

**KARNATAKA POWER TRANSMISSION CORPORATION LIMITED**

**SECTION – AC OUT DOOR DISTRIBUTION BOX**

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## **1.0 SCOPE**

This specification covers the requirements of design, materials, manufacturing, testing and inspection at Vendor's works of outdoor type Low Voltage switchgear for voltage not exceeding 1100 V A C.

## **2.0 CODES AND STANDARDS**

The distribution boards shall generally conform to IS:2675/1966 (with latest amendments) - specification for enclosed distribution fuse boards & courts for voltages not exceeding 1100 Volts.

## **3.0 GENERAL REQUIREMENTS**

- 3.1 Irrespective of anything said or omitted in this specification, the distribution box shall be suitable for the purpose they are intended be used. Each distribution box shall be complete with accessories such as bus-bars, fuses, lock & key etc.
- 3.2 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.
- 3.3 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.
  - 1) Typical Single Line Diagram for Double Front Distribution Box (DFDB)-Drg.No.KPTCL/TECH/400KV DFDB.
  - 2) Typical Single Line Diagram for Single Front Distribution Box (SFDB)-Drg.No.KPTCL/TECH/400KV SFDB.
- 3.4 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. and iron frame. The shutters & body shall be suitably ribbed to give light but strong structure.
- 3.5 The A.C. distribution fuse boards shall have hinged double doors at front & at back for double front type. Each door shall have independent type door lock & shall be capable of being opened & closed independently.
- 3.6 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°C and in addition hinges shall permit doors being completely removed when necessary.

3.7 The distribution boxes shall be provided with suitable aprons/canopy. 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.

3.8 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 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.

3.9 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.

3.10 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.

3.11 FINISH:

All steel surface shall be sand blasted, grounded, pickled as required to produce a smooth, clean surface free of scale, grease & 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.

3.12 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- AD 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.

- 3.13 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.
- 3.14 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.
- 3.15 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, ISI mark. Suitable cable gland should be provided for the main incomer/outgoing to the distribution boxes.
- 3.16 The outgoing feeders should be provided with MCB of adequate rating. The MCB, MCCB shall be rated for rupturing capacity of 25 KA 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.
- 3.17 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. cable glands should provided for the outgoing feeders of the distribution box.
- 3.18 The drawing of distribution box shows the typical arrangement. The current ratings etc., are also specified in the drawings.
- 3.19 All the fuse cutouts & cable terminals shall be so arranged that they shall be 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, while 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 strips similar 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.
- 4.2 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:**

- 5.1 The AC distribution box shall be labeled wired at the factory to ensure proper functioning & control of protection scheme. Wiring shall be done, using 660V Grade PVC insulated with stranded fanned annealed copper conductor.
- 5.2 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.
- 5.3 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:**

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:**

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. going fuse ways.
3. Total number/current of out'.
4. Manufacture's name.
5. P.O. reference & date.

## 8.0 **EQUIPMENT**

## **DETAILS:**

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.

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

Sl 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, 4pole, 100 A MCCB with rupturing capacity of 25	1 No.	1 No.

	KA for 1 sec b) outgoing 100 A, removable HRC fuse links with fuse base of rating 100A & rupturing capacity of 25KA for 1 sec, with separate neutral line c) Motorized Change over switch, 100A, 4pole	6 Nos.  1No.	6 Nos.  1No.
3	Outgoing feeders : a) 415V, 15/16A, 3 pole MCB with Neutral link	6 Nos. 18 Nos.	24 Nos. 72 Nos.
4	a) 240V, 5/15 A, 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 aluminum 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:**

### 9.1 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 (13S 214-1973):

Prepare a solution of 7.5 grams potassium femicyanide (K3PC Cns) & 2.5 grams of ammonium per sulphate (NHS) 2 (S2013) in I 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 should, 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.

9.2 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.

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

**a) For AC outdoor distribution box manufactured in India:**

- i. Type tests on indigenous equipment for which testing facility is available in India, should have been conducted in any independent laboratories approved by Government or accredited by National accreditation body of the country like Central Power Research Institute (CPRI), Electrical Research and Development Association (ERDA), etc.
- ii. 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 manufacturers shall also be acceptable provided the lab (manufacturer's) is accredited by National accreditation body of the country and the tests have been witnessed by a representative of NABL accredited Independent laboratory/Power utility.

**b) For AC outdoor distribution box 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 respective country.

Type tests conducted in-house by manufacturers shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests have been witnessed by a representative of accreditation body/Power utility.

**APPLICABLE STANDARDS:**

- |     |   |   |
|-----|---|---|
| 1.  | SWITCHGEAR GENERAL  | <input type="checkbox"/> IS : 13947 <input type="checkbox"/> BSEN: 60947 <input type="checkbox"/> IEC   |
| 2.  | AC CIRCUIT BREAKERS   | <input type="checkbox"/> IS:13118 <input type="checkbox"/> BSEN 60947-2 <input type="checkbox"/> IEC 947-2<br><input type="checkbox"/> BS:3871(PI) MCCB |
| 3.  | FACTORY BUILT ASSEMBLIES OF SWITCHGEAR AND CONTROL GEAR FOR VOLTAGES UPTO AND INCLUDING 1000V A.C. & 1200 V D.C | <input type="checkbox"/> IS:8623 <input type="checkbox"/> BS:5486 <input type="checkbox"/> IEC:439  |
| 4.  | AIR BREAK SWITCHES  | <input type="checkbox"/> IS:13947 <input type="checkbox"/> BSEN:60947-3 <input type="checkbox"/> IEC-947-3  |
| 5.  | MINIATURE CIRCUIT BREAKERS  | <input type="checkbox"/> IS:8828 <input type="checkbox"/> BS:3871 <input type="checkbox"/> IEC:   |
| 6.  | HRC CARTRIDGE FUSES   | <input type="checkbox"/> IS:13703(P2) <input type="checkbox"/> BS:88 <input type="checkbox"/> IEC-769   |
| 7.  | D TYPE FUSES  | <input type="checkbox"/> IS:8187 <input type="checkbox"/> BS: <input type="checkbox"/> IEC:   |
| 8.  | CONTACTORS  | <input type="checkbox"/> IS:13947 <input type="checkbox"/> BSEN-60947-1 <input type="checkbox"/> IEC:9474-1   |
| 9.  | STARTERS  | <input type="checkbox"/> IS:13947 <input type="checkbox"/> BSEN-60947-4-1<br><input type="checkbox"/> IEC:947-4-1                                       |
| 10. | CONTROL SWITCHES/PUSH BUTTONS   | <input type="checkbox"/> IS:13947 <input type="checkbox"/> BS: <input type="checkbox"/> IEC:  |
| 11. | CURRENT TRANSFORMERS  | <input type="checkbox"/> IS:2705 <input type="checkbox"/> BS:7626 <input type="checkbox"/> IEC:185  |
| 12. | VOLTAGE TRANSFORMERS  | <input type="checkbox"/> IS:3156 <input type="checkbox"/> BS:7625 <input type="checkbox"/> IEC:186  |
| 13. | RELAYS  | <input type="checkbox"/> IS:3231 <input type="checkbox"/> BS:142 <input type="checkbox"/> IEC:255   |
| 14. | INDICATING INSTRUMENTS  | <input type="checkbox"/> IS:1248 <input type="checkbox"/> BS:89 <input type="checkbox"/> IEC:51   |

15. ARRANGEMENT FOR BUSBARS MAIN CONNECTIONS AND ACCESSORIES ☐ IS:5578 ☐ BS:159 ☐ IEC: ☐ IS:11353
16. AC ELECTRICITY METERS ☐ IS:8530 ☐ BS:37 ☐ IEC:
17. DEGREE OF PROTECTION ☐ IS:13947(PI) ☐ BS: ☐ IEC:947-1
18. THE PERFORMANCE OF AC CONTROL GEAR EQUIPMENT RATED UPTO 600 V FOR USE ON HIGH PROSPECTIVE FAULT CURRENT SYSTEM ☐ IS: ☐ BS: ☐ IEC:
19. CODE OF PRACTICE FOR INSTALLATION AND MAINTENANCE OF SWITCHGEAR ☐ IS:10118 ☐ BS: ☐ IEC:
20. CLIMATE PROOFING OF ELECTRICAL EQUIPMENT ☐ IS: ☐ BS: ☐ IEC:
21. CODE OF PRACTICE FOR PHOSPHATING IRON AND STEEL ☐ IS: 6005 ☐ BS: 3169 ☐ IEC:
22. WROUGHT ALUMINIUM AND ALUMINIUM ALLOYS FOR ELECTRICAL PURPOSES ☐ IS:5082 ☐ BS:2898 ☐ IEC:
23. CONTROL TRANSFORMER FOR SWITCHGEAR AND CONTROL GEAR FOR VOLTAGE NOT EXCEEDING 110V AC ☐ IS:12021 ☐ BS: ☐ IEC:

NOTE :

EQUIPMENT, ACCESSORIES, COMPONENT PARTS, RAW MATERIALS AND TESTS SHALL IN GENERAL CONFORM TO :

**DATA TO BE FURNISHED BY THE VENDOR AFTER  
AWARD OF THE CONTRACT**

Time periods indicated below are for project with equipment delivery period of 12 months these will be proportionately revised as per agreed delivery period.

1.0 **OVERLOAD RELEASE**

(a) Characteristics

(b) Settings

2.0 **SINGLE PHASING PREVENTERS**

2.1 Make

2.2 Type designation

2.3 Rated voltage

3.0 **AUXILIARY RELAYS AND TIMERS**

3.1 Time delay range (for timers) Sec.

3.2 Resetting features

3.3 No. of contacts

3.3.1 Normally open/Normally closed

3.3.2 Contact rating A

3.4 Whether operation indicator is provided YES/NO

4.0 **CONTROL/SELECTOR SWITCH**

4.1 Whether contact arrangement as given in control scheme YES/NO

## 5.0 **LIST OF DRAWINGS**

The VENDOR shall furnish the following drawings for each panel and switchgear within the time indicated after placing the order. If a large number of switchgears are involved, the PURCHASER will indicate the priorities.

- 5.1 Overall outline dimensions and general arrangement including plan, front elevation, rear & side elevations, clearances required in front and back, details of busduct connections, if any.
- 5.2 Switchgear layout plan including floor openings, fixing arrangements and loading details.
- 5.3 Schematic control diagrams to cover controls, protection, interlocks, instruments, space heaters, etc. for each type of module
- 5.4
  - (a) Detailed internal wiring diagram of each type of module, including terminal block numbers, ferrule numbers and the PURCHASER's external cable connection designations
  - (b) Itemized bill of material for each module, listing all devices mounted and also otherwise furnished like cable glands, indicating the MANUFACTURER's type, rating, quantity & special notes, if any.
- 5.5 Interpanel interconnection wiring diagram including terminal numbers and ferrule numbers
- 5.6 Switch development diagrams

- 5.7 Each type of protection relay and circuit breaker release characteristics
- 5.8 Fuse characteristic curves for each type and rating of fuse
- 5.9 Space heater ratings and numbers provided per cubicle and the internal distribution scheme for the same, for each switchgear

**NOTES:**

- (a) The VENDOR shall be entirely responsible for the correctness of the internal wiring diagrams mentioned against Item 5.4.
- (b) The VENDOR shall ensure that the characteristics of the CTs, fuses, protection relays, VTs and all other devices offered by him are such as to be suitable for the purpose for which they are intended.
- (c) The VENDOR shall plan his manufacturing schedule so as to allow atleast 4 weeks time for approval of the drawings after their receipt by the PURCHASER.

**6.0 TEST CERTIFICATES**

- 6.1 Type test certificates of all standard component parts, e.g. contactors, breakers, switches, fuses, relays, CTs, VTs, and for the standard factory built assembly shall be submitted by the VENDOR within 3 months from receipt of order.

**7.0 INSTRUCTION MANUALS**

The VENDOR shall furnish specified number of copies of the instruction manual which would contain detailed instructions for all operational & maintenance requirement. The manual shall be furnished at the time of despatch of the equipment and shall include the following aspects :

- a) Outline dimension drawings showing relevant cross-sectional views, earthing details and constructional features.
- b) Rated voltages, current, duty-cycle and all other technical information which may be necessary for correct operation of the switchgear.
- c) Catalogue numbers of all components liable to be replaced during the life of the switchgear.
- d) Storage for prolonged duration.

- e) Unpacking.
- f) Handling at site.
- g) Erection.
- h) Precommissioning tests.
- i) Operating procedures.
- j) Maintenance procedures.
- k) Precautions to be taken during operation and maintenance work.







