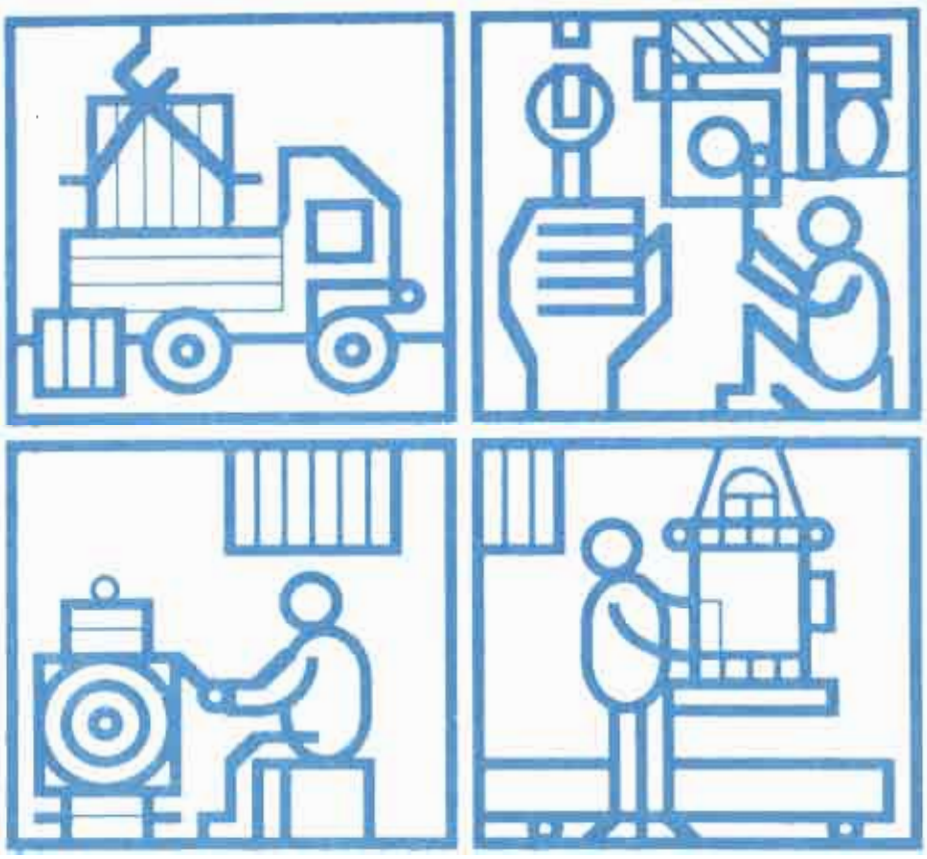
Jyoti Ltd.

'Jyoti'

12 kV Indoor
Horizontal isolation
Horizontal Drawout
Vacuum Circuit Breaker
VCB Type 'VK' &
Panel Type : PH

Installation, Operation &
Maintenance Manual



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IMPORTANT INSTRUCTIONS

1. Always keep the packed case with its right side up so as to protect the circuit breaker against damage during transportation and handling.

2. Never use the disconnecting contact arms to lift the VCB.

3. Do not lift or lower the VCB with jerk. This can damage the Vacuum Interrupter.

4. Do not disturb any settings of latches and linkage, or their positions in the operating mechanism.

5. While charging the VCB manually, "stop" the handle movement as soon as a distinct 'click' sound is heard and indicator changes over to 'charged' position

6. Do not attempt manual closing with interlock lever in raised position.

7. Insertion of VCB into service position is complete only when a "click" sound is heard and the driving handle rotates freely.

8. Do not hold the interlock lever while pulling the VCB to test position.

9. Conduct high voltage test on the Vacuum Interrupters before commissioning.

10. Replacement of Vacuum Interrupter or any other component on the pole part side of the VCB should be done under the supervision of our expert only.

11. Keep the panel door closed, weather the breaker is in " Test", " Service" or "Withdrawn" condition.

12. Do not discard/override any safety interlock.

13. Acccess cable compartment only after earthing the circuit side.

GLOSSARY

VCB	Jyoti Vaccum Circuit Breaker
SERVICE	Position of the breaker in the panel, wherein a) The power circuit is connected to the breaker b) The control circuit is connected to the breaker
TEST	Position of the breaker in the panel, wherein a) The power circuit is NOT connected to the breaker b) The control circuit is connected to the breaker
CHARGED	Closing springs of the breaker are charged
DISCHARGED	Closing springs of the breaker are discharged
OPEN	Breaker in OFF condition
CLOSE	Breaker in ON condition
Mulit-pin Plug	16-pin plug used for connecting or disconnectiong the control circuit
NO	Normally Open Contacts
NC	Normally Closed contacts
PH	Type designation of Jyoti VCB Panels.
Driving Handle	An accessory provided for final insertion of VCB to SERVICE position as well as for initial withdrawal of the VCB form SERVICE position.
Wipe	The compression of the wipe springs which provides sufficient contact pressure.
Jaw contacts	Sliding type contacts used for connecting the breaker power circuit with that of the panel.
Disconnecting arms	Copper arms mounted on the breaker, which hold the jaw contacts jawcontact

INDEX		PAGE
1.0	**INDEX**	5
2.0	**GENERAL**	8
	2.1 Type & Rating	8
	2.2 General Description of equipment	12
	2.3 Salient Design Features of VCB Panel	12
	2.4 Cubicle	13
3.0	**TRANASPORTATION**	21
	3.1 Mode of packing	21
	3.2 Unpacking	21
	3.3 Storage	22
4.0	**INSTALLATION**	24
	4.1 Site Preparation (Foundation)	24
	4.2 Erection of Individual Panels	26
	4.3 Erection of Multipanels (Busbar Connection)	26
	4.4 Method of Mounting Insulationg Cover	28
	4.5 Control Auxiliary and Earth Connection	30
	4.6 Closing of Covers	30
5.0	**DESCRIPTION OF CIRCUIT BREAKER**	33
6.0	**WORKING OF OPERATING MECHANISM**	35
	6.1 Charging Operation	35
	6.2 Closing Operation	36

2.0 GENERAL

2.1 TYPE & RATING

This instruction manuals applicable to the handling, maintenance and inspection of JYOTI Vacuum Circuit Breaker,Type VK & Panel PH.

A) NOMINAL RATING OF VCB TYPE VK

Designation	6J/M/P20	6M/P32	6M/P40	VK-10J/M13	10J /M/P25	10M/P/Q40
Operating Method	---------- Manual / Motor Spring charge type ----------					
Rated Voltage (kV)	7.2 / 3.6	7.2 / 3.6	7.2	12	12	12
Short Circuit Current(kA)	20/25	31.5/40	40	13.1	25	40
Rated Current (A)	---------- J : 630---------- M : 1250 P : 2000 Q : 2500/3150					
Frequency (Hz)	----------50----------					
Making Current (kAp)	50 / 63	80 / 100	100	33	63	100
Short Time Current Rating for 3 Sec.(kA)	25	40	40	13.1	25	40
Interrupting Time	----------Less than 3 cycles ----------					
Opening Time	---------- Less than 2 cycles ----------					
Closing Time	----------Less than 2.5 cycles----------					
Insulation Level	Impulse 60 kVp AC 20 kV, 1 minute			Impulse 75 kVp* Power Frequency 28 kV, 1 minute		
Normal Operating Duty	----------O-3 minutes-CO-3 minutes-CO----------					
Rapid Reclosing Duty	----------O-0.3 sec.-CO-3 minutes-CO----------					

Designation	6J/M/P 20	6M/P32	6M/P40	VK-10J/M13	10J /M/P25	10M/P/Q40
Closing Coil	----------24/30/48/110/220 V DC----------					

Voltage					
Closing Coil Wattage	----------350 to 450 Watts----------				
Trip Coil Voltage	----------24/30/48/110/220V DC----------				
Trip Coil Wattage	----------350 to 450 Watts----------				
Charging Motor Rating	----------300 Watts, 48/110/220Volts DC----------				
Weight (kg)	J : 70 M : 80 P : 110	M : 90 P : 110	M : 95 P : 120	J : 70 M : 85 P : 100	M : 130 P : 150 Q : 240

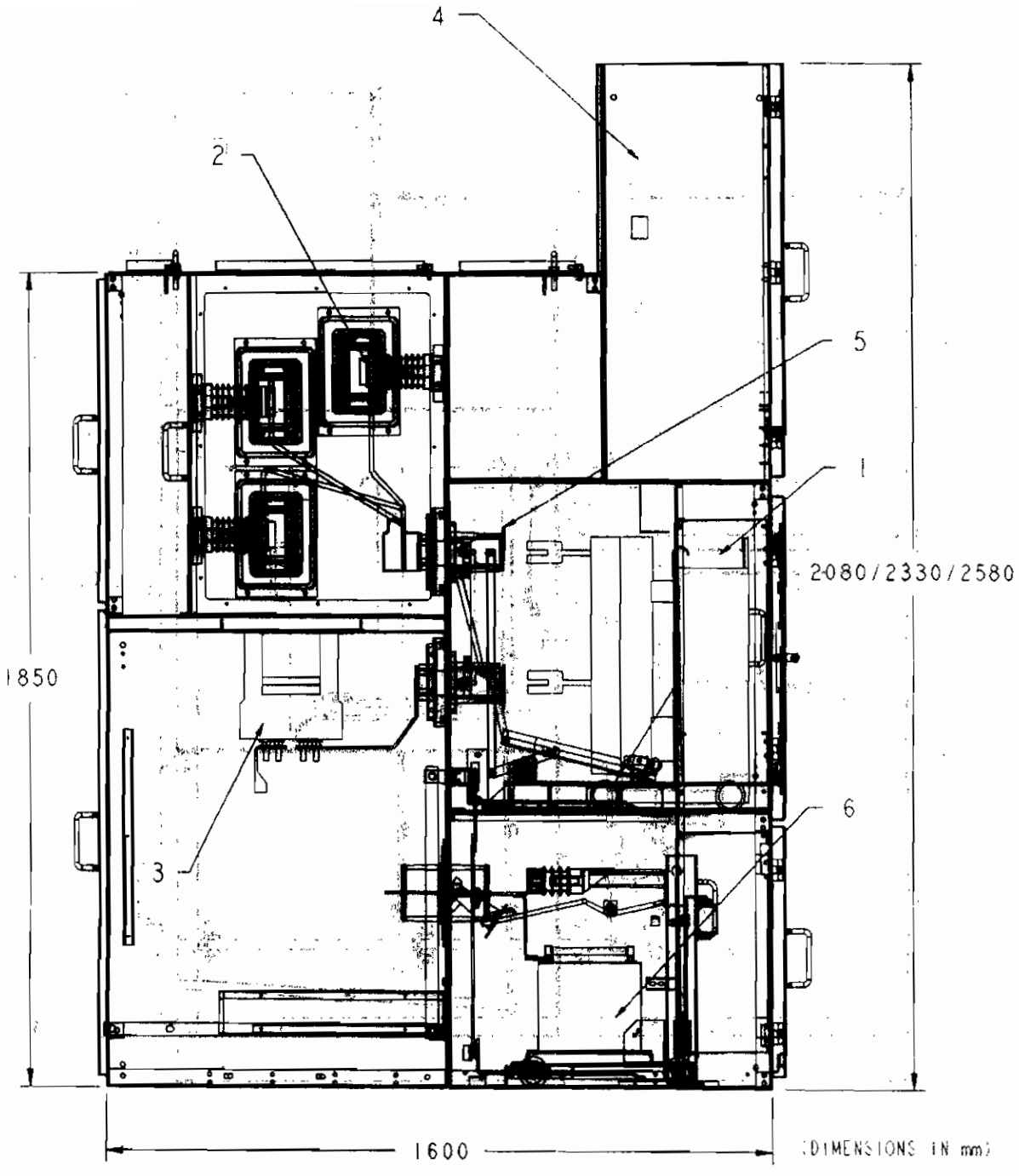
* 38 / 95 kVp on Request.

B) CUBICLE DETAILS :

Type of Cubicle	----------PH----------
Rated Voltage	----------3.6 / 7.2 / 12 kV----------
Rated Circuit Breaker Current	----------630 to 3150 Amps.----------
Rated Busbar Current	----------Upto 3150 Amps. ----------
Rated Short Time Current 3 Sec.	----------Uptc 44 kA ----------
Rated Dynamic Current	----------Upto 110 kAp----------
Rated Insulation Level (Impulse)	----------60 / 75 kVp*----------
Power Frequency 1 minute Withstand Voltage	----------20 / 28 kV*----------

Dimensions in mm	Width : ----------600/700/800/1200---------- Depth :----------1500 /1600 / 2150---------- Height : a) Basic Cubicle of 1850 mm b) With top box for instrument compartment, the height varies from 2080 to 2580 mm
Weight including VCB (approx.) in kg.	---------- 1200 / 1500 Kg ----------
Floor Loading including Live Load	----------1200 Kg / sq. m.----------

* 38 / 95 kVp on request



1 VCB COMPARTMENT

2 BUSBAR COMPARTMENT

3 CURRENT TRANSFORMER/CABLE COMPARTMENT

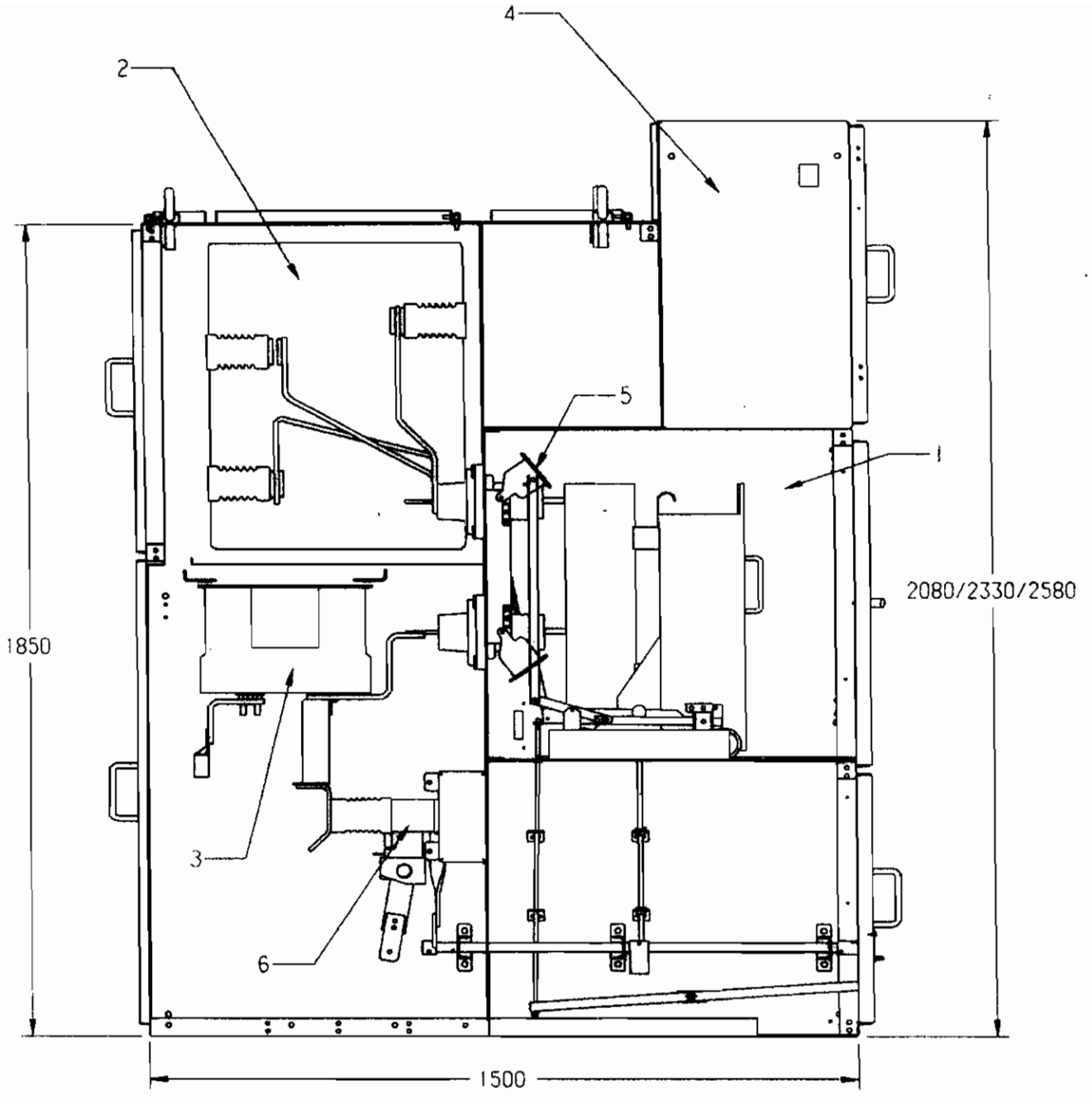
4 INSTRUMENT BOX

5 SHUTTER

6 VOLTAGE TRANSFORMER

GENERAL ARRANGEMENT FOR PH PANEL

FIG:-1 A



1 VCB COMPARTMENT
2 BUSBAR COMPARTMENT
3 CURRENT TRANSFORMER/CABLE COMPARTMENT
4 INSTRUMENT BOX
5 SHUTTER
6 EARTHING SWITCH

GENERAL ARRANGEMENT FOR PH PANEL

FIG. 1B

2.2 GENERAL DESCRIPTION OF EQUIPMENT

PH type switchgear is an indoor Metal Clad equipment

The Vacuum Circuit Breaker is horizontally isolatable and horizontally withdrawal Vacuum Circuit Breaker.

The Panel is compartmentalized into

a) Circuit Breaker Compartment

b) Busbar Compartment

c) Cable/CT/Integeal Earth Switch

d) V.T. Compartment

e) Low Voltage Instrument / Relay Compartment

A typical General Arrangement drawing is shown in Fig. 1A & 1 B

2.3 SALIENT DESIGN FEATURE OF VCB PANEL

The Vacuum Circuit Breaker cubicle has four main compartments ; namely, Busbar Compartment Breaker Compartment Cable/CTCompartment and Low Voltage Instrument / Relay Compartment.

Each HT compartment is provided with an independent pressure discharge system through flaps on the top of the panel. In the unlikely event ofthe occurrence of an internal arc, the hot gases are released to the atmosphere through the flaps at a safe height thereby proctecting theoperating the operating personnel. The independent pressure discharge system localises the fault to the affected compartment only.

The connections from the busbar and cable compartments to the circuit breaker compartment are taken through epoxy moulded disconnectcontacts thereby providing complete segregation between the compartments. The Circuit Breaker compartment is fully segregated from allother compartments thus ensuring that no arc product or foreign bodycan travel from the cable/ busbar compartment to the circuit breaker compartment or vice-versa.

The busbar and jumper joints are covered with removable insulating shrouds. This arrangement provides full insulation over the live partsand also makes maintenance easy.

The specially designed insulating housing / barriers of the circuit breaker, and the epoxy moulded disconnect contacts between busbar / cable compartment and circuit breaker compartment ensures that in the SERVICE position of the VCB no live parts are directly exposed to earth or to other live parts.

All live parts of the cubicle have adequate air clearance between phases as well as between phase and earth. The cubicle is type tested for the required impluse withstand voltage. However insulating sleeves / removable insulating shrouds are provided to prevent any flash over due to external reasons.

Movement of the VCB truck between TEST and SERVICE positions is fully inside the cubicle and even with the VCB in the 'TEST' position, the compartment door can be closed.

Safety interlocks between the VCB and the cubicle ensure correct and safe operation. One interlock system ensures that insertion or withdrawal of the circuit breaker form TEST to SERVICE position and vice-versa is possible only when the VCB is OPEN condition, and the breaker can be closed / opened only when it is either in TEST to SERVICE position. Another interlock system ensures that the breaker can not be moved from TEST to SERVICE position, unless the multipin-plug of auxiliary circuit is inserted into its socket. Once the VCB is pushed into the SERVICE position, the multipin-plug cannot be removed.

2.4 CUBICLE

The cubicle is of rigid sheet steel construction. It is divided into various com- -partments as noted above. Further details are given in the following sections

2.4.1 CIRCUIT BREAKER COMPARTMENT

The circuit breaker compartment is situated in the front, middle portion of the panel. It's hinged front door is provided with an observation window covered with a transparent sheet through which the position of the Breaker truck, the mechanical ON/ OFF push buttons, spring Charged / Discharged indicator and operation counter can be seen.

The truck is of rigid, bolted sheet steel construction, mounted on four wheels. The truck is fitted with breaker interlocks parts, spring loaded sliding contact fingers at the bottom to maintain earthing, rollers for shutter operating levers etc.
The breaker is guided by two guide-rails provided at the bottom. The base plate provided at the bottom locates the TEST and SERVICE position of the breaker.

provided at the bottom locates the TEST and SERVICE position of the breaker. The shutter remains closed in TEST / WITHDRAWN position of the breaker thereby providing necessary shielding to HT compartments. This shutter is operated automatically via operating levers when the breaker movesfrom the TEST position to the SERVICE position; thus uncovering openings to make passage of isolating (disconnecting) contacts. The upper and lower shutter plates can be padlocked in the CLOSE position independently as shown in Fig. 1C and in OPEN position as shown in Fig. 1D

An earthing strip is provided at the bottom of the base assembly which in turn is connected to the main earthing system of the cubicle. Under the Breaker carriage a finger contacts assembly, which slides on the Earthing strip, is provided. This is to maintain effective earthing of the breaker carriage form TEST to SERVICE positions.

For control cable entry, openings are provided at the front and rear side of the Panel. Control cables which run upto the instrument compartment are segregated form the HT compartment by sheets steel partitions.

In addition to these, the following features are provided

I) Intelocks to prevent breaker truck of on current rating going inside the cubicle having a different rating of the breaker.

II) Auxiliary switch for SERVICE / TEST position indication.

2.4.2 INSTRUMENT COMPARTMENT

A seperate insturment box to accommodate meters, relays, switchers etc, as per requirment is provided on the upper front portion of the cubicle. All instruments and relays to be seen from outsided are mounted on a sturdy, hinged fornt door.

The compartment includesl terminal stations, terminal strips for external control cable, side terminal blocks and an opening for inter-panel wiring etc.

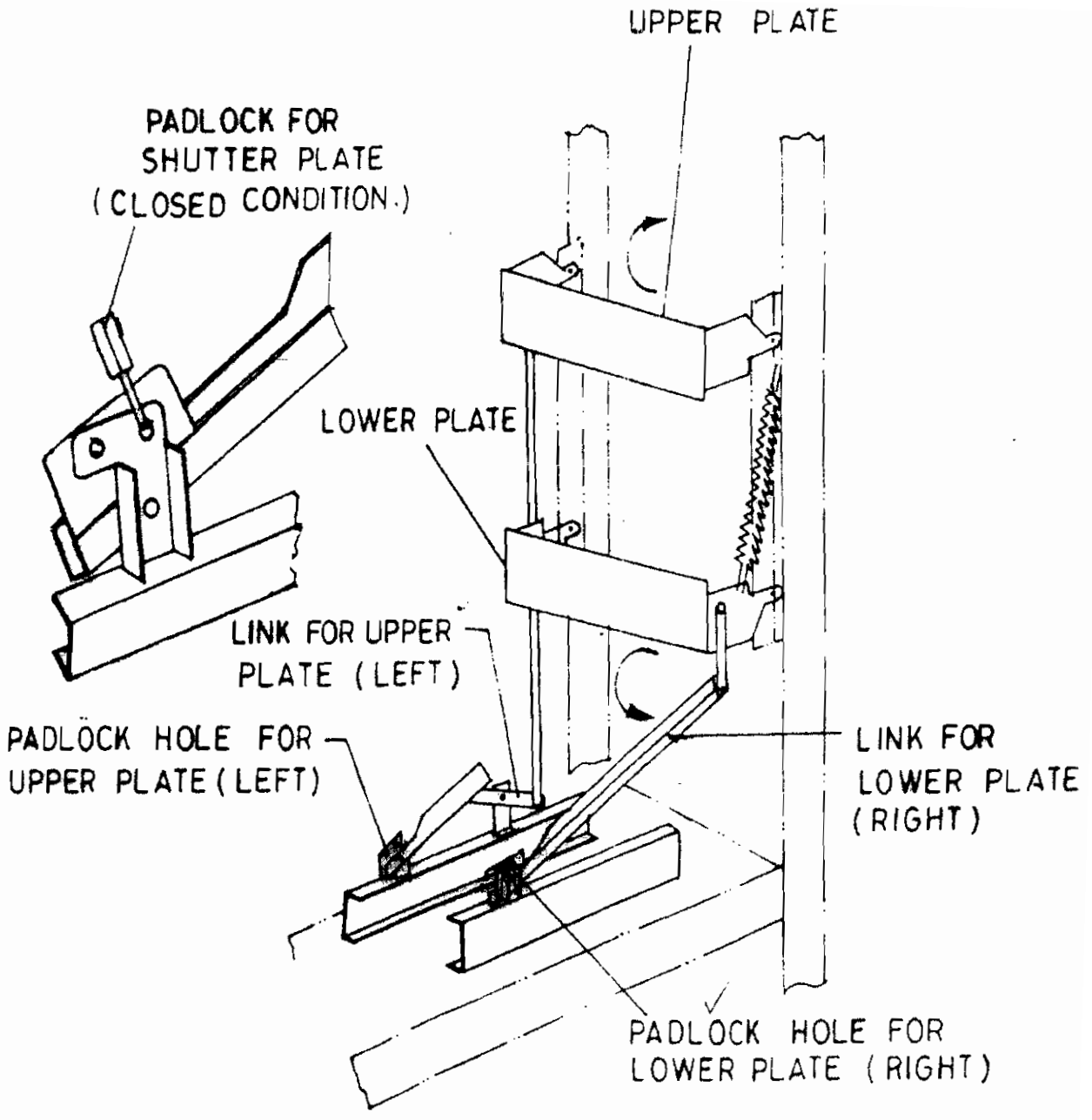


FIG. 1C SHUTTER ASSEMBLY WITH PADLOCKING ARRANGEMENT IN CLOSED CONDITION

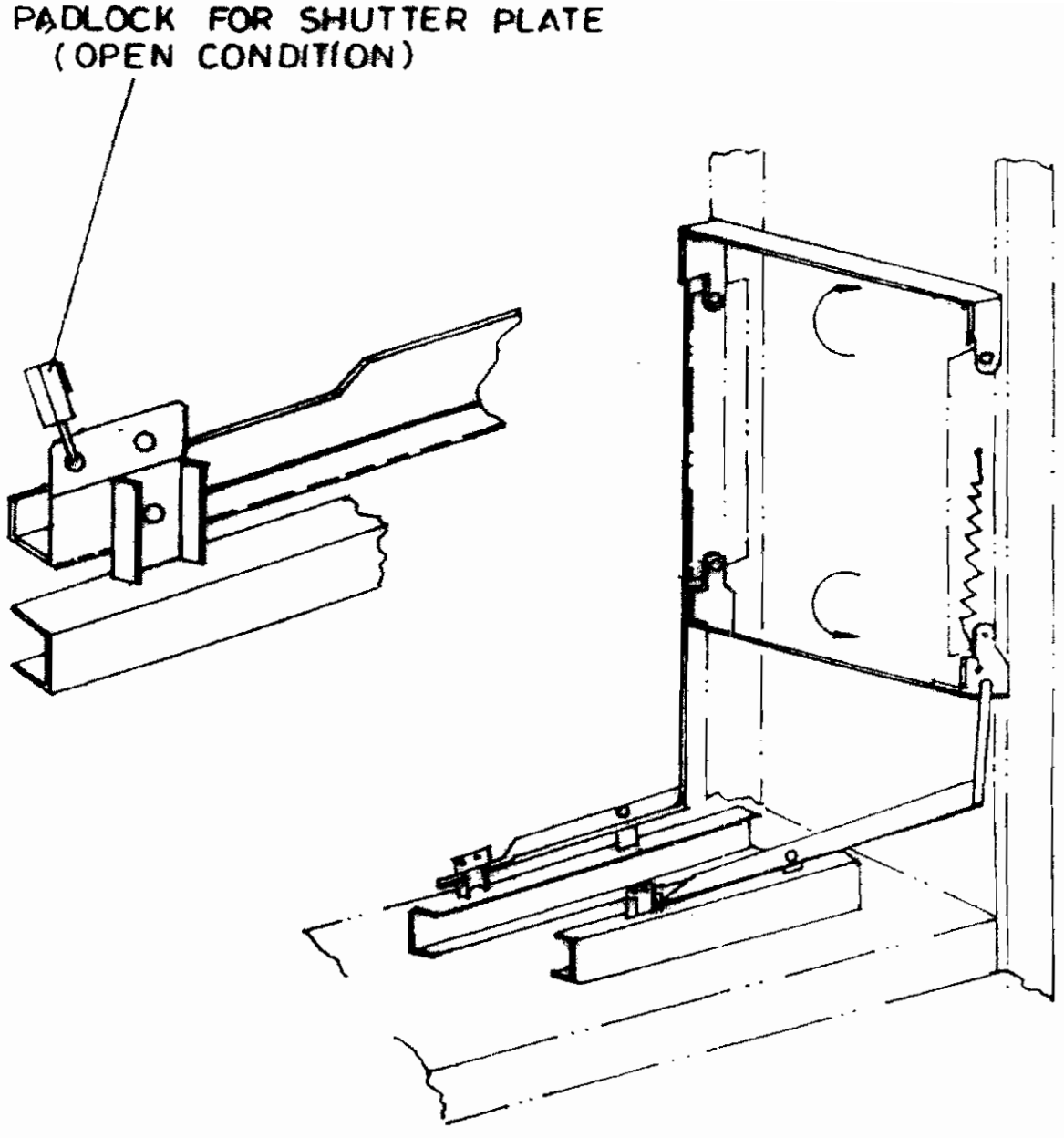


FIG.1D. SHUTTER ASSEMBLY WITH PADLOCKING ARRANGEMENT IN OPEN CONDITION

2.4.3 BUSBAR COMPARTMENT

The busbar compartment situated at the rear upper portion is fully segregated from other compartments of the cubicle. It accommodates busbar which are mounted on epoxy resin post insulators. The busbar system is designed to meet the thermal and electrodynamic requirments. The busbar are divided in sections equal to the width of the cubicle for easy transportion. Two busbar sections are connected by a link. The busbar and jumpers are covered with insulating sleeves.

Shrouds to cover busbar / jumper joints and bushing plate/insulating plate to segregate bus compartments of adjacent panels through which busbar pass are also provided. The busbars can be easily extended when further extension of switchboards is required in the future.

2.4.4 VT COMPARTMENT

The VT compartment is situated at the front bottom. The VT truck is of rigid, bolted steel construction, mounted on 4 wheels. The truck is fitted with spring loaded sliding contacts fingers at the bottom to maintain earthing. Arragement to fix multi- pin plug is also provided. In SERVICE position of the VT truck, a vertically moving rod, sits in the slot provided in the bottom of the compartment to prevent inadvertent truck movement. 3 - Phase star or 3 - phase V connected VTs are mounted on the VT truck, with horizontal draw-out unit. The VTs are supplied with inbuilt-fuse facility. The VTs get energised through epoxy moulded disconnect contacts thereby providing complete segregation between compartments. ' An automatics Shutter' is providing which operates automatically by insertion by insertion & withdrawal of P. T. truck.

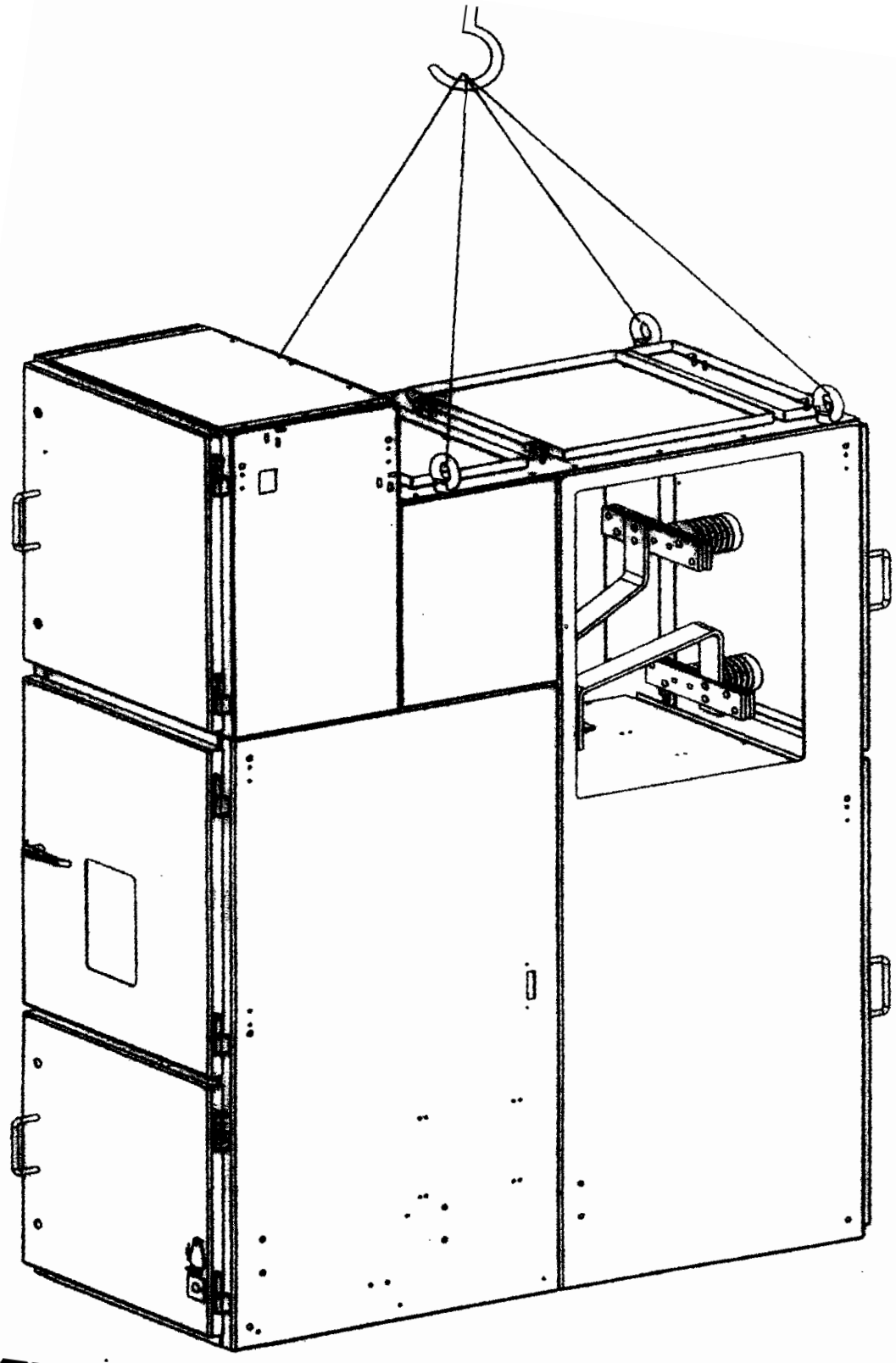
2.4.5 C.T. COMPARTMENT

The CT compartment is at the rear middle portion. It accommodates one set of CTs. An additional set of CTs can be provided with suitable rear extension. Insulated partition sheets are provided between two adjacent phases to prevent accidental flash-overs. Alternatively shrouds are provided to cover the CT primary connections.

The compartment is segregated from the cable compartment by use of fibre glass sheet / MS sheet. The jumpers pass through hollow bushings to the cable compartment.

2.4.6 CABLE COMPARTMENT

The cable compartment, which is at the rear lower side of the cubicle, accommodates 2 Nos. 3 core of 12 kV cable termination kits. Additional cable termination kits can be provided with suitable rear extension. Sufficient height of the cable connection from the bottom of the panel ensures that the cable termination is accommodated inside the panel and proper vermin proofing is achieved between cubicle ottom and cable gallery / trench



METHOD FOR LIFTING OF CUBICLE

FIG. 2

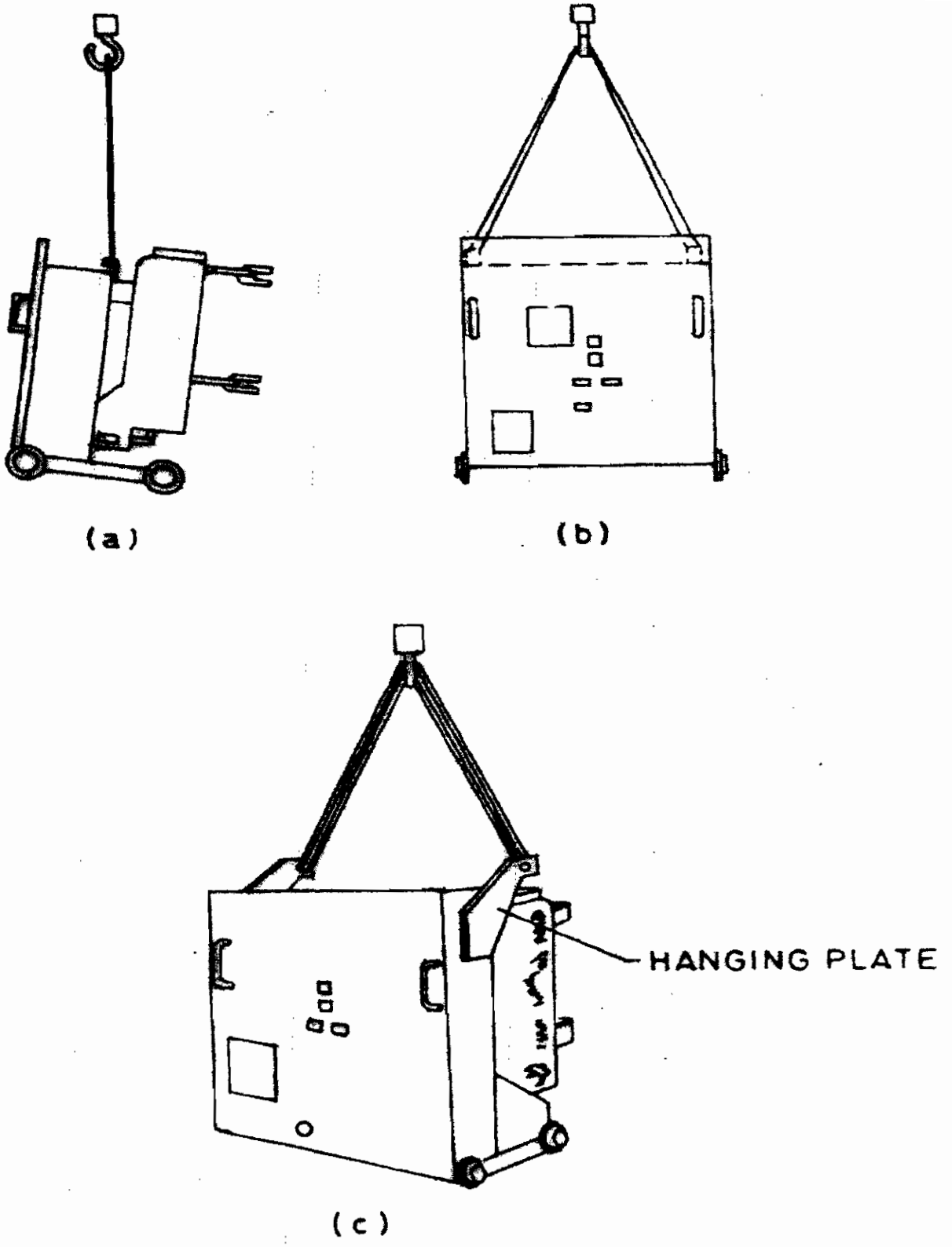


FIG. : 2

LIFTING OF CIRCUIT BREAKER

3.0 TRANSPORTATION

3.1 MODE OF PACKING

Switcher panels are packed as individual or 2 panel units. This inclues Vacuum Circuit Breaker truck.

3.2 UNPACKING

During unpacking, take the following precautions :

1) Never allow the circuit breaker / panel to be laid on its side or turned upside down before, during or after unpacking.

2) Ensure that the circuit breaker/panel is free form nails, piece of wood etc.

3) Check for damage or deformations caused during transit or unpacking the crate.

4) Check the accessories/spares and all items as per packing note.

- The circuit breaker should be removed from panel inspection of Circuit breaker/panel

I) Open the Panel Door

II) Withdraw the breaker from the panel using the driving handle as per the withdraw/insert instruction given on the breaker.

- Check the Circuit Breaker, primary disconnect contacts, the resin cast compartments for visible crack / damages

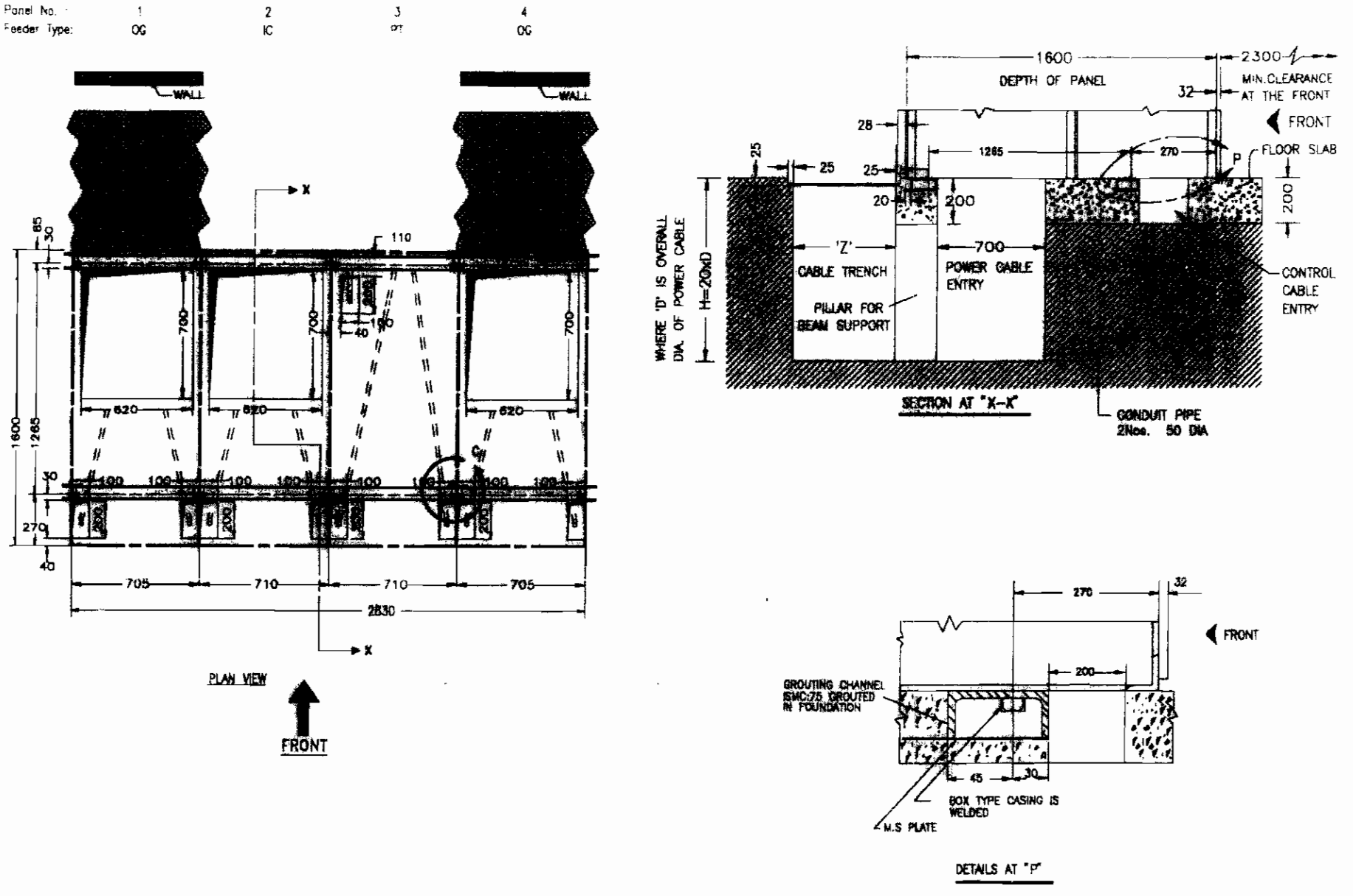
- Similarly check the shutters, CTs epoxy resin cast contact shrouds, loose items such as busbar, shrouds etc. carefully.

If any damages/shortage noticed, report it within 5 days of receipt of the equipment.

For handling during packing, transprotation & unpacking a crane with slings or a fork lift with adequate capacity to be deployed Ref Fig 2 for lifting the cubicle.

3.3 STORAGE

Once the wooden packing and the polythene sheets cover or corrosion-proof packing used inside are removed, inspect for any damage to instruments, relay etc. Check and verify the items as per the relevant despatch note. Store the switchgear in up right position on levelled platform under permanent cover, free from moisture and dust



FOUNDATION DETAIL

FIG–3

4.0 INSTALLATION

4.1 SITE PREPARATION (FOUNDATION)

4.1.1 The Swithchgear is jig assembled on level surface at the work and is an accurately made product. Satisfactory performance is therefore assured if the area of the substation floor IS FINISHED AND LEVELED ACCU RATELY TO AN ACCURACY OF 1mm FOR EVERY 1000 mm. Once this is ensured, the VCB carriage truck would be truly vertical in position at the point of entry into the housing with fixed panel also erected and aligned to be truly vertical. The movements of the VCB contacts with the fixed housing contacts will be prefectly matching.

4.1.2 The minimum working clearance recommended from the wall to the rear and sides of the switchboard shall be more than 1 meter. The working clearance in front of the swithcgear panel shall be preferably VCB truck and to facilitate inspection and testing. The overhead clearance shall be such as to permit maintenance and for access to the mounted equipment on the fixed housing.

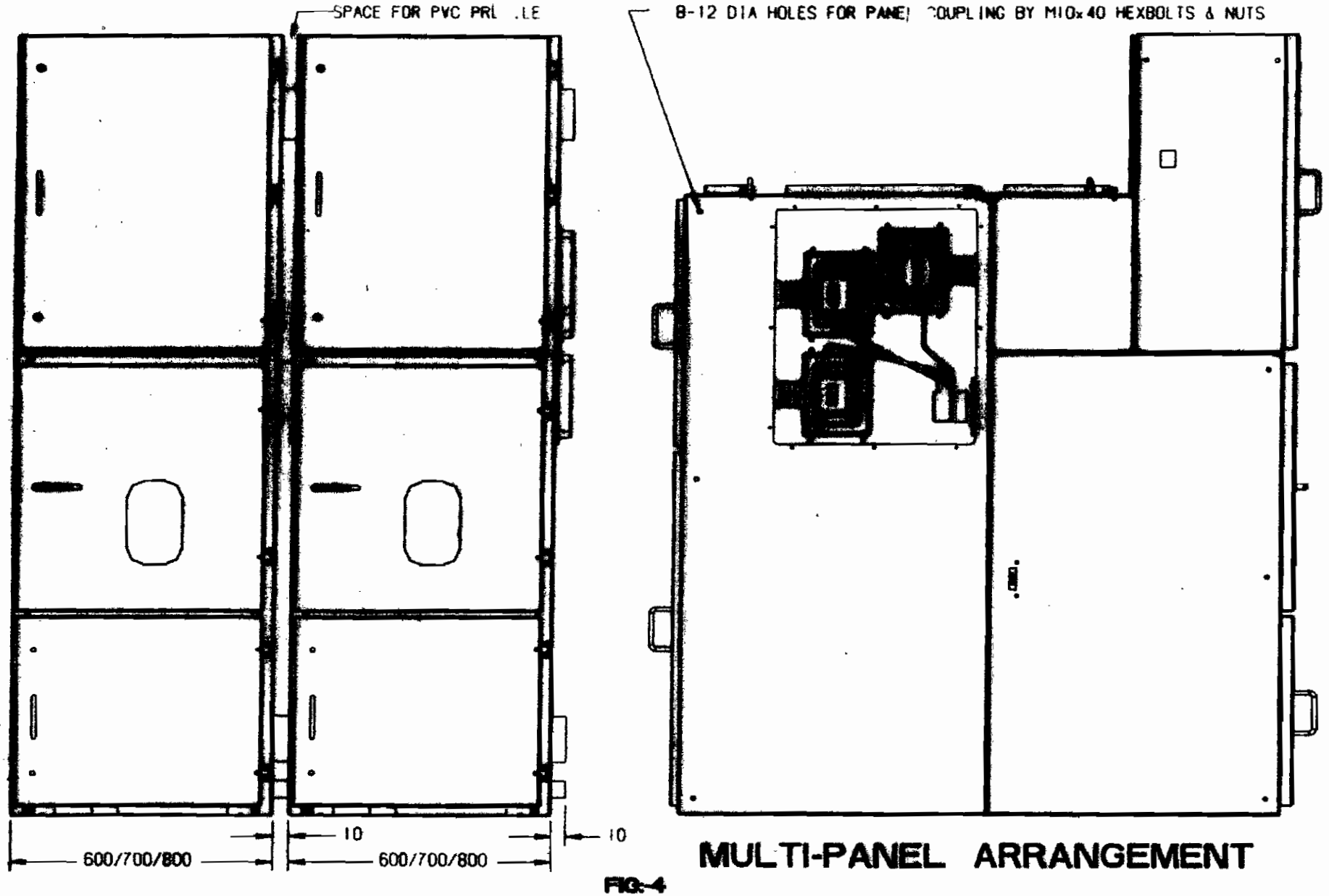
4.1.3 The Switchboards are of free standing type on the accurately levelled floor.

The levelling is to be checked with a spirit level in perpendicular directions also.

4.1.4 Foundation pockets for bolts shall be marked and made using a tem plate. (A typical foundation plan, is shown in Fig. 3. However, for exact foundation plan please refer GA, drawing for the particular Salenote)

4.1.5 After final grouting, sufficient time shall be allowed to elapse to enable curing.

4.1.6 Correct site preparation as per clause 4.0 above is a percondition for proper erection of the Switchboard.



MULTI-PANEL ARRANGEMENT

FIG-4

4.2 ERECTION OF INDIVIDUAL PANELS

4.2.1 Before erection of the panel over the foundation, please remove the circuit breaker truck from the Fixed Housing.

4.2.2 Position the panel unit on the prepared area using the lifting bolt provided on either side of the panel aligning the fixed housing to the foundation bolts. Shims or washers may be used to obtain vertical aligment of the panel.

4.2.3 Locate the holes on the panel over that of the grouted bolts and tighten, the 4 - M12 Bolts ensuring that no excessive force is applied.

4.2.4 Ensure that the panel is erected vertical with spirit level as described earlier with shims, washers if necessary.

4.2.5 Verify that the openings for cable entry are provided at the correct locations.

4.2.6 In case of bus ducts verify the position of incorner of incomer cubicle with refer ence to the transformer or cubicle on the other end of the busduct.

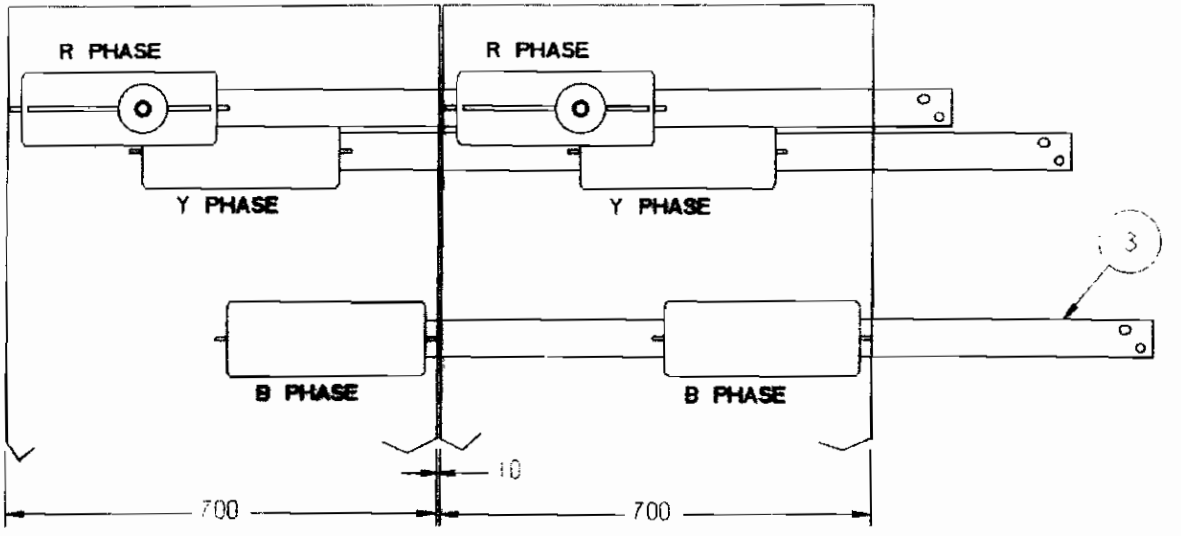
4.3 ERECTION OF MULTIPANEL PANELS (BUSBAR CONNECTION)

4.3.1 Assemble together the extension panel as in 4.2.1 above. Bolt the panels to gether on the side using M10 x 40 mm long bolts and nuts. Ref. Fig.4 coupling panels.

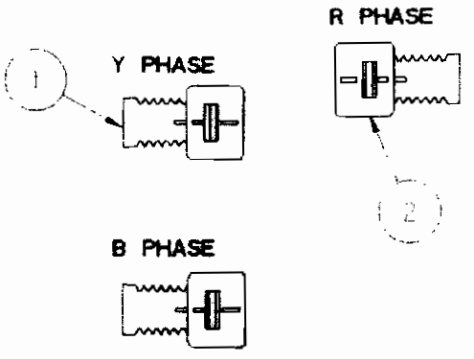
4.3.2 Clean the busbar chamber and the interior of breaker housing thoroughly to remove dust using a Vacuum cleaner if necessary.

4.3.3 Install the busbar supplied after making sure that there are no transit damage. Clean the contacts area surface with dry lint-free cloth. Apply a thin film of silicon grease, (MS4). Care is needed to ensure that when applying the grease, hands are devoid of dirt, dust and moisture. Refer Fig. 5 for busbar layout.

4.3.4 In case of Switchboard consisting of more than five cubicles, it is recommended to commence erection with centre cubicle and add cubicle on either side of it. This facliltates compensation of manufacturing tolerances.

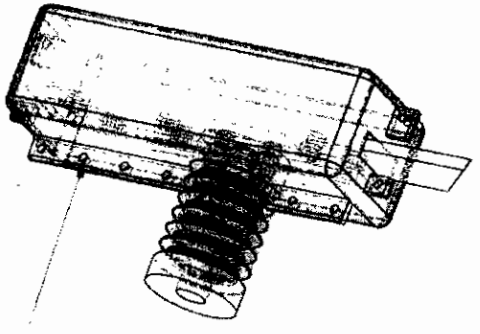


FRONT VIEW

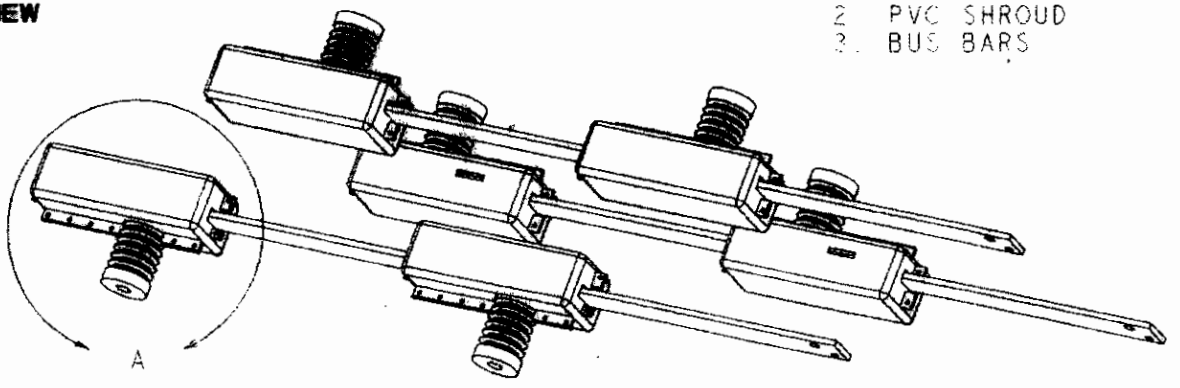


LHS VIEW

1. SUPPORT INSULATORS
2. PVC SHROUD
3. BUS BARS



--NYLON SCREW & NUT



ISOMETRIC VIEW

Details at 'A'

BUSBAR ARRANGEMENT BETWEEN PANELS

FIG.3

4.3.5 Take care of following points during busbar assembly

a) After erection of cubicles, the busbar are to be bolted with links. Special care is required for aluminum busbar joints for which instruction has been given in Appendix - 1

Also verify that bolt head should come on post insulator side. The bolts are of high tensile grade

b) If busbar / jumper joint shrouds are provided, fix them in position. Ref. Fig. 5.

c) Instructions for busbar joints

The copper busbar have adequate cross section for continously carrying the rated current. In order to have more surface contact, large plain wash ers should be used alongwith spring washers. There must be a space a atleast 4 min between adjacent washers; otherwise there is danger of excessive heating by eddy currents due to the magenetic circuit. Plain washers should be used under both the head of the bolt and the nut.

It is recommended to use 12 mm bolts for making busbar joints. 12 mm bolts should be tightened with a torque of 5 kg.m.

4.3.6 BUSBAR CONNECTIONS

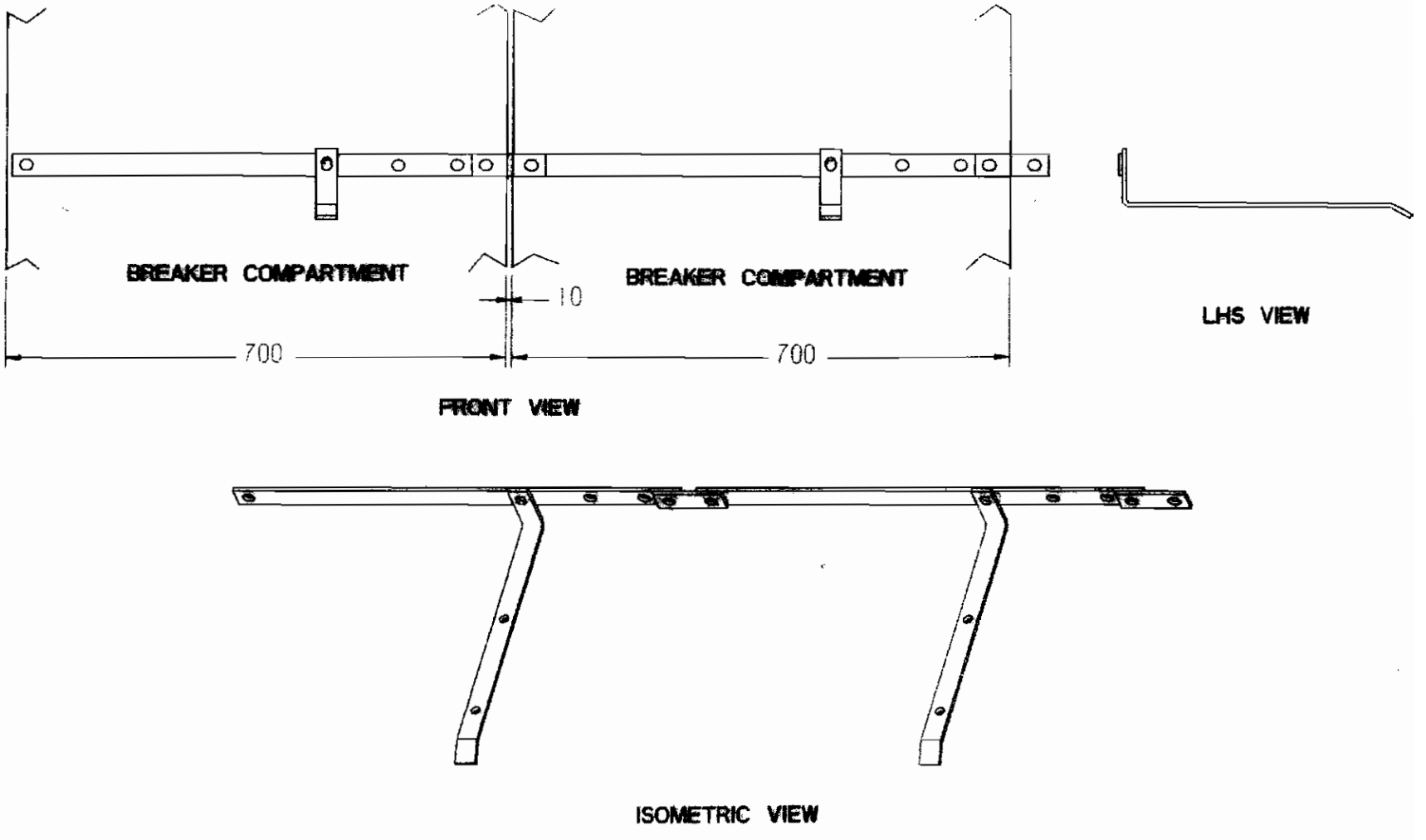
When installation is completed, connect the bus bars as shown in Fig. 5 with care described in 4.3.5

4.4 METHOD OF MOUNTING INSULATING COVER (PVC SHROUD)

After the busbar are connected the insulating covers should be mounted in the following manner

1) Mount the insulating Cover as shown in Fig.5.

2) Tighten all the nylon screws



EARTHING ARRANGEMENT BETWEEN PANELS

FIG. 6

4.5 CONTROL, AUXILLARY SUPPLY AND EARTH CONNECTION

4.5.1 All control and auxillary supply cables from the control borad to switch board shold be connected as per wiring diagram. Similarly the auxillary and control lines be tween the adjoining cubicles are to be connected. The entries of control cables should be sealed properly against possible entry of vermin.

4.5.2 The earthing busbar are located at the rear bottom side of VCB compartment in each cubicle. Connect the earthing busbar as shown in Fig. 6

4.6 CLOSING OF COVERS

4.6.1 Cable termination kits are to be mounted as indicated in the drawing and then connect cables to the terminals by lugs. After cable connection is over, proper sealing should be provided to prevent vermin entry.

4.6.2 Whenever shrouds are provided in cable compartment fix them properly.

4.6.3 Clean all the compartments.

4.6.4 Ensure that no foregin parts or tools are left inside the panel.

4.6.5 Plug unnecessary openings/holes

4.6.6 Close all removed covers using appropriate fasteners.

4.7 FIX THE INTERPANEL PROFILE BETWEEN THE CUBICLE. (Ref. Fig. 7).

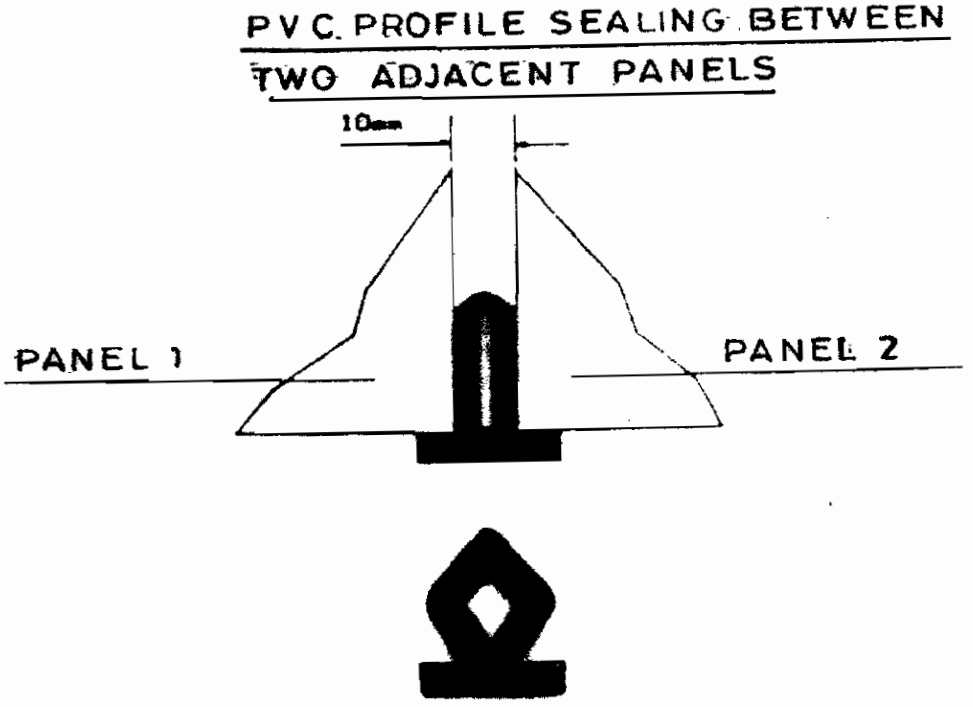
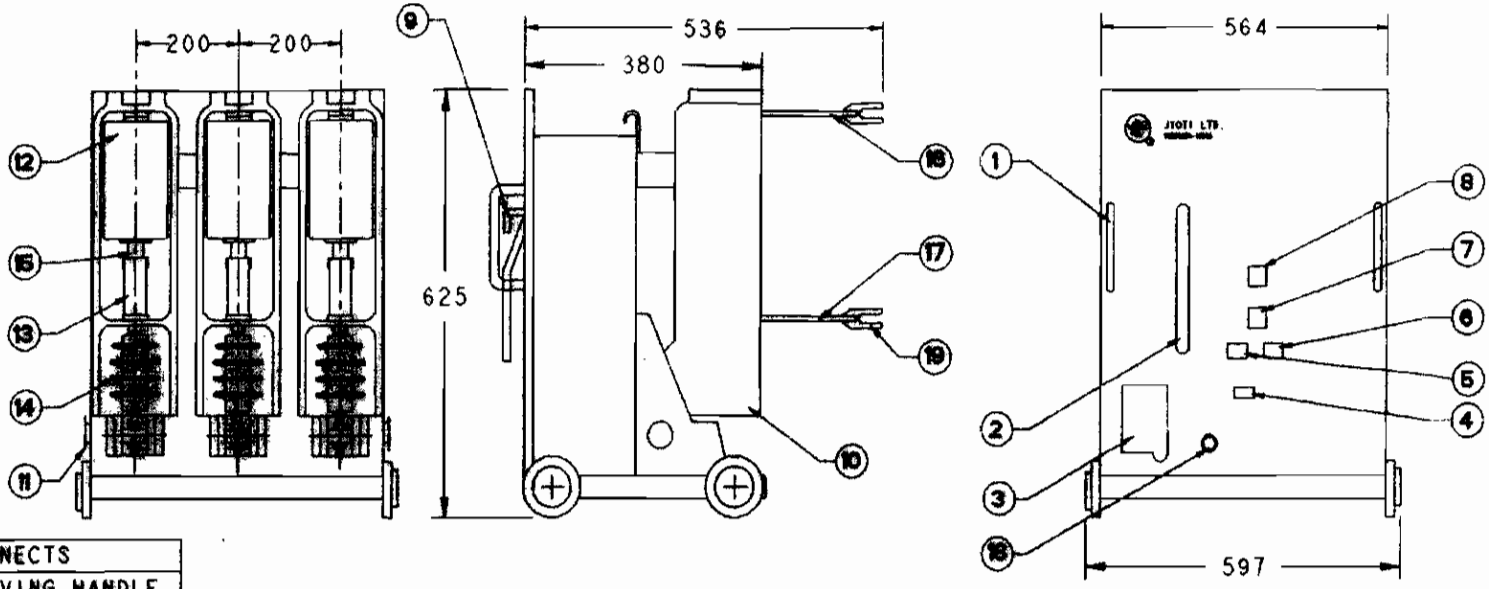


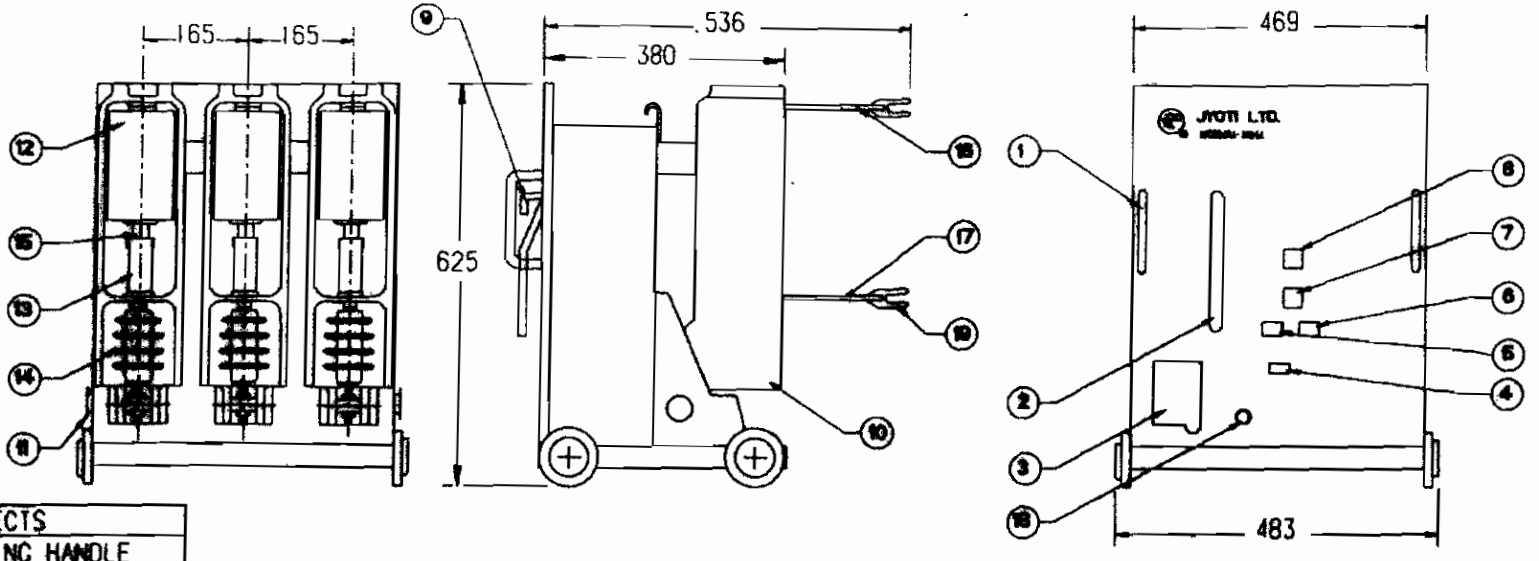
FIG. : 7



No.	DESCRIPTION
1	HANDLES
2	CHARGING HANDLE
3	SOCKET FOR MULTIPIN PLUG
4	COUNTER
5	ON/OFF INDICATOR
6	SPRING CHARGING INDICATOR
7	CLOSING BUTTON
8	TRIP BUTTON
9	INTERLOCK LEVER
10	INSULATING BARRIER
11	DRIVING ROLLER FOR SHUTTER
12	VACUUM INTERRUPTER
13	FLEXIBLE CONDUCTOR
14	INSULATING STUD ASSEMBLY
15	COUPLING
16	UPPER BUS CONDUCTOR
17	LOWER BUS CONDUCTOR
18	SOCKET FOR DRIVING HANDLE
19	PRIMARY DISCONNECTS

VACUUM CIRCUIT BREAKER (200 POLE CENTRE)

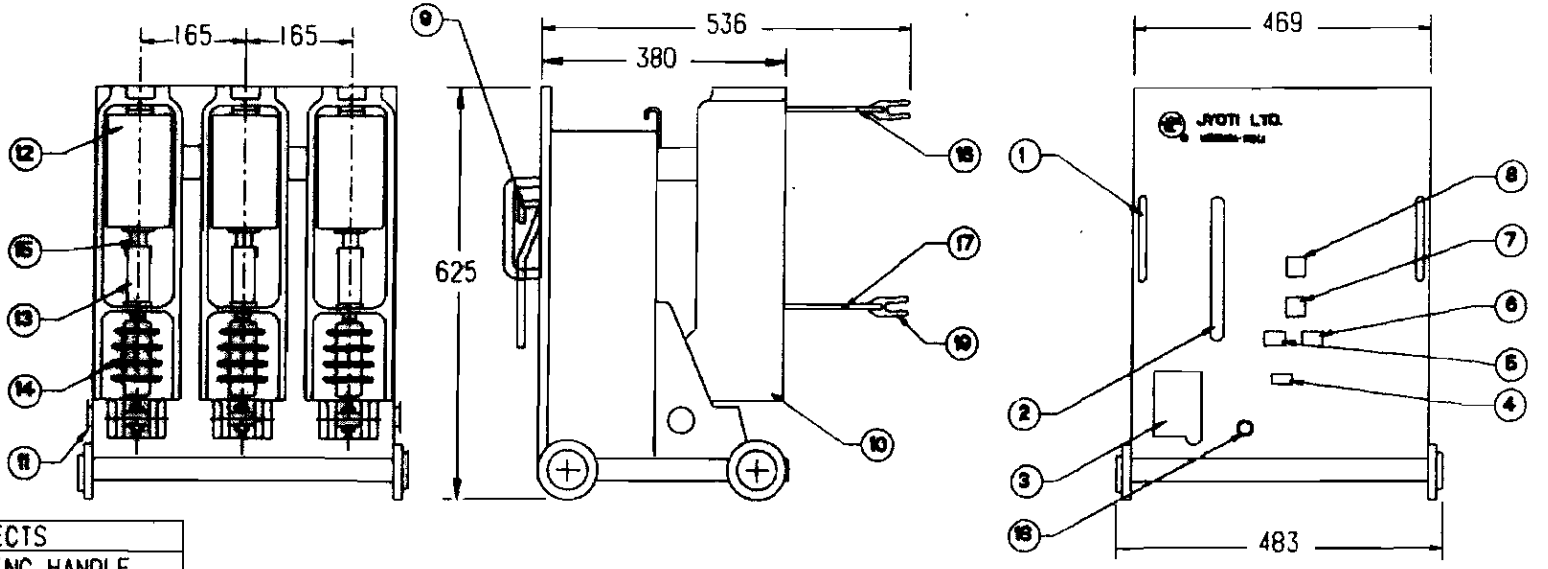
FIG. : 8



No.	DESCRIPTION
19	PRIMARY DISCONNECTS
18	SOCKET FOR DRIVING HANDLE
17	LOWER BUS CONDUCTOR
16	UPPER BUS CONDUCTOR
15	COUPLING
14	INSULATING STUD ASSEMBLY
13	FLEXIBLE CONDUCTOR
12	VACUUM INTERRUPTER
11	DRIVING ROLLER FOR SHUTTER
10	INSULATING BARRIER
9	INTERLOCK LEVER
8	TRIP BUTTON
7	CLOSING BUTTON
6	SPRING CHARGING INDICATOR
5	ON/OFF INDICATOR
4	COUNTER
3	SOCKET FOR MULTIPIN PLUG
2	CHARGING HANDLE
1	HANDLES

VACUUM CIRCUIT BREAKER (165 POLE CENTRE)

FIG : 9



No.	DESCRIPTION
19	PRIMARY DISCONNECTS
18	SOCKET FOR DRIVING HANDLE
17	LOWER BUS CONDUCTOR
16	UPPER BUS CONDUCTOR
15	COUPLING
14	INSULATING STUD ASSEMBLY
13	FLEXIBLE CONDUCTOR
12	VACUUM INTERRUPTER
11	DRIVING ROLLER FOR SHUTTER
10	INSULATING BARRIER
9	INTERLOCK LEVER
8	TRIP BUTTON
7	CLOSING BUTTON
6	SPRING CHARGING INDICATOR
5	ON/OFF INDICATOR
4	COUNTER
3	SOCKET FOR MULTIPIN PLUG
2	CHARGING HANDLE
1	HANDLES

VACUUM CIRCUIT BREAKER (165 POLE CENTRE)

FIG : 9

5.0 DESCRIPITON OF CIRCUIT BREAKER (Fig. 8 & 9)

Vaccum Circuit Breaker incorporates a specially designed and completely sealed vaccum Interrupter to perform its basics funciton of opening as well as closing when called upon to do so, both under normal operating conditions and under fault conditions such as short circuit.

In VCB type VK upto 2000A rating the Vacuum Interrupters are housed in a unique U shaped barrier which ensures stable mounting of the vacuum inter rupters and also provides adequated inter phase and phase to earth segrega tion. The barrier is mounted on hte rear side of the VCB mechanism cabinet. In VCBs rated for 2500 Amps and above the U shaped barrier because of higher heat dussipation requirement.

A spring operating mechanism mounted inside a sheet steel cabinet is used to provide the energy required for breaker operation. The closing springs, which are charged manually or through a motor, provide the energy for closing the VCB and for applying sufficient contact pressure on the moving contracts of Vacuum Interrupters through the wipe springs. The wipe springs proved the intial energy during opening of the VCB. The opening springs, which get charged on closing the VCB, provide the energy for opening the VCB.

The mechanism energy is transmitted to the Vacuum Interrupters via insulating links during closing as well as opening. There is a dash pot in the mechanism which provides sufficient damping during the opening operation of the VCB.

The VCB is provided with OPEN/CLOSED and CHARGED/DISCHARGED indicators on its front side. A green colour push button is provided for manual closing and red colour push button is provided for manual opening of the VCB. When VCB is received at site it is in OPEN condition and the springs are DIS CHARGED. A charging handle is provided in the front for manual spring charg ing. TWO handles are provided on the sides for moving the VCB. An interlocking lever is provided behind the right side handle. At the bottom centre of the VCB cabined front cover, an opening is provided for inserting the driving handle to rake in / rake out the VCB as explained in 8.0. On the bottom left hand corner a provision has been made for inserting the multi pin plug socket. In case Second ary Disconnecting Switch (SDS) is provided instead of multi pin plug, one part of the SDS is mounted on top of the VCB.

The VCB has closing coil, tripping coil and breaker operated auxiliary switch IV.

The VCB is provided with as anti-pumping feature to prevent the re-closing of the breaker after opening in case of continuous electrical closing

command. The anti pumping relay 'Y' and auxiliary relay for spring charging motor 'X' are mounted in the mechanism cabinet on the top left hand side.

The moving contact of the Vacuum Interrputer is connected to the bottom disconnecting arm through flexible jumpers. The fixed con tact of the Vacuum Interrupter is assembled with the top disconnect ing arm.

The jaw contacts, fixed at the end of the disconnecting arms, are made of specially designed copper strips which are assembled to gether spring loaded. This ensurers sufficient contact pressure when the jaw contacts get engaged with thecontact blades in the panel while the VCB is in SERVICE.

6.0 WORKING OF OPERATING MECHANISM (Ref. Fig. 10&11)

6.1 CHARGING OPERTION

Initially the VCB is OPEN and closing springs are DISCHARGED, Charing of closing springs is done either manually or electrically through a motor. The CHARGED/DISCHARGED indicator shows the status of the closing springs.

6.1.2 MANUAL CHARGING

Hold the charging handle (1) and move it by approximately 30 degree till it stops. This will rotate gear (2) which in turn will rotate gear (3). Gear (3) will rotate cam shaft (4). The closing springs (5) which are hinged at one end , will start getting charged due to rotatation of cam shaft as the other end of the spring is connected to crank (6) fitted on the cam shaft (4).

Now return the charging handle back to its original position and move it up again. Repeat this, till the springs are fully charged. A distinct click ing sound will be heard as soon as springs are fully charged and the CHARGED/DISCHARGED indicator changes over to CHARGED position. The VCB is now ready for closing.

In order to prevent overcharging, "stop" the handle movement as soon as a distinct 'click' sound is heard and indicator changes over to 'CHARGED' position. Overcharging can damage the mechanism.

The number of times charging handle is to be moved up and down for full charging of closing spring depends on the angle of handle is kept to about 30 degree every times, approximately 14 strokes will be required for full charging.

6.1.3 MOTOR CHARGING OPERATION

As soon as electrical supply is given to the charging motor (7), it will rotate the shaft (8) which in turn will rotate the gear (3). The remaining charging operation is similar to maual charging.

When the springs are about to get charged fully, the cam (9) mounted on cam shaft (4) will operate the micro switch (10) through lever (11) and supply to the motor will be cut off. The motor takes about 6 to 8 seconds to charge the springs.

The closing springs will get automatically recharged through the springs charging motor as soon as they get discharged on closing of the breaker.

6.2 CLOSING OPERATION

When the springs are fully CHARGED, the linkages attain position (A) (Fig.11). Now the VCB is ready for closing operation.

6.2.1 MANUAL CLOSING

Push the closing push buttom (12). The closing shaft (13) wil turn about its axis, thus releasing the closing catch (14). Now, energy of the closing springs will cause the cam (15) to rotate at fast speed and bring linkages to position (B) (Fig. 11). The rotation of cam will turn the main shaft (16) and the breaker will get CLOSED. The opening spring (17), mounted on main shaft (16) will get charged during closing operation. The breaker position indicator changes over to CLOSED and the charging indicator changes over to DISCHARGED.

t is possible to re-charge the closing springs in this position.

6.2.2 ELECTRICAL CLOSING

When supply is given to the closing coil (18), the plunger (19) of closing coil will push the closing paddle (20). This will cause the closing shaft (13) to turn.

The remaining closing operation is similar to manual closing operation. The supply to the motor is re-connected immediately on closing of the breaker due to rotation of cam (9), Lever (11) and Micro switch (10) and the closing springs get recharged and linkages attain the position (D).

The breaker position indicator changes over to CLOSED, and after immediate re-charging, the charging indicator will show CHARGED

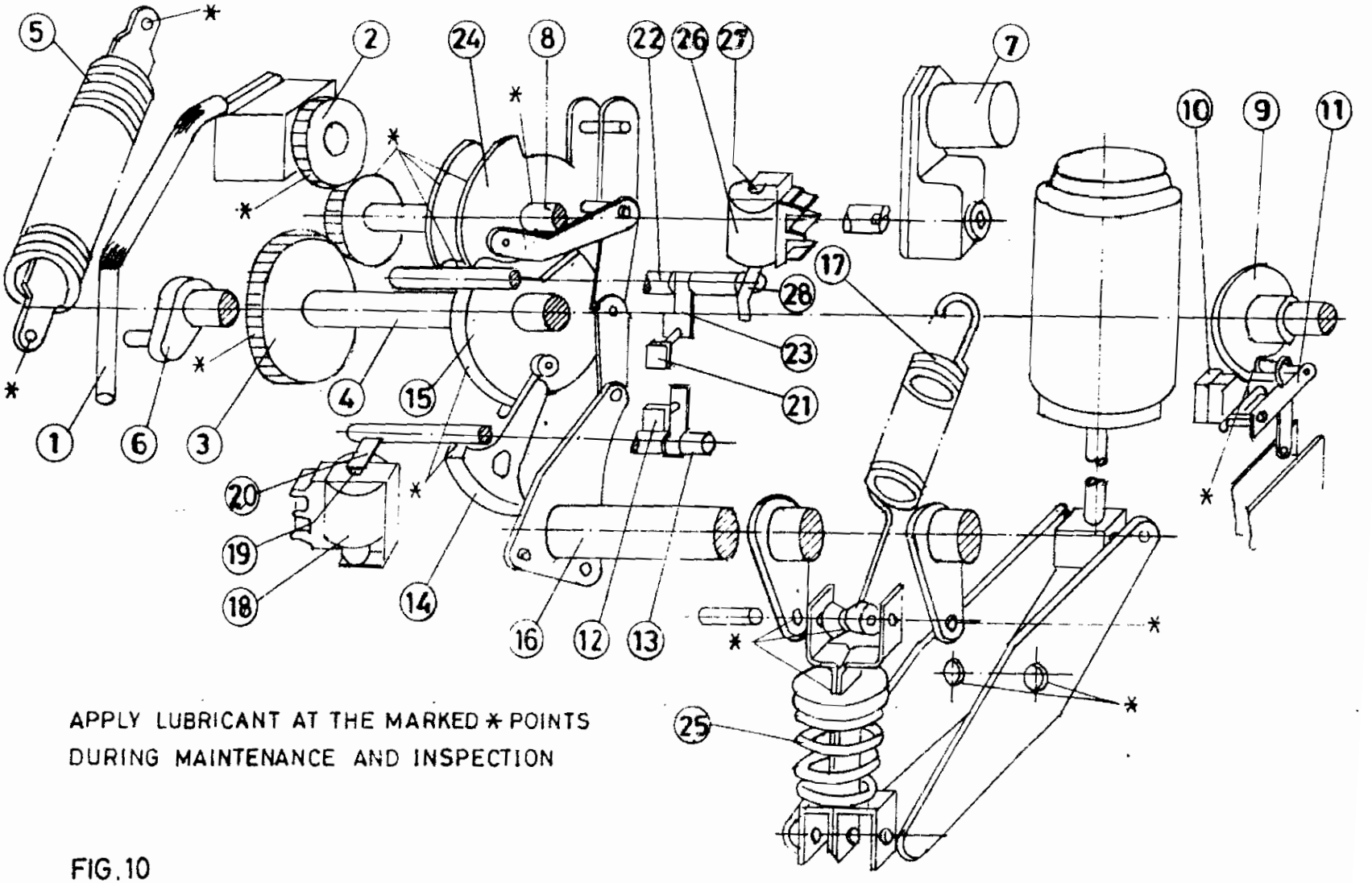
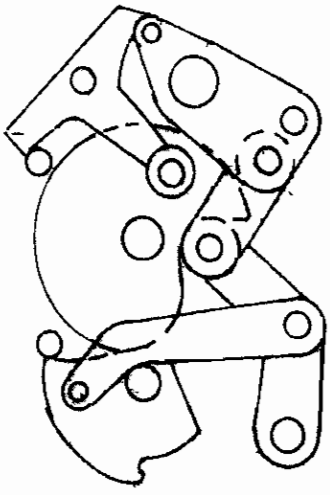


FIG.10
SPRING OPERATING MECHANISM

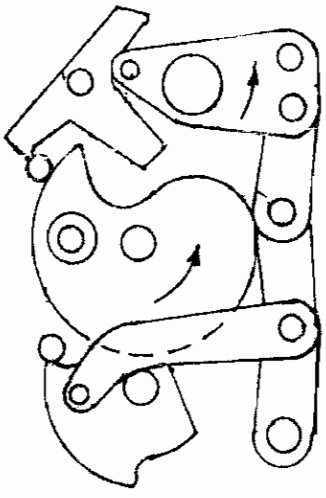
LEGEND FOR ITEM NUMBERS IN FIG. 10

1	Charging handle	15	Cam of cam-shaft assembly
2	Gear for changing handle	16	Main shaft
3	Spur gear assembly	17	Opening spring
4	Cam Shaft	18	Closing coil
5	Closing Spring	19	Plunger of closing coil assembly
6	Crank	20	Closing paddle (for coil)
7	Geared spring charging motor	21	Trip push button
8	Shaft of trip catch assembly	22	Opening half shaft
9	Cam for charging indication	23	Paddle (for opening push button)
10	Microswitch (LS)	24	Trip catch
11	Lever	25	Wipe spring
12	Closing push button	26	Tripping coil
13	Closing shaft	27	Plunger of tripping coil assembly
14	Closing catch	28	Trip paddle (for coil)



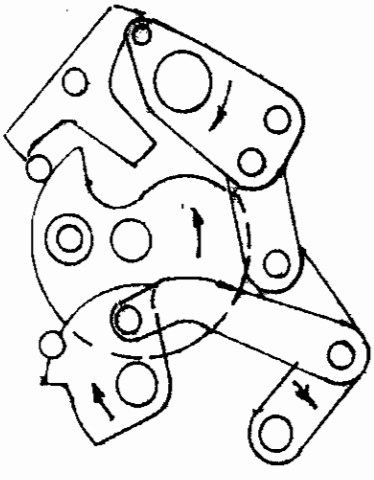
POSITION - A

OPEN AND CHARGED



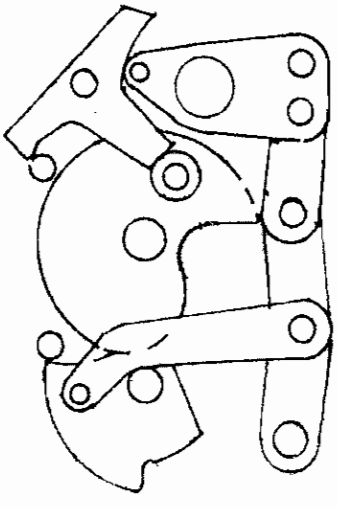
POSITION - B

CLOSED AND DISCHARGED



POSITION - C

OPEN AND DISCHARGED



POSITION - D

CLOSED AND CHARGED

FIG : 11

6.3 OPENING OPERATION

When the VCB is CLOSED, the linkage attain the position (D) or (B), and the breaker is ready for opening.

6.3.1 MANUAL OPENING

Push the trip push button (21). This will turn the trip shaft (22) through tripping paddle (23), which in turn will release the tripping catch (24). The energy of opening springs (17) and wipe springs (25) will cause the linkage to attain the position (A) or (C).

This movement of linkage from position (D) or (B) to position (A) or (C), will turn the main shaft (16) and the circuit breaker will OPEN. During opening operation, initially, energy of wipe springs (25) will be release to attain the required inital speed. The same will be further maintained by the released of opening spring energy.

The breaker position indicator changes over to OPEN and the charging indicator remains at the same position as it was when the breaker was in CLOSED condition. i.e. CHARGED in case the closing springs where charged after the breaker had CLOSED or DISCHARGED if closing springs where not charged after the breaker was CLOSED.

6.3.2 ELECTRICAL OPENING

SHUNT TRIP

When supply is given to the tripping coil (26), the plunger (27) of tripping coil will push the tripping shaft (22), causing it to turn. The remaining operation is similar to manual opening operation.

6.4 AUTO RE-CLOSING FEATURE

The VCB is provided with a facility for auto re-closing. This feature is achived since it is possible to charge the closing springs as soon as they get discharged during closing operation. The mechanism is tnus kept ready to reclose the VCB as soon as it is opened.

6.5 AUXILIARY SWITCHES

All switches have their normally open (NO) and normally closed (NC) contacts when the VCB is OPEN and the mechanism is DISCHARGED.

Auxiliary Switch	IV	Cam Switch (Rotary Switch)
Auxiliary Switch	LS	Micro Switch
Auxiliary Switch	IL	Micro Switch

The auxiliary switch IV (Cam Switch / Rotary switch) is breaker operated and is driven by a link attached with the main shaft. This switch has 10 contacts (5 NO + 5 NC). Within the VCB one pair of these contacts are used to cut-off the control supply to the closing coil (or opening coil) as soon as the breaker is CLOSED (or OPENED).

When the circuit breaker is CLOSED, 'NC' contact open. When the VCB is OPENED the auxiliary contacts regain their original status.

Auxiliray switch LS is a micro switch. It is controlled by the rotation of cam shaft (4). When the closing springs are in DISCHARGED condition, its NC contact supply to the spring charging motor. When the spring are fully CHARGED, micro switch LS changes it position and cuts offf the supply to control relay 'X', thus diconnecting the motor supply.

Auxiliary switch IL is a microswitch. The switch is operated by movement of interlocking lever this switch is in open condition thus diconnecting the closing circuit and preventing the VCB from closing. When the interlocking lever is lowered, which is the case only when the VCB is fully in SERVICE or TEST positions (and, of course when the VCB is completely withdrawn outside the cubicle), the contact of IL is in closed condition, thus permitting closing operation. This inerlock ensures that closing of VCB is prevented in intermediate positions between TEST and SERVICE.

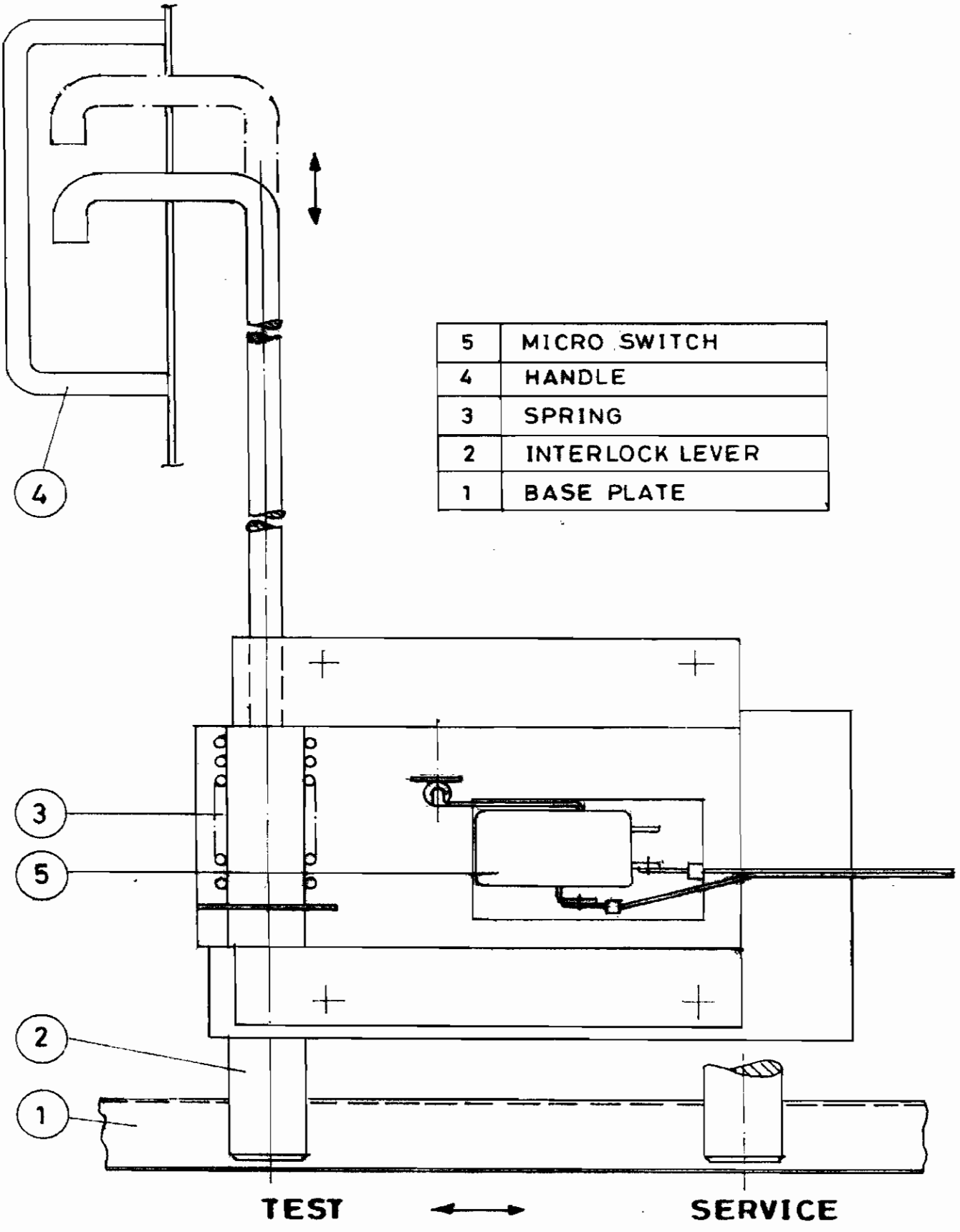


FIG:12 **INTERLOCK ARRANGEMENT**

7.0 INTERLOCKS

Interlocking mechanism provided between Vacuum Circuit Breaker and cubicle ensures safe operating, protection to personnel and the correct sequence of operations.

7.1 INTERLOCKING FEATURES

1. VCB cannot be inserted from TEST to SERVICE position or withdrawn form SERVICE to TEST position unless it is OPEN.

2. VCB cannot be closed while moving between TEST and SERVICE positions.

7.2 INTERLOCKING MECHANISM

a) Interlock LEVER (fig.8,9 & 12) cannot be lifted up, when the VCB is CLOSED. Before lifting the lever, ensure that the VCB is OPEN. Do not try to force the interlcok lever.

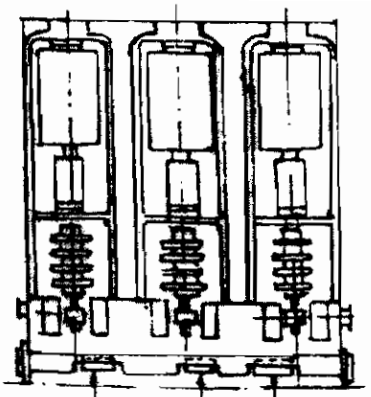
b) When interlock lever is lifted up, electrical closing operation is blocked and mechanical closing cannot be completed.

NOTE:

When the VCB is fully in the TEST or SERVICE positions, interlock lever drop in the grooves provided in the base channel in the cubicle, thus permitting closing, but preventing the movement of the VCB. Do not at tempt manual closing when interlock lever is lifted. This will lead to in stant discharging of springs.

c) The VCB and the cubicle have requisite interlocks to prevent the insertion of circuit breaker into the cubicle unless it is of matching current rating.

The interlock is achieved by provision of check plate assembly on circuit breaker as shown in Fig. 13, in all VK type circuit breakers.



A,B & C ARE LOCATION OF CHECK PLATES.

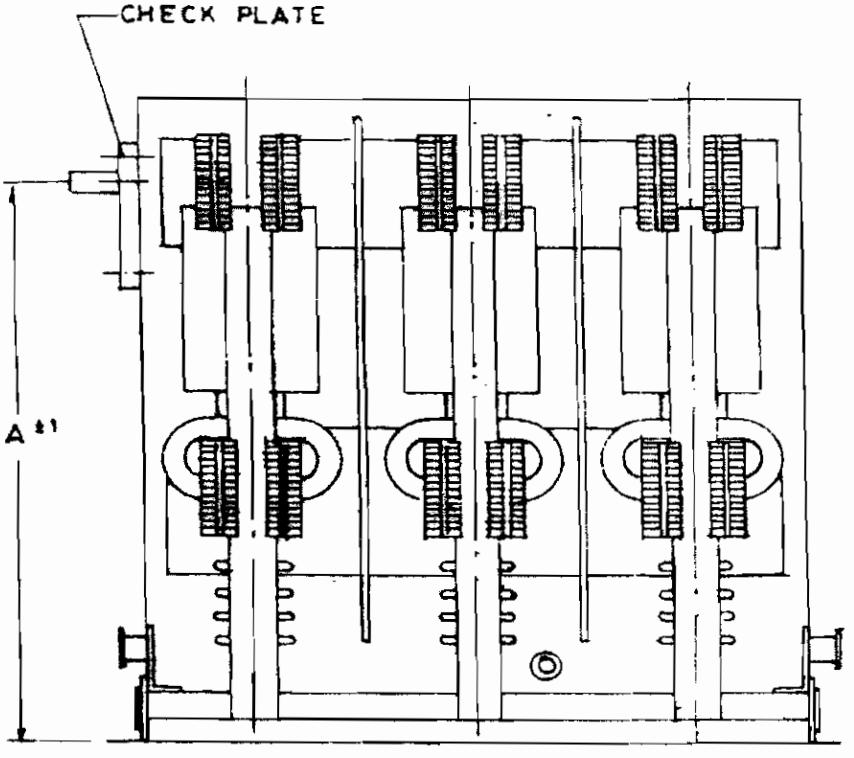
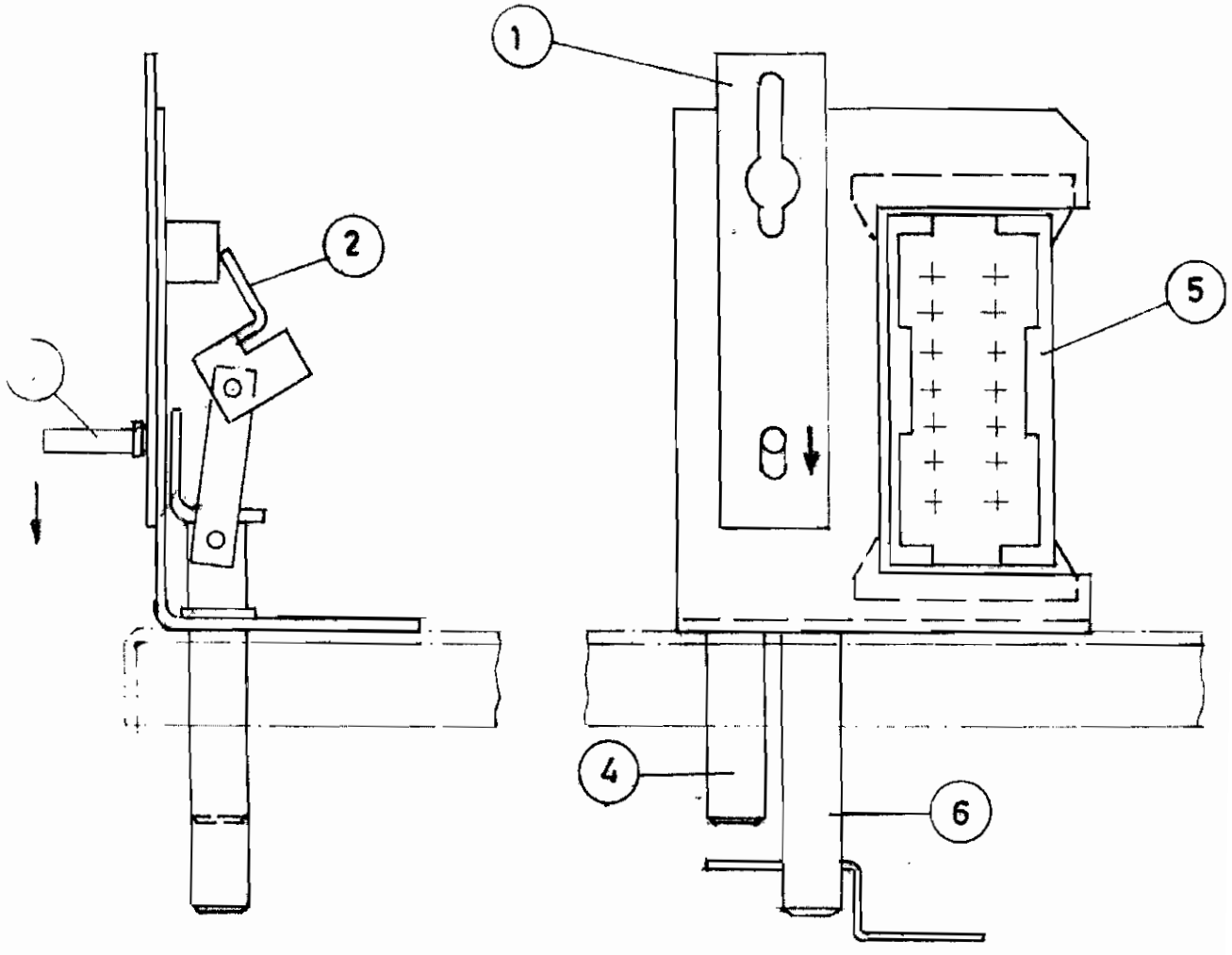


FIG. : 13

03	VK-10 Q 40	614
02	VK-10 Q 40A	634
01	VK-6 Q 40	654
TYPE	VCB TYPE	A

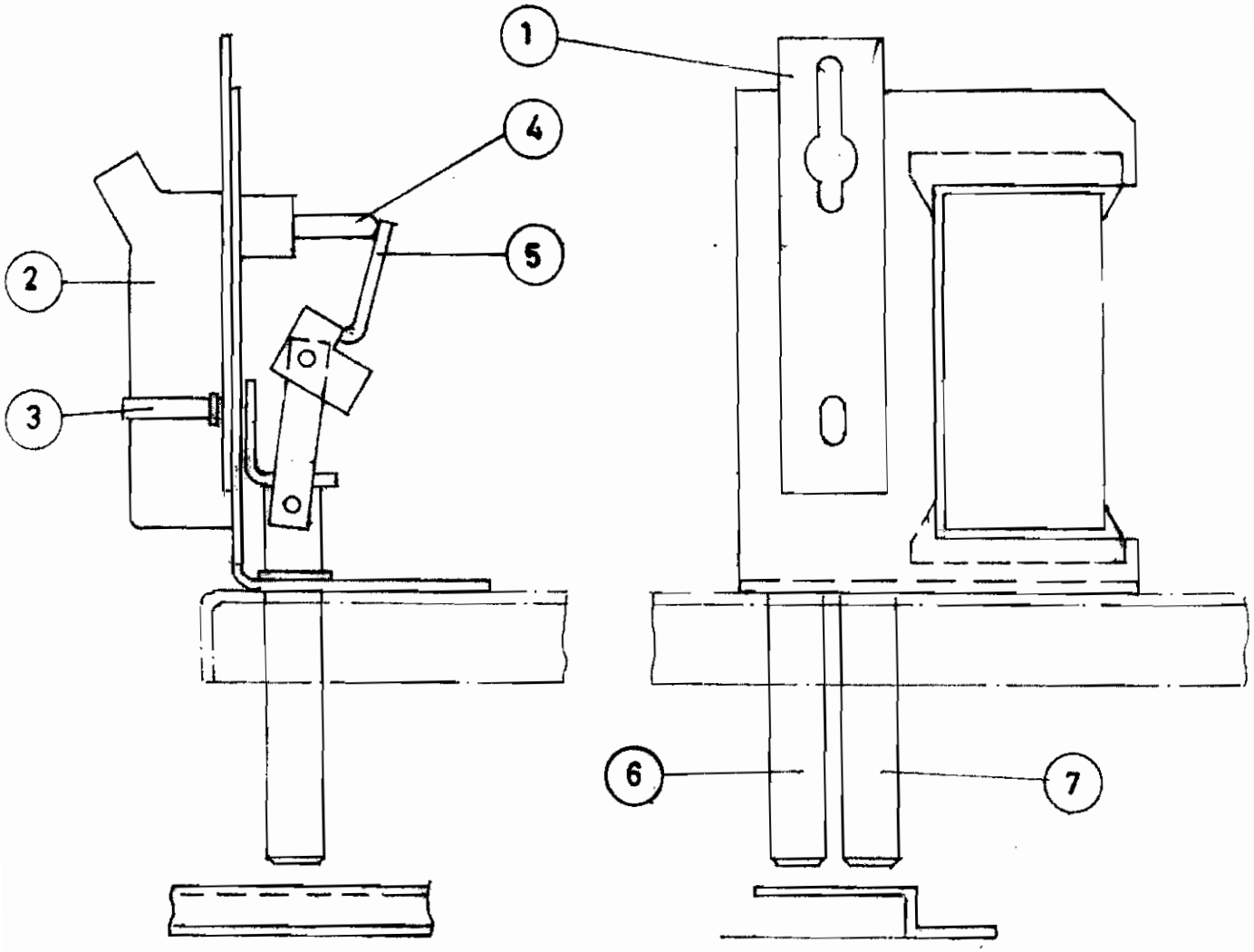
1	PLATE
2	INTERLOCK PLATE
3	LEVER
4	LOCK PIN NO. 1
5	SOCKET FOR PLUG
6	LOCK PIN NO. 2



MULTI PIN PLUG IS NOT INSERTED BREAKER IN TEST POSITION OR OUTSIDE

FIG-14 A

1	PLATE
2	SECONDARY DISCONNECTS PLUG
3	LEVER
4	INTERLOCK PIN
5	INTERLOCK PLATE
6	LOCK PIN NO.1
7	LOCK PIN NO.2



MULTI PIN PLUG INSERTED AND BREAKER IN TEST POSITION

FIG.14B

7.3 CONTROL CIRCUIT MULTI - PIN PLUG INTERLOCK (Fig.14)

VK type VCBs in PH type panels are provided with a multi-pin plug for the connection of control supply. An interlock is provided on the breaker and panel such that VCB cannot be inserted from TEST to SERVICE position unless multi-pin plug is inserted in its receptacle located in bottom left corner of the VCB.

Similarly an interlock is also provided so that multi-pin plug cannot be removed unless the VCB is in TEST position

Following procedure should be followed for insertion of multi-pin plug into its receptacle provided in the VCB

a) Keep the VCB in TEST position.

b) Press the lever shown in Fig.14, down, it will not be possible to press the lever down unless VCB is in TEST position, as movement of lock channel no.1 is restricted in all other position except TEST position.

c) Insert the multi-pin plug properly. This will lift the lock channel no.2 due to the pin on the plug on the multi-pin plug assembly.

d) Release the lever, lock channel no. 1 will be lifted up and multi-pin plug will be locked. It will not be possible to withdrawn the multi-pin plug un less the lever is pressed down, which is possible only in TEST position.

e) A clamp is provided over t he multi-pin plug, to hold it with its socket dur-ing operation of the VCB. Fix this clip over the plug tightly.

For removing the multi-pin plug, bring the VCB to the TEST position, remove the clip provided over the plug, push the lever down and pull the plug out of its receptacle.

8.0 PROCEDURE FOR INSERTION / WITHDRAWL OF VCB (FIG. 8,9 & 12)

8.1 INSERTION OF VCB FROM TEST TO SERVICE

(If the VCB is provided with the multi-pin plug arrangement, before insertion of VCB, procedure mentioned in 7.3 above should be followed.)

1) Ensure that the VCB is OPEN before inserting.

2) Hold the handles provided on the VCB front side and raise the interlocking lever will come out of the groove provided on the base channel of the cubicle.

3) Push the VCB gently into the cubicle with the interlock lever lifted. The VCB will move inside the cubicle about 140mm and stop.

4) Keeping the interlock lever lifted, inserted the driving handle (pro vided for final insertion and initial withdrawan of VCB) into the opening provided in the VCB at the bottom centre; such that it gets engage with the driving rod.

5) Rotate the handle clockwise to move the VCB further in, for about 35mm in the cubicle. Stop rotating the handle when a distinct "click" sound is heard and the driving handle rotates freely.

6) Remove the handle, check that the right side interlock lever has automatically dropped completely in the groove provided in the base channel near the SERVICE position lable in the cubicle.

7) Now the VCB is correctly positioned in SERVICE and ready for operation.

The VCB is held in SERVICE position with the help of the interlocking lever and the driving rod which gets inserted in the nut assembly provided in the panel cubicle.

8.2 WITHDRAWAL OF VCB FORM SERVICE TO TEST

1) The circuit breaker should be OPEN before withdrawal. If it is CLOSED, trip the circuit breaker using the mechanical trip push button (Fig.10 (21)), or with cubicle mounted electrical controls.

2) Raise the interlock lever, insert the driving handle into the opening provided provided and rotate the handle anti-clockwise untill the handle rotates freely. The VCB will move only by about 35 mm. Remove the driving handle.

3) For further withdrawal of the circuit breaker, hold both the VCB handles (without holding the interlocking lever) and gently pull the VCB till its front reaches the TEST position lable, and the interlock lever will the then drop in the groove of the base channel, thus ensuring correct TEST position.

   Do not hold the interlocking lever while pulling the VCB to TEST position, as this will prevent identification of correct TEST position.

9.0 COMMISSIONING INSTRUCTIONS

a) Check manual spring charging, closing and opening operations.

b) Check operation of all indicators (e.g. CHARGED / DISCHARGED, OPEN / CLOSED)

c) Check tightness of all wire terminations.

d) Check electrical operations of the VCB

e) Check all interlocks for satisfactory working.

f) Check and ensure that there are no loose connections in the power circuit.

g) Clean the VCB with compressed air and/or dry lint-free cloth.

h) Check insulation resistance between phase and also phase to earth with the help of a megger as described in Table 1 (9).

I) Conduct High Voltage test on the Vacuum Interrupters, as described in 11.1, before commissioning

10.0 MAINTENANCE AND INSPECTION

The stroke of Vacuum Circuit Breakers being very small, the energy required to operate the Vacuum interrupter at specified speed is very less as compared to other types of circuit breakers of the same rating.

As operating energy required is very less, the VCB requires minimum mainteneace check points and methods to ensure consistent performance are mentioned in Table - 1.

The checking should be done for the first time after 2000 operations or one year. whichever is earlier and thereafter every 3 years or 5000 operations, whichever is earlier

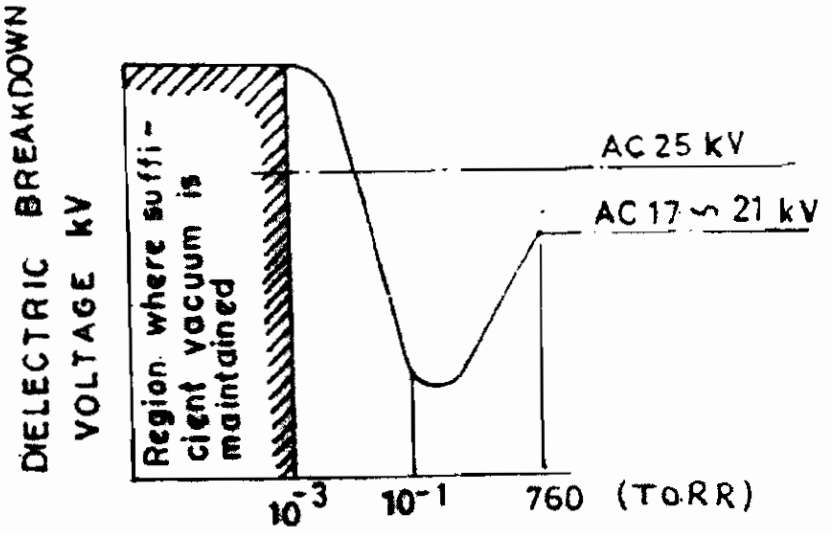


FIG. : 15 CHECK ON VACUUM

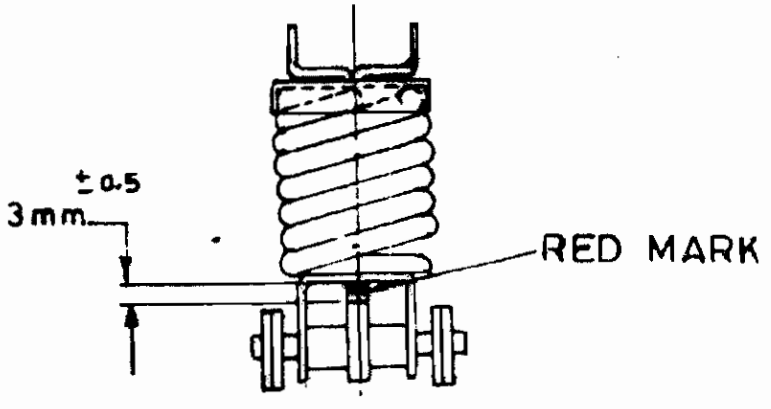


FIG. : 16 MEASUREMENT OF WIPE

10.1 CHECK ON VACUUM (Fig. 15)

The relationship between dielectric breakdown voltage and internal pressure in the Vacuum Interrupter is shown in Fig. 15

Whether the interrupter maintains a high internal vacuum can be checked by applying a voltage of AC 25 kV rms as a voltage withstand test for about 10 seconds. Measurement is taken with the VCB OPEN and the voltage applied between the terminals of the Vacuum Interrupter.

When the pressure inside a Vacuum Interrupter has attained atmospheric pressure, dielectric breakdown occurs at a voltage between and AC 17kV rms to 21kV rms.

When the internal pressure (vacuum level) is not sufficently low, there is almost no delay in the breakdown. So a duration of 10 seconds of voltage application is enough.

If test set up trips, repeat the process thrice. If test set up trips all three times, the Vacuum Interrupter is deemed to be defective and needs to be replaced.

NOTE: Megger test (I.R. test) is not a method recommended for assessing intergrity vacuum in the interrupter

10.2 MEASUREMENT OF WIPE (Fig. 16)

The wipe springs (25) shown in Fig.10, provide sufficient contact pressure to the Vacuum Interrupter when it is CLOSED. In case of excessive fault tripping, the main contacts may get eroded progressively. When the contacts get eroded, the wipe of the wipe springs get reduced

Wipe can be observed for each phase by removing the front cover of the VCB. It can be seen by the red mark on the link of the wipe springs (25) with circuit breaker CLOSED as shown in Fig.16. As a routine inspection, the presence of wipe can be seen by the red mark

When the red mark is about to disapper with the breaker CLOSED, the value of wipe reaches its minimum permissible value. Nominal valu of wipe, when circuit breaker is supplied is 3±0.5mm. When the value of wipe reaches 1 mm or less, the Vacuum Interrupter is required to be replaced.

10.3 PANEL

The switchboard should be cleaned at regular intervals depending on the local conditions.

The insulation of the high and low tension circuits should be checked with the appropriate meggers.

All resin cast components within the panel shall be observed for any damage crack etc.

All busbar, cable and jumper joints should be checked for healthiness periodically.

Relays should be tested for correct performance at least once a year.

Heaters and thermostats should be checked periodically.

11.0 REPLACEMENT OF PARTS

Customers are advised not to be replace Vacuum Interrupter or any other components on the pole part of the VCB.

For such replacement, customers are advised to contact Customer Service Dept., Jyoti Ltd., Switchgear Plant, J / 44-59, BIDC, Gorwa, Vadodara - 390 016, India or our nearest branch office. Fax No. 0265 2280153 Tel. No. 0265 2280770.

Replacement of other parts like coil, motors, micro switches etc. should also be done only by those personnel who are properly trained at our Works which be arranged on specific request.

11.1 LIST OF RECOMMENDED SPARES

Sr. No.	Item	Rating	Part No.	Qty. per unit
1.	Closing Coil	220V DC 110V DC 30 V DC 24 V DC	DEG/VS/TP/200/5	1
2.	Tripping Coil	220V DC 110V DC 30 V DC 24 V DC	DEG/VS/TP/200/6	1
3.	Auxiliary Switch (IV)		DEG/VS/TP/200/4	1
4.	Micro Switch (LS & ILB)		DEG/VS/TP/200/1	3
5.	Busbar and other support post - insulators			
6.	H.T.P.T. fuses			
7.	Multi-pin plug and socket			
8.	Terminal station blocks			
9.	Indicating lamps			
10.	Control fuses			
11.	Heater and thermostat			
12.	Cast resin bushing plates			
13.	Shrouds			
14.	Safety shutters			

Other voltage of 110 V AC are possible using rectifier and power pack units.

NOTE : While ordering spares please specify the auxiliary Voltage.

11.2 LIST OF ACCESSORIES

Following accessories are provided with VCBs for each board.

1. Driving handle for initial withdrawal / final insertion of VCB.
2. Hanging plates (in case of VCBs rated for 2500 Amps. and above)
3. Philips head screw driver set.
4. Transport trolley.

12.0 EARTHING TRUCK (APPLICABLE FOR PANEL SUPPLIED WITH LOOSE EARTHING TRUCK)

12.1 INSTRUCTION FOR EARTHING SWITCH INSERTION - WITHDRAWAL INSIDE CUBICLE

A) WITHDRAWAL OF VCB INSIDE CUBICAL

1) The circuit breaker should be in OPEN condition before withdrawal. If it CLOSED it must be tripped electrically or mechanically by pushing "Red" button.

2) Lift the interlock lever & inserts the driving handle into the opening pro vided in VCB.

3) Rotate the handle anticlock wise untill the handle rotates freely. (Breaker will come out by 35 to 40mm).

4) Pull out the driving handle, hold the handles and gently pull the VCB till its front reaches the test position lable and interlock drops into the slot at 'Test' position.

B) WITHDRAWAL FROM TEST POSITION TO TRANSPORT TROLLEY.

1) Disconnect the multipin plug.

2) Aling the transport trolley with the base of panel.

3) Lock the transport trolley so that it can't move.

4) Lift the interlock lever & pull out the breaker gently from panel on to transport trolley.

C) INSERTION OF EARTHING SWITCH FROM TRANSPORT TROLLEY TO TEST POSITION.

1) Aling the transport trolley with the base of panel and wheels of earthing switch with guide provided on it.

2) Push the earthing switch gently into panel till it reaches to "TEST" position. Confirm that interlock lever has dropped in the slot provided at "TEST" position.

D) **INSERTION OF EARTHING SWITCH FROM "TEST" TO "SERVICE" POSITION.**

1) Confirm that Earthing Switch is in **OPEN** condition. If the earthing switch is in **CLOSED** condition, it will not be possible to insert it in "Service" position because it will not be possible to lift the interlock lever.

2) The inseration and withdrawl of E.T. is similar to VCB

E) **OPERATION OF EARTHING SWITCH**

CAUTION

If the fixed contact of panel are live, as soon as the P.D.S of Earthing Switch touches the fixed contact, bell will start ringing & on lamp will glow.

1) When bell does not ring, lamp is not 'on' and both the interlocks are in slots provided at service position, earthing switch is ready to be ON.

2) Inserts the operating handle into socket as per the direction shown on the Fig. 18.

3) Lower the handle forcefully as shown in Fig. 18

4) To open the earthing switch (unearthed), insert the operating handle and move the handle in upward direction forcefully as shown in Fig. 18

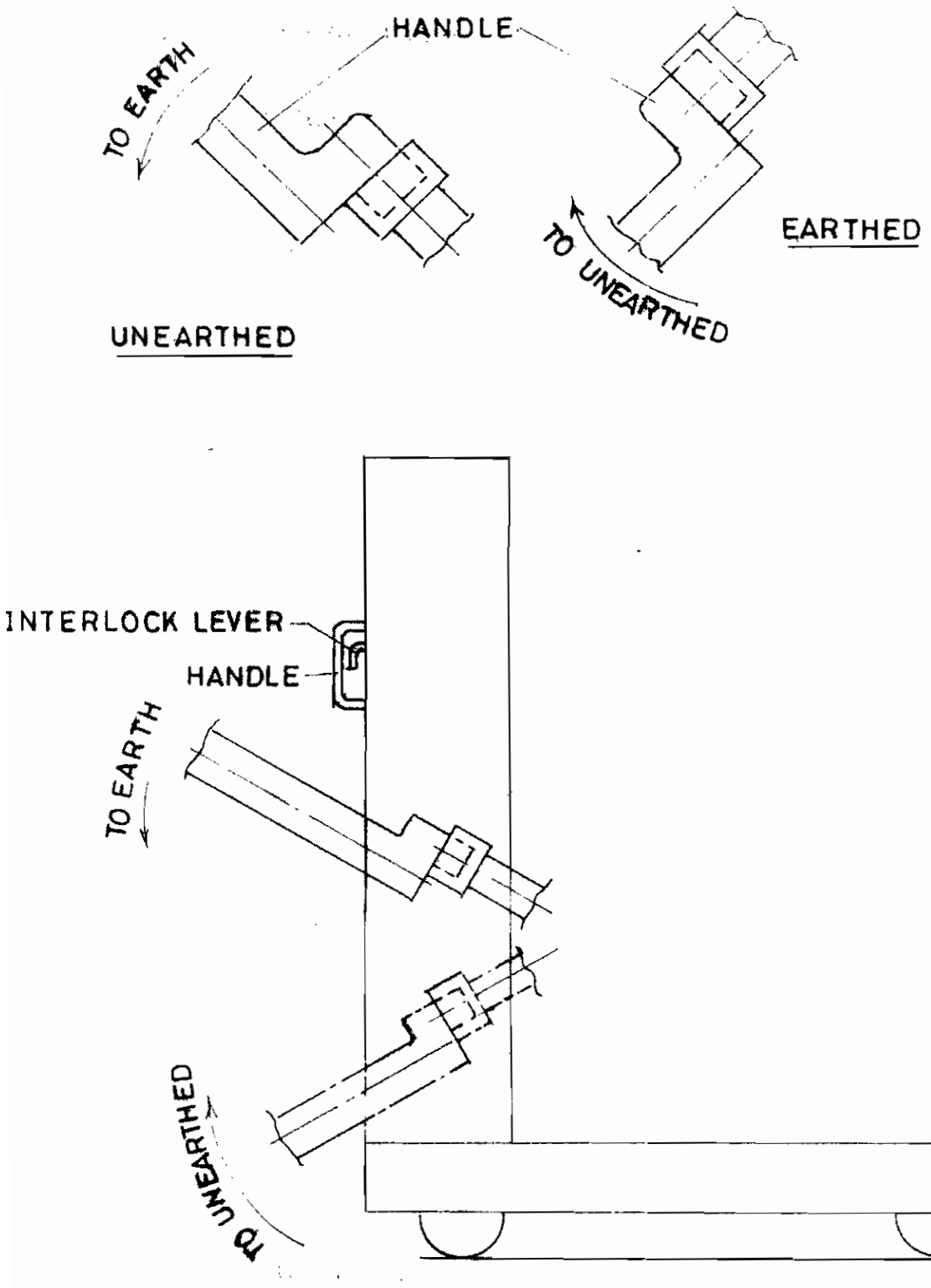

HANDLE
TO EARTH
EARTHED
TO UNEARTHED
UNEARTHED
INTERLOCK LEVER
HANDLE
TO EARTH
TO UNEARTHED

FIG. 18

13.0 INTEGRAL EARTH SWITCH

(APPLICABLE WHEN PANEL SUPPLIED WITH INBUILT EARTH SWITCH)

13.1 INSTRUCTION FOR OPERATING THE EARTHING SWITCH

- The Earthing Switch is located in the cable compartment to earth the cable
- The Earthing Switch in equipped with springs for quick make.
- It is to be operated from the front of the panel and necessary interlocks with VCB has been provided for safety.

13.2 INTERLOCKS BETWEEN VACUUM CIRCUIT BREAKER & INTERGRAL EARTHING SWITCH

1. Earthing Switch handle can be inserted in its socket only if the Vacuum Circuit Breaker is in ' Test' position.
2. Vacuum Circuit Breaker cannot be inserted from 'Test' to 'Service' position while the Earthing Switch is 'ON' i.e. " Earthed".

13.3 OPERATION OF INTERGRAL EARTH SWITCH

- Open the Vacuum Circuit Breaker Manually or Electrically
- Withdraw the Vacuum Circuit Breaker from 'Service' to 'Test' position.
- Insert the Earthing Switch handle in the socket provided for it

Rotate the handle in anticlock wise as shown in fig. to 'EARTH' the cables.

- Now the Vacuum Circuit Breaker can not be inserted from 'Test' to 'Service position.
- Insert the handle in socket rotate the handle in clock wise direction to 'open' (unearth) the Switch (as shown in fig. 19).
- Now the Vacuum Circuit Breaker can be inserted from 'Test' to 'Service' position

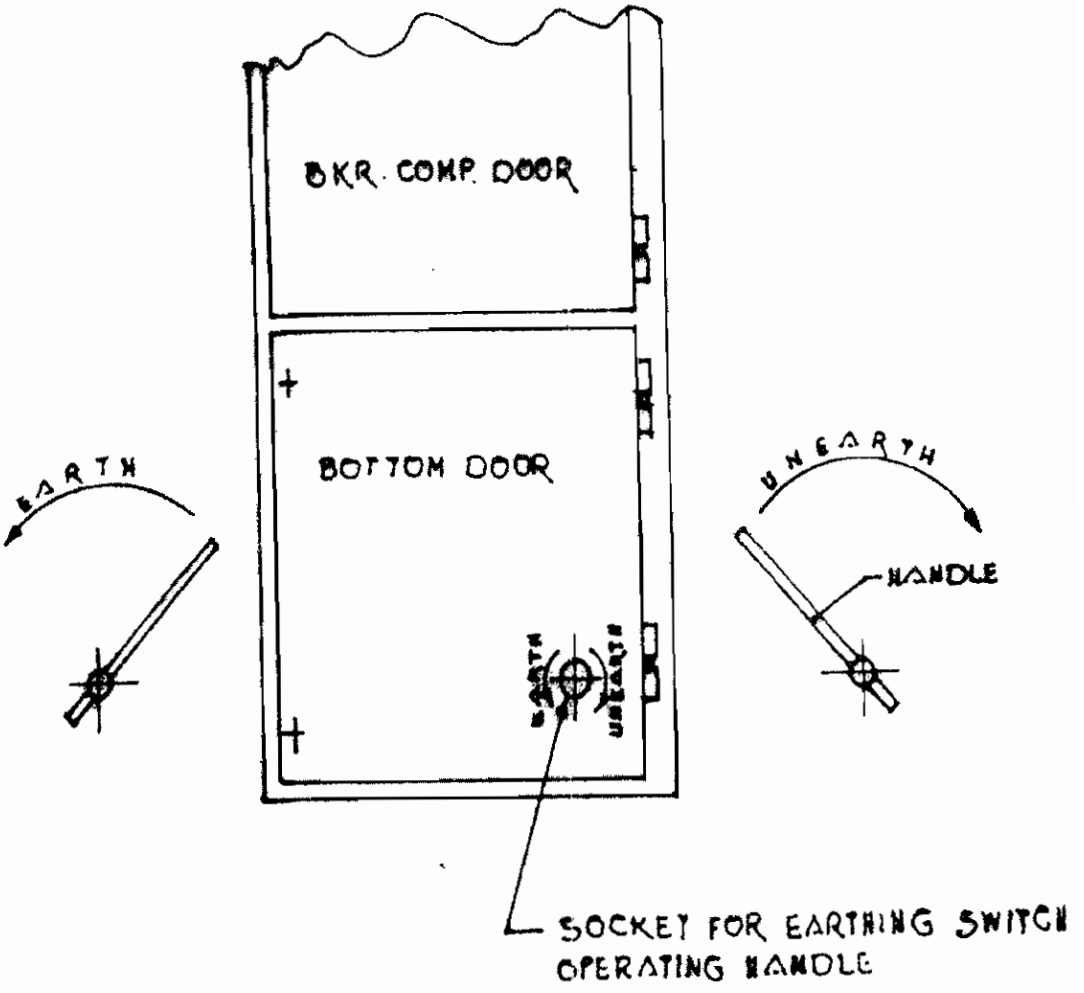


FIG. 19

14.1 CHECK POINTS FOR PERIODICAL INSPECTION

Sr. No.	Check Point	Item	Checking Method	Criteria	Actions required
1	Complete Circuit Breaker	Screws, Bolts & Nuts	By screw driver & wrench	There should not be any loose	Tighten if found loose
		Dust & foreign Matter	Visual Check	The breaker should be clean and should not have any foreign matter on any part	Clean with compressed air and wipe the accessible parts by clean and dry lint free cloth
		Deformation, excessive wear	Visual Check	There should be no deformation or excessive wear or damage to any part	Remove cause and replace the part
2	Operating Mechanism	Dust & foreign matter	Visual check	There should be no dust or foreign matter	Clean with compressed Air
		Smooth Operation	Manual Operation	Operation should be smooth	
		Lubrication of bearings pins, latches etc.	Visual check	Should be well lubricated	Apply PTFE grease, Beacon Q2 grease or its equivalent as shown in Fig.3
		Closing and tripping shaft	Visual Check	Must rotate freely	Apply PTEF grease, Beacon Q2 grease or its equivalent as shown in Fig. 3.

Sr. No.	Check Point	Item	Checking Method	Criteria	Actions required
3	Vacuum Interrupter	Contact Wear	Visual Check	Wipe should be 3.0 +/ -0.5 mm when breaker is in closed position	If it is less than
		Vacuum Integrity	See check on vacuum (9.1)	The Interrupters should withstand the test.	Vacuum Interrupter should be replaced if found defective. The manufacturer should be consulted for replacing the Vacuum Interrupter
		Number of operations	Counter	When counter reading reaches 10,000, check vacuum. If OK, continue to use and check again when counter reading reaches 15,000. Check vacuum and if OK, continue to use till 20,000 operations.	Vacuum Interrupter should be replaced, if vacuum is not OK or when counter reaches 20,000 operation.
4	Auxiliary Switch	Terminal	Tighten by screw driver	There should be no loose connection	Re-tighten if found loose
		Case and contacts	Visual check	There should not be any damage	Replace if found damaged
5	Main Power Circuit	Discoloration of contact surface by heat	Visual check	There should not be any discoloration	Check contacts and joints. Apply petroleum jelly, if required.
6	Control Circuit	Operate Breaker Electrically	Check at test position	Smooth operation	Check circuit and operation of micro switches & auxiliary switch

Sr. No.	Check Point	Item	Checking Method	Criteria	Actions required. ,
7	Control Circuit disconnect contacts (only for automatic disconnect contacts)	Insulating part	Visual Check	There should not be any damage	Replace if any damage is found
		Contact Switch	Visual Check	Petroleum jelly layer	Apply petroleum jelly
8	Barrier (Vacuum Interrupter Support)	---	Visual check	There should be no dust or foreign matter	Clean by compressed air and then wipe with clean and dry cloth.

Sr. No.	Check Point	Item	Checking Method	Criteria	Actions required
9	Measurement of Insulation resistance				

Measuring Location	Insulation resistance	Megger
Main conductor to ground	500M Ohm or more	1000V
Control Circuit to ground	2M Ohm or more	500V
Between main circuit terminals with breaker OPEN	100M Ohm or more	

When insulation resistance between the main circuit terminals is low, clean vacuum interrupter surface by clean and dry lint free cloth and recheck

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