220V & 48V DC POWER DISTRIBUTION BOARD

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Engineering Department

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TECHNICAL SPECIFICATION OF D.C. POWER DISTRIBUTION SWITCH BOARD

1. SCOPE:

1.1. This specification covers design, manufacture, assembly, testing at manufacturer's works of DC switchboard.

1.2. DC PANEL

The DC Panel shall have Two Incomer connected with Battery Charger -1 & Battery Charger -2. The DC Panel shall have one Bus Coupler.

i) In DCDB electrical interlock with bypass arrangement is to be provided between Incomers and Bus Coupler. No mechanical interlock is required.

ii) For DCDB, under voltage and over voltage tripping of feeders are to be avoided.

iii) Indication lamp for MCCB / MCB trip and "ON-OFF" must be provided with potential free contact for SAS.

2. STANDARDS :

The equipment covered by this specification shall unless otherwise stated, be designed, constructed and tested in accordance with the applicable sections of the latest Indian Standard Specification and Indian Electricity Rules and as per this technical specification. The degree of protection shall not be less than IP-52 as per IS:2147. However, Bus bar chamber having a degree of protection of IP:42 as per IS:2147 where continuous bas bar rating exceeds 1000A.

3. I.) DEVIATION :

Normally the offer should be as per Technical Specification without any deviation.

II) MODIFICATION :

If any modification felt necessary to improve performance, efficiency and utility of equipment, the same must be mentioned in the 'Modification schedule' with reasons duly supported by documentary evidences and advantages. Such modifications suggested may or may not be accepted, but the same must be submitted along with Pre-Bid Queries. The modifications not mentioned in Schedule will not be considered.

4. GENERAL SPECIFICATION OF D.C. SWITCH BOARD :

4.1. 220V or 48V, (+/- 10%) volt D.C. supply shall be made available from the station storage battery banks associated with battery charger. The charger and battery shall be connected to the load bus of D.C. switchboard through separate 2-pole MCCB of suitable rating.

4.2. The D.C. switch boards shall be of multi-cubicle on multi box factory build air insulated type, fully enclosed with doors for access to the interior, 3.00 mm. thick steel sheet shall be used for the fabrication of the panels. However 2mm thick cold rolled sheet steel with powder coating is also acceptable. Boards shall be easily extendible on both side, by addition of the vertical sections after removing the end covers. Dimension shall preferably not more than 1800 mm. high with channel base and 750 mm. depth measured from the rear to front face. The working height of the switch board shall be minimum 450 mm. to maximum 1650 mm. The back cover of the switch board shall be provided with hinged door with locking arrangement. Width of the panel shall be determined as per no of circuits to be accommodated. All boards shall be divided into distinct vertical sections each comprising of -

(i) A completely enclosed bus bar compartment for running horizontal and vertical Copper bus bar. Bus bar chamber shall be completely enclosed with metallic portions. Bolted covers shall be provided for access to horizontal and vertical bus bars and all joints for repair and maintenance, which shall be feasible without disturbing feeder compartment. Proper ventilation arrangement shall have to be arranged and that shall be decided by the purchaser at the time of approval.

(ii) Completely enclosed switchgear compartments one for each circuit for housing incoming or outgoing MCCB.

(iii) A compartment for power and control cables shall be provided. Door of compartment shall be hinged. Cable compartment shall have no communication with bus bar chamber.

(iv) A compartment for control devices associated with Incoming MCCB.

4.3. **Design:**

Where two incomer MCCB compartment are provided in the same vertical section, insulating barriers and shroud shall be provided in the rear cable compartment in order to avoid accidental touch with live part of one circuit when working with the other circuit.

The connections from bus bars to main switch shall be fully insulated/shrouded and securely bolted. The partition between the feeder compartment and cable alley may be non-metallic and shall allow cable cores with lugs to be easily inserted in the feeder compartment for termination.

Necessary and safe earthing arrangement with supply of all accessories required for safe earthing shall be within the scope of supply.

A galvanised steel earthing shall be provided at the bottom of each panel and shall extend throughout the length of switchboard. It shall be welded / bolted to the frame work of each panel and breaker earthing contact bar vertical bus shall be provided in each vertical section which shall in turn be bolted/welded to main horizontal ground bus.

The earth bus shall have sufficient cross-section to carry momentary short circuit and short line fault currents to earth bus without exceeding the allowable temperature rise.

The horizontal earth bus shall be projected out the switchboard ends and shall have predrilled holes for bolted connection between this bus to sub-station earthing conductor. A joint spaced and taps to earth bus shall be made through at least two bolts.

All non-current metal works of the switchboard shall be effectively connected to the earth bus.

4.4. The switchboard shall be dust and vermin proof and suitable for use in tropical climate. All ventilating louvers and holes shall be covered with fine non-ferrous wire mesh from inside. A suitable rust resisting primer paint shall be applied on the panel after the same is polished and the primer shall be evenly sprayed. The colour of the exterior of the panel shall be of same colour as that of the main control and relay panel. The colour of the interior panel should be as to provide a colour contrasting background for the wiring inside the cubicle.

The switchboards shall be mounted on channel and shall be complete with channel bottom plates, grouting bolts, earthing bolts, washers, cable glands etc.
All the MCCB's shall be of best quality and easy in operation.

4.5. **220V DCDB:**
The number of outgoing feeders shall be controlled by suitably rated MCCB. Necessary arrangement shall be kept especially for emergency sub-station control building lighting particularly in Control room, ACDB room, Battery room, Firefighting pump house, Corridor, Lobby, Stairs etc. in case of failure of AC main supply.

4.6. Provision for audio visual indication with lamp and bell with facility for manual cancellation & resetting of alarm for failure of D.C. supply to the load bus or blowing of any fuse of D.C. circuit shall be made. In case of tripping of any outgoing feeder MCCB, visual and audible alarm arrangement shall be provided in the DC Board as well as in the control room. Necessary arrangement shall also be provided for acceptance and resetting of the audible alarm. Visual indication of the failure of D.C. voltage at the load bus or blowing of any fuse can only be cancelled when the supply at bus will be restored or the fuse is replaced.

4.7. Adopter panels and dummy panels required to meet the various bus bar arrangements and layouts required shall be included in bidders' scope.

4.8. The temperature rise of horizontal and vertical bus bars when carrying rated current along its full run shall not exceed 55ºC with Silver plated joints and 40ºC with all other type of joints over an outside ambient temperature of 50ºC.

4.9. All identical circuit breakers and module chassis of same test size shall be fully interchangeable without doing any modification work

4.10. For MCCB / MCB, relays and other sub components, WBSETCL Vendor list available at Company's portal may be followed.

Proper arrangement shall have to be done for Control & Monitoring of Incomers, Bus-Coupler, Outgoing feeders through SAS / SCADA system.

5. INTERNAL WIRING AND TERMINAL BLOCK :

5.1. All connection terminals shall be brought in the terminal block which shall be fixed in such a position as may be readily accessible.

5.2. All switchboards shall be supplied completely wired internally upto the terminal blocks.

5.3. All inter cubicle and inter panel wiring and connections between panels of same switchboard including all bus wiring for A.C. and D.C. supply shall be provided by the contractor.

5.4. All internal wiring shall be carried out with PVC insulated stranded single core 2.5 sq. mm copper conductor. However, for annunciation scheme wiring may be drawn with 1.5 sq. mm. PVC insulated stranded copper conductor.

5.5. All wiring shall be properly supported, neatly bunched, and readily accessible and securely connected to equipment terminals and terminal blocks.

5.6. There shall be ferrule marking at both ends of the connections. Red ferrule with positive marking shall be used for the positive terminals and white ferrule with negative marking for positive terminal for D.C. wiring.

5.7. Each wire shall be continuous and there shall not be any joint within itself. Wiring for meter, relays, instruments and MCCB etc. used in the switchboard shall be brought to the terminal block.

5.8. Terminal blocks shall be of 1100V grade suitable to carry short circuit current for specified duration. The terminal blocks shall be fully enclosed with removable covers of transparent, non-deteriorating type plastic material. Insulating barrier shall be provided between the terminals. The terminal blocks shall have locking arrangement to prevent its escape from the rails.

5.9. All terminal blocks shall be suitable for terminating two nos. of 2.5 sq. mm. stranded copper conductor on each side.

5.10. All terminals shall be numbered for identification and grouped according to the function. Engraved white on black labels shall be provided on the terminal blocks.

5.11. Terminal blocks shall be arranged with at least 100 mm. clearance between two sets of terminal block. The minimum clearance between the first row of terminal block and the associated cable gland plate shall be 250 mm.

6. NAMEPLATES AND LABELS :

D.C. distribution boards shall be provided with prominent, engraved identification plates. The module identification plate shall clearly give the feeder number and feeder designation. For single front switchboards, similar panel and board identification labels shall be provided at the rear also.

7. EQUIPMENT AND OTHER TECHNICAL INFORMATION FOR D.C. SWITCHBOARD :

7.1. Copper bus bar of adequate continuous and short circuit current rating having current density less than 1.75 A per sq. mm. shall be provided.

7.2. Aux. Relay and contactor for alarm as well as visual indication against tripping of incoming MCCB as well as outgoing feeder MCCB shall be provided. However, indication will not go off till the restoration of failure.

7.3. 'ON', 'OFF' and 'TRIP' indicating lamps for both the incoming MCCB along with required number of push button shall be within the scope of supply.

7.4. One no. digital D.C. voltmeter having a scale range of 0-300 V for 220V system and 0-60 V for 48V system, flush mounted type having accuracy. +/- 1% of full scale, shall be provided. The meters shall conform to the appropriate IS specification.

7.5. Two nos. digital D.C. ammeter having accuracy +/- 1% of full scale, shall be provided for measurement of load current flowing to the D.C. switchboard.

7.6. The ampere rating of MCCB for feeder protection shall be as per requirement of the feeder current but shall not be less than 16 Amps (for 220V DCDB).

7.7. Doors at the back of the panel shall be provided for inspection with door switch for illumination of the lamp to be provided inside the panel with separate switch fuse unit for controlling the lamp.

7.8. All the indicating lamps shall be of panel mounting cluster LED type. The lamps shall have suitable size plates marked with its function, wherever necessary. Lamps shall have translucent lamp covers of 'RED', 'GREEN' & 'WHITE' colour for indicating , 'ON', 'OFF' and 'AUTO-TRIP' indication of incoming MCCB's. One no. Indicating lamp is to be provided for tripping of outgoing feeder & DC supervision.

7.9. Space heater shall be provided for preventing harmful moisture condensation in all the D.C. Boards. The space heaters shall be suitable for continuous operation of 240V AC, 50HZ single phase supply and shall be automatically controlled by thermostats. Necessary isolating switches and HRC fuses shall be provided.

7.10. All the D.C. and A.C. HRC fuses, D.C. Aux. Relays, isolating copper links, D.C. emergency fuse, D.C. emergency & A.C. emergency contactor, A.C. bell, indicating lamp for indicating D.C. fail of main bus, D.C. contactor etc. shall be within the scope of supply of the contractor. Three nos. Push Button for testing annunciation scheme, resetting annunciation scheme and accept of fault and bell cancellation shall be provided.

7.11. For 220V DCDB, moulded case circuit breaker for both incomer circuit shall be of 100 Amp. rating and double pole type. Each MCCB shall be provided with trip coil. MCCB shall be capable of safely breaking the fault current of the associated incoming feeder.

All the MCCB shall be flush mounted on D.C. Distribution boards.

MCCB's shall be provided with thermo-magnetic type release for over current and short circuit protection.

The setting range of thermal release and breaking capacity of MCCB's are to be specified and shall conform to circuit requirement.

MCCB shall have Mechanical Anti-reclosing and facilities for over load and short circuit setting adjustment. MCCB knob shall indicate the true position of the equipment. MCCB's shall conform to relevant Indian Standard.

Interlocks shall be provided such that it is possible to open the cubicle door only when the MCCB is in 'OFF' position and to close the MCCB when the door is closed.

48V DC Distribution Bus :

Each Sub-Station shall have one DC Distribution Bus for Communication Equipment. The DC Distribution Bus shall have the following provisions:

a) The DC output from each of the two chargers shall be in the range of 48 volt to 55 volt which would be connected through a switch with suitable MCCB to a separate Distribution bus. Distribution bus shall have 10 amperes outlets as detailed below and as per attached SLD –
   i. For 132KV Sub Station number of outgoing feeders = 12
   ii. For 220KV Sub Station number of outgoing feeders = 16
   iii. For 400KV Sub Station number of outgoing feeders = 20

b) There should be two incomer and one bus coupler of 32A rating.

c) Provision for remote annunciation and acknowledgement shall be there to acknowledge any abnormality in DCDB from remote location such as control room/SAS.

d) DCDB will have separate Voltmeter and Ammeter for each separate incomer.

Connection between battery charger to battery, battery charger to DC Distribution Bus and DC Distribution Bus to different loads shall have to be done by copper cable of adequate capacity to avoid voltage drop in the associated line. DC bus shall also be of copper of suitable cross section.

8. GUARANTEE :

Electrical characteristics shall be guaranteed by the contractor. In case of failure of materials to meet the guarantee, WBSETCL shall have right to reject the material. Guaranteed Technical particulars are to be submitted by successful bidder during detailed engineering along with submitted drawings/documents.

9. PAINTING

The Panels shall be pre-treated using 7-Tank process and then Epoxy Powder Coated with Paint shade of RAL 7032.

10. PACKING AND DESPATCH :

All equipment shall have to be despatched suitably and securely packed in wooden crates, suitable for handling during transit by rail and / or road.

11. CONTRACT DRAWINGS AND CATALOGUE :

11.1. After placement of order, six (6) copies of following drawing, G.T.P and literature shall be submitted for approval.

(i) Single line diagram for each type of switchboard.

(ii) Dimensional drawing showing clearly the location of meter switches, MCCB etc. in the D.C. switchboard arrangement in plan and elevation with foundation details.

(iii) Wiring diagram of D.C. switchboard showing the interconnection between terminals of various equipment and devices on and within the panel including approved schematic drawings.

(iv) Take off terminal connection arrangement.

(v) Catalogue of D.C. switchboard equipment.

11.2. Four (04) sets of approved drawings and Catalogue of D.C. switchboard equipment **in both hard & soft format** shall be submitted for record and distribution to site.

12. TEST AT MANUFACTURER'S WORKS AND TEST CERTIFICATES :

Acceptance and routine test at manufacturers' works shall be carried out on each Board as per stipulation of relevant Indian Standard. The following tests on each switchboard shall be carried out and three (03) copies of the Type, Routine & Acceptance test certificates **in both hard & soft format** to be submitted to this end for approval and distribution at site.

(i) Checking of wiring and continuity of the circuit.
(ii) Power frequency voltage test of 3KV for one minute between wiring and earth terminal.
(iii) Insulation resistance value of all equipment. Connected in switchboard and function of the same.

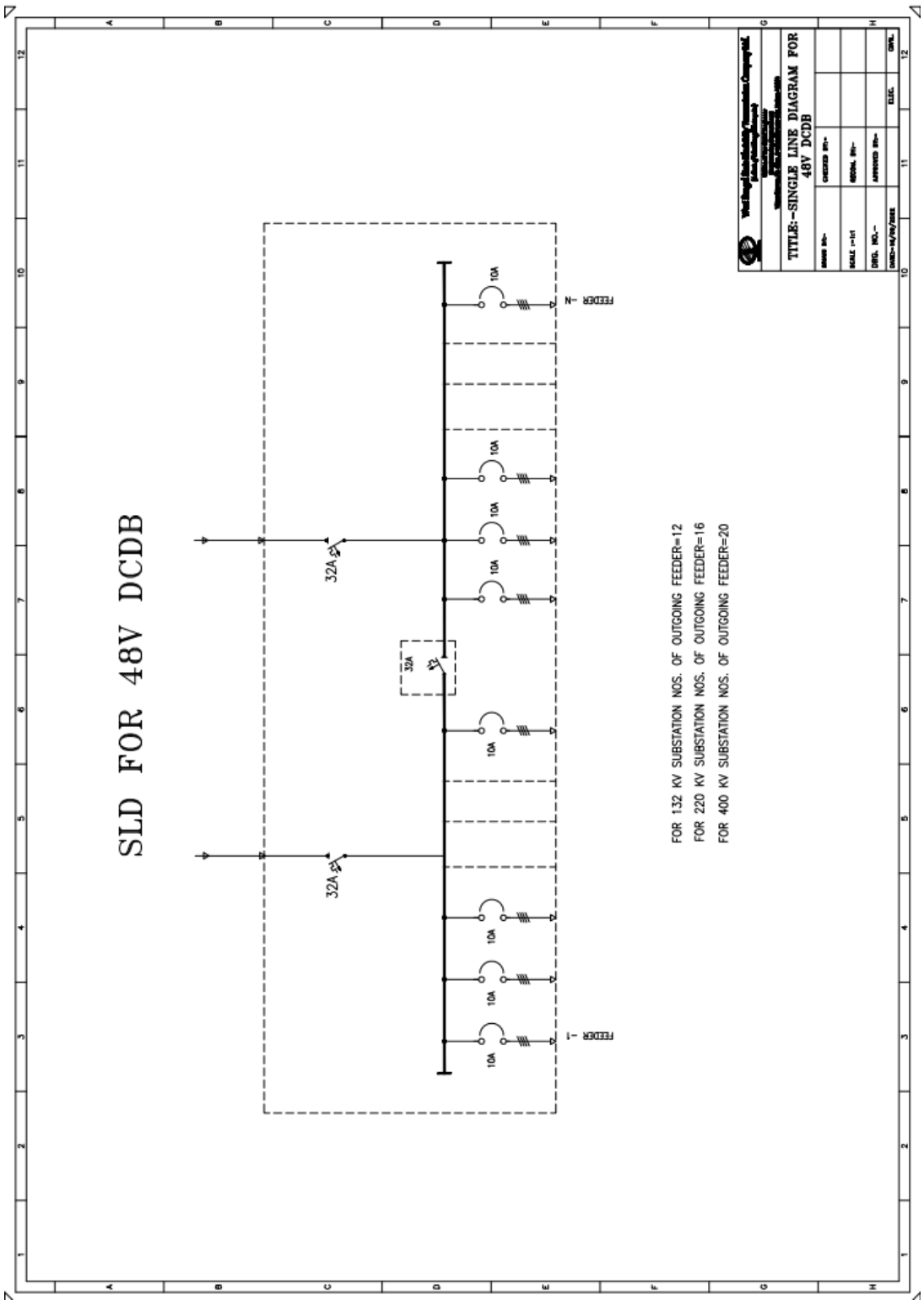
All the acceptance and routine tests shall be carried out in presence of representative of WBSETCL.

The Contractor shall give advance notice intimating the actual date of inspection and details of all tests that are to be carried out. The entire cost of acceptance and routine tests that are to be carried out as per relevant IS shall be treated as included in quoted price of DCDB.

SPECIFIC TECHNICAL PARTICULARS OF D.C. DISTRIBUTION BOARDS

SNO	DESCRIPTION	TECHNICAL PARTICULARS
1.	Dimensions : a) Height of complete panel (mm.) b) Working height (mm.) c) Width (mm.) d) Depth	 Preferably within 1800 450(min.) to 1650(max.) As per requirement. 750 mm (max.)
2.	Sheet steel thickness of panel (mm.)	3 (min.) However 2mm thick cold rolled sheet steel with powder coating is also acceptable.
3.	Grade of insulation Level of equipment and wiring (KV)	1.1
4.	Annunciation for blowing of fuse or tripping of breaker	Alarm and visual indication
5.	Ammeter range	0 to 100 (for 220V DCDB)
6.	Voltmeter range	0 to 300 (for 220V DCDB)
7.	Accuracy class of Ammeter & Voltmeter	1% of full scale deflection
8.	Current density of Copper for Busbar (A/sq.mm.)	1.75
9.	Wiring for annunciation scheme shall be done with copper of cross-section area (sq.mm.)	1.5 (Stranded)
10.	MCCB (for 220V DCDB) i) System Voltage ii) Insulating Voltage iii) Rated Imp withstand Voltage of main Ckt iv) Ambient Temperature v) Rated Continuous Current at 40^{o}C vi) Ultimate Short Ckt Breaking Capacity vii) Utilisation Category viii) Suitable for Isolation ix) No. of Poles x) Shunt Release Voltage xi) Permissible Variation in Voltage xii) Short Circuit Setting	 220 V DC 690 V 8 KV 40^{o}C As per Rating 10 KA (DC Breaking) for < 100 A & 30 KA for > 100 A A Yes 4 Pole or 2 Pole 220 V DC 85% to 110% Adjustable for 4 Pole and Fixed for 2 Pole

Note: DC Emergency lamp circuit in control room shall be automatically put into service through contactors from 220V DCDB when the AC supply will fail.


SLD FOR 48V DCDB
TITLE:-SINGLE LINE DIAGRAM FOR 48V DCDB
FOR 132 KV SUBSTATION NOS. OF OUTGOING FEEDER=12
FOR 220 KV SUBSTATION NOS. OF OUTGOING FEEDER=16
FOR 400 KV SUBSTATION NOS. OF OUTGOING FEEDER=20
32A
32A
32A
10A
FEEDER -N
FEEDER -1