

## **TECHNICAL SPECIFICATION FOR ELECTRICAL LT PANELS/ COMPONENTS**

### **1.0 SCOPE**

This specification covers the technical requirements of design, test, supply of 415V L.T. Panels complete with all accessories for efficient and trouble free operation.

All the panels shall be manufactured as per the following specification. In case of any deviation from the mentioned, vendor shall bring into notice the same alongwith it's offer. In absence of such deviation, it will be presumed that equipment offered is exactly similar to the specification.

### **2.0 The following IS Standards shall be referred:-**

The equipment covered by this specification shall, unless otherwise stated, be designed, constructed and tested in accordance with the latest revisions of relevant Indian Standards and shall conform to the regulations of local statutory Authorities.

5	Colours for Ready Mixed Paints
375	Specification for Marking & Gen Arrangement of Swgr, Busbars, Main Connection & Aux. Wiring
398	Specification for Hard Drawn Stranded Aluminium & Steel Cored Aluminium Conductors for Overhead Power Transmission Purpose
513	Cold Rolled Low Carbon Steel Sheet & Strips
722	Specification for A. C. Electricity Meters. (Integrity Meters)
1248	Specification for Direct Acting Electrical Instruments.
1822	AC Motor Starters of Voltages not exceeding 1000
1841	Specification for EC grade Aluminium Rod Produced By Rolling
1897	Specification for Copper Strips for Electrical Purposes
1901	Visual Indicator Lamps.
2147	Degree of Protection provided by Enclosure for Low Voltage Switchgear
2208	Specification for HRC Fuse Links upto 650 Volts
2516	A.C. Circuit Breaker Requirement for Voltages not Exceeding 1000 V (Part - I, Sec - I + Part - II, Sec-II)

2705	Specification for Current Transformers.
2834	Specification for Capacitors for Power System
2959	AC Contactors for voltages not exceeding 1000 V
3202	Code of Practice for Climate Proofing of Electrical Equipment
3231	Electrical Relays for Power System Protection.
3247	Switchgear General Requirements
3427	Metal Enclosed Switchgear & Control gear
4064	Specs for Heavy Duty Air Break Switches Fuses for Voltages not exceeding 1000 V.
4237	General Requirement for Switchgears & Controlgear for Voltage not exceeding 1000 V
6875	Control Switches / Push Buttons
8623	Factory Built Assemblies of Switchgears & Control Gear.
8828	Miniature Circuit Breaker
13947	LV Switchgear and Control Gear.

### 3.0 Indian Electricity Acts & Rules :-

All codes & standards mean the latest, wherever not specified. The manufacturing shall generally follow the Indian Standard codes of practice or the relevant British Standard Codes of Practice in the absence of corresponding Indian Standard.

### 4.0 Construction :-

The panel shall be metal-enclosed, free-standing compartmentalized, modular type suitable for indoor installation. The panel shall be dust and vermin proof and the enclosure shall provide a degree of protection of not less than IP-52. The height of all the panels shall not exceed more than 2200 mm & depth shall not be more than 500 mm for Single Front & 800 mm for Double Front, except for the Circuit Breaker panel, where the depth could be 1000 mm.

Control panel shall be fabricated out of 14 SWG cold rolled steel plates & properly supported using angles & channels. The Panels shall be divided into convenient continuous line. The whole panel shall be mounted on a base frame made out of suitable structural, preferably ISMC Channels. Joints of any kind in sheet shall be seam welded, all welding slag grounded off and welding pit wiped smooth with plumber metal. All panels and covers shall be properly fitted and square with the frames and holes in the panel correctly positioned. Self-threading screws shall not be used in the construction of switchboards.

The Panel shall be fully compartmentalised with all doors on the front only. When compartment door is opened, busbar and cable alley shall be shrouded by barrier plates.

All panels shall be provided with suitable cable alley and vertical bus bar alley. Vendor shall submit Busbar Calculation confirming the suitability of Busbars offered along with the bid.

Each cable chamber shall have cable entry from bottom and suitable removable gland plates shall be provided for this purpose. The cable chamber shall be provided with suitable supporting arrangement between the gland plate and terminals, in the middle. The cable chamber shall have a minimum width of 300 mm depending upon the outgoing cables. Each vertical chamber shall be divided into two parts using 14 SWG cold rolled steel plate and shall be of removable type screwed to the lugs projecting from the main body of the panel. Each chamber shall be provided with a hinged type door opening away from the cable alley and shall be provided with black flower type thumb screw which shall ensure tight closing. The edges of the door shall be provided with a neoprene rubber gasket to make the compartment dust proof. All retaining catches, screws and bolts for doors and covers shall be cadmium plated. Screws and bolts shall be captive.

Compartment door shall be inter-locked with the switch unit in such a way that the door can not be opened when the feeder switch is ON. The door of the compartment and busbar chamber shall be fully removable type and not hinged. Equipment to be mounted outside cubicles shall be flush mounted on cubicle door. No externally mounted equipment shall be mounted above 2.0m or below 0.4m above floor level.

All similar materials and removable parts of the panel shall be interchangeable. The panel shall be filled with the same family of switches for various ratings with a view to ensure uniformity of design, maintenance and replacements. A horizontal wire way with screwed cover shall be provided at the top/bottom to take inter-connecting control wiring between different vertical sections. Separate and adequate compartments shall be provided for accommodating instruments, indicating lamps, control contractors and control fuses etc. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker busbar connections. Earth Busbar shall be provided all around the cubicle at the bottom & it shall be of the same size as neutral busbar. Painting shall be done by surface coating comprising pre-treatment, Electrostatic Powder Spraying & curing. The surfaces to be coated shall be chemically derusted & degreased, Zinc Phosphatised & then Passivated after proper drying subjected to spraying of powder. (All panels shall undergo 7 tank pre-treatment procedures strictly). All the panels shall be coated using Siemens Grey shade (RAL 7032).

#### **5.0 The panel shall be divided into the following compartments: -**

##### **5. a) BUSBAR CHAMBER :-**

- 1.1** The busbar chamber shall be provided at the top of the panel horizontally throughout the length. There shall be 3 Nos. of phase busbar and 1 No neutral busbar and 1 No earthing busbar. The busbars shall be air insulated and made up of high conductivity Aluminium.
- 1.2** Busbars shall be of high conductivity Aluminium with current density of 800 A Inch<sup>2</sup> and shall have specified capacity suitable for fault level of 30 MVA. All busbars shall be fully screened by means of PVC sleeves in their own compartment running throughout the length of the panel and also suitable allowance shall be made for bus expansion. Suitable segregation shall be provided in between busbar chamber and adjoining compartments. Busbars shall run throughout the length of the chamber and shall be of extendable type on either side
- 1.3** The busbar shall be PVC sleeved with colour strips of red, yellow, blue and black and the same shall be arranged in accordance with IS-375.
- 1.4** The busbar shall be properly segregated, suitably braced with insulated supports (DMC/FRP/SMC) placed at appropriate intervals to withstand the electro magnetic stresses during short circuit. Minimum electrical clearances shall be maintained between phase, neutral and body as per standards.

##### **5.b ) CABLE CHAMBER :**

Sufficient size chambers of min 250 mm width shall be provided to house copper connector channels to take out connections for individual starter / FSU feeders. Cables entry shall be as shown on the panel schedules & a min entry depth at Top / Bottom (as the case may be)

shall be provided. 10 swg M.S. sectionalized gland plates shall be provided for cable entries.

### **5.c) AIR CIRCUIT BREAKERS**

#### **General**

All Air circuit breakers (ACB) are EDO type 50kA, 4pole Microprocessor based with O/L, S/C, E/F protection with 415V Under voltage release, 230V AC Motor for Spring charging, 230V AC Closing and Tripping coil. Micro sw. for Common Fault Indication. They shall be complete in all respects having the following minimum requirements.

- I. Motor wound spring closing mechanism.
- II. Full draw-out type with indication for service, test and isolated positions.
- III. Trip free mechanism.
- IV. Mechanical open, closed and spring charges indicator.
- V. Main contacts made up of copper.
  
- VI. Magnetic blow out arc control device.
- VII. Facilities for pad locking.
- VIII. 3 Nos. indicating lamps for ON / OFF and Breaker 'Auto Trip' indication.
- IX. Electrical operated mechanism.

#### **Construction**

- 1.1 The breakers shall be designed, manufactured as per IS:13947. The circuit breaker shall be fully draw out type. Suitable guides shall be provided to facilitate easy withdrawal of the trolley. All identical feeder compartments shall be interchangeable.
- 1.2 The current transformers for the ammeter circuit shall be mounted on the fixed portion of the compartment.
- 1.3 All current carrying contacts of the breaker shall be silver plated. Contacts subjected to arcing shall be tipped with suitable arc resisting material.
- 1.4 The contacts shall be self-aligning, plug-in type, designed to ensure adequate contact pressure on the main busbars and requiring minimum maintenance.

#### **Operating Mechanism**

- 1.1 The breaker mechanism shall be 230V AC motor charged spring operated type. Tripping shall be effected by mean of shunt trip coil.
- 1.2 The operating mechanism shall be trip-free. Failure of spring, vibrations or shocks shall not cause unintended operation of breaker or prevent intended tripping operation. Closing of breakers shall be prevented unless the spring is fully charged.

#### **Interlocks**

- 1.1 The breaker shall be provided with all necessary interlocks to prevent inadvertent operations and to ensure safety of operating personnel and also the equipment.
- 1.2 It shall not be possible to push in a drawn out breaker in closed condition or withdraw a breaker in closed condition. Compartment doors shall be interlocked against opening when breaker is in 'Closed' condition. It shall not be possible to operate the breaker in intermediate position while inserting or withdrawing a circuit breaker.

#### **5.d) MCCB's :-**

The MCCB shall comply with the requirement of IS 13947. MCCB's shall be provided with spring assisted quick make, quick break manually operated Trip free mechanism. MCCB's shall be provided with tripping device with inverse time characteristics for short circuit protection.

MCCB shall be operated by ON OFF PUSH BUTTON System not manual handle.  
MCCB's shall be rated as specified in the Bill of Quantities.

#### **5.e) CONTACTOR :-**

- 1.1 Contactor shall be of electromagnetic type rated for uninterrupted duty as defined in IS-13947-4-1 unless otherwise specified and also suitable for capacitor duty.
- 1.2 The main contacts shall be of silver or silver alloy.
- 1.3 The insulation class for the coil shall be class E or better.
- 1.4 Each contactor shall be provided with 2 N/O and N/C aux. contacts.
- 1.5 Contactor coil rating shall be minimum pick up of 85% of rated voltage and minimum drop out of 75% rated voltage.

#### **5.f) THERMAL OVERLOAD RELAY :-**

Thermal Overload Relay shall be 3 element positive acting; ambient temperature compensated type with adjustable setting range & with built in Single Phase Preventer. Overload Relays shall be manually reset type with Reset Push Button on the front of the panel. Reset P / Button shall be capable of being operated without opening the compartment door.

#### **5.g) CAPACITOR BANKS :-**

Each Capacitor Unit shall be 3 phase unit suitable for 415 V Delta connection. Each Capacitor Unit shall consist of Capacitor Element connected in parallel. Each Unit shall be protected by internal fuse. Each Capacitor Unit shall be housed on a leak proof & explosion proof metallic box.

The Capacitor shall be low wattage Polypropylene film capacitors, self healing type & are vacuum impregnated with non - PCB, non-toxic, bio degradable oil, in nylon container & are provided with Inductor Coil for limiting Inrush Current for individual compensation. The same should be cut- off switching on suitable device. Capacitor Unit shall be provided with Discharge resistor to reduce the Phase voltage to 50 V within 1 minute. Each Unit shall be provided with 2 nos.earthing terminals.

#### **5.h) INDICATING LAMPS :-**

Indicating Lamps shall be cluster LED type suitable to operate on 240 V AC.

#### **5.i) INDICATING METERS INSTRUMENT XMERS:-**

All measuring instrument shall be square pattern & 144 mm<sup>2</sup> in size for Incomer feeders & 96 mm<sup>2</sup> for the outgoing feeders. All the meters shall be of Class - 1 accuracy. Ammeters and Voltmeters shall be of digital type. They shall be industrial grade and shall have means of zero adjustment from the front without dismantling them. They shall be capable of carrying the normal full load current (via CTS) and shall not be damaged by effects of rated fault current. The instruments shall have an accuracy class of 1.0 as per IS - 1248. Energy Meters shall be 3 Element & switchboard mounting type suitable for unbalanced load. Current transformers shall be encapsulated / resin cast type, with 15 VA burden & class-1 accuracy. All the CT's shall be provided with CT shorting links.

#### **5.j) INTERNAL WIRING :-**

- 1.1 Panel shall be supplied with all internal wiring comprising of PVC insulated 1.1 KV grade, multistrand flexible copper conductor of 2.5 Sq.mm cross section.
- 1.2 Wiring associated with a particular phase shall be the colour of that phase viz. Red / Yellow, or Blue. Wiring associated with earthing shall be with green colour insulation and for neutral it shall be with black colour insulation.
- 1.3 Wiring shall be neatly laid and run on insulated cleats of limited compression type insulated straps.

- 1.4 All cables shall have crimped terminations and shall be identified by means of glossy plastic ferrules at both ends, showing the wire number as indicated in the schematic diagrams. The ferrules shall be indelibly marked.
- 1.5 Wiring to items mounted on hinged doors or wiring that is subject to movement, shall run in helical binding. The binding shall be securely anchored at both ends and sufficient slack provided to prevent any strain being imposed on wiring.

#### **5.k ) TERMINAL BLOCK :-**

- 1.1 Terminal blocks shall preferably be grouped according to circuit functions and each terminal block group shall have at least 10% spare terminals. Terminal blocks for control circuit shall be of 650V grade with contact ratings not less than 10A and stud/clamp type.
- 1.2 Not more than two wires shall be connected to any terminal block.
- 1.3 Elmex type Clip-on terminals of 650 V grade shall be provided for the cables up to 35 mm<sup>2</sup>. Higher size connections shall be carried out using suitable size Al links.

#### **5.l) PUSH BUTTONS**

Push buttons shall be generally shrouded. Each push button shall be provided with 1 N/O and 1 N/C aux. contacts. "Stop" push button shall have, 'stay-put' feature. Colour code shall be as per IS-6875.

#### **5.m) INTERCONNECTION**

- 1.1 The interconnections of all the phases between the busbars and the incoming side of the switch control shall be inaccessible when the doors of the controls are opened for removal of fuses etc.
- 1.2 For each and every tapping from the busbars, separate connections shall be made.
- 1.3 No direct tapping from the busbar shall be made for any feeder without control and protection.
- 1.4 The incoming and outgoing cable shall be properly identified and also the circuit to which it is connected on each outlet.

#### **5.n) EARTHING**

- 1.1 All the metal parts of all equipment supplied within the panel (including doors and gland plates) other than those forming part of all electric circuit, shall be connected by means of two independent earth conductors to continuous copper earth bar of size 25 x 3 mm running along the full length of the panel.
- 1.2 The panel shall be provided with two brass earthing stud terminals, with suitable nuts, washers etc. for connection to ground bus.

### **6.0 LABELS**

- 1.1 Labels shall be provided to describe the duty of or otherwise identify every Instrument, or other item of equipment mounted internally and externally. Switch positions shall be fully identified. Wording shall be clear, concise and unambiguous.
- 1.2 Each label shall be permanently secured to the panel surface below the item to which it refers.
- 1.3 The labels shall be engraved plastic (4 mm thick) with white letters in black background.
- 1.4 In addition to component labels, each cubicle door shall bear a large identification labels and the panel shall include large, prominent overall identification label.

