

KARNATAKA POWER TRANSMISSION CORPORATION LIMITED

TECHNICAL SPECIFICATION

SECTION – LTAC & DC PANELS

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LTAC & DC PANELS

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SECTION

LT AC PANELS & DC PANELS

Technical Specification for 415/240 Volts LTAC & 110 V DC Panels.

1.0 Scope:

- 1.1 This specification covers the design, manufacture, shop testing, supply and commissioning of 415/240 volts indoor type LTAC panels for control of AC supply and 110 DC to various auxiliaries in 110kV, 66kV & 33kV stations with all materials and accessories for efficient and trouble free operations.

2.0 Completeness of supply:

- 2.1 It is not the intent to specify completely herein all details of the equipment. Nevertheless, the equipment shall be complete and operative in all aspects and shall conform to highest standard of engineering and design and workmanship.
- 2.2. Any material or accessory which may not have been specifically mentioned, but which is necessary for satisfactory and trouble free operation and maintenance of the equipment shall be supplied without extra charges.
- 2.3 The contractor shall supply all brand new equipment and accessories as specified herein with such modification and alteration as agreed upon in writing after mutual discussion.

3.0 Tropical Protection.

- 3.1 All equipments, accessories and wiring shall have fungus protection involving special treatment of insulation & material against fungus insects and corrosion. Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent the entrance of insects.

4.0 INTERCHANGEABILITY:

All similar component parts supplied shall be interchangeable with one another physically and electrically.

5.0 TECHNICAL PARTICULARS OF LTAC BOARDS

- 5.1 The switchboard shall consist of completely enclosed self supporting cubicle type sheet steel panels. The switch boards shall consists of the required number of sheet steal enclosures for mounting the circuit breakers, relays, instruments and other equipments.
- 5.2 Each panel assembly shall be provided with the back easily removable or shall be provided with hinged doors at the back to enable easy access for inspection and maintenance work.
- 5.3 Cold rolled sheet steel not less than 3mm thick and structural steel having light sections shall be used and also 2mm thick sheet shall be used for sides and doors. All fastening between the structural members shall preferably be bolted and not welded, to provide flexibility during installation. The base of switch gear frame shall be suitable for erecting on flush concrete floor by means of evenly spaced grounding bolts projecting through the base channel members of the frame.
- 5.4 The depth of the boards shall be the order of 400 mm to 500 mm. Typical of AC & DC panels are furnished in the Annexure. The working height shall be limited within 400mm to 1200mm from floor level.
- 5.5 The breakers, fuses, bus bars and associated jumps etc., in the LTAC panel shall be capable of withstanding 25 KA for one second. The symmetrical breaking capacity of the breakers should be not less than 25 KA.
- 6.0 VENTILATION AND PAINTING PROCEDURES :
- 6.1 Ventilating louvers shall be provided.
- 6.2 All steel surfaces shall be sand blasted, grounded pickled as required to produce a smooth, clean surface free of scale, grease and rust.
- 6.3 After cleaning, the surface shall be given a phosphate coating followed by two coats of high quality primer and stoved after each coat.
- 6.4 The finishing coat on the exterior of the panels shall be opaline green corresponding to shade no. 275 of I.S. 5 with two coats of synthetic enamel paint and color to the interior surface shall be finished staved enamel white. Any other standard painting procedure is also acceptable.
- 7.0 BUSES, SWITCHING DEVICES AND CONNECTIONS:
- 7.1 All buses, switching device and connections shall be of sufficient size to limits the temperature rise to 45 deg. C over ambient temperature of 45 deg. C (peak) inside the enclosure while carrying full load current.

- 7.2 The main buses and connections shall be of high conductivity electrolytic copper. All main bus joints, all bus taps shall be tin/silver plated. All joints shall be tightly clamped with through bolts to ensure maximum conductivity.
- 7.3 All buses wherever possible shall be of rigid type. They shall be liberally spread and so mounted that their expansion and contraction do not subject either the bus bars or the insulating supports to any stresses and should withstand the stresses due to maximum short circuit current wherever required suitable expansion joints shall be provided.
- 7.4 All bus work and connection shall be accessible for inspection and maintenance purpose from ends and rear after first removing the respective enclosing plates.
- 7.5 Bus bars and connections shall be fully insulated for working voltage with adequate phase to phase and phase to ground clearance. Insulating sleeves for bus bars and shrouds for joints shall be provided. Bus insulators shall be flame retardant, track-resistant types with high creepage surface.
- 7.6 In case of LTAC panels Bus bars shall be color coded for easy identification and so located that the sequence R-Y-B shall be from left to right, top to bottom or front to rear when viewed from the front of the assembly. In case of D/C panels the bus bars are to be coded for positive and negative for easy identification.

Note:

Sufficient No of potential free contacts shall be provided for status indication for SCADA system for monitoring.

- 8.0 GROUND BUS:
- 8.1 For ensuring the rigid connection, the minimum section of the ground bus shall not be less than 160 sq. mm.
- 8.2 The ground bus is to be earthed solidly and connected to the station main earth in system, for which suitable provisions shall be made. The ground bus shall be provided with two bolt drillings with G.I. bolts and nuts at each and to receive 50 x 6 mm GI flat.
- 8.3 All stationery structures shall be directly connected to the ground bus for effective grounding.
- 9.0 **Current Transformers:**
- The current transformers shall be of cast resin type. Current transformers to be provided shall be mounted in the associated circuit breaker housing in a separate accessible compartment. The core

lamination shall be of high grade low loss ,silicon steel and the excitation current shall be as low as possible. The current transformers shall be designed to withstand the thermal and electromagnetic stress- resulting from the maximum expected short circuit current. Suitable arrangements shall be made so that secondary of CT shall not be open circuited with primary fully loaded. All secondary connections shall be brought out to terminal blocks where star or delta connection shall be made. Suitable shorting links shall be provided for shorting the secondary- links shall be provided for shorting the secondary winding of C.T, if necessary. The particulars of C.T i.e.burden, accuracy class is detailed in the feeder wise requirement detailed elsewhere in the specifications.

10.0 SPACE HEATERS AND LIGHTING OUTLETS:

- 10.1 Space heaters shall be provided inside to prevent condensation of moisture. The cubicle heater shall be provided with individual switch fuse circuits. All switch boards, cubicles etc., shall be provided with suitably located lighting outlets. The lighting switch shall be provided inside each entrance door of the back of the panels.

10.0 WIRING:

- 10.1 The panels shall be fully wired at the factory to ensure proper functioning of control, protection and inter locking schemes.
- 10.2 Fuse and Links shall to be provided to permit individual circuit isolation from bus without disturbing other circuits. All spare contacts of relays, push buttons and other devices shall be wired up to terminal blocks.
- 10.3 Wiring shall be done with flexible 1100 V grade, PVC insulated switch board type super flexible multi stranded tinned unleaded copper conductors of 2.5 sq. mm for control and current circuits and 1.5 sq. mm for voltage circuits.
- 10.4 Each wire shall be identified at both ends with permanent markers or ferrules bearing wires numbers as per contractors wiring diagrams.
- 10.5 Wire terminations shall be made with crimping type connector with insulating sleeves. Wires shall not be spliced between terminals.

11.0 TERMINAL BLOCKS:

- 11.1 Terminal blocks shall be 1100 V grade marshalling box clamp type with marking strips.

11.2 Not more than two wires shall be connected to any terminal. Spare terminals to extend of 20% should be provided.

11.3 Terminal blocks shall be located to allow easy access. Wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.

12.0 CABLE ENTRY:

12.1 Sufficient space provision shall be made for entry of the cable at bottom of cubicle and sufficient space shall be provided at base for termination and connection. Suitable cable glands are to be provided.

12.2 All provisions and accessories shall be furnished for termination and connection of cables including removable gland plates, cable support and crimp type tinned copper lugs brass compression glands with tapered washer (power cables only) and terminal blocks.

12.3 Gland plates shall be minimum 4 mm thick.

13.0 CONTROL AND INDICATION:

13.1 Push button shall be heavy duty, oil tight, push to activate type with integral escutcheon plate marked with its function.

13.2 Lamps shall be low-watt, filament type with series resistors and colored lens. Lens and lamps shall be replaceable from the front.

14.0 NAME AND IDENTITY PLATES:

14.1 12 mm wide plastic plates bearing suitable identification marks shall be fixed on the exterior of the switch board in a appropriate place to indicate the function of different electrical devices, measuring instruments etc., and circuit labels. All equipments shall be numbered according to ASA code numbers.

15.0 EARTHING:

15.1 Earthing of dead metallic parts or metallic bodies of the equipment on the panel shall be connected with soft drawn single conductor bare copper Tail connections shall have minimum area of 14.5 sq. mm and the main earthing connections to the earthing bus bar 65 sq. mm. Those wires shall be connected to suitable terminals and close junction. Soldered connections shall not be employed. The number of earthing terminals shall be two for the whole assembly of panels.

16.0 INDICATING INSTRUMENTS:

- 16.1 All instruments shall be of the square switchboard type, back connected, suitable for semi-flush mounting and provide with dust tight case for tropical use with dull black enamel finish. The dials shall be made of such materials as to ensure freedom from wrapping, fading and de-coloring. Marking on scales shall be black on white background. All instruments shall have easy laboratory means of adjustment to accuracy. The limits of error shall be those permissible for switchboard instruments as per relevant Standards.
- 16.2 The instruments shall be capable of indicating correctly when operated continuously any temperatures from 0 deg. C to 50 deg. C instruments shall be able to give correct indication at a temperature of 65 deg. C for a period of 10 hours. Necessary test blocks shall be provided.
- 16.3 Indicating instruments shall be of 96 x 96 mm, 90 deg. Scale, antiglare glass and accuracy class of 2% full scale. Each meter shall have zero adjustment on front.

17.0 SWITCH AND FUSE UNITS:

- 17.1 Switch and fuse units back of board mounting type and shall comprise of a switch and high rupturing capacity fuses. The frame of these shall be suitable for mounting at the back of sheet steel cubicles.

18 NEUTRAL CONNECTIONS:

- 18.1 All incoming and outgoing feeders shall be provided with bolted disconnect link for insulation of neutral in case of LTAC panel.

19.0 SCHEDULE OF EQUIPMENTS OF LTAC SWITCH BOARD:

- 19.1 a. Refer drawing no. 407 for 110 V DC distribution Board for 110, 66, 33KV Sub-stations.
- b. Refer drawing 407A for 415V LTAC panel (Typical) for 110, 66, 33KV station auxiliaries.
- 19.2 For LTAC panel :
- A. Two numbers of incoming feeders each comprise of the following components:
- a) One No. MCCB 415V, AC 3 phase 200 Amps rating
 - b) One volt meter 0-600V with selector switch.
 - c) Indicating lamps.
 - d) 3 No's CT's – Ratio 200-100/5-5 A
 - e) 1 No Ammeter with selector switch.

B. Each outgoing feeders consist of

- a) One number of 415V switch fuse unit of reputed make with associated HRC fuse.
- b) Cable Glands.
- c) No. of feeders shall be as follows :

		For 110/66 KV Stn.,	For 33 KV Stn.
63 Amps	3 Phase	2 Nos.	2 Nos.
32 Amps	3 Phase	2 Nos.	
16 Amps	3 Phase	6 Nos.	4 Nos.

19.3 Schedule of equipments for DC panels for 110 & 66 KV stations.

- a. One number 100A switch fuse unit for incomer to suit 110V DC
- b. 12 Nos. 32A – switch fuse unit for outgoing feeders.
- c. One no. Earth fault indicator.
- d. Indication circuit for AC main failure etc., as per annexed drawing.

20.0 The successful bidder shall furnish the following drawings in quanta duplication for purchaser's approval.

20.1 Details of construction of cubicles and the directions diagram and cross section drawing of the switch board indicating details of location of switches, indicating instruments relays, bus bars, cable glands and bus supports.

20.2 Detailed plan and foundations diagram showing necessary floor openings.

20.3 Consolidated Bill of materials.

20.4 Schematic diagram.

20.5 Wiring diagram.

20.6 Instrument manual of LTAC panel and individual equipment.

20.7 The manual shall clearly indicate the installation method, check up and tests to be carried out before commissioning of the equipment.

21.0 TESTS:

21.01 All equipments shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standard.

21.02 ROUTINE TEST:

The tests shall include but not necessarily limited to the following:

- a. Operation under simulated service condition to ensure accuracy of wiring, correctness of control scheme and proper functioning of the equipment.
- b. All wiring and current carrying part shall given appropriate high voltage test.

- c. Routine test shall be carried out on all equipment such a circuit breakers, switch fuses, contractors, relays, meters, etc.,

21.03 TEST WITNESS OF ROUTINE TEST:

All tests shall be performed in presence of purchaser representatives, if so desired by the purchaser in accordance with the procedure mentioned else where in this tender document. No dispatches shall be made without specific approval of purchaser.

21.04 Type tested panels shall be offered. The type test reports shall not be older than ten (10) years as on the last date of submission of bid.

a) For panels manufactured in India:

- i. The type tests on indigenous equipment for which testing facility is available in India, should have been conducted in any independent laboratories approved by the Government or the laboratories accredited by the National accreditation body of the country like Central Power Research Institute (CPRI), Electrical Research and Development Association (ERDA), etc.
- ii. The type tests on indigenous equipment, for which testing facility is not available in India, should have been conducted in a laboratory of foreign country accredited by National accreditation body of that country.
- iii. The type tests conducted in-house by a manufacturer shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests has been conducted in the presence of a representative of NABL accredited laboratory or any of the purchasing utilities or CEA in that order. Such type test reports shall record the details of such witness including the signature/authentication in the type test report.

b) For panels manufactured Abroad:

- i. Type tests on imported equipment should have been conducted in an Indian Laboratory or foreign laboratory accredited by National accreditation body of the country where the Type test has been conducted.
- ii. The type tests conducted in-house by a manufacturer shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests has been conducted in the presence of a representative of accredited laboratory or any of the purchasing utilities or CEA in that order. Such type test reports shall record the details of such witness including the signature/authentication in the type test report.

In case of in-house type tested imported equipment of foreign OEM, the term "Purchasing Utility" covers the foreign Utility who has purchased that equipment

Section -A.C.Outdoor Distribution Box

TECHNICAL SPECIFICATIONS FOR OUTDOOR DISTRIBUTION BOX (A.C.) FOR POWER & LIGHTING CIRCUITS IN 220KV / 110KV / 66KV SUB-STATIONS

1.0 SCOPE:

This specification covers the manufacture, testing at manufacturer's works, Supply & delivery of outdoor type distribution fuse boards for lighting & power circuits at 220 kV & 110 kV Receiving stations.

50 STANDARDS

- 2.01 The distribution boards shall generally conform to IS:2675/1966 (with latest amendments) - specification for enclosed distribution fuse boards & cutouts for voltages not exceeding 1000 Volts.

3.0 GENERAL REQUIREMENTS

- 3.01 Irrespective of anything said or omitted in this specification, the distribution box shall be suitable for the purpose they are intended to be used. Each distribution box shall be complete with accessories such as bus-bars, fuses, lock & key etc.,
- 3.02 The distribution fuse boards are required for distribution of 415V \pm 10%, 3Phase, 4 wire / 240V \pm 10% single phase AC with phase AC neutral earthed, required for power supply to group operating switches, CB, lighting of outdoor yard, cable duct fighting & emergency lighting.
- 3.03 The A. C. distribution fuse boards shall be 500 V grade. The distribution boxes shall be double front or single front type, as specified with provision for incomers & outgoing feeders in each section of the box as shown in the drawing. The general arrangement of the AC/DC distribution boxes are shown in the following drawings
1. Drawing No.KEB/TECH/Sub-Station/220/168/9.9.92 - detailed arrangement of distribution box "Type - A" - Single front type.

2. Drawing No. KEB/TECH/Sub-Station/220/168/9-9.92 - detailed arrangement of distribution box "Type - B" - Double front type.
- 3.04 The distribution fuse boards shall be fabricated out of 2.5mm thick-M.S.sheets of tested quality for body & shutters with 40x40x4mm M.S.angle iron frame. The shutters & body shall be suitably ribbed to give light but strong structure.
- 3.05 The A.C. distribution fuse boards shall have hinged double doors at front & back for double front type. Each door shall have independent internal type door lock & shall be capable of being opened & closed independently. The doors shall be so fitted as to provide the interior with maximum protection from atmospheric condition. The hinges shall be of such construction that the doors can swing open by not less than 150° and in addition hinges shall permit doors being completely removed when necessary.
- 3.06 The distribution boxes shall be provided with suitable aprons/canopy as shown in the drawing enclosed. The un-drilled sides, bottom & top covers shall be detachable, The distribution fuse boards shall be designed in such a way that when closed they are perfectly water tight, dust & vermin proof. Special arrangement to prevent ingress of moisture into the interior of the distribution boxes shall be made. All bolts nuts & washers used shall be galvanized mild steel. All the doors of the distribution box shall be fitted with dust proof gaskets. The louver type ventilators shall be provided in the front as shown in drawing & wire nets shall be provided on the back of the ventilator for prevention of entry of dust, insects etc., into the boxes.
- 3.07 The cable entry & exit are the sides through the extended box at the top on both sides & the design of the box must be such as to facilitate for housing of 100A, MCCB for incoming & 100 A HRC fuse link, for outgoing. The clearance inside the box must be such as to afford fair working facilities during erection & maintenance.

There shall be provision for easy removal of cable during erection & repairs, by suitably bolting the box cover & preferably sliding the bottom plates. A front hinged door with lock arrangement shall be provided for each of the side box for operation of MCCB &HRC fuse links. However, the entry of the cable at the extended box is to be through a 50mm G.I.pipe & projecting 50mm inside the box through suitable gland. The extended box must be provided with suitable gland & clamp for fixing the cable rigidly. The box shall be suitably ribbed to give a light but strong structure.

3.08 The distribution boxes shall be mounted on, a suitable angle iron mounting structure. 2 Nos of rust proof grounding lugs shall be provided on the angle iron framework of box with terminals suitable for M.S.flat. The earthing terminal shall be identified by means of the sign marked legibly & indelibly adjacent to the earthing terminals.

3.09 **FINISH:**

All steel surface shall be sand blasted, grounded, pickled as required to produce a smooth, clean surface free of scale, grease and rust. After cleaning, the surfaces shall be given a phosphate coating followed by quality primer & stowed after each coat. The finishing coat on the exterior of the distribution box shall be light Grey corresponding to shade No. 631 of IS-5 with two coats of synthetic enamel paint & colour to the interior surface shall be finished stowed enamel white. A small quantity of finishing paint shall be supplied with each consignment of distribution box to enable to restore at site any finish, which may get damaged during transit.

3.10 The distribution fuse boards shall be provided with high purity electrolytic aluminum bus bars. The side of aluminium, bus-bars phase to phase spacing should be consistent with the currents & voltage rating of the incoming / outgoing feeders. The bus bars shall be fixed on the Hylam sheets 10mm thick & of suitable width using 30mm brass bolt & nuts. Exposed portion of the bus-bar shall be provided with insulated sleeves, red for top phase, yellow for the mid phase, blue for the bottom phase & black for the neutral. The overhung portion shall be suitably supported. All current carrying parts shall be rigidly supported to withstand short circuit stresses. The fuse carrier shall be easily withdrawable. The short circuit will be about 20 KA at 400V.

3.11 All the terminals used for interconnection shall be made out of solid drawn copper tubing having suitable conductivity. The interior & exterior surface of tubular sockets shall be tinned by electroplating or by hot dip tinning. After final connections of the bus bars, the bus-bars shall be completely insulated with the approved quality insulation tapes.

3.12 In the A.C. distribution boxes there will be 2 independent circuits each with an incomer & outgoing is provided with removable HRC fuse links for positive isolation of the circuit & also from the point of high fault level on the sub-station. The general arrangement of the circuits is shown in the drawing referred earlier.

There should be insulated barrier of hylem sheets between the front & back portion of the distribution boxes carrying different circuits & it should be possible to work on one side of the box (say front) with circuit

in another side (back) in energised condition The moulded case CB & HRC fuses shall be of stranded make with ISI mark. Suitable cable gland should be provided for the main incomer/outgoing to the distribution boxes.

- 3.13 The outgoing feeders should be provide with HRC fuses front connected type, & MCB of adequate rating. The MCB, MCCB & the HRC fuse links shall be rated for rupturing capacity of 25 KV at 400 V & they shall be of reputed & standard make. The 'OFF& 'ON' position of the MCB & MCCB shall be clearly visible when the doors is open- MCB & MCCBs used shall be of ISI approved make. All the outgoing circuits should be brought to terminal blocks of adequate rating from which outgoing cables will be taken out . The inter connecting wires shall be of copper & suitable bimetallic connections for connections with the bus-bars should be used. table cable glands should provided for the outgoing feeders of the distribution box.
3. 14 The drawing of distribution box shows the typical arrangement. The current ratings etc., are also specified in the drawings.
- 3.15 All the fuse cutouts & cable terminals shall be so arranged that they shall not cause them to come in contact with one-another or with the enclosure by the movement of the cable after insulation & the fixed connections shall be such that the necessary contact pressure is maintained under the conditions of service & operation. The terminal shall be such that they shall not turn or get displaced when the connecting screws are tightened & such that the conductors shall not be displaced. The wiring inside the distribution fuse boards shall be arranged neatly by grouping the leads properly.

4.0 **TERMINAL**

BLOCKS:

- 4.1 Terminal blocks shall be 600V grade box clamp type with marking stripssimilar to ENGLISH / ELECTRIC / JOHNSON / ELMEX type, of stud & bolt type, not more than two wires shall be connected to any terminal. Terminals equal in number to 20% of active terminals shall be finished as spares. Terminal block shall be located to allow easy access. Wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.

5.0 **SMALL**

WIRING:

The AC distribution box shall be fully wired at the factory to ensure proper functioning & control of protection scheme. Wiring shall be done, using 660V Grade PVC insulated with stranded famed annealed copper conductor. The size of the wire shall be 25 sq mm for 100 Amps circuits

& 4sq mm for outgoing 15 Amps circuits. Each wire shall be identified at both ends with permanent markers bearing Wire numbers as per contractors wiring diagram. Wire terminals shall be made with crimping type lugs with insulating sleeves. Wires shall not be spliced between terminals. for each circuit the neutral wire to be connected from neutral bus to terminal block. The colour of the wires used shall be Red for phase. Yellow for 'Y' phase, blue for 'B' phase & black for neutral.

6.0 CIRCUIT

LABELLING:

- 6.01 Each outgoing & incoming circuits shall be labeled both near the MCCBS / HRC fuse, MCB s and also near the terminal blocks, provision shall be made. by means of a label (which is preferably of the renewable type & protected by transparent material) for recording the circuit title, cable size etc.

7.0 RATING

PLATE:

- 7.01 The following information shall be clearly & indelibly marked on all the distribution fuse boards

1. Rated Voltage.
2. Total number/current rating of incoming fuse ways.
3. Total number/current of outgoing fuse ways.
4. Manufacture's name.
5. P.O. reference & date.

8.0 EQUIPMENT

DETAILS:

- 8.1 One set of AC distribution box complete with all the equipments listed below with 3 pole electrolyte aluminium bus-bar system & neutral, completely wired, painted, with MCB, MCCB, HRC fuse units, Circuit labels as indicated in the drawing shall be supplied.

- 8.2 Single & double front AC distribution box shall comprise of the following equipments.

S1 No.	ITEM	SINGLE FRONT	DOUBLE FRONT
1	Free standing sheet steel clad outdoor type, MS cubicle of dimension	750 x 1350 x 300 mm	1200 x 1350 x 600 mm
2	Two independent circuits a. incomer 415V, 3pole, 100A MCCB with	1 No.	2 Nos.

	rupturing capacity of 20 KA for 1 sec with separate neutral line b. outgoing 100A, removable HRC fuse links with fuse base of rating 100A & rupturing capacity of 25KA for 1 sec, with separate neutral link	3 No.	6 Nos.
3	Outgoing feeders : a. 415V, 15/16A, 3 pole MCB b. 10A, HRC fuse links (for 3 phase) with suitable base (rupturing capacity 25 KA for 1 sec)	6 Nos. 18 Nos.	24 Nos. 72 Nos.
4	a. 240V, 5/15A, multi pin industries socket & plug b. 240V, 15A, 2 pole, ON/OFF switch c. 10A, HRC fuse link with suitable fuse base, of rupturing capacity 25 KA for 1 sec with separate neutral link.	1 No. 1 No. 1 No.	2 Nos. 2 Nos. 2 Nos.
5	Electrolytic aluminium bus-bars a) for phases & neutral 20 x 6 mm	As required	As required
6	10 mm thick 100 grade HYLEM sheet for bus-bar mounting 7 installation	As required	As required
7	a. 50/70 sq. mm shrouded terminals for 100 A incoming & outgoing circuits b. 4 sq. mm shrouded terminals for 10A outgoing feeders.	If required As required	If required As required
8	Indication lamp for live bus indication	4 numbers	-----

9.0 Test:

Tests for rust protection: This shall be made on a representative sample

of the material used for enclosure. The test shall be carried out either on a sample cut from a complete enclosure or metal identical in all respects to the metal used for the enclosure & given an identical protective finish. The same shall be first cleared with a piece of wadding soaked in Benzons & then dried. Then it shall be totally immersed in a solution prepared as detailed below:

Solution for use in test for rust protection (BS 214-1973):

Prepare a solution of 7.5 grams potassium femicyanide (K3PC Cns) & 2.5grams of ammonium per sulphate (NHS) 2 (S20B) in 1 liter of water. Add a quantity of about 1 gram of suitable wetting agent for instance a sodium salt of alkaline naphthalene sulphuric acid to each-liter of the solution. The solution & the sample being maintained. at a temperature of $20 \pm 1^{\circ}$ C. After immersion for 5 minutes, the sample shall be removed from the solution & left dry in air at room temperature. After the test the sample shall show, no more than two blue colour red spots in any area of 100 sq mm & no spot shall have a dimension larger than 1.5 mm. Traces of rust on sharp edges & screw threads & any yellowish film removable by rubbing shall be ignored.

9.1 TESTS & TEST CERTIFICATES:

All the other type & routine tests prescribed in IS 2675/1966 shall be conducted on all complete distribution box assembled & completed in all respects & the copies of the certificates shall be submitted for approval before dispatch of the material. Copies of the latest Type test certificates from a cognized test house for having conducted such tests on a distribution box to prove the conformity of the equipment with the above ISS shall be submitted along with the tender.

Copies of the type & routine test certificates for all components used in manufacture of the box from a recognized test house (to prove the conformity of the components to the relevant standards) shall be submitted along with the tender.