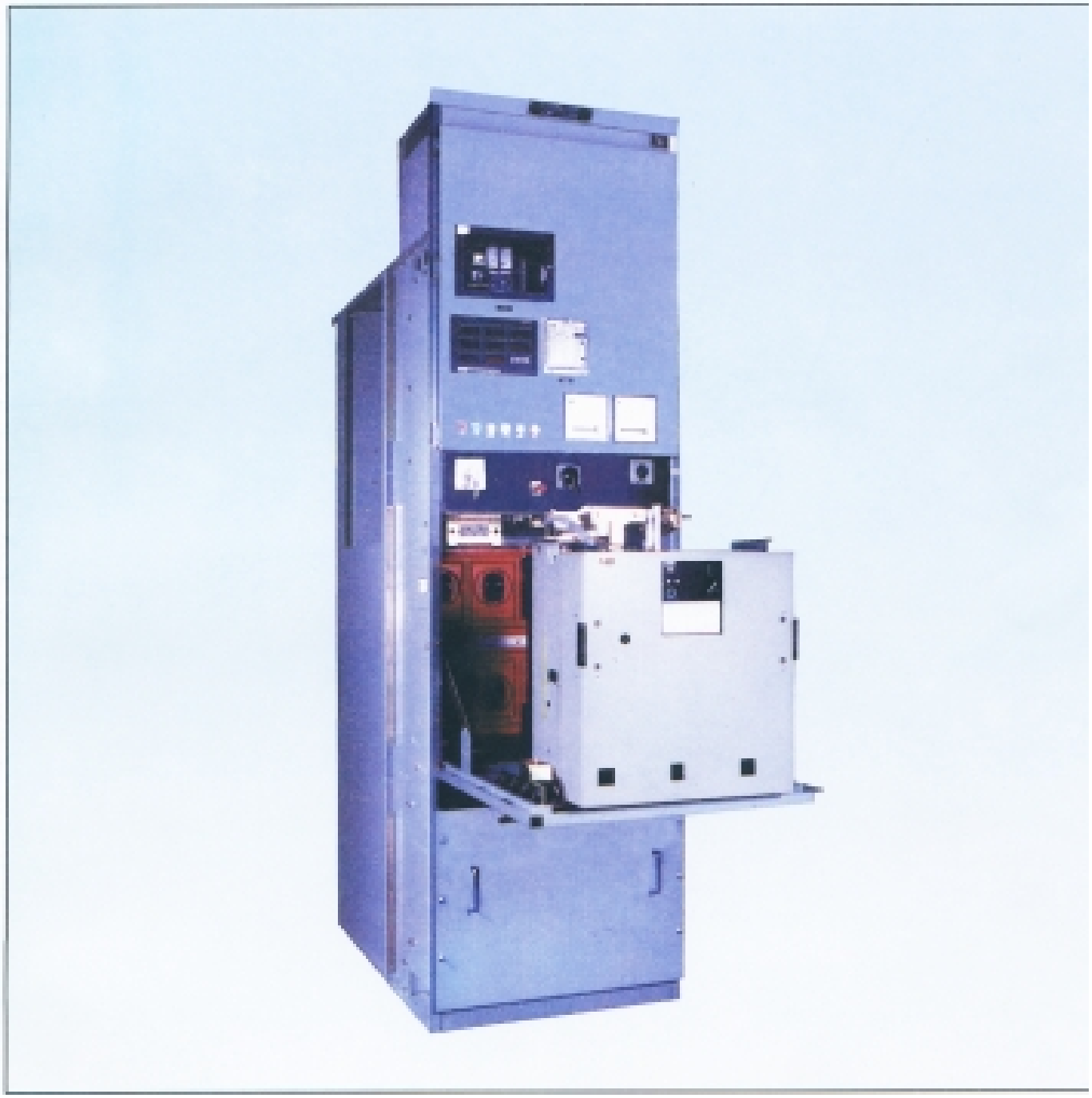
MV Air Insulated Indoor Switchgear

Model VHA 12S with HPA circuit breaker - 12 kV

Instruction for Installation, Service and Maintenance

1VDU22002-YN



Notice 1

Based on our own experience, you will obtain the best possible operational reliability from our equipment by following the recommendations given in these instructions.

The data contained herein purports solely to describe the product and is not a warranty of performance or characteristics. It is with the best interests of our customers in mind that we constantly strive to improve our products and keep them abreast of advances in technology. This may, however, lead to discrepancies between a product and this instruction.

Notice 2

Within the scope of these instruction, it is impossible to take into account every possible eventuality which may arise with technical equipment in service. Please consult our local agents in the event of any irregularities. Especially if not referred to herein.

Notice 3

We expressly decline liability for any damages resulting from any incorrect operation or wrong handling of our equipment, even if these instructions contain no specific indication in this respect. We lay particular stress on the fact that only genuine spare parts should be used for replacements.

Notice 4

Contents

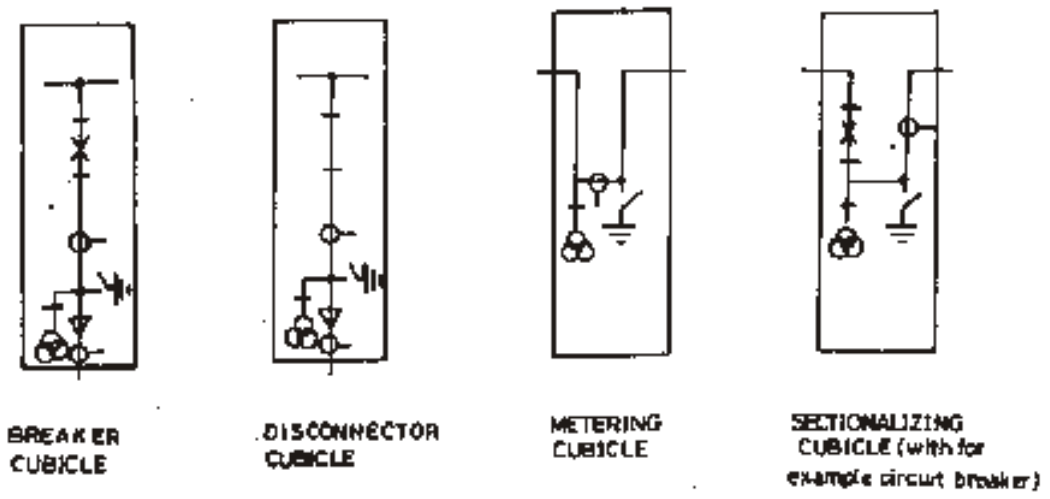
(B) SWITCHGEAR CUBICLE

1.0 *GENERAL DESCRIPTION*

ABB make Switchgear cubicles type VHA is a Switchgear divided into compartments and is meant for indoor use. The Switchgear is available in two voltage ratings, 12 and 24 kV. This documentation is valid for the rated currents up to 3150 A and short-circuit breaking currents up to 40kA.

The Switchgear manufacturing range includes the following cubicles :

* Breaker cubicle - with SF_6 breaker type HPA
* Disconnector cubicle - with disconnector.
* Metering cubicle - with metering transformers (P.T.)
* Sectionalising cubicle - with connecting apparatus. (Breaker or Disconnector)



(Fig 1)

Example of the types of cubicle available in the ABB'S VHA range.

The connecting apparatus have the following functions :

Circuit Breaker : can make carry and break load and short circuit currents

Disconnector : operated manually. It is only capable of carrying normal operating current. In the VHA Switchgear the disconnector is interlocked so that it can not be operated while it is carrying current.

1.1 *Standard*

The requirements following standards are met :
IEC 298, IEC 694 & IS 3427

Rated Voltage : 12 kV & 24 kV

Test Voltage : Impulse withstand voltage 75kV 1.2/50μS and 125kV, 1.2/50μS Power frequency voltage 28kV, 50Hz, 1min and 50kV, 50 HZ, 1min.

All voltage levels are valid to earth and between phases (max. 1000m over sea level).

Rated current : Busbar 630, 800, 1250, 1600, 2000,2500 & 3150 Breaker and Cubicle 630, 800, 1250, 1600, 2000, 2500 & 3150A. The above current values are valid at a degree of protection IP4x and max temperature rise according to IEC 298 / IEC 694.

Short time : 40kA for 1 second for rated current 1250A cubicle and rated current max 3 seconds for cubicles with higher rated current for 12kV 25kA for 3sec for 24 kC cubicles.

Rated dynamic withstand current : 100kA peak for 12kV and 62.5kA for 24 kV

Degree of protection : External IP 4X according to IEC 298. Internal IP 2X

1.2 *Receipt, Storage and Transport*

Each delivery is to be checked on receipt for

- completeness and correctness (check against order and delivery documents)
- any possible damage in transit and material losses.

1.2.1 *Receipt*

Any irregularity must be notified immediately to

- our representatives
- the last forwarding agent and the insurance company
- the responsible claims inspector with the insurance certificate, for the purpose of making out a damage or loss certificate.

1.2.2 *Storage*

Care is to be taken to ensure that the breaker is stored in an upright position and the available pressure gauge can be seen all times. Equipment must be stored indoors.

1.2.3 *Transport & Unloading*

The Switchgear cubicle is delivered packed in wooden case and covered with a plastic bag tied to the transport pallet and the connecting apparatus is inside the cubicle. The simplest method to unload the cubicle is with a forked lift truck. It is necessary to hoist the cubicle, there are 4 hoist fixing on top to lift it by refer fig.2.

Check that no damage has occurred during transportation.

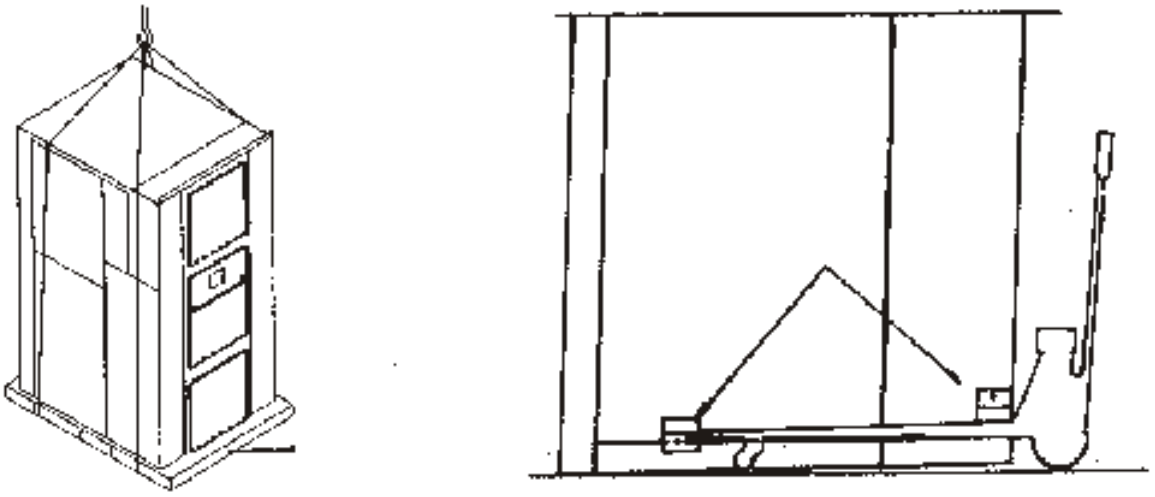


Fig 2
(Hoisting & Position of Pallet Truck)

1.2.4 *Unpacking*

Cubicle are delivered packed in wooden case and the cubicle is then fixed with bottom wooden palet by screws. At the time of unpacking, wooden planks of all the four sides and top are to be removed. ***Do not remove the bottom pallet.*** This pallet is to be removed after the cubicle is transported to its installation location. It is preferable to open packing case only after the foundation is ready in order to avoid damages.

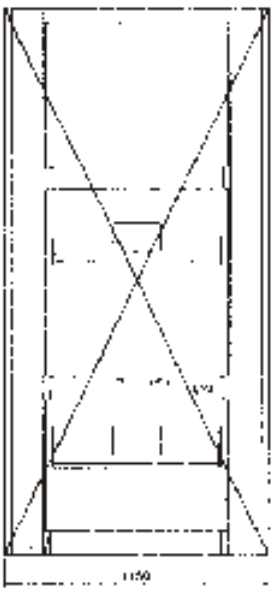


Fig 2A
(Front view)

1.2.5 *Check the cubicle for damages*

Before mounting the cubicle on the foundation frame, the cubicle should be checked for any damages. The cubicle frame should be checked for any twisting or bends due to improper handling. This will ensure leveled mounting of the cubicles. The crakes. Check the two diagonal distances of cubicle as shown in fig 2A to

1.2.6 *Transport within Switchgear room*

Cubicle within the room can be moved using overhead crane as shown in fig.2. Cubicle in the room can also be transported by rolling the pallet on the pipes. Cubicle can unloaded on foundation frame by pushing on frame and using pipes. Refer fig 2B for details.

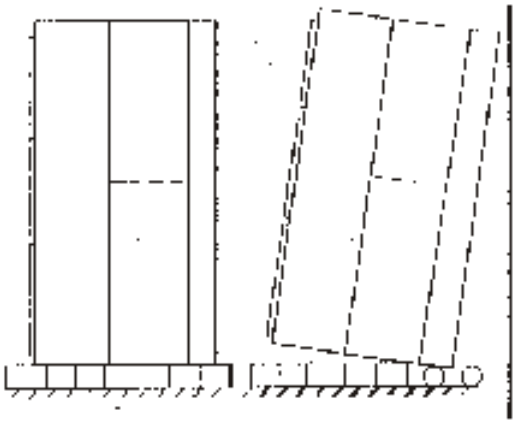


Fig 2B
(Unloading on foundation frame)

1.3 *Attention*

Please remove the steel bracket between Breaker and Panel provided at the left side top, which is provided for transport purpose. Then remove transport packing provided under the wheel bracket. To remove packing pads, rack the breaker in service position.

CAUTION
Do not rack the breaker into service unless the transport bracket is removed.

1.4 *Racking mechanism and interlocking system*

The connecting apparatus viz breaker or disconnector is fitted with wheels that move in profiles on each side of the cubicle. The breaker can be pulled out on the door until it reaches the stop. Instruction for removal of breaker see section 1.5 The racking mechanism has a selector device which prevents faulty operations.

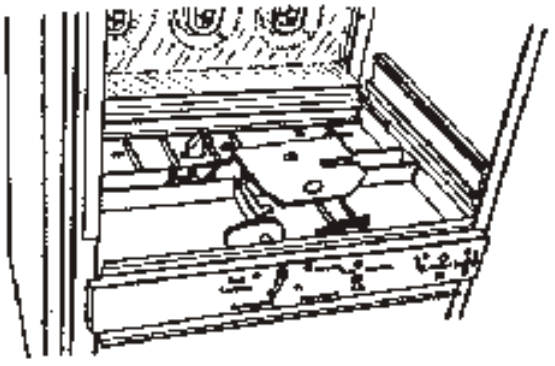


Fig 3
(Interlock system)

INTERLOCKING SYSTEM

SR. NO.	ITEM DESCRIPTION	PART NO.
01	HANDLE FIXING SCREWS M4 X 15	IN 2188 0001 - 3 IN 2121 2452 - 293
02	SHAFT	IN 2239 0002 - C
03	FRONT PLATE	IN 5283 0007 - AS
04	TORSION DISC	IN 2184 0001 - AP
05	RAIL PROFILE LEFT RAIL PROFILE RIGHT	IN 2179 0001 - 5 IN 2179 0001 - 6
06	CAM SHAFT	IN 2239 0002 - A
07	WHEEL	IN 2299 0001 - 1

It is therefore impossible to :

1 Move a breaker from service to test position or vice versa if it is in "closed" condition.

2 Close the breaker during truck transfer.

3 Move the breaker from test position to service position if the earthing switch is closed.

4 Close the earthing switch if the breaker is in "service" position or is being moved.

5 Move the breaker to service position from test position if the selector has had a faulty position when the breaker is racked in from the door.

6 Put the selector in position " Movement if the breaker is "closed" in service position.

7 Put the selector in "service" position if the breaker is not completely moved into that position.

1.5 Removal of Breaker

Below the circuit breaker door there is the mechanical racking mechanism.

On the left hand side of Racking mechanism is selector device which is used to put the mechanism in the correct operation mode.

Operate the selector handle and select appropriate position either test or service, before operating the racking mechanism. The racking mechanism can be operated by crank. (Supplied along with panel) to move the connecting breaker between 'test' and 'service' position.

On the extreme right is the device for operating the earthing switch. This device is operated with the same crank used for racking mechanism and it can be operated after the selector device has been moved to the EARTHING position. If the earthing switch has electric interlocking, then the catch to the right of the socket has to be released to insert the crank. If the catch cannot be released, it means that the interlocking magnet has blocked it (has not drawn). This due to the cubicle is then live and cannot be earthed before the feeding breaker (incoming) has been disconnected.

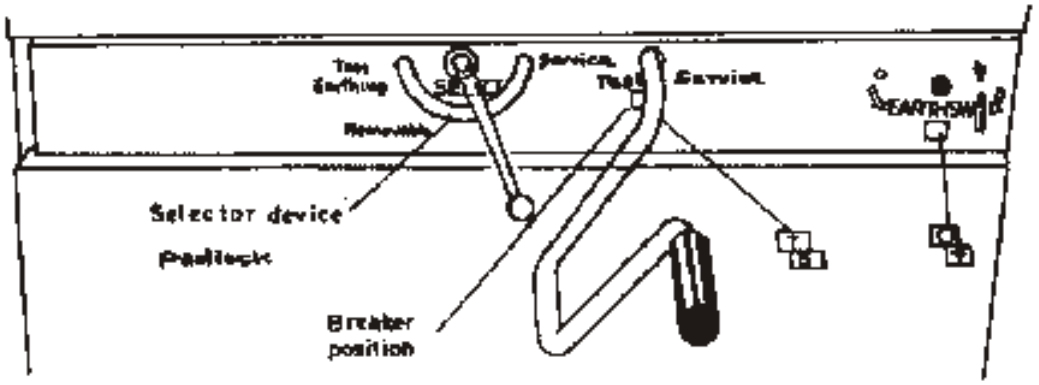


Fig 4A
(Breaker locked in test position
Locked against moving to service position)

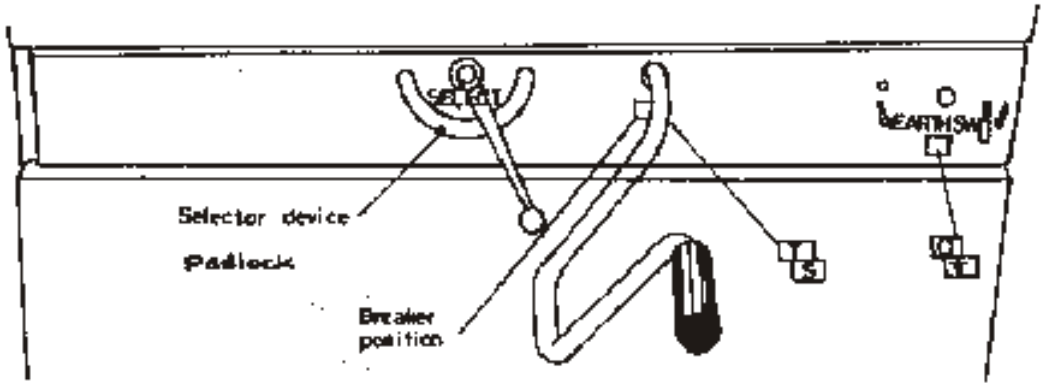


Fig 4B
(Earthing switch unable to operate
Breaker locked against moving to service position)

If, for example, the breaker is to be removed from the cubicle when it is in the closed position, it should be done in the following stages :

(1) Trip the breaker, because if the breaker is not tripped the selector cannot be operated.

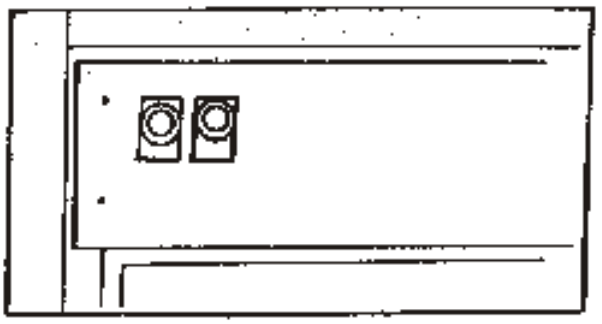


Fig 5
(Stage 1)

(2) Operated the selector device handle and turn from service to Moving Position

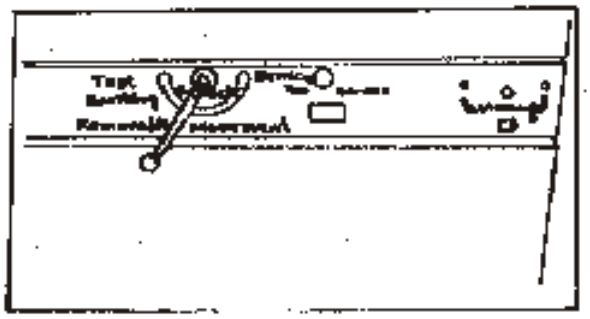


Fig 6
(Stage 2)

(3) Move the crank to the racking mechanism. Turn the crank anti-clockwise. The breaker is moved from Service position to the Test Position

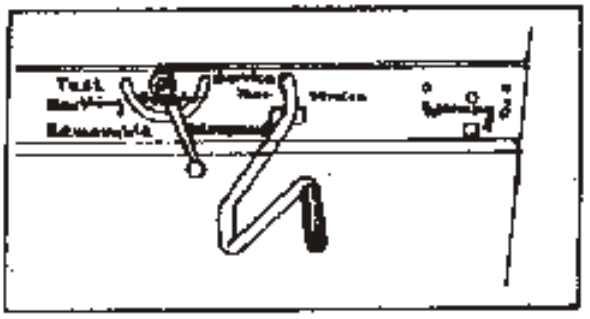


Fig 7
(Stage 3)

4 Operate the selector device with help of the handle. Turn to position "Removable". The breaker can now be pulled out on the folded down door. If the breaker is to be removed from the cubicle, see section 6 for details.

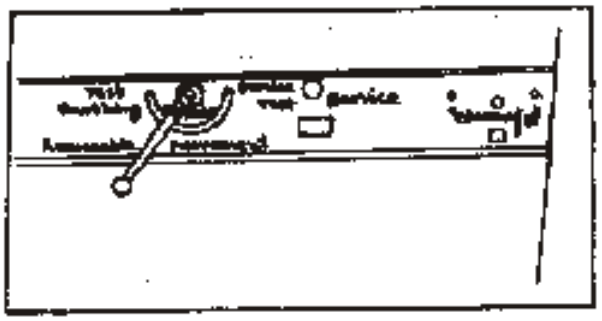


Fig 8
(Stage 4)

5 Test-Earthing position, this position of the selector device is used when the breaker is to be operated in test position. The breaker is disconnected from the busbar system. This position is also used when the cubicle is to be temporarily earthed. If back voltage is to be detected in the cubicle, it should be fitted with an interlocking magnet. When the selector device is in position "Testing" earthing the earthing switch can be turned to earthing position (?), the cubicle is now temporarily earthed. Note the low voltage circuits are not affected.

6 Prepare the lifting trolley for the breaker. Crank up the lifting bracket so that the lifting breakers are connected to the lifting pins on the breaker. Engage the pins and crank up the lifting bracket further so that the breaker can be removed.

➤ ➤ ➤ ➤ ➤ ➤ ➤ ➤

2.0 Circuit Breaker

2.1 Data

★ Rated voltage	kV	12	24
★ Rated breaking current	kA	40	25
★ Rated making current (peak)	kA	100	62.5
★ Short time rated current, 1 sec	kA	40	25
★ SF_6-pressure, (over pressure)	bar	2.5	2.5
★ Electrical endurance, (number of interrupting at rated breaking current)	No	6	25
★ Mechanical endurance (Number of interruptions at rated current)	No	10000	10000

With maintenance as detailed in this manual.

2.2 Construction and Function

The circuit breaker type HPA breaker of puffer type.

2.2.1 Breaker poles

The breaker pole contains SF_6 gas (sulphur hexafluoride). This gas in many respects is one of the best media for circuit breakers. It has been in use for several decades and its excellent performance is demonstrated by experience.

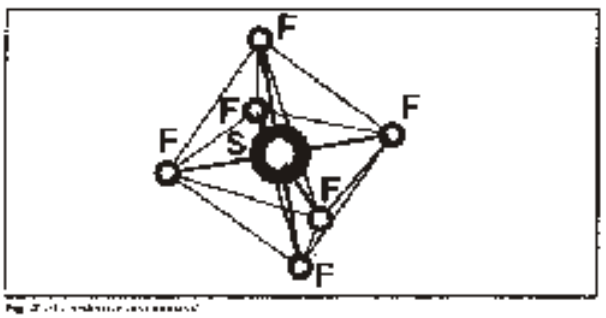
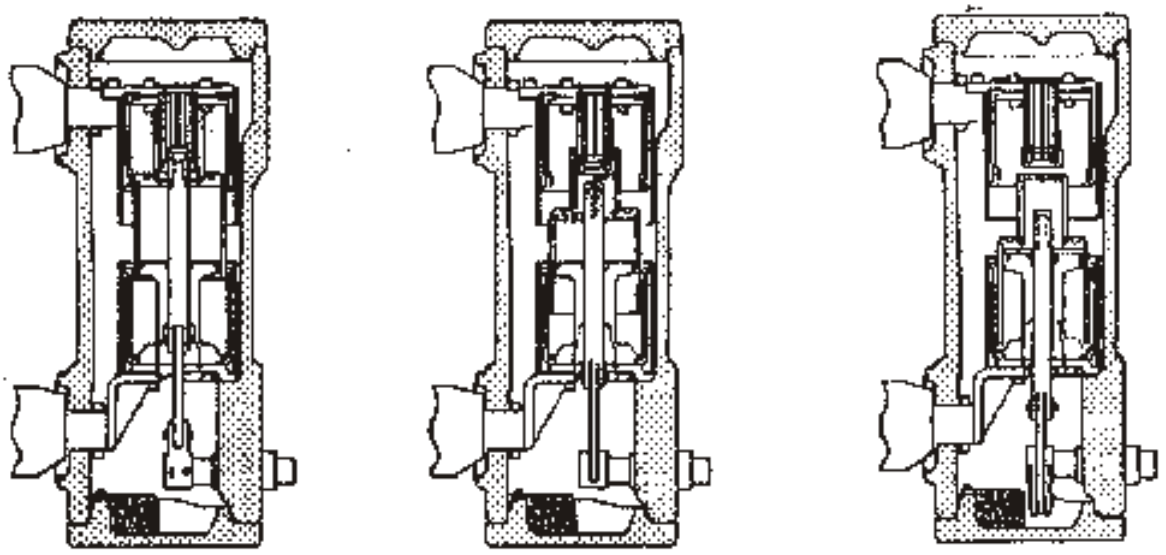


Fig 9
(Structure of SF_6 - molecule)

The main characteristics of the SF_6 gas are :

- ★ The gas is neither combustible nor toxic.
- ★ It is chemically stable and will not age with time
- ★ Breaking capacity of SF_6 gas is high even at relatively low pressure, because of its superior dielectric and thermal properties.
- ★ The interruption in SF_6 gas is not forced and thus no overvoltages are generated. No damping resistor or surge arrester is needed, not even when controlling small motors.
- ★ The dielectric strength at the relevant pressure is about 3 times higher than air and is roughly on par with oil.
- ★ Any leakage is easily detected. To provide an extra margin of safety, the breaker is capable of interrupting its rated current at rated voltage even at atmospheric pressure.

The SF_6 breaker type HPA operates on what is usually referred to as the puffer principle. This involves compressing the gas between a static piston and a movable cylinder during the interruption action. The compressed gas is then blown through a nozzle in which the arc is taking place A combination of careful attention to design and the use of proven components has meant that arcing times in the new HPA breaker have been reduced to a minimum. As a result, the new breaker contacts will normally not need replacement during the service life of the breaker. The breaker pole operation is shown in fig. 10.



Breaker unit in closed position

Breaker unit during opening

Breaker unit in open position

Fig 10
(The puffer principle)

During manufacture of the breaker pole it is dried internally through vacuum pumping. The breaker pole is then to pressurised and also tested against leaks. Inside the pole there is an absorption medium for the decomposition products of the gas. The breaker poles should only be opened up by trained service personnel at the manufacturing factory. The locking screws are tightened up to a predetermined torque at the factory and must not be opened. If it is assumed that moisture has entered (gas pressure = atmospheric 0) the pole, the same should be returned to the factory for repair.

SF_6 gas which has been exposed to arcs contain components which combined with moisture become corrosive. Filling up of gas should always be carried out according to section 2.3.2 "Checking and refilling of SF_6 gas".

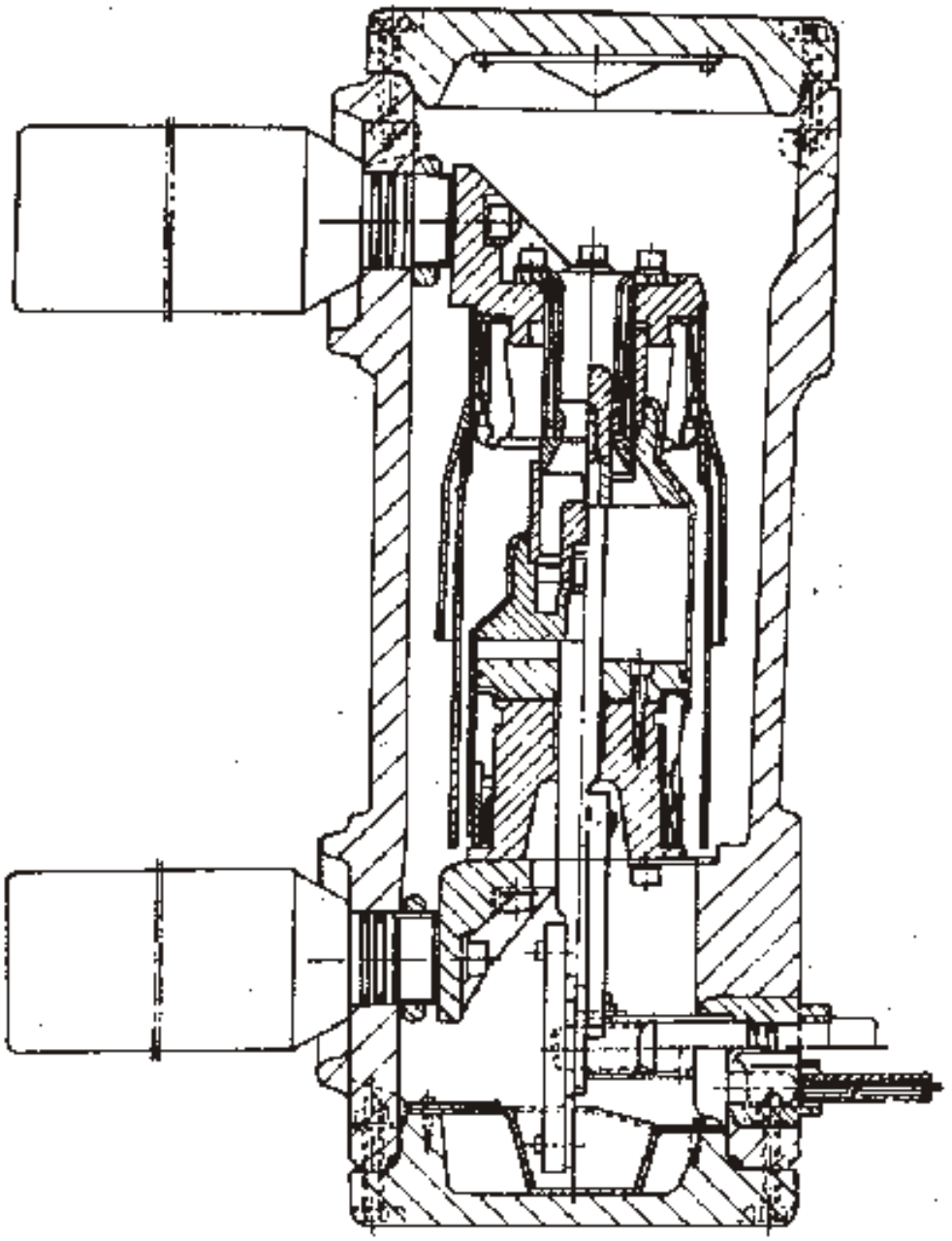


Fig 11
(HPA Breaker pole)

2.2.2 *Operating Mechanism*

The operating mechanism has a spring charging device which can be operated by motor or by hand. Once a closing command has been given it is always completed by the breaker; this is important in the event of a short circuit. Since the circuit-breaker closes completely before it opens, the correct contact speed and full breaking capacity are obtained. The operating device has compression springs for closing and opening. The openings spring is charged automatically when the breaker is closed. A closed breaker with charged closing springs can be operated open-close open without intermediate motor or manual charging and the breaker can therefore be used for auto re-closing. Charging of the closing spring can be discharged by disconnecting the voltage to the motor and manually operate the breaker close-open.

An indication show whether the closing spring are charged or not and the number of opening operations are recorded on a counter.

The motor can be supplied via a station battery, a network or via a voltage transformer with a limit load of at least 300 VA. The motor starts after each closing operation and charges the closing springs within 9 seconds. The breaker is fitted with a knob for mechanical openings and with magnetic coils for closing and openings. The same operating mechanism is used for all types of HPA breaker.

The construction if the operating mechanism is shown in figure 10. The device has two shafts. The lower shaft (6) is connected to the breaker poles via links and is directly actuated by the openings springs (5). The upper shaft (3) is connected directly to the closing spring (11). These two shafts are linked via the driving disc (9) and the link (12), and by the trip free device (14). The upper shaft is also connected to the charging device via the trip-free device (1) and the link (4).

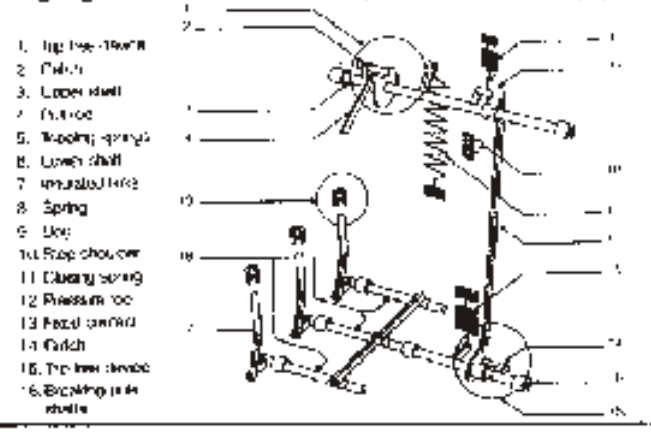


Fig 12
(Principle diagram of Circuit Breaker)

The latching & trip free devices (1) and (14) are of the same type that have been used in ABB equipment since 1950 and have proven extremely reliable.

The motor operated unit consists of a toothed transmission gear with an eccentrically driven tooth wheel as a last step. The operating device also contains auxiliary contacts and trip coils.

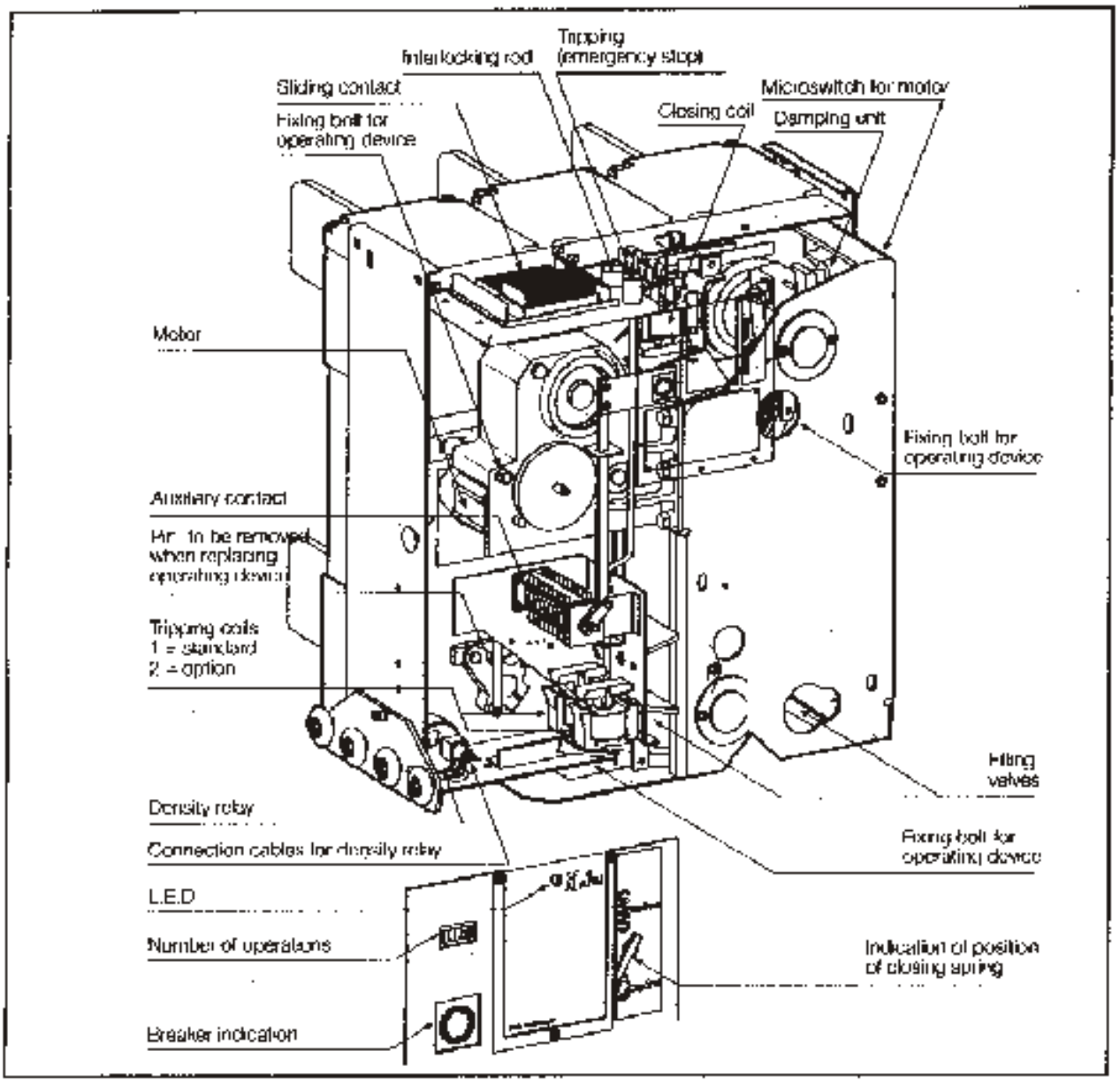


Fig 13
(Circuit Breaker)

SPRING MECHANISM

SR. NO.	ITEM DESCRIPTION	PART NO.
1 & 2	Trip Free Device Top	IN 5436 0001 - A
3	Upper Shaft Assly.	IN 5439 0002 - D
4	Link or Pull Rod	IN 2104 00101 - AK
5	Opening Spring	IN 2192 0002 - D
6	Bottom Shaft Assly.	IN 5439 0002 - B
7	Insulating Links	Will not be supplied Loose
8	Spring	IN 2192 0001 - 21
9	Driver	IN 2164 0002 - 34
10	A) Stopper or M16 X 50 Hex Socket Head Grub Screw	IN 2122 2768 - 50
	B) M16 Nut	IN 2126 2768 - 124
	C) M16 Spring Washer	IN 2154 2022 - 9
11	Closing Spring	IN 2192 0002 - B
12	Link	IN 2194 0001 - AE
13	Contact	Will Not be supplied Loose
14 & 15	Trip Free Device (Bottom)	IN 5436 0001 - B

OPERATING MECHANISM

SR. NO.	ITEM DESCRIPTION	PART NO.
1	Closing coil	IN 5274 0001 - A*
2	Closing damping Device	IN 5256 0711 - 4
3	Micro Switch	IN 5445 0744 - A
4	Fixing bolts for Operating Device Tripping coil	IN 5274 0001 - A*
5	Short Cover	IN 5428 0002 - 2 @
6	'O' Ring	IN 2152 2018 - 10 @
7	Density Switch	IN 5663 0162 - 1
8	Auxiliary Contact	IN 5218 0004 - 1
9	Motor	IN 4461 0002 - E*
10	Indicating Plate Assly.	IN 5428 0001 - M
11	Counter	IN 5692 0501 - 2

*Please Specify Voltage.
@ If density Switch is used, short cover will be supplied in place of refilling vent.

Operating Mechanism Working Principle :

Fig.14A shows the operating device with the breaker in the open position. The closing spring (11) is charged If the latch (2) is tripped, the upper shaft is released, its turning is transmitted via link (12) to the breaker pole shafts (6)

In figure 14B the breaker has closed and at the same time the opening spring (5) has been charged Driving disc (9) comes to rest against stop (10) which, via link (12) and trip-free device (14) also prevents the opening spring turning the breaker pole shaft. (6) Now the charging device starts and link (4) moves upwards until latch (2) is engaged. At this point link (4) turns and begins to move downwards, whereupon the upper shaft turns and retentions. The closing spring position is reached according to fig.14C.

During the breaker opening, latch (14) is released, thus releasing the lower shaft which via the insulating links (7), actuates the moving contact of the breaker poles, for interruption. The spring (8) returns the link (12) with the associated driving pin and the operating device to the position in fig.14A

For rapid re-closing the associated switchgear cubicles can be fitted with suitable relay equipment. The HPA can be fitted with two opening coils, one closing coils.

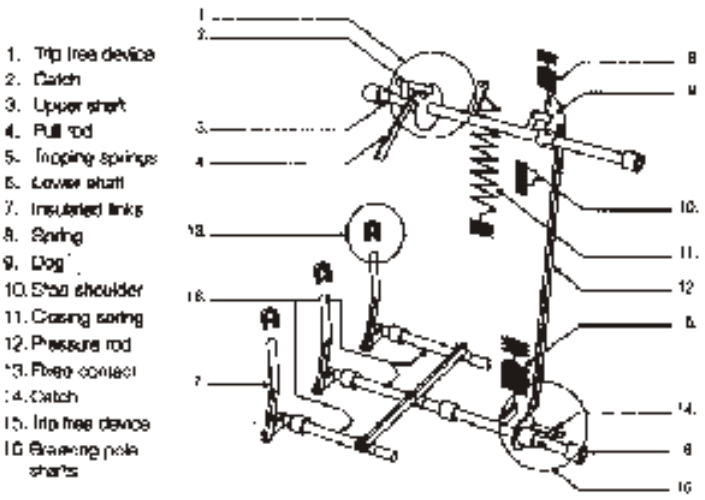


Fig 14A

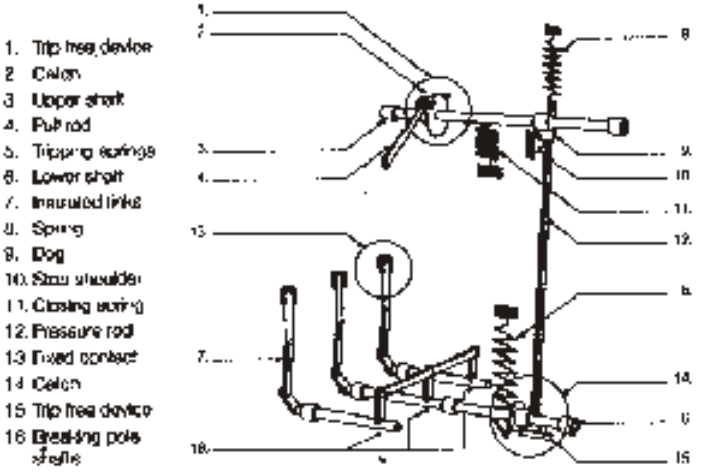


Fig 14B

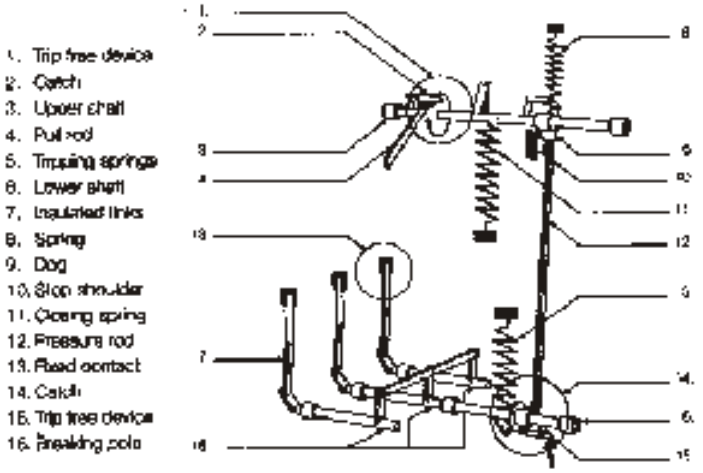


Fig 14C

2.3 *Maintenance*

2.3.1 *Maintenance Schedule (As per Drg. iVYN400290-005)*

Sr. No.	Description	Before Start up	Interval of 6 Months	Interval of 5 years	Every 1000 Operation
01	CHECKING OF OPERATING MECHANISM.				
1.1	Checking of fastener tightness Fig.15A Item B,H,L,&M.	✓	✓	—	✓
1.2	Checking of shock absorbers for leakage or stuck-up. Fig.15A item F&G.	✓	✓	—	✓
1.3	Checking of top & bottom trip free mechanism, cap & coupling Fig.15A, Item J&K.	✓	✓	—	✓
1.4	Closing & Tripping spring assembly & split pin (N) on them (Fig.15A).	—	—	—	✓
1.5	Bearing item (P) Fig.15A	—	—	—	✓
1.6	Checking of setting *Coupling & knife catch gap (Setting 1, Fig.15B * Bottom TFM & CAP gap (setting2, Fig.15A) Both gaps should be between 1-2mm)	✓	✓	—	✓
1.7	Spring cut off micro switches.	✓	✓	—	✓
02	OVERHAUL AND LUBRICATION OF CHARGING DEVICE AND OPERATING GEAR.	—	—	✓	—
03	GAS PRESSURE CHECK.	✓	✓	✓	✓

NOTE :

1) Complete overhaul of circuit breaker with replacement of poles to be done after 10,000 operations.

2) Ask ABB for details of overhaul procedure.

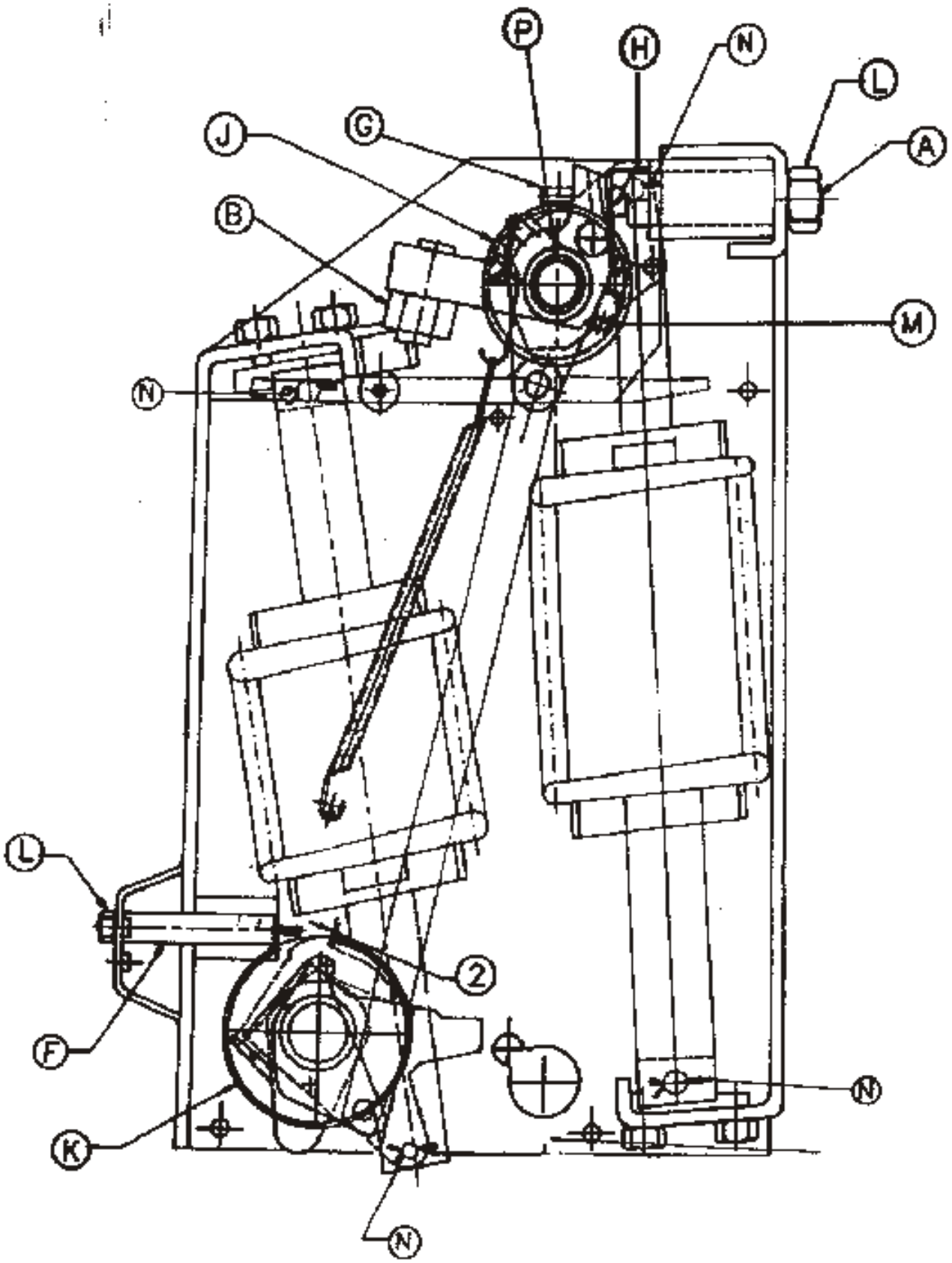


Fig 15A

Maintenance schedule for frequently operated breaker type HPA (1VYN400290-005)

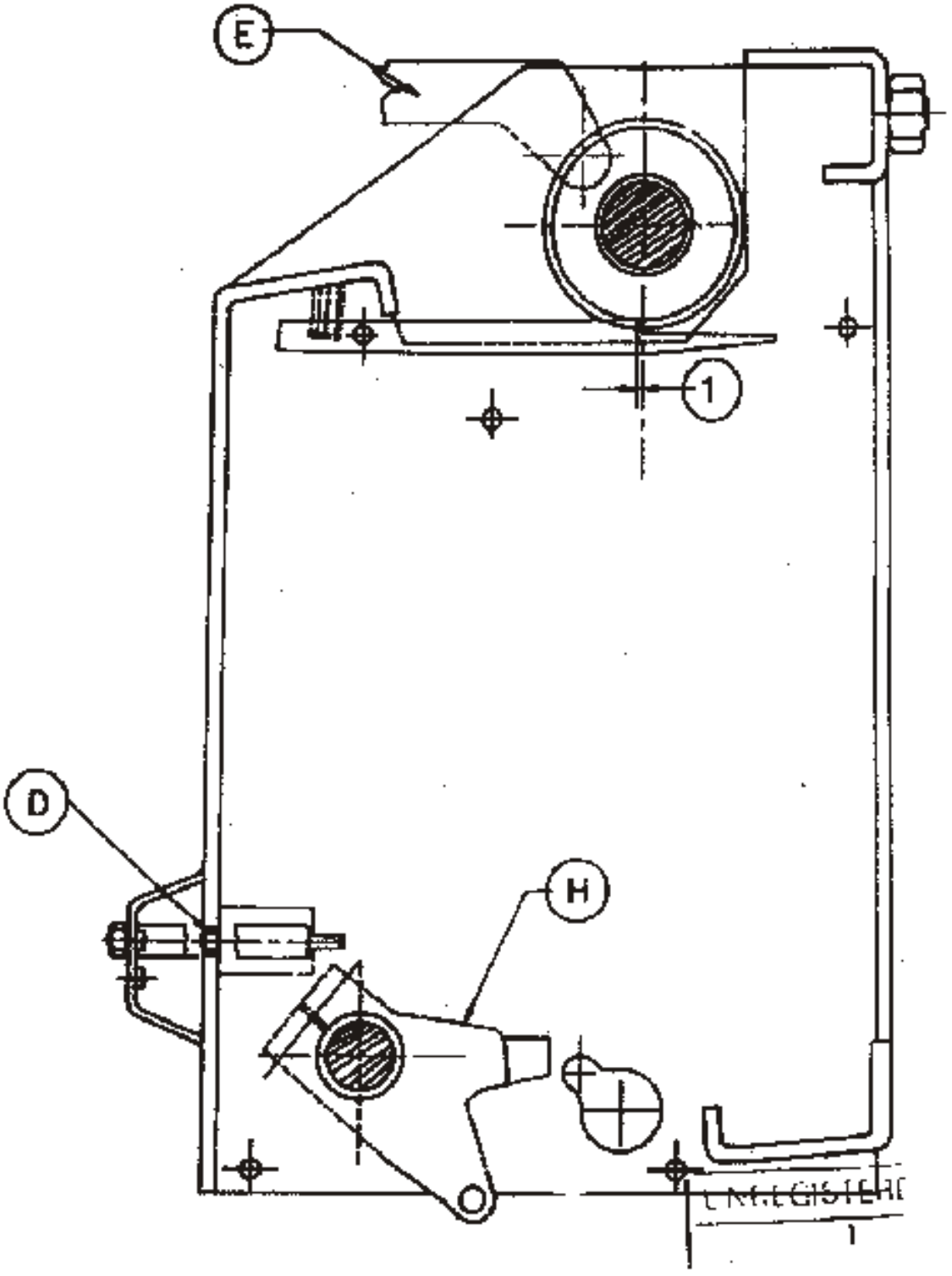
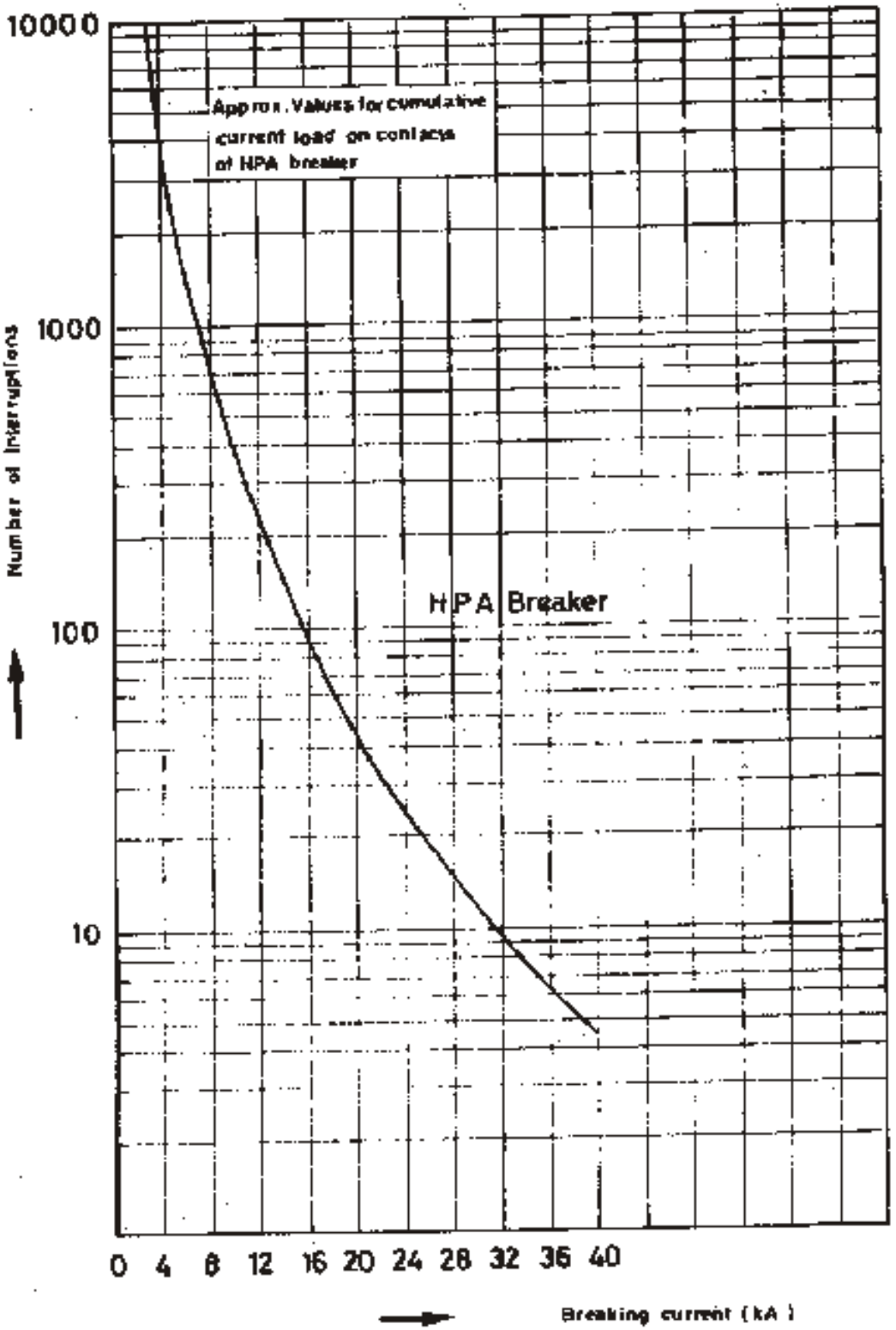


Fig 15B

Maintenances schedule for frequently operated breaker type HPA (1VYN400290-005)



Electrical endurance (HPA)

2.3.2 *Checking and refilling of SF_6 Gas*

Checking and refilling can be done with the front plate fixed. Refilling not be carried out with the breaker in service position. The gas pressure should be between 3 and 3.5 bar absolute, in other words 2 and 2.5 bar over pressure at 20°C. Lower currents than 25kA can still be in broken at lower pressure. Rated current can be interrupters at atmospheric pressure provided that there is SF_6 gas in the breaker pole, which is certainly valid if there is little over pressure.

At temperature others that 20°C of the gas the pressure (abs) must be according to the table below.

Pressure at at 20°C abs	Corresponding pressure in bars at various temperatures				
bar	0°C	10°C	20°C	30°C	40°C
0.5	0.47	0.48	0.50	0.52	0.54
1.0	0.93	0.97	1.00	1.03	1.06
1.5	1.4	1.45	1.50	1.55	1.6
2.00	1.36	1.93	2.00	2.07	2.14
2.50	2.33	2.41	2.50	2.59	2.68
3.00	2.80	2.90	3.00	3.10	3.2
3.50	3.26	3.42	3.50	3.62	3.74

The HPA-breaker can be fitted with a density gauge with an alarm contact and indicator. The green area of the indicator shows the correct pressure, the yellow area indicates enough pressure for breaking, and when the indicator shows red the pole has to be refilled with SF6 gas. If the breaker is not supplied with density gauge the pressure is measured manually with a special instrument. The measurements should take place at three intervals. The HPA Circuit Breaker can also be fitted with pressure switches.

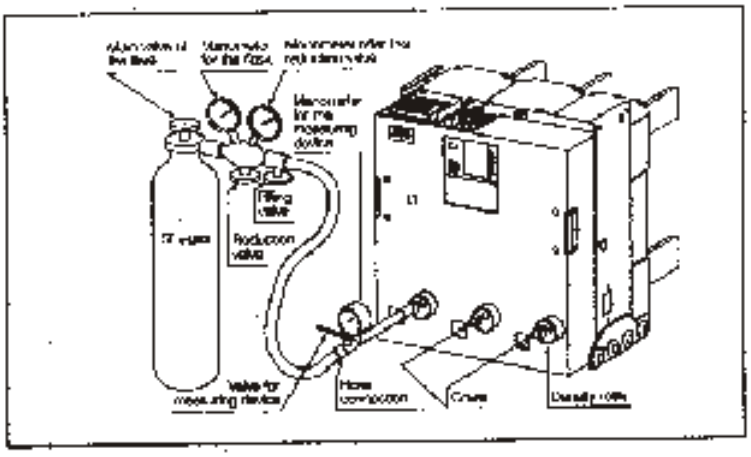


Fig 16
Connection for filling of breaker with SF_6 gas

Checking and refilling of SF_6 gas is carried out according to the following instruction. Equipment according to figure 16 is needed.

Sr. No.	ITEM DESCRIPTION	PART NO.
1	Gas cylinder S 194-5600-103-17	Supplied in 10kg or 25kg cylinder.
2	Regulator a) cylinder pressure gauge b) outlet pressure gauge c) reducing valve	IN 6821.0001 - 1
3	Pressure House	IN 2515 0001 - 1
4	Gas Filling Valve 'OR' Snap Connection	IN 2529 0001 - 7
5	Connecting Nipple	IN 2529 0001 - 8 IN 2529 0001 - 9 IN 2529 0001 - 5
6	Refilling Unit with Density Switch ..... without Density Switch..... with pressure Switch.....	IN 5428 0001 - 5 IN 5428 0001 - 6 1VYN 400 201-AY

2.3.3 Control of gas pressure (only for poles without pressure gauge)

1. Close metering pressure valve.
2. Connect metering pressure gauge to pole.
3. Read pressure,compensation for temperature are shown on page 24. If reading is between 2.0 and 2.5 disconnect gauge
4. Disconnect the operating device by Disconnecting the voltage to the motor and operate by hand "close" and "open".
5. Close cylinder reducer valve.
6. Close charging valve.
7. Open cylinder main valve, and note reading on gauge (should show approx 70 bar for full cylinder).
8. Open the reducer valve until a reading of 2.5 bar pressure is registered. (If the reading is too high, close reducer valve and release gas by opening charging valve with hose disconnected).
9. Open charging valve a little so that the gas leaks a little, thereby emptying hose of any air.
10. With the use of the snap connection, connect the hose to the metering tube.
11. Open the metering pressure valve.

12 Open the charging valve until a reading of 2.5 bar (20°C) is registered on the metering gauge.

13 Close cylinder main valve

14 Close both charging and metering valves

15 Loosen the snap connection.

***Note** : The hose contains gas at a pressure of 2.5 bar and this will blow out.*

16 Loosen the metering unit until gas begins to escape, then disconnect immediately the metering unit so that the back pressure valve in the pole automatically closes.

17 Disconnect metering unit

18 Check the O-ring of the covers, if they are dry exchange with new ones which have been greased with ABB grease IN 11714014-49.

***Note** : Mineral grease must not be used on EPDMO - rings). Replace the cover on the connection nipple.*

2.3.4 Checking of operating speed & time

Checking of operating speed can be made with a capacitive sensor. The sensor is connected to a conventional oscilloscope. The curve shown in figure 16 shows what values should be obtained on the oscilloscope.

Closing speed (a/10)	2.0 - 2.5 mtrs./sec.
Opening speed (b/10)	3.6 - 4.3 mtrs./sec.
Closing time with nominal voltage max	75 ms
Opening time with nominal voltage	36 - 45 ms
Contact travel	62 - 66 mm

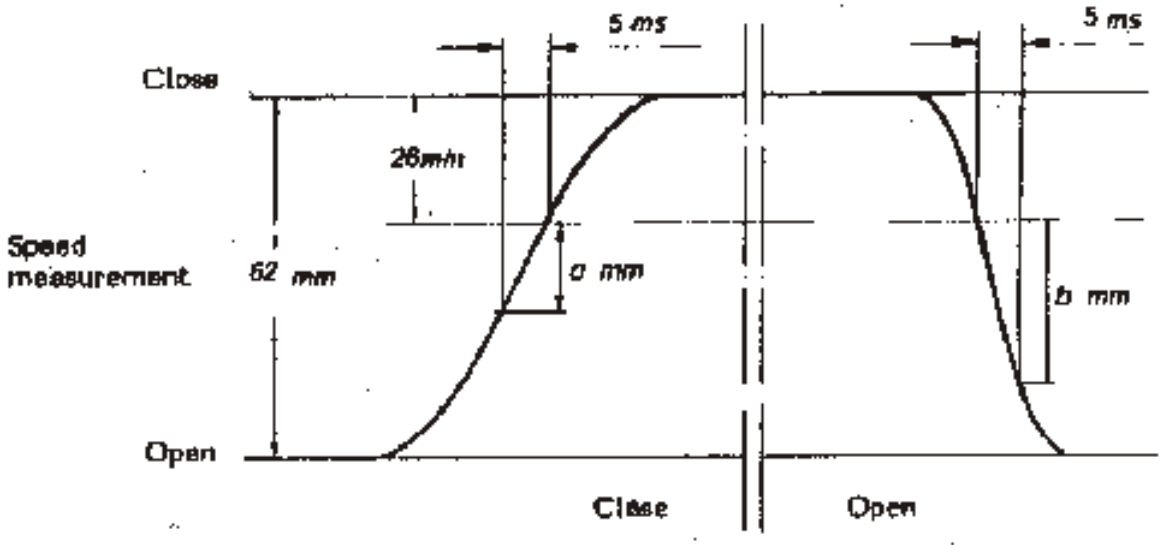


Fig 17
Travel diagram

Functional check is carried out as follows :

1) Connect the sensor to the connecting link of the poles, see figure 16.
2) Check with the aid of vernier callipers that the movement from open to closed positions is 81 - 85 mm
3) Adjust the oscilloscopes input to 85mm, see figure 17.
4) Make an opening operation. The curve on the oscilloscope should be as shown in figure 17.
5) Make a closing operation. Assess the curve shown.
6) If the speeds are not correct the spring force is to be adjusted. See section 2.4.9 "Adjustment of operating device".

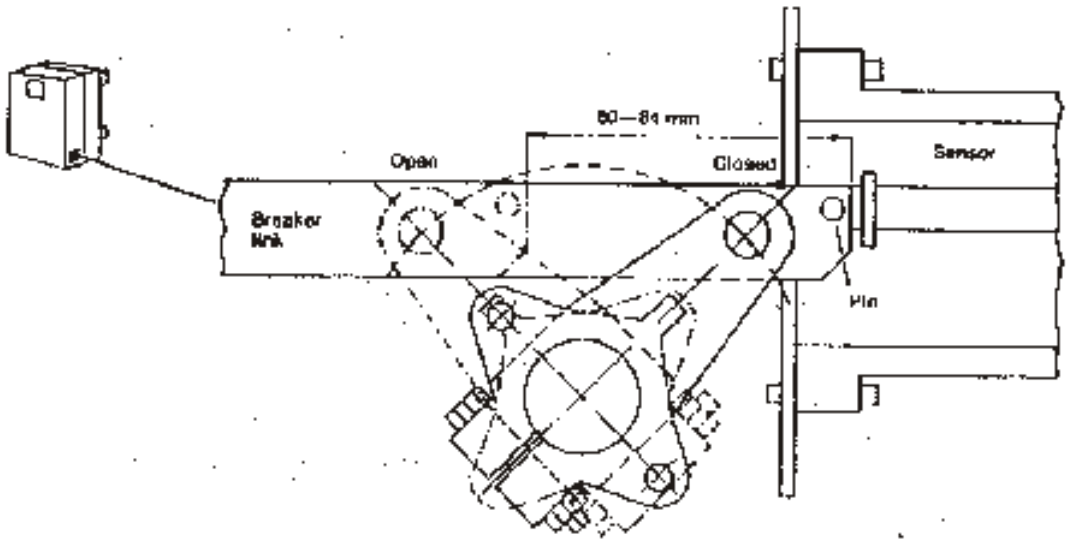


Fig 18
Connection of capasitive sancer

2.4 *Service Instructions*

Safety Instructions - For dismantling and servicing of breakers the following steps should be followed :

1) Disconnect the breaker.
2) Pull out the breaker on the door.
3) Manually release the closing springs.
4) Manually released the opening springs.

2.4.1 *Fault Finding Chart*

FAULT	*CAUSE*	*REMEDY*
Spring will not charge	Motor has wrong or no operating voltage	Measure voltage on the motor leads
	Motor shaft broken	Change motor
	Motor gear damage	Change motor
	The latch for the tripping tripping device does not function	Check mechanism NOTE : Read safety instructtion in paragraph 2.3 before taking action!
	Disconnection in the wires	Check by measuring
Closing of breaker does not take place although there is an indication that the the springs are tencioned	Operating coil does not pull	Measure the voltage adjust the coils adjustment screw. Check the breaker springs.
Breaker closes then opens again	The toggle joint of the mechanism are incorrectly adjusted	Adjusts the toggle joint
	Main circuit is wrong	Find fault and adjust
	Wrongly adjusted clearance of opening magnets armature	Adjust
Breaker continuously opens and closes	Anti-pumping relay wrong	Change relay
Breaker will not close completely	Micro-switch arm wrongly adjusted	Find fault and adjust
	Under-voltage relay released	Find fault and adjust

2.4.2 *Replacement of operating coils*

For positioning of operating coils, see figure 19A & 19B. The coil is fixed with 4 screws.

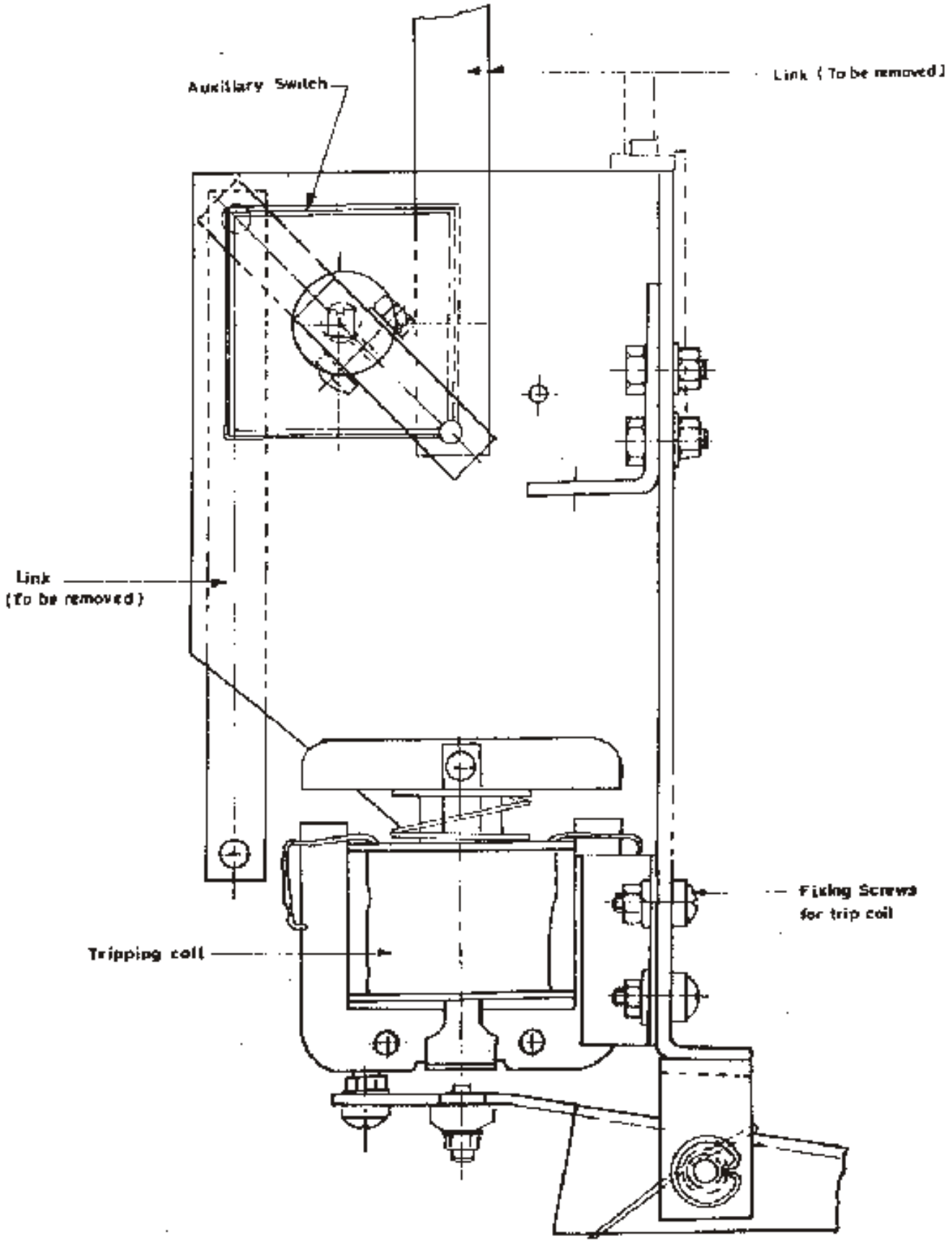


Fig 19A
Replacement of trip coil & auxiliary switch

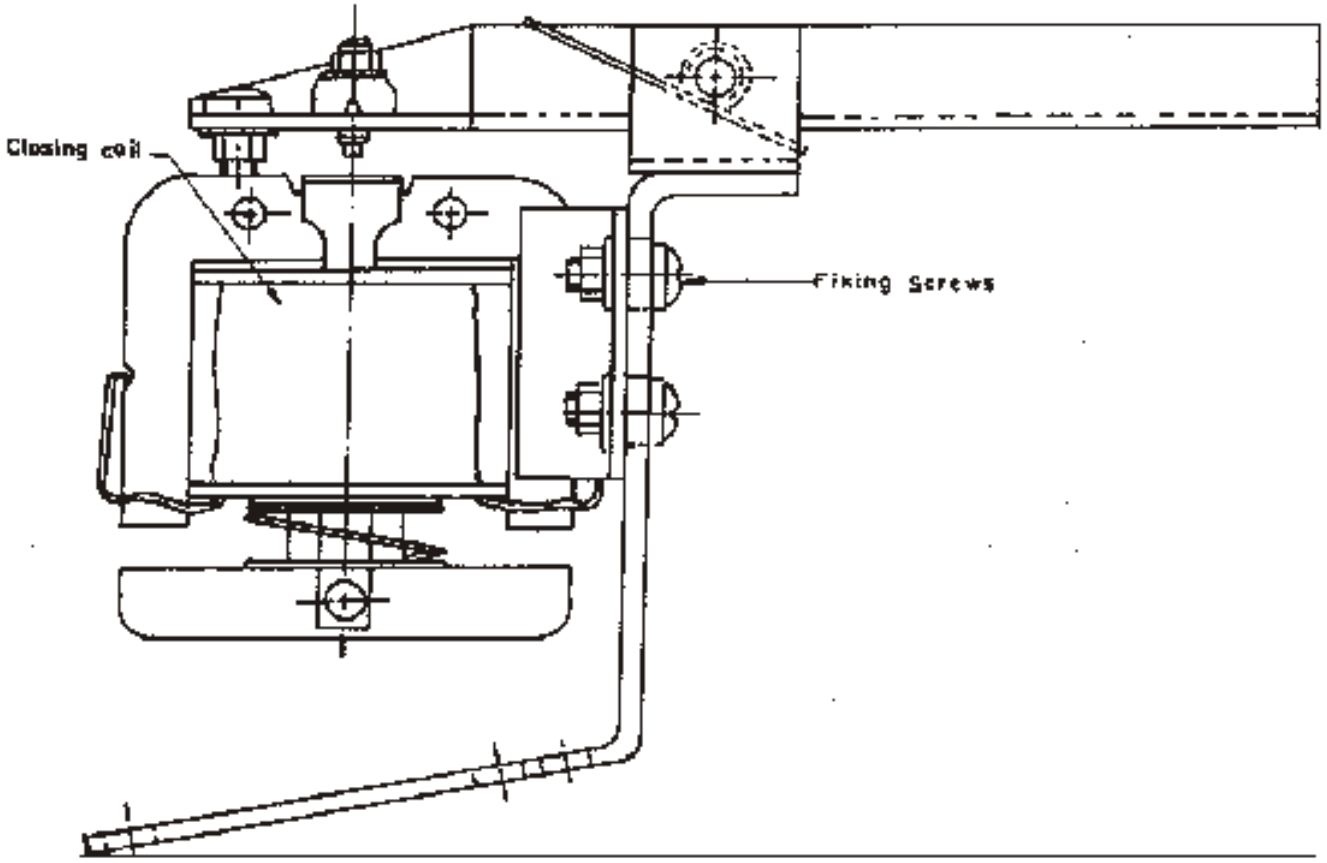


Fig 19B
Replacement of closing coil

2.4.3 *Replacement of Micro-Switch*

For positioning of Micro-switches, see fig.20. The switches is fixed with 2 screws.

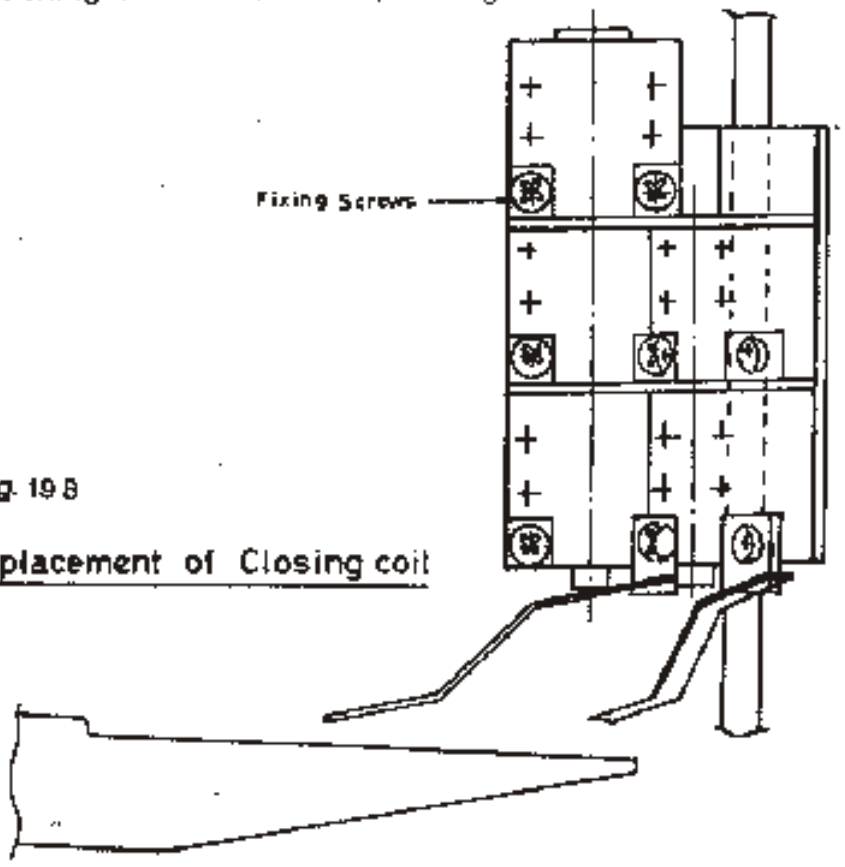


Fig. 19 B

Replacement of Closing coil

Fig 20
Replacement of Micro-switch

2.4.4 *Replacement of Auxiliary Contacts*

Positioning of auxiliary contacts, see figure 13. The contacts are fixed with 4 screws. Remove the 2 links as shown in the figure 19A Disconnecting cable (note marking before removing switch & connect in same position)

2.4.5 *Replacement of Motor*

Motor is fixed with 4 screws. There are flat terminals for cables. See figure 21.

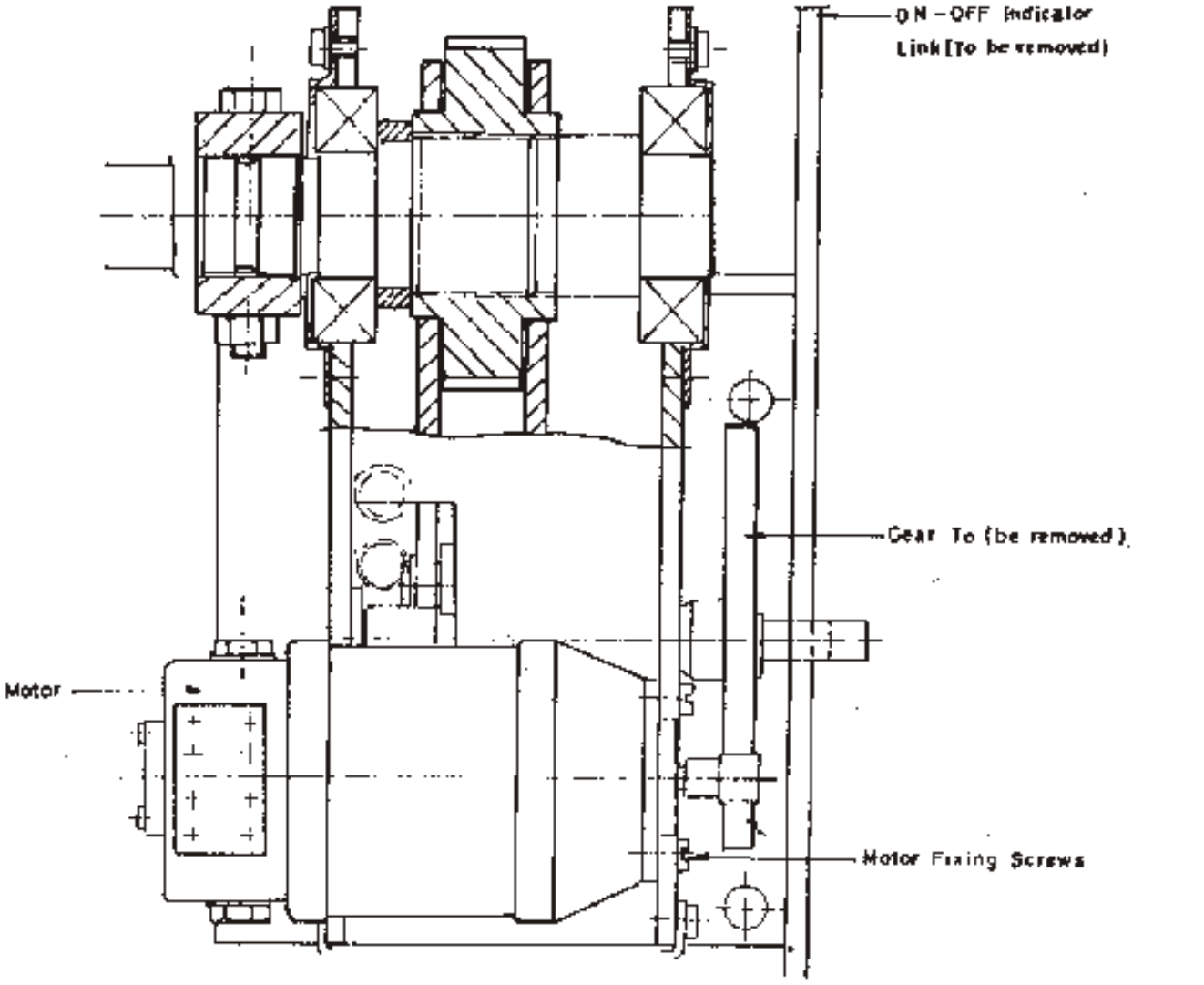


Fig 21
Replacement of motor

2.4.6 *Replacement of Damping Device*

When replacing the damping device, the closing spring must be charged. For this work the release mechanism for the spring unit must be secured, see figure 22. Securing the device can be achieved with a G-clamp.

Note : for extra security both the opening and the closing springs must be fastened On one side of the damping deice there is an adjustment screw. The position of this screw should not be altered.

Reasons for changing the damping device can be oil leaks normally the device does not need maintenance. Repair of the device must not be carried out. Never operate the breaker without the damping device as damage to the breaker can occur.

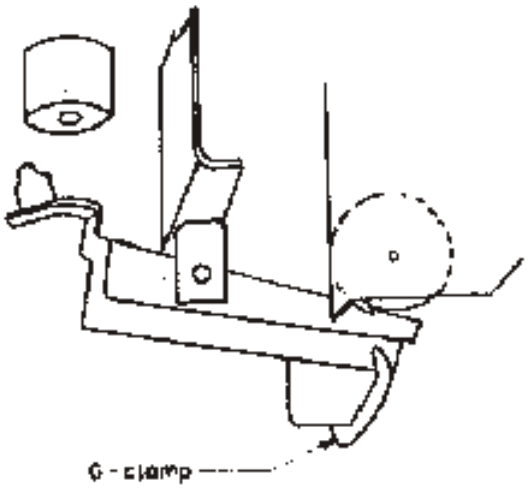


Fig 22

Locking of the release mechnism for spring

Changing of damping device is carried out as follows :

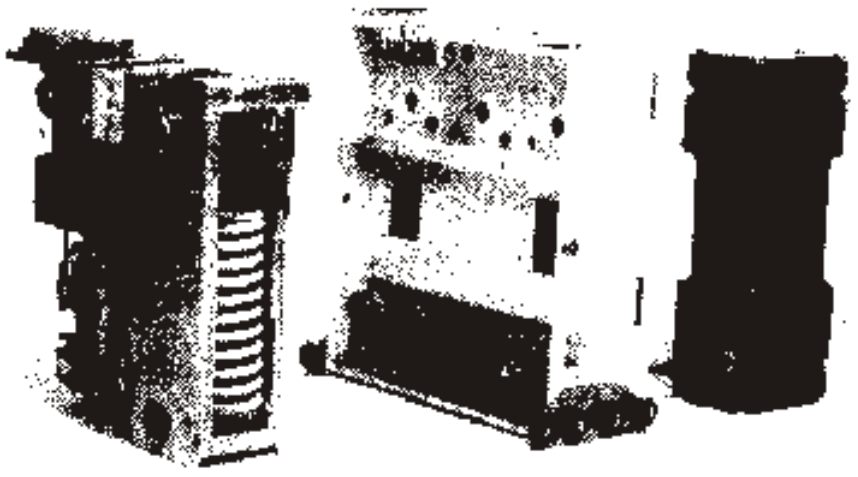
1. Move the breaker out onto the door.
2. Close the breaker if the damping device is to be changed.
3. Lock and secure the release mechanism according to figure 22. Be extremely careful that hands are kept clear of the mechanism and the springs in case of release.
4. Loosen the devices safety nuts. Withdraw the device from the plate. (No other units need to be loosened. If other units are loosened, there is a risk of the springs being released. The lower part of the device is pulled out through a hole in the plate).
5. Insert the new damping device. Adjust it so that at the "ON" position, the step of the shaft of damping device shall be in line with the damping device housing.
6. Tighten the safety nuts.
7. Loosen the locking for the release mechanism

2.4.7 Replacement of Operating Mechanism

1. Remove the breaker from the cubicle and keep it on a suitable foundation.
2. Loosen the operating devices cover, see figure 11. Lift off cover.
3. Loosen the sliding contacts screws, pin, connecting cables and the 4 screws, see fig.13.
4. Completely withdraw the operating device.

CHANGING OF BREAKER POLE

SR. NO.	ITEM DESCRIPTION	PART NO.
1	Sliding Contact Screws	IN 2121 2016 - 408
2	Operating Mechanism	IN 5432 0001 - F
3	Fixing Screw of Operating Arm	IN 2121 2016 - 418
4	Density Gauge	IN 5663 162 - 1
5	Nut M 45	IN 2126 0001 - 9
6	Nut M 27	IN 2126 0001 - 10
7	Screw M 12 X 20	IN 2121 0001 - 523
8	Breaker Pole 11 kV Breaker Pole 22 kV	IN 5452 0002 - L IN 5452 0002 - U
9	Short Cover	IN 5425 0002 - 2



HPA brekaer with operating device and breaking pole dis-assembled.

2.4.8 Changing of Breaker Pole

1 Loosen the operating device according to section 2.4.7

2 Loosen the 2 screws of the operating arms. (The pole in the middle has no screws). Remove the links and arms.

3 Remove the density gauge (Special key) or loosen the cover for gas refilling.

4 Put on the long cover which is mounted on the new pole.

Note : Do not put on the short cover, without the density gauge, because the back pressure valve will open allowing gas to escape.

5 Loosen the pole with key 32 and 55. Loosen the M12 screws.

6 Mount the long cover on to the new pole.

7 Fit the new pole.

8 Mount the long cover on the old pole and mount the density gauge and short cover. (Check that the 'O-ring are good.) Fasten the nuts with special tool)

9 Replace the short cover.

2.4.9 HPA-Operating gear adjustments (Ref. fig.13, 15A & 15B)

For a preliminary adjustment, check the operating gear separate and without springs and dash pot.

Locate the dock point screw (B) on top shaft are in minimun position (Unlocked). This is to ensure that the trip free mechanism operates safely when the spring is charged and thus preventing "dummy stroke".

1 Adjustment of knee joint (blue gauge) adjust gap (3) (from centre of upper pin in push rod to a line from centre of upper shaft to the lower pin in push rod) 3.5 - 4.5 with the help of dog point screw (A). Lock the screw after adjustment.

2 Adjustment of lower shaft - close position. The arm (H) must hit the stop (C), but not enough to cause blocking of push rod when forced over knee position. Lower trip free mech. must remain in licked position. 'Secure the lock nut after adjustment.

3 Adjustment of lower shaft.

4 Lower dash pot. Mount the dash pot (F). Check that dash pot piston has an over travel of 0.5 to 2mm when lower shaft is in final "trip" position. If necessary adjust with washers. Secure the loci nut.

5 Upper dash pot and springs. Mount upper dah pot (G) opening spring, closing spring and return spring. Over travel in dash pot should be 0.5 to 2mm if necessary adjust with washers.

6 Link (E). Mount charging device on the spring mechanism. Adjust link (E) to allow the trip free device to catch when the closing spring is about to be charged. Ensure that coupling is locked in 2nd step of knife catch.

7 Complete Operating gear. Mount the operating gears on frame with breaker poles.

7.1 Charge the closing spring.

7.2 Close the breaker

7.3 Charge the closing spring again. Check that clearance

1) at upper trip free mechanism and knife catch is 0.8 - 1.0mm. This should be checked when spring is fully charged, i.e. before the link (E) is disconnected (immediately before click noise).

7.4 If clearance is more than 1.0mm then shorten the pull link (E), and if it is less than 0.3mm. extend the link.

7.5 Secure the lock nuts in link (E)

8 Lower trip free mechanism. Open the breaker and check the clearance (2). Adjust clearance (2) to 1mm by using dog point screw. (B) on upper arm. Secure the lock nut, when breaker is closed.

9 Micro switches. Micro switches to be adjusted as per instruction IN 5452 0003 - 15

10 Final test. Check breaker with operating circuit connected. While charging at minimum operating voltage of motor the charging gear is supposed to rotate until the coupling is locked by knife catch.

11 After 50 electrical operations, knee point setting (3), coupling clearance (1) and cap clearance (2) should be checked and corrected, if necessary.

12 Seal various lock nuts of various setting with red point.

2.5 *Accessories, Spare Parts And Additional Equipment*

We recommend the following parts to be held as spare parts for the breaker unit :

1 X Motor	IN 4461 0002*
1 X Coil	IN 5445 0007*
2 X Micro-switches	IN 5445 0744 - A
1 X Breaker pole	

The above quantity we estimate to be suitable for a station size of between 1-10 cubicles.

* You must state voltage when ordering.
* You must state rated voltage and rated current when ordering.

For details refer SAFESIX spare parts list.

Crank

For cranking on cubicle front. Normally supplied with cubicle.	Ordering No. IN 6887 0001 - 1
For HPA	Ordering No. IN 2188 0002 - C

Moving trolley

For removal and insertion of cassette into cubicle.	Ordering No. IN 6189-0001-A

Loose Tools

Refilling device for SF_6 gas for a breaker without density gauge	Drg. No. IN 5428 0001 - C
Refilling device for SF_6 gas for a breaker with density gauge	Drg. No. IN 5428 0001 - E
Pack of washer for refilling device	IN 2152 2018 - 1070 - 4nm
Pressure refilling equipment with a regulator for connecting to SF_6 gas cylinder	Drg. No. IN 5428 0001 - K
Handle for protective covers on breaker for refilling of SF_6 gas.	IN 2188 0002 - G

3.0 *Cubicle Construction*

The cubicles are manufactured out of bolted 2mm steel sheet. The doors are made of 2.5/3mm steel sheet.

The switchgear cubicles can be erected up against a wall or away from a wall to give access to the back if required.

The cubicle is divided into the following compartments :

* Busbar compartment
* Low voltage compartment
* Compartment for connecting apparatus (Breaker disconnector etc.)
* Cable compartment

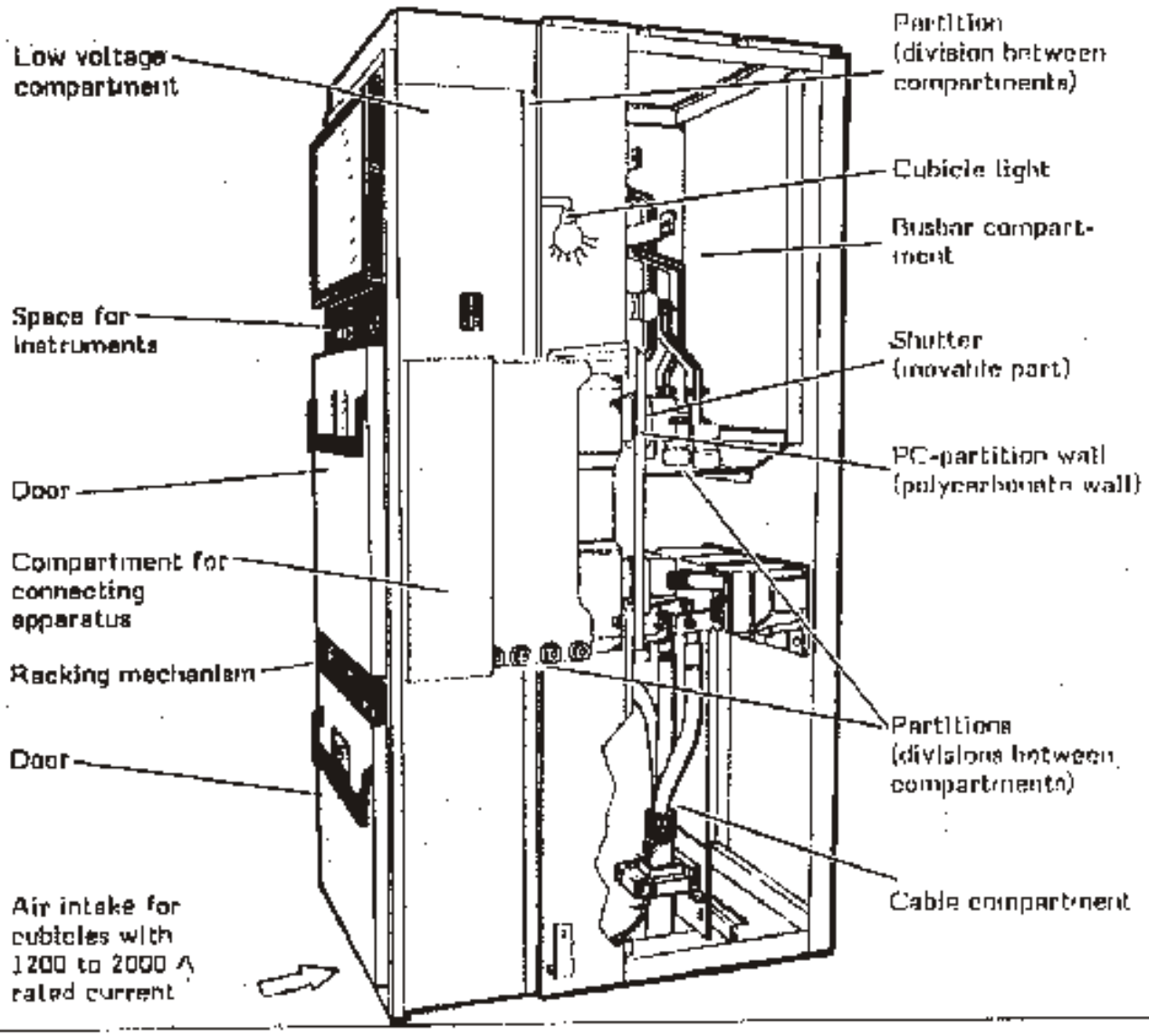


Fig 24

The names of the compartments in the ABB Safesix

All high voltage compartments (busbar compartments, cable compartments and compartments for breaker) have individual channels with roof plates for pressure relief.

3.1 *Temporary earthing*

There are some important demands that are needed to have on a good temporary earth.

* It must be able to be operated with closed doors
* It must withstand full short-circuit current
* It must be visible
* It must be interlocked against faulty operation

In order to accommodate this, Safesix, can be fitted with a new type of earthing switch with making capacity against full short circuit current.

3.2 *Education*

Last but not least it is demanded, that you who will work with Safesix get practice and education of the equipment operation.

3.3 *Dimensions*

Rated Voltage	Measurement in mm		
	B	D	H
12kV	800	1370	2340
24kV	1150	1900	2476

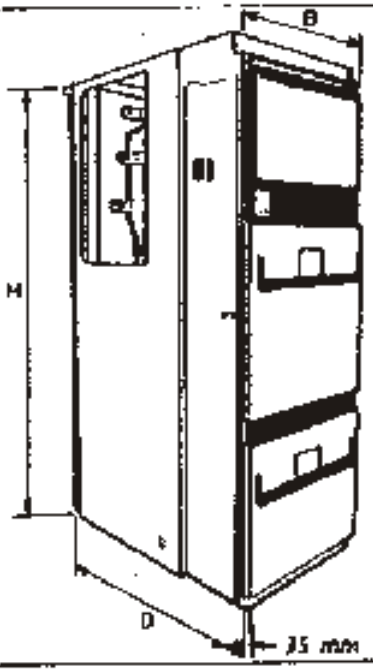
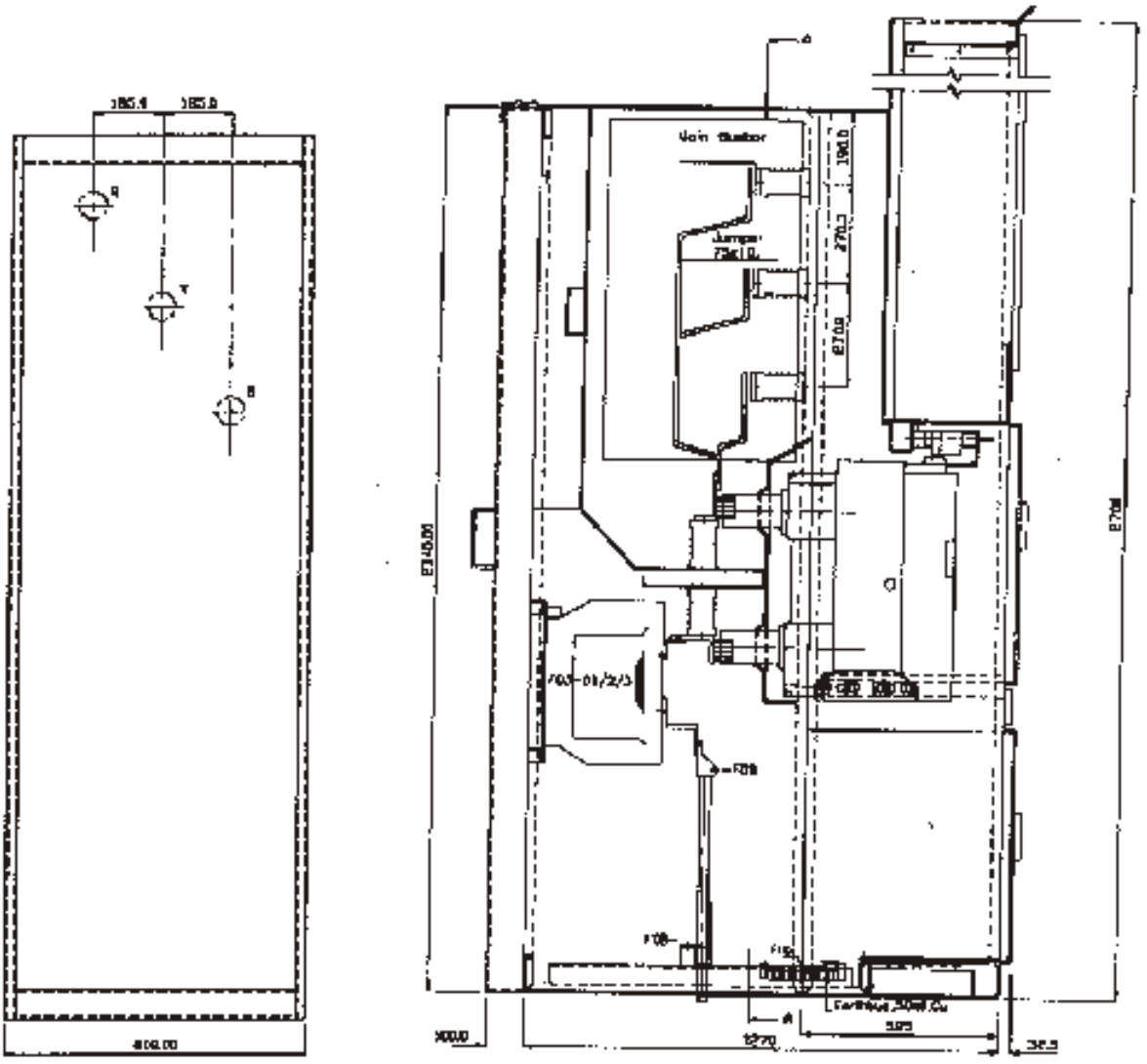


Fig 25

Measurements of 12kV / 24kV switchgear cubicle



NOTE : Minimum Clearance of Phase to Phase & Phase to Earth is ***104mm***

Fig 25A

Sectional side view (1VYN352531-CN)

3.3.1 *Busbar*

Busbar are normally delivered un-insulated. They can, on request, be delivered with insulation. The bars are manufactured of Aluminium with an area which is selected according to the rated current.

3.3.2 *PC Partition with Shutters*

The Circuit Breaker is made for cassette installation. It can be moved in and out of the compartment. Between the compartment of the Circuit Breaker and the busbar compartment, there is a partition wall of polycarbonate which stops unintentional touching of live parts when the Circuit Breaker is taken out. In this partition wall there are 6 shutters which are opened by the connecting bars when the Circuit Breaker is put into service position.

The partition wall and the shutter give a degree of protection of IP 3X according to IEC 298.

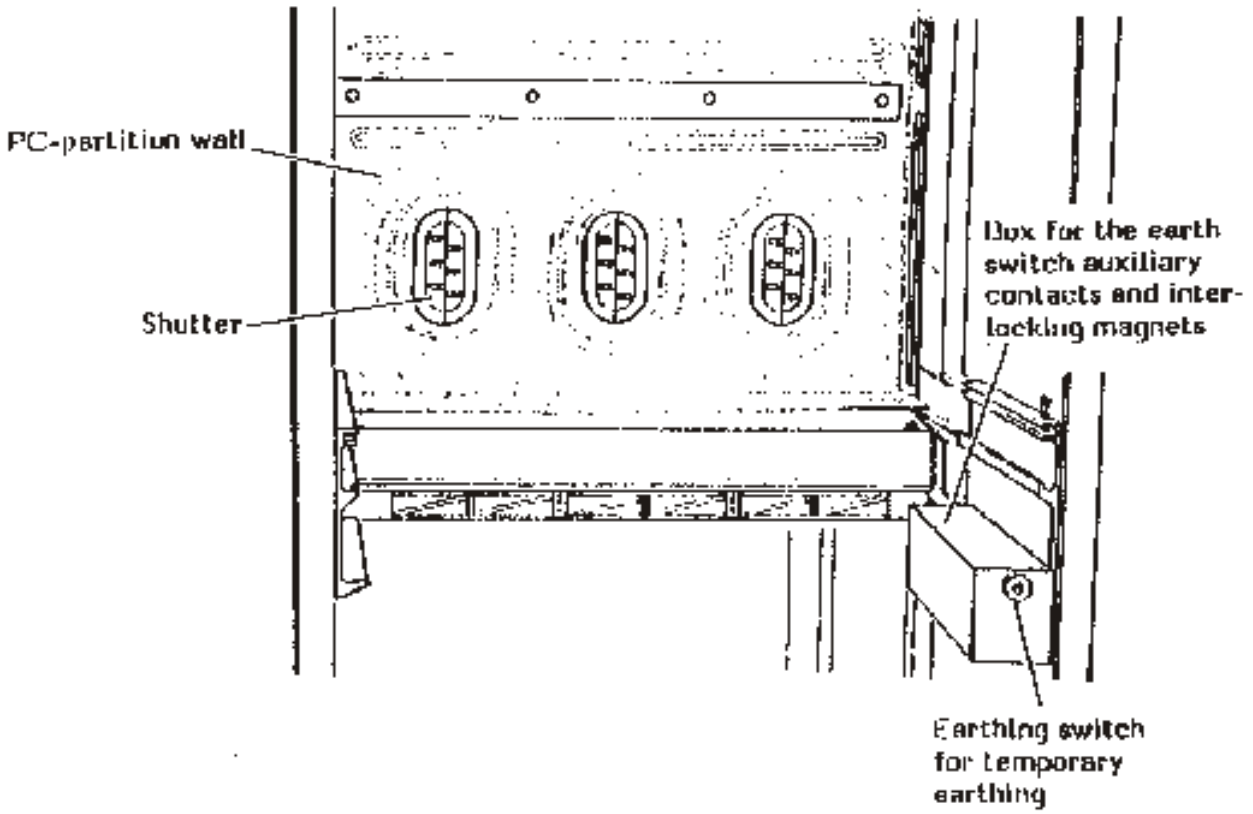


Fig 26
Partition wall with shutters

PARTITION WALL WITH SHUTTER

Type 1

Sr. No.	ITEM DESCRIPTION	PART NO.
1	P.C. PARTITION WALL	
	Upper	IN 2158 0002 - 19
	Lower	IN 2158 0002 - 20
	Shutter Assly.	IN 2158 0003 - A

Type 1

Sr. No.	ITEM DESCRIPTION	PART NO.
1	SMC PARTITION WALL	
	Upper	IN 2158 0002 - 68
	Lower	IN 2158 0002 - 55

3.3.3 Earthing

PERMANENT EARTHING

The permanent earthing is provided by a through earthing bar in all cubicles. There are terminals for connecting external earthings to this bar. The stations earthing terminal is connected only in the end cubicles.

All apparatus are connected to earth through the framework, with the exception for earthing switches current transformers, voltage transformers and breaker that having earthing strips connected directly to the main earth bar.

TEMPORARY EARTHING

The earthing switch is operated from the front of the cubicle with the help of a crank. For operation of the earthing switch see section 1.5 "Removal of apparatus".

EARTHING TRUCK

Alternatively, earthing trucks can also be provided.

3.4 *Breaker Cubicle*

DATA

Rated Current	A	630, 1250, 1600, 2000, 2500, 3150A	
Rated Voltage	kV	12	24
Insulation Level	kV	28/75	50/125
Rated dynamic withstand current peak value	kA	100	625
Short time rated current	kA	40	26.25

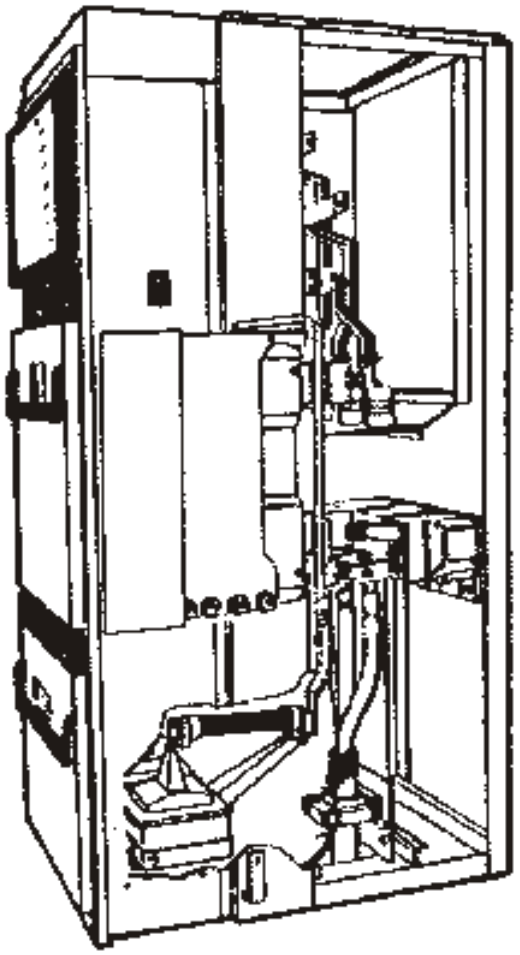


Fig 27
Circuit breaker cubicle

The cubicle contains a SF_6 Circuit Breaker. The CB which is described under item 2 is movable. The cubicle can be equipped with current transformers, voltage transformers and fitting details for cables. In the basic series 4 parallel XLPE cables can be connected. In the deeper series (with rear extension) there is space for six XPLE cables. There is a blocking device in the cubicle which prevents and under dimensioned apparatus to be connected.

3.5 *Disconnector Cubicle*

The disconnector cubicle is built like the breaker cubicle. The cassette disconnector has the same contact positions in the circuit as the corresponding breaker. Disconnection is achieved by moving the truck from service to test position. The cubicle can be fitted with current and voltage transformers.

The disconnector has no opening or closing capacity. Interlocking devices stop faulty operation. The disconnecting distance is visible through the window in the low voltage compartment.

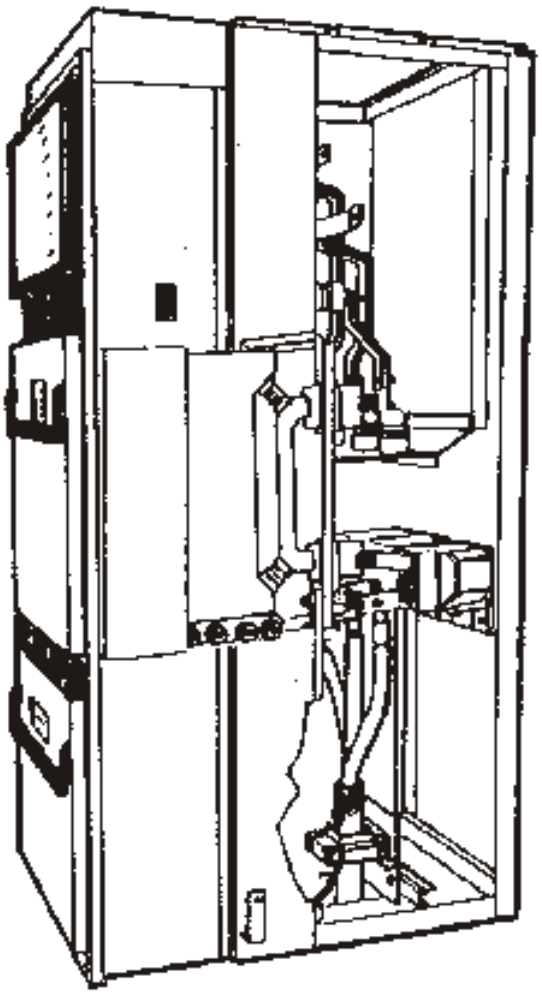


Fig 28
Disconnector for cubicle

3.6 Metering Cubicle

The metering cubicle can be fitted with voltage transformers

Primary rated voltage	3.6/7.2/12kV
Secondary rated voltage	110/V3 V and 110/3V
Frequency	50 Hz

3.7 Sectionalizing Cubicle

The cubicle has a function to divide the switchgear into two sections. The cubicles is mainly built up like the breaker cubicle with a breaker or a disconnector cassette.

The cubicle has space for current and voltage transformers.

Note : *Separate dummy cubicle required for sectionalizing 2500/3150 A*

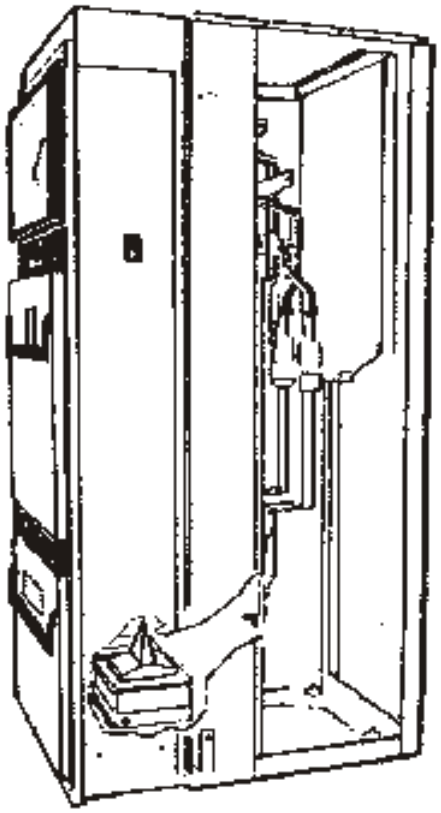


Fig 29
Metering cubicle

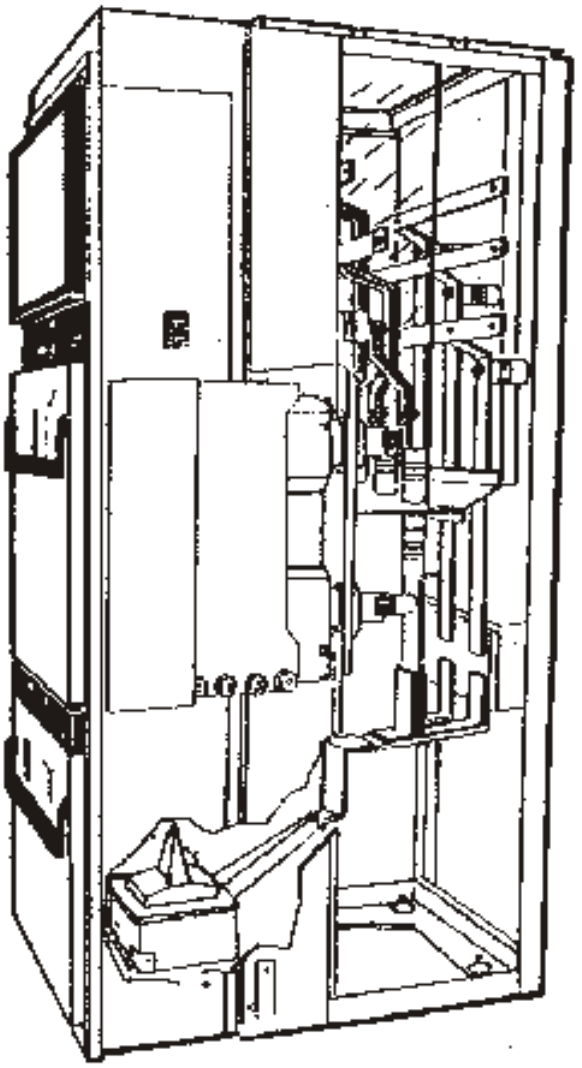


Fig 30
Sectionalising cubicle

3.8 *Checking of foundation*

Check the foundation w.r.t. the foundation drawing supplied. The foundation frames on which the cubicles are to be installed must be properly levelled. The level differences more than 2mm is not permitted. Refer fig 31 for details. Level is to be checked using a water level.

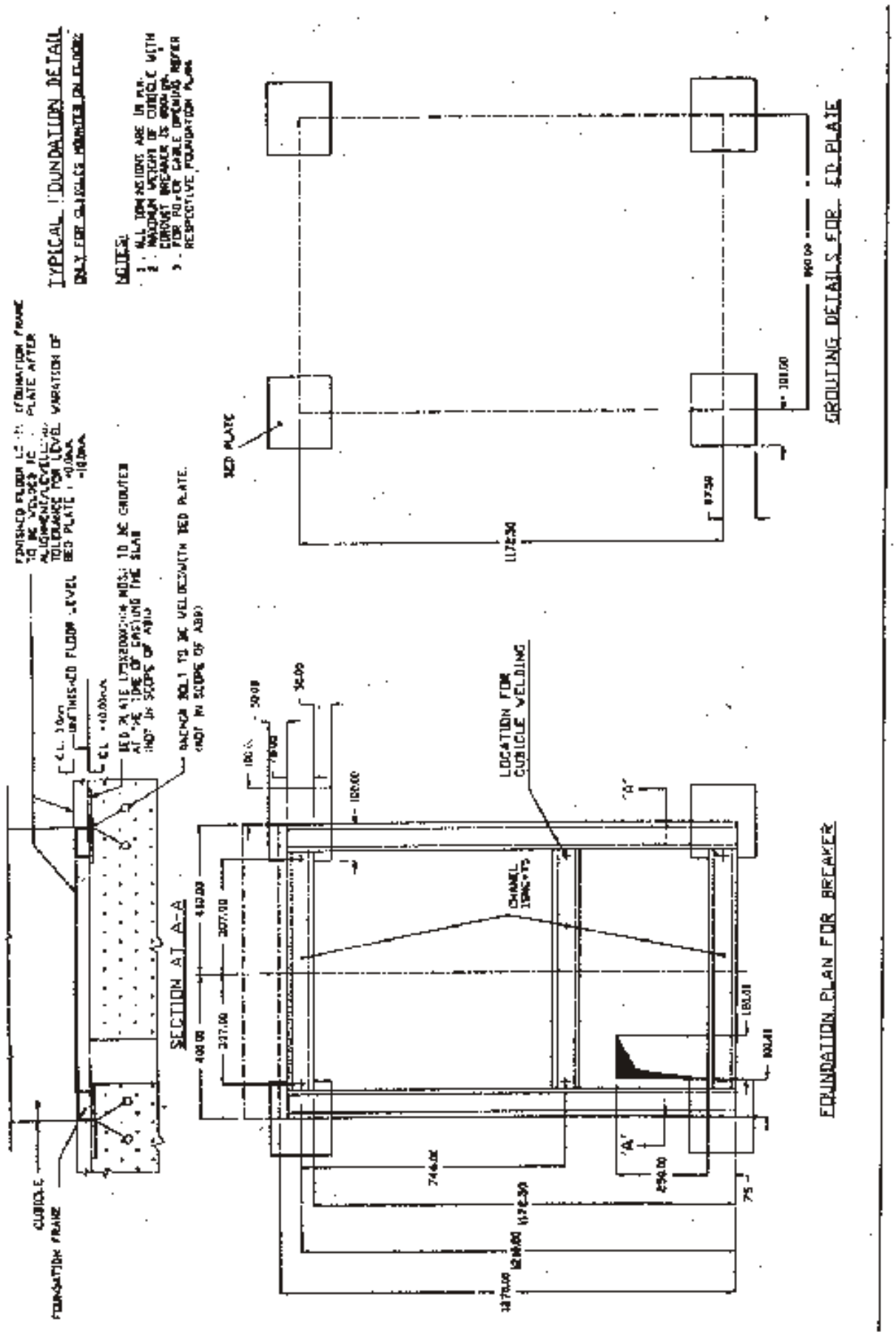


Fig 31
Instruction No. IVYN402260 - 008

3.9 *Erection*

3.9.1 *Mounting of first cubicle on foundation frame*

Start installation of cubicle from anyone side. The cubicle when despatched from the factory is pallet mounted. It should be unloaded from the pallet as close as possible to the foundation frame position so that less movement is required after the cubicle is on the ground. Once the cubicle with pallet is on the ground, the same is to be pushed manually on the foundation frame. If use of crowbar is unavoidable, the crowbar is to be inserted either on sides or on rear of the cubicle. Do not insert crowbar in the ***front side of the cubicle***. Please ensure that the cubicle, when mounted on the frame, is vertical. If necessary, use shims to make the cubicle vertical.

First cubicle on the frame is to be welded after the cubicle is properly mounted on the foundation frame.

3.9.2 *Mounting of second, third, ... cubicle on frame*

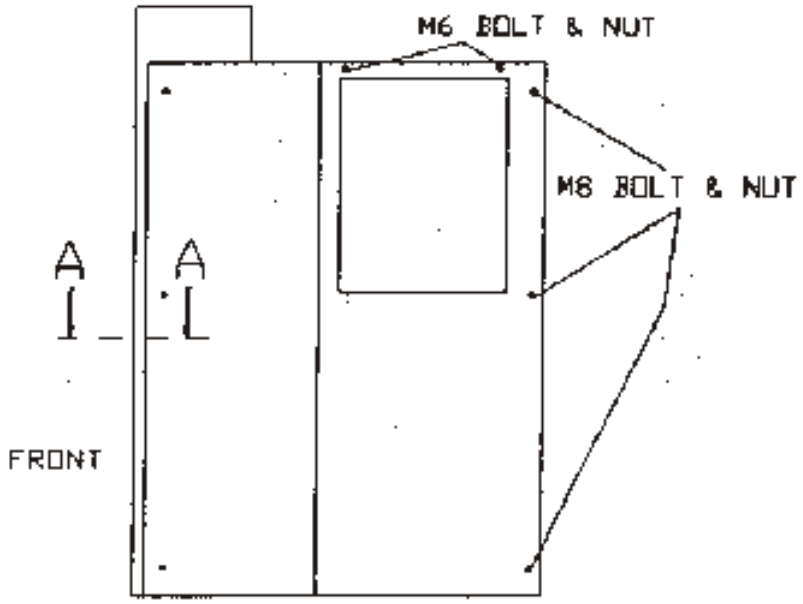
Follow the procedure described under item no. 5. When the second cubicle is placed on the foundation, it must be pushed as close as possible to the first cubicle so that two cubicles touch each other from top to bottom.

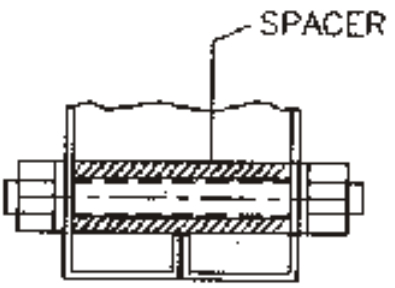
Do not weld other cubicles on frame till all cubicles are erected and busbar are coupled.

When all the cubicles are erected, check that the cubicle fronts are in line and that the cubicle doors with the locking devices work correctly. It should be easy to move all handles. Check that the circuit breaker moves correctly.

3.9.3 *Coupling of cubicles*

Fasteners for coupling are supplied loose and kept inside cubicle. Cubicles are coupled together at points as shown in fig.32 For inserting the spacer in between two cubicles, remove the plates provided on the left hand side wall of cubicle as shown in fig. 32. These plates should be reassembled after the affection is completed.





ASSEMBLY WITH SPACER AND STUD

COUPLING POINTS

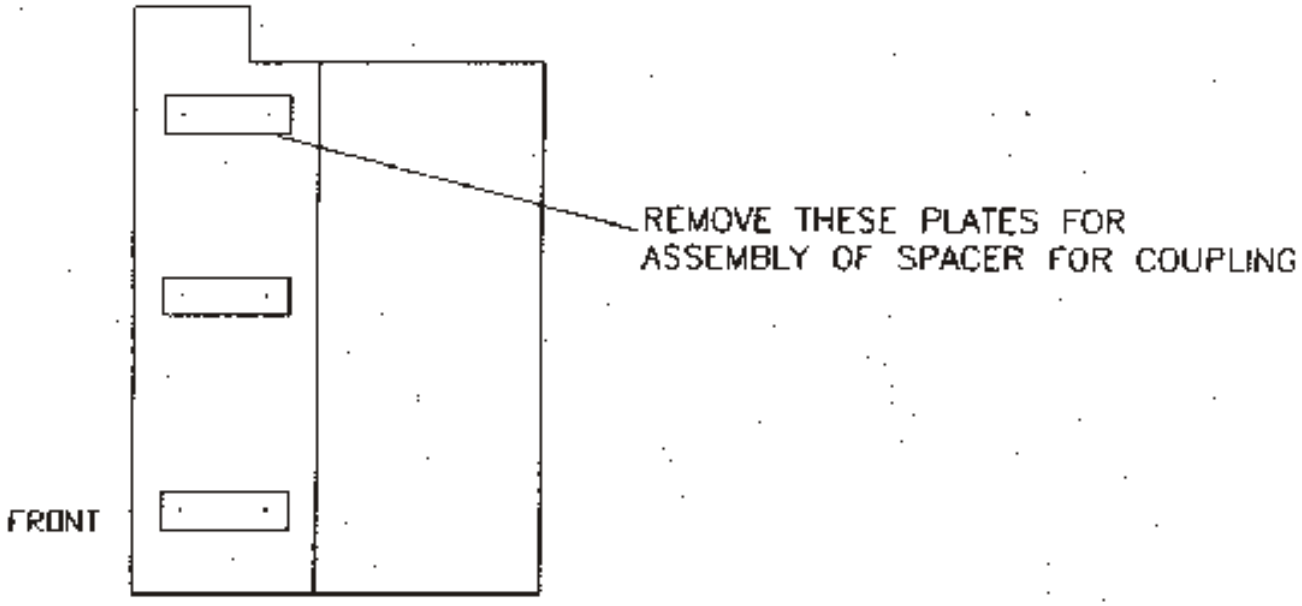
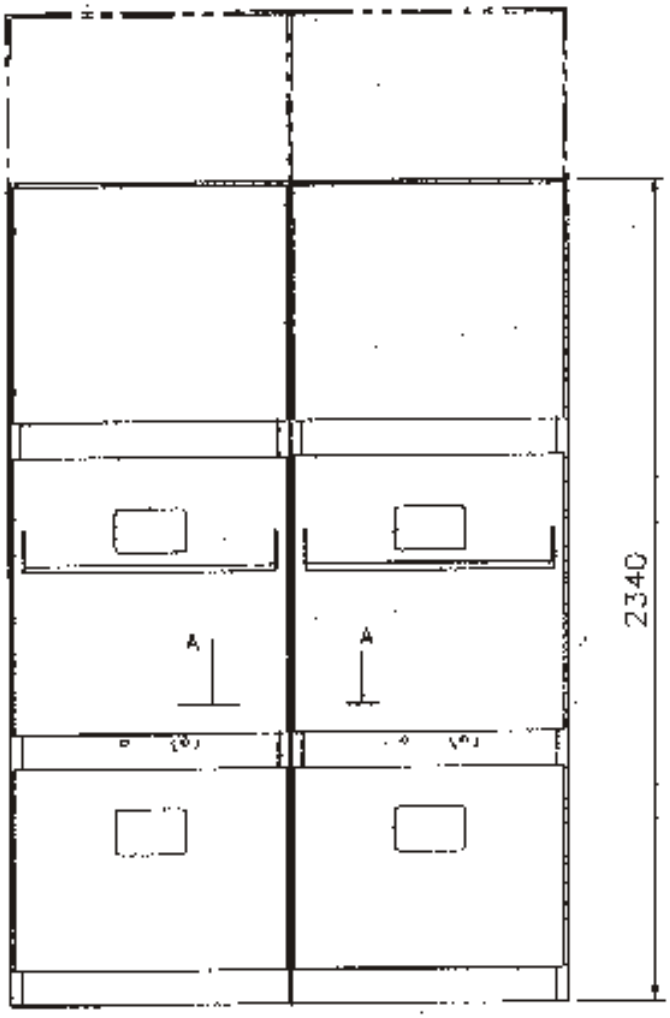


Fig 32

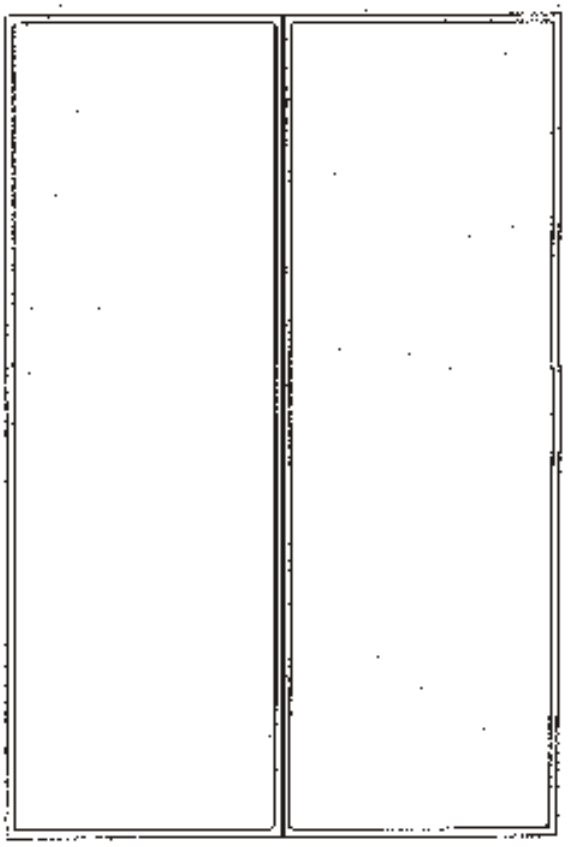
Instruction No. IVYN402200 - 008

3.9.4 *Fixing of 'T' profile*

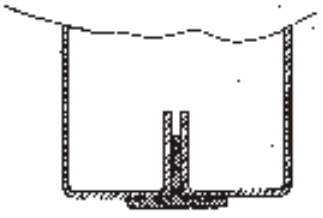
The details are given in fig. 33



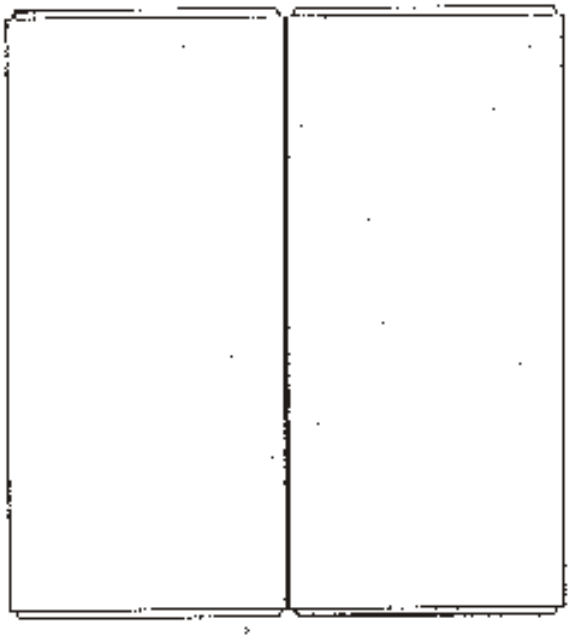
FRONT VIEW



REAR VIEW



SEC.–AA



TOP PLAN

1. Put RHS Cubicles in place
2. Put 2nd Cubicles next to RHS Cubicle
3. Fix coupling bolts,but do not tighten fully
4. Insert 'T' profiles as shown in dwg.
5. Tighten coupling Bolts
6. Repeat same procedure for 3rd/4th cubicle etc.

Fig 33

Instruction No. IVYN402290 - 008

3.9.5 Coupling of Busbar (Ref. fig. 34A & 34B)

Start mounting of busbar from one end. Aluminium Busbar are delivered, mounted on the top of the cubicle. Copper Busbar are supplied separately, packed i a box. All the joint are to be properly cleaned using a stainless steel wire brush and conducting grease must be applied on the joints.

Fasteners required for the busbar assembly, are already mounted in the cubicle at the busbar-jumper connection point. For VHA12SS cubicles, fasteners are supplied loose and can be found in a plastic bag in the cable compartment. Remove these bolts and insert Busbar at the required location as shown in drawing. The Busbar for all the cubicles should be mounted first and after proper alignment, the fasteners should be tightened. Normally the Busbar are mounted using M12, high tensile bolts and these bolts are to be tightened with 70-80 N/m torque.

40kA switchgear cubicle is delivered with extra support insulator (Ref Fig 34A). Please ensure that the stud is slightly touching the conductor.

Note : Before tightening the busbar bolts, please check the length of bolt. Longer bolt may damage the insulator.

VHA 12S

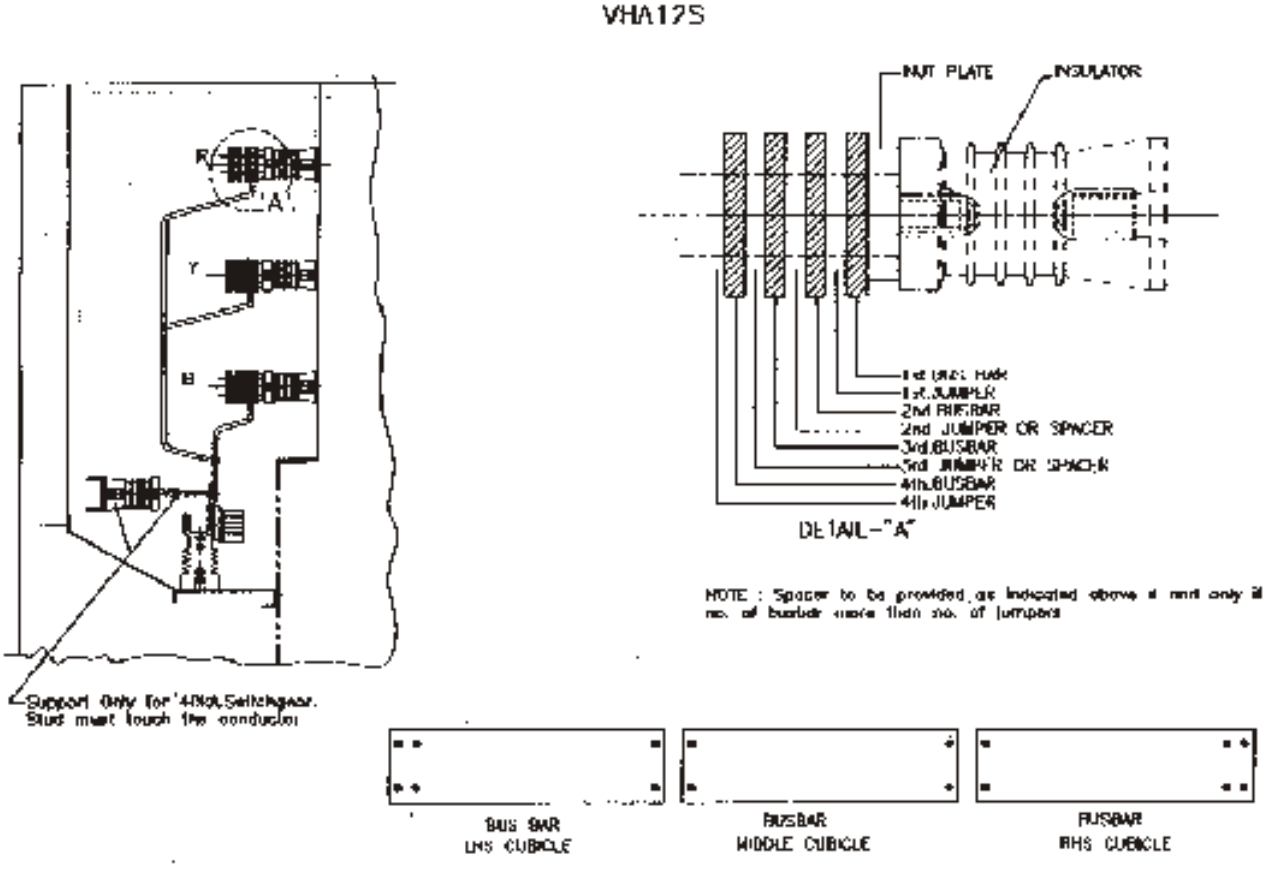


Fig 34

Instruction No. IVYN402290 - 008

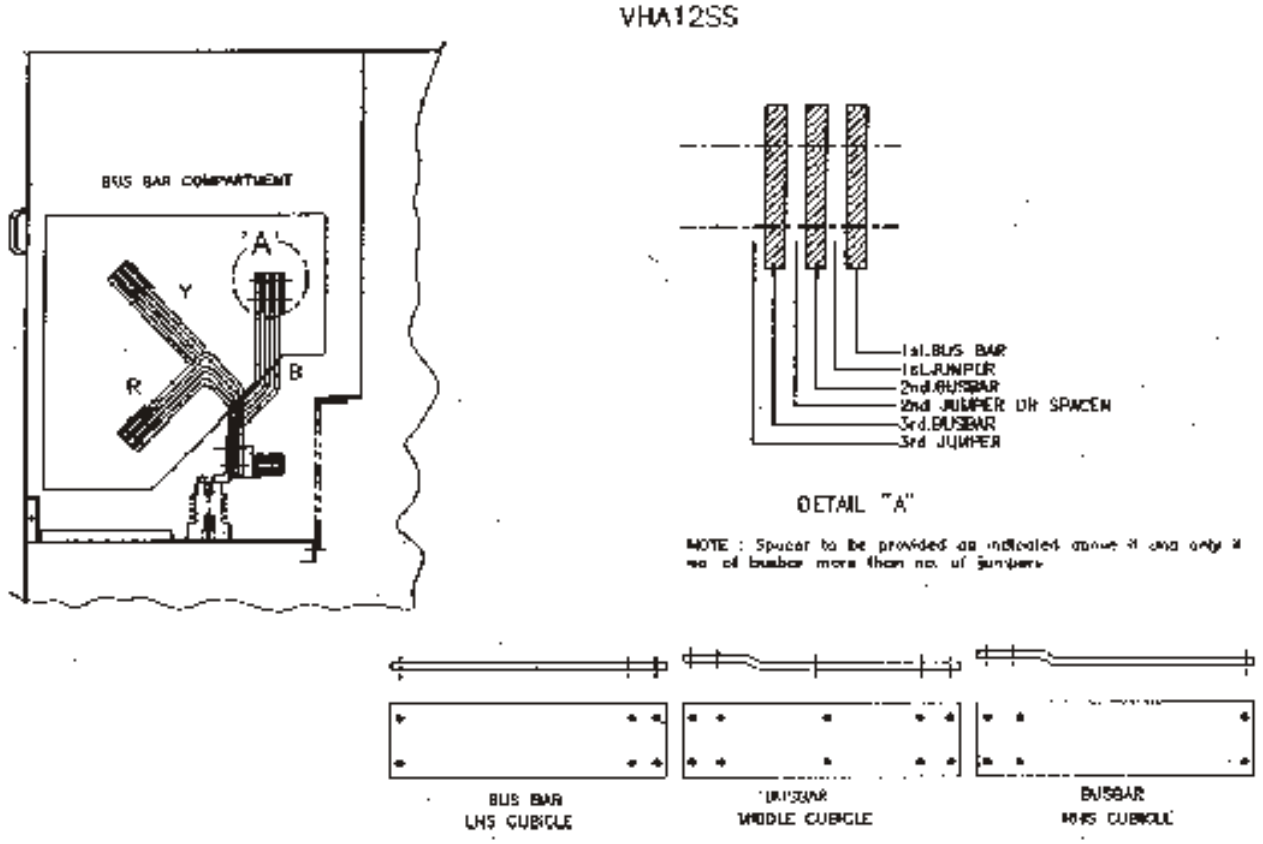


Fig 34
Instruction No. IVYN402290 - 008

3.9.6 If the cubicles have a through earth bar, this should be fitted according to figure 35. Check that the bushings between the cubicles are seated correctly. The external earth-cable is only fitted to the outer cubicles in a row in the same way as above.

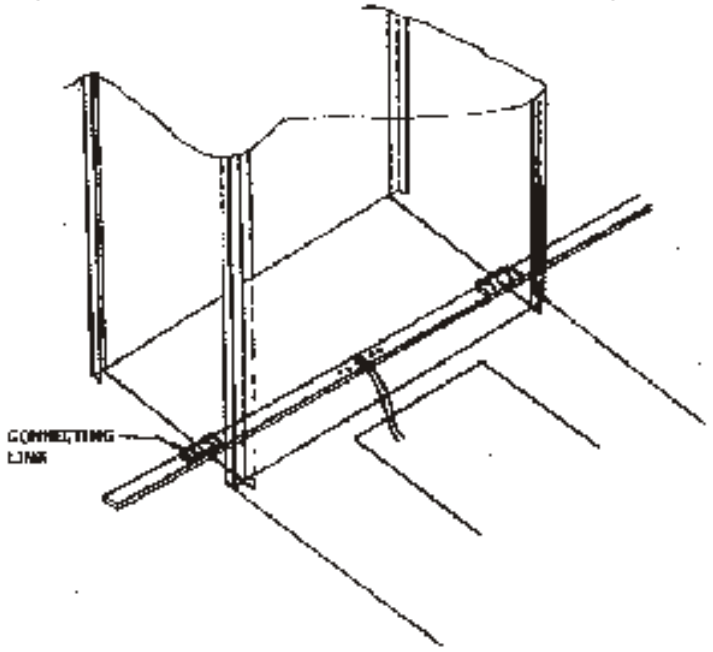


Fig 35
Through Earth Bar

3.10 *Racking in - Racking out of circuit breaker*

Before racking in or racking out, remove the transport packing from the breaker. ***Do not move the breaker without removing the packing.*** Details are indicated on the label fixed on the breakers front.

Circuit breaker has two positions in the cubicle viz test and service. The breaker can also be withdrawn on door for purpose of inspection / testing / maintenance. Breaker is moved in or out using racking mechanism. The operations are carried out as described below : -

a) To withdraw on door (Ref. fig. 36)

Move the selector to "Removable" position. Open the door and pull the breaker on the door

b) To insert breaker in service position from the door.

Ensure that breaker is in open condition. Keep the selector in "Removable" position and push breaker to test position. Move the selector to "Movement" position. Insert handle and rotate in the direction marked on the racking mechanism front. When the breaker is in the service position, indicator will move and service indication will appear. Now the breaker is in service position.

<u>Do not rotate the handle too hard after service indication has come as this may damage the racking mechanism.</u> Move the selector to service position.

Note : Remove the handle while moving the selector.

C) To withdraw to test position

Open the circuit breaker. Move selector to the "Movement" position. Insert handle and rotate in direction shown. When breaker comes to test position, indicator will move and "Test" indicating will appear. over the selector to test earthing position.

Note : If cubicle is provided with earthing switch, open the earthing switch before moving the breaker in or out.

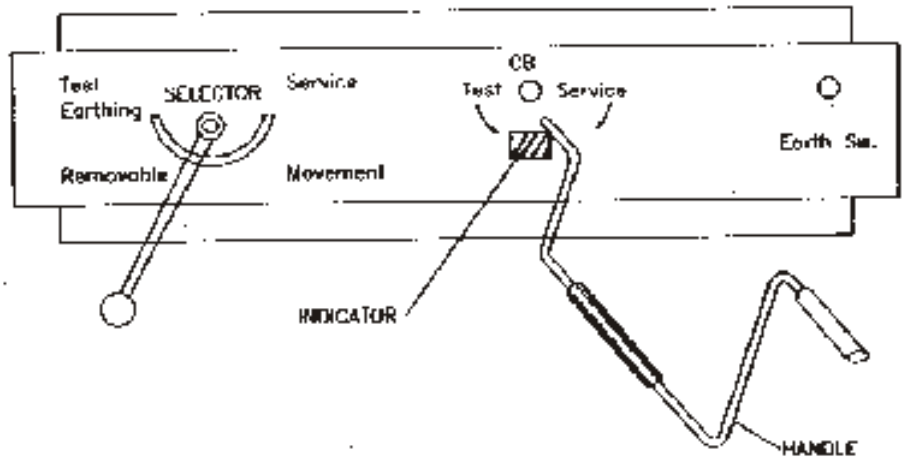


Fig 36
IVYN402290-006

3.11 *Connecting auxiliary supply 24 pole plug socket in test position*

For connecting 24 pole plug while the breaker is in test position, it is advisable to rack the circuit breaker in the service position (as described in 10) and then withdraw the breaker back to test position. Once the 24 pole is connected in service position, it will remain connected in test position also. 24 pole plug will be disconnected only when the breaker is withdrawn on door.

3.12 *Important dimensions*

Important check dimensions are indicated in Fig. 37

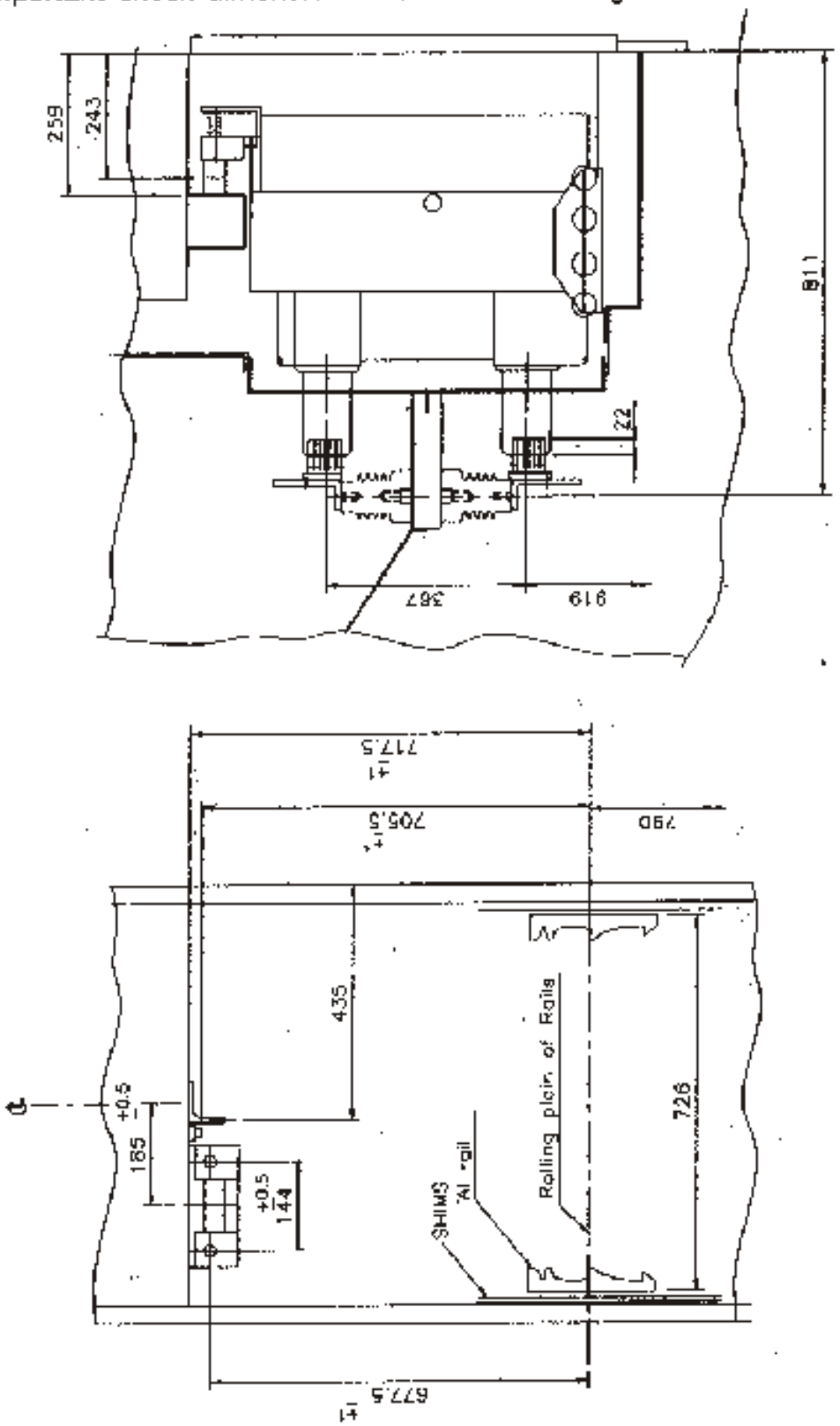


Fig 37
1VYN402290 - 008

3.13 *Connection of Power Cable*

Both incoming and outgoing cables are connected in the cable compartment. It is possible to connect up to 6 parallel cables depending on type of cables and the rated current. The power cables can be connected when the Circuit Breaker, moving device and doors have been removed. The PC-middle partition can be left, as this is transparent. The fitter can sit comfortably in the cable compartment or on the threshold and do the connections for the cables.

The rear panel can be removed if there is sufficient space. To facilitate removal, use an extended Allen key.

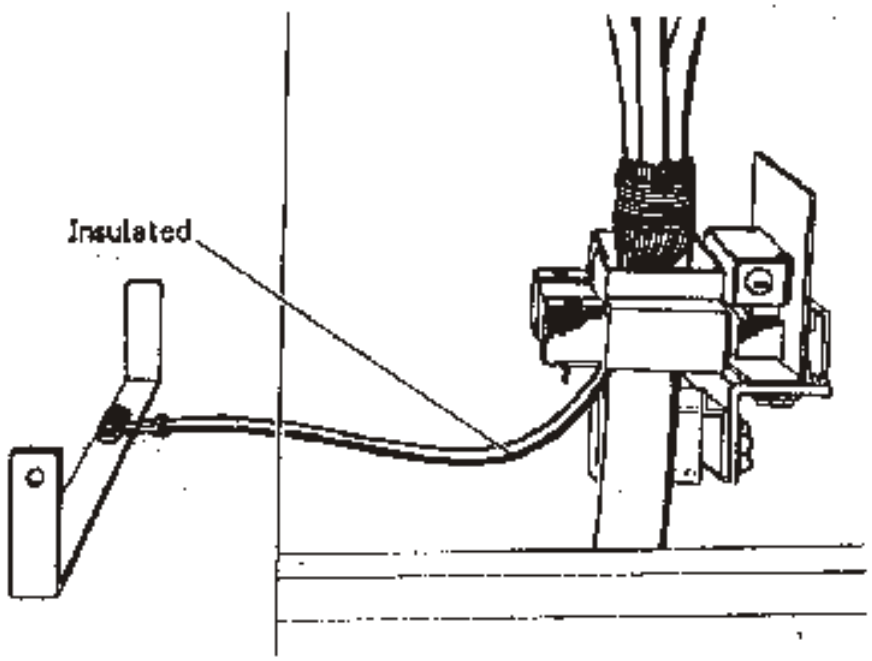


Fig 38
Assembly of cable current transformer

3.14 *Connection of Auxiliary Wires*

The auxiliary wires is terminated in the low voltage compartment. If the wires come through the floor they can be drawn up inside the side plates which have a channel approximately 65 X 340mm, see figure 38.

The channel has openings at the top and bottom and access via a cover half way up on the inside of the cubicle. The auxiliary wires are pulled to their respective cubicles where they are fed out to a 30mm wide column.

In the low voltage compartment, draw the wires to the terminal blocks where most of them will be connected. Fix the wires firmly with cable wraps in the oval holes and if screened leads are used they are fitted in the upper connection bars.

Fig 39
Drawing of wires from floor to low voltage compartment

3.15 Retightening

The busbar bolts should be tightened up to the torques shown below. (Tolerance±10%).

M8 = 24.5 Nm
M10 = 40 Nm
M12 = 70 - 80 Nm
M16 = 150 Nm

After all fitting has been completed, the cubicle should be carefully cleaned. Insulators, metering transformers and screens to be wiped down.

4.0 COMMISSIONING

All data to be checked or pressured are to be entered in the commissioning report and filed for subsequent comparison.

4.1 Preparatory Work

Prepare the built in circuit breakers, load breaker switches or other operating equipment for service in accordance with the operating instructions.

4.2 Functional Test

4.2.1 Functional Tests on the breaker

Functional tests on the breaker to be performed in accordance with 2.2.4

4.2.2 *Functional Tests On The Cubicles*

Following switch-on of all control circuits in the low-voltage compartment ensure that the high-voltage section is de-energized.

- Push in disconnector or breaker into the isolating or testing position of their relevant cubicles in accordance with the pertinent instruction for operation and maintenance of the breaker.
- Shortly afterwards the spring tension indicator must indicate readiness for closing (Spring charged position)
- Operate the breaker electrically from all control points to "CLOSED" and then "OPEN".
- Check the function of Earthing switches in accordance with the relevant assembly instructions.
- Check the heating elements and their control and protection equipment. The admissible relative humidity in the switching compartment 70%. If this is exceeded the switchgear must not be put into operation before humidity is reduced to below 70% by switching on the heating.
- When performing voltage tests on the high voltage cable, disconnect any connected voltage transformer or arresters if necessary by separating them from the live parts with insulating plates.

4.3 *Voltage Test*

4.3.1 *Power Cable*

The cable supplier is responsible for voltage testing the power cable and also determines the height of the test voltage.

Before testing, the cables must be disconnected from the cubicle and adequately insulated.

The cores of the cable are to be disconnected from the busbar and to be insulated according to the height of the test voltage or to be sent away to the required distance of the flashover air gap.

During the voltage test the busbar must be connected to earth.

4.3.2 *Repetition of the voltage tests on the cubicles*

As a rule each cubicle is tested in accordance with contractually established standards before leaving the factory. Before performing a test after erection at the destination the approval of the supplier must be obtained, and the height and type of the test voltage stated. Exception when erected by the manufacturer.

CAUTION

Several cubicle components are designed for operating voltage but not for the test voltage. They must therefore be disconnected or short-circuit before a voltage test is carried out.

4.4 Final Tasks

- ➡ Switch off the entire installation.
- ➡ Remove all tools, testing and measuring equipment and clean the entire installation
- ➡ Connect the installation to the high voltage lines, ensuring that the safety regulations are complied with.
- ➡ Ensure that the cooling air can leave and enter freely through all ventilation and venting openings.
- ➡ On completion of all these checks the switchgear installation can be accepted for service.

5.0 MAINTENANCE

Maintenance covers inspection and overhaul work as listed in the maintenance chart in Sect. 5.1

5.1 Maintenance Chart

Summary of inspection and overhaul work

Task	Inspection every 2 years*	Overhaul after every 5 years or after every 5000 switching operations (O)	Overhaul as required (X)	Procedure Reference
Entire switchgear inst.	▪	-	-	2*
Guide rail	-	O	-	3*
Earthing rail	-	O	-	3*
Insulating parts	-	O	X	-
Heating	-	-	X	4*
Transformer	-	-	X	6*
Various lubricating points	-	-	-	-
Breaker, low-voltage equipment, truck	-	-	-	5*

* On round or normal operation interruption.

2* In service conditions and without any dismounting work

3* Maintenance according to sect. 6.2.2.

4* Replace according to sect. 6.2.3

5* Refer to the operating instructions, handling and storage instruction pertaining to that particular piece of equipment.

6* Replace according to sect. 6.2.4

5.2 Procedure

5.2.1 General

Maintenance must only be carried out on the cubicle when the -- and 1.v sections are de-energized and earthed.

The br. to be completely withdraw in accordance with the instruction for operation and maintenance of the breaker.

For metal (clad) cubicles the contacts are automatically covered by shutters when the br. is withdrawn

5.2.2. Guide rails for br. and earthing bar

Clean with cleaning agent or and lubricate lightly with grease.

5.2.3 Heating Element

Remove cover disconnect heating element lines from the terminal strip and remove together with heating element. Mount new heating element. Connect up and replace covers.

5.2.4 Replacement of transformer

Disconnect transformer from cable connecting bars and remove from cubicle. Install new transformer in cubicle and clean connections with cleaning agent or and lightly grease with grease and connect up to cable connecting bars.

5.2.5 Trouble shooting

a) Breaker movement hard in cubicle
Breaker moves on rails in cubicle. If the dimension 726 (Refer fig. 37) is not maintained, or has been disturbed during transport, movement can become hard. This can be corrected by adding or removing shims below the rail.

b) Selector does not move
Check the position of circuit breaker and earthing switch. Both the devices should be in the off position.

c) 24 Pin plug-socket not aligned

Breaker : Check the free movement of socket assembly. Also check the centre distance between the guide pins. This distance must be 144 ± 0.5mm.

Cubicle : In the cubicle, the grip action can be checked with the help of guide pin of 24 pin plug assembly and the rubber grip of 24 pin socket in cubicle can be set right by loosening of M6 fixing bolt provided.

d) Test-service position switch not operating.

Check the demension of switch assembly from rolling plane as shown in Fig.37. If required, this can be corrected by adjusting set screw on switch assembly. If switch still does not work, the height of actuator on the breaker is to be adjusted.

IMPORTANT NOTES :

1) Do not step on the explosion vents
2) Do not step on the circuit breaker compartment door.
3) Cover the complete switchboard with polythelene sheet when the construction work is in progress.

5.3 List of recommended lubricants and cleaning aids

Lubricant	Application	Notes
Grease	Greasing contact transition points and sliding surfaces	(Vaseline) pure petroleum jelly
Cleaning agent	Cleaning single parts	Patrol, Trichloroethylene, Carbontetra-chloride
Steel wool	Cleaning of silver-coated contact surface	fine clean steel wool to be lightly rubbed.

* * * * * * * * * * *

1VDU22002-YN

As the designs of switchgear from ABB are subject to constant improvement, the product supplied may differ in some details from the specifications and illustrations given here.

ABB LIMITED
Plot No. 79, Street No. 17
MIDC, Estate Satpur
Nashik - 422 007
Telephone : (0253) - 2351095 / 96 / 97 / 98
: (0253) - 2351261 / 62 / 63 / 64
Fax : (0253) - 2350611 / 2351249
Grams : ABBFILIAL