1VDD006116 GB

SafeRing / SafePlus 36kV
Installation and operating instructions

Power and productivity
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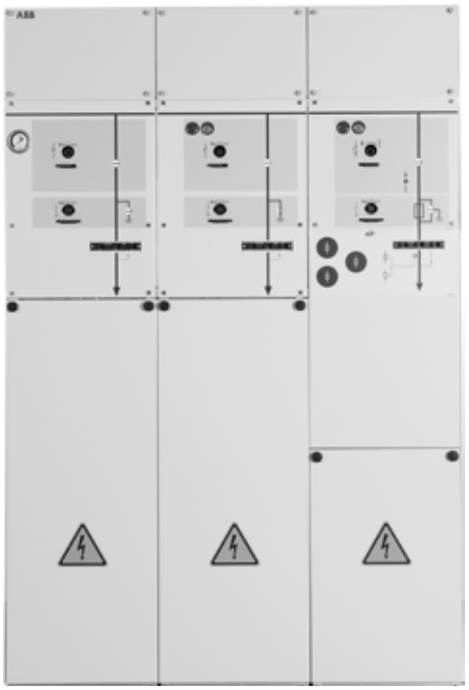


SafeRing CCF

SafePlus CFV

1. GENERAL DESCRIPTION

SafeRing is a SF_6 insulated ring main unit and SafePlus is a compact switchgear for applications in medium voltage distribution networks. SafeRing can be supplied as 2-, 3- or 4-way standard configurations with additional equipment according to customer specification.

The standard configurations are DeF, CCF, CCCF, CCFF, CCC, CCCC, DeV, CCV, CCCV and CCVV.

SafePlus is more flexible. For SafePlus it is possible with combinations of C, F, V, D and De modules to fully modular and semi-modular configurations.

Available modules are :
C - Cable switch
F - Switch fuse combination
V - Vacuum circuit breaker
D - Direct cable connection
De - Direct cable connection with earthing
M - Metering module (air-insulated)

The maximum number of modules within one SF_6 tank is 4. SafeRing and SafePlus offers a sealed stainless steel tank which contains all the live components and switching functions.

The transformer is protected by a switch-fuse combination or by a vacuum circuit-breaker with relay.

The units / modules are delivered from the factory ready for installation.

Routine tests are carried out on all units/ modules before dispatch. No special tools are required for the installation of units / modules.

SafeRing / SafePlus with switch fuse combination in compliance with IEC 62271-105.

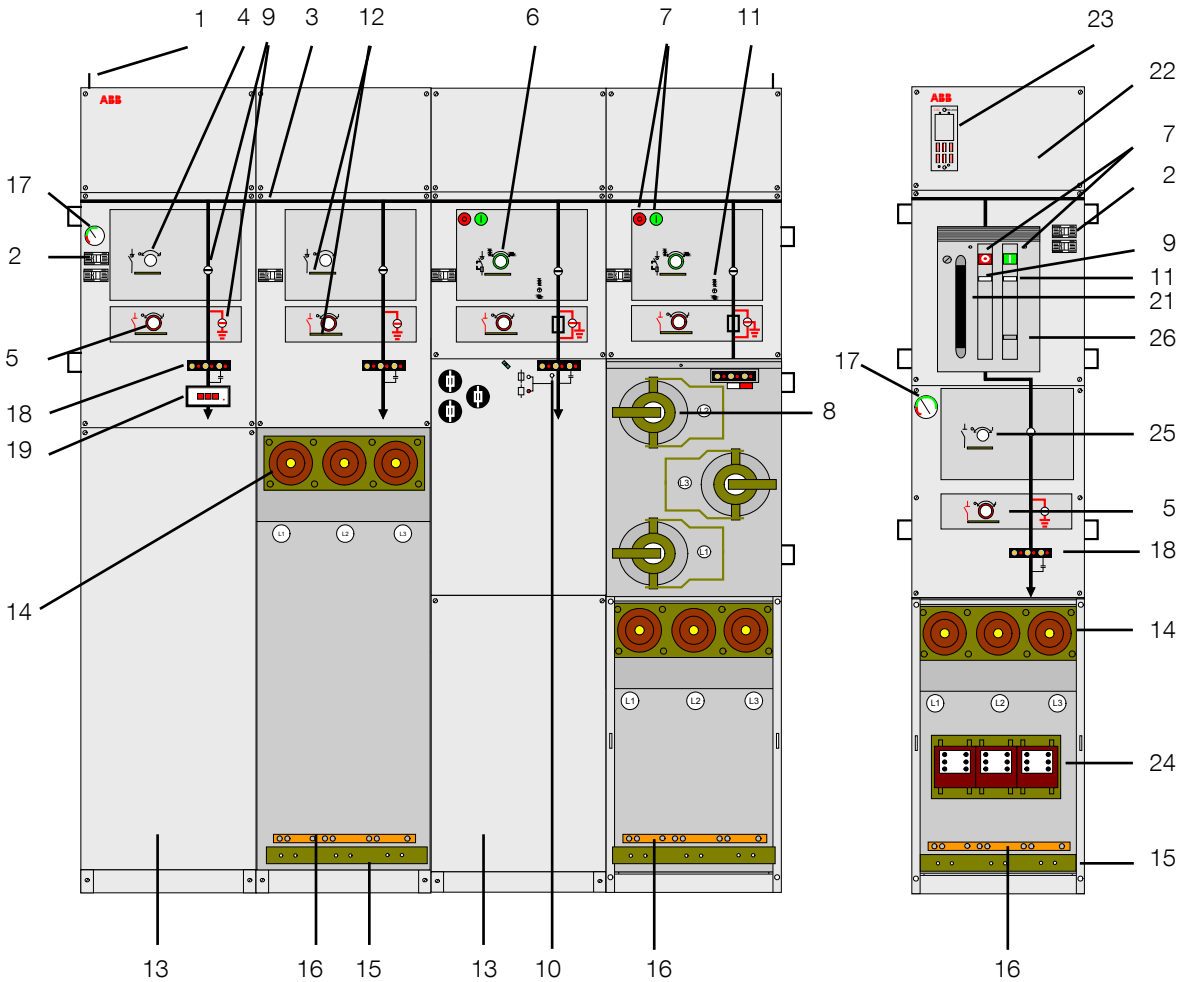
With this unit the transformer will be protected by current-limiting HV fuses in combination with a load break switch. The load break switch is equipped with a stored energy spring mechanism which can be tripped by the fuse striker pin.

SafeRing / SafePlus with vacuum circuit-breaker in compliance with IEC 62271-100

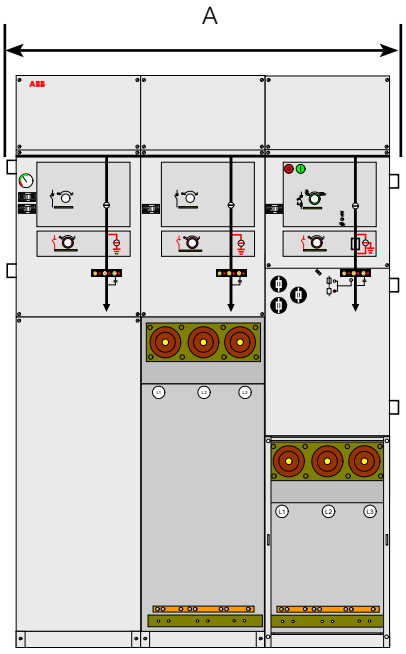
With this unit the transformers will be protected by a vacuum circuit-breaker combined with relay and current transformers. The standard protection relay is based on digital technology and does not require an external power supply.

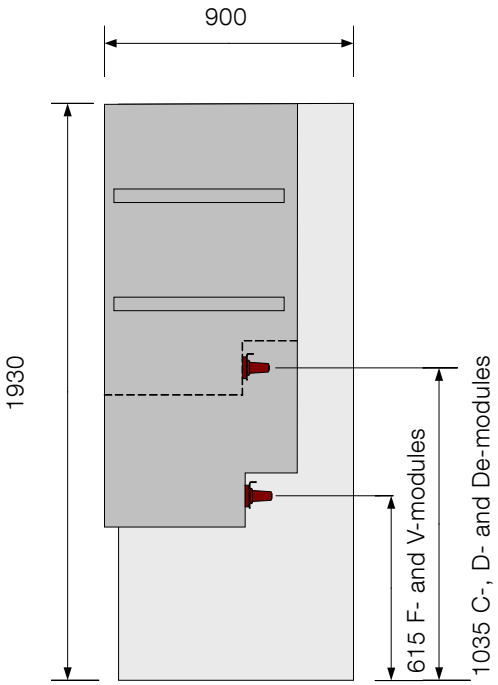
1.1 DESCRIPTION OF FUNCTIONS

1. Lifting lugs (hinged)
2. Nameplate with serial number
3. Mimic diagram
4. Load break switch
5. Earthing switch
6. Switch-fuse disconnector
7. Push buttons close/open
8. Fuse canister
9. Position indicator
10. Blown fuse indicator
11. Charged spring indicator
12. Padlock device
13. Cable compartment cover
14. Cable bushing
15. Cable support bar
16. Earth bar
17. Pressure indicator (additional equipment)
18. Capacitive voltage indication (additional equipment)
19. Short circuit indicator (additional equipment)
20. Ronis key interlock (additional equipment)
21. Operating mechanism for vacuum circuit-breaker
22. Low voltage compartment
23. Protection relay
24. Current transformers
25. Disconnector
26. Counter



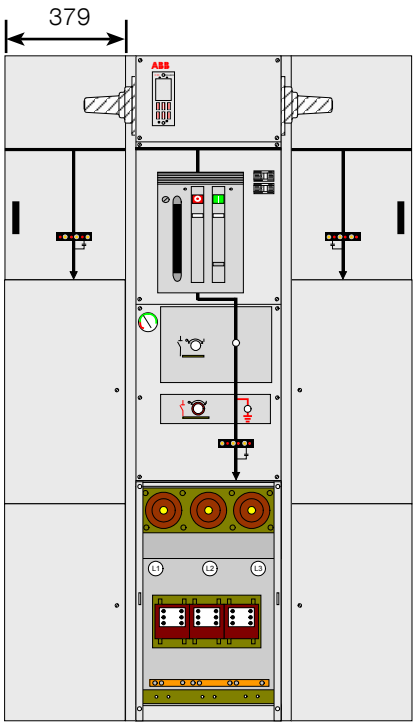
1.2 DIMENSIONAL DRAWINGS

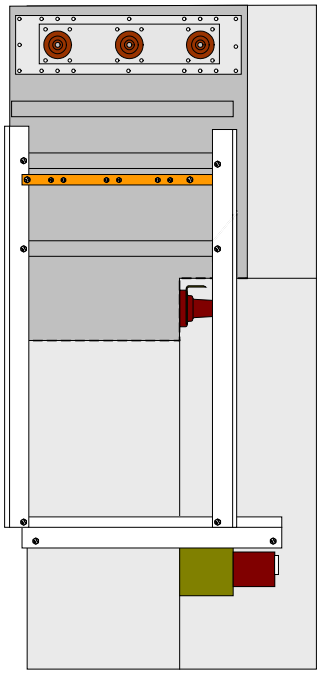


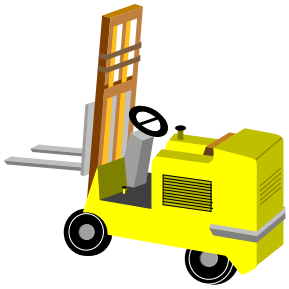


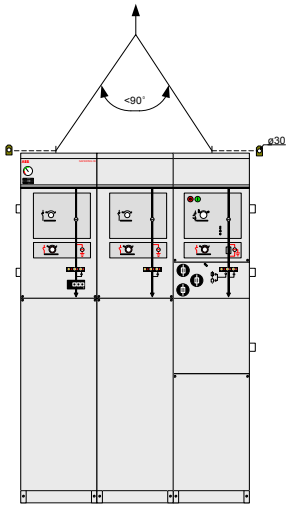
Unit	1-way	2-way	3-way	4-way
A (mm)	490	910	1330	1750

1.3 SIDE CONNECTIONS









2. TRANSPORT AND HANDLING

The units are delivered from the factory ready for installation.

Weight table for standard SafeRing

2-way DeF / DeV	550 kg
3-way CCF / CCV	800 kg
4-way CCCF / CCCV	1050 kg
4-way CCFF / CCVV	1100 kg
3-way CCC	750 kg
4-way CCCC	1000kg

SafePlus

Standard 1-way	300 kg
Standard 2-way	600 kg

3 and 4-way as for SafeRing

The weights are including additional equipment.

SafeRing / SafePlus is fitted with lifting lugs, but can also be moved on pallets with a forklift truck.

The units are top heavy so please handle with care!

2.1 BY RECEIVING INSPECTION

Upon receiving the SafeRing / SafePlus please check that the delivered equipment has not been damaged during transport. If any such damage has occurred, a claim must be submitted to the carrier immediately.

After unpacking, the following must be checked:

1. Operating handle – 1 piece should be included, normally fixed on right hand side .
2. Check that the pointer on the pressure indicator is in the green area.
3. Carry out a function test on the mechanical parts.

Any faults or omissions must be reported immediately to the supplier.

2.2 STORAGE

SafeRing / SafePlus must be stored under cover in a dry and well ventilated area until it is installed and put into operation.

3. TECHNICAL DATA
3.1 ELECTRICAL DATA

SafeRing / SafePlus 36		C-module		F-module		V-module	
		Switch disconnector	Earthing switch	Switch-fuse disconnector	Downstream earthing switch	Vacuum circuit-breaker	Earthing switch/ disconnetor
Rated voltage	kV	36/38,5/40,5	36/38,5/40,5	36/38,5/40,5	36/38,5/40,5	36/38,5/40,5	36/38,5/40,5
Power frequency withstand voltage	kV	70/80/95	70/80/95	70/80/95	70/80/95	70/80/95	70/80/95
- across disconnector	kV	80/95/110		80/95/110			80/95/110
Lightning impulse withstand voltage	kV	170/180/185	170/180/185	170/180/185	170/180/185	170/180/185	170/180/185
- across disconnector	kV	195/210/215		195/210/215			195/210/215
Rated normal current	A	630/630/630[1]		200/200/200[2]		630/630/630[1]	
Breaking capacities:							
- active load	A	630/630/630		200/200/200			
- closed loop	A	630/630/630		200/200/200			
- off load cable charging	A	20/21/21		20/21/21		50/50/50 (Class C1)	
- earth fault	A	60/63/63		60/63/63			
- earth fault cable charging	A	35/36/36		35/36/36			
- transfer current	A			840/750/750			
- short-circuit breaking current	kA			see[3]		20/20/20 (Class E1,S1)	
Making capacity	kA	50/50/50 (5 times)	50/50/50 (5 times)	see[3]	2,5/2,5/2,5 (5 times)	50/50/50	50/50/50
Class (Electrical endurance)		E3/E2/E2	E2/E2/E2	- / -	E2/E2/E2	E1/E1/E1	E2/E2/E2
Short time current 1 sec. [4]	kA	16/16/16	16/16/16		1/1/1	16/16/16	16/16/16
Short time current 3 sec.	kA	16/16/16	16/16/16	see[3]		16/16/16	16/16/16
Internal arc classification IAC AFL, 1s	kA	20/20/20		20/20/20		20/20/20	

[1] 400A for bushings Interface B (400 series plug-in)
[2] Depending on the current rating of the fuse-link
[3] Limited by high voltage fuse-links
[4] Maximum rating for bushings Interface B (400 series plug-in)

3.2 FUSE TABLE - CEF

SafeRing 36 SafePlus 36 F-panel 100% load		Rated voltage: 36 kV Operating voltage: 30 kV $I_{transfer}$ at 36 kV: 840 A T_o: 40 ms		
Transformer rating (kVA)	u_k (%)	Transformer rated current (A)	ABB Catalogue no.	Fuse link rated current (A)
100	4	1,9	1YMB531006M0001	6
125	4	2,4	1YMB531006M0002	10
160	4	3,1	1YMB531006M0002	10
200	4	3,8	1YMB531006M0003	16
250	4	4,8	1YMB531006M0003	16
315	4	6,1	1YMB531006M0003	16
400	4	7,7	1YMB531006M0003	16
500	4	9,6	1YMB531006M0004	25
630	4	12,1	1YMB531006M0004	25
800	5	15,4	1YMB531006M0004	25
1000	6	19,2	1YMB531006M0005	40
1250	6	24,1	1YMB531006M0005	40

SafeRing 36 SafePlus 36 F-panel 120% load		Rated voltage: 36 kV Operating voltage: 30 kV $I_{transfer}$ at 36 kV: 840 A T_o: 40 ms		
Transformer rating (kVA)	u_k (%)	Transformer rated current (A)	ABB Catalogue no.	Fuse link rated current (A)
100	4	1,9	1YMB531006M0001	6
125	4	2,4	1YMB531006M0002	10
160	4	3,1	1YMB531006M0002	10
200	4	3,8	1YMB531006M0003	16
250	4	4,8	1YMB531006M0003	16
315	4	6,1	1YMB531006M0003	16
400	4	7,7	1YMB531006M0003	16
500	4	9,6	1YMB531006M0004	25
630	4	12,1	1YMB531006M0004	25
800	5	15,4	1YMB531006M0005	40
1000	6	19,2	1YMB531006M0005	40
1250	6	24,1	1YMB531006M0005	40

- Both tables above are based on using ABB CEF high-voltage current-limiting back-up fuse-links
- Normal operating conditions with no overlaod of transformer (table 1) and with 20% overlaod of transformer (table 2)
- Ambient air temperature -25°C to +40°C

3.2 FUSE TABLE - SIBA

SafeRing 36 SafePlus 36 F-panel 100% load		Rated voltage: 36 kV Operating voltage: 30 kV $I_{transfer}$ at 36 kV: 840 A T_o : 40 ms			Rated voltage: 40,5 kV Operating voltage: 35 kV $I_{transfer}$ at 40,5 kV: 750 A T_o : 40 ms		
Transformer rating (kVA)	u_k (%)	Transf. rated current (A)	SIBA article no.	Fuse link rated current (A)	Transf. rated current (A)	SIBA article no.	Fuse link rated current (A)
100	4	1,9	30 008 13	6,3	1,6	30 340 13	6,3
125	4	2,4	30 008 13	10	2,1	30 340 13	6,3
160	4	3,1	30 008 13	10	2,6	30 340 13	10
200	4	3,8	30 008 13	10	3,3	30 340 13	10
250	4	4,8	30 008 13	16	4,1	30 340 13	10
315	4	6,1	30 008 13	16	5,2	30 340 13	16
400	4	7,7	30 008 13	20	6,6	30 340 13	16
500	4	9,6	30 008 13	25	8,2	30 340 13	20
630	4	12,1	30 016 13	31,5	10,4	30 340 13	20
800	5	15,4	30 016 13	31,5	13,2	30 341 13	25
1000	6	19,2	30 016 13	40	16,5	30 341 13	31,5
1250	6	24,1	30 016 13	40	20,6	30 341 13	40
1600	6	30,8	30 024 43	63	26,4	30 342 13	50
2000	6	38,5	30 024 43	63	33,0	30 342 13	63

SafeRing 36 SafePlus 36 F-panel 120% load		Rated voltage: 36 kV Operating voltage: 30 kV $I_{transfer}$ at 36 kV: 840 A T_o : 40 ms			Rated voltage: 40,5 kV Operating voltage: 35 kV $I_{transfer}$ at 40,5 kV: 750 A T_o : 40 ms		
Transformer rating (kVA)	u_k (%)	Transf. rated current (A)	SIBA article no.	Fuse link rated current (A)	Transf. rated current (A)	SIBA article no.	Fuse link rated current (A)
100	4	1,9	30 008 13	6,3	1,6	30 340 13	6,3
125	4	2,4	30 008 13	10	2,1	30 340 13	6,3
160	4	3,1	30 008 13	10	2,6	30 340 13	10
200	4	3,8	30 008 13	16	3,3	30 340 13	10
250	4	4,8	30 008 13	16	4,1	30 340 13	10
315	4	6,1	30 008 13	20	5,2	30 340 13	16
400	4	7,7	30 008 13	25	6,6	30 340 13	16
500	4	9,6	30 008 13	25	8,2	30 340 13	20
630	4	12,1	30 016 13	31,5	10,4	30 341 13	25
800	5	15,4	30 016 13	31,5	13,2	30 341 13	25
1000	6	19,2	30 016 13	40	16,5	30 341 13	40
1250	6	24,1	30 024 13	50	20,6	30 342 13	50
1600	6	30,8	30 024 43	63	26,4	30 342 13	63

- Both tables above are based on using SIBA HV-back-up fuse-links
- Normal operating conditions with no overlaod of transformer (table 1) and with 20% overlaod of transformer (table 2)
- Ambient air temperature -25°C to +40°C
- Fuse-links with rated current 63A are SSK type (for 36 kV)

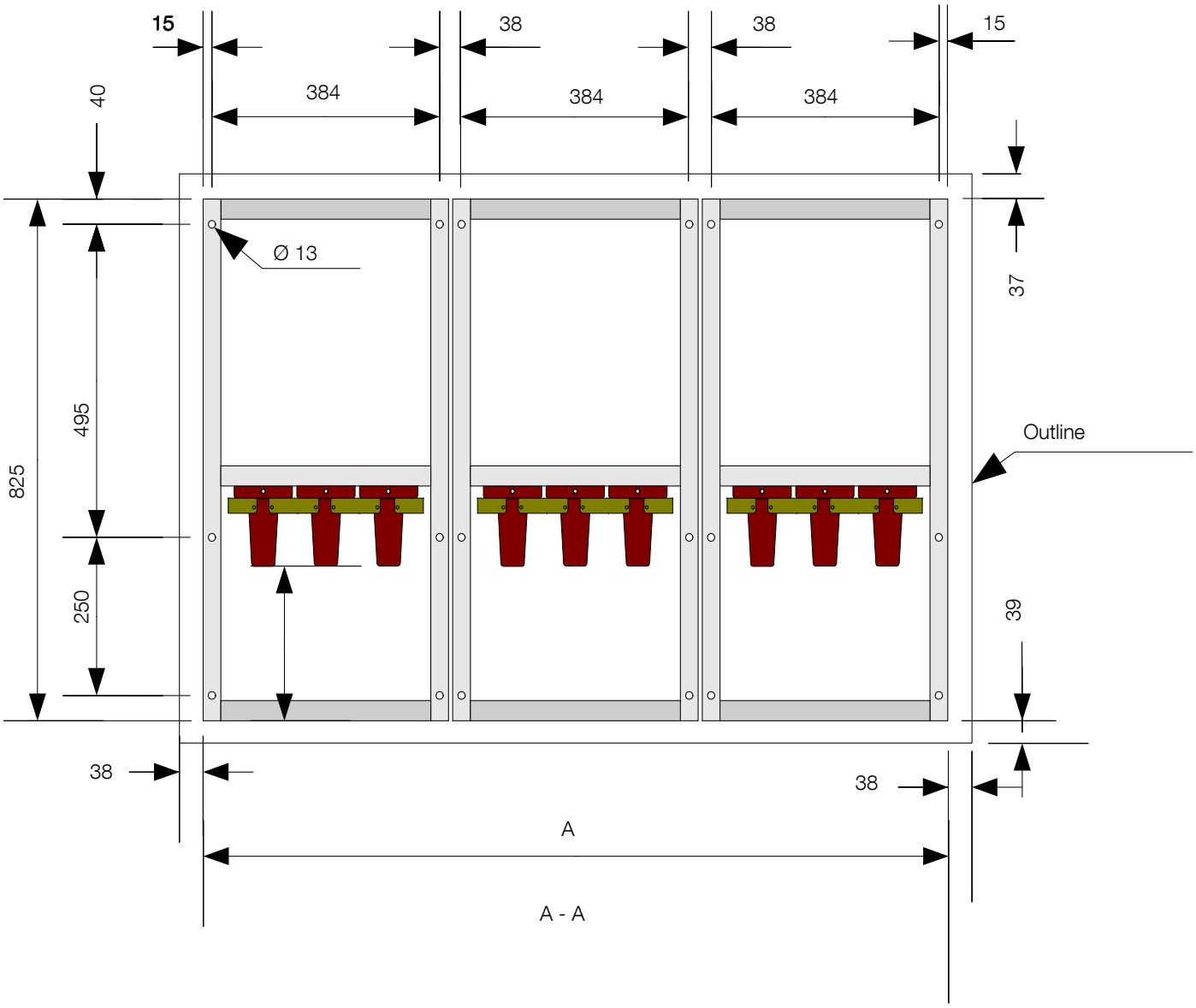
4. INSTALLATION

The floor must be well leveled and the unit must be fixed by means of anchor bolts in accordance with the dimensional drawing for the number of modules or units as appropriate.

The unit should have a minimum distance of 100 mm to the wall behind the unit and 20 mm to the side of the unit.

When installing Ring Main Unit or Compact Switchgear with Internal Arc Classification AFL, the following must be considered:

- Unit must be equipped with arc proof cable covers.
- Distance from floor to roof must be minimum 2600 mm
- Distance from back of unit to wall must be 100 mm.
- Distance from side wall of unit to wall must be minimum 20 mm.
- If unit is freestanding (i.e. distance from back of unit to wall exceeds 100 mm), the area behind the unit must be restricted and not accessible.
- Minimum dimensions of cable trench are 230 x 355 mm.



Unit	1-way	2-way	3-way	4-way
A (mm)	420	840	1260	1680

4.1 CABLE COMPARTMENT

Removal of cable cover:

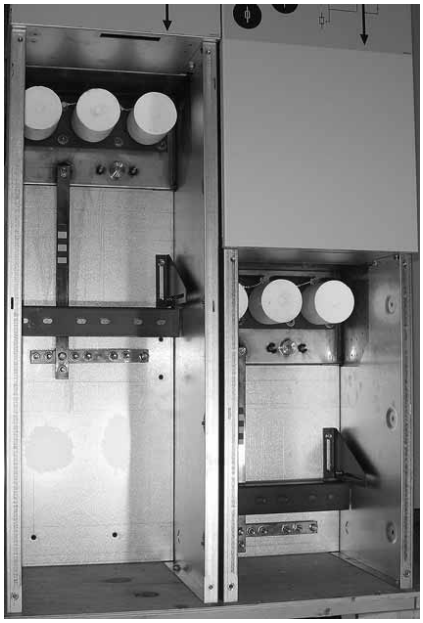
1. Loosen the two screws on the cable cover

2. Pull out and lift the cover off

NOTE!

The cable cover can be supplied with interlocking to earthing switches (additional equipment). When interlocking is fitted, the cable compartment can only be accessed when the earthing switch is in the closed position.

3. Removal of front section



4. Front sections removed

4.2 CABLE CONNECTION

SafeRing/ SafePlus is equipped with cable bushings outside cone type which comply with CENELEC EN 50181 interface B

(400 series plug-in) or interface C (400 series bolted).

All bushings are protected by the cable cover.

Cable terminations

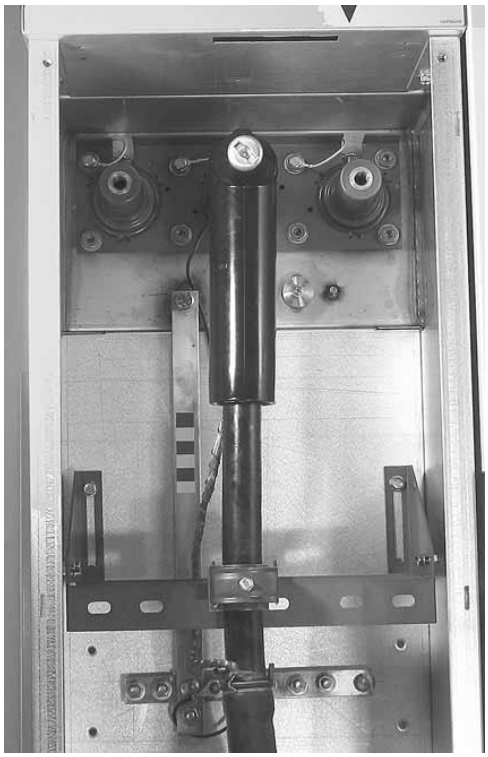
The following types are recommended:
Euromold / Elastimold
Tyco Electronics
nkt-cables
Prysmian
Südkabel
ABB Kabeldon

Please see supplier documentation for details.

The manufacturer's installation instructions must be followed. Be sure to lubricate the bushings thoroughly with the silicone supplied.

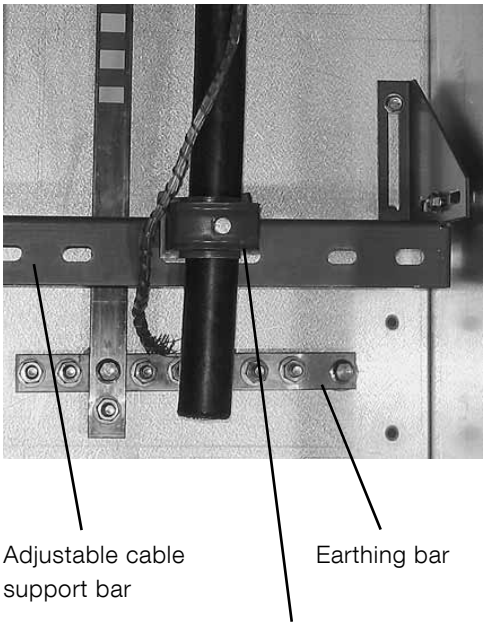
NOTE!

Where cables are not connected, the earthing switch must be locked in closed position or the bushings must be fitted with-dead end receptacles before the unit is put into operation.

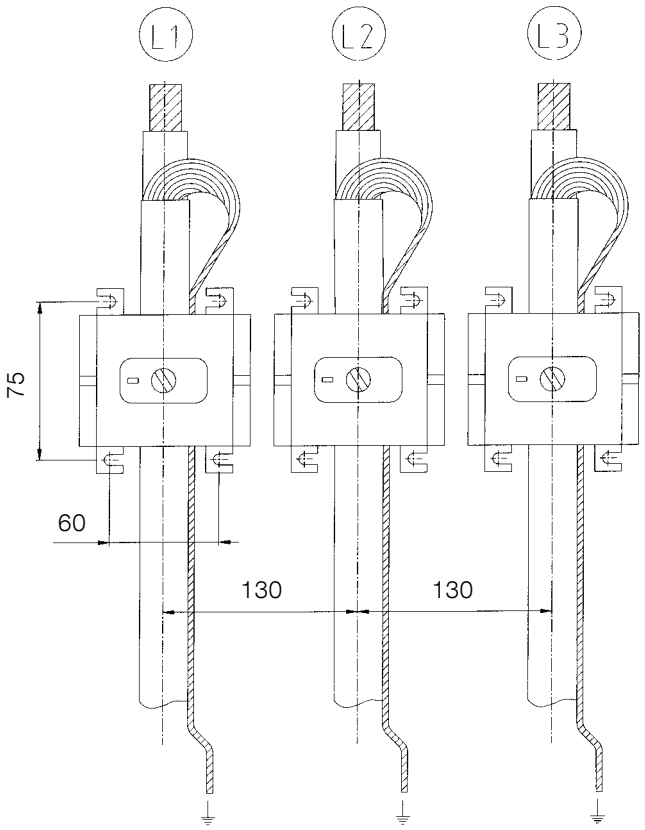


Prefabricated cable termination.

Cable compartment for C-, D- and De-modules



Cable compartment V-module with mounting plate for current transformers and fixed cable support bar



Installing current transformers. The cable shielding is led back through the centre hole and earthed

V-module with protection relay type REF610 in integrated LV-compartment with hinged door

4.3 RELAY AND CURRENT TRANSFORMERS

A protection relay is installed in each vacuum circuit-breaker module. The cables from the protection relay to the current transformers are installed from the factory, and end up in the cable compartment, ready for connection to the three current transformers supplied.

Before installation:

- Check that the three current transformers have been delivered and that they are all of the same type.
- Check that the current transformers are of the correct type, with the correctly rated transformer ratio, for the distribution transformer's rated current and for the adjustment range on the protection relay (see protection relay manual).

Each current transformer must be mounted onto its high voltage cable before the cable termination is fitted.

The earth shield on the cable must be led back through the centre hole in the current transformer (see figure on left) and earthed on the earthing bar in the cable compartment.

A mounting plate for the current transformers is fitted in the cable compartment.

After the current transformers have been installed in the unit, the cables from the protection relay are connected. Consult the manual supplied with the protection relay for a description of the connections.

SafeRing / SafePlus with vacuum circuit-breakers are prepared for self-powered OCEF protection relay ABB type REJ 603.

Relays with auxiliary voltage

SafePlus can be delivered with advanced protection relays:

- REF610 (integrated LV-compartment with hinged door)
- REF615 (high LV-compartment with hinged door)
- REF630 (high LV-compartment with hinged door)
- REF541 (high LV-compartment with hinged door)
- REF542+ (high LV-compartment with hinged door)

Separate manuals with examples of settings
have been prepared for each of these protection relays.

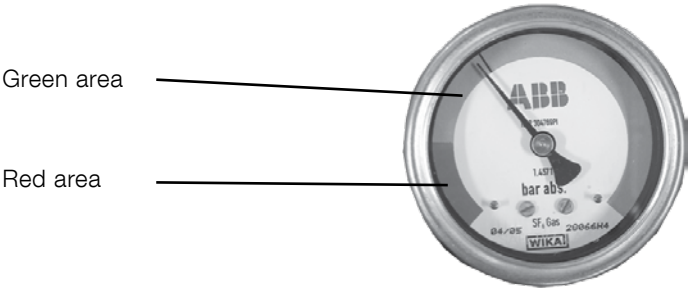
4.4 GAS PRESSURE

SafeRing / SafePlus contain SF_6 gas with a nominal pressure of 1,4 bar at 20° C.

SafeRing / SafePlus are «sealed for life» and is fitted with a temperature-compensated pressure indicator.

Pointer in green area - unit has correct pressure.
Pointer in red area - pressure is too low.

A temperature-compensated device emitting an electrical signal to indicate low gas pressure can be supplied on request

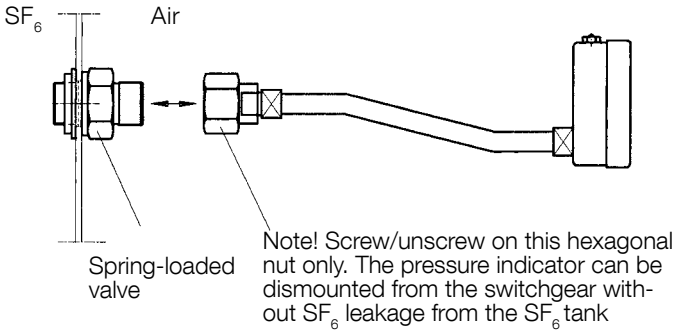


Topping up of SF_6 gas in SafeRing/SafePlus

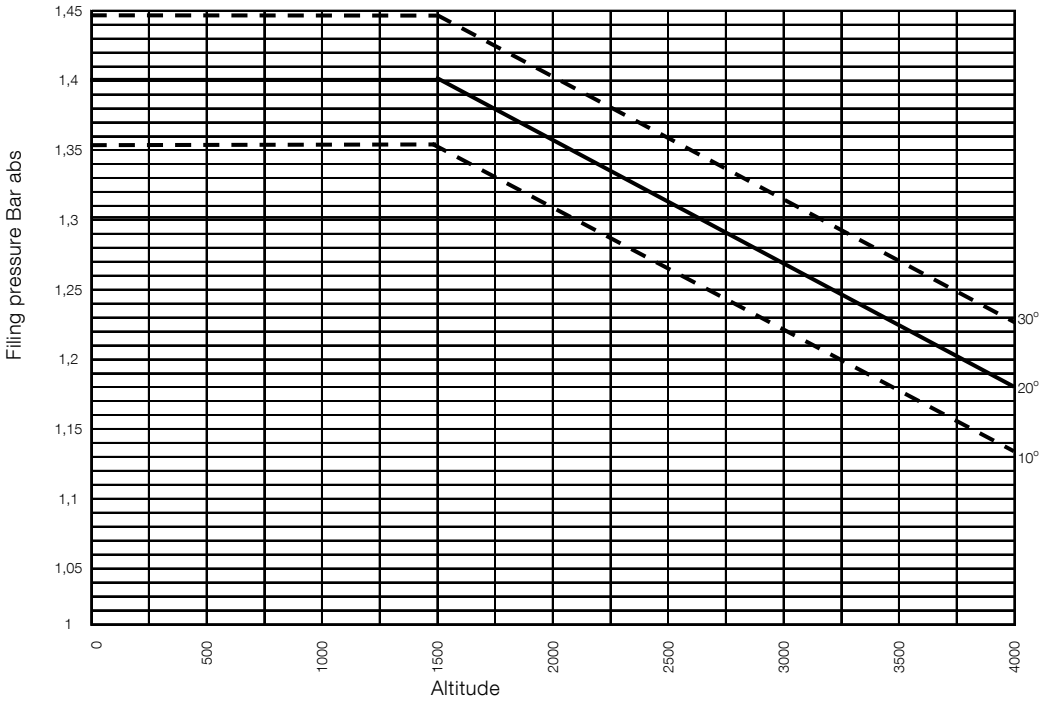
Potensial risk!

Operators must be trained and qualified for SF_6 gas handling

Following equipment is needed: SF_6 gas bottle with manometer and reduction valve, bottle for recovery of SF_6/air mixture, adapter and pressure measuring device. It is important that the pressure measuring device shows absolute pressure. If you have a pressure measuring device showing overpressure, please contact ABB for instructions (NHP 408025).



1. Remove the front cover and unscrew the pressure indicator by unscrewing the hexagon nut as shown on the figure at the right.
2. Screw the adapter to the valve. The tightening torque is max 45 Nm.
3. Before connecting the hose from the gas bottle to the adapter, the air in the hose must be removed by running SF_6 gas through the hose. The SF_6 gas must be recovered.
4. When gas is flowing into the RMU/switchgear, the manometer on the gas bottle has to be observed. When it shows 0,4 bar at ambient temperature 20° Celsius, (1,4 bar absolute) the gas filling must be stopped. See table for filling pressure below.
5. Remove the filling hose and connect the pressure device to check the pressure inside the RMU/switchgear.
6. When the correct pressure of 0,4 bar (1,4 bar absolute) is obtained, remove the adapter, check that the sealing between the pressure indicator and the valve is smooth and clean, and screw the pressure indicator to the RMU/switchgear with tightening torque max 45 Nm as shown above.



SF_6-gas temp °C	Absolute filling pressure mbar
0	1305
5	1328
10	1352
15	1376
20	1400
25	1424
30	1448
35	1472
40	1496

5. OPERATION

5.1 OPERATING CONDITIONS

Normal ambient conditions

SafeRing / SafePlus is generally equipped for operation/ service in normal indoor conditions in accordance with IEC 62271-1.

The following limitations apply:

Ambient temperature

Max. temperature	+40°C
Max. temperature (24-hour average)	+35°C
Min. temperature	- 25°C

Humidity

Max. average relative humidity measured over 24 hours	95%
Max. average relative humidity measured over 1 month	90%

Altitude

Max height above sea level for installation without reducing gas pressure is 1500 metres. In the interval from 1500 to 2500 meters, gas pressure has to be reduced according to figure on previous page. For installation above 2500 meters, please contact ABB for instructions.

Special conditions

In accordance with IEC 62271-1, the manufacturer and end-user must agree about special operating conditions which deviate from operation under normal conditions.

The manufacturer/supplier must be consulted in advance if especially difficult operating conditions are involved. When SafeRing/SafePlus is installed more than 1500 metres above sea level, the atmospheric pressure will be lower and the overpressure inside the tank will have to be reduced.

Airfreight

Units / modules transported by airfreight are delivered with reduced overpressure. For topping up, please see procedure for topping up of SF_6 gas.

Application of the X-ray regulations

One of the physical properties of vacuum insulation is the possibility of X-ray emissions when the contact gap is open. The specified type test performed by the Physikalisch-Technische Bundesanstalt (PTB) in Brunswick demonstrates that the local dosage output of 1 µSv/h at a distance of 10 cm from the touchable surface is not exceeded.

The results are as follows:

- The use of the vacuum interrupters at rated operation voltage is completely safe.
- The above requirement is also fulfilled on application of the rated power frequency withstand voltage specified for the switching device by DIN VDE 0670 and IEC 60056 or a DC voltage of 48 or 70 kV during cable tests.
- Higher voltages than the rated power frequency withstand voltage specified in DIN VDE or IEC standards or the DC test voltage should not be applied!
- Fulfillment of the above requirement with the vacuum interrupter in the open position is dependent on maintenance of the specified distance between the contacts (which is automatically ensured with correct mechanism function and force transmission).

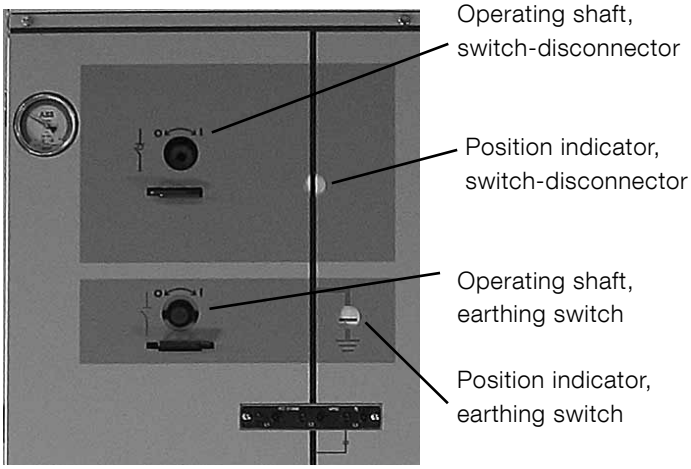
5.2 OPERATION

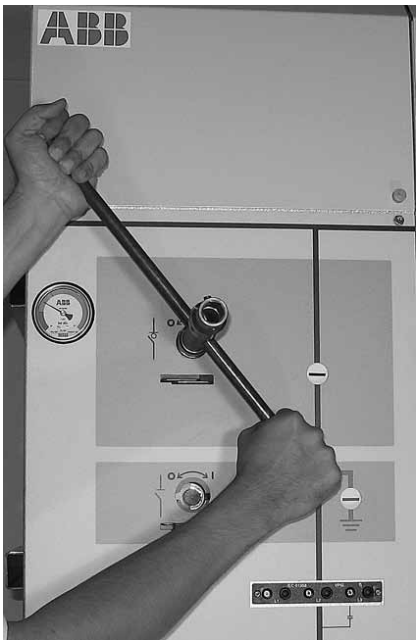
Before any operation of mechanisms, make sure that front covers are mounted.

All switch-disconnectoer and earthing switches can be operated with the included operating handle.

All mechanisms are designed and manufactured in such a way that all three phases are operated simultaneously. The speed of operation is independent of the operator action. An anti-reflex system, standard on all operating handles, prevents an immediate re-operation of switches.

5.2.1 SWITCH DISCONNECTOR





Switch disconnector:
Close: Turn the operating handle clockwise
Open: Turn the operating handle anti-cloclwise

The vacuum circuit-breaker has an integrated lever for the charging og the springs and push-buttons for operation.

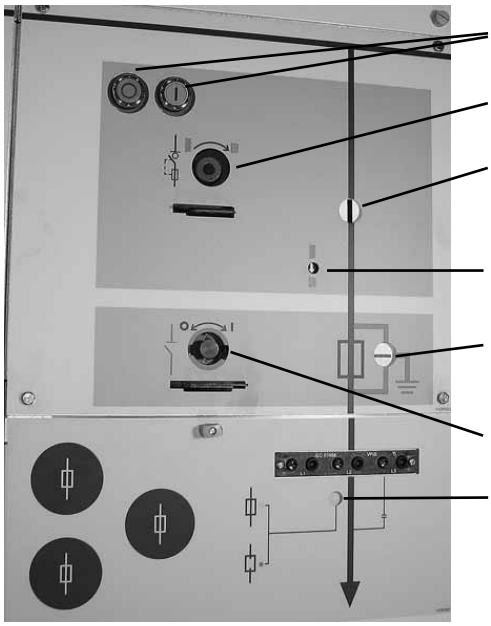
Internal mechanical interlocking between the switch-disconnector / isolator and the associated earthing switches prevents incorrect operation. The operation of the switch disconnector and earthing switches can be further interlocked by means of a padlock.

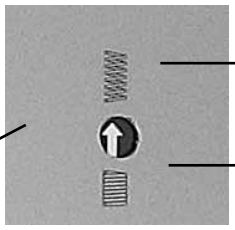
5.2.2 EARTHING SWITCH

Earthing switch:
Before entering handle, press interlocking bracket towards left. If the earthing switch is open, enter the handle with its pin on the left side. If the earthing switch is closed, enter the handle with its pin on the right side.

Earthing switch:
Close: Turn the operating handle clockwise
Open: Turn the operating handle anti-cloclwise
It may happen that the spring for the earthing switch is discharged during the opening operation, but the earthing switch does not open. If this happens, just continue the anti-clockwise operation of the handle, until the earthing switch is fully open. (check the position indicator of the earthing switch.)

5.2.3 SWITCH-FUSE COMBINATION

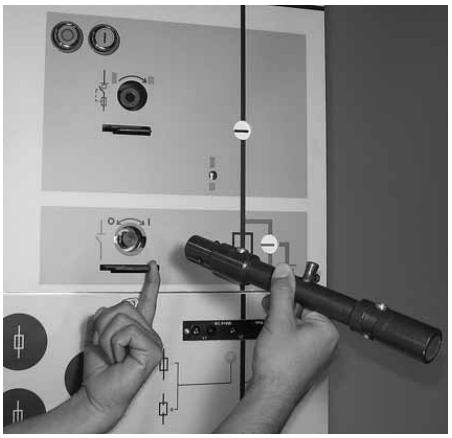




5.2.4 SWITCH-DISCONNECTOR

Switch-disconnector:
Close: Turn the operating handle clockwise. Then both closing and opening springs are charged. Charged spring indicator shall now show charged springs (arrow pointing downwards). Push green (I) button.
Open: Push red (O) button.Charged spring inicator shall now show uncharged sprongs (arrow pointing uwards).

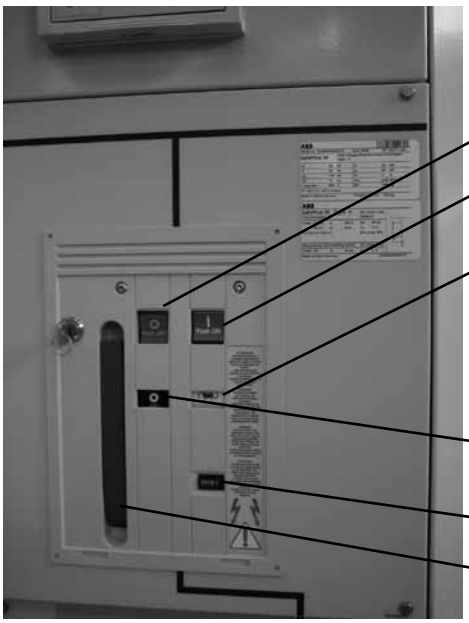
5.2.5 EARTHING SWITCH



Earthing switch:
Before entering handle, press interlocking bracket towards left. If the earthing switch is open, enter the handle with its pin on the left side. If the earthing switch is closed, enter the handle with its pin on the right side.

Earthing switch:
Close: Turn the operating handle clockwise
Open: Turn the operating handle anti-cloclwise
It will normally happen that the spring for the earthing switch is discharged during the opening operation, but the earthing switch does not open. If this happens, just continue the anti-clockwise operation of the handle, until the earthing switch is fully open. (check the position indicator of the earthing switch.)

5.2.6 VACUUM CIRCUIT-BREAKER - VCB



Push button - VCB (OFF)

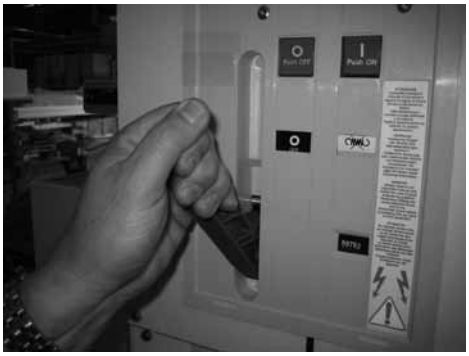
Push button - VCB (ON)

Indication -
spring charged /(discharged

VCB position indicator

Counter - closing and opening operations

Spring-charging leverr



Before operating of the VCB, check that the spring is charged. If the spring is not charged, it can be charged by means of the charging lever. The spring is fully charged when the indicator turns to charged spring (yellow symbol, about 10 operations needed to fully charge the spring).

Note: If the VCB is equipped with motor operation (optional) it is not necessary to charge the spring by hand. The motor starts charging the spring automatically as soon as the auxiliary voltage is switched on.

Close: Push green (ON) button

Open: Push red (OFF) button

Note: the downstream disconnector is mechanically interlocked with the VCB..

Operation of the downstream disconnector and earthing switch, see pos. 5.2.1 and 5.2.2.

5.3 INSTALLATION AND REPLACEMENT OF FUSE LINKS

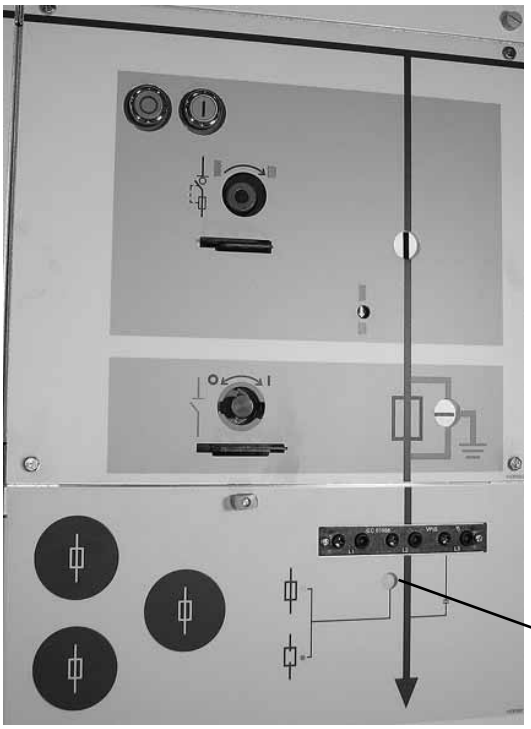
The F-module is equipped with a blown fuse indicator. If this indicator changes colour from white to red, this means that at least 1 fuse-link has blown. This will also automatically trip all three phases of the switch-fuse disconnector. It also makes operation of the switch-disconnector impossible before the blown fuse-link(s) has been replaced.

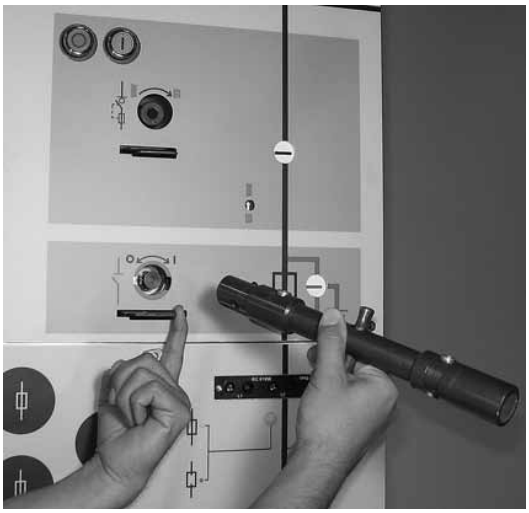
Acc. to IEC 60282-1 it is advisable to replace all 3 fuse-links even if only 1 or 2 has blown.

Fuse-links are replaced as shown in the sequence of illustrations.

Switch-fuse combinations are supplied without fuse-links installed.

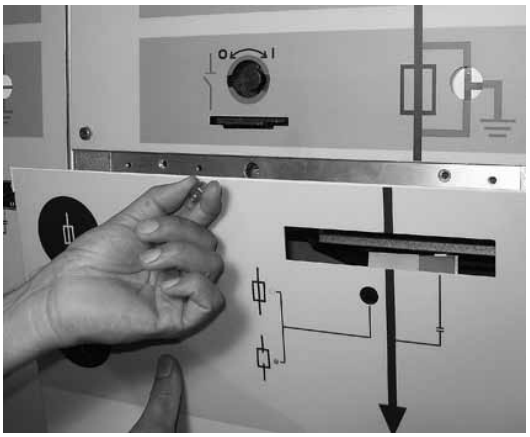
When installing fuse-links, follow the sequence of illustrations 1-9.



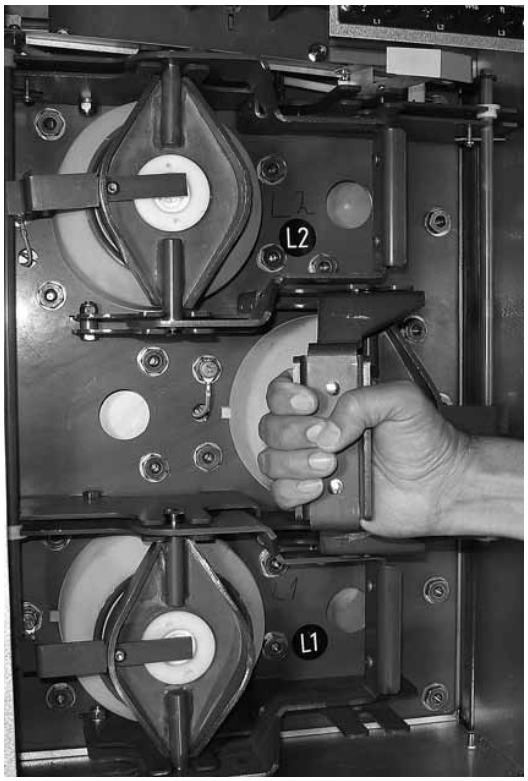


1. Before entering handle on to earthing switch, press interlocking bracket towards left.

2. Close earthing switch by turning operating handle clockwise..



3. Turn knob anticlockwise and tilt out front cover to gain access to fuse canisters.



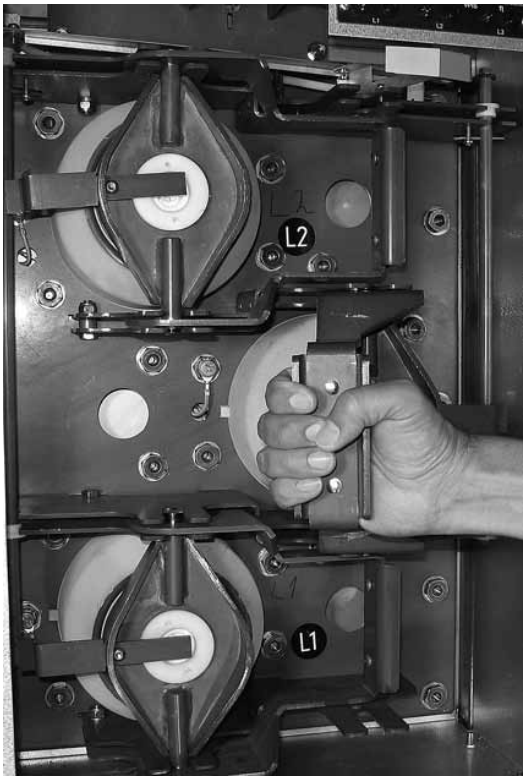
4. Pull handle and open the fuse canister.

5. If a fuse-link is already installed but has to be replaced, pull it out.

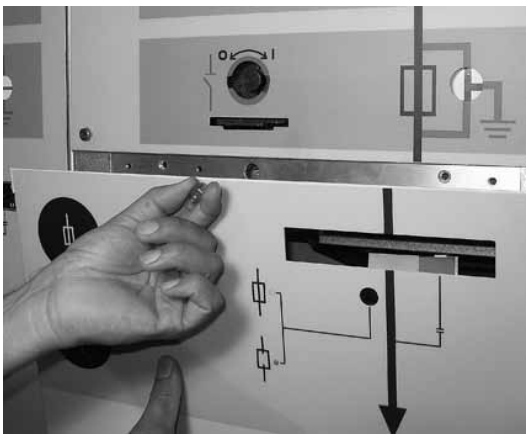
6. Fix the new fuse-link to the fuse cover by means of the contact screw.

Note! the striker pin must point towards the fuse cover.

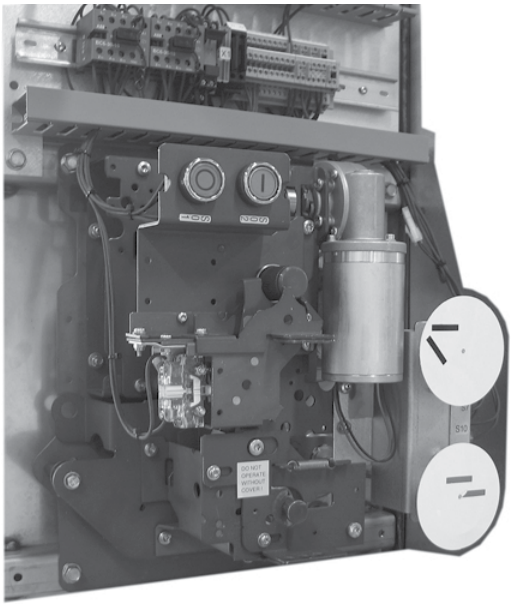
7. Insert the fuse-link into fuse canister..



8. Press the handle and close the fuse canister.



9. Fix the front cover. The switch-fuse combination is ready for operation.



6. ADDITIONAL EQUIPMENT

6.1 MOTOR OPERATION AND AUXILIARY SWITCHES

Circuit-breakers, switch-fuse disconnectors and load break switches can be equipped with motor operation. Available control voltages are 24, 48, 60, 110, 230 VDC and 110, 230 VAC. F- and V- modules can also be equipped with closing and opening coils. Motor operated F- and V-modules will always have closing and opening coils.

Auxiliary switches (2NO+2NC) can be supplied to indicate switch positions on all switches. Blown fuse-link can also be indicated by means of an auxiliary switch (1NO).

Motor operation, coils and auxiliary switches can easily be retrofitted.

When ordered, switchgear can also be supplied with an auxiliary switch (1NO) for monitoring of SF_6 pressure.

Access to the low-voltage connections is gained by removing the top front panel.

VPIS

HR-module

VIM-1

VIM-3

6.2 CAPACITIVE VOLTAGE INDICATION

All modules can be equipped with capacitive voltage indication type HR-module (VDS) or VPIS (Voltage Present Indicating System) acc. to IEC 61958.

This system has integrated LEDs.

By means of the sockets in VPIS and HR it is possible to carry out phase balance check using suitable phase comparators.

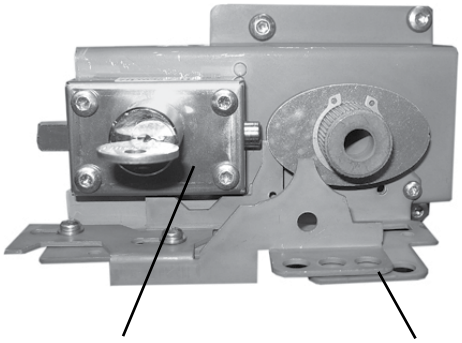
6.3 CURRENT MEASUREMENT

Ammeter (72 x 72 mm) and selector switch can be installed in each module. Current transformers have to be installed inside the cable compartment.

6.4 SIDE EXTENSION

When ordered, switchgear can be manufactured with side extension on both sides. This makes the switchgear more flexible and it can then be prepared for future extension.

For connection of switchgear, please see separate Installation manual for side extension, VDD006146 GB



Ronis key interlock Padlocking device

6.5 RONIS KEY INTERLOCK

To prevent unintended operations, all switches (except switch-disconnector on switch-fuse combination and circuit-breakers) have the possibility to be equipped with Ronis key interlock type EL11AP.

6.6 PADLOCKING DEVICE

All switches except circuit-breakers are equipped with padlocking device as standard. For circuit-breakers, padlocking device can be ordered as option.

6.7 SHORT CIRCUIT INDICATION

C, V, D and De-modules can be supplied with different types of short circuit and earth fault indicators.

7. MAINTENANCE

All components in the SF_6 tank are maintenance-free for the declared life expectancy of the product. The tank is made of stainless steel.

If the panels get any scratches or damage, these must be repaired with paint to prevent corrosion.

Mechanical parts are positioned outside the tank and behind the front panel. This enables easy access and replacement if required.

Mechanical parts are surface-treated to prevent corrosion. Moving parts are lubricated at the factory for the product's life expectancy. In extreme conditions (dust, sand and pollution), inspection and maintenance will be imperative, and in some cases replacements will be necessary. Check that the lubricants are not washed or wiped away from the mechanical moving parts.

7.1 CONTROL AND MONITORING THE GAS

SafeRing / SafePlus is a pressure-sealed system that normally does not require special inspections. However the gas pressure on the pressure indicator should always be checked prior to operation.

7.2 ENVIRONMENTAL CERTIFICATION

LIFE EXPECTANCY OF PRODUCT

The product is developed in compliance with the requirements denoted by IEC 62271-200. The design incorporates a life span under indoor service conditions exceeding 30 years.

The switchgear is gas-tight with an expected diffusion rate of less than 0.1 % per annum. Referring to the reference-pressure of 1.4 bar, the switchgear will maintain gas-tightness and a gas-pressure better than 1.3 bar at 20°C throughout its designed life span.

RECYCLING CAPABILITY

Raw Material	Weight (kg)	% of total weight	Recycle	Environmental effects & recycle/reuse processes
Iron	139,9	31,4	Yes	Separate, utilise in favour of new source (ore)
Stainless steel	130,8	29,3	Yes	Separate, utilise in favour of new source (ore)
Copper	71,9	16,1	Yes	Separate, utilise in favour of new source (ore)
Brass	3,0	0,7	Yes	Separate, utilise in favour of new source (ore)
Aluminium	1,0	0,2	Yes	Separate, utilise in favour of new source (ore)
Zinc	5,1	1,1	Yes	Separate, utilise in favour of new source (ore)
Silver	0,075	0,017	Yes	Electrolysis, utilise in favour of new source
PBT	2,3	0,5	Yes	Make granulate, re-use or apply as energy
PA6-6	5,3	1,2	Yes	
PC	0,8	0,2	Yes	
Other thermoplastic	0,1	0,0	Yes	
Packing foil	0,3	0,1	Yes	High-grade energy additive in refuse incineration
SF_6 gas	7,14	1,6	Yes	ABB AS in Skien reclaims used SF_6 gas
Dielectric oil	0,3	0,1	Yes	Collect / reclaim / regenerate
Wooden pallet	27,8	6,2	Yes	Re-use
Total recycleables	395,815	88,8		
Rubber	1,9	0,4	No	Incinerate energy in rubber
Epoxy compounds	46,5	10,4	No	Contains 60 % quartz sand, incinerate energy in epoxy
Unspecified	1,5	0,3	No	Stickers, film foils, powder coating, lubricates
Total non-recycleables	49,9	11,2		
Total weight **	445,715	100 %		

**) All figures are collected from CCF 3-way unit with fuse canisters

LIFECYCLE CONCEPT FOR TRANSPORT, INSTALLATION, REPAIR , SERVICE AND DISPOSAL AT END OF LIFE

ABB is committed to the protection of the environment and adhere to ISO 14001 standards. The unit contains no substances listed on the hazardous substances list.

The unit contains SF_6 with 0,4 bar overpressure in a maintenance free and sealed unit. The unit is a sealed pressure system and restrictions for air transport exist. Units damaged during transport are returned to the manufacturer for inspection and possible repair.

SF_6 is a fluorinated greenhouse gas covered by the Kyoto Protocol and care must be taken not to cause emission of SF_6 and at end-of-life the greenhouse gas must be recovered.

It is ABB's obligation to facilitate end-of-life recycling for our products. In the EU and EEA, the F-Gas Regulation must be followed. ABB's recycling service is according to IEC 61634 edition 1995 section 6: «End of life of SF_6 filled equipment» and in particular 6.5.2.a: «Low decomposition»: «No special action is required; non-recoverable parts can be disposed of normally according to local regulations.»

We also advise customer always to consult ABB's website : http://www.abb.com/sf6 .

ABB AS, Power Products Division's manufacturing site in Skien is equipped to recover SF_6 gas from discarded switchgears.

For more information please contact:

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