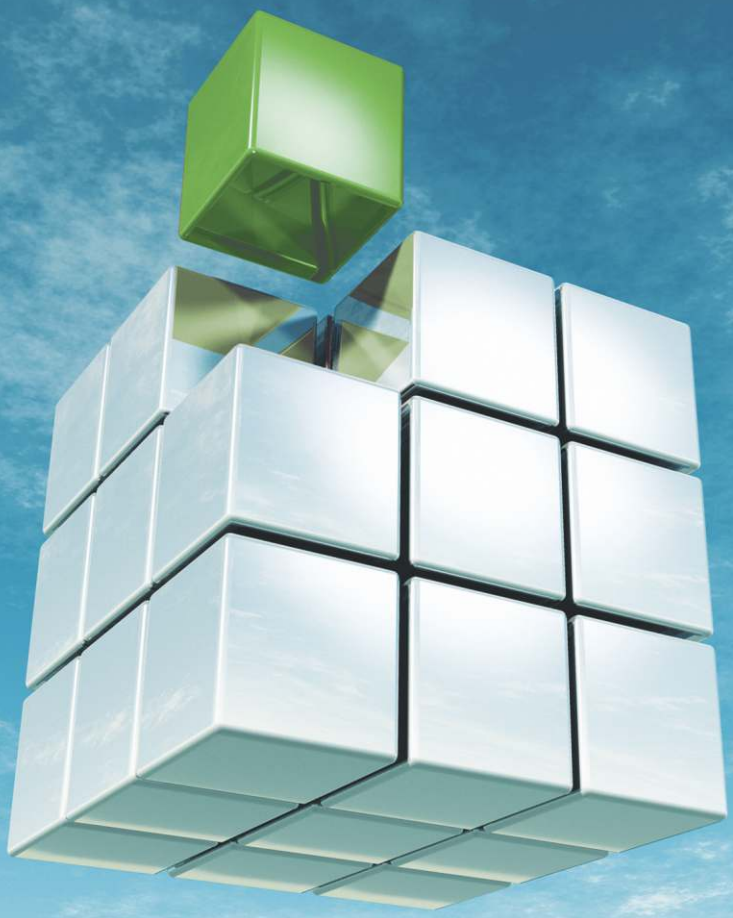
L&T Electrical & Automation



A Comprehensive guide for installation

T-ERA

MCC (TX)


1F
AUTO TRIP
EM. STOP
START
ON
PUSH
TRIP
OFF
1-F-J
1.5KW
MPCB DOL FEEDER
1-F-G
50A
MPCB OUTGOING FEEDER
1-F-K
50A
MPCB OUTGOING FEEDER
OFF
ON
AUTO TRIP
A
100
50

Thank you for choosing L&T Electrical & Automation (E&A) as your supplier of Low Voltage Switchgear and giving us the opportunity to serve you. Please read this manual carefully for proper installation, safe, easy and efficient operation.

Only authorized and qualified personnel should be allowed to work on the switchgear. An authorized and qualified operator is a person having detailed information about installation and commissioning of switchgear or specially trained for the maintenance of the switchgear and fully aware of the hazards caused by unsafe operation. An operator should also have basic knowledge of First Aid.

The information herein is general for all specifications, part of which may not be applicable for specific applications or variants. Refer the following 'as built' documents for any particular installation:

- Reference list of drawings (RLD)
- Single line drawings
- General Arrangement (GA) drawings
- Master bill of materials (MBOM)
- Scheme drawings

In case of any conflict between this manual and drawings available with you, the drawings shall take precedence.

For additional information or clarification please send your queries to *AtYourService@Lntebg.com* for quick resolution.

All our switchgear undergo rigorous testing and quality checks at our factory. However, we recommend verification and testing at site, especially after storage.

Following symbols have been used in this manual to indicate varying levels of danger:

Warning-Highly dangerous- can cause death or serious injury

Caution-Dangerous- can cause injuries or damage the switchgear.

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2R
3R
PMCC
PLC-5.0

INTRODUCTION

IMPORTANT NOTE

Only the Specific written Technical Instructions supplied by E&A must be used. Our products must only be commissioned, operated, serviced, repaired or decommissioned in accounts with Technical Instructions which have been supplied by the manufacturer. Non Compliance with this instruction may result in serious damage to the product and its associated items, as well as health hazard or mortal danger.

WARRANTY

Our products are subjected to factory inspection and testing according to the applicable standards and provisions.

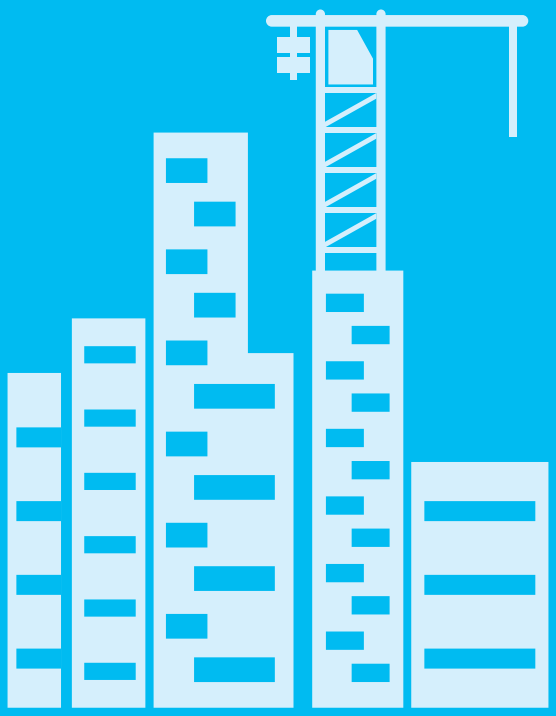
The correct function and the service life of the switchgear are influenced greatly by compliance with the installation, commissioning and operating conditions stipulated in this manual.

Non-compliance with these provisions may compromise warranty claims.

Any local provision which does not contradict the specifications of this document, especially as regards safety for personnel and buildings, must be complied with.

E&A cannot be held liable for the possible consequences of:

- Non-compliance with the provisions contained in this manual, which refer to international regulations.
- Non-compliance with the instructions of the suppliers of cables and connecting accessories as regards application and installation.
- Any aggressive climate conditions (humidity, pollution etc.) prevailing in the immediate environment of switchgear not suitable to this effect or not protected accordingly.
- This manual does not contain any instructions regarding the mechanical lock-outs to be performed. The work described is performed on de-energized (on installation) or mechanically locked - out (decommissioned) switchgear.



CONSTRUCTION

CONSTRUCTION

- Motor Control Centre type TX is a free-standing and floor mounting switchboard available in single front and back to back versions. Suitable for indoor installation.

- Each vertical panel is divided into distinct zones for busbars, feeders, power cabling and auxiliary busbars Figure 2.

- The compartment houses modules for individual feeders comprising equipment such as fuse switches, MCCB, contactors, relays, timers and associated auxiliary equipments.

- For optimum utilization of panel space, modules have variable width and variable heights which is further explained on Page No. 9.

- The structural members of the panel are closed profiled providing higher strength against mechanical forces generated.

Figure 1 - Floor mounted panel

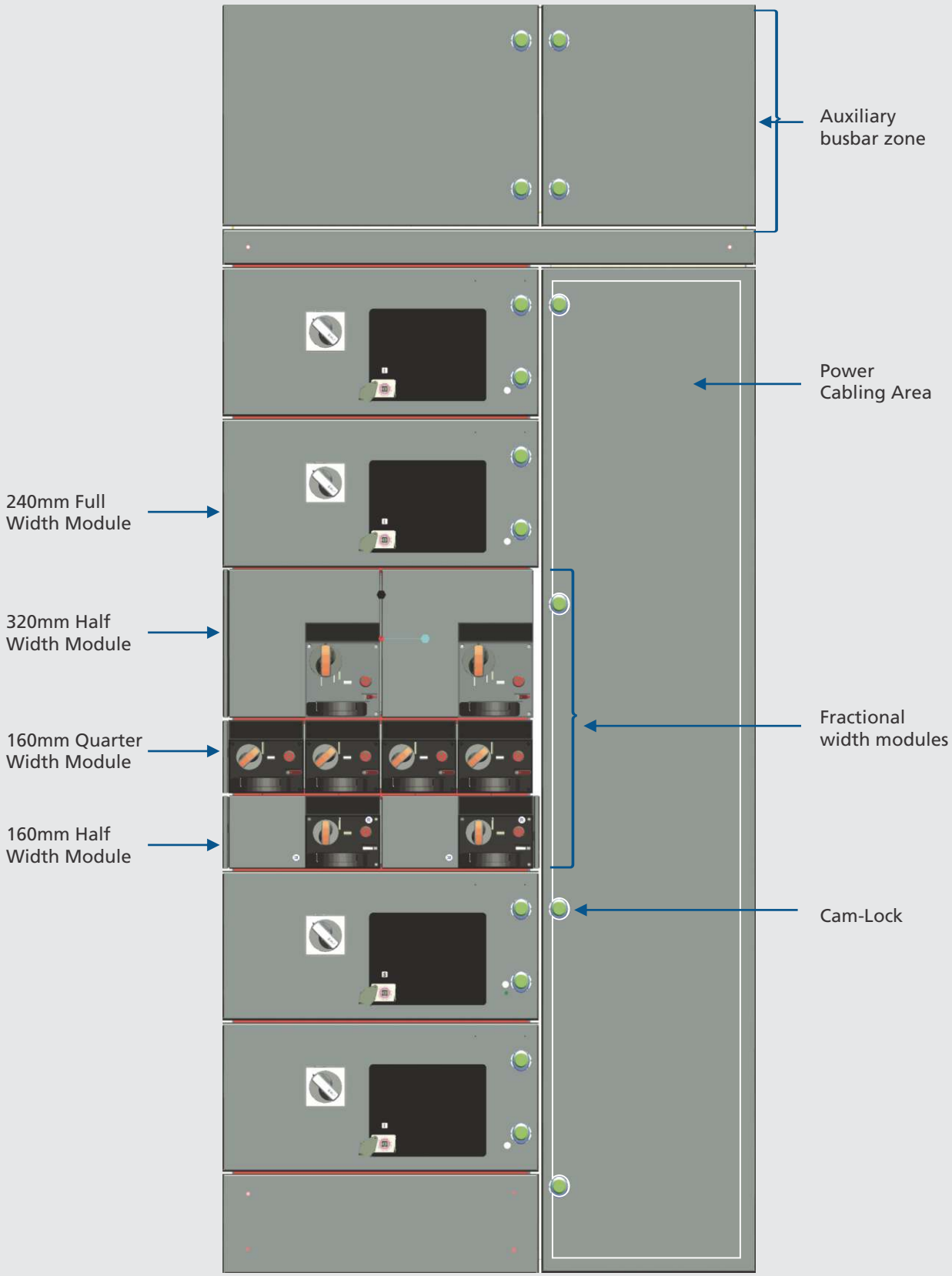


Figure 2 - Different Compartments

E&A's TX range of Low Voltage Motor Control Centers comply with IEC 61439-Part 1 & 2. It is designed to enhance safety of the users. Its modular construction facilitates logistics, installation, commissioning and maintenance.

Designation		Motor Control Center (MCC)	Type TX
Standards and specifications		Power Switchgear and Controlgear (PSC) Assemblies	IEC 61439 - 2, BS EN 61439 - 2
		Testing under conditions of arcing due to internal faults	IEC 61641
Insulation characteristics		Clearance	> 20 mm
		Creepage distances	> 20 mm
		Overvoltage category	II / III / IV
		Pollution degree	3
		Field condition	Inhomogeneous (non-uniform)
Electrical characte-ristics	Voltage ratings	Rated operational voltage (U_e)	up to 690 V
		Rated insulation voltage (U_i)	1000 V
		Rated impulse withstand voltage (U_{imp})	6 / 8 / 12 kV
		Rated frquency (f_n)	50 / 60 Hz

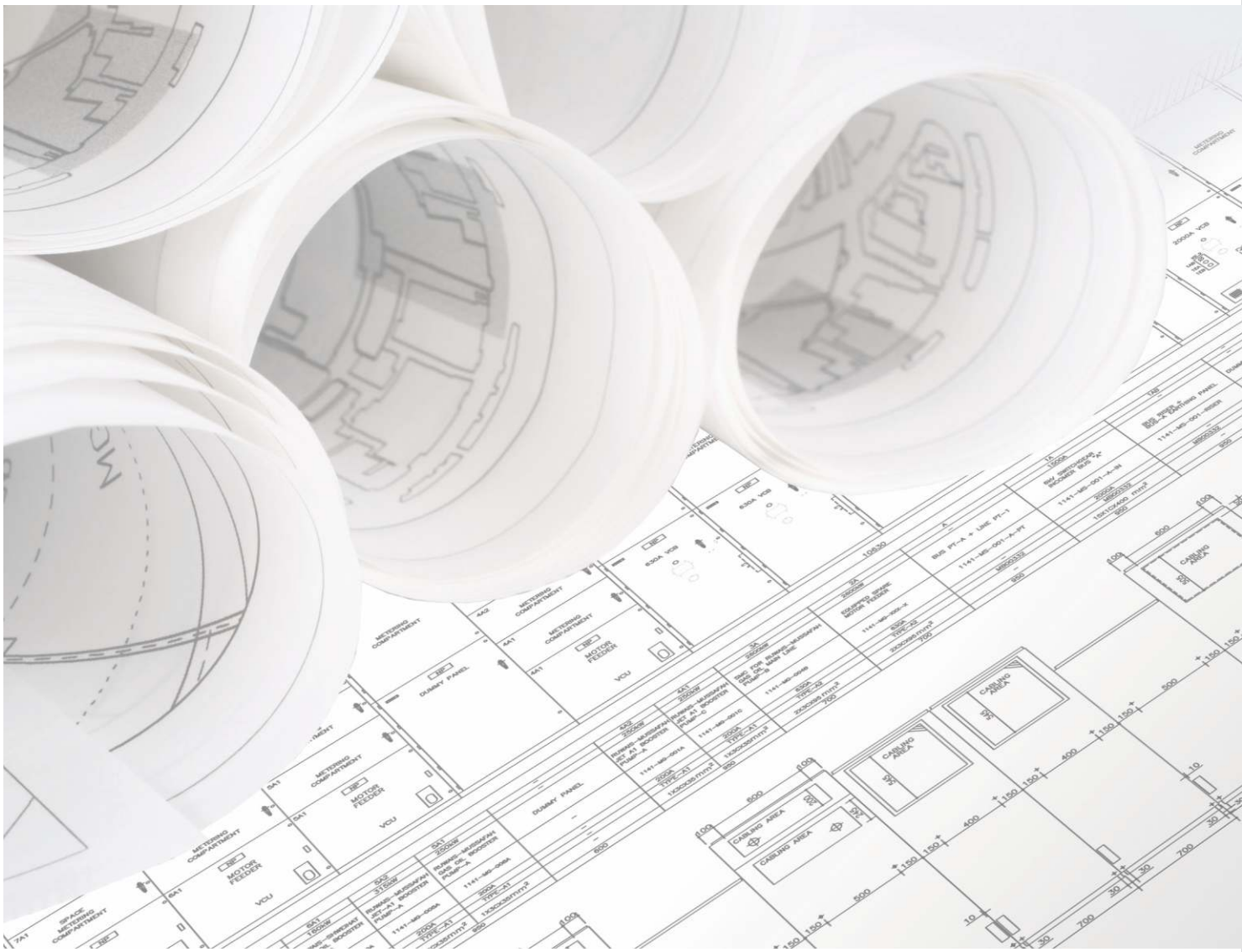
Table No. 1

Electrical characte-ristics	Current ratings	**Main Horizontal busbars:**	
		Rated current (I_{nA})	up to 6300 A
		Rated peak withstand current (I_{pk})	up to 220 kA
		Rated short-time withstand current (I_{cw})	up to 100 kA, 1s
			up to 50 kA, 3s
		Vertical Distribution busbars for MCC:	
		Rated current (I_{nA})	up to 2000 A
		Rated peak withstand current (I_{pk})	up to 220 kA
		Rated short-time withstand current (I_{cw})	up to 100 kA, 1s
			up to 50 kA, 3s
		Rated conditional short-circuit current (I_{cc})	up to 80 kA
	Internal Arc fault conditions	Permissible conditional short-circuit current	up to 100 kA
		Duration	500 ms
		Acceptance Criteria as per IEC 61641	1 to 7
Mechanical characte-ristics	Degree of Protection	In accrodance with IEC 60529:	
		External	IP 30 / IP 40 / IP 42 / IP 54
		Internal	IP 2X / IP XXB / IP 4X / IP XXD
	Mechanical Impact	as per IEC 62262	IK 08 / IK 09 / IK 10
	Forms of Separation	as per IEC 61439 - 2	Form 1 to Form 4
		as per BS EN 61439 - 2	upto Form 4, Type 6
	Dimensions	Height (mm)	2200, 2400
		Width (mm)	700, 900, 1000 (MCC)
		Depth (mm)	600, 1000, 1100 (MCC)
	Surface Treatment	Structure	Powder coated / painted
		Internal Components	Powder coated / painted
		External Components	powder coated / painted
	Resitance to Corrosion	Damp heat cycling test	IEC 60068-2-30
		Salt mist test	IEC 60068-2-11
	Plastic components	Flame retardant, self-extinguishing, Halogen-free	IEC 60695-2-10, IEC 60695-2-11

Table No. 1

Panel configurations					
Material	Version	Height (mm)	Width (mm)	Depth (mm)	Depth including doors (mm)
Aluminium	Single Front (Side cable entry)	2400	900 / 1000	600 / 1000	644 / 1044
	Single front (Rear cable entry)		700	1000	1044
	Double front		900	1100	1144
	Double front		1000	1100	1044
Copper	Single Front (Side cable entry)	2200 / 2400	900 / 1000	600/ 1000	644
	Single front (Rear cable entry)		700	1000/1100	1044
	Double front		900	1100	1144
	Double front		1000	1100	1044

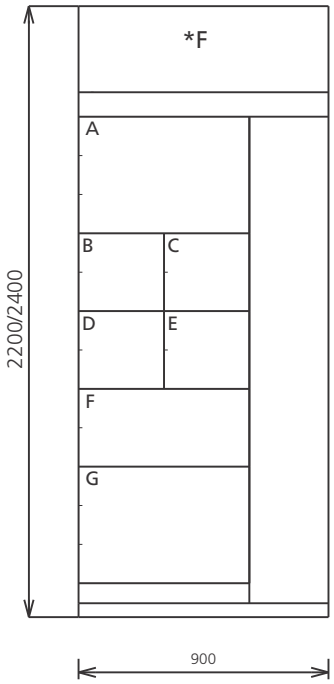
Table No. 2



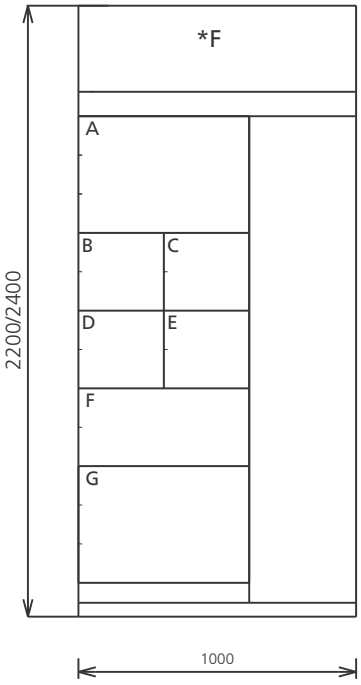
CONSTRUCTION

PANEL CONFIGURATIONS

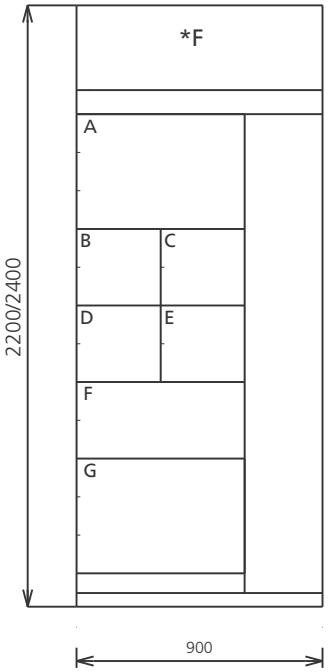
SINGLE FRONT



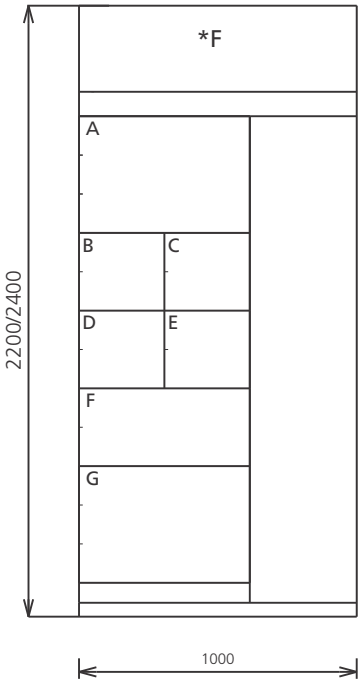
SINGLE FRONT

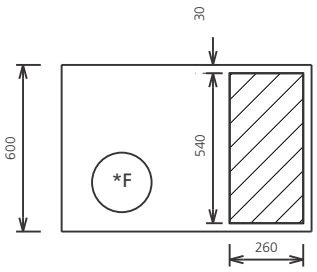


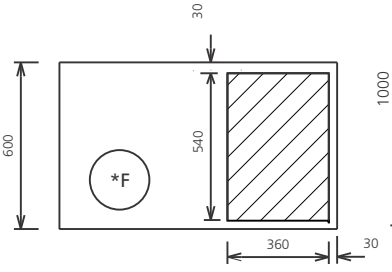
SINGLE FRONT

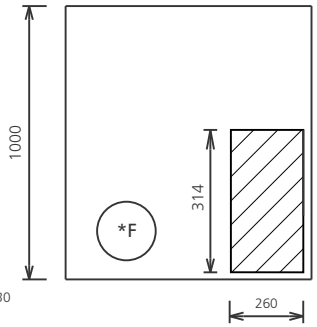


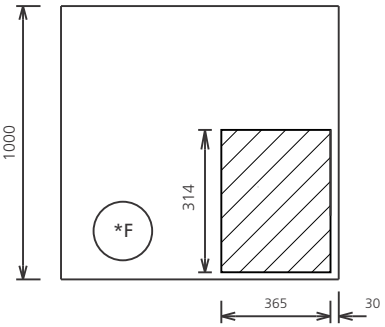
SINGLE FRONT

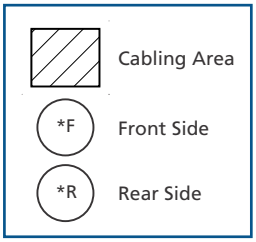












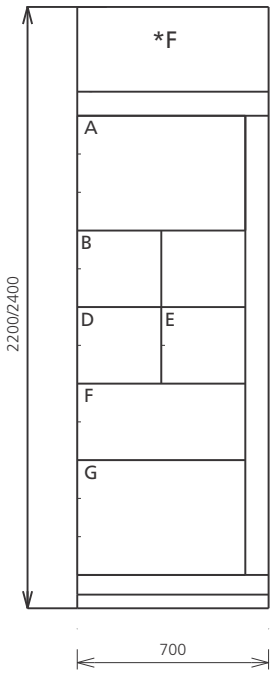
(All dimensions are in mm)

**Dimensions do not include doors*

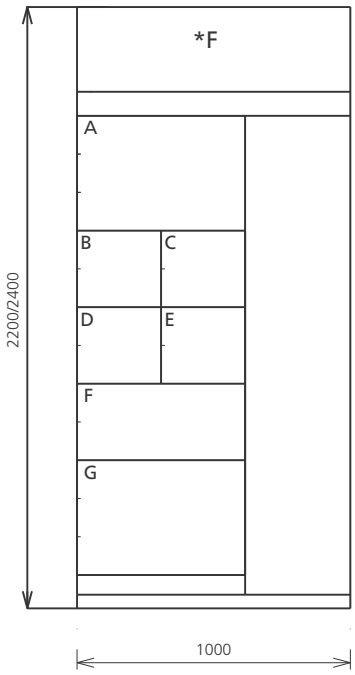
CONSTRUCTION

PANEL CONFIGURATIONS

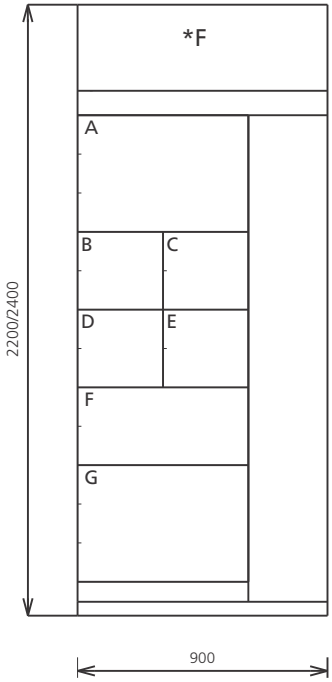
SINGLE FRONT

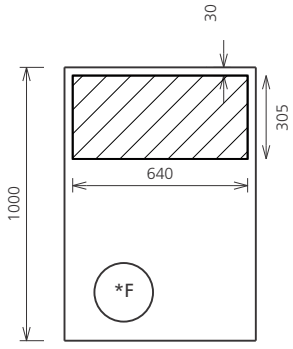


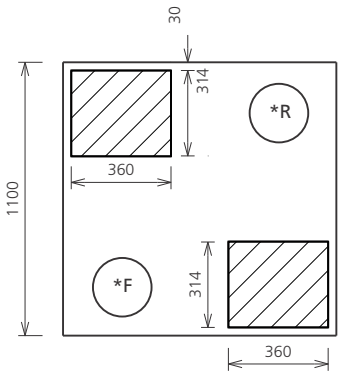
BACK TO BACK

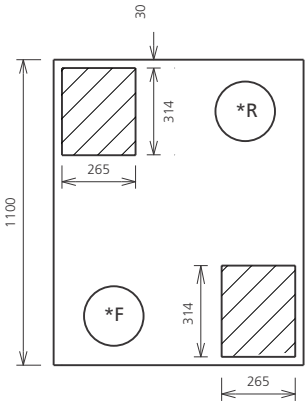


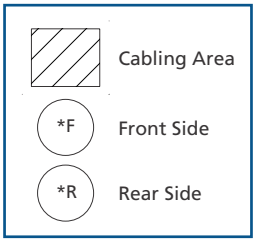
BACK TO BACK











(All dimensions are in mm)

**Dimensions do not include doors*

BUSBARS AND DROPPERS

1. Bus-bars are arranged in a Double deck configuration Figure 3. They are available in two different arrangements depending on the rating / busbar material (Aluminum or Copper), - Double deck non-interleaved (DDNIL) arrangement – with phase sequence of B-Y-R-N-Double deck interleaved (DDIL) arrangement with phase sequence of B-Y-R-B-Y-R-N with 50% neutral (B-Y-R-B-Y-R-N-N in 100% neutral) Figure3.
2. Aluminum and Copper droppers are fixed by supports and covered to form a fault free zone Figure 5, 5.1 & 5.2.

Figure 3 - Double Deck Arrangement of busbars

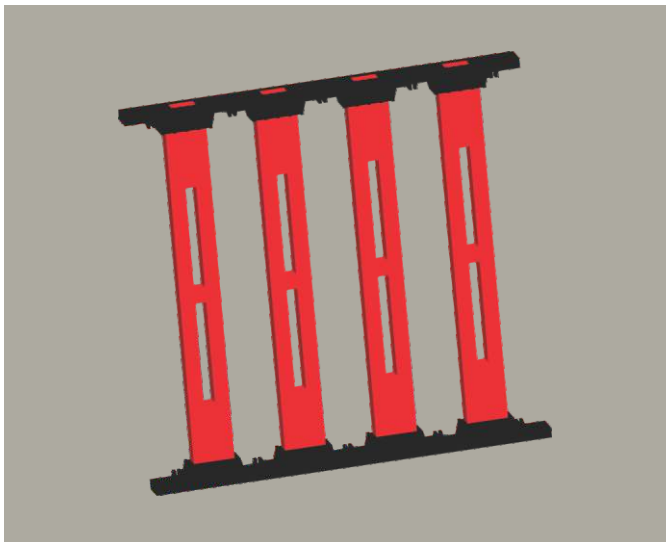


Figure 4 - Busbar Supports

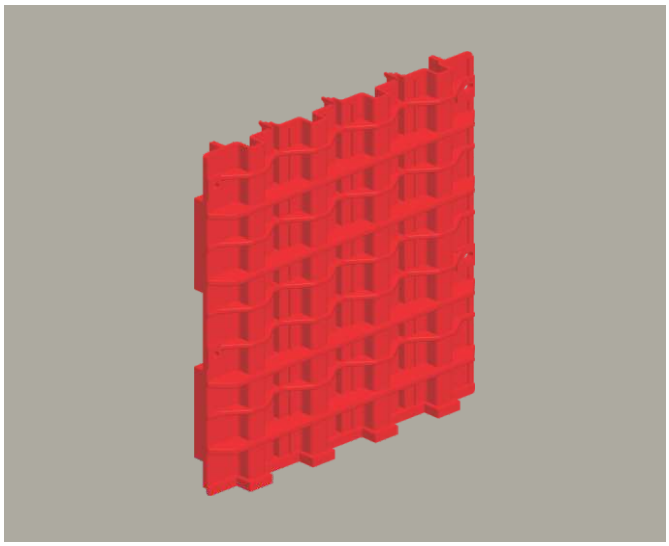


Figure 5 - Dropper supports

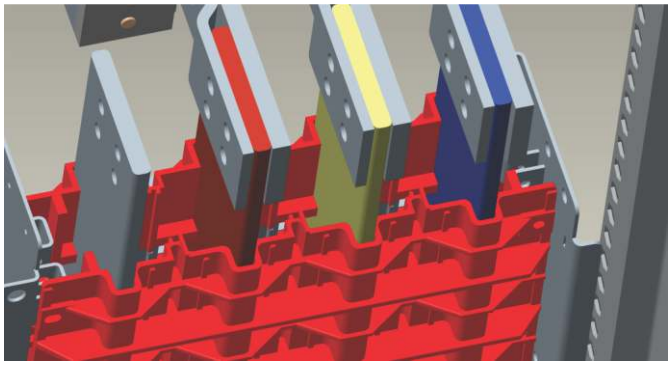


Figure 5.1 - Fully enclosed droppers

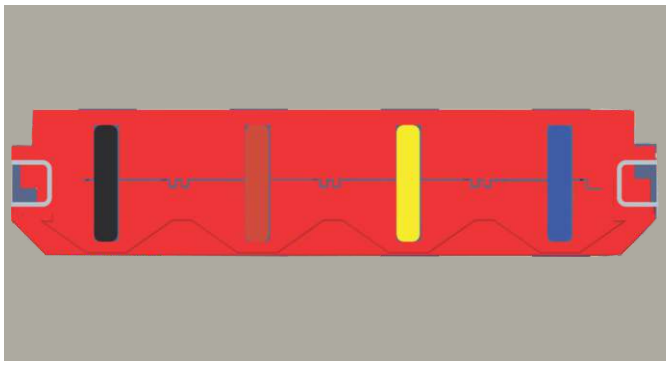


Figure 5.2 - Fully enclosed droppers (top view)

AUXILIARY BUSBARS

Auxiliary busbars are located in the top front chamber of the panel and segregated from main busbars by a metallic partition.

In back-to-back TX's, auxiliary busbars are placed in one of the fronts and tap-offs are taken for the units in both the fronts.

A horizontal wireway is provided immediately below the auxiliary busbar for interpanel wiring. Shipping section terminals are mounted in the horizontal wireway if required. Figure 6.

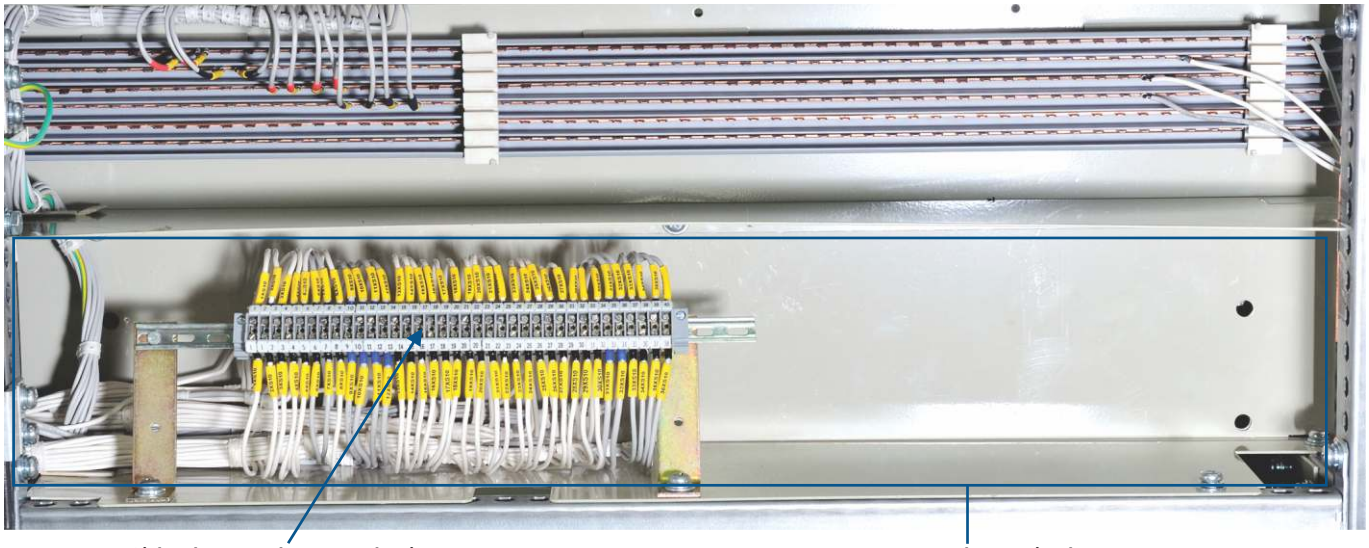
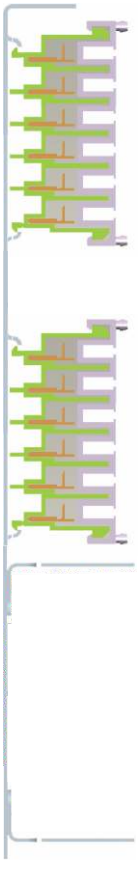


Figure 6 - Aux bus chamber

Up to 12 Auxiliary busbars of 63 A rating can be provided. The Auxiliary busbars are mounted in Nylon Housing to provide segregation and prevent accidental contact.



Block	Sr. No.	Description
	1	Space Heater - Ph
	2	Space Heater - N
1 st	3	240 / 110 AC V Aux supply - Ph / Clean Earth Bus
block	4	240 / 110 AC V Aux supply - N
	5	110 V DC Aux Bus supply - +ve
	6	110 V DC Aux Bus supply - -ve
	7	Annunciation Test Bus
	8	Annunciation Accept Bus
2 nd	9	Annunciation Reset Bus
block	10	Annunciation Alarm Bus
	11	Clean Earth Bus
	12	Configurable
		Wire Way

Table No. 3

** The above table is indicative and can be configured based on actual requirements.*

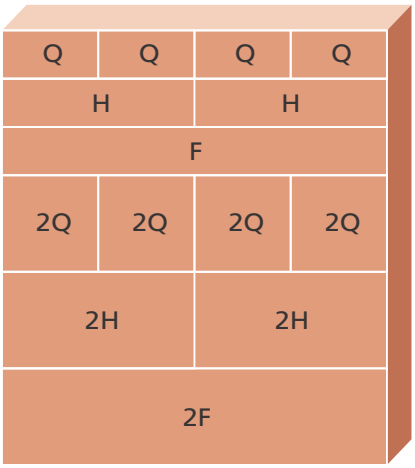
CONSTRUCTION

TX COMPARTMENTS

The modules are fully interchangeable with optional rating error preventers. Modules can be replaced quickly, reducing maintenance downtime.

The modules in TX come in two broad categories.

a. Fractional Width
b. Full width



Flexibility of MCC Modules

1Q

Figure 7 - 1 Quater (160 mm height)

2Q

Figure 8 - 2 Quater (240 mm height)

1H

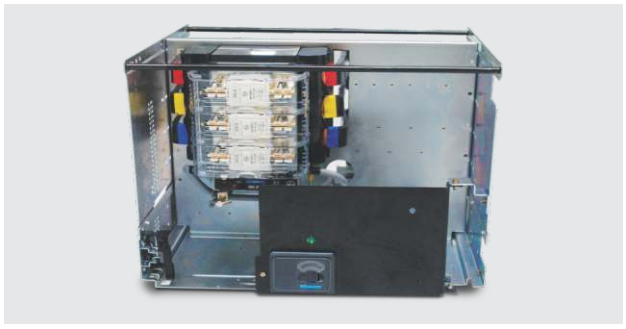
Figure 9 - 1 Half (160 mm height)

2H

Figure 10 - 2 Half 240 mm height)

1F

Figure 11 - 1 Full (160 mm height)



2F

Figure 12 - 2 Full (320 mm height)

3F

Figure 13 - 3 Full (480 mm height)

FEEDER DETAILS

1. All operations of the Feeder (Module) are possible in closed door condition. The module can be drawn out from Service to Isolated position without opening the compartment door.

2. The feeders are mounted on guiding rails which are specially designed to provide positive guidance and smooth movement of the unit.

3. Padlocking facility for power switches is available in 'ON' and 'OFF' positions Figure 14.

Figure 14 - Full width power switch padlocking

4. Module padlocking facility is available in Service, Test and Isolated position Figure 15 & 16.

Figure 15 - Full width module padlocking

Figure 16 - Fractional module padlocking

5. Interlocks are provided for safe operation. Module cannot be racked IN / OUT if the power switch is in ON condition. Module door cannot be opened in Service and Test position. However, interlock defeat facility is available which should be used judiciously Figure 17.

6. In case of VSD/VFD feeder, ensure disconnection of power source before opening the door.

Figure 17 - Door defeat interlock

7. Safety shutters are provided for total separation from live busbar when Module is not inserted in the panel Figure 18.

Figure 18 - Safety shutter

8. The 'make first, break last' type scraping earth system is provided on all draw out units. For full width module, scrapping earth contact is provided on left side of the module. Counter part of the scrapping earth is mounted on vertical connection of the main earthbar Figure 19.

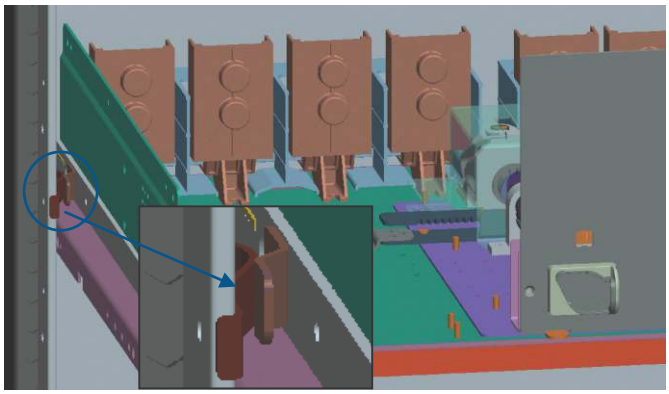


Figure 19 - Earthing for full width module

9. For the Fractional Modules, earthing is achieved through the fixed contact as highlighted in Figure 20 which is connected to the copper strip running at the bottom of the tray connecting to vertical earthbar.

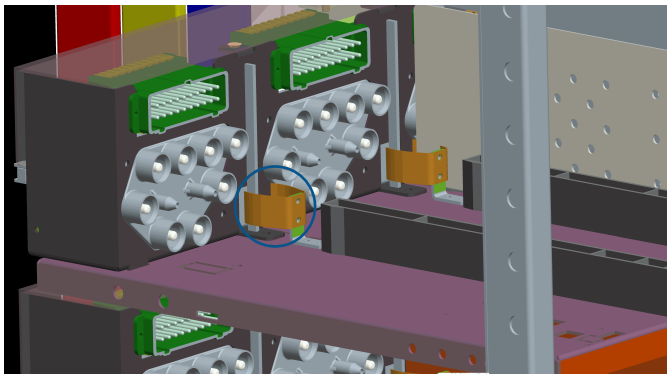


Figure 20 - Earthing for fractional module module

10. Incoming, outgoing contacts have ratings of 63A, 135A, 250A, 400A, 630A. The incoming power contacts are located on the LHS while the outgoing power contacts are located on RHS in the Full width module and bottom and top respectively in Fractional width module Figure 21

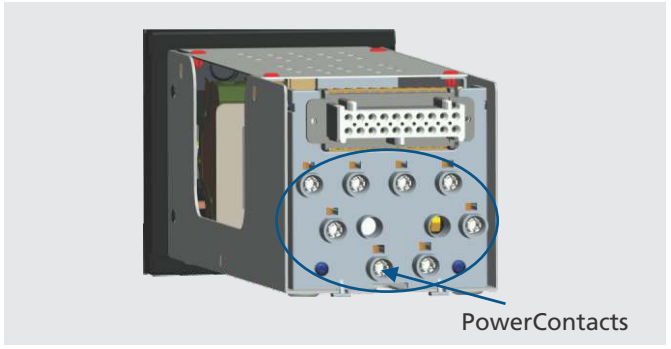


Figure 21 - Power contacts (Quarter Module)

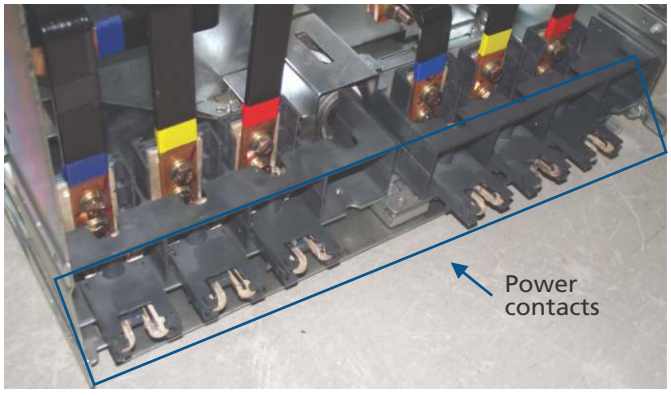


Figure 21 - Power contacts (Full Module)

11. Ammeters, indicating lamps, control switches and push buttons are mounted on a control plate, fitted on the unit.This can be hinged out for access to their rear terminals and to the equipment behind it by removing screw shown in Figure 22.

Figure 22 - Control plate

12. The starter unit in the fully draw-out version has following positions:
    a) Service (connected) position.
    b) Test position
    c) Isolated position

    Position indicator visible from the outside is provided at the bottom of the module.

13. The control contacts, i.e. the Secondary Isolating Contacts (SICs) are mounted in 2 columns in the full width module. Both columns can have the following varieties of SICs Figure 23.
    - Service + Test SICs (which make contact in Service and Test positions)
    - Test SICs (which make contact in Test position only)
    - Service SICs (which make contact in Service position only).

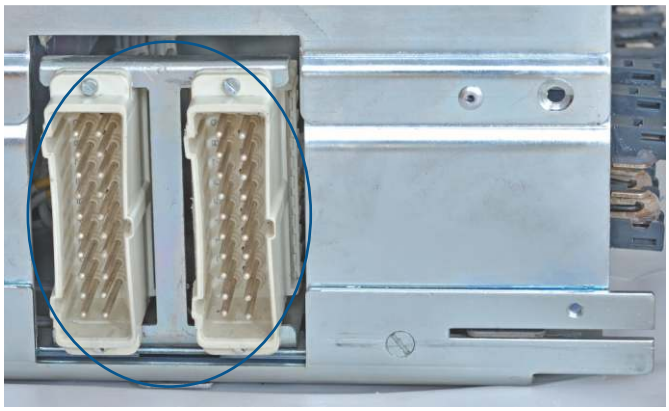


Figure 23 - SICs in a full width module

14. SIC Mounting in Fractional modules Figure 24.
    a. Test SICs are not provided in Quarter width modules.
    b. All SICs are mounted on the rear Side of the module.
    c. Only one SIC block is provided in a quarter width module and two blocks in a half width module.

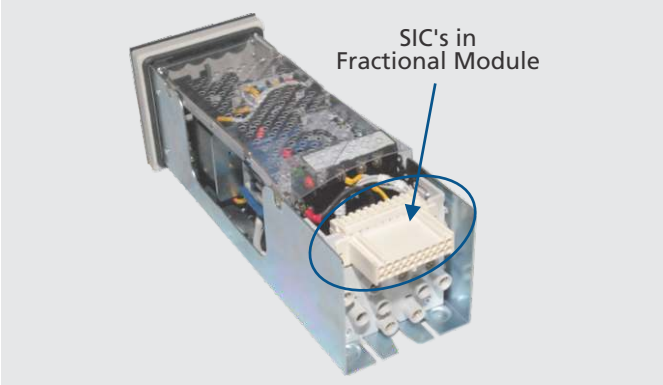


Figure 24 - SICs in a fractional module

State of SICs in various positions:

POSITION OF THE MODULE	POWER CONTACTS	CONTROL CONTACTS
SERVICE	CONNECTED	CONNECTED
TEST	DISCONNECTED	CONNECTED
ISOLATED	DISCONNECTED	DISCONNECTED

Table No. 4

LOCATION OF POWER AND CONTROL CONTACTS IN VARIOUS POSITIONS

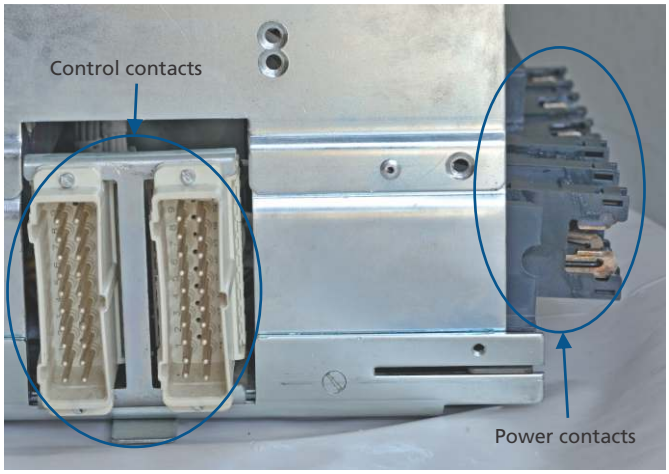


Figure 25 - Service position

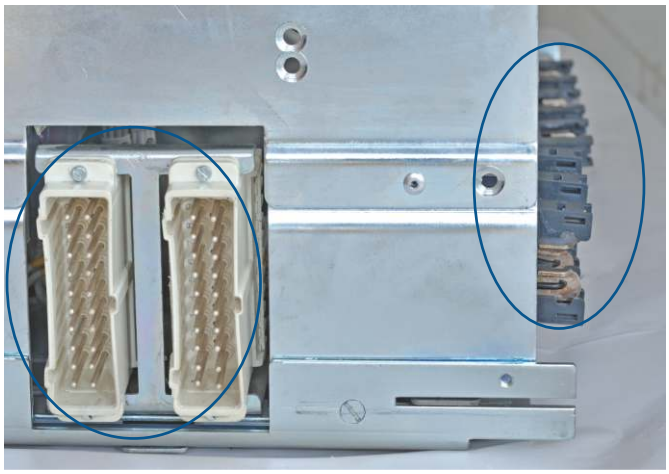


Figure 26 - Test position

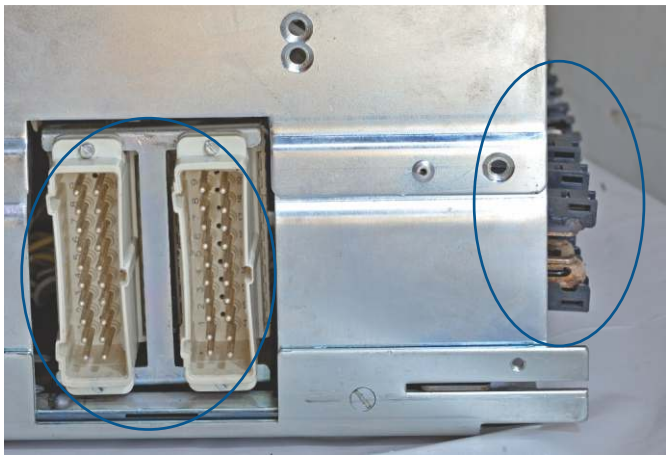


Figure 27 - Isolated position

For 90KW ABB MCCB DOL feeder (E&A circuit code: E-76-D under 100KA MCC) control plate cut out is smaller in comparison with other feeders. The height of the control plate cut out is reduced by 20mm (172mm to 152mm) from upper edge by maintaining remaining three edges same as cutout on other modules. A special blanking plate (TH72046XXX4) shall be used for this non standard control plate.

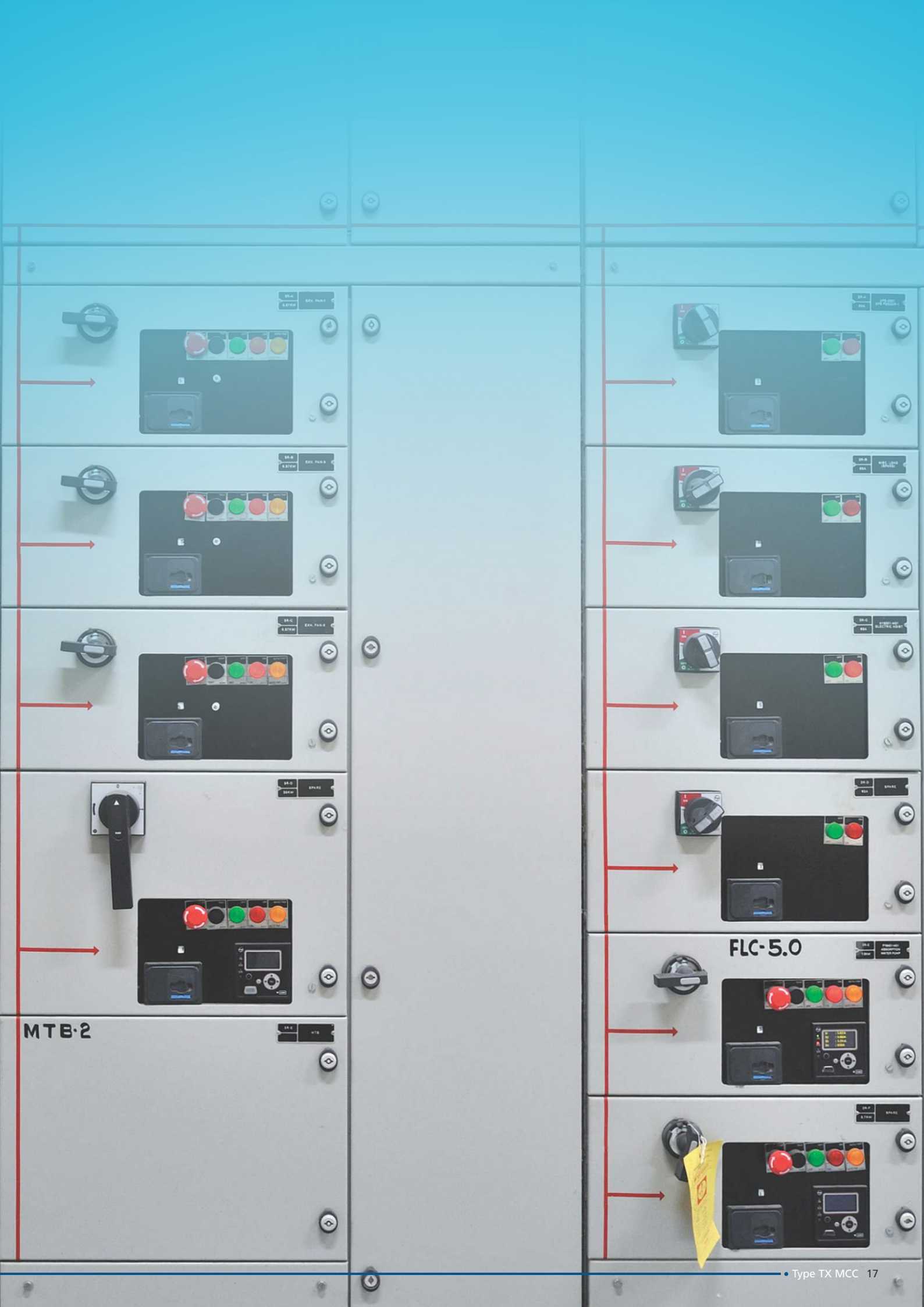
Closed door operations

Comparison of TERA with IEC

	Circuit	Method of Connection	Position			
			Service Position	Test Position	Isolated Position	Removed Position
IEC 61439	Incoming Main Circuit	Withdrawable Contacts	|	⟍	○	○
	Incoming Main Circuit	Withdrawable Contacts	|	| or ⟍	| or ○	○
	Auxiliary Circuit	Withdrawable Contacts	|	|	○	○
	Condition of circuits within withdrawable parts		Live	Live	Dead if no backfeed is present	○
	Condition of outgoing Assembly terminals of Main terminals		Live	Dead	Dead if no backfeed is present	Dead if no backfeed is present

	Circuit	Method of Connection	Position			
			Service Position	Test Position	Isolated Position	Removed Position
T-ERA	Incoming Main Circuit	Withdrawable Contacts	|	○	○	○
	Incoming Main Circuit	Withdrawable Contacts	|	○	○	○
	Auxiliary Circuit	Withdrawable Contacts	|	|	○	○
	Condition of circuits within withdrawable parts		Live	Live	Dead if no backfeed is present	○
	Condition of outgoing Assembly terminals of Main terminals		Live	Dead	Dead if no backfeed is present	Dead if no backfeed is present

|	Connected
⟍	Open but not necessarily disconnected (isolated)
○	Isolated


MTB·2
FLC-5.0

HANDLING AND TRANSPORTATION

RECEIPT AND HANDLING

Receiving:

On receipt of the MCCs at site:

- Verify the following details on packing case (Fig. 28) :
  - Item no.:
  - Description of material:
  - Package No.:
  - Gross weight:
  - Net weight:
  - Dimensions:
  - Volumes:
  - Storage of goods:
  - Special instruction:

- Verify the quantity of TUs & loose material as per the packing list.

- If the packing case is damaged, open the case and inspect the MCCs. Report any damage or loss of components to the transport/carrier and lodge a claim with the insurance agency or inform your nearest E&A office.

Figure 28 - Packing case Details

Handling:

TUs can be hadled either either by fork-lift or overhead cranes in an upright position depending on where they have to be placed. Care should be taken to see that the TUs don't topple during transportation.

- Avoid tilting of TUs (Panels).
- While transporting the panel using a forklift, ensure that the distance between the legs of the forklift and ground is at least 12 cm.
- Limit the speed of the forklift to 10 kmph.
- Use both legs of the forklift.

If switchgear are to be installed at higher elevations, shift them from the unloading spot through the opening planned in the building for this purpose. This should be done with all safety precautions and strict supervision by trained personnel.

Figure 29 - Positioning of TU on truck

In case of handling by lifting crane,

- Suspend ropes from the hook and pass them under the wooden pallet at the bottom of the TU.
- Centre of gravity indicators and chain marks are provided on the TU as shown in Figure 31.
- Use PP (Poly-propylene) ropes of minimum 1" diameter for this purpose. Choose the diameter of the rope according to the weight of the TU which is mentioned in your GA drawing.
- Verify that the route from the unloading spot to the erection spot has free access.
- Unload the TUs after reaching the unloading spot.

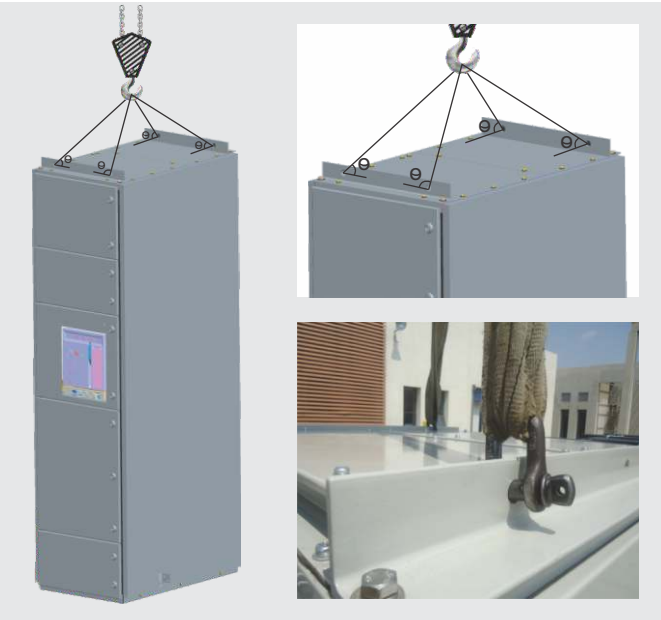


Figure 30 - Lifting Angle

⚠ *While unloading a TU, ensure that the remaining TUs are placed securely on the truck and are not in danger of toppling over.*

If rollers are used for placing the sections on the foundation, retain the base plank to avoid damage to the base frame.

Ensure that:

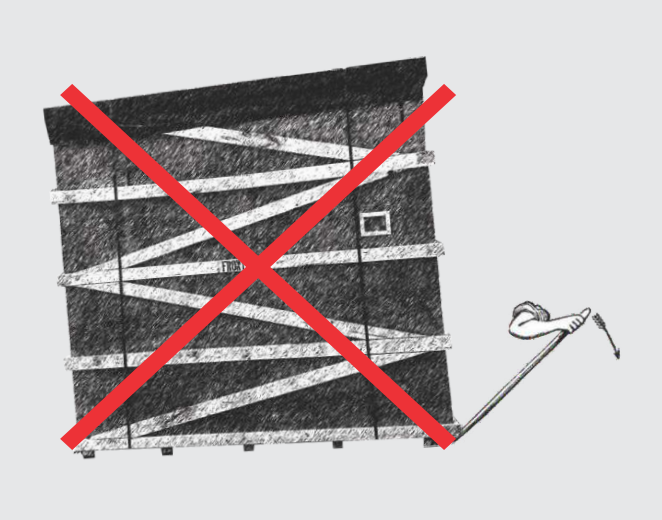
- The load of the TU is equally distributed by using all the lifting angle holes.
- The sling of the crane is in good condition.
- The TU does not tilt or topple during transit.

Figure 31 - Chain marks on packed Tus

⚠ *We recommend handling and shifting panels in packed condition only.*

⚠ *DO NOT MOVE THE PANEL BY INSERTING A CROWBAR BELOW THE BASE FRAME. This may cause damage to the base frame.*

- In case the TU is unpacked before reaching the site, use the lifting channel provided at the top of the panel for easy transportation Figure 29 & Figure 30.



RECEIPT AND HANDLING

To facilitate transportation and handling, the Motor Control Centre (MCC) TX is split into multiple sections/ transport units (TUs). Each section is wrapped with a HDPE (High Density Polyethylene) 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.

List of equipments and special tools for site erection and assembly

- Crane and truck for equipment shifting.
- Slings and ropes - As per requirement.
- Rolling pipes - 10 Nos.
- Channels - 10 m.
- Crowbars - 4 Nos.
- Welding machines - 1 No.
- Spanner sets - 1 Set.

(Ring & Open spanner size 13mm, 17mm, 19mm, and 24mm. Box or pipe spanner 13mm.)

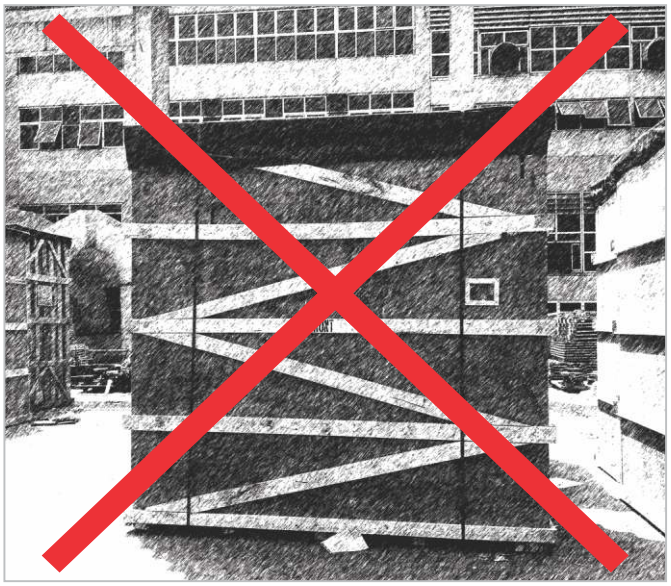
⚠ *For safe handling lifting angle (θ) should be greater than 45° Figure 29 & Figure 30.*

STORAGE

STORAGE

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

- 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.
- Maintain a minimum temperature of - 5 C and humidity of less than 50%.
- If civil construction is being carried out in the vicinity, ensure that the MCC is completely protected from debris and dust.
- Keep proper tags/markings on the panels for easy traceability.
- Unpacking of the TUs at site is preferable. In case it becomes necessary to unpack the TUs during storage, make sure that packing of all the internal components e.g. covers on the relays and meters mounted on the door etc. remain intact (Highlighted in the figure below). Also inspect the MCC for scratches, if any. Please use paint supplied with the loose materials to touch up scratch marks, if any.



The switchboard should be stored indoors with proper ventilation. Moist/ corrosive environments may affect the metallic parts and cause their insulation to deteriorate.

GENERAL SAFETY

GENERAL SAFETY

While shifting the panel from storage point to erection site:

- Use a lifting crane to load the panel on to the truck. Ensure that TUs are placed in a vertical position on the truck.
- Tie the TUs properly to prevent unwanted movement.
- Refer the previous section for TU handling instructions. Page No.1.
- Personnel handling the equipment must be skilled and authorised to handle the intended voltage level.
- All working personnel must be aware of safety practices.
- Safety shoes should be worn so as to avoid the risk of any electric shock while at work.
- Gloves and goggles should be used while working in the proximity of hot and hazardous materials to avoid bodily injury.
- Appropriate tools and instruments should be used as stated on page no. 21 for precise workmanship.
- Suitable Caution labels and sign boards should be erected at the time of installation and testing of boards as a mark of caution.

INSTALLATION

Typical arrangements

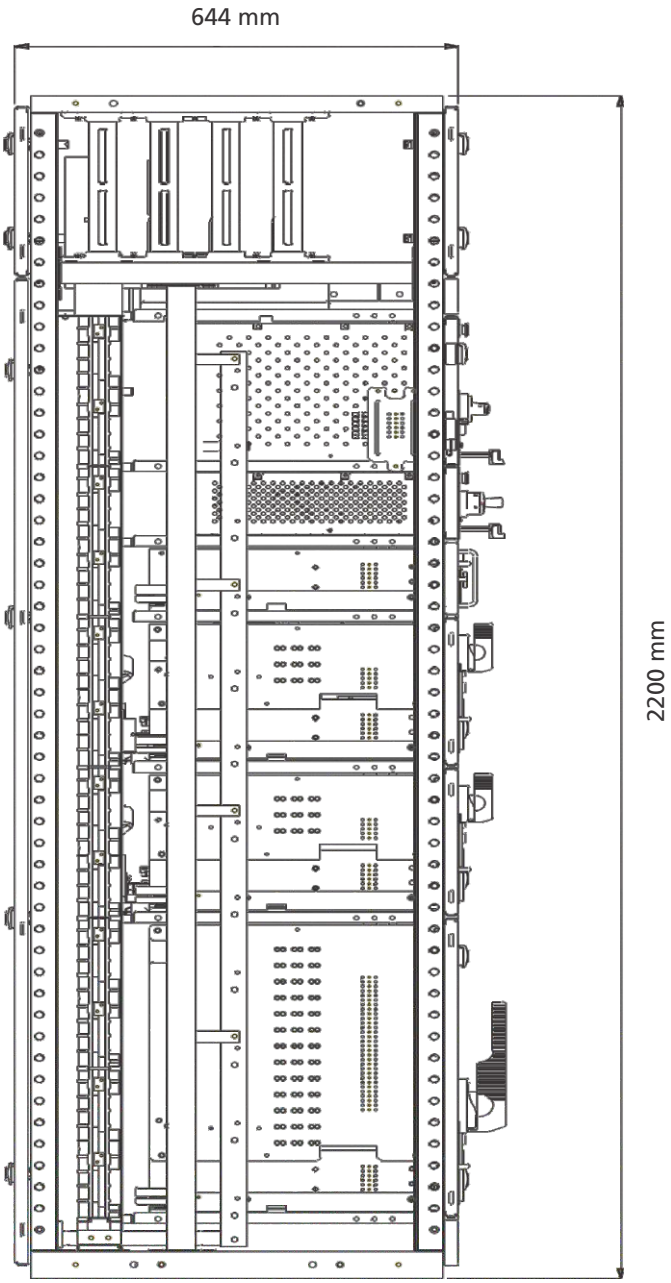


Figure 32 - Typical arrangements

INSTALLATION

TOOLS

- Torque wrench
- Bush Ratchet
- Hydraulic jack
- Rubber mallet
- Clamps

Figure 33 - Tools

SITE PREPARATION

1. The installation site must be clean and the surface even. Use shims if the floor is uneven. An uneven foundation may cause misalignment of sections, bus-bars and hinged doors of the unit.
2. Walls and ceilings must be plastered with painting completed.
3. Doors and windows must be installed.
4. Openings in the floor, wall and ceiling for cables, conductor pipes, bars and ventilation must be in accordance with the construction drawings provided.
5. Supporting brackets, beams, enclosures and foundation frames must be assembled and painted.
6. If necessary, braces appropriate to the basic dimensions of the switchgear installation with cross struts corresponding to the panels must be assembled.

⚠ *Suitable indoor conditions must be maintained and necessary emergency exits must be provided in the switchgear room.*

⚠ *Excessive temperature fluctuations and high humidity should be prevented.*

⚠ *Condensation should be prevented.*

⚠ *If the plant's atmosphere is likely to contain excessive steam or reactive gases comprising sulphur or chlorine, ensure that the Switchboard is placed in a separate pressurized room.*

ERECTION

1. After TUs have reached the installation site, unpack the TUs and move the packing material to its allocated area.
2. Check if all components are in place as per your drawings (MBOM) and the packing list.
3. Vertical sections should be shifted sequentially into the installation site for ease of installation.
4. The TUs must be carried in an upright position to avoid the risk of toppling. Refer the section *Floor preparation & panel mounting.*
5. Place the first TU over the base channel frames erected in the floor concrete by the civil contractor. Check correctness of leveling (± 1 mm tolerance per meter is allowed) and alignment of panels & proceed as per General Arrangement (GA) Drawings.
6. Maintain clearances as mentioned in GA drawings. Provide sufficient space on all sides of the panel for personnel to work conveniently.

FLOOR PREPARATION AND PANEL MOUNTING

Mount the panel on the floor either by bolting or by tack welding with the ISMC base channel / base frame. The panel has an integral 50 mm base frame made of 3 mm sheet metal.

Follow the steps listed below to mount the panel:

- Grout / weld the ISMC base channel / base frame on the inserts on the floor. Ensure that surface is perfectly levelled.
- Place the panel on to the ISMC base channel / base frame.
- Refer Figure below for placing the panel on to the ISMC base channel / base frame

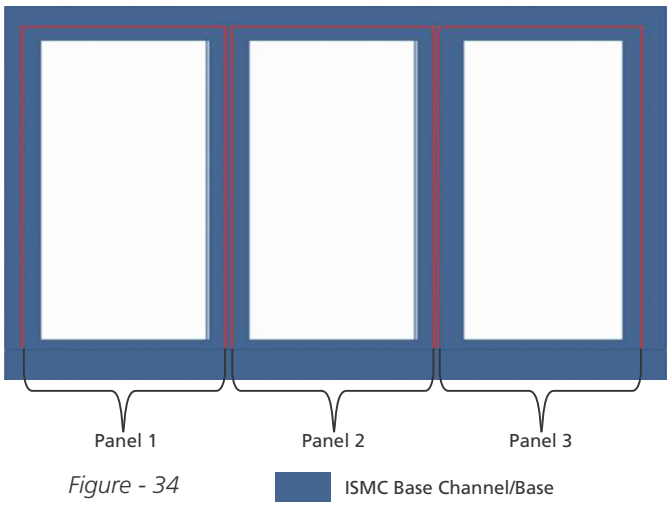


Figure - 34

- Tack-weld or bolt the panel with the ISMC base channel / base frame.
- When bolting the panel, drill the required holes in the ISMC base channel / base frame, so that it matches with the holes provided in the integral base frame.

Please ask for project specific drawings if you are bolting the panel to an ISMC base channel/frame. If you decide tp tack-weld the panels to the base channels/frames, such drawings are not required Figure 35.

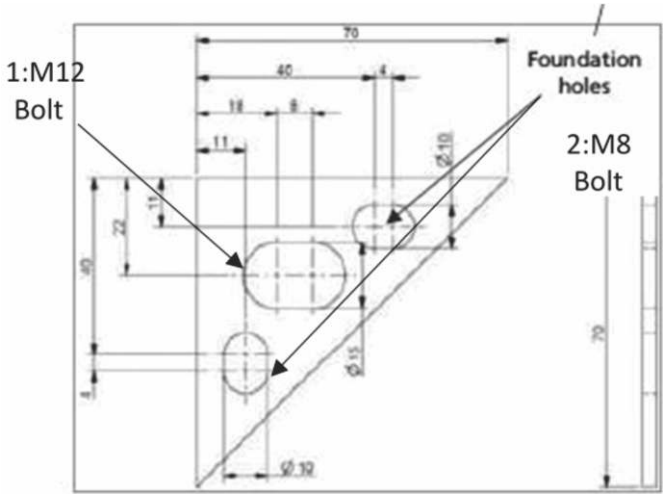


Figure35 - Integral Base Frame

The fixing the integral base frame using 2: M8 bolt or 1: M12 bolt.

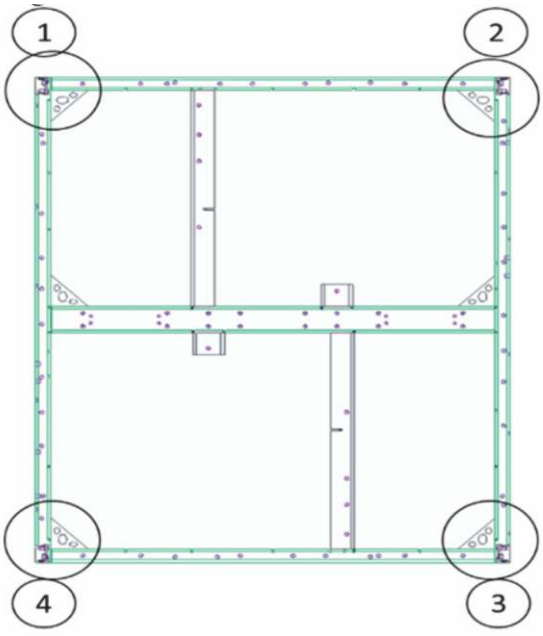
If ISMC frame is used, 2:M8 holes to be used for fixing ISMC frame with panel bottom frame and ISMC frame to foundation base fixing shall be with 1:M12 bolt or with tack welding as mentioned above.

Bolt the panel at locations explained below:

MCC

For double front

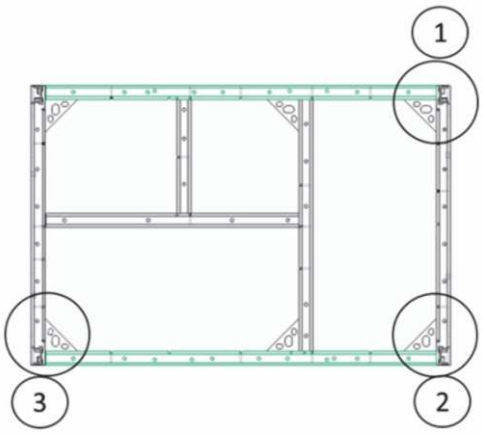
Mounting locations: 1 to 4



Top view of double front MCC panel

For single front

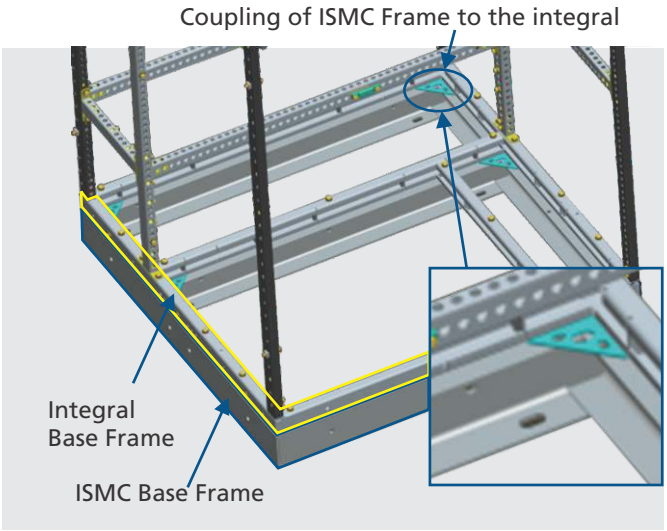
Mounting locations: 1 to 3



Top view of single front MCC panel

The foundation holes in the locations marked above can be accessed from front by removing the bottom gland plates.

A typical drawing for the ISMC base frame and the coupling of the integral base frame to the ISMC frame is as shown below.



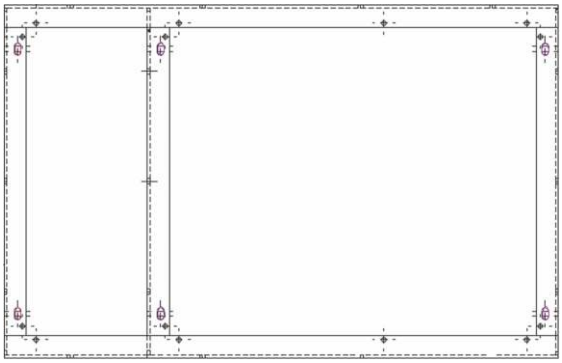


Figure 36 - ISMC Base Frame

1. For base frame, maintain welding points as per the bolting location as in-line with Panel frame and fixing drawing (VP-2025JV0J10145-000-G71-005) and Installation manual.
2. If rear access is limited, do welding from front after removing bottom plates.

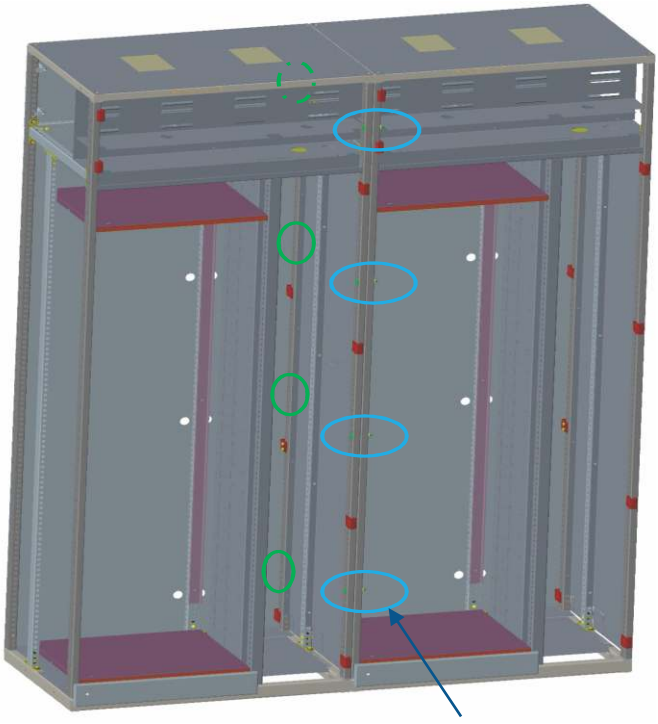
CONNECTION OF TRANSPORT UNITS AND BUSBARS

1. For access to the horizontal busbars, remove top plates and hoods (if provided) by removing all the bolts provided on the top Figure 37.

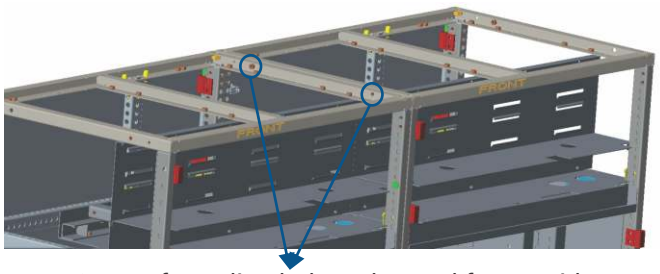
2. Remove the fish plates provided on the right side of the busbar to connect it with subsequent TUs placed sequentially.

3. 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.

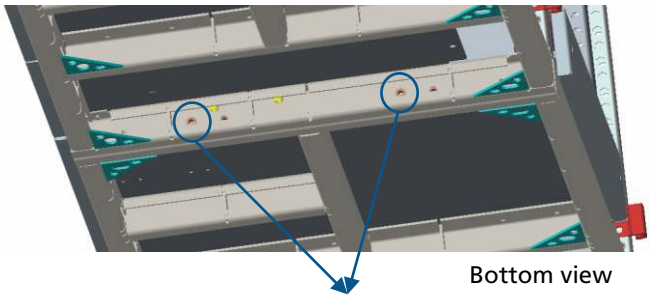
4. Bolt adjacent TUs together - holes are provided in the gasketted side pillar. This should be done before joining the busbars.



4 Nos of coupling bolts to be used per vertical channel front and rear coupling



2 Nos of coupling bolts to be used for top side of 600D panels & 4 nos for above 600D panels



Bottom view

2 Nos of coupling bolts to be used for bottom side of 600D panels (accessible from front after removing gland plate if rear access is zero) & 4 nos for above 600D panels

⚠ Use 4 nos of coupling screws per vertical channel while coupling at front & rear. Rear coupling screws are accessible after opening the CBC door if rear access is zero.

⚠ Use 2 nos of coupling screws for top side & bottom side of 600D panels & 4 nos for above 600D panels.

5. Join horizontal bus bars using the fishplates as shown in Figure 38.

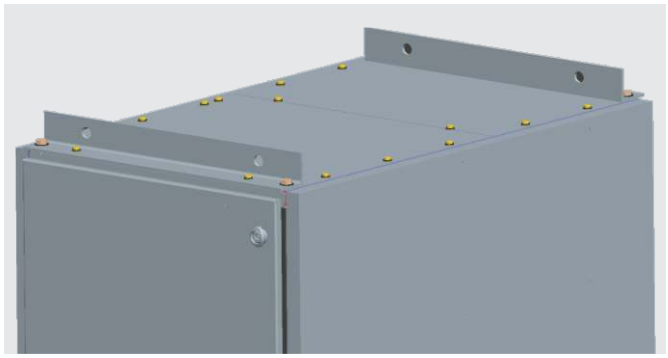


Figure 37 - Top plate

⚠ Ensure bus bars are properly aligned so that there is no strain on any of the support insulators.

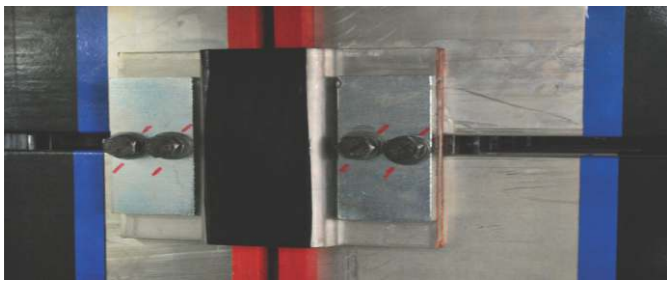


Figure 38 - Top plate

⚠ For aluminum bus bar system normal torque to be applied even if the bolt is HT. HT torque values are applicable only for hole less bus bar joints.

6. Tighten all electrical connections, except Hole-less Horizontal busbar joints (HBB) ,with a torque wrench to the torque values as mentioned in table no.5. For Hole-ess HBB joints, torque values to be as mentioned in table 5A Figure 39.

Figure 39 - Tightening of Busbar joints

Size of bolt Torque in m.kg

Thread (Bolt size)	Kgfm		Nm		Socket No. (mm)
	Normal Bolt (Grade: 4.8)	High Tensile Bolt (Grade: 8.8)	Normal Bolt (Grade: 4.8)	High Tensile Bolt (Grade: 8.8)	
M6	0.38	1.05	3.7	10.29	11/10
M8	0.85	2.5	8.3	24.51	13/12
M10	1.88	4.7	18.8	46.09	17/16
M12	3.2	6.5	31.38	63.74	19/18

Table No. 5

Thread (Bolt size)	Cumulative thickens of conductor at joint (T) mm	Torque (kgfm)	Socket No. (mm)
M12 High Tensile Bolt (Grade 8.8)	T<20	5.75±0.25	18/19
	20<T<35	6.25±0.25	
	T>35	6.75±0.25	

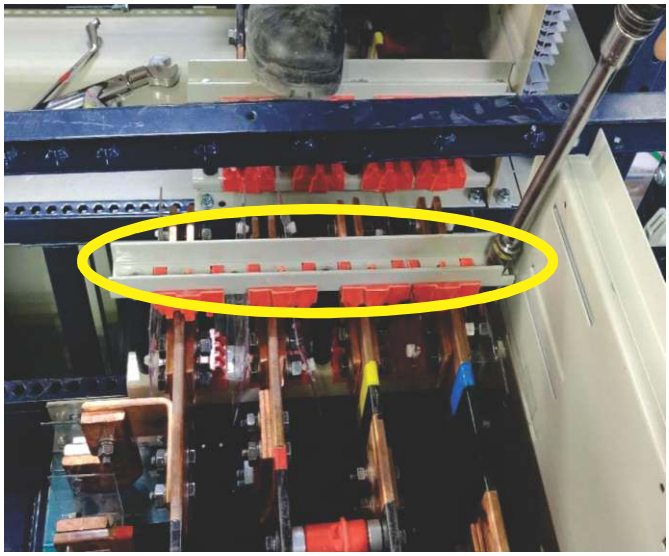
Table No. 5A

7. Join the auxiliary busbars by joining the auxbus fish plate provided for the same in the left side TU Figure 40.

Figure 40 - Auxbus joining

Procedure for Single-Deck busbar coupling and Torque Verification

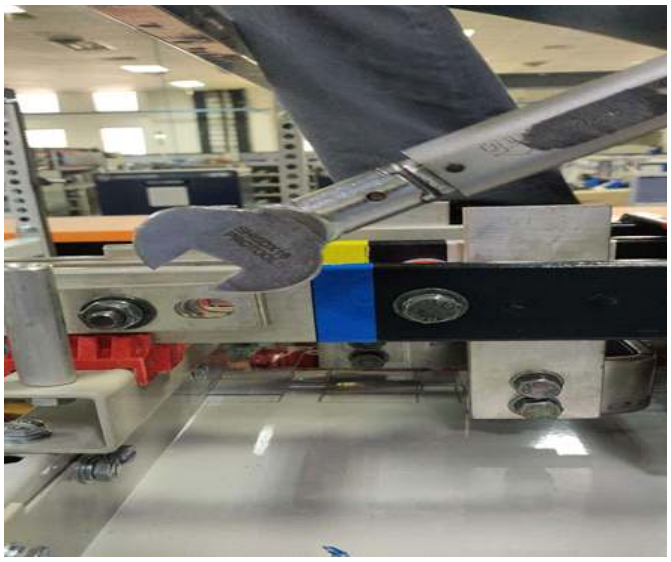
1. The top MS support with grip support hinders the tightening and torque checking of fishplate coupling hardware and Torque checking is not possible without removing the top MS support with grip support.
2. Torque to be verified using Tonichi make torque wrench along with standard 16 mm socket (SHI5DX16).



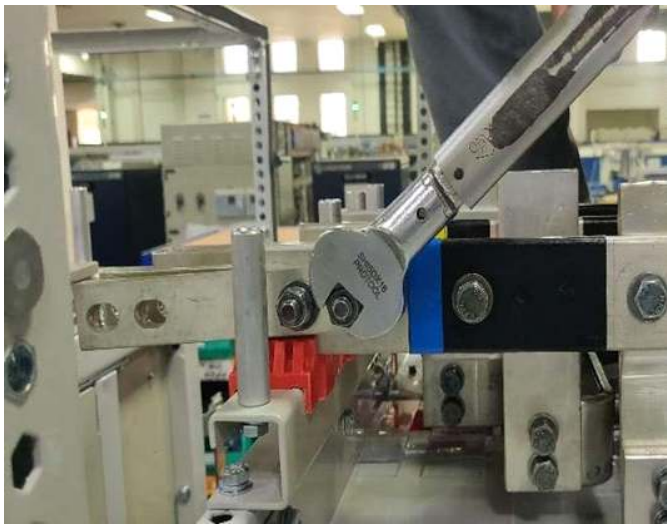
SHI5DX16

3. Once the top support is removed, tightening & torque checking is done in sequential manner from B-Y-R-N.
4. The outer most hardware is tightened first with open end / ring spanner (Size 16 - 17 mm) and torque is verified followed by inner hardware.

(Refer figure of Outer & Inner H/W on next page)



Outer H/W



Inner H/W

CONNECTION OF EARTHBARS

MCC-MCC

1. For single front panels, open the rear door of the panel to access the horizontal earthbar.
2. In case of a back to back arrangement, open the cable alley to access horizontal earthbar.
3. Remove the fishplate provided on left hand side TU to connect it with subsequent TUs placed sequentially.
4. Join the earth bars using the fishplate provided and check correctness.
5. Tighten the connection with a torque wrench to the torque values as mentioned in Table no. 5.

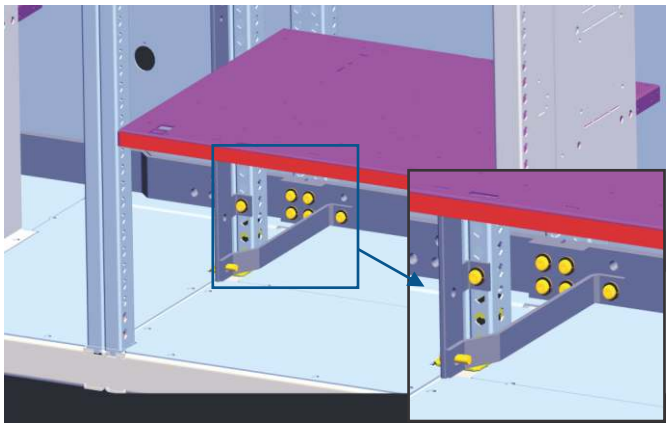


Figure 41 - MCC - MCC Earthbar Coupling

PCC-MCC

1. Open the rear door of the PCC.
2. Remove the fishplate provided at the end of horizontal earthbar at the bottom.
3. Join the earthbar of PCC with the already extended MCC earthbar using the fishplate.
4. Tighten the connection with a torque wrench to the torque values as mentioned in Table No.5.

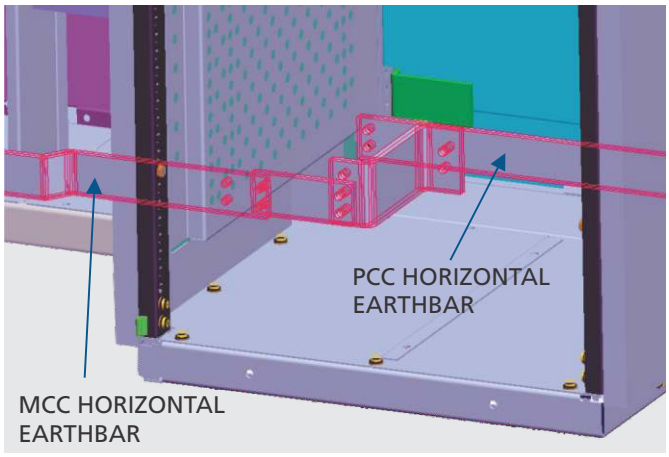


Figure 42 - PCC - MCC Earthbar Coupling

POWER CABLE TERMINATION

Power cable routing & dressing in cable alley chamber:

- Step 1: Branch out the cables (in case of multicore cables) just after the gland plate at the bottom (in case of bottom cable entry)

  This will ease the flexibility required for fool-proof termination
- Step 2 : By approximation, estimate the length of the cable required to terminate the cable with required bending radius (approx. 12 times the outer radius of the cable as shown in Detail B, C, D)
- Step 3 : Take the branched out cables to the respective feeder through the side walls of the cable alley as shown in figure 44.
- Step 4 : Make the required curvature depending on the type adaptor used for the feeder. Refer Termination of Power Cables section.
- Step 5 : Adequately tie the cables with cable ties in the cable bracket provided on the sides of the cable alley Lug termination at the power terminal to be done only after cable routing & dressing.
- Step 6 : *Using appropriate hardware and lug & with the required torque value, tighten the cables to the respective terminals, Refer table no. 6 (ensure the cable's stress / weight is not transferred to the terminals).

  *Hardware selection should be according to the specification of Lug manufacturer/ supplier.

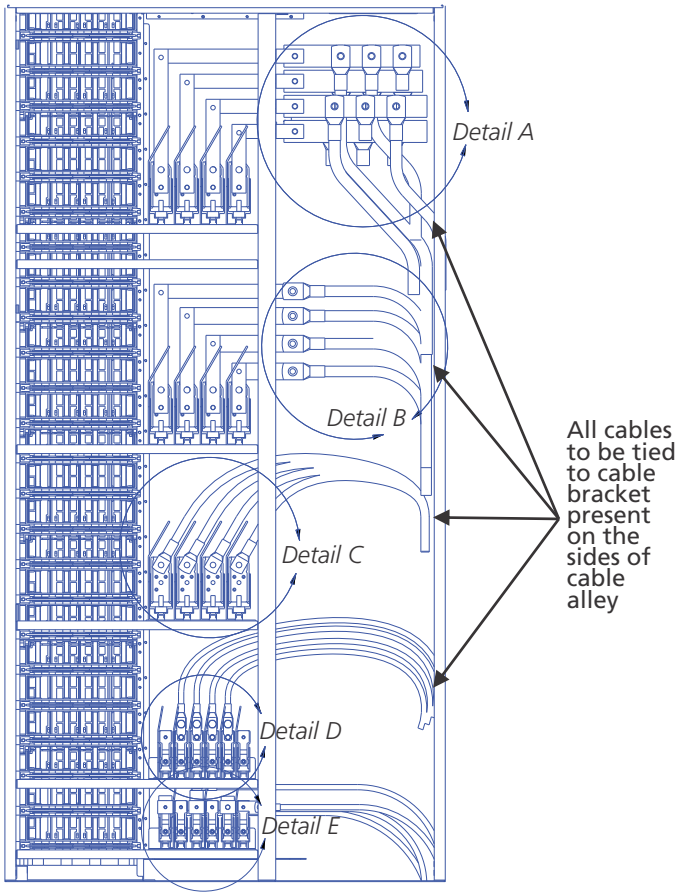


Figure 44 - Side Cable Entry (Front View) Cables tied to cable bracket present on the sides of cable alley

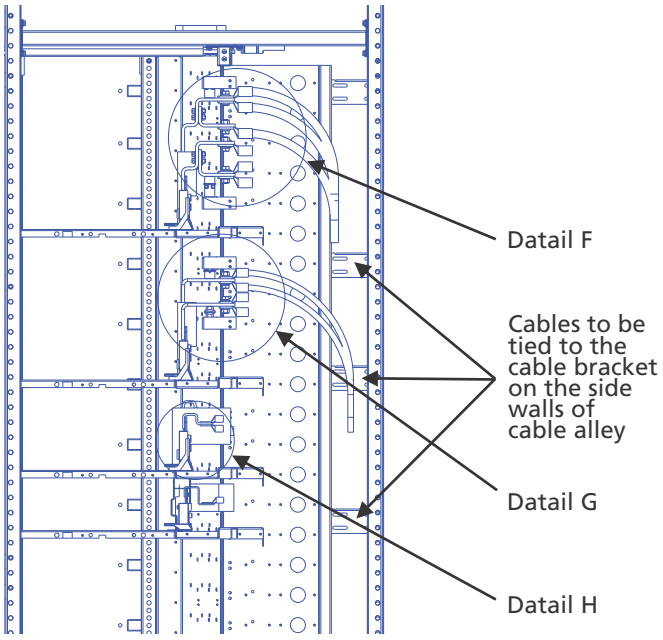


Figure 43 - Rear Cable Entry (Side View). Cables branching out though the side walls of cable alley.

⚠ *Ensure no cables are free hanging.*

⚠ *All cable wires should be supported appropriately and rigidly on the cable brackets.*

⚠ *Ensure cables are at a safe distance (min 50 mm) from live parts.*

⚠ *Ensure bus bars are properly aligned so that there is no strain on any of the support insulators.*

⚠ *Use of copper wires/cables is recommended for control circuits purposes.*

⚠ *Oblong holes are provided for Aluminium fishplate joints. Extra drilling on the bus-bars/fish plates should be avoided.*

⚠ *Re-inserte the modules removed during cabling process in the respective locations. A sticker is provided on the RHS side of the module contains the location details.*

In case of replacement of identical modules from a different cubicle, change the communication node ID of the MCU accordingly. Else it may lead to mal-operation of the feeders.

TERMINATIONS OF POWER CABLES

Power cables routed from cable chamber are connected to feeder's power contacts through lugs. Below instruction are for all types of cable entries and terminations.

- Cable routing method to be followed in all the cases
- Cable clamp brackets are fixed at the same level as their respective feeder so as to hold the cables rigidly.
- According to side and top cable entry and link arrangement, chose one from below options and follow the steps.

There are 2 types of lug termination in TX .This is based of the rating of the feeder and cable size (No of runs of cable/phase and Sq.mm of cable). The following are the types

1. Direct termination - Lug is directly terminated on the outgoing power contacts of the feeder.

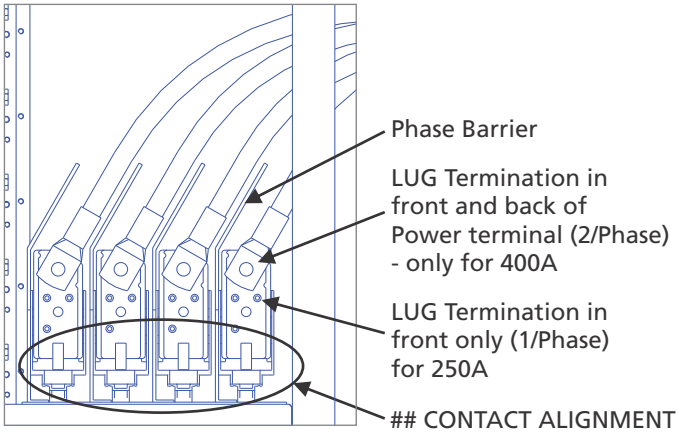
2. Adaptor Termiantion - Adaptors are provided on the power terminals and lug termination is done on the adaptors

1. Direct Termination

There 4 types of direct cable termination SCE and 1 in RCE.

Side Cable Entry (Top/Bottom)

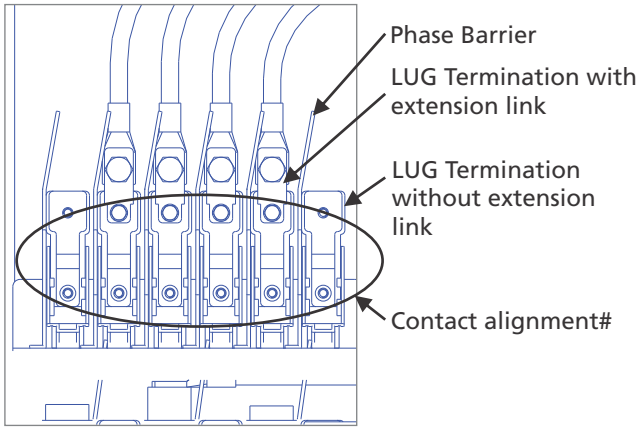
1. 400A contact direct termination -Refer Detail C
   No. of runs of power cable possible per phase :2 (front & back)
   *M12 bolt to be used for lug termination



Detail C

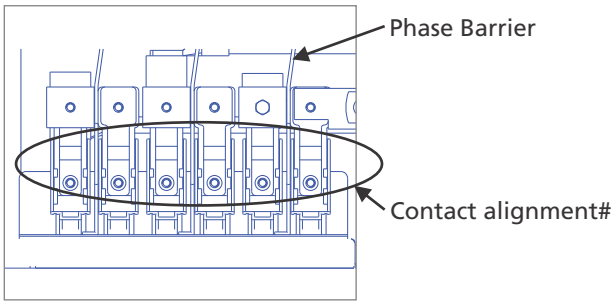
The contacts encircled must not be tilted / misaligned / stressed due to cable weight after termination.

2. 250A contact direct termination -Refer Detail C
   No. of runs of power cable possible per phase :1 (front only)
   *M12 bolt to be used for lug termination
3. 135A contact direct termination -Refer Detail D
   No. of runs of power cable possible per phase: 2 (front & back)
   *M6 bolt- lug termination -without extension link
   *M8 bolt- lug termination -with extension link

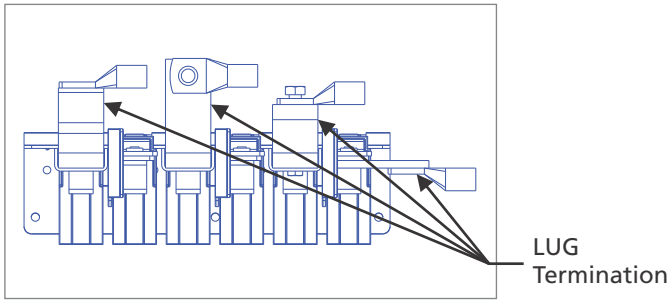


Detail D

4. 135A contact direct termination - Refer Detail E & E Top View
   No. of runs of power cable possible per phase: 2 (front & back)
   *M8 bolt to be used for lug termination



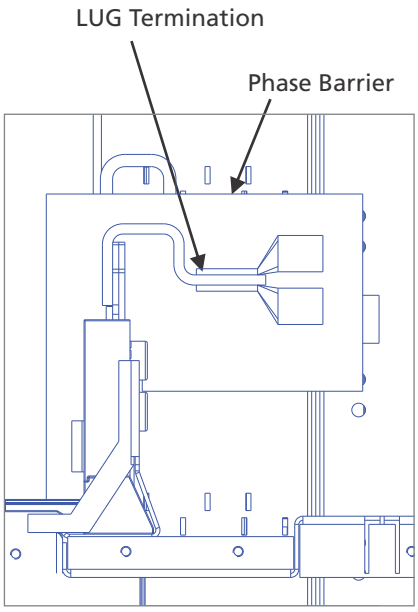
Detail E



Detail E - Top View

Rear Cable Entry

5. Refer detail H
   No. of runs of power cable possible per phase: 2
   *M12 bolt to be used for lug termination

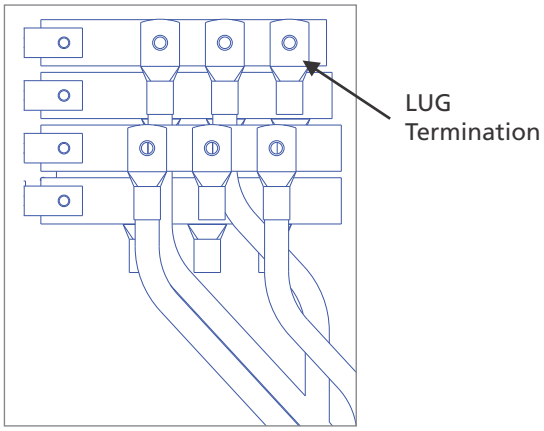


Detail H

2. Adaptor Termination

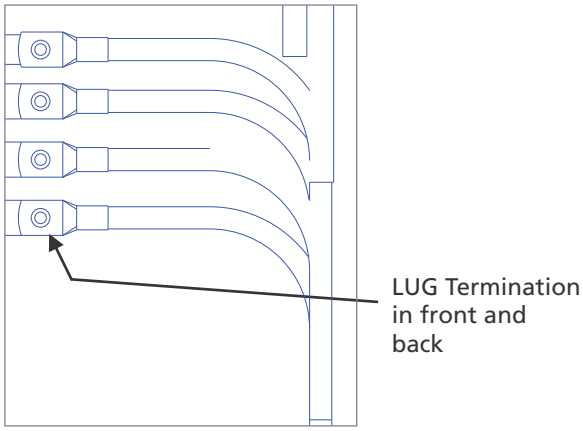
Side Cable Entry (Top/Bottom)

1. Refer Detail A
   No. of runs of power cable possible per phase: 3
   *M12 bolt to be used for lug termination



Detail A

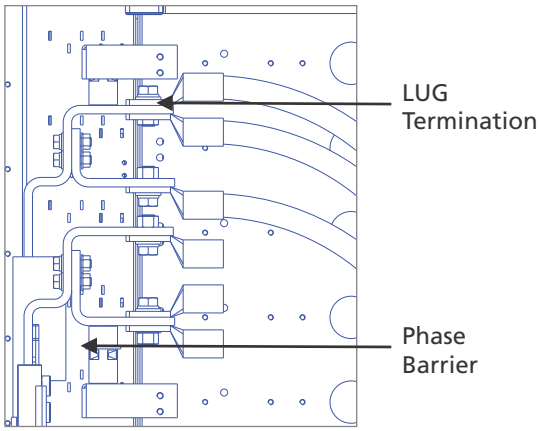
2. Refer Detail B
   No. of runs of power cable possible per phase: 2
   *M12 bolt to be used for lug termination



Detail B

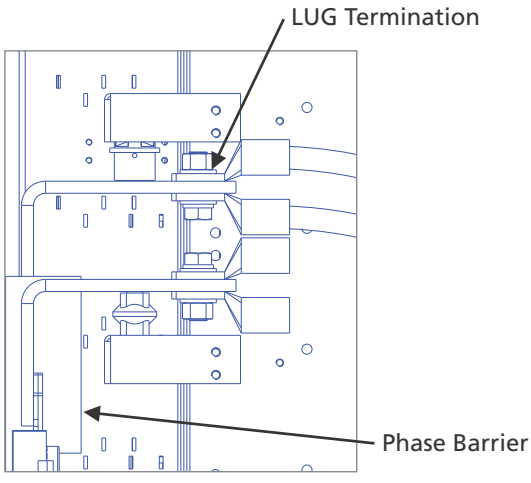
Rear Cable Entry (Top/ Bottom)

3. No. of runs of power cable possible per Phase: 3
   *M12 bolt to be used for lug termination
   Refer Detail F



Detail F

4. No. of runs of power cable possible per phase:2
   M12 bolt to be used for lug termination
   Refer Detail G



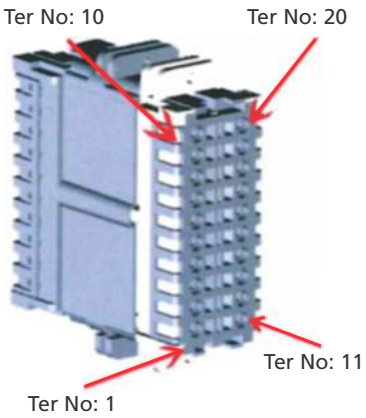
Detail G

SIC CABLE TERMINATION

1. All cables to be unprepared (lugless) -strip length 12mm± 1mm (Caution: termination with lug will either cause damage to terminals or loose terminations)
2. Cable termination capacity: 1:1.5 sq.mm / 1:2.5 sq.mm only per terminal
3. For operating the SIC terminal for termination only E&A supplied tool to be used (Caution: any other tool will cause damage to the SIC contacts)
4. Ensure the cable is dressed with cable ties and the stress of the cable doesn't affect the SICs free movement

PROCEDURE TO BE FOLLOWED FOR FIELD CONTROL WIRES TERMINATION ON SIC

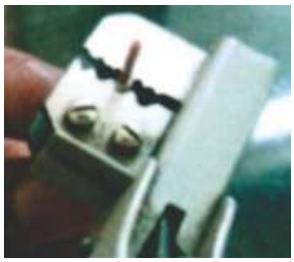
CAUTION



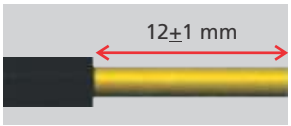
- The SIC which is mounted on the cable alley is suitable for LUG LESS TERMINATION
- SPECIAL TOOL to be used for SIC TERMINATION
- The tool will be supplied as a loose item in a separate box along with each switchboard

SPECIAL TOOL

STEP 1



a) Wire to be stripped using wire stripper up to 12±1 mm



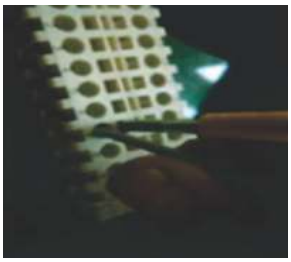
b) The wire must be multi stranded

c) Do not use wire cutter for stripping the wires

STEP 2

All wires strands to be twisted together

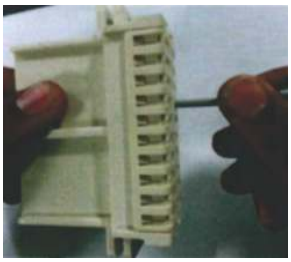
STEP 3



a) Special tool to be inserted in the respective SIC terminal (as shown in photo) cavity and press it.

b) Wire to be inserted on the respective SIC terminal as per scheme

STEP 4



a) Remove the SIC special tool from SIC

b) Following self check to be performed after the termination.

(i) Termination strength

(ii) No strands out

Pictorial Representation of procedure to be followed for termination of control wires on SIC.
The same sticker is applied inside your switchgear assembly as well.

Figure 45 - Control Cable terminals

Tightening torque values have been provided in Table No.5 on page No. 30.

Follow the following steps for removal of SICs for re-wiring / replacement:

1. Female SIC

Step 1 : Take the corresponding feeder to isolate position. When the feeder is in isolated position, male SICs gets disengaged from female SIC.

Step 2 : Open the cable alley door, without disturbing any other feeder or Power cable termination follow the below steps

Step 3 : Remove the SIC covers (1).

Step 4 : Unscrew the bottom SIC screws (7 & 8)

Step 5 : Unscrew the bottom SIC bracket's (2) hardwares (4, 5, & 6)

Step 6 : Unscrew the female SICs (3) top screws

Step 7 : Plug out all the terminals &Remove the female SICs (3)

2. MALE SIC

Step 1 : Take the feeder out of the boards

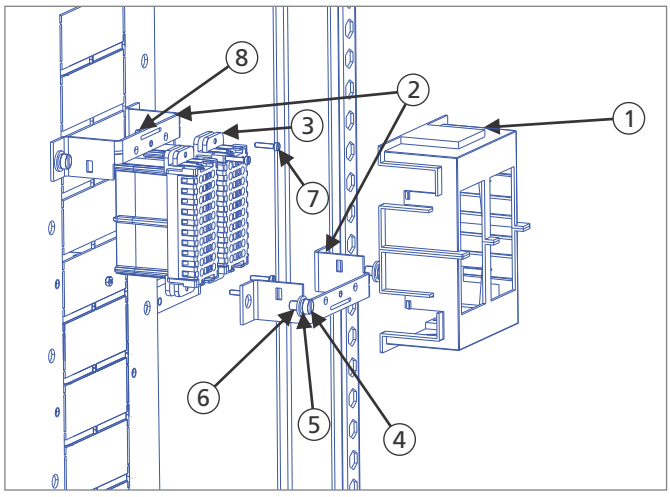
Step 2 : Place it on a table

Step 3 : With the mechanism racking handle, take the feeder to service position (Ref fig 2.2)

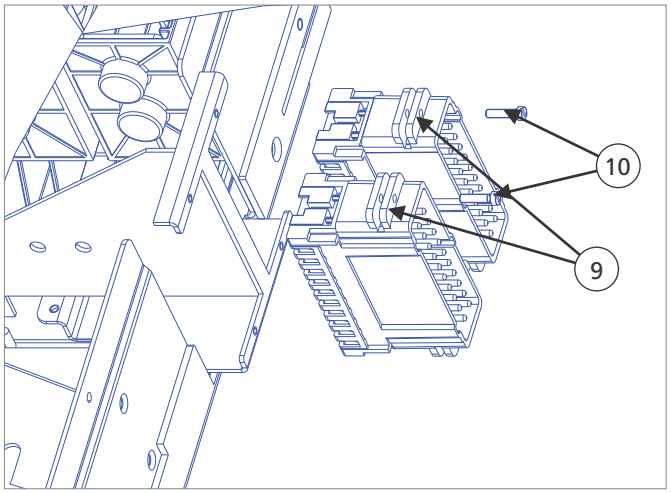
Step 4 : Unscrew (10) the male SIC (9) (Ref fig 2.3)

Step 5 : Plug out all the terminals and take the SIC out

Follow the following steps for fixing SICs:



Detail A - Female SIC Removal



Male SIC Fixing in Module

MALE SIC FIXING

Step 1 : Take the feeder out of the boards.

Step 2 : Place it on a table.

Step 3 : With the mechanism racking handle, take the feeder to service position (Ref fig 2.2).

Step 4 : Mount the male SIC (ensure terminal numbering (1- 20) matches with female SIC) outside the slot of SIC holder as shown in detail f.

Step 5 : Fix the SIC using hardwares (9) & (10).

FEMALE SIC FIXING

Step 1 : Fix the top SIC bracket (8) alone using hardwares (4), (5) & (6).

Step 2 : Take the female SIC (3), (ensure terminal numbering (1-20) matches with male SIC) and fix the bracket between the slot as shown in detail g.

Step 4 : Fix female SIC using harwares (7) & (8).

Step 3 : Fix the bottom SIC bracket (8).

Step 4 : Terminate all the cables on the SIC as per scheme.

Step 5 : Carry out SIC alignment (refer SIC alignment sop).

Step 6 : Replace the SIC covers (1).

Follow the following steps for SIC Alignment:

Step 1 : Remove the SIC covers and loosen the bracket hardwares - 4 nos of screws.

(caution :do not remove the hardware)

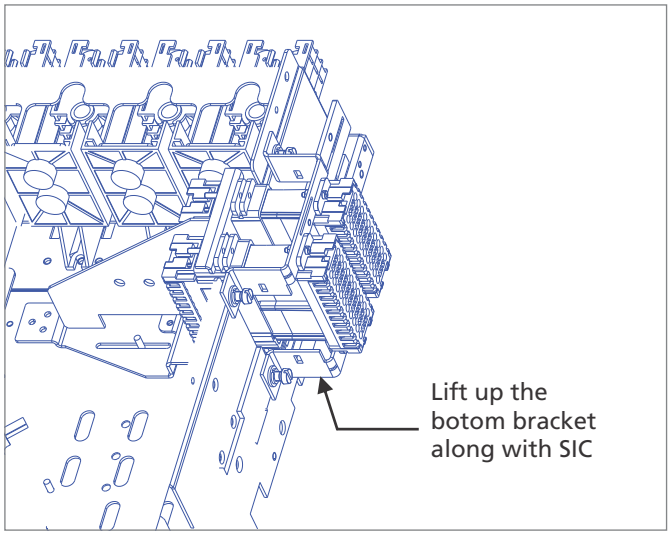
Step 2 : Take the corresponding feeder to test state slowly. (caution : operate the racking handle slowly & do not damage the SIC pins)

Step 3 : Lift up the bottom SIC bracket and align both male and female SIC. (caution : continue to hold the bracket from bottom)

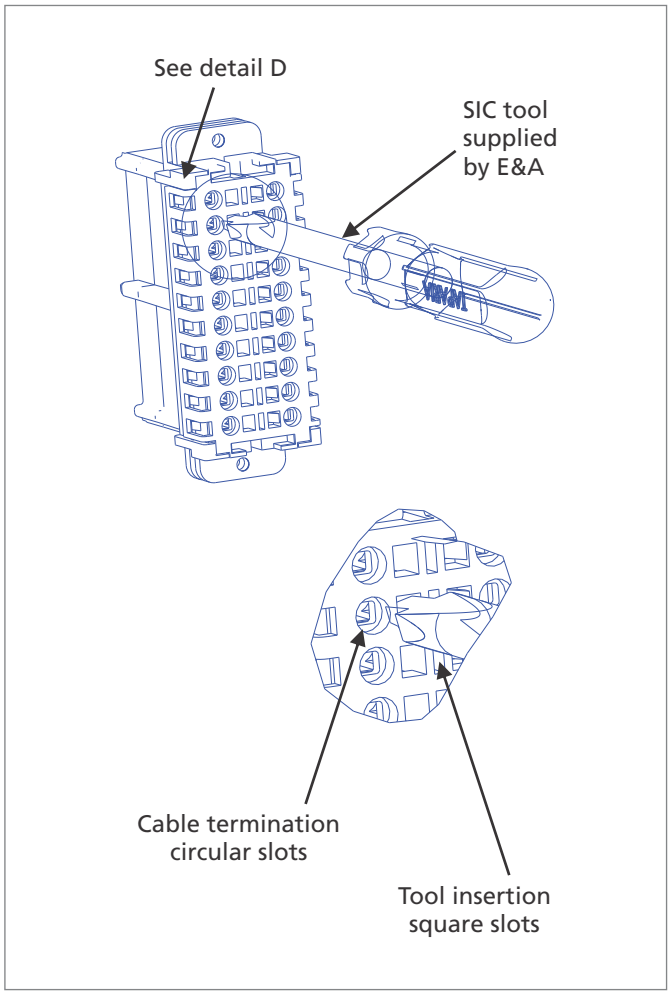
Step 4 : Tigheten the hardware by continuing to hold the SIC bracket from bottom.

Step 5 : The SICs are aligned. Operate the module from isolate to test & then to service.

Step 6 : For any issues, refer SIC trouble shooting page 38.



Detail C - Female SIC Removal



Detail D

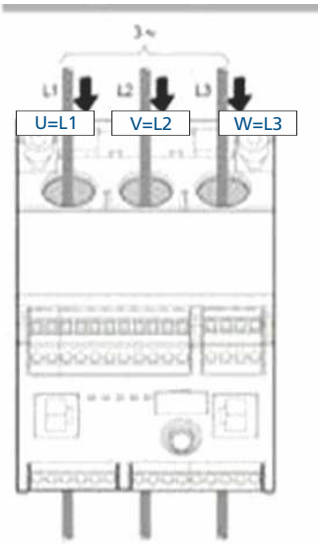
SIC TROUBLE SHOOTING

S.No.	PROBLEM	POSSIBLE CAUSE	ACTION
1	FEEDER is not racking from ISOLATE (I) position to TEST (T) position in door closed condition	The handle is not inserted properly	Insert the handle, press it and Turn the handle Clock-wise. Refer Page 53 for details
		The Racking mechanism is not working	Racking mechanism need to be fixed
		The female SIC holding bracket in cable aley is bent / deformed	Replace the bracket if they are deformed, Repeat SIC alignment
		Cable stress on the female SIC / or on SIC Cover due to routing near sides of female SIC	Re-route the cabling near the Female SIC. Ensure cable ties don't obstruct SIC free movement
		The SIC alignment is not correct	Repeat SIC Alignment procedure
		The Male SIC is damaged	Replace Male SIC. Do SIC alignment
2	FEEDER is not racking from TEST (T) position to SERVICE (S) position	The Racking mechanism is not working	Racking mechanism need to be fixed
		The O/G contact fixing support is loose	Check the tightness of the O/G Contact fixing support
		The O/G Contacts are misaligned / damaged	Check Power cable termination instruction
3	FEEDER status indication Lamp not working	No control supply available	Check control supply
		The male SIC is damaged	Replace Male SIC. Repeat SIC aliment
		Loose termination	Re-check termination. Refer SIC termination procedure
		Indication lamp burn-out	Replace indication lamp
4	Loose termination of SIC	SIC termination tool not used	Use the SIC special tool for termination
		Lugs on cables are used for termination	Use only bare condctor stripped to 12mm length for termination
		SIC block damaged	Replace damaged SIC. Repeat SIC alignment

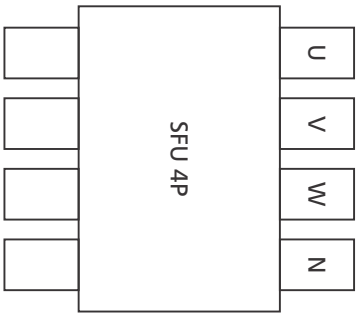
Table No. 6

Identification of U/V/W

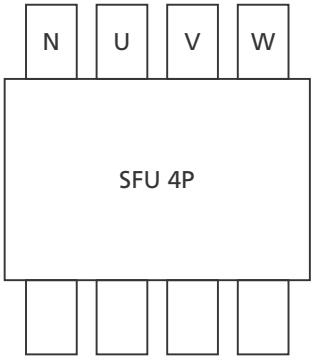
1. MCU feeder



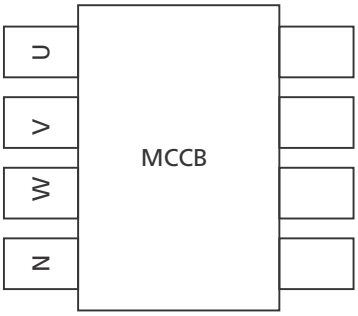
2. SFU draw-out feeder



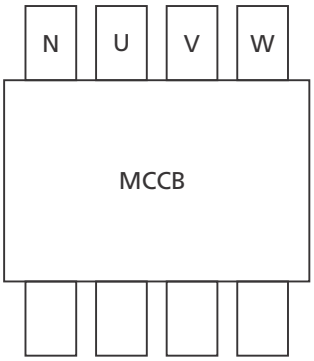
3. SFU fixed feeder



4. MCCB feeder



Link/wire feeder
HORIZONTAL ORIENTATION



Link/wire feeder
VERTICAL ORIENTATION

Terminal Numbering Denotation:
(1-2) – (U)
(3-4) - (V)
(5-6) – (W)
(7-8) – (N)

The switchboards draw-out feeders shall be of standard construction with phases arranged Red-Yellow-Blue and connected within equipment in the normal phase sequence with Red-Yellow-Blue laid out from top to bottom and left to right, when viewed from the front.

Interpanel wiring

1. Wiring is through the horizontal wire-way at the top along the auxiliary bus.

2. For wiring, separate terminals are provided in the left hand side of the right most TU which are named XS-YY (X - terminal no. and YY - panel no. (01,02,03 etc.)). The wire bunch to be connected to these terminals is in the left-hand side transport unit. The wires have ferrules with the terminal no. and should be connected their respective terminals. The no. of terminals and no. of wires to be connected are equal.

For example, consider the panels and transport units shown in the sketch. The transport unit (TU) consists of panel 1F and 2F, while TU-2 consists of panel 3F and 4F. The terminals named 1,2,3... -XS03 are mounted in panel 3F as shown in the figure. The mounted terminals are connected to their respective equipment in panels 3F and 4F. The wires going from TU-1 to TU-2 are bunched and kept with panel 2F. The wire which is to be connected to terminal 1 of panel 3F will have a ferrule marked 1XS03 at the end of it and will be kept in 2F.

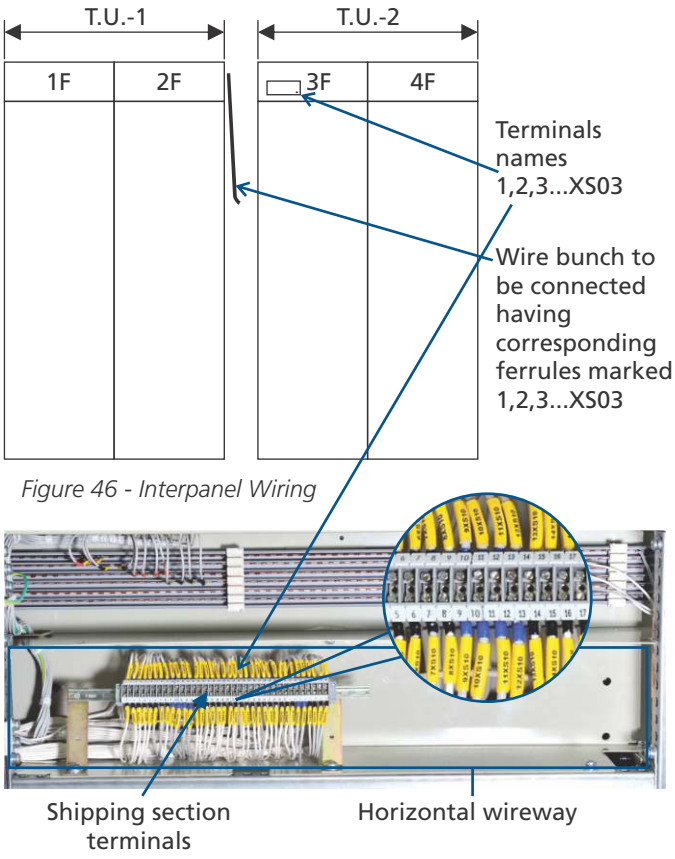


Figure 46 - Interpanel Wiring

INSTALLATION OF LOOSE MATERIAL

Metering and control devices:

1. Unpack the metering and control devices (like meters and relays) if they were sent as separate packages.
2. Position the device in the apt cut-out or base plate provided.
3. Wire them as per the scheme drawing provided.
4. Refer product inserts for further details about thedevice.
5. Carry out the settings of magnitude and time delay (if any) for the installed protective and control devices as shown in scheme drawing and MBOM (Master Bill of Materials).
6. Place the terminal covers properly to adhere to stated ingress protection (IP) level.
7. Check alignment of operating handles for all switches.
8. While dispatching the switchboard, secondaries of all current transformers are shorted. Remove these shorting cables while connecting relays/meters and store them separately Figure 48.

Figure 47 - Relay Mounting on Panel

9. Ensure again that all doors are closed and no connection is left loose.

Modules

1. Modules are not bolted inside the panel.

2. Open the compartment door.

3. Take the module out. Refer Page No.38 & 39

4. Remove the padding provided (for transit) at the sides of the module.

5. Insert the module inside the panel and bring it to service position.

Control Transformers

1. Unpack the Control Transformer.

2. Open the compartment door in which the Control Transformer is to be installed.

3. Bolt the Control Transformer to the base plate Figure 49.

4. Terminate the primary and secondary wires of the transformer on the respective terminals.

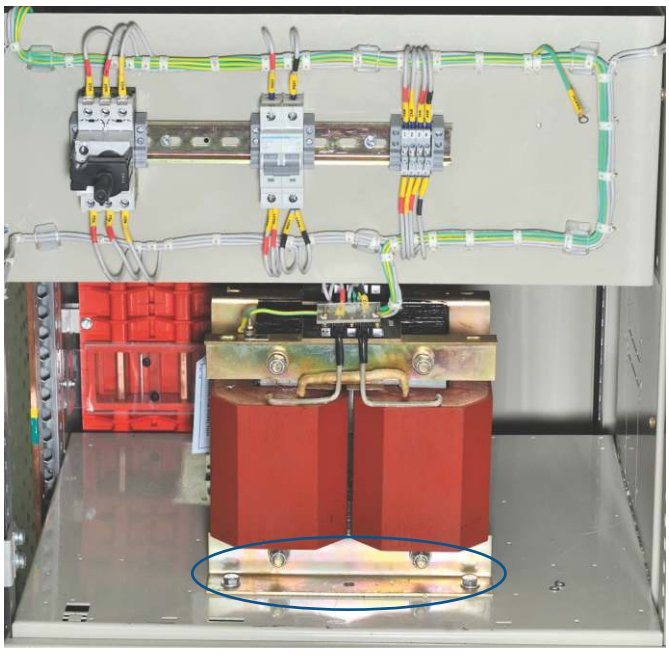


Figure 48 - Control Transformer Mounting on Panel

5. The primary wire has a ferrule with capital letters while that of the secondary is with unicase Figure 50.

6. Check the connections and tighten the bolt.

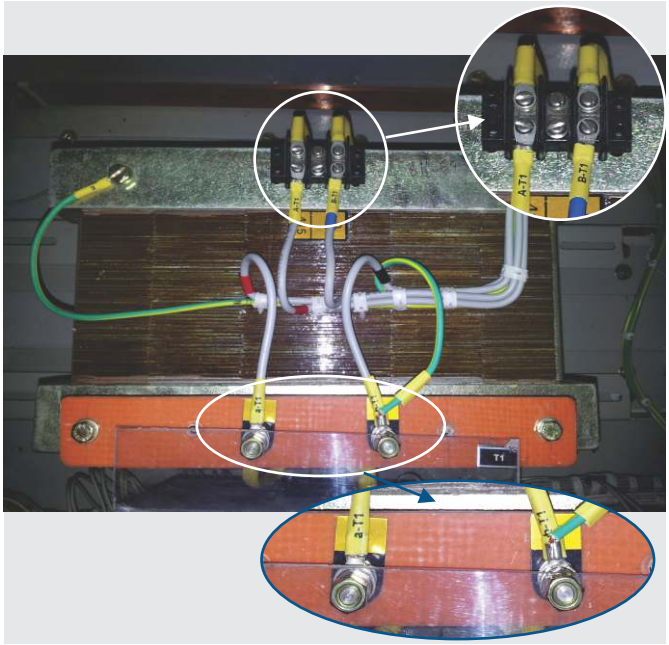


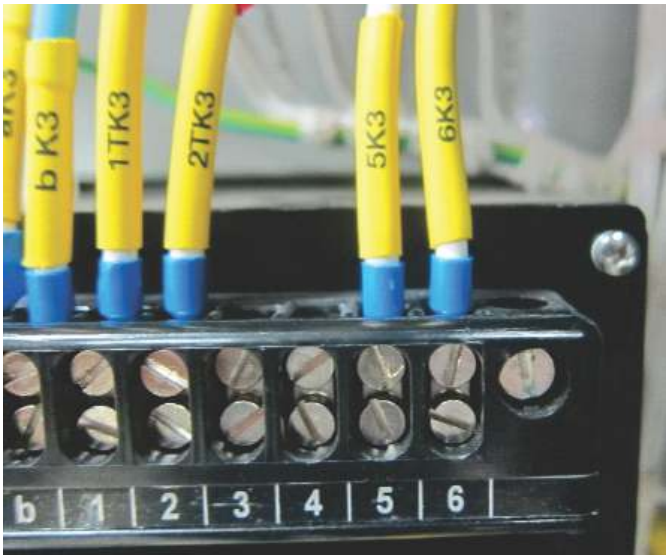
Figure 49 - Installation of Control Transformer

Ferruling Practice

1. Control wiring
   - Prefix – Terminal numbering
   - Suffix – Equipment numbering
   - Ferrule -13 K11

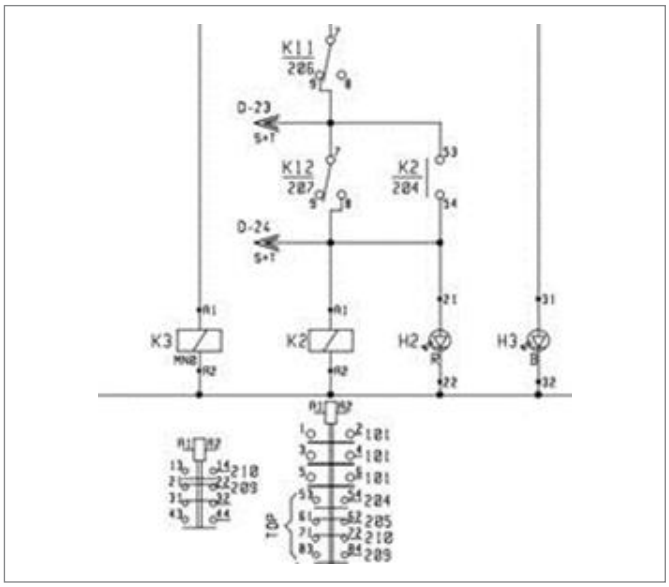
(13 - terminal no & K11 -equipment numbering)

Ferruling practice has been used, to identify the right wire termination on the correct terminal of the equipment. So the ferrule should carry the information of terminal number & identification of the equipment. The information sequence on ferrule will be terminal number first and followed by equipment ID.



Example:

Refer to the schematic, K2, K3 are equipment identification numbers for contactors. In the below, 10 control wires have to get terminated in K2 contactors and each wires ferruling will as per table.

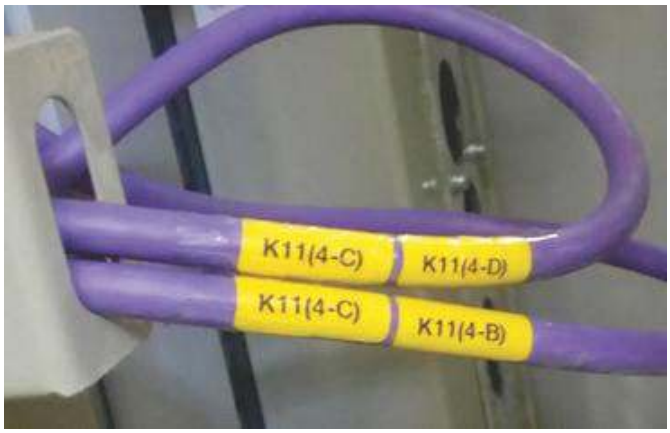


Terminal Location	Ferruling Number
A1	A1K2
A2	A2K2
53	53K2
54	54K2
61	61K2
62	62K2
83	83K2
84	84K2

2. Communication wiring

Cross ferrule numbering philosophy followed for looping wires i.e. Profibus cable, FO patch cord, CAT6 cable in relay etc. examble photo shown as below.

- Prefix – MCU/FCU/Component number (current feeder number)
- Suffix – MCU/FCU/Component number (from/to feeder number)



INSTALLING AN EXTENSION PANEL

To join an extension panel to your existing TX,

1. Remove the end cover of existing TX at the joining end Figure 51.
2. Follow instructions listed in 'Connection of TUs' under Installation on Page No. 24.
3. Necessary busbars / fishplates are supplied with the extension panel.
4. Place the end cover on the newly added panel.

Figure 50 - Extension of Panel

Ensure that both power and control circuits are switched off before taking the end cover off the TU.


11F
12F
13F
14F
15F
16F
PMCC

SITE TESTING

SITE TESTING

TESTING SWITCHBOARDS

1. Keep all power circuit switches ON.

2. Isolate all parallel paths.

3. Ensure all power circuits are connected.

4. Measure all insulation resistance (IR) values between phases with respect to earth, phases with respect to neutral and between phase and earth with respect to neutral with a 500 V megger and compare with the table below.

A) Insulation Resistance Test with 500V Megger before and after H.V.Test (All values in M.ohms).

	R	Y	B	N
E	0.5	0.5	0.5	0.5
N	0.5	0.5	0.5	~
B	0.5	0.5	~	~
Y	0.5	~	~	~

In case megger trips while testing, go on isolating one panel from the switchboard till the fault is found.

B) Dielectric Strength Test at 2.5KV for 1 Sec.

Check (phase)	With respect to
a) R/Y/B/N	.....E
b) R/Y/B	.....N
c) R/Y	.....B
d) R	.....Y

5. Carry out HV test at 2 KV for control circuits and at 2.5 KV for power circuit for one second and limit the voltage to 85% of the preceding value for every consecutive test.

HV test kit

TESTING CURRENT TRANSFORMERS (CTs):

1. Check nameplates and ensure CTs they are as per drawings and specifications.

2. Check wether the CT secondary is wired correctly with proper gauge of conductor.

3. Check CT secondary links are properly connected as per the scheme drawing.

4. Check CT mountings and ensure they are adequately supported and clamped..

5. Check CT polarity. Use a battery operated polarity tester. Depending upon the type of CT apply a positive pulse at P1 and a negative pulse at P2 (where P1 and P2 are two ends of the coil). Connect a null deflection galvanometer and observe the direction. It should be towards the right hand side.

6. Measure winding resistance of CT secondary using a multi meter in ohmmeter mode in case of protective CT core to ensure that the CT secondary is not open.

7. Check for any physical damage.

8. Check tightness of all bolts, clamps connecting terminals.

9. Check for earthing connections of CT is as per drawing.

TESTING POTENTIAL TRANSFORMERS (Voltage Transformer and Control Transformer)

1. Check nameplates and ensure they are as per drawings.

2. Check PT Secondary is wired correctly with proper gauge of conductor.

3. Check PT mounting and ensure they are adequately supported.

4. Check PT circuit's earth link.

5. Check polarity of PT. Using a battery operated polarity tester, check that positive EMF is induced between terminals S1 and S2 when a positive current pulse is applied between P1 TO P2.

6. Check ratio of all cores. Conduct ratio test by applying 1 phase 240V across the primary. Note voltage at secondary. Calculate the ratio, tabulate and compare the value with the nameplate values.

7. Measure winding resistance.

8. Check for any physical damage.

9. Check tightness of all connecting terminals.

10. Check for the earthing of PT as per the drawing.

TESTING METERS AND TRANSDUCERS:

1. Inspect all meters and transducers for proper mounting and for any damage.

2. Test with calibrated meters.

3. Check CT and VT connections with particular reference to their polarities for power type meters wherever they are provided.

4. Check for the earthing of meters and transducers as per the drawing.

TESTING RELAYS:

1. Inspect for proper mounting and for any breakage.

2. Ensure gagging on all the moving parts is removed.

3. Check nameplate details as per specification.

4. Set the relay as per setting sheet, (protection co-ordination) and check for its operation at set values.

TESTING CONTROL CIRCUITS

1. Check the insulation of the auxiliary circuit before testing the control circuitry using megger.

2. Check that fuses are fitted in the main and auxiliary circuit and that ratings are appropriate for the circuit.

3. Perform the electrical continuity test on the control circuit for any lapse in connection.

4. Check for the phase sequence of the incoming supply.

5. Repeat the test as stated in the FAT (Factory Acceptance Test) for all the feeders existing.

6. Check the settings of overload relays and other protection relays. During commissioning checks, set the overload relay to the minimum value. Setting of the relay should be as per setting chart supplied by E&A.

CLOSING, TRIP AND EMERGENCY CIRCUITS

1. Close the incomer and check the functionality of the closing feeder as per scheme drawing provided.

2. Check the indication corresponding to the feeder.

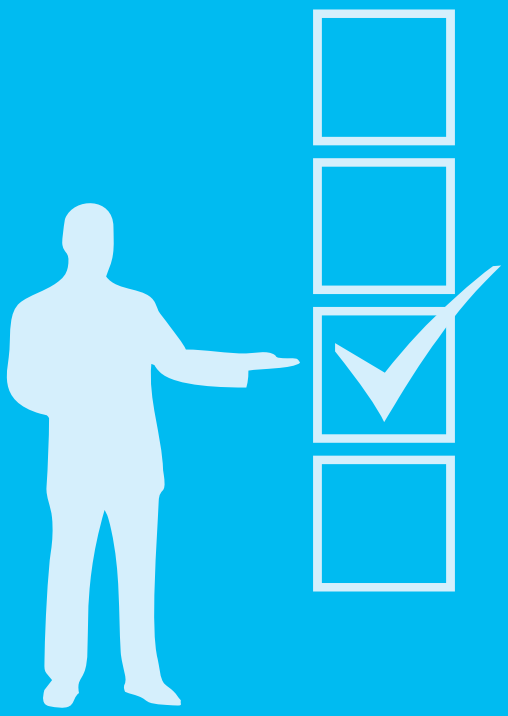
3. Carry out the test for tripping as per FAT (Factory Acceptance Test) that is unique for every switchboard.

4. Check the Emergency push buttons and other trip mechanisms using scheme drawing provided.

Perform the test as per SAT (Site Acceptance Test) if provided. *(Note that SAT is provided on request.)*

SITE TESTING

CHECK	POTENTIAL PROBLEMS
Verification of vendor documents	Incomplete documentation
Verification of General Arrangement & Mechanical check • Appearance (Visual) • Dimension • Verticality & Waviness	Cleaning Wobbling of doors Misalignment of pillars Alignment of handle
Powder Coating: • Surface Finish Glossy or Matt • Paint Shade • Dry Film Thickness	Orange peel effect, Bubbles, Dent Marks, Pinholes Paint shade difference, low gloss DFT low / high
Busbar Arrangement	Busbar coupling not ok Fishplate & harwdware missing
Busbar& Power Joints Tightness	Loose joints, No red marking, Wrong H / W size
Pull test for crimping and termination and visual inspection of wiring	Loose crimping Wrong lug used Loose termination Poor wire bunching & dressing
Clearance	Low clearance
Partition Provision (Form of Separation)	Shroud not provided at Live terminal, Cover / Barrier missing
Degree of Protection (IP)	Pinholes at door corners, control plate gasket not proper, extra holes on pillars / end cover / doors
CT Polarity	Wrong CT wiring, mixing of protection & metering CT wires, neutral CT connection wrong
Current Injection (Primary / Secondary)	Wrong wiring of trip circuit / protection circuit, wrong termination at relays
Insulation Resistance (Megger)	Low IR value
Dielectric Test (High Voltage) for Power & Control Circuit	Presence of foreign material in Busbar zone, insulation puncture

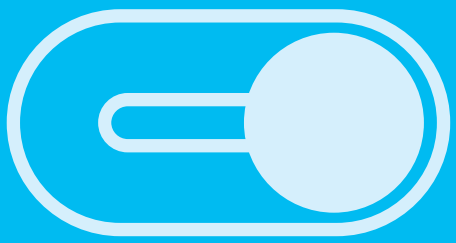


PRE-ENERGISING CHECKS

PRE-ENERGISING CHECKS:

Ensure the following checks are carried out before energizing:

Sr.No.	Check Point	OK
1	Overall Appearance & surface finish	
2	Panel is on a level surface	
3	Room ventilation	
4	Fire Extinguisher	
5	Rubber mats of grade 1100 V	
6	Loose items fitted	
7	Verification as per BOM and GA	
8	Tightness of busbar Joints	
9	Wiring check as per scheme drawings	
10	Phase sequence / Polarity check	
11	CT & PT ratio check (on Sampling)	
12	Insulation Resistance	
13	High Voltage Test (Power Circuit)	
14	High Voltage Test (Control Circuit)	
15	All doors closed	

OFF  ON

COMMISSIONING

COMMISSIONING

General parameters which must be checked before commissioning the switchboard are :

- Control and Indication
- Remote Operation (if any)
- Electrical Interlocks (if any)

Figure 51 - Energised Panel

Congratulations!
Your switchboard has now been commissioned.

OPERATION

FRACTIONAL MODULES:

Racking-in:

1. Prior to insertion of the module, ensure that the position indicator of the module is showing 'isolated' position. If not, bring it to 'isolated' position using the camlock key Figure 53.

2. Insert the module by racking it and moving it in, while keeping the key turned. Bring it to service position by pushing the racking handle twice Figure 54.

Racking-out:

1. Turn the key anticlockwise until the position indicator indicates isolated (I) position.

2. Bring the module to draw out position using the camlock key and pull the module out.

   Refer Table No. 7 for position / condition of Knob, ROM (Rotary Operating Mechanism) and Handle, power contacts and SICs of fractional width modules during the Rack-in and Rack-out process.

Figure 52 - Camlock key

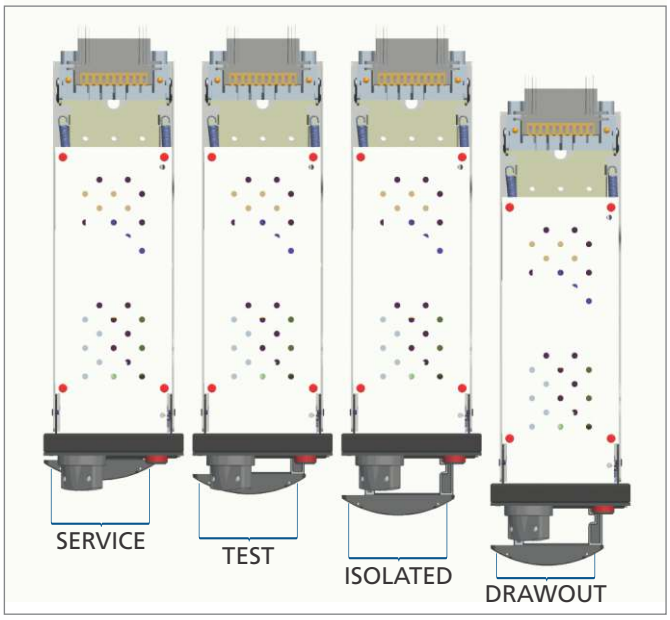


Figure 53 - Service-Test-Isoalted-Withdrawable Position of the Fractional Module

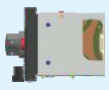
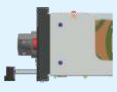
	KNOB POSITION	ROM POSITION	HANDLE POSITION	POWER CONTACTS	SIC
SERVICE (S)		 - OFF OR - ON		CONNECTED	CONNECTED
TEST (T)		 - OFF		DISCONNECTED	CONNECTED
ISOLATION (I)		 - OFF		DISCONNECTED	DISCONNECTED
DRAWOUT		 - OFF	SAME AS IN ISOLATION	DISCONNECTED	DISCONNECTED

Table No. 7

FULL WIDTH MODULES

1. Prior to insertion of the module, ensure that the position indicator of the module is showing 'isolated' position Figure 22. If not, bring it to 'isolated' position using the racking handle.

2. To rack in, Insert the handle in the slot provided on the front of the module Figure 58.
   - Press and rotate clockwise to move forward (I->T->S) Figure 55.

Figure 54 - Full width module in Service position

- After a 90 degree turn from service position, the module will come to the test position and the handle can be taken out. Figure 56.

Figure 55 - Full width module in Test position

- Rotate the handle through 90 degree in clockwise direction to bring it to Isolated position Figure 57.

Figure 56 - Full width module in Isolated position

3. To rack out, follow the sequence mentioned above in an anti-clockwise direction from service to isolated.

> ⚠ The handle cannot be taken out in any intermediate position.

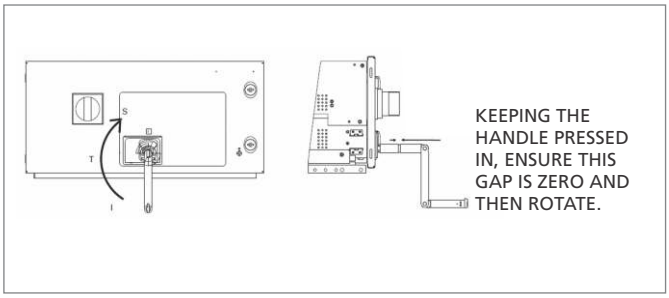


Figure 57 - Position for handle insertion

4. To withdraw the module, lift the strip and use the lifting rod provided to take it out Figure 59.

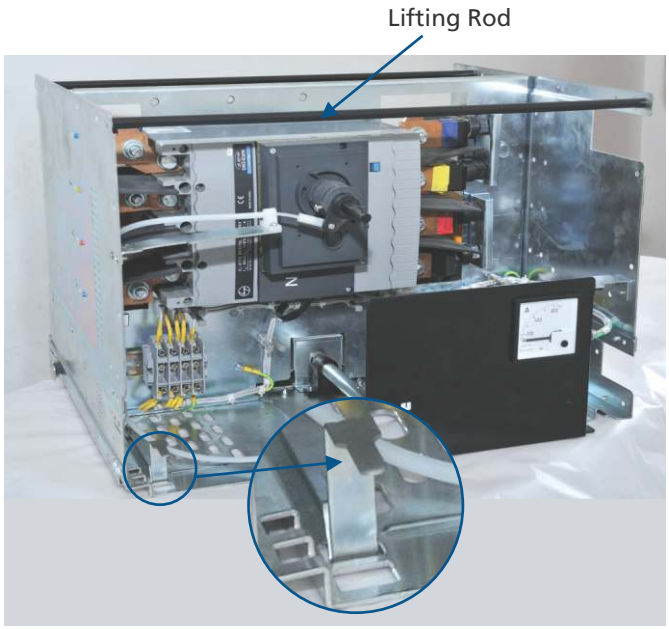


Figure 58 - Lifting of Full width module


15R

MAINTENANCE

PRECAUTIONS

1. Switch off the incoming power supply before removing top plates and side covers. Isolate incoming power supply.
2. For safety of personnel, while working on bus bars, provide temporary earthing using a metallic chain/strip near the work place. Remove this earthing only after the job is completed.
3. Switch off the control supply. Isolate remote control voltage sources.
4. Measure busbars voltage to ensure that bus bars are de-energized.
5. Ensure that only qualified personnel are 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. After maintenance, if TX 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 every two months to ensure that the equipment is in proper working order.
2. Check tightness of bolted joints (mainly Busbar) Figure 60.

   - prior to energisation
   - six months after load is connected
   - one year after the second check and then once a year

Figure 59 - Tightening of Busbar & Dropper Joint

3. Inspect all wiring for wear and cuts every two months.
4. Look for signs of 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 when module is outside the panel.
5. Clean and lubricate the stab-in contacts once a year with HP MPL (EXXON) grease.
6. Remove burnt out fuses if any.
7. Check terminal block contacts for loose connections.
8. Examine indicating lamps and replace if required.
9. Ensure all safety interlocks are functional and in proper working order every two months.
10. Look for indications of overheating, sparking or insulation breakdown on the busbars.
11. Inspect power and control contacts. Replace worn out contacts (refer the section replacement of power contacts on Page No. 28)
12. Inspect all auxiliary and control circuits every two months for desired functioning.
13. Grease racking screw and telescopic rails at least once a year. Use grease 'HP-LETHON-2' or 'SYNTHOLUBE-20 of HJ Leach & Co.
14. Ensure that the earth wires are connected to the main earth bar (except electronic device earthing).
15. Ensure no tools or loose materials are left inside the TX as these can cause faults.
16. Keep the switchboard free of dust. Use a vacuum cleaner to remove the dust.

Figure 60 - Tightening of Busbar Joints

Do not operate equipment whose arc chutes are removed.

UNIT REMOVAL AND REPLACEMENT

- Make sure that the power switch in the unit is in the 'OFF' position before withdrawal (Refer section operation of the module for withdrawal of the module on Page No. 38 & 39).
- Remove the module.
- Reverse the process for unit replacement.

REMOVAL OF DRAWOUT POWER CONTACTS AND DOORS

Although extremely unlikely, if sparking occurs at the power contacts due to pitting (corrosion), then adopt the following procedure to remove the unit from TX and replace the stab-in contacts.

⚠ *Keep the unit free from dust. (Specially for power and control contacts)*

REMOVAL OF POWER CONTACTS

For fractional modules

- Bring the power switch to OFF position.
- Bring the module to isolated position using the key provided as explained in operation of fractional width module on Page No. 38.
- Withdraw the module.
- The power contacts are visible on the back side of the module.
- Remove the SIC block mounted on the upper side of the power contacts Figure 59.
- Remove the grub screw which joins power contact and housing.
- Gently push the power contact out from the back. Figure 62.

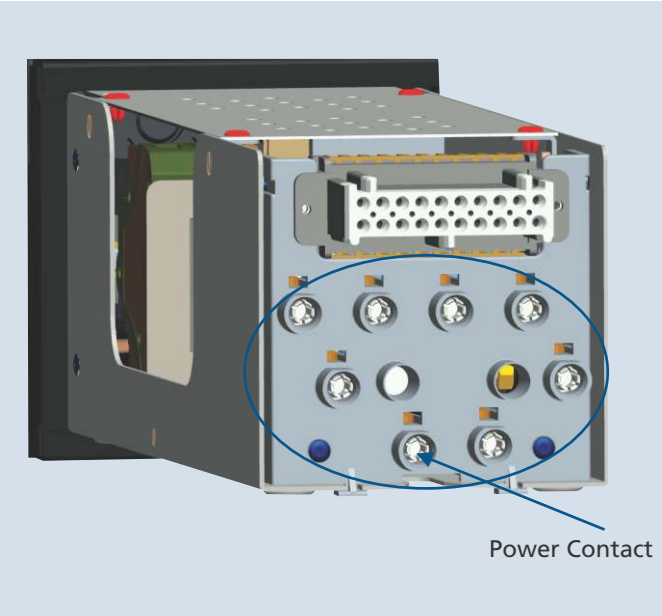


Figure 61 - Power Contacts in Fractional module

For full width modules:

- To rack the module out, refer to the procedure mention on Page 39.
- Remove the connection of links and power contacts by removing the bolts shown in Figure 63 (1).
- Remove the power contact from it's arm by unscrewing it with the help of a screw driver through provided access as show in Figure 63 (2).

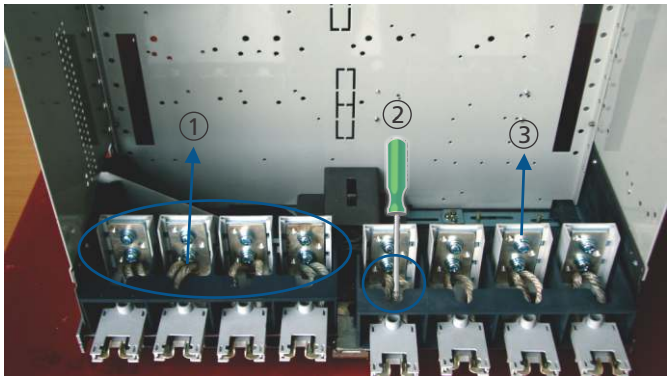


Figure 62 - Power Contacts in Full width module

- To remove the fixed power contact, slide them up in the direction indicated in Figure 63 (3)

- The power contacts are housed in a click-fit cap arrangement. A screw driver may be used as a lever to open the cap replace with new contact.

- Reverse this procedure to fix power contact back on the module.

If only the cap needs to be replaced, do not remove the connection between the link and the power contact.

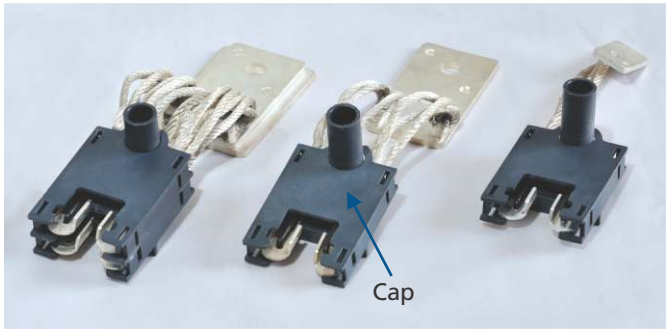


Figure 63 - Power contacts in a contact housing

REMOVAL OF DOORS

- Isolate the feeder.

- In fixed type module disconnect all wires terminating at equipment located on the door.

- Remove the bolts provided at the hinge Figure 65 and slide out the door.

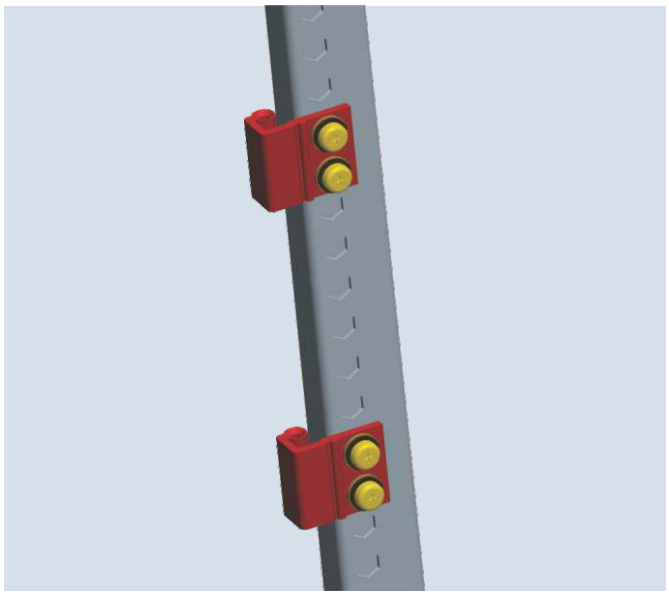


Figure 64 - Concealed hinge door

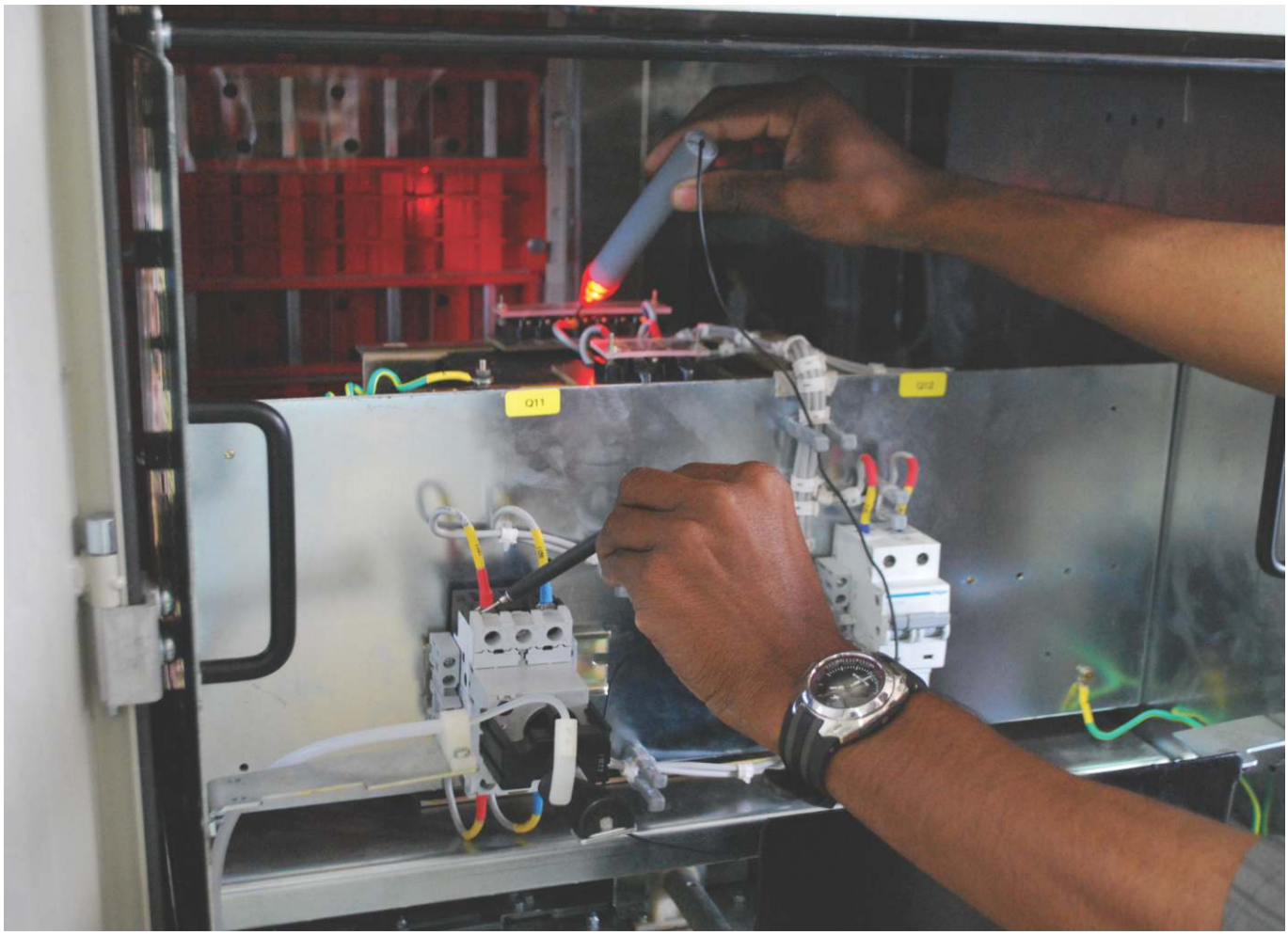
TROUBLE SHOOTING

TROUBLE SHOOTING

On a live switchboard :

- Identify fault location using indicating lamps or monitoring system.
- Check for availability of supply at SIC's (Secondary Isolating Contact or Draw-out terminals) connected to auxiliary bus.
- Check if power switch/MCCB is in 'ON' position.
- Reset the relay or MCB after the fault has been cleared.
- Check if control MCB is 'ON 'after opening the compartment door.
- If control fuse is used, check the health of the fuse. Replace if necessary.
- Check whether terminations from field connections are :
  1. Correctly terminated
  2. Tight
- Check whether inputs coming from the field are functioning or not.
- Switch on control MCB/ control fuse, ensure interlocks are active and turn on the feeder.
- If control MCB/ control fuse trips verify the field terminations on the SIC.
- If control MCB/ control fuse has not tripped but the module still fails to operate, then check the health of the control circuit using a line tester.
- If the problem persists, check for component failure.
- After trouble-shooting ensure that the module is racked in to service position.

If the problem persist, contact your nearest sales office or email your query to AtYourService@Intebg.com



RECOMMENDATIONS

1. Provide a small storage cabinet in every switchgear room for:

   - Tools like screw drivers, fuse pulling handle, chassis racking handles.

   - All reference drawings like General Arrangement Drawing, Scheme drawing.

   - Consumable spares like bulbs, fuses etc.

2. Do not use rewired HRC fuses. They may cause arcing or explosions, leading to a fire.

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Services we offer:

ACB Maintenace:

- Thorough cleaning of the ACB and its cradle
- Mechanical checks such as arcing contact gap, tightness check, greasing all moving parts
- Checks- Closing coil, trip coil and auxiliary contacts etc

Annual Maintenance Contracts (AMC):

- Electrical substation Maintenance (periodic maintenance of entire low voltage range of switchgear)
- Switchboard maintenance (periodic maintenance of Low voltage switchboard)

Switchboard Maintenance:

- Erection, Testing and Commissioning
- Commissioning assistance
- Total visual check
- Vacuum cleaning
- Tightness check for busbar joints and droppers
- Greasing of all moving parts
- IR(Insulation resistance) and high voltage test
- Maintenance workshop
- Modification (change or addition in the rating of motor feeder)
- Retrofitting of the necessary products

L&T Electrical & Automation

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