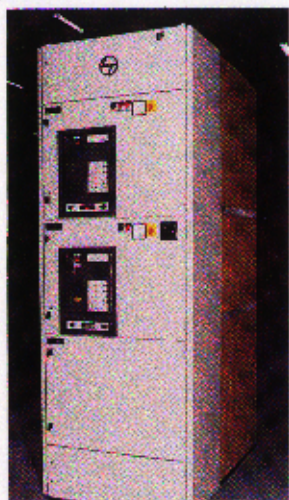
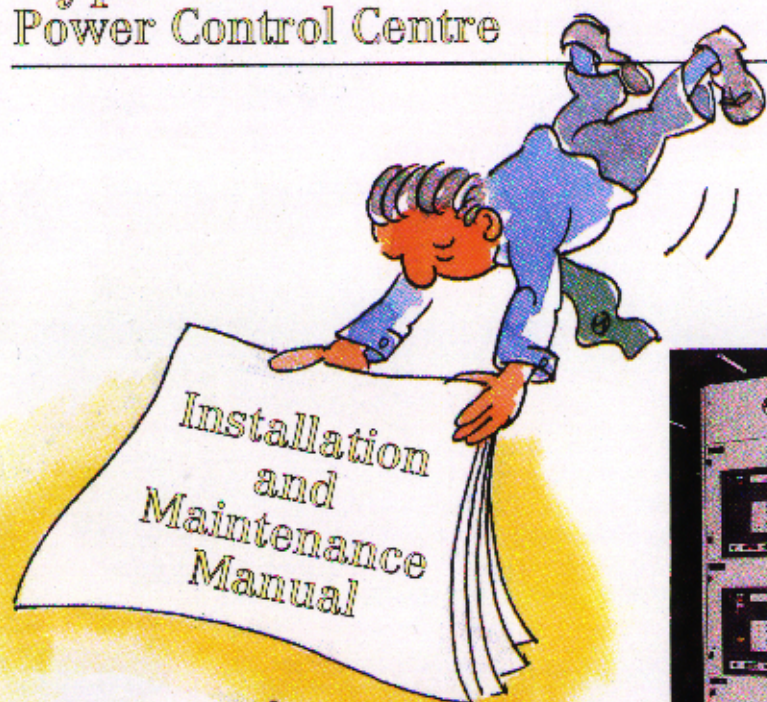


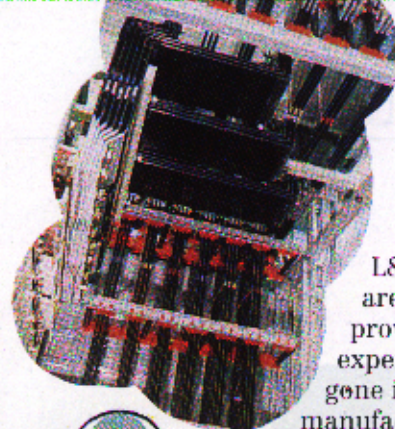
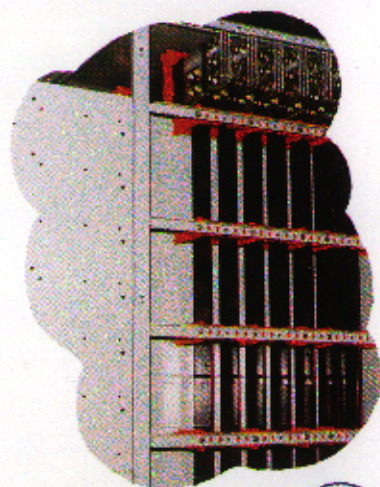
Type TF Power Control Centre



Just For You

Contents

Construction	4
Dimensions of TF Panel	7
Busbars and Droppers	8
Safety Interlocks	10
Receipt and Handling at Site	11
Storage	14
Installation	15
Extension Panel	18
Cabling	19
Pre-energising Checks	21
Maintenance	23
Routine Checks	24
ACB Removal	25
Recommendations	26
Common Problems and Solutions	27 & 28
Notes	29



L&T's switchboards Type TF are power control centres of proven design. Over 25 years of experience and expertise have gone into the design and manufacture of these switchboards.

Each switchboard is tailored to meet individual customer requirements at the workplace or at site.

Like our switchboards, our manual is designed specially for you. It's interesting and informative. And it is user-friendly. Divided into distinct sections and easy to refer. At the end, we have recommended possible solutions to problems commonly faced.

This manual will help you to install and maintain the PCC so that it renders the trouble-free service it has been designed for. For further clarifications, please call us on Tel. No. 852 1401, Mumbai.



Construction



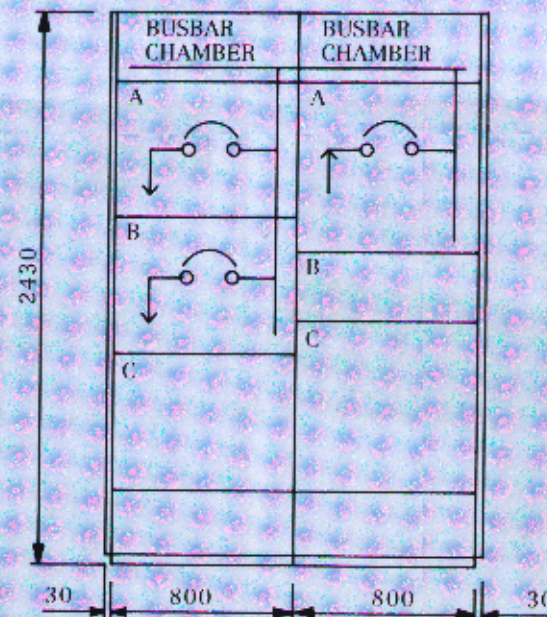
1. The Power Control Centre (PCC)
Type TF is a free standing and floor mounting type switchboard, suitable for indoor installation.
2. The frames are of riveted construction.
3. Each vertical panel is divided into distinct zones for busbars, droppers, auxiliary busbars, feeders, power cabling and control terminals.
4. The compartments house main equipment like Air Circuit Breakers, Fuse Switches, Moulded Case Circuit Breakers and associated auxiliary equipment.
5. For optimum utilisation of panel space, compartments have variable heights – from 300 mm up to 900 mm in steps of 150 mm. This design can accommodate up to three tiers of ACBs in a panel.
6. Compartment doors are provided with twin-action door fasteners. While closing, the fastener engages with the frame pillar in first quarter turn, and in second quarter turn, it pulls the door towards the pillar. This ensures compression of gasket between door and pillar.
7. The cable alley doors are of lift-off type. They are provided with half-turn locks operable by a special key.

Overall Dimensions

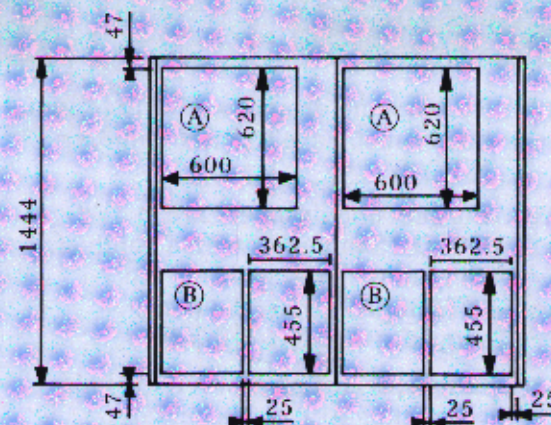
1. Height : 2430 mm (without ventilating hoods)
: 2550 mm (with ventilating hoods)
Width : 600, 800 mm
Depth : 1100, 1400 mm (base frame)
1144, 1444 mm (with front and rear doors)
2. To increase cabling area, add-on-chambers (AOCs) with a depth of 310 mm are provided on the rear side. AOCs can also be used for bus trunking arrangement on the PCC.
3. To accommodate relays, relay panel of 320 mm width may be used.



OVERALL DIMENSIONS



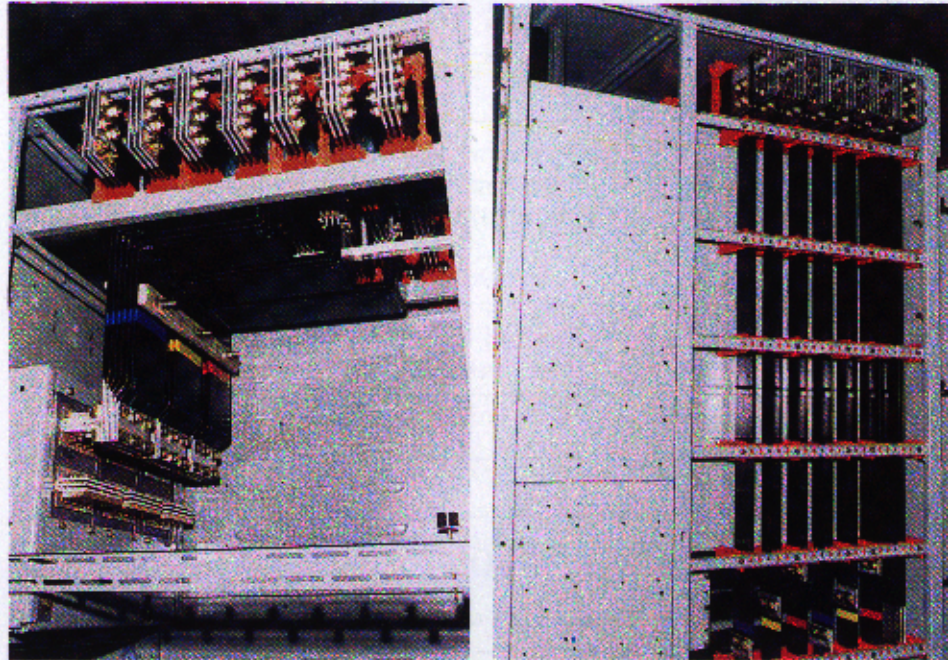
FRONT VIEW



FOUNDATION PLAN

- * POWER CABLING AREA (A) = 600 X 620 Sqmm
- * CONTROL CABLING AREA (B) = 2 X 455 X 362.5 Sqmm
- * ALL DIMENSIONS ARE IN MM

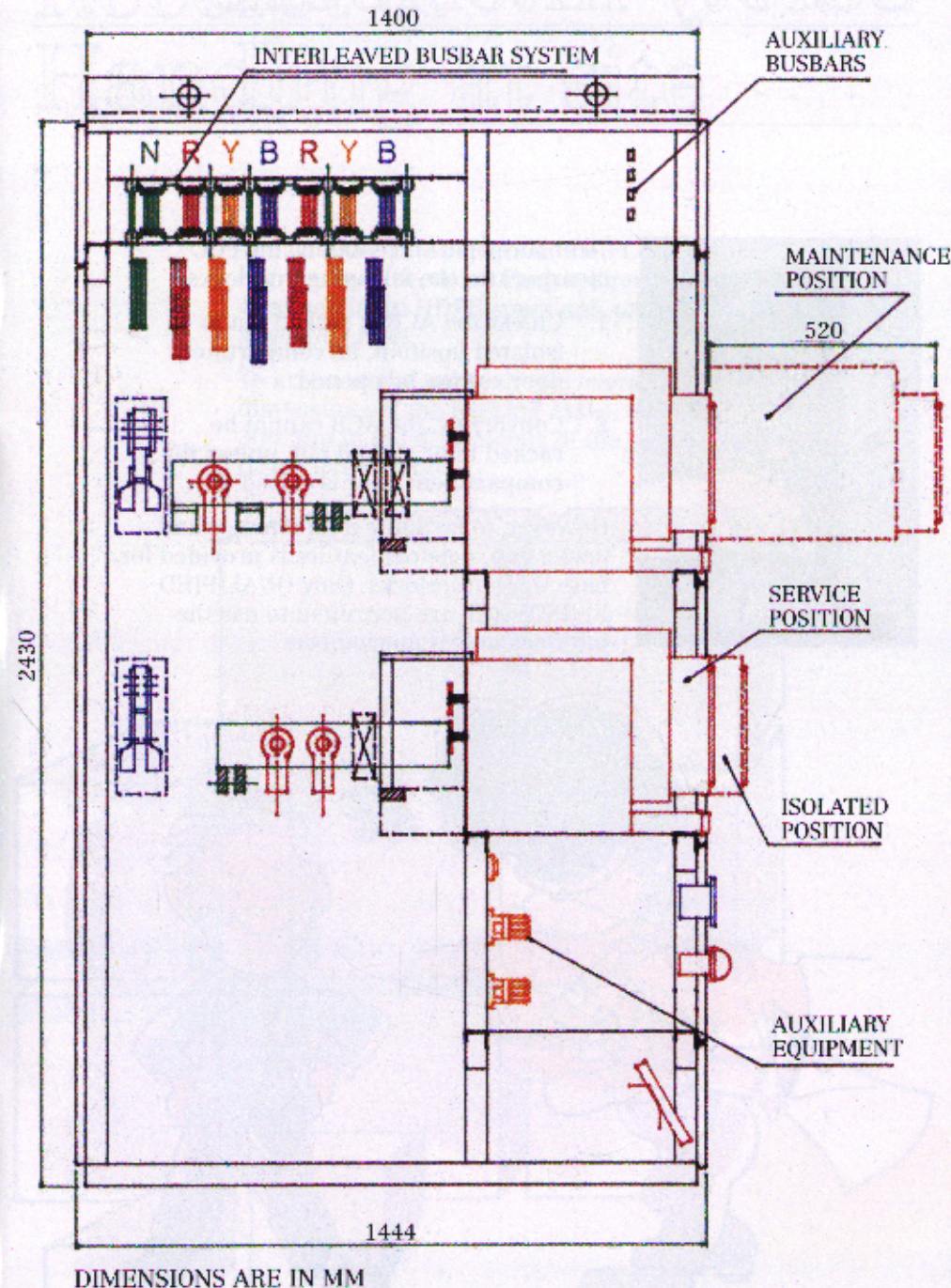
Busbars & Droppers



1. Busbars and droppers, in a 1144 mm deep panel, have a phase sequence N-R-Y-B.
2. Busbars and droppers are in TWO PACKETS in panels with a depth of 1444 mm. These packets are INTERLEAVED i.e. the phase sequence is N-R-Y-B-R-Y-B.

In this arrangement, even the links connecting ACB to busbars or droppers are interleaved, and are connected to both packets of busbars and droppers.

To facilitate cable/duct termination, cable/duct links are not interleaved. They are stacked together for each phase.



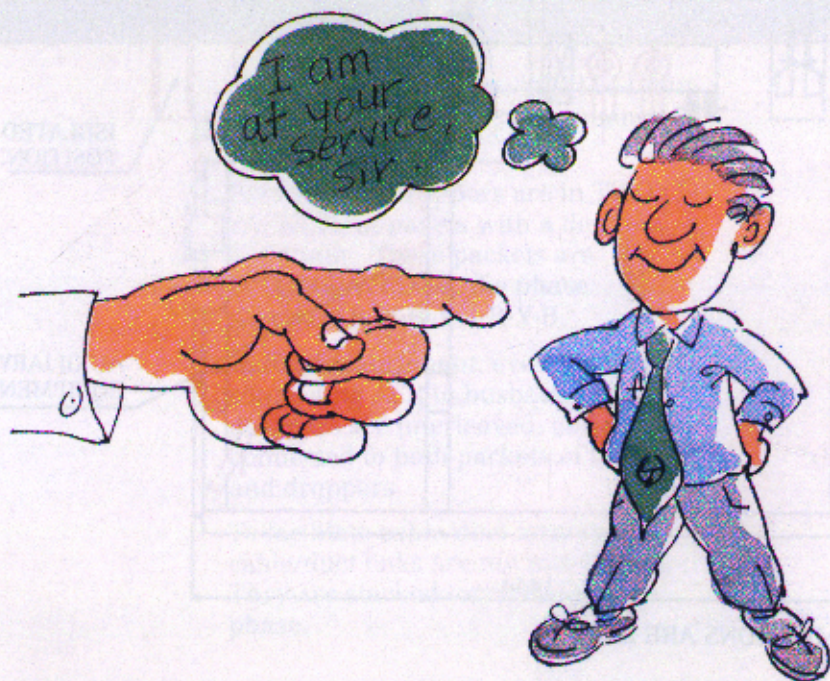
Safety Interlocks



To ensure operator's safety, the PCC incorporates the following interlocks:

1. Unless the ACB is racked out to isolated position, its compartment door cannot be opened.
2. Conversely, the ACB cannot be racked in or racked out, unless the compartment door is closed.

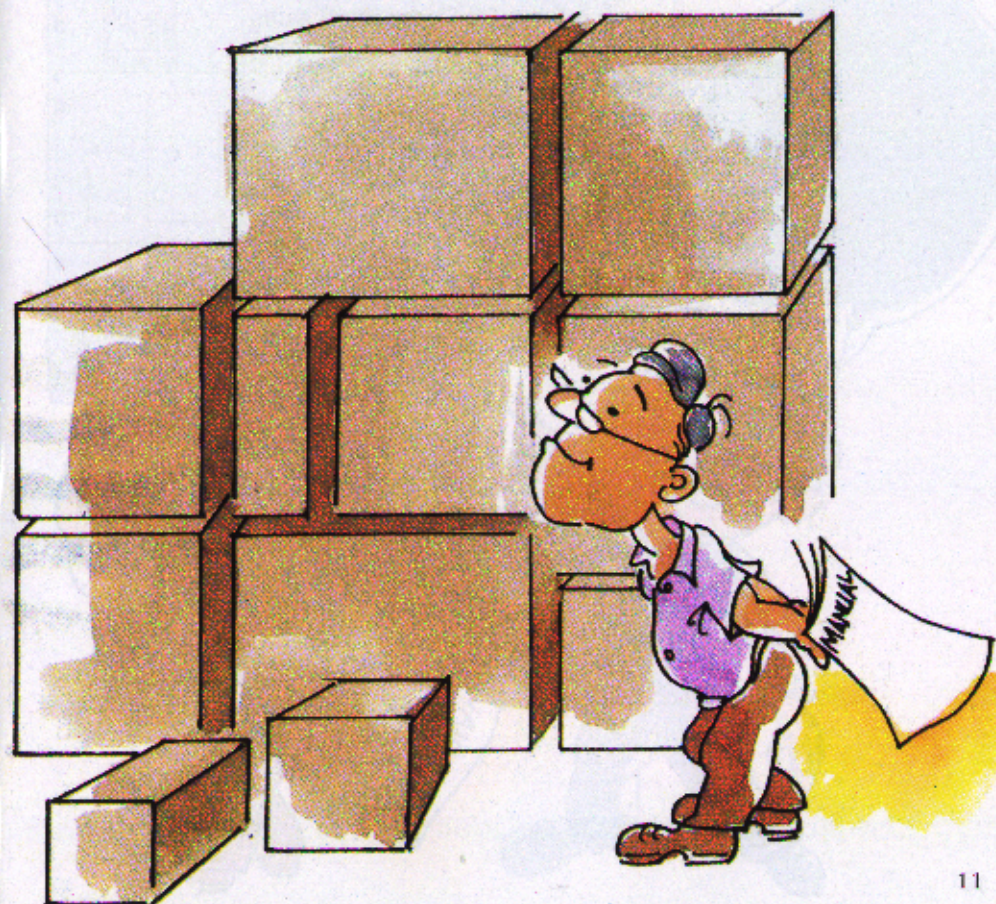
However, to facilitate maintenance and inspection, a defeat feature is provided for both these interlocks. Only **QUALIFIED PERSONNEL** are permitted to use the interlock defeat mechanism.



Receipt & Handling at site

To facilitate transportation, the PCC is split into multiple sections. Each section is wrapped in an HDPE cover and packed in a wooden case.

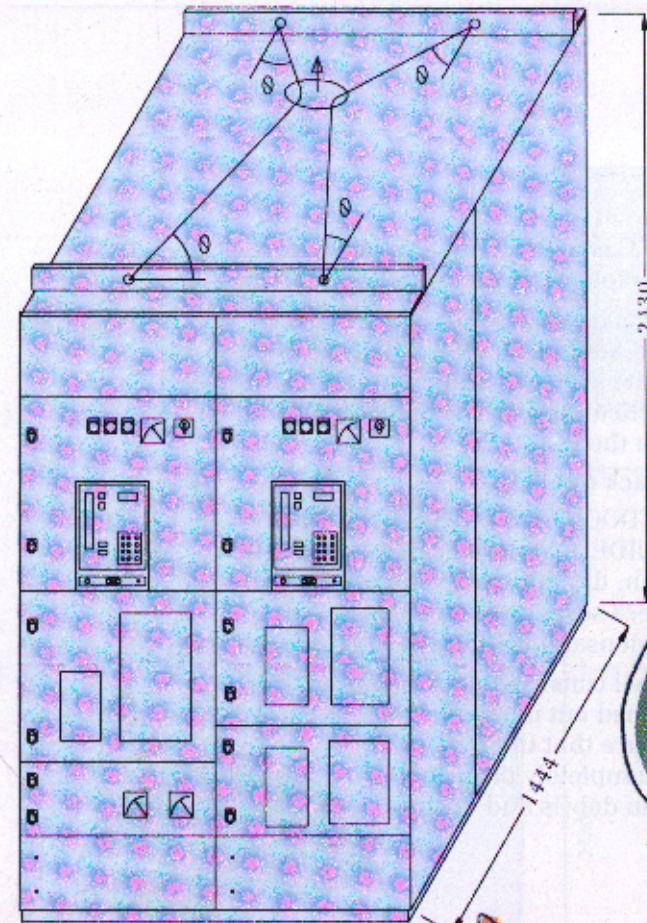
To arrive at the approximate overall dimensions of the packing cases, add 300 mm to the dimensions of the respective section.



On receipt of the PCC at site

On receipt of the PCC at site:

1. Inspect the packing cases for any damage.
2. Open the packing cases and inspect the PCC.
3. Report any damage or loss of components to the transport carrier and lodge a claim with the insurance agency or inform L&T's regional sales office.
4. Use crane for shifting the various sections. For this purpose, lifting channels are provided on top of panels. For selecting the length of the sling, follow guidelines specified on page 13.
5. If rollers are to be used for placing the sections on the foundation, retain the base plank to avoid damage to base frame.



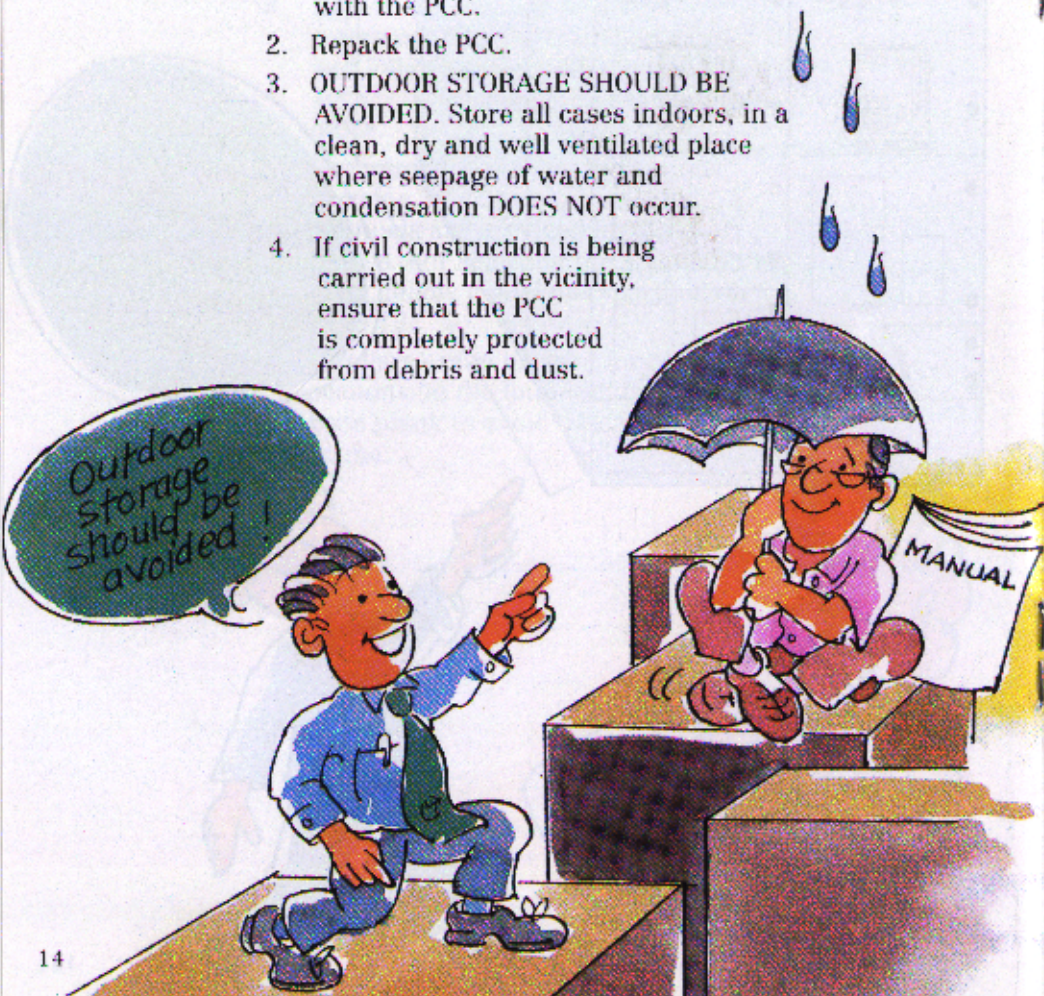
For safe handling, Lifting Angle (θ) should be greater than 45°



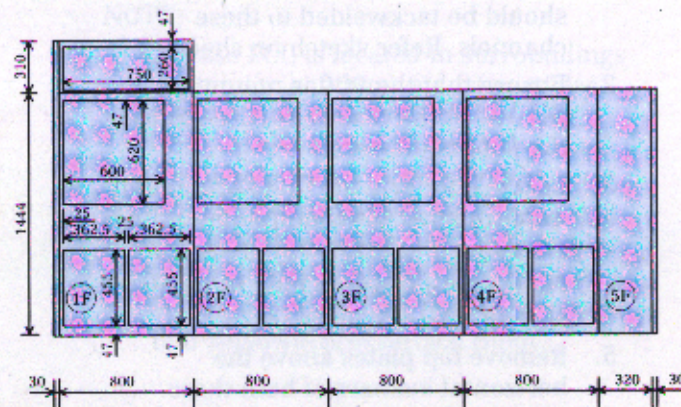
Storage

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

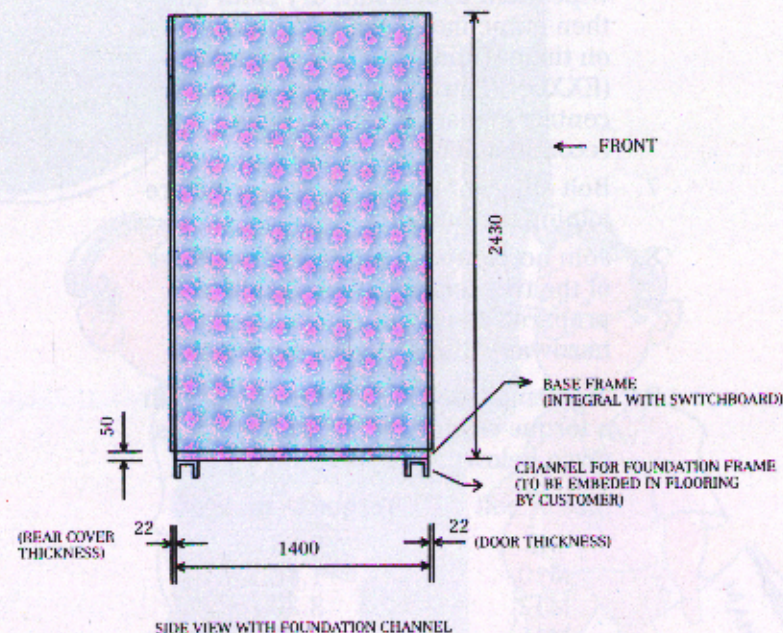
1. Open and inspect the PCC. Scratches on the switchboard, if any, should be touched up with the paint supplied with the PCC.
2. Repack the PCC.
3. **OUTDOOR STORAGE SHOULD BE AVOIDED.** Store all cases indoors, in a clean, dry and well ventilated place where seepage of water and condensation DOES NOT occur.
4. If civil construction is being carried out in the vicinity, ensure that the PCC is completely protected from debris and dust.



Installation



TOP VIEW



TF FOUNDATION PLAN & SIDE VIEW

Installation:

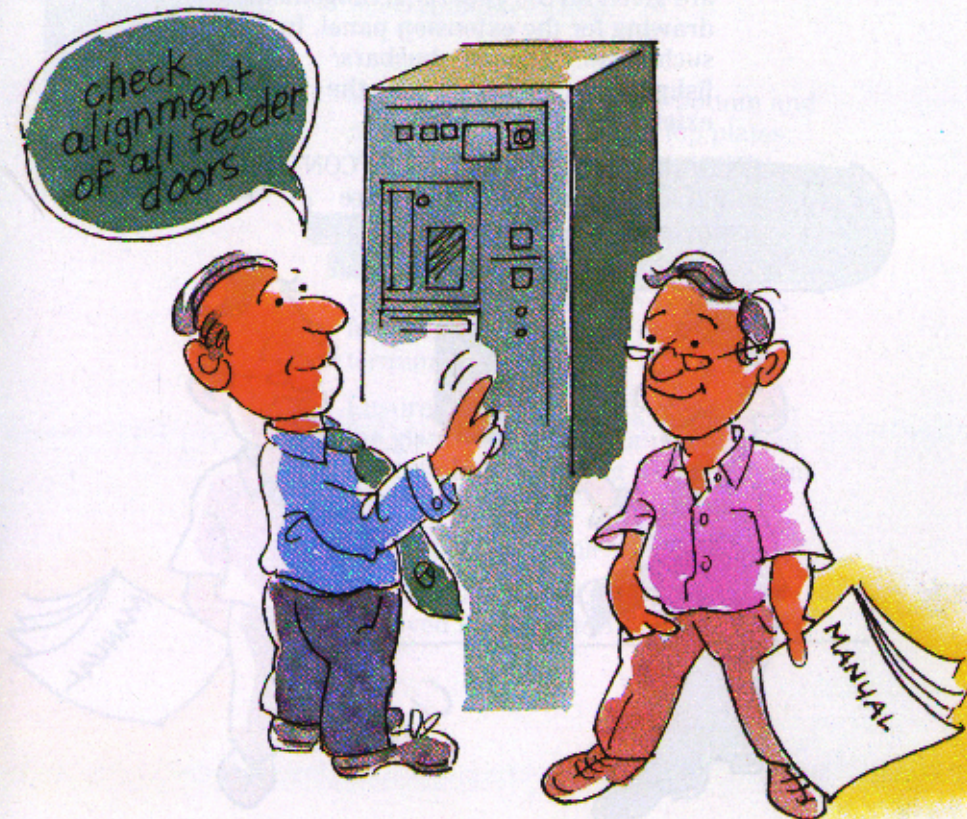
1. Embed fabricated 'C' channels in the foundation and place the PCC on these channels. The base frame of the PCC should be tackwelded to these channels. Refer sketch on sheet 15.
2. Ensure that the PCC is mounted on a flat and levelled surface. Use shims if the floor is uneven.
3. Locate and level the first section unit in position on the foundation channels.
4. Place second section next to the first section.
5. Remove top plates above the horizontal busbars of 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 or equivalent 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 PCC.
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 the top plates.
11. Join auxiliary busbar located in the front.

12. Connect interpanel wires to the adjacent transport unit terminals.
13. Check alignment of all feeder doors.

NOTE:

1. In case PCC is located in surroundings containing conductive dust particles like iron ore, coal dust or metallic dust, 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 the PCC is placed in a separate pressurised room.

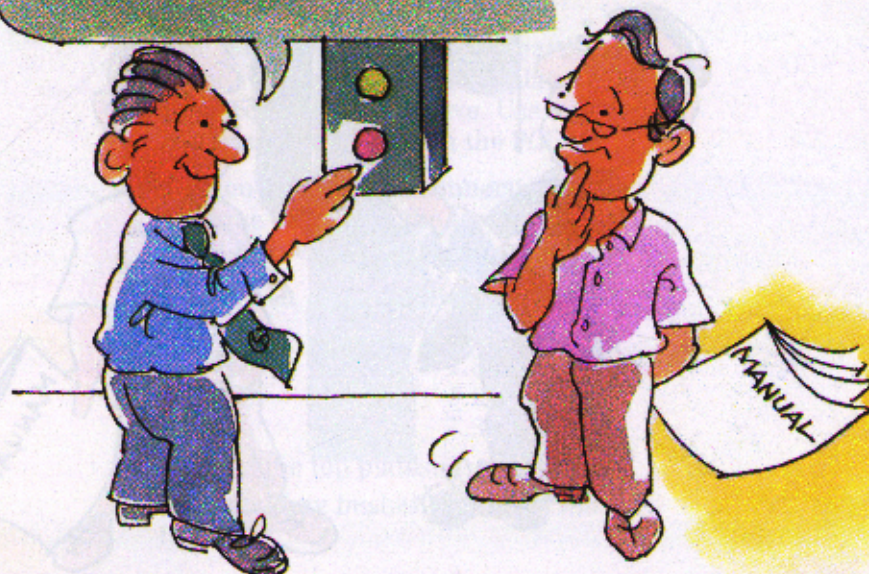


Extension Panel

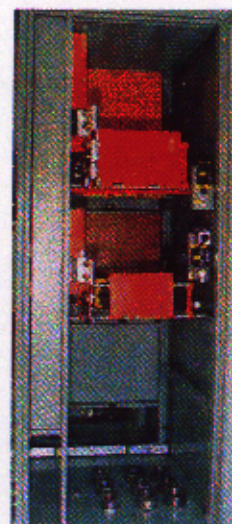
For joining extension panel to the existing PCC:

1. Remove end cover of existing PCC at the joining end.
2. Follow instructions listed above in 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 SUPPLY IS SWITCHED OFF before removing the end cover of the PCC.



Cabling



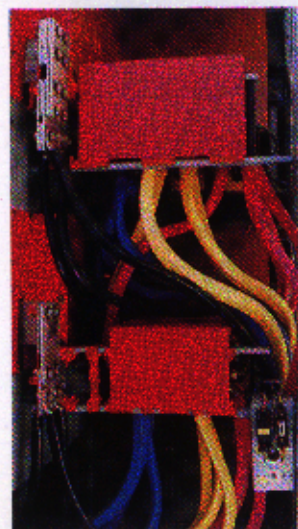
1. In PCC type TF, busbars are located at the top and cable entry is possible from the bottom. To facilitate punching cutouts for glands, bottom plates are provided in two segments.
2. When top cable entry is desired, there are two alternatives:

Retaining busbars at top: add-on-chambers (AOCs) are provided to accommodate cables.

or

Busbars are shifted to the bottom and cables are taken through top plates, without adding AOC.

3. 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.
4. Ensure proper clamping of cables on the glands and cable clamps to avoid weight of cables acting directly on the termination.
5. Block all unused holes.
6. Replace all shrouds, if they are removed for cable termination.



7. Take following steps for cable termination:
 - i) Remove insulation from cable end without damaging conductor strands. Cut the ends clean and square.
 - ii) Clean the conductor and coat immediately with inhibiting compound.
 - iii) In case sector shape conductors are used, form the conductor using a circular forming die. Forming should be done prior to cleaning and applying inhibiting compound.
 - iv) Use lugs with serrated barrels for crimping aluminium conductors. Serration increases the pull strength after crimping. It also cuts through the oxide film, if any, formed on the conductor.
 - v) Coat the lug barrel with inhibiting compound from inside.
 - vi) Use proper crimping dies, as recommended by the lug manufacturer. For aluminium conductors, use ring or hexagonal dies. Ensure that the die surfaces meet during crimping. Incomplete crimping will result in higher temperature rise at the joint.
 - vii) In case of long barrel lugs, increase number of crimps i.e. crimp the lug at 2 to 3 places.

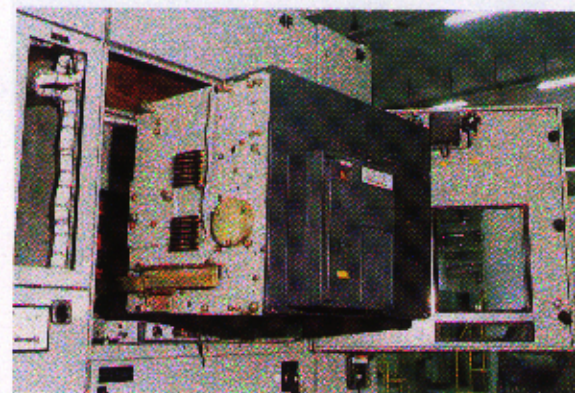
Pre-Energising Checks

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 etc. Do not use air hoses which may contain oil, moisture...
3. Wipe the interior, particularly the insulation, using a clean cloth. Do not use cotton waste.
4. Check tightness of all electrical joints.
5. Plug all unused openings on outer surfaces.
6. Check alignment of operating handles for all switches and MCCBs.
7. While despatching the switchboard, SECONDARIES OF CURRENT TRANSFORMERS ARE SHORTED. Remove these shortings while connecting relays/meters.
8. Close all doors before energising the board. Do not operate any equipment with its compartment door open when the PCC is energised.
9. Ensure that settings on protective devices are set for proper overload and short circuit co-ordination.
10. Check operation of ACB and associated control circuit in accordance with the relevant scheme drawing.

11. Measure insulation resistance of the system for any short or ground connection, using a 500V DC meggar. During the monsoon, the switchboard may show lower meggar values. If insulation level is lower than 1 MOhm, switch on the space heaters and check meggar value after some heating.
12. If meggar value is satisfactory, the HV test need not be carried out. (Repeated HV tests cause deterioration of insulation properties. All individual components as well as switchboard assemblies undergo HV test in the factory). However, if HV test is deemed necessary, it should be conducted as per relevant Indian Standard.
13. Ensure proper earthing connection.
14. Ensure that all other ACBs/switches are off before switching on the Incomer.



Maintenance



Precautions before starting maintenance:

1. Switch off incoming power supply before removing top plates and side covers. Lock out incoming power supply. For safe operations, rack out the incomer ACB to isolated position and lock it.
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. Short all CT secondaries.
6. In case of shutdown on only one feeder, lock the upstream breaker in isolated position.
7. For safety of personnel, while working on busbars, provide temporary earthing using a metallic chain/strip near the work place. Remove this earthing only after the job is completed.

Routine checks

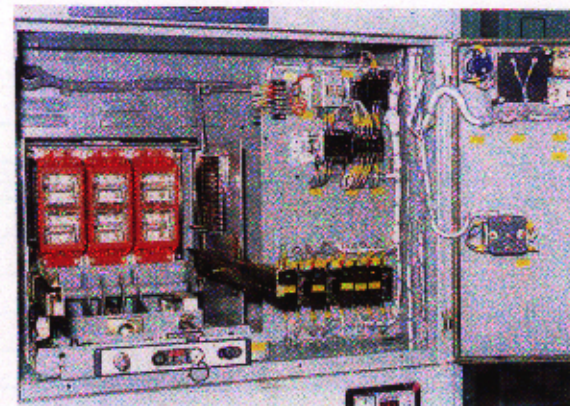
Carry out the following checks regularly:

1. Check tightness of bolted joints
 - prior to energisation
 - six months after load is connected
 - one year after the second check and then once a year.

THIS IS VERY IMPORTANT FOR ALUMINIUM BUSBARS AND LINKS.

2. Inspect all wiring for wear and cuts.
3. Look for indications of overheating, arcing or insulation breakdown.
4. Inspect main and arcing contacts. Replace all worn out contacts.
5. Inspect all auxiliary and control circuits for desired functioning.
6. Grease ACB parts and carry out maintenance as per ACB Instruction Manual.
7. Grease racking screw and telescopic rails at least once a year. Use grease "HP-LETHON-2" OR "SYNTHOLUBE-20 of HJ Leach & Co."
8. Inspect all door gaskets for wear. Replace where necessary.
9. Keep the switchboard free of dust. Use vacuum cleaner to remove the dust.

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 switchboard room to store:
 - i) Tools like screw drivers, fuse pulling handle, door opening key for cable alley....
 - ii) All reference drawings like General Arrangement Drawing, Scheme Drawing....
 - iii) Consumable spares like bulbs, fuses....
2. Do not use rewired HRC fuses. It may cause an explosion or arc, leading to a fire.



Common problems & solutions

Problem

1. Difficulty in racking the ACB in or out
2. Single phasing of ACB
3. Excessive pitting in the main contacts
4. Overheating of main contacts
5. Overheating of jaws and terminals
6. ACB trips on closing
7. ACB trips soon after closing
8. ACB trips on closing for a motor feeder

Our Suggestion

ACB may not be properly mounted on telescopic rails. Withdraw ACB and check mounting.

Check lubrication of mechanism. Refer ACB Instruction Manual for greasing of mechanism.

Check adjustment of arcing contacts with filler gauge (>0.9 mm and <1 mm)

Check whether arcing contacts are touching each other. Adjust arcing contacts as per (3) above.

Occurs due to loose terminals and loose termination. Tighten terminals periodically.

- Check for overcurrent release reset.
- Check supply to undervoltage release.
- Check whether shunt trip is getting energised.

Check setting of overcurrent release or relay. It may be lower than current drawn by feeder.

Check magnetic threshold setting on overcurrent release.



This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.



Switchgear – Contracts Section

LARSEN & TOUBRO LIMITED

Indian Cancer Society Building
Plot No. C/6, Bandra-Kurla Complex
P.O. Box 8119, Bandra (E)
Mumbai 400 051

L&T House
191/1, Dhole Patil Road
P.O. Box 119, Pune 411 001

Venkataramana Centre
No. 563, Anna Salai
Teynampet
Madras 600 018

32, Shivaji Marg
New Delhi 110 015

3B, Shakespeare Sarani
P.O. Box 619
Calcutta 700 071

-
- *Information given in this manual is illustrative. For information on specific equipment, please refer to the relevant contract document.*
 - *Product improvement is a continuous process at L&T. For latest information on this equipment, contact any of our offices listed here.*