
| H | IS: 13703/1993 Part-I & II | HRC Fuses |

## 4.0 GENERAL TECHNICAL PARTICULARS:

These D C Distribution Boards shall be supplied as per this specification.

### 4.1 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. 30 volts. The supply voltage may vary by ± 10% of rated voltage. All the equipments used in the Board shall operate satisfactorily at this voltage variation.

### 4.2 General Requirements:

4.2.1 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 IP 43. 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 of reputed make. The DB shall be provided with double door in front having 2 nos. hinges which should be suitable for movement of 120 degree and 2 no. 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.

4.2.2 Each Distribution Board shall be made out of at least 2.0 mm thick cold rolled steel sheet, suitably reinforced to provide flat level surface. Size 1000(H) x 750(W) x 300(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.

4.2.3 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 their side. 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 shall have cable supports and metallic clips for supporting power and control cables for internal wiring of the panels.

4.2.4 The DC Distribution Board shall have double bus arrangement with change over switch. The Distribution Board shall have provision for one set of +ve and –ve connected to Charger-1 and another set of +ve and –ve connected to Charger-2. Each busbars shall consist of tinned electrolytic copper of cross-sectional area of a minimum of 25mm x 3mm, suitable for carrying their rated continuous current without their temperature exceeding 85 deg C. The busbars shall be continuous throughout each section. The busbars shall have current rating to suit the requirements corresponding to the loads incident thereon 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 fibreglass material or porcelain. Busbars shall be encased in heat-shrunk sleeves of insulating material which shall be suitable for the operating temperature of busbars during normal service. The busbar joints shall be provided with removable thermosetting plastic shrouds.

The busbars shall be housed in totally enclosed busbar chambers. The incoming connections from the busbar 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 not be more than 1.6 Amp/sq. Mm.

A cable alley preferably 230 mm wide shall be provided in each vertical section for taking cables into the compartments.

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

4.2.6 Danger board (Caution Plate) shall be fitted suitably on inner door of the DB. Danger board shall be of 100x100 mm size with details as per WBSEDCL standard format.

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

i. Double bus arrangement with change over switch with provision for one set of +ve and –ve connected to Charger-1 and another set of +ve and –ve connected to Charger-2. Each busbars shall consist of tinned electrolytic copper of cross-sectional area of a minimum of 25mm x 3mm.

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.

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

4.2.9 All sheet metal used for DB shall undergo seven tank mechanical/ chemical cleaning process & painting shall be done using powder coating process. Colour of the Paint shall be admiral gray as per shade no. 632 of IS 5 on exterior and white from interior sides.

## 5.0 **MAJOR COMPONENTS**:

5.1 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.

For all 32 A rated MCBs, 16 sq. mm. stranded cable shall be used. For all 16A rated MCBs, 10 sq. mm. stranded cable shall be used.

**All MCBs, cable used in the DB shall be of reputed make and ISI marked.**

DCDB should have 2 sets of Bus Bars in Two separate compartments to facilitate termination of Incomers from two sets of 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.

5.2 Incoming circuit:

Two double pole MCBs of 63 Amps capacity shall act as Incoming breaker of load bus. Change over switch of 63 Amps DP is to be provided.

Incoming cable for incomer **LT XLPE, 2 C, 120 sq. mm** shall be provided by WBSEDCL.

5.3 Outgoing Circuits:

| Sr. No. | Feeder Rating | Cable size | Source-1 | Source-2 |
|---|---|---|---|---|
| 1. | Double pole DC MCB 32A,250 V | 2 core 16 sq. mm LT PVC cable | 04 nos. | 04 nos. |
| 2. | DP 16 A MCBs, 250 V | 2 core 10 sq. mm LT PVC cable | 08 nos. | 08 nos. |

5.3.1 Total 24 Nos. outgoing circuits shall be provided as per the details given below.

MCBs shall comply following specifications as per IS 8828/1996.

a) Rated voltage & freq. shall be 240V & 50 Hz respectively for DP MCBs.
b) Rated current shall be 32A/16 A as mentioned above.

c) Rated short circuit capacity shall be min. 6 KA at 0.7 p.f. lag
d) Service short circuit capacity shall be 6KA as per table 15 of IS:

8828 /1996.

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

f) Under voltage release and shunt-trip release coils are not required. Only overload release and short circuit release shall be provided.

g) Tripping time shall be as per (clause No. 8.6.1) table 6 of IS: 8828 /1996. Tripping mechanism thermal magnetic type.

h) 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.

i) Limits of temperature rise shall be as per (clause No. 9.8) table 5 of IS: 8828/1996.

j) Standard range of instantaneous tripping shall be type 'B' as per (clause No.5.3.5) table 2 of IS: 8828 /1996.

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

5.3.3 The enclosure shall be provided with proper earthing arrangement. Earthing arrangement shall consist of 2 G.I. Bolts of 12 mm x 50mm (min.) with 2 spring/ plain washers and 2 check nuts.

5.3.4 PVC cable glands of adequate size shall be provided for all incoming and out going cables.

5.3.5 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 up to 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 | 30 |
| Rated short circuit breaking capacity kA | 10 |
| Ambient temperature(deg C) | -5 to +55 |
| Protection class | IP-20 |

5.3.6

i. One Mains failure Alarm relay.
ii. One Earth Fault alarm relay
iii. One 30 Volt DC Bell to be operated by the Mains failure alarm relay.
iv. One 30 volt DC Buzzer to be operated by the earth fault alarm relay.

5.3.7 AC/DC Change Over Contacts

Emergency lighting circuit shall be provided by the Bidder such that the lights normally burn on AC 240 Volts, 50 Hz but in case of failure of AC supply, these come up on DC supply with the help of automatic change over contactors and again change over 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.

## 5.4 Indicating Instruments:

Principal requirements of indicating instruments are as follows:

### 5.4.1 D.C Ammeter:

Ammeter shall comply the following requirements

| | |
|---|---|
| Class of accuracy | 1.0 |
| Range | 15 Amps |
| Mounting | Flush type |
| Size | 96 x 96mm |
| Type | Analog |

### 5.4.3 D.C Volt Meter:

Voltmeter shall comply the following requirements

| | |
|---|---|
| Class of accuracy | 1.0 |
| Mounting | Flush type |
| Size | 96x 96 mm |
| Range | 0-40 volts |
| Type | DC moving coil |

### 5.4.5 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 'DC ON' 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. The intensity of light should be minimum 100 milli cd at 20 mA. Indication lamp should be suitable to operate on 30 V DC.
Necessary wiring shall be provided accordingly.

### 5.4.6 MARKING

Each compartment shall be provided with legible and indelibly marked/ engraved name plate.
Name plates shall be white with black engraved letters. On top of each module, name plates 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.

### 5.4.7 Earthing Arrangements:

Two nos. Earthing studs of galvanized M.S. 25 X 6 mm 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.

### 5.4.8 Mounting Clamps:

The DCDB box are to manufacture with suitable mounting arrangement on wall/steel support by means of 4 nos. 25X6 mm size clamps having hole dia. 14mm, fixed over the body as per drawing.

### 5.4.9 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.

### 5.4.10 Name Plate:

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

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

## 6.0 CONTROL WIRING

Each 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 stranded 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 bear an identifying ferrule or tag at each end or connecting point.

Control cables for external connections shall consist of stranded copper wire with 1.5, 2.5, 4.0 sq. Mm or higher cross-sectional areas and shall enter the bottom.

All interconnecting/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 6 mm. 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.

## 7.0 TYPE TEST CERTIFICATES:

MCBs & other components used in DCDB shall be fully type tested as per relevant IS and this specification. The successful Bidder shall furnish detailed type test reports before commencement of supply.

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.

## 8.0 DRAWINGS:

Successful bidder shall submit the detailed drawings along with component details/makes etc. for necessary approval.

## 9.0 INSPECTION:

All tests and inspection shall be made at the place of manufacturer. The manufacturer shall provide reasonable testing and inspection facilities and co-operation without any charge to satisfy him that the material is being supplied is in accordance with this specification. The proto of DCDB shall be inspected & checked by Ordering Authority or his representative for approval before commencement of supply.

## 10.0 SCHEDULES:

The tenderer shall fill in the following schedules, which form part of the tender specification and order. If the schedules are not submitted duly filled in with the offer, the offer shall be liable for rejection.

Schedule 'A' - Guaranteed Technical Particulars.

Schedule 'B' - Tenderer's Experience

## 11.0 Deviations

Deviation from this specification, if any, shall be clearly bought out in the offer. Unless owner explicitly accepts such deviations, it shall be constructed that the offer fully complies with the specification.

## SCHEDULE 'A'

## GUARANTEED TECHNICAL PARTICULARS OF DCDB

| Sr. No. | Parameter Name | |
|---|---|---|
| 1. | Enclosure fabricated from M.S sheet of 2.0 mm thickness | Y/N |
| 2. | All sheet metal work has undergone 7 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 our specification | Y/N |
| 5. | Busbar is of electrolytic tinned copper of size 1.6 sq. mm with 200 A rating and without joints. | Y/N |
| 6. | Make and type of switch Fuse Disconnector Unit | Y/N |
| 7. | No. of 1 ph 36 A DP MCBs provided | Y/N |
| 8. | Make and type of 1 Ph 36 A DP MCBs | Y/N |
| 9. | No. of 1ph 16 A DP MCBs provided | Y/N |
| 10. | Make and type of 1 Ph 16 A DP MCBs | Y/N |
| 11. | All MCBs are type tested and having short circuit rating of Min. 6 KA at 0.7 pf lag | Y/N |
| 12. | Ammeter is having range of 0-15 A and accuracy class 1.0 | Y/N |
| 13. | Make and type of Ammeter | Y/N |
| 14. | Voltmeter is having range of 0-40V 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 knockout type arrangement for providing cable glands at the bottom | Y/N |
| 20. | Cable glands as per requirements provided separately | Y/N |

## SCHEDULE 'B'

## SCHEDULE OF TENDERER's EXPERIENCE

**The tenderer shall furnish here the list of the similar orders executed/under execution by him to whom a reference may be made by the purchaser in case he considers such reference necessary.**

| Sr. No. | Name of the client & description of the order | Value of order | Period supply & commissioning | Name and address to whom ref can be made |
|---|---|---|---|---|
| | | | | |

**NAME OF THE FIRM----------**

**NAME & SIGNATURE OF THE TENDERER----------**

**DESIGNATION----------**

**DATE----------**

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