

Type TQ Motor Control Centre

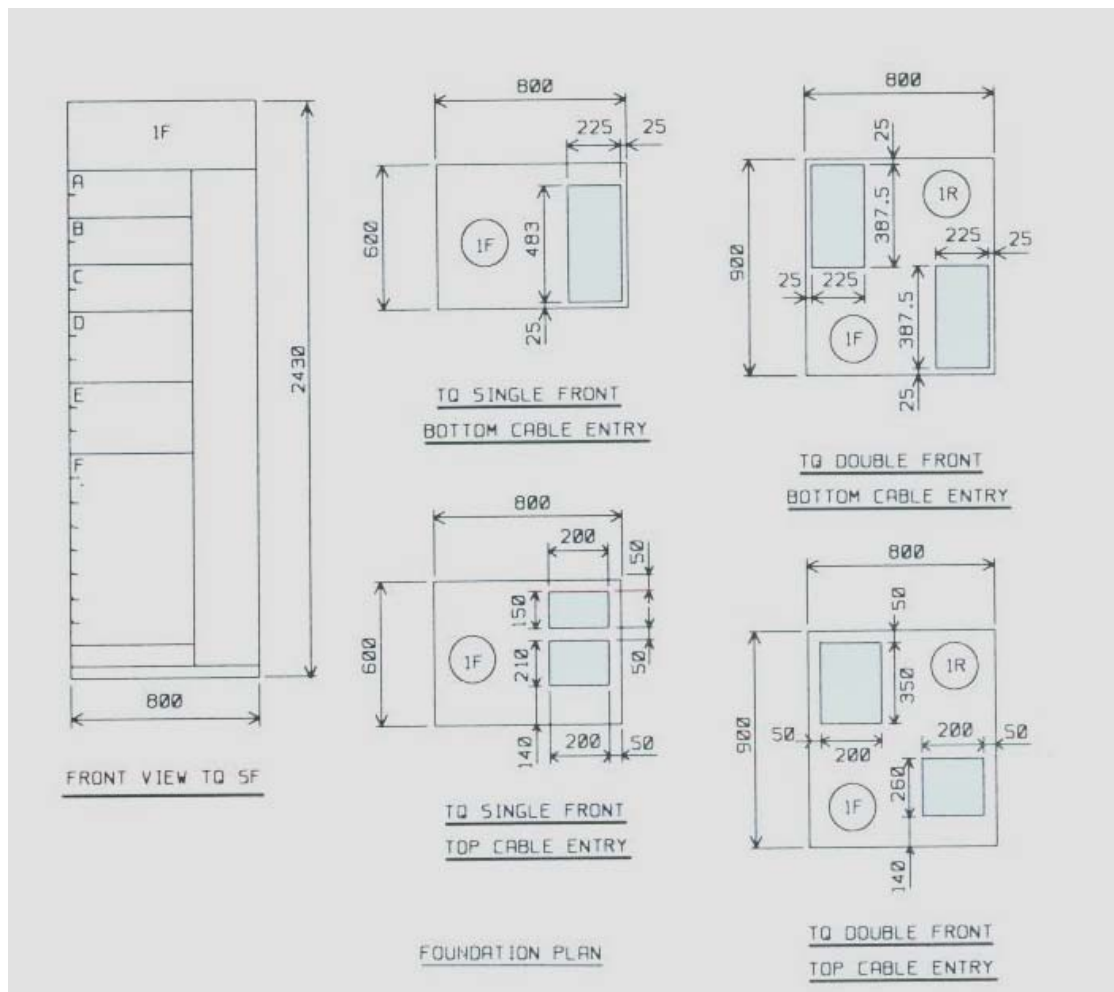
A comprehensive guide to installation and maintenance



LARSEN & TOUBRO LIMITED
Electrical & Electronics Division

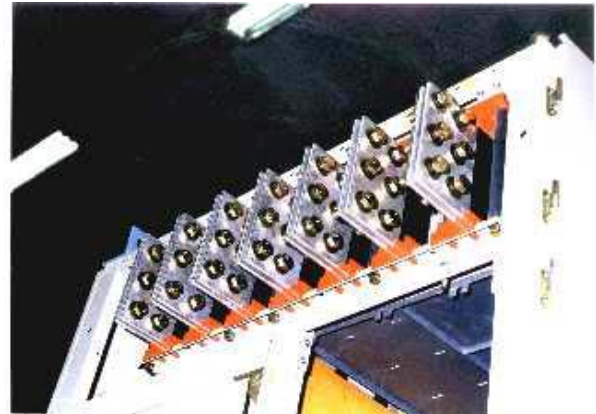
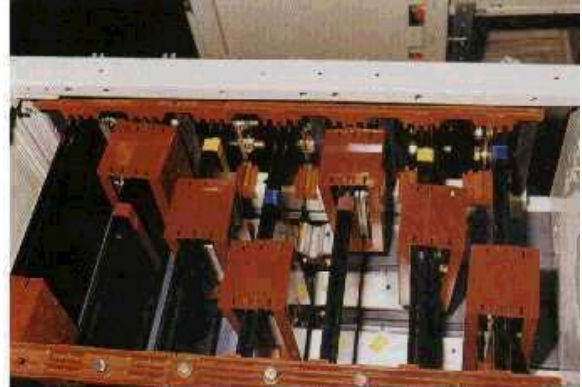
CONSTRUCTION

1. Motor Control Centre type TQ is a free-standing and floor mounting type switchboard available both in single front and double front versions, suitable for indoor installation.
2. Each vertical panel is divided into distinct zones for busbars, feeders, power cabling and auxiliary busbars.
3. The compartment houses modules for individual feeders comprising equipment such as fuse switches, contractors, relays, timers and associated auxiliary equipment. The modules are in two versions-fixed and drawout type.
4. For optimum utilisation of panel space, compartments have variable heights-from 100 mm up to 1300 mm in steps of 100 mm, thus allowing up to 20 feeders in a panel.
5. This design can also accommodate to tiers of ACBs in a 944 mm deep panel. The ACB compartments have a standard height of 750 mm each.



BUSBARS AND DROPPERS

1. In the TQ MCC, horizontal busbars (HBB) are located at the top of the panels. The phase sequence, from rear to front, is N-R-Y-B.
2. Where the number of bars per phase exceed three, the HBB is split into two packets per phase. The phase sequence is N-R1-Y1-B1-R2-Y2-B2 from rear to front.
3. The droppers are located behind the unit chamber and isolated from the unit compartment with an insulating barrier. The Phase sequence, as seen from front left to right, is R-Y-B-N. Busbars joint shrouds can be provided on the HBB for complete insulation. These shrouds are click-fit and can be easily removed from tightening the joints.
4. Both busbars and droppers are sleeved, using heat shrinkable PVC sleeve.

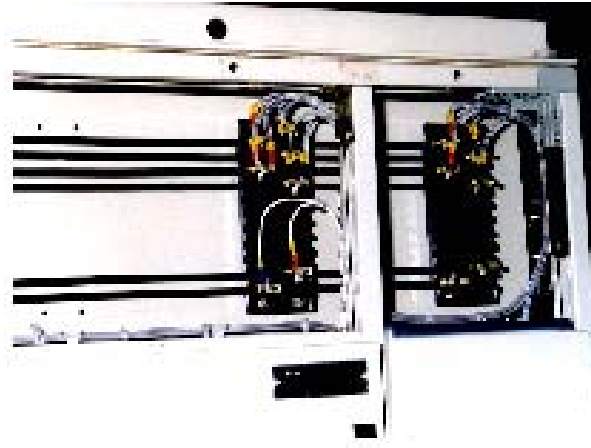


AUXILIARY BUSBARS

1. Auxiliary busbars, if required, are located in the top-front chamber of the panel. The support and tap-off system is integrated.
2. In the double front MCCs, auxiliary busbars are placed in one of the fronts, and tap-offs are taken for the units in both the fronts .

CAUTION:

While making joints/connections, ensure that sleeve/tape is removed at the location of the joint between the two conductors/flats.



UNIT

1. The smallest unit is 100 mm in height. Larger units come in steps of 100 mm up to a maximum of 1300 mm.
2. Padlocking facility for power switches is available in 'ON' and 'OFF' positions. Facility for interlock defeat is also available on the door.
3. The units are mounted on telescopic rails which are specially designed to provide positive guidance and smooth movement of the unit.

Telescopic rails for 200 and 300 mm units offer additional tilting facility in maintenance position. The 100 mm units have the door as an integral part of the unit. For 100 mm units, a lever on the door is to be pressed to pull out the unit from Service to Test or Isolated positions.



4. The incoming contacts have ratings of 135, 250 and 500A, while the outgoing contacts have ratings of 125, 250 and 500A. The incoming power contacts are located on the left hand side, while the outgoing power contacts are located on the right hand side.



5. The starter unit in the fully drawout version has the following positions:
 - (i) Connected (service) position
 - (ii) Test position
 - (iii) Disconnected (isolated) position
 - (iv) Maintenance position
 - (v) Hinged/tilted position

The connected/test/disconnected positions are indicated by matching red lines on the bottom tray of the compartment and the red arrow mounted on the withdrawable unit.



6. For padlocking the unit in 'Connected' and 'Test' positions, push the lever to the left and insert padlock. It prevents access to the racking screw.

7. The control contacts, i.e. the Secondary Isolating Contacts (SICs) are mounted in 2 columns of the unit. The rear column comprises SICs making in Service position. The front column can have the following varieties of SICs.

(i) Service + Test

(ii) Test only

(iii) Service only

All control contacts disconnect automatically when the unit is withdrawn to Isolated position.



Power contacts are disconnected as soon as unit is withdrawn from Service Position.

Service SICs are disconnected when module is not in Service position.

Test SICs are disconnected when module is not in Test position.

Service + Test SICs make contact in both Service and Test positions.

Scheme interlocks and testing can be programmed using these SICs.



For 100, 200 and 300 mm units, SICs can be located on LHS also. Such control terminals are duplicated in the cable alley. Wiring from the LHS SICs to the fixed terminals is factory-assembled and routed through a PVC duct mounted on the bottom side of upper tray for respective unit.

8. Ammeters, indicating lamps, control switches and push buttons are mounted on hinged plate fitted on the unit. This can be swung out for access to their rear terminals and to the equipment behind it.





9. The 'make first, break last' type scraping earth system is provided on all drawout units. Located on the left bottom side on the tray is the fixed contact of scraping earth which is directly connected to vertical earth bar. A silver plated copper strip mounted on the bottom of the withdrawable unit makes contact with the fixed the silver plated copper contact.
10. A shroud is provided on the incoming terminals of the power switch in each unit for safety of maintenance/ inspection personnel.
11. In the fixed units, the incoming supply is tapped from the droppers through an anti-turn coach bolt. Hence this connection needs access only from the front.

RECEIPT AND HANDLING AT SITE

To facilitate transportation, the MCC is split into multiple sections.

Each section is wrapped in an HDPE cover and packed in a wooden case.

To arrive at the approximate overall dimensions of the packing cases, add 300 mm to the dimensions of the respective section.

On receipt of the MCC at site:

1. Inspect the packing cases for any damage.
2. Open the packing cases and inspect the MCC.
3. Report any damage or loss of components to the transport carrier and lodge a claim with the insurance agency and inform L&T's regional sales office.
4. Use crane for shifting the transport sections. For this purpose, lifting lugs are provided on top of panels.
5. If rollers are to be used for placing the sections on the foundation, retain the base plank to avoid damage to base frame.



STORAGE

If the MCC is to be commissioned at a later date, the following precautions should be taken:

1. Open and inspect the MCC.
Scratches on the MCC, if any, should be touched up with the paint supplied with it.
2. Repack the MCC.
3. Outdoor storage should be avoided. Store all cases indoors in a clean, dry and well ventilated place where seepage of water and condensation does not occur.
4. If civil construction is being carried out in the vicinity, ensure that the MCC is completely protected from debris and dust.

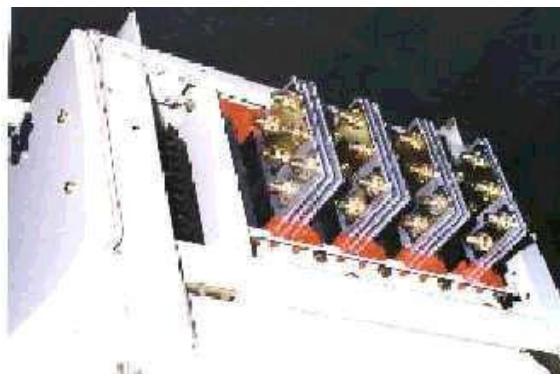
INSTALLATION

1. Embed fabricated 'C' channels in the foundation and place the MCC on these channels. The base frame of the MCC should be tack welded to these channels.
2. Ensure that the MCC is mounted on a flat and leveled surface. Use shims if the floor is uneven. An uneven foundation may cause misalignment of sections, busbars and hinged doors of the unit.
3. Locate and level the first section in position on the foundation channels.
4. Place second section next to the first section.
5. Remove top plates above the horizontal busbars of the both these sections. Remove fishplates from the horizontal busbars and the earthbar.
6. Clean the fishplates with a wire brush, wipe them with a soft, dry cloth and then immediately apply contact grease on them. Hindustan Petroleum MPL(EXXON)/Petroleum Jelly J.P.grade contact grease is recommended.
7. Bolt adjacent sections together before joining the busbars.
8. Join horizontal busbars and earthbar of the two sections with fishplates prepared as per (6) above. Use hardware supplied with the MCC. In case of one bar per phase, the fishplates should be fitted on the same side of the bar had there been two bars per phase.

9. Tighten all electrical connections with a torque wrench to the torque values given below:

Size of bolt	Torque in m.kg
M8	0.85
M10	1.88
M12	3.20
M16	7.30

10. Replace top plates.
11. Join auxiliary busbar located in the front, using fishplates provided with the board.
12. Connect interpanel wires to the adjacent transport unit terminals.
13. Check alignment of all feeder doors.



NOTE:

1. In case MCC is located in dusty surroundings, ensure that all doors are closed firmly to prevent ingress of such dust.
2. If plant atmosphere is likely to contain excessive percentage of steam or reactive gases comprising sulphur or chlorine, ensure that MCC is placed in a separate pressurised the room.
3. Oblong holes are provided for fishplate joints. Extra drilling on the busbars/fish plates should be avoided because it will create a bad joint.

EXTENSION PANEL

For joining extension panel to the existing MCC:

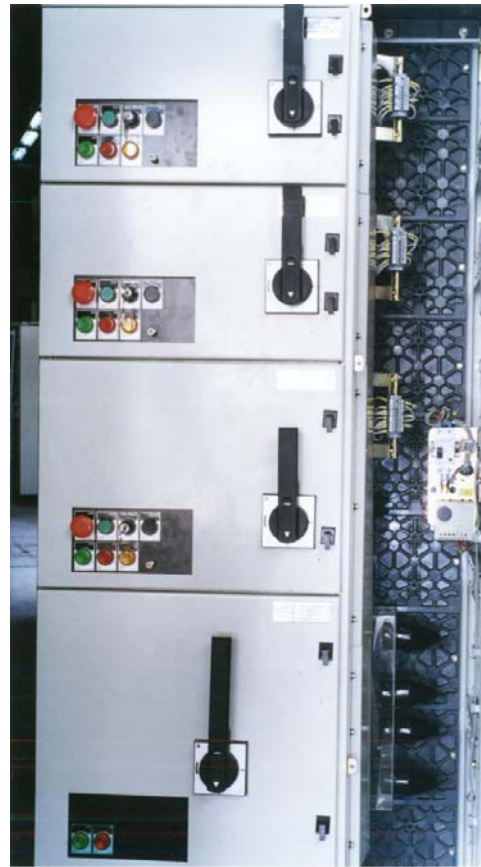
1. Remove end cover of existing MCC at the joining end.
2. Follow instructions listed under 'Installation'.
3. In some cases, it may be necessary to replace existing busbars for joining the extension panel. Such instructions are given on the general arrangement drawing for the extension panel. In such cases, necessary busbars/fishplates are supplied with the extension panel.

Ensure that both power and control circuits are switched off before removing that end cover from the MCC.



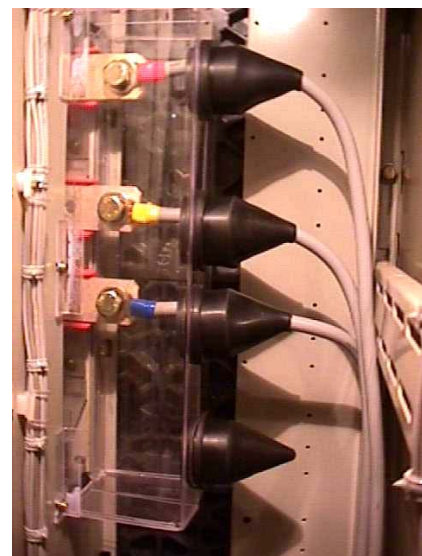
CABLING

1. In MCC type TQ, busbars are located at the top, and cable entry is possible from the top. For top cable entry, the busbars are shifted to the bottom.
2. While routing the cables in the cable alley, adequate bending radii ($R \geq 12 \times$ overall diameter of cables) should be considered. This will prevent cables from exerting pressure on the termination. A wide cable alley is provided for easy bending and termination of cables.
3. Ensure proper clamping of cables on the glands and cable clamps to avoid weight of cables acting directly on the termination.
4. Block all unused holes.
5. Replace all shrouds, if they were removed for cable termination.
6. Extension links are provided to facilitate higher size cable termination. These links should be properly fastened to the terminals after cable termination.



Cable area available (in mm)

	Width	Depth
Single front bottom entry	225	483
Single front top entry with aux. bus	200	360
Double front bottom entry	225	387.5
Double front top entry with aux. bus	200	260
Double front top entry without aux. bus	200	350
Single unit panel bottom entry	500	350
	225	483



WIRING

1. Always use copper wires/cables for control purposes.
2. Inter-unit wiring within the same panel is through the wireway on the right hand side.
3. Intersection wiring is through the horizontal wireway at the top along with auxiliary bus.
4. In the single front version, rear access to the vertical wireway is available if the section is installed at least one metre away from the wall.
5. For double front sections, inter-front wiring is through the shield in the middle of the section.
6. Refer to the relevant scheme diagrams and terminal charts for inter-connections.
7. Special connectors are provided in cable alley, auxiliary bus zone for communication cables, wherever required. These cables are run in front vertical pillar, providing a shield from other cables in cable alley.
8. Shielding on communication cables should not be earthed in the MCC.



PRE-ENERGISING CHECKS

1. Inspect busbar chamber, unit compartments and cable alleys.
Remove tools, conductor strands and any other material lying loose.
2. Use vacuum cleaner to remove dust, small particles...Do not use air hoses which may contain oil, moisture....
3. Wipe the interior, particularly the insulation, using the clean cloth.
Do not use cotton waste.
4. Check all power and control circuit connections at terminal blocks, cable terminals, switch terminals, contactor terminals and busbolts for tightness.
This is **MOST IMPORTANT** especially after long periods of storage .
5. Plug all unused holes and openings, including those for cable entries.
6. In case flush mounting meters and relays are packed separately, mount these on the respective cutouts and connect them. Refer to the GA/ schematic diagrams and terminal chart before connecting the meters and relays.
7. Check alignment of operating handles for all switches and MCCBs.
8. While despatching the switchboard, secondaries of current transformers are shorted. Remove these shortings while connecting relays/meters.
9. Check operation of ACB and associated control circuit in accordance while the relevant scheme drawing.
10. Check all timers for proper time interval setting and contact operation. Check that fuses are fitted in main and auxiliary circuit and that ratings are appropriate for the circuit.
11. Check the setting of overload relays and other protection relays. Observe proper co-ordination and check the adequacy of the fuses. During



commissioning checks, set the overload relay to the minimum value. Setting of supervision relays should be as per setting chart supplied by L&T.

12. Close all access plates, doors and openings before the MCC is energised.
Do not operate any power equipment with doors open unless it is disconnected from the main supply.
13. Ensure that wires are not hanging loose. Anchor them firmly, preferably with plastic clamps.
14. Temporary connections made during testing should be removed.
15. A through check of control and protection scheme is essential before commissioning.
16. Ensure that all outgoing switches are in the OFF position before energising the bus.



MAINTENANCE

Precautions before starting maintenance

1. Switch off incoming power supply before removing top plates and side covers. Lock out incoming power supply.
2. Measure voltage on busbars to ensure that busbars are de-energised.
3. Switch off the control supply.
4. Isolate remote control voltage sources.
5. Ensure that only qualified personnel are instructed and permitted to use the defeat mechanism to gain access to an energised compartment.
6. Do not attempt to withdraw the unit or disconnect any terminations when the defeat mechanism has been used to open a compartment door.
7. Current transformer primaries must not be energised when secondaries are open circuited.
8. Short all CT secondaries.
9. In case of shutdown on only one feeder, padlock the power switch in OFF position.
10. For safety of personnel working on busbars, provide temporary earthing using a metallic chain/strip near the workplace. Remove this earthing only after the job is completed.
11. After maintenance, if MCC is going to be de-energised for a longer period, switch on the panel space heaters to prevent moisture condensation on the cables/insulators.

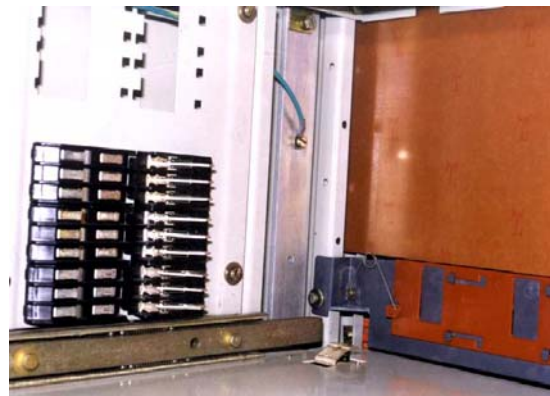


ROUTINE CHECKS

Carry out the following checks regularly:

1. Inspect all devices periodically to ensure that the equipment is in proper working order.
2. Check tightness of bolted joints
 - prior to energisation
 - six months after load is connected
 - one year after the second check and then once a yearThis is very important for aluminium busbars and links.
3. Inspect all wiring for wear and cuts.
4. Look for wear of the silver plating on the stab-in contacts and on the contacts fixed to the dropper at the point where the stab-in contacts engage with the fixed contacts. The plating is part of the protection against corrosion.
5. Clean and lubricate the stab-in contacts once a year with HP MPL (EXXON) grease.
6. Look for indications of overheating, arching or insulation breakdown.
7. Inspect power and control contacts. Replace worn out contacts.
8. Inspect all auxiliary and control circuits for desired functioning.
9. Grease ACB parts and carry out maintenance as per ACB Instruction Manual.
10. Grease racking screw and telescopic rails at least once a year. Use grease 'HP-LETHON-2' or 'SYNTHOLUBE-20' of HJ Leach & Co.
11. Inspect all door gaskets for wear. Replace where necessary.
12. Ensure that the earth wires are connected to the main earth bar except electronic devices earthing connection.
13. Ensure no tools or loose materials are left inside the MCC as these can cause faults.

14. Keep the switchboard free of dust. Use vacuum cleaner to remove the dust.
15. When the MCC is not in use, it is advisable to use space heaters to prevent moisture condensation in the MCC.
16. Do not operate switches and contactors if their arc chutes are removed.



UNIT REMOVAL AND REPLACEMENT

1. Make sure that the power switch in the unit is in the 'OFF' position before withdrawal.
2. Refer to the scheme diagram and terminal chart before de-energising the control circuits.
3. The initial movement from 'connected' to 'Test' position is accomplished by turning the racking screw anti-clockwise. The screw disengages from the racking nut (mounted on the tray) approx. 3 turns after the 'Test' position. Thereafter the unit can be pulled out to 'Disconnected' and 'Maintenance' positions.
4. In the 'Maintenance' position, the unit is completely out of the panel, yet mechanically attached to it. A spring-loaded pin prevents the unit from sliding accidentally into 'Test' position. For inserting the unit back to 'Test' or 'Connected' position, this pin has to be simultaneously pressed in with the unit.
5. In the 'Maintenance' position, the unit can be tilted over to gain access to the contacts behind the unit as well as to the equipment mounted on the rear of the base plate.

ONLY TWO COUNTER-SUNK SCREWS NEED TO BE REMOVED TO TILT THE UNIT.

6. To remove the unit from the panel, withdraw it to the 'Maintenance' position and remove the four counter-sunk screws fixing the unit to the telescopic rails. Lift the unit and place it on a table/the floor. Push the telescoping part of the two rails inside to close the door. The unit will rest on the telescopic rail studs even when all

- the four counter-sunk screws are removed.
7. As far as possible, keep the unit free from dust. Special care must be taken to protect the power and control contacts.
8. Reverse the process for unit replacement.



REMOVAL/REPLACEMENT OF DRAWOUT POWER CONTACTS

Although extremely unlikely, if during a heavy through fault the incoming stab-in contact gets welded to the contact plate, then adopt the following procedure to remove the unit from the MCC and replace the stab-in contacts and the contact plates.

When the contacts weld, do not try to force the unit out by exerting excessive force on the racking handle, as that would damage the racking mechanism.

REMOVAL

1. De-energise the MCC completely by switching off the incoming feeders. ENSURE THAT THE BUS IS COMPLETELY DEAD.
2. In case of single front, open the rear doors to disconnect the contact plates from the dropper and remove the unit in the usual manner.
3. In case of double front section, approach the dropper contact plates of Front 1 (F1) through the wire/way of Front 2 (F2) after removing the barriers behind the droppers of F1.
4. Having removed the unit from the MCC, the drawout power contacts can then be easily removed from the unit.

REPLACEMENT

1. Bolt the new contact plates to the vertical droppers. Anti-corrosion contact grease must be used at the joint. Hindustan Petroleum MPL (EXXON) or its equivalent contact grease is recommended.
2. Replace the busbar barriers and supporting tray.
3. Check the insulation with the help of a Megger.

4. Follow the directions given under 'Instructions Before Energising'.

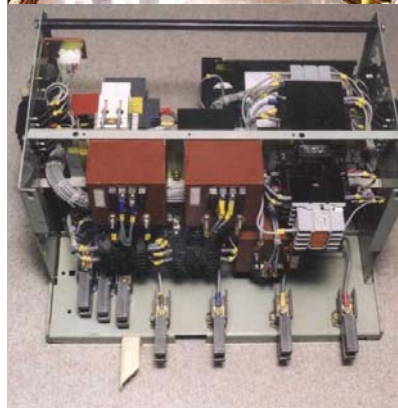
REMOVAL OF DOORS

a. Feeder doors:

- i) Isolate the feeder and open the door wide. Disconnect the control supply.
- ii) In fixed the feeders, disconnect all wires terminating on the equipment on the door.
- iii) Press the spring-loaded hinge pin and slide out the door with an upward motion.

b. Cable alley door:

- i) Open the door wide.
- ii) Unfasten the bolts on the two intermediate hinges, so as to remove these hinges from the frame.
- iii) Lift off the door.



ACB REMOVAL

1. Trip the ACB. Isolate all remote voltage sources. ENSURE THAT CONTROL CIRCUIT IS DE-ENERGISED
2. Rack out the ACB to 'Isolated' position. Open compartment door. Pull out the ACB to 'Maintenance' position.
3. Position the ACB lifting truck in front of ACB. Put lifting sling around the ACB lifting lugs.
4. Remove nuts anchoring ACB to telescopic rails and lift the ACB carefully by raising lifting arm of ACB lifting truck.
5. Push the rails inside and close the compartment door.
6. After removal, the ACB should be stored properly. Keep it covered with a polythene bag, free from dust.
7. While re-inserting the ACB, ensure that the ACB as well as all downstream feeder switches/isolators are open.



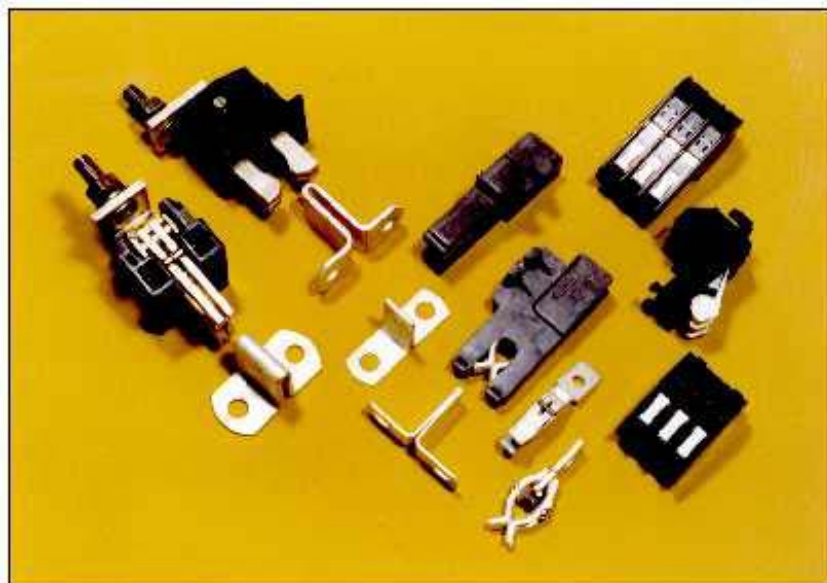


RECOMMENDATIONS

1. Provide a small cabinet in every switchgear room to store:
 - a) Tools like screwdrivers, fuse pulling handle, chassis racking handles...
 - b) All reference drawings like General Arrangement Drawing, Scheme Drawing....
 - c) Consumable spares like bulbs, fuses...
2. Do not use rewired HRC fuses.
It may cause an explosion or arc, leading to a fire.

SPARE PARTS

Description	Location	Quantity Required
Incoming & Outgoing Contacts		
Incoming /Outgoing contact assembly (125A) Female	On Module	6 for TP 8 for TPN
Incoming /Outgoing contact assembly (250A) Female-Moving	On Module	6 for TP 8 for TPN
Incoming /Outgoing contact assembly (500A) Female-Moving	On Module	6 for TP 8 for TPN
Outgoing contact assembly (250A) Female (For FN200 switch link connections)	On Module	6 for TP 8 for TPN
Outgoing contact assembly (250A) Female (For cable connections)	On Module	6 for TP 8 for TPN
Outgoing contact assembly (125A) Male -TP	On Frame	1 per Compartment
Outgoing contact assembly (125A) Male -TPN	On Frame	1 per Compartment
Outgoing contact assembly (250A & 500A) Male	On Frame	6 for TP 8 for TPN
Contact on the dropper (125A) Fixed	On Dropper	3 for TP 4 for TPN
Contact on the dropper (500A) Fixed	On Dropper	3 for TP 4 for TPN
Secondary Isolating Contacts		
Secondary Isolating Contacts (S + T) Service only -Female	On Frame	As required
Secondary Isolating Contacts (S + T) Test only -Female	On Frame	As required
Secondary Isolating Contacts (S + T) Service plus Test with break- Female	On Frame	As required
Secondary Isolating Contacts (S + T) Service only -Female	On Module	As required
Secondary Isolating Contacts -Male		





Description	Location	Quantity Required
Compartment related spares		
Door Camlock -RHS	On Door	As required
Door Camlock -LHS	On Door	As required
Racking Handle		As required
Racking Nut	On Compartment Tray	As required
Racking Screw	On Module	As required
Rail Assembly pair for 100 mm Compartment	On LHS & RHS of Compartment Tray	One per Compartment
Rail Assembly pair for 200 mm Compartment	On LHS & RHS of Compartment Tray	One per Compartment
Rail Assembly for Compartment size higher than 200 mm - Single	On Compartment Tray	Two per Compartment
Other Spares		
Busbar Joint Shroud	On busbars	As required
Outgoing terminal shroud (125A)	In CBC	As required
Outgoing terminal shroud (125A) with adaptor links	In CBC	As required
Outgoing terminal shroud (250A & 500A)	In CBC	As required
Handle -100 mm feeder	On 100 mm feeder door	1 per feeder