

Technical Specification

Bhutan: TLF MCC cum lighting panel

- The required characteristics of the TLF cum lighting panel like feeder / circuit rating, instruments and meters, protections, reference schematic drawings etc. are indicated in the the SLD and this sheet. The tenderer / supplier shall include all accessories, spare parts, whether indicated in our specifications or not, to make the boards complete in all respects. These items shall be quoted with unit prices.
- **STANDARDS TO BE FOLLOWED**

The design, manufacture and testing of the equipment shall comply with the latest issue of the following Indian Standards, unless otherwise Specified :

- IS: 8623 Specification for low voltage switchgear and controlgear assemblies.
- IS: 13947 Low-voltage switchgear and controlgear (General rules)
- IS: 5578 Guide for marking of insulated conductors.
- IS: 11353 Guide for uniform system of marking and identification of conductors and apparatus terminals
- IS: 10118 Code of practice for selection, installation and maintenance of switchgear and controlgear.
- Various components housed in the switchboards shall conform to the Indian Standard specification as mentioned against the component details.
- The design and operational features of all the equipment offered shall also comply with the provisions of the latest issue of the Indian Electricity Rules and other Statutory Acts and Regulations. The supplier shall, wherever necessary, make suitable modifications in the equipment to comply with the above.
- Wherever any requirement, laid down in this-standard, differs from that in Indian Standard Specification, the requirement specified herein shall prevail.

- **OPERATING REQUIREMENTS**

The Medium Voltage Switchboards shall be suitable for operating at the specified rating continuously, with the specified voltage and frequency variations under the ambient conditions indicated in Specification Sheet, without exceeding the permissible temperature rise and without any detrimental effect on any part.

⇒ **DESIGN AND CONSTRUCTIONAL FEATURES**

- **General**

The switchboards shall consist of an assembly of a series of floor mounting, identical, metal clad, single front type sheet steel panels of unitized design. The panels shall be placed side by side to form a compact assembly and shall be extensible on either side.

The complete assembly shall be dust, damp and vermin proof having minimum degree of protection equivalent to IP-52 as per IS: 13947.

The frame work of the cubicles shall be of bolted/welded construction. The minimum thickness of sheet steel shall be 2 mm for load bearing members, 1.6 mm for non-load bearing members and 3 mm for base channel. The doors and covers shall be fabricated from cold rolled sheets. Suitable reinforcement, wherever necessary, shall be provided.

The door hinges shall be concealed type.

All external hardwares shall be cadmium plated. The hardwares for fixing the removable parts shall be provided with retaining devices.

The doors and the removable covers shall be provided with non-deteriorating neoprene gaskets. Gaskets without any discontinuity shall be preferred. Gaskets shall be held in position in groove, in shaped sheet steel work or these shall be of U type. Adhesive cement, if used, shall be of good quality so that the gasket do not come off during service.

All the components shall be accessible for inspection and maintenance without the necessity for removal of the adjacent ones.

The layout of the component inside the module shall be liberal to facilitate maintenance and interconnecting wiring between the components shall not be subjected to any undue stresses at the bends.

Mounting height of components requiring operations and observation shall not be lower than 300 mm and higher than 1800 mm.

Inter panel barriers shall be provided.

All the live parts which are accessible after opening of front cover/cable alley cover/back cover shall be properly insulated or provided with insulating barrier to prevent accidental contact. Removal facility shall be provided for all such parts.

Adequate arrangement for earthing shall be provided to safeguard the operator or other personnel from electric hazards under all conditions of operation.

- **Panel Arrangement**

The Switchboards shall be in fixed/draw out, single front/ double front execution as specified in Specification Sheet, fully compartmentalised type and divided into distinct panels, each comprising of

- i) A completely metal enclosed bus-bars compartment running horizontally the top.
- ii) Individual feeder modules.
- iii) Enclosed vertical bus-bars serving all modules, in case of multi-tier panels.
- iv) A vertical cable alley.
- v) Separate horizontal enclosure for all auxiliary power and control buses.

- **Bus-Bars and Connections**

The bus-bars shall be for three phase and neutral. The main bus-bars and connections shall be made of high conductivity Aluminium alloy conforming to grade E 91 E of IS: 5082 / electrolytic grade copper of rectangular cross-section.

The horizontal bus-bars shall be insulated with heat shrinkable PVC sleeves of reputed make to protect against approach to live parts. The vertical busbars shall be sleeved or shrouded by barriers. Removable type insulating shrouds shall be provided for all joints of horizontal bus-bars.

The bus-bars shall be amply sized to carry the rated continuous current under the specified ambient temperature without exceeding temperature limits specified in IS:8084. The thermal rating of the bus-bars shall be designed to withstand the system fault current for 1 second without exceeding the limiting temperature of 200°C for bare Aluminium/Copper. Calculation for bus-bars sizing shall be furnished along with the offer.

Horizontal bus-bars shall be of the same cross-section through out. Stepped bus-bars shall not be acceptable.

The bus-bars shall be arranged and colour coded according to IS: 5578/11353.

The bus-bar chamber shall be sufficiently spacious and shall have separate screwed covers for maintenance purpose.

The bus-bars shall be rigidly supported at equal intervals to withstand maximum short circuit stresses. The supports shall be of moulded construction with built-in anti-tracking barriers. The support materials shall be of DMC or fiberglass reinforced thermosetting plastic.

Bus-bar joints shall be between the two transporting sections only.

A minimum of two bolts shall be used in bus-bar joints. Only high tensile electric galvanized bolts, nuts and washers shall be used.

In case of Aluminium bus-bars, all joints shall be suitably treated to avoid oxidation of contact surfaces and bimetallic corrosion.

- **Feeder Details**

The requirements of incomer, and outgoing feeders shall be as indicated in the single line diagram, feeder details and corresponding schematic diagrams.

- **COMPONENT DETAILS**

Components of the switchgear shall ensure type of coordination C as per IS:8544 (Part-1). The make of the components shall be as specified in Specification Sheet.

- **Moulded Case Circuit Breakers**

The circuit breaker shall conform to IS: 13118 and shall be of P2 category having rupturing capacity as specified in Specification Sheet .

The circuit breaker shall be provided with spring assisted quick make quick break type manually operated trip free mechanism, mechanical 'ON', 'OFF' position indicators, thermal tripping devices of inverse characteristics, instantaneous short circuit tripping devices and necessary auxiliary and alarm switches.

The MCCB Chassis shall be provided with service, test and isolated position and automatic safety shutter. The thermal and short circuit tripping devices shall be adjustable type.

When used for motor circuits, shunt trip device shall be provided and the let through power of controlling MCCB shall be lower than the respective contactor.

In addition, under voltage trip shall be provided, if specified in Specification Sheet.

- **Switches**

The switches shall be motor duty type AC 23 Category and shall comply with the requirements laid down in IS: 13947.

Switches upto 63 Amps shall be rotary type and those of 100 Amps. and above, link type. 'ON' and 'OFF' position of the switches shall be indicated on the module.

Provision shall be made to lock the switch in the 'OFF' position.

The fixed contacts shall be shrouded type. All contacts shall be silver plated.

- **Fuses**

The fuses shall be of non-deteriorating HRC cartridge link type and shall conform to IS:9224.

They shall be suitable for the load and service required in the circuit.

One fuse puller shall be supplied along with each board.

- **Air Break Contactors**

The Air Break Contactors shall be of Category AC3/AC4, unless otherwise specified, conforming to IS: 13947 and flapper type.

The dropout voltage shall not exceed 65% of rated voltage.

Each contactor shall be provided with auxiliary contacts as required. The rating of the auxiliary contacts shall be 5 Amps. AC or 1 Amp DC at the specified control voltages.

The spare auxiliary contacts shall also be wired upto the terminal blocks.

- **Bimetal Thermal Overload Relays**

The contactor shall be provided with three pole bimetal thermal overload relays, unless other-wise specified.

The bimetal relays shall be of suitable range, ambient temperature compensated and shall be separate mounting type.

They shall be adjustable through graduated scale and shall be provided with changeover contact. Thermal relays having long time/current characteristics, operated through saturated CTs shall be supplied, wherever required.

Bimetal thermal relays shall conform to IS: 3231 and IS: 13947 and shall have built-in single phasing preventor. The bimetal relays shall be provided with a manual resetting device resettable after opening module door. Auto reset thermal relays are not acceptable.

- **Current Transformers**

The current transformers shall conform to IS: 2705.

C.T.s shall be Class F insulated and vacuum impregnated or resin cast. The C.T.s shall be rigidly mounted and shall be easily accessible for maintenance and testing.

The short time thermal withstand ratings of C.T.s shall be same as the thermal withstand rating of the breakers.

The C.T.s output shall be minimum 15VA for breaker feeders and 7.5 VA for the other feeders per phase and in any case, the output shall be adequate for the protection and metering duties involved with sufficient margin. The C.T.s shall have the following accuracies for the various applications:

Application Class of accuracy as per IS: 2705

i) For metering service 1

ii) For use with protective relays 5 P

iii) For use with restricted earth fault and PS differential relays

The C.T. cores for metering and protection shall be separate.

The ratio of C.T.s shall be as specified in Feeder details.

All the C.T.s shall be provided with terminals and shorting links. One of the terminals of the C.T. shall be earthed.

The polarity of the C.T.s shall be clearly marked.

Provision of Interposing C.T.s is not acceptable.

The C.T.s shall be capable of withstanding momentary open circuit on the secondary side without injurious effects.

- **Voltage Transformers**

The V.T.s shall be Class F insulated and vacuum impregnated or resin cast conforming to IS: 3156.

The primary nominal voltage shall be equal to the system nominal voltage. The secondary terminal voltage shall be 110 V.

The primary and secondary winding shall be protected by HRC fuses in each phase except in the ground phase of the secondary side.

The V.T.s shall be mounted on separate withdrawable carriage. The accuracy Class of

V.T.s shall be 1.

The rated output of each V.T. shall be adequate for the relays, meters and associated wiring connected to it and shall not be less than 50 VA per phase.

- **Control Transformers**

These shall be air cooled Class F insulated and vacuum impregnated. The rating of control transformer shall be twice the hold on VA of all contactor/relays or 2.5 KVA whichever is high. It shall be free from hum and rigidly mounted. Epoxy cast transformers shall be preferred.

- **Relays**

All protective relays shall conform to IS: 3231 and shall be provided in drawout and dust proof cases and shall be flush mounted type.

Auxiliary relays may be fixed type. The relays shall be fully tropicalised.

IDMTL overcurrent relays shall generally have adjustable plug settings ranging from 50% to 200%. IDMTL earth fault relays shall have setting range of 20% to 80%. All IDMTL relays shall have extremely inverse characteristics similar to GECA make CDG 14 relay.

The restricted earth fault relays shall be high impedance and high speed type and shall be complete with required stabilising resistor.

The relays shall be stable under through faults and magnetic inrush currents Motor protection relays shall be suitable to cater wide range of motor characteristics.

This should include elements for overcurrent, high set instantaneous, earth fault, negative sequence and stalling protection. Stalling protection relay contact shall be connected across other relay contact and left free in the terminal block of the relays for external looping.

Under voltage relays for motor protection shall be IDMTL type having setting range 50% to 90%. All other relays shall have a setting range of as specified in Specification Sheet.

The DC relay operating coils shall be so placed in the circuit that they are not connected to the positive pole of the battery except through contact which are normally open.

Mechanical/self power flag indicators shall be provided for all protective relays and for auxiliary relays, where required.

All relays directly tripping the breakers shall be provided with hand reset contacts.

The flag indicator shall be suitable for external hand resetting and shall be mechanically interlocked to prevent it from falling when the relay is subjected to vibration. Access to the setting device shall be possible only after the front covers are removed. Access to resetting device shall be external to the case.

All relays shall be provided with test plug.

All relays shall be suitably marked as per relevant ISS.

Where relays are required to operate, with a time delay, the delaying attachment shall not be of dash pot type.

All relays and other protective devices shall be properly coordinated.

Necessary auxiliary relays shall be provided, where required.

The VA burden of all the relays and instruments shall be clearly indicated in Technical Particulars.
All contacts of the relays, whether utilized or not, shall be wired upto the terminal board of the panel.
Static/numerical relays, if provided, shall be suitable for installation condition.

- **Timers**

The timers shall be electronic pneumatic or synchronous type with manual/auto reset features as per the functional requirements. The time delay shall be 'ON' delay or 'OFF' delay type as specified. The repeat accuracy shall be 0.5% or better.

- **Instruments and Meters**

All instruments shall be flush mounting type with square/round face and shall be tropicalized and dust tight.

The size of the instruments shall be 96 mm x 96 mm for incomer and bus coupler and 72 mm x 72 mm for lower size modules.

Dials shall be parallax free with scale marked in black on white background and shall be suitable for direct reading.

Zero adjusters shall be provided for operation from the front of the cases.

All ammeters and voltmeters shall have 0 - 240° scale and shall be moving iron spring controlled type of Class 1.5 accuracy as per IS: 1248. The scale range of the ammeter and voltmeters shall be as indicated in the feeder details.

In case of motor feeders the ammeter, shall be graduated uniformly upto C.T. primary current and with a Compressed end scale upto 6 times the C.T. primary current. Red pointer shall be provided which can be adjusted at site for indicating full load current.

- **Push Buttons and Control Switches**

The switches and push buttons shall conform to utilization category AC11/DC11 as per IS: 6875.

The contact shall be rated to make, break and carry inductive current of 5 Amp at 415 V AC and 1 Amp at 220 VDC.

The control switches shall be spring return rotary type, unless otherwise specified and provided with pistol grip type handle.

The control switches for circuit breakers shall be additionally fitted with lost motion devices and sequencing devices.

The selector switches shall be stay put rotary type and provided with oval shape handles.

The push buttons shall be of momentary contact spring loaded type with a set of normally close and open contacts. The push button for 'Start' shall be shrouded type and coloured green, stop push button shall be unshrouded type and coloured red and other push buttons shall be unshrouded type coloured black. The fixing ring shall be metallic white.

Emergency stop push buttons, if specified, shall be lockable in pushed position.

- **Miniature Circuit Breakers**

The miniature circuit breakers shall conform to IS: 8828 and shall be of duty category M-9. It shall be provided with overload and short circuit protective devices in a heat resistant housing.

A certificate for short circuit rating and Current-Time tripping curve shall be furnished along with the offer.

- **Signal Lamps**

Signal lamps shall be provided to indicate the various circuit conditions as shown in scheme drawings. The colour of the lamps for various functions shall be as follows:

Red -- Circuit breaker/switch/contactors closed.

Green -- Circuit breaker/switch/contactors open.

White -- Trip circuit healthy.

Amber -- Alarm and auto trip.

Blue -- Non-Trip

All lamps shall be of LED type with lumen output of 200 milli candella in axial direction.

- **Name Plates**

The switchboard shall have large name plate on the top indicating its Name, Designation and Code No.

Each feeder shall be provided with name plate. Each single front panel shall have name plate indicating panel number both in front and back.

All control switches, push buttons, lamps etc. shall have functional identification labels.

Name plate shall be of black perspex with white engraving and of minimum 3 mm thick.

Any other accessories required, but not specified, shall also be supplied to make the switchboard complete in all respects and ensure safe and proper operation.

- **PAINTING**

The enclosure, after degreasing, pickling in acid, cold rinsing, phosphatising, passivating etc. shall be painted with two coats of anti-rust paint followed by two coats of anticorrosive paint.

Epoxy based paint shall be used, if indicated in Specification Sheet.

All paints shall be carefully selected to withstand tropical heat and extremes of weather.

The paint shall not scale off, crinkle or be removed by abrasion due to normal handling.

Unless otherwise specified, the finishing shade shall be light grey having Shade No.631 as per IS: 5.

One litre of paint shall be supplied along with each board for touch up at site.

- **TESTS AND INSPECTION**

All the switchboards shall be subjected to routine test as per IS: 8623 and their components as per relevant standards.

Additional tests, wherever specified, shall be carried out. (TPIA Report is must)

All the above tests shall be carried out in presence of Purchaser's representative.

In addition, the equipment shall be subjected to stage inspection during process of manufacture at works and site inspection.

These inspection shall however, not absolve the vendor from his responsibility for making good any defect which may be noticed subsequently.

- **PACKING**

The board shall be properly packed before despatch to avoid damage during transport, storage and handling. The packing box shall contain a copy of the installation, operation and maintenance manual.

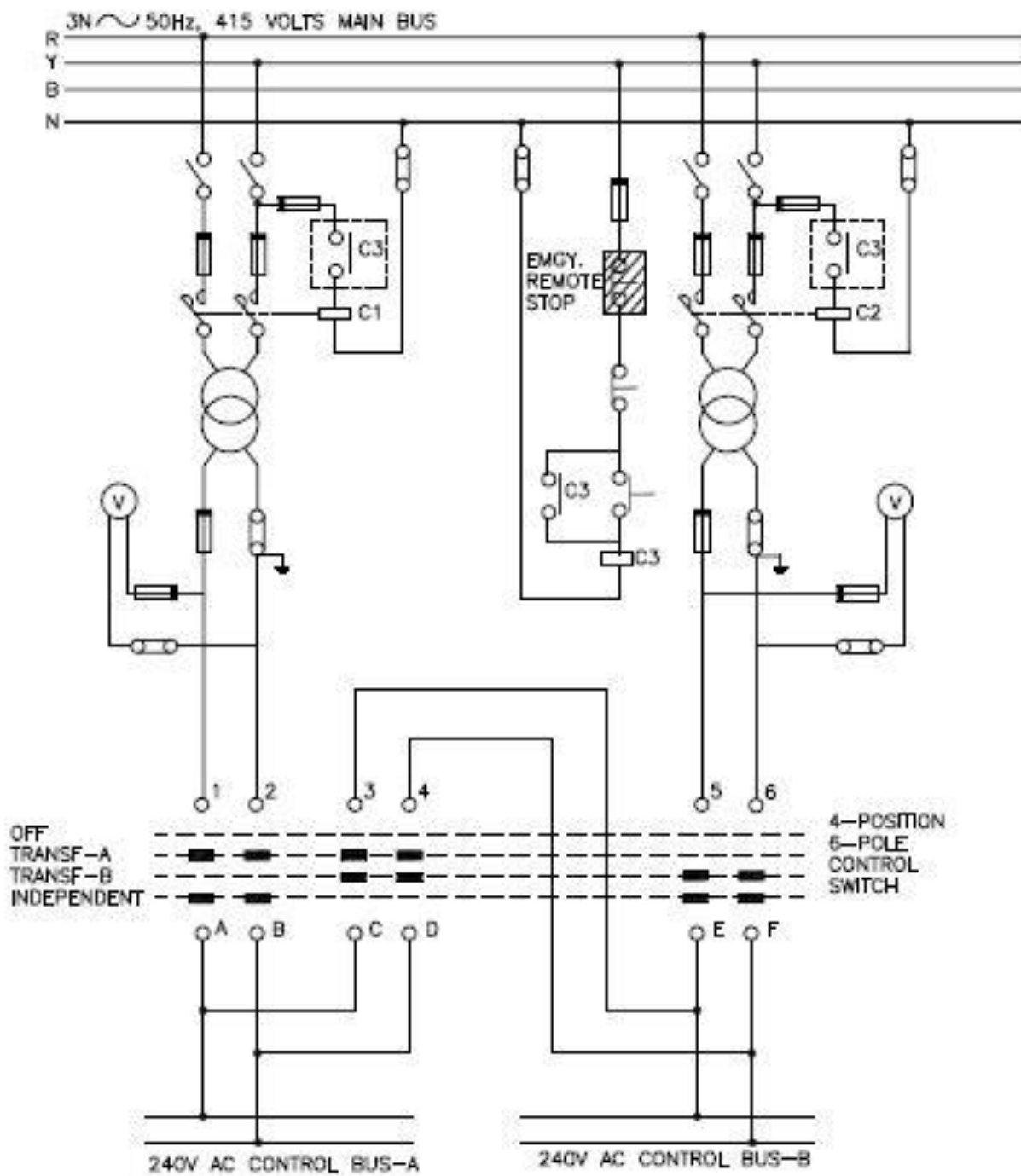
A sign to indicate the upright position of the panels to be placed during transport and storage shall be clearly marked. Also proper arrangement shall be provided to handle the equipment.

- **DEVIATIONS**

Deviations if any, from this standard shall be clearly indicated in the offer with reasons there of. Deviations from the data indicated in Specification Sheet shall be shown clearly by encircling it and indicating the revised data in Specification Sheet.

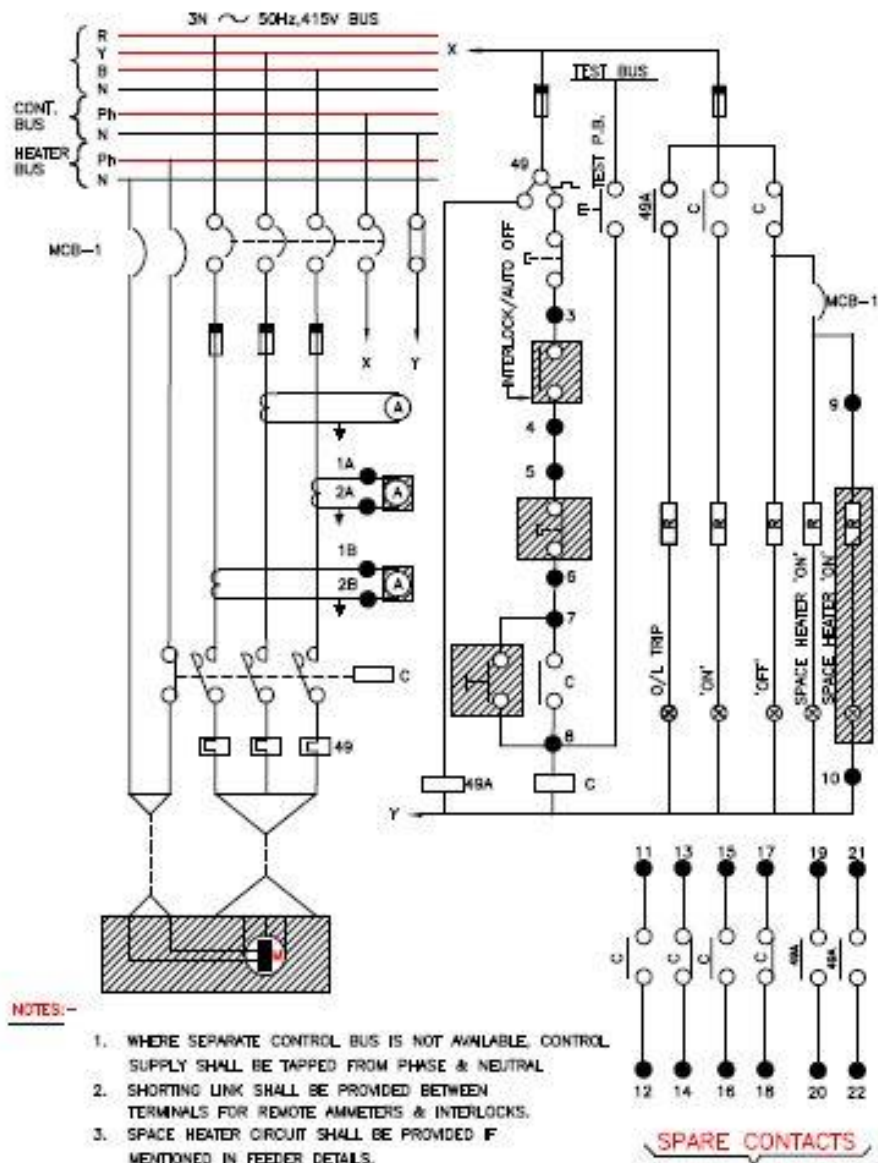
MAKE OF COMPONENTS	
Air Circuit Breaker	L&T / ABB / Siemens / G.E Power / Schneider
M.C.C.B	L&T / ABB / G.E Power / Siemens / Schneider
M.C.B.	Standard Kopp /MDS /Legrand / Hager / ABB / Schneider
switch	L&T /Siemens / G.E Power / Kaycee / ABB / Schneider
Fuse	L&T / Siemens / G E Power / ABB / Schneider
Contactora	L&T / Siemens / GE Power / ABB / Schneider
Thermal O / L Relay	L&T / Siemens / GE Power / ABB / Schneider
Protective Relay	Areva / ABB / Easun Reyrolle
Auxiliary Relays	Areva / Universal Electrical / Jyoti / ABB /Easun Reyrolle / Alind
Timers	G E Power / Bhartia Cutter Hammer / L&T
Single Phasing Preventor	L&T / Siemens / GE Power / ABB / Schneider
Current Transformer	Siemens / AEP/ Ind Coil / Precise / Current Electricals/Kappa / Kalpa
Potential Transformer	L&T / Siemens /G.E Power/AEP /Kappa Electricals / Kalpa / Indcoil
Control Transformer	L&T / Siemens /G.E Power /AEP /Kappa Electricals / Kalpa / Indcoil
Instruments	AEP /IMP / MECO / Universal
Push Buttons	L&T /Siemens / GE Power / Teknik
Control Switches	L&T /Siemens / GE Power /Kaycee
Signal Lamps	L&T / Siemens / GE Power / Teknik
Cable Glands	Baliga / Comet / Electro Mech / Power Engg.
Cable Lugs	Dowel / Forward Engg. / Power Engg.

List of the Make for components



Control Supply through Control Transformers.

240V, 1 Ph, AC control supply shall be arranged by providing control transformers of suitable rating.



Schematic Diagram DOL Starter



- ### Schematic Diagram Star Delta Starter

SL. NO.	MOTOR RATING IN KW	FULL LOAD CURRENT IN AMPS	STARTING CURRENT IN AMPS	SWITCH RATING IN AMPS. AC-23	FUSE RATING IN AMPS	CONTACTOR RATING IN AMPS	THERMAL O/L RANGE IN AMPS		C.T. RATIO	POWER CABLE	
							L & T	SIEMENS		SIZE	Sq. mm
1	0.18	0.59	4.2	63	2	16	0.4 - 0.65	0.5 - 0.8	1/1	3x2.5(Cu)	
2	0.25	0.88	6.3	63	4	16	0.6 - 1.0	0.8 - 1.2	1/1	3x2.5(Cu)	
3	0.37	1.05	7.56	63	4	16	1.0 - 1.6	0.8 - 1.2	2/1	3x2.5(Cu)	
4	0.55	1.50	10.8	63	6	16	1.0 - 1.6	1.4 - 2	2/1	3x2.5(Cu)	
5	0.75	1.80	12.96	63	6	16	1.5 - 2.5	1.4 - 2	2/1	3x2.5(Cu)	
6	1.10	2.50	18.0	63	10	16	2.5 - 4	2.0 - 3	5/1	3x2.5(Cu)	
7	1.50	3.4	24.4	63	16	16	2.5 - 4	2.5 - 4	5/1	3x2.5(Cu)	
8	2.20	4.60	33.1	63	16	16	4.0 - 6.5	3.5 - 5	10/1	3x2.5(Cu)	
9	3.00	7.0	50.4	63	25	16	6.0 - 10	5.5 - 8	10/1	3x2.5(Cu)	
10	3.70	7.3	52.5	63	25	16	6.5 - 10	5.5 - 8	10/1	3x2.5(Cu)	
11	5.50	10.5	75.6	63	32	16	9.0 - 14	8 - 12	15/1	3x2.5(Cu)	
12	7.50	14.0	100.8	63	40	30	10.0 - 16	11 - 16	20/1	3x6(Cu)	
13	9.30	17.5	126.0	63	50	30	13.0 - 21	14 - 20	20/1	3x6(Cu)	
14	11.0	20.6	148.3	63	63	30	20.0 - 32	17 - 25	25/1	3x16(Al)	
15	15.0	28.0	201.6	100	80	38	20.0 - 32	22 - 32	35/1	3x16(Al)	
16	18.5	33.0	237.6	100	80	38	28.0 - 42	25 - 40	40/1	3x25(Al)	
17	22.0	40.0	288.0	125	125	70	30.0 - 48	30 - 45	50/1	3x25(Al)	
18	30.0	52.0	374.4	200	160	70	45.0 - 70	38 - 63	60/1	3x25(Al)	
19	37.0	63.5	457.2	200	200	105	45.0 - 70	50 - 90	75/1	3x35(Al)	
20	45.0	76.0	557.2	250	200	105	60.0 - 100	50 - 90	100/1	3x70(Al)	
21	55.0	96.0	691.7	250	250	170	90.0 - 150	70 - 110	125/1	3x95(Al)	
22	68.0	119.0	858.0	250	250	170	90.0 - 150	90 - 135	125/1	3x150(Al)	
23	75.0	140.0	1008.0	400	300	170	90.0 - 1500	140 - 170	150/1	3x185(Al)	
24	90.0	156.0	1123.2	400	300	200	120.0 - 200	140 - 170	200/1	3x240(Al)	
25	110.0	192.0	1382.4	400	350	300	180.0 - 300	175 - 250	200/1	3x300(Al)	
26	125.0	217.0	1627.5	A.C.B.	A.C.B.	A.C.B.	CTMM	RELAY	250/1	3x400(Al)	
27	132.0	234.0	1684.8	A.C.B.	A.C.B.	A.C.B.	CTMM	RELAY	250/1	3x400(Al)	
28	160.0	279.0	2008.8	A.C.B.	A.C.B.	A.C.B.	CTMM	RELAY	300/1	2-3x185(Al)	
29	180.0	304.0	2188.8	A.C.B.	A.C.B.	A.C.B.	CTMM	RELAY	400/1	2-3x240(Al)	
NOTE:- 1.The above data is applicable for 415V 4pole motors 2.Ammeters shall have uniform scale up to C.Tprimary current and compressed end scale upto six times the C.T primary current											

Component Rating for DOL Starter

SL. NO.	MOTOR RATING IN KW	LINE CURRENT IN AMP.	PHASE CURRENT IN AMP.	STARTING CURRENT IN AMP.	SWITCH RATING IN AMP.	FUSE RATING IN AMP.	CONTACTOR RATING IN AMP.	RELAY RANGE		C.T RATIO
								L & T	SIEMENS	
1	11	20.6	11.8	49.4	63	25	16	10-16	8-12	25/1
2	16	28	16.1	67.2	63	32	32	13-21	14-20	35/1
3	18.5	33	19	79.2	63	40	32	13-21	17-25	40/1
4	22	40	23	96	63	50	32	20-32	17-25	50/1
5	30	52	30	124.8	100	63	38	20-32	22-32	60/1
6	37	65	37.5	156	100	63	70	28-42	25-40	75/1
7	45	76	43.8	182.4	125	80	70	30-45	38-63	100/1
8	55	96	55.4	230.4	125	100	70	45-70	38-63	125/1
9	68	119	68.7	285.6	250	160	105	60-100	50-90	150/1
10	75	140	80.8	336	250	160	105	60-100	50-90	150/1
11	90	156	90	374.4	250	160	110	60-100	70-110	200/1
12	110	192	110.8	460.8	250	200	170	90-150	70-110	200/1
13	125	217	125.2	520.8	250	250	170	90-150	90-135	250/1
14	132	234	135	561.6	250	250	170	90-150	120-155	250/1
15	160	279	161	669.6	400	250	200	120-200	140-170	300/1
16	180	310	178.9	744	400	300	300	120-200	140-200	400/1

Component Rating for Star delta Starter