SafeRing / SafePlus

SF$_6$-insulated Ring Main Unit and Compact Switchgear
Installation and operating instructions

1VDD005976 GB

ABB

Contents

SafeRing 3 - way unit CCV

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 a 2, 3 or 4-way standard configurations with additional equipment according to customer specification.
Available configuraitons:
DF, CCF, CCC, CCCF, CCFF, DV, CCV, CCCC, CCCV, CCVV.

SafePlus has a unique flexibility due to its extendibility and the possible combination of fully modular and semi-modular configurations.
Available modules:
Be - SL - Sv - M - C - De - D - F - V.

SafeRing and SafePlus offer a sealed stainless steel tank which contains all the live components and switching functions.
The transformer is protected either by a switch fuse combination or a vacuum circuit-breaker.
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 installing the equipment.

Available modules are :
C - Cable switch
F - Switch fuse disconnector
D- Direct cable connection
De - Direct cable connection with earthing
V - Vacuum circuit breaker
SL - Busbar sectionalizer, load break switch
Busrise needed when SL on right side of SF6 tank
Sv - Busbar sectionalizer, vacuum circuit breaker
Sv always together with busrise (total width=650 mm)
Be - Busbar earthing
M - Metering cubicle

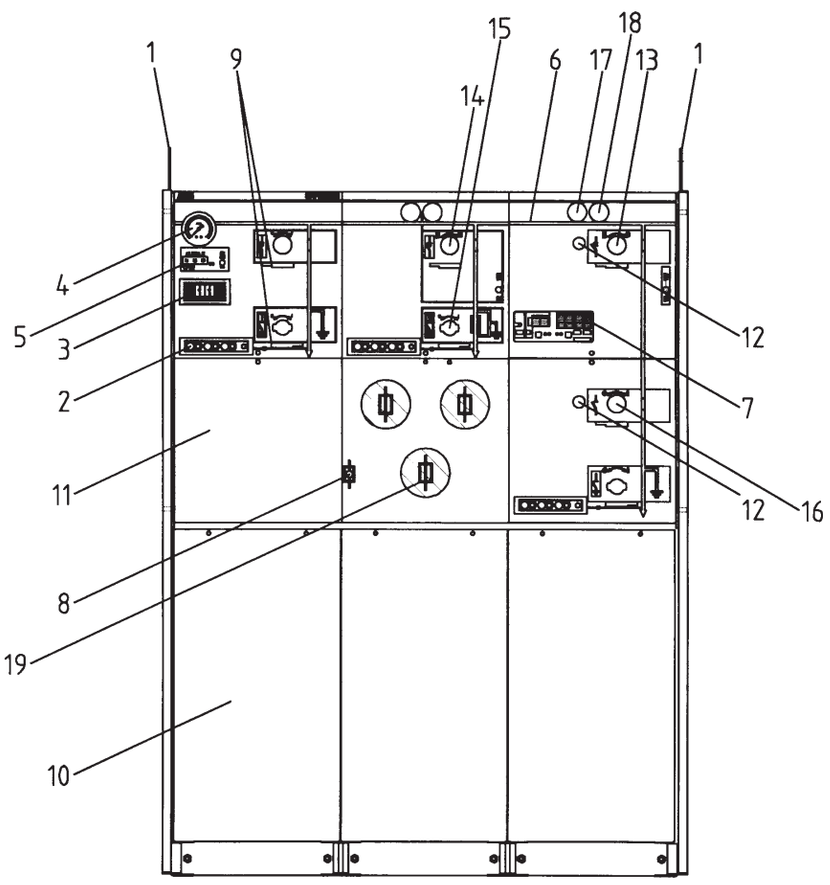
SafeRing / SafePlus with switch fuse combination in compliance with IEC 62271-105.
With this unit the transformer will be protected by current-limiting HV fuses in combination with a load break switch.
The load break switch is equipped with a stored spring energy mechanism which can be tripped by the fuse striker pin.

SafeRing / SafePlus with vacuum circuit-breaker in compliance with IEC62271-100
With this unit the transformer will be protected by a vacuum circuit breaker combined with relays and current transformers. The standard relays are based on digital technology and do not require an external power supply.

Further information can be found in the product catalogue for SafeRing and SafePlus, 1VDD006104 GB.

1.1 TABLE OF LOCATIONS

1. Lifting lugs
2. Capacitive voltage indication (additional equipment)
3. Short circuit indicator (additional equipment)
4. Pressure indicator (additional equipment)
5. Legend plate with serial number
6. Mimic diagram
7. Relay protection
8. Blown fuse indicator
9. Padlock device
10. Cable compartment
11. Test bushings (additional equipment)
12. Ronis key interlock (additional equipment)
13. Circuit breaker
14. Fuse switch disconnector
15. Earthing switch
16. Isolator
17. Circuit breaker open/ emergency stop
18. Circuit breaker close
19. Fuses



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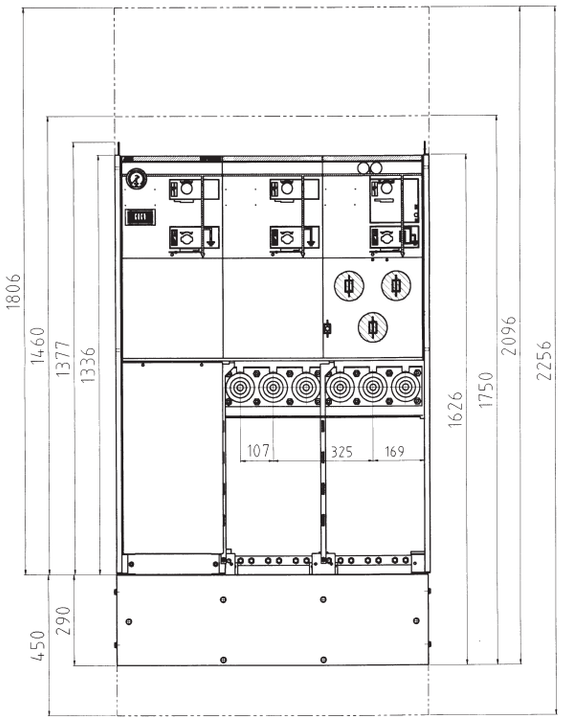
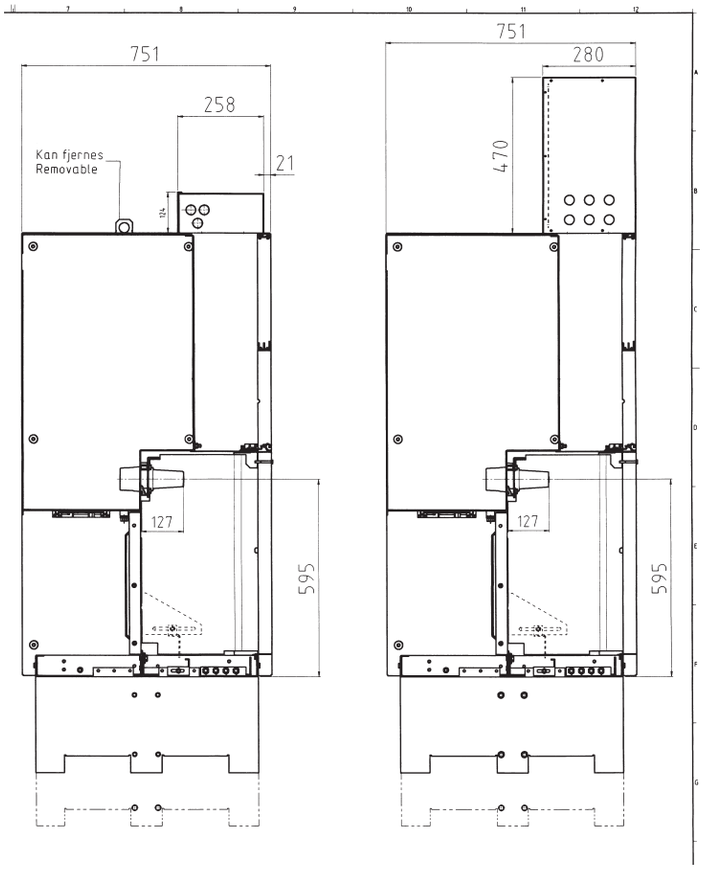
1.2 Dimensional drawings





Unit	mm
1-way	371
2-way	696
3-way	1021
4-way	1346
5-way	1671

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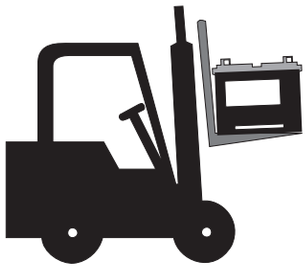

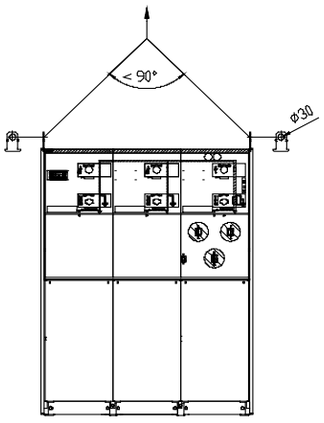

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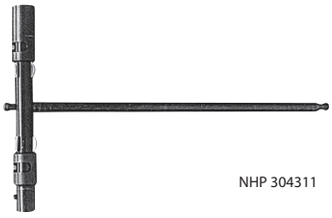
Unit	h_{min} (mm)
1-way	200
2-way	350
3-way	520
4-way	680
5-way	850



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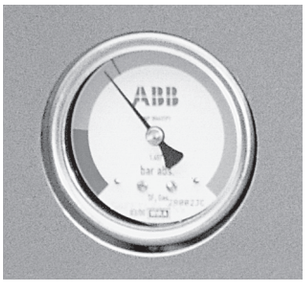


ABB			
Serial No.		Prod. year	IEC 62271-200
SafePlus	Medium Voltage Metal Enclosed Switchgear Type :		
Ur	kV	Ik	kA
fr	Hz	Ip	kA
Up	kV	tk	s
Ud	kV	Pre	0.04 MPa
Ir	A	SF6	kg
Temp. Class -25°C to +40°C indoor		IAC AFL	kA s
Made in Skien Norway		Weight max (m)	kg

2. TRANSPORT AND HANDLING

The units are delivered from the factory ready for installation.

Weight table for standard		SafeRing	
2-way DV	300 kg	2-way DF	300 kg
3-way CCV	450 kg	3-way CCF	450 kg
4-way CCCV	600 kg	4-way CCCF	600 kg
4-way CCVV	600 kg	4-way CCFF	600 kg
3-way CCC	450 kg		
4-way CCCC	600 kg		

SafePlus	
Standard 1-way	150 kg
2–3 and 4-way as for SafeRing	
5-way approx. between	750 kg
M-metering cubicle approx.	250 kg

The weights is without additional equipment

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

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.
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		C-Module		F-Module		V-Module	
		Switch-disconnector	Earthing switch	Switch-fuse combination	Downstream earthing switch	Vacuum circuit breaker	Earthing switch
Rated voltage	kV	12/15/17,5/24	12/15/17,5/24	12/17,5/24	12/17,5/24	12/15/17,5/24	12/15/17,5/24
Power frequency withstand voltage	kV	28/38/38/50	28/38/38/50	28/38/50	28/38/50	28/38/38/50	28/38/38/50
Impulse withstand voltage	kV	95/95/95/125	95/95/95/125	95/95/125	95/95/125	95/95/95/125	95/95/95/125
Rated current	A	630/630/630/630		see [1]		200/200/200/200	
Breaking capacities:							
active load	A	630/630/630/630					
closed loop	A	630/630/630/630					
off load cable charging	A	135/135/135/135					
off load transformer	A			20/20/20			
earth fault	A	200/150/150/150					
earth fault cable charging	A	115/87/87/87					
short circuit breaking current	kA			see [2]		16/16/16/16	
Making capacity	kA	52,5/52,5/40/40	52,5/52,5/40/40	see [2]	12,5/12,5/12,5	40/40/40/40	40/40/40/40
Short time current 0,5 sec.[3]	kA					16/16/16/16	
Short time current 1 sec. [4]	kA				5/5/5		
Short time current 3 sec. [5]	kA	21/21/16/16	21/21/16/16			16/16/16/16	16/16/16/16

[1] Depending on the current rating of the fuse-link
[2] Limited by high voltage fuse-links
[3] Maximum rating for bushings Interface A (200 series plug-in)
[4] Maximum rating for bushings Interface B (400 series plug-in)
[5] Maximum rating for bushings Interface C (400 series bolted)

SafeRing is tested according to IEC publications IEC 60265, IEC 60694 and IEC 62271, parts 100, 102, 105, 200

SafePlus		C-Module		F-Module		V-Module	
		Switch-disconnector	Earthing switch	Switch-fuse combination	Downstream earthing switch	Vacuum circuit breaker	Earthing switch
Rated voltage	kV	12/15/17,5/24	12/15/17,5/24	12/17,5/24	12/17,5/24	12/15/17,5/24	12/15/17,5/24
Power frequency withstand voltage	kV	28/38/38/50	28/38/38/50	28/38/50	28/38/50	28/38/38/50	28/38/38/50
Impulse withstand voltage	kV	95/95/95/125	95/95/95/125	95/95/125	95/95/125	95/95/95/125	95/95/95/125
Rated current	A	630/630/630/630		see [1]		630/630/630/630	
Breaking capacities:							
active load	A	630/630/630/630					
closed loop	A	630/630/630/630					
off load cable charging	A	135/135/135/135					
off load transformer	A			20/20/20			
earth fault	A	200/150/150/150					
earth fault cable charging	A	115/87/87/87					
short circuit breaking current	kA			see [2]		21/21/16/16	
Making capacity	kA	62,5/52,5/50/50	62,5/52,5/50/50	see [2]	12,5/12,5/12,5	52,5/52,5/40/40	52,5/52,5/40/40
Short time current 0,5 sec.[3]	kA					16/16/16/16	
Short time current 1 sec.	kA	25/-/-/- [5]	25/-/-/- [5]		5/5/5	16/16/16/16 [4]	
Short time current 3 sec.	kA	21/21/21/21	21/21/21/21			21/21/16/16	21/21/16/16

[1] Depending on the current rating of the fuse-link
[2] Limited by high voltage fuse-link
[3] Maximum rating for bushings Interface A (200 series plug-in) with rated current 200A
[4] Maximum rating for bushings Interface B (400 series plug-in)
[5] Maximum rating for bushings Interface C (400 series bolted)

SafePlus is tested according to IEC publications IEC 60265, IEC 60694 and IEC 62271, parts 100, 102, 105, 200

3.2 FUSE TABLE FOR MODULES

100% Transformer rating (kVA)

U_N (kV)	25	50	75	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	CEF
3	16	25	25	40	40	50	50	80	100	125	160	160					7,2 kV
3,3	16	25	25	40	40	50	50	63	80	100	125	160					
4,15	10	16	25	25	40	40	50	50	63	80	100	125	160				
5	10	16	25	25	25	40	40	50	50	63	80	100	160	160			
5,5	6	16	16	25	25	25	40	50	50	63	80	100	125	160			
6	6	16	16	25	25	25	40	40	50	50	80	100	125	160	160		
6,6	6	16	16	25	25	25	40	40	50	50	63	80	100	125	160		
10	6	10	10	16	16	25	25	25	40	40	50	50	80	80	125	125	12 kV
11	6	6	10	16	16	25	25	25	25	40	50	50	63	80	100	125	
12	6	6	10	16	16	16	25	25	25	40	40	50	63	80	100	125	
13,8	6	6	10	10	16	16	25	25	25	25	40	50	50	63	80	100	17,5 kV
15	6	6	10	10	16	16	16	25	25	25	40	40	50	63	80	100	
17,5	6	6	6	10	10	16	16	16	25	25	25	40	50	50	63	80	
20	6	6	6	10	10	16	16	16	25	25	25	40	40	50	63	63	24 kV
22	6	6	6	6	10	10	16	16	16	25	25	25	40	50	50	63	
24	6	6	6	6	10	10	16	16	16	25	25	25	40	40	50	63	

– The table is based on using fuses type ABB CEF
– Normal operating conditions with no overload
– Ambient temperature -25°C + 40°C

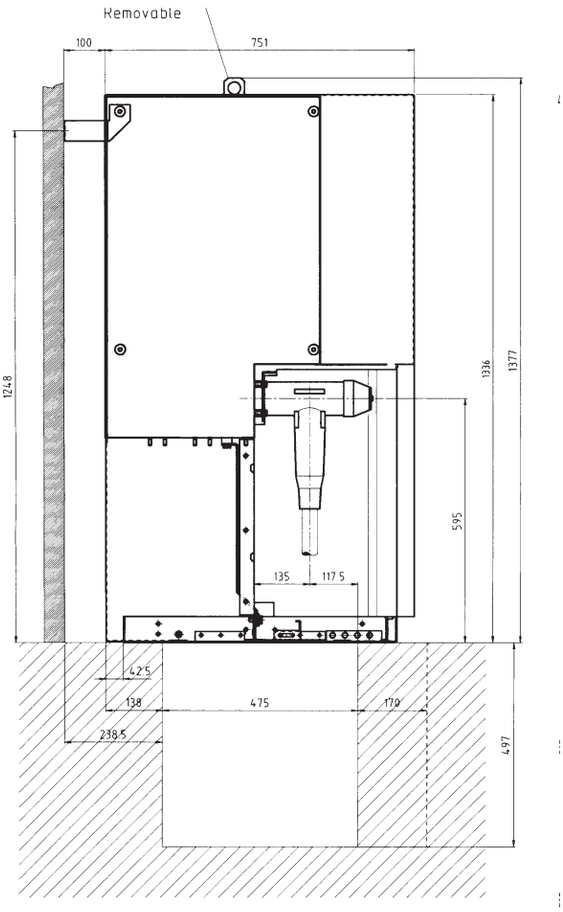
120% Transformer rating (kVA)

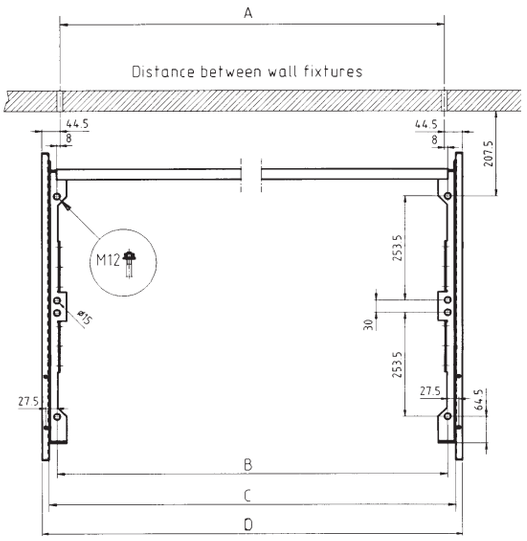
U_N (kV)	25	50	75	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	CEF
3	16	25	25	40	40	50	63	80	100	125	160						7,2 kV
3,3	16	25	25	40	40	50	63	80	80	100	125						
4,15	10	16	25	25	40	40	50	63	80	80	100	125					
5	10	16	25	25	25	40	40	50	63	80	80	125	160				
5,5	6	16	16	25	25	25	40	50	50	80	80	100	125	160			
6	6	16	16	25	25	25	40	40	50	63	80	100	125	160			
6,6	6	16	16	25	25	25	40	40	50	63	80	80	100	125			
10	6	10	10	16	16	25	25	25	40	40	50	63	80	80	125		12 kV
11	6	6	10	16	16	25	25	25	25	40	50	50	80	80	100	125	
12	6	6	10	16	16	16	25	25	25	40	40	50	63	80	100	125	
13,8	6	6	10	10	16	16	25	25	25	25	40	50	50	80	80	100	17,5 kV
15	6	6	10	10	16	16	16	25	25	25	40	40	50	63	80	100	
17,5	6	6	6	10	10	16	16	16	25	25	25	40	50	50	63	80	
20	6	6	6	10	10	16	16	16	25	25	25	40	40	50	63	80	24 kV
22	6	6	6	6	10	10	16	16	16	25	25	25	40	50	50	63	
24	6	6	6	6	10	10	16	16	16	25	25	25	40	40	50	63	

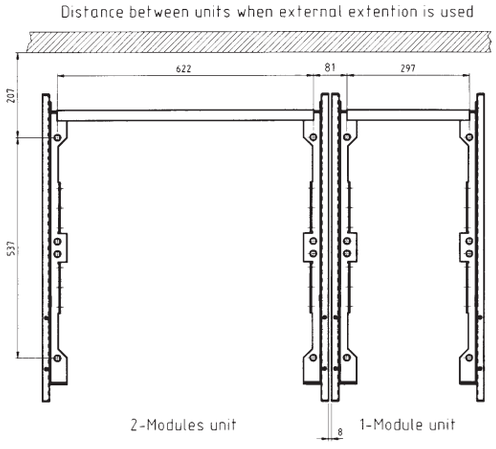
– The table is based on using fuses type ABB CEF
– Normal operating conditions with 20% overload
– Ambient temperature -25°C + 40°C

4. INSTALLATION

The base must be flat and fitted with anchor bolts in accordance with the dimensional drawing for the number of modules or units as appropriate.

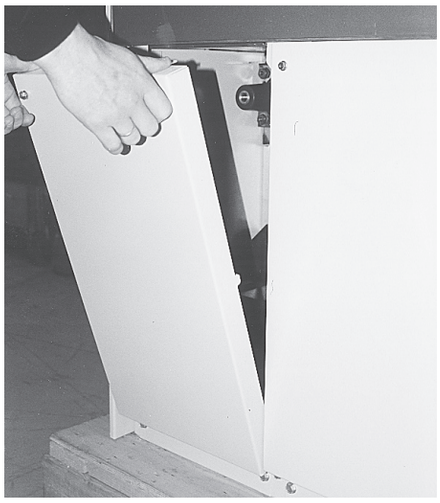






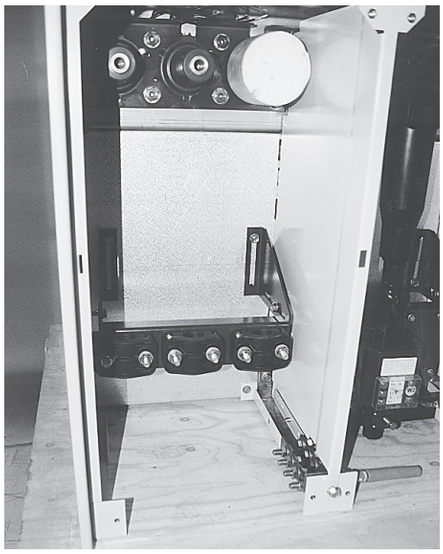
NHP 102102

Unit	A	B	C	D
1-way	271	297	336	371
2-way	696	622	661	696
3-way	1021	947	986	1021
4-way	1346	1272	1313	1346
5-way	1581	1597	1636	1671



1. Loosen the screws on the cable cover, pull out and lift cover off.

2. Removal of front section.

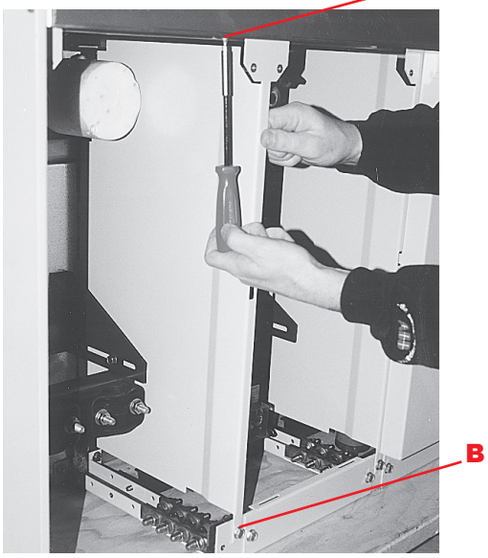


3. Front section removed.

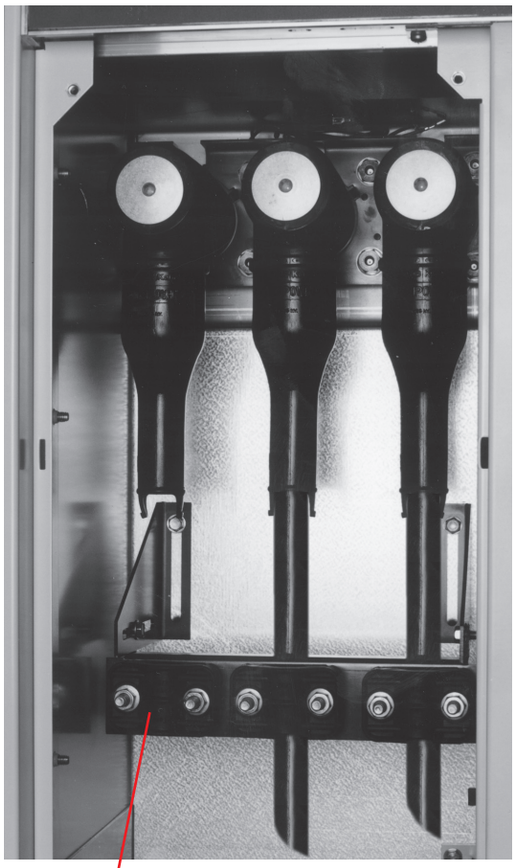
4.1 CABLE COMPARTMENT

Removal of cable cover:

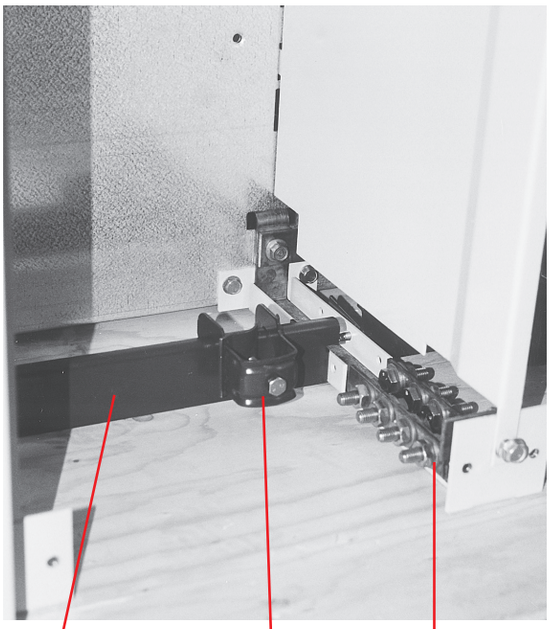
NB!
The cable cover can be supplied with interlocking to earthing switches. When interlocking is fitted, the cable cabinet can only be accessed when the earthing switch is in the closed position.



4. The panel can be removed by unscrewing A and B.



Adjustable cable support beam (additional equipment).



Cable support beam

Earthing bar

Cable clamp(additional equipment).

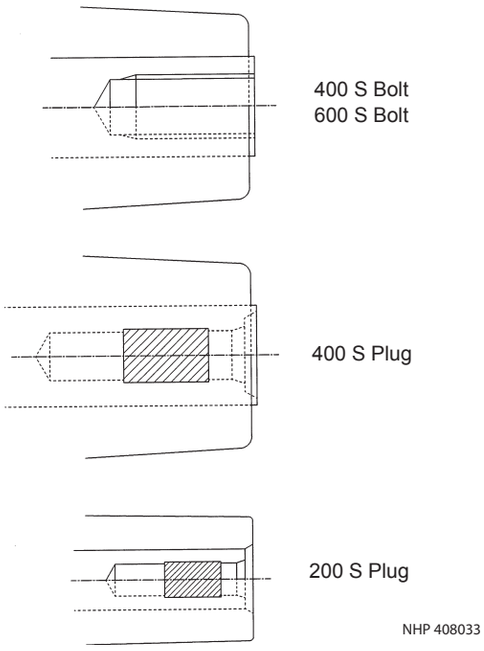
4.2 CABLE CONNECTION

SafeRing/SafePlus is equipped with external bushings which comply with DIN47636T1 & T2/EDF HN 525-61 for termination of cables.

All bushings are situated in the same height from the floor and are protected by the cable cover.

SafeRing / SafePlus can be supplied with the following bushings for the various type of cubicle.

Type of module / Bushings	C	F	V
200 series plug in		X	X
400 series plug in	X	X	X
400 series bolted	X	X	X
600 series bolted	X		

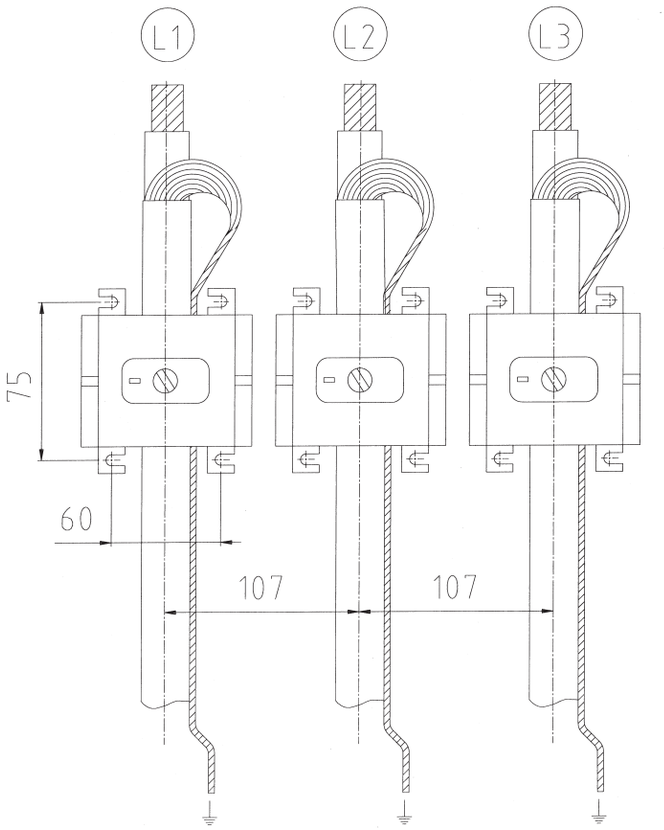


Cable adapters

The following types are recommended:
ABB Kabeldon
ABB Kabel und Draht
Elastimold
Raychem
Cooper
3M

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.

N**B!**
Where cables are not connected, the earthing switch must be locked in closed position or the bushings must be fitted with deadend recepticals before the unit is put into operation.



NHP 304712

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

4.3 CURRENT TRANSFORMERS FOR RELAY PROTECTION

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

A protection relay is installed in each vacuum circuit breaker module. The cables from the protection relay to the current transformers are placed 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.

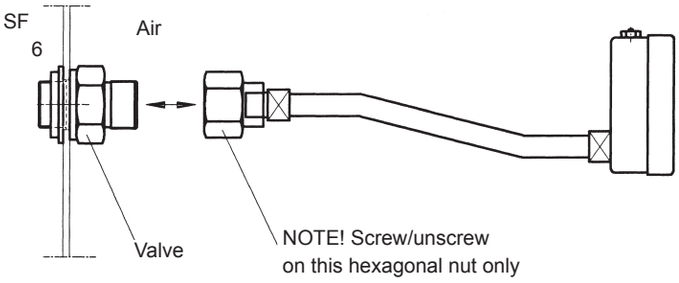
SafeRing with vacuum circuit breakers are prepared for three different types of protection relays: SACE PR521, SEG WIC1 and MPRB 99-1.0-GF. All three types are designed so that there is no need for external auxiliary voltage for correct functioning.

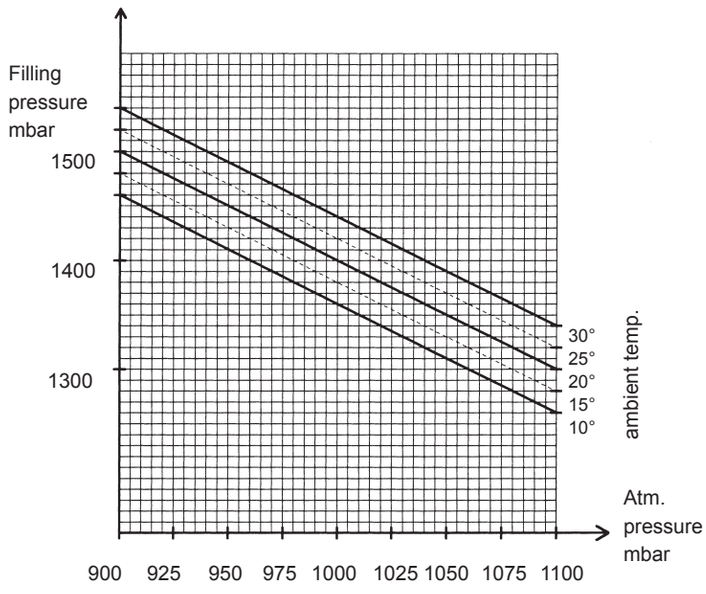
Separate manuals have been prepared for each of these protection relays, with examples of adjustments.

SACE PR 521 and SEG WIC1
These relays offers advanced protection with facilities for constant-time, normal inverse, very inverse and extremely inverse characteristics as well as simple earth fault protection in accordance with IEC 60255-3.

MPRB 99-1.0-GF
This is a simple type of inverse-time protection relay, with fixed settings specially developed for distribution transformers.The MPRB 99-1.0-GF also has a earthfault protection module.
It is essential for correct functioning that the current transformers are properly connected and that the protection relay is properly adjusted.

SafeRing can be delivered with advanced protection relays. As option SPAJ140 can be delivered and also other ABB relays like REJ and REF54_ can be fitted. This will require additional low voltage compartment.
See separate documentation for these relays.





NHP 408025

Refilling of SF_6 gas in SafeRing/SafePlus

Following equipment is needed gas bottle with manometer and reduction valve adapter pressure measuring device

1. Remove front cover and unscrew manometer as shown.
2. Screw (tightening the torque.45 Nm) the adapter to the valve.
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.
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 tem perature 20° Celsius, (1,4 bar absolute) the gas filling must be stopped. See table for filling pressure above.
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, re move the adapter and screw with tightening torque 45 Nm the manom eter to the RMU/switchgear as shown above.
   Observe that the sealing between the manometer and the valve is smooth and clean.

4.4 GAS PRESSURE

SafeRing / SafePlus contains SF_6 gas with a nominal pressure of ***1.4*** bar at 20° C.

SafeRing/ SafePlus is «sealed for life» and is fitted with a temperature-compensated pressure indicator.
A temperature-compensated device that emits an electrical signal to indicate lower pressure can be supplied on request.

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

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 60694.
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%

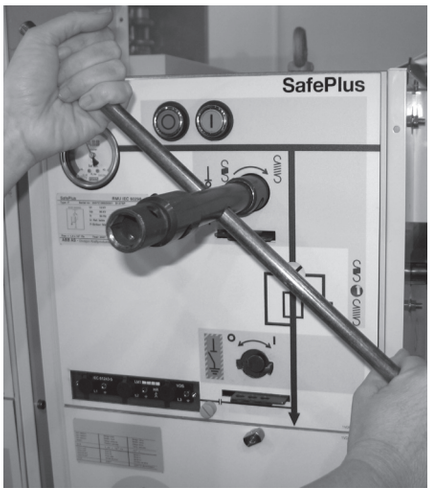
Max height above sea level for installation without reducing gas pressure	1,500 metres

Special conditions
In accordance with IEC 60694, 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 electrical equipment is installed at more than 1,500 metres above sea level, for example, the atmospheric pressure will be lower and the overpressure in the tank will have to be reduced.

Airfreight
Units / modules delivered with reduced overpressure - see procedure for refilling.

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

Earthing switch:
Close: Turn the operating handle clockwise.
Open: Turn the operating handle anti-clockwise.

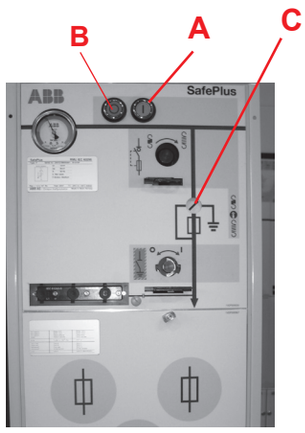


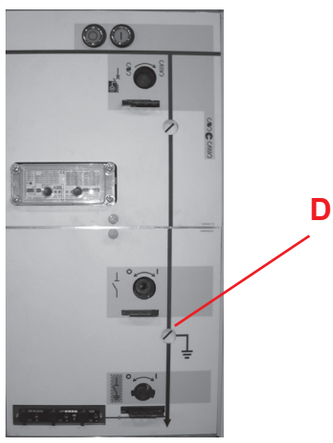
Switch fuse disconnector.
Close: Turn the operating handle clockwise to charge the close/open spring. Then push the green button. **(A)**
Open: Push the red button. **(B)**
In circuit breaker configurations, the transformer circuit breaker can be tripped by the protection relay, while in switch fuse configurations fuse switch disconnector can be triggered by the fuse striker pin if an over current or short-circuit occurs.

5.2 OPERATION

All switches can be operated with the included operating handle.
Internal mechanical interlocking between the switch disconnector/isolator and the associated earthing switches prevents incorrect operation.
The isolator in the V-Module can only be opened after the circuit breaker is opened. Then the circuit breaker can be closed for testing purpose.The operation of the switch disconnector/circuit breaker and earthing switches can be further interlocked by means of a padlock. The earthing switches are operated by a snap action mechanism, which ensures fast closing.
The earthing switch is closed by turning the operating handle clockwise. Turning the operating handle anti-clockwise opens the switch.
For closing the switch fuse disconnector / circuit breaker the spring mechanism must be charged. Turning the operating handle clockwise does this. Then the green “on” button must be pressed to close the switch/breaker.
An anti-reflex system, standard on all operating handles, prevents the immediate re-operation of switches.

F-Module





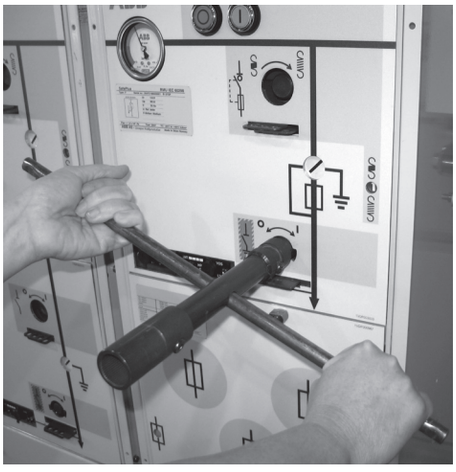
V-Module

Mechanical position indicators:
C: Switch fuse disconnector and Earthing switch both open
D: Isolator and Earthing switch both open

5.3 INSTALLATION AND REPLACEMENT OF FUSES

A red indicator below the fuse symbol on the lower front panel indicates a fuse trip. Fuses are replaced as shown in the sequence of illustrations. Switch fuse configurations are supplied without fuses installed.
When installing fuses for the first time, follow the sequence of illustrations 1-9.

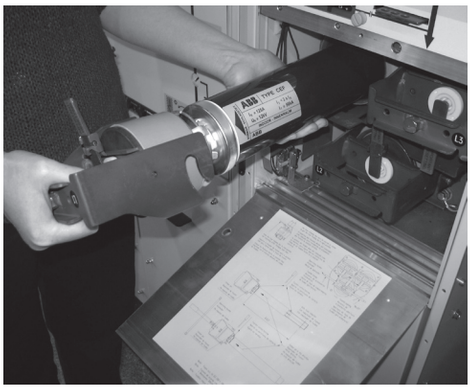
1. Fuse trip indicator.



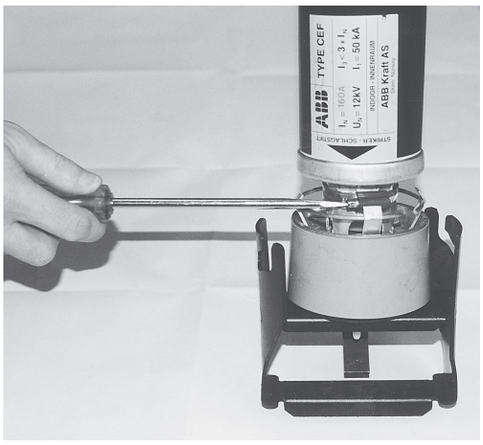
2. Close earthing switch by turning operating handle clockwise.

3. Unscrew fuse cover.
4. Tilt out the fusepanel to gain access to fuse canisters.

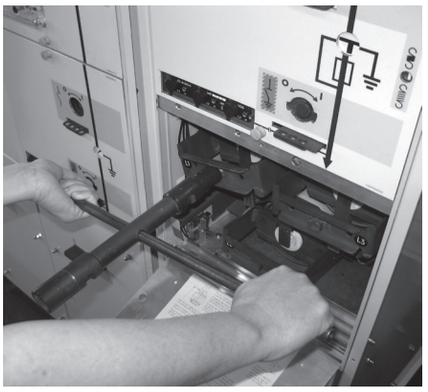
5. Applying the operating handle and turning anti-clockwise opens the fuse canisters.



6. Pull out the fuse handle. The fuses are firmly fixed in the fuse cover.

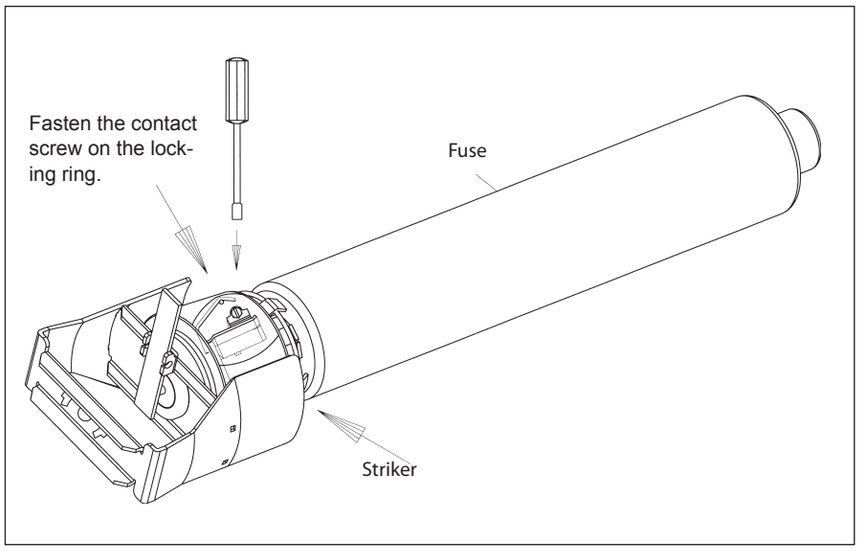


7. Fix the fuses to the fuse cover using the contact screw
   - The striker must point out from the fuse canister for the fuse to function properly.



8. Turn the handle on the fuse cover clockwise to lose and seal the fuse canister. Use the operating handle.

9. Close the fuse panel.
   The switches are ready for operation.



5.4 RELAYS

SafeRing / SafePlus with vacuum circuit breakers are prepared for three different types of protection relays: SACE PR521, Circutor, MPRB 99-1.0-GF and SEG WIC1. All three types are designed so that there is no need for external auxiliary voltage for correct functioning.

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

MPRB 99-1.0-GF
This is a simple type of inverse-time protection relay, with fixed settings specially developed for distribution transformers.The MPRB 99-1.0-GF also has a earthfault protection module.
It is essential for correct functioning that the current transformers are properly connected and that the protection relay is properly adjusted.

SafePlus can be delivered with advanced protection relays. As option SPAJ140 can be delivered and also other ABB relays like REJ and REF54_ can be fitted. This will require additional low voltage compartment.
See separate documentation for these relays.

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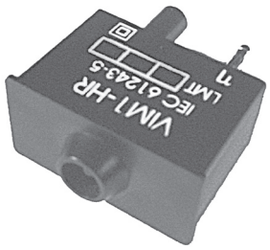
6. ADDITIONAL EQUIPMENT

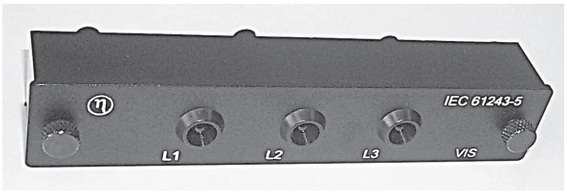
6.1 LOW-VOLTAGE CONNECTIONS
AUXILIARY CONTACTS
(2NO+2NC) can be supplied to indicate switch positions on all switches/breakers. Access to the low-voltage connections is gained by removing the top front panel. A shunt trip coil (AC or DC) can be fitted on the transformer switch/breaker.

6.2 REMOTE CONTROL AND MONITORING UNIT
SafeRing can be equipped with an integrated remote control and monitoring unit (see picture left).
This unit is preengineered and can be delivered and installed as a retrofit solution or complete from factory.
SafePlus can have the same equipment but need an additional low voltage compartment on top of the switchgear.



Vim 1

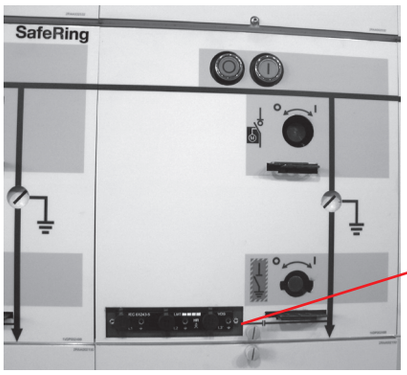
Voltage indicator



Vim 3

6.3 CAPACITIVE VOLTAGE INDICATION

Socket for capacitive voltage ondication
HR-module IEC 61243-5



Capacitive voltage indicator type HR

Phase balance check

6.4 SHORT CIRCUIT INDICATOR

Three types can be supplied:
Horstman ALPHA-M
Horstman ALPHA-E
Horstman GAMMA

6.5 MOTOR OPERATION

Cable switches, vacuum circuit-breakers and earthing switches are operated by mechanisms located behind the front panel. The mechanisms for all the switches and breakers are operated manually with the operating level (standard), or are fitted with motor operation (additional equipment). The earthing switch can only be operated manually and is fitted with mechanisms to achieve fault making capabilities.

Motor operation can be easily retrofitted.

6.6 CABLE TESTING

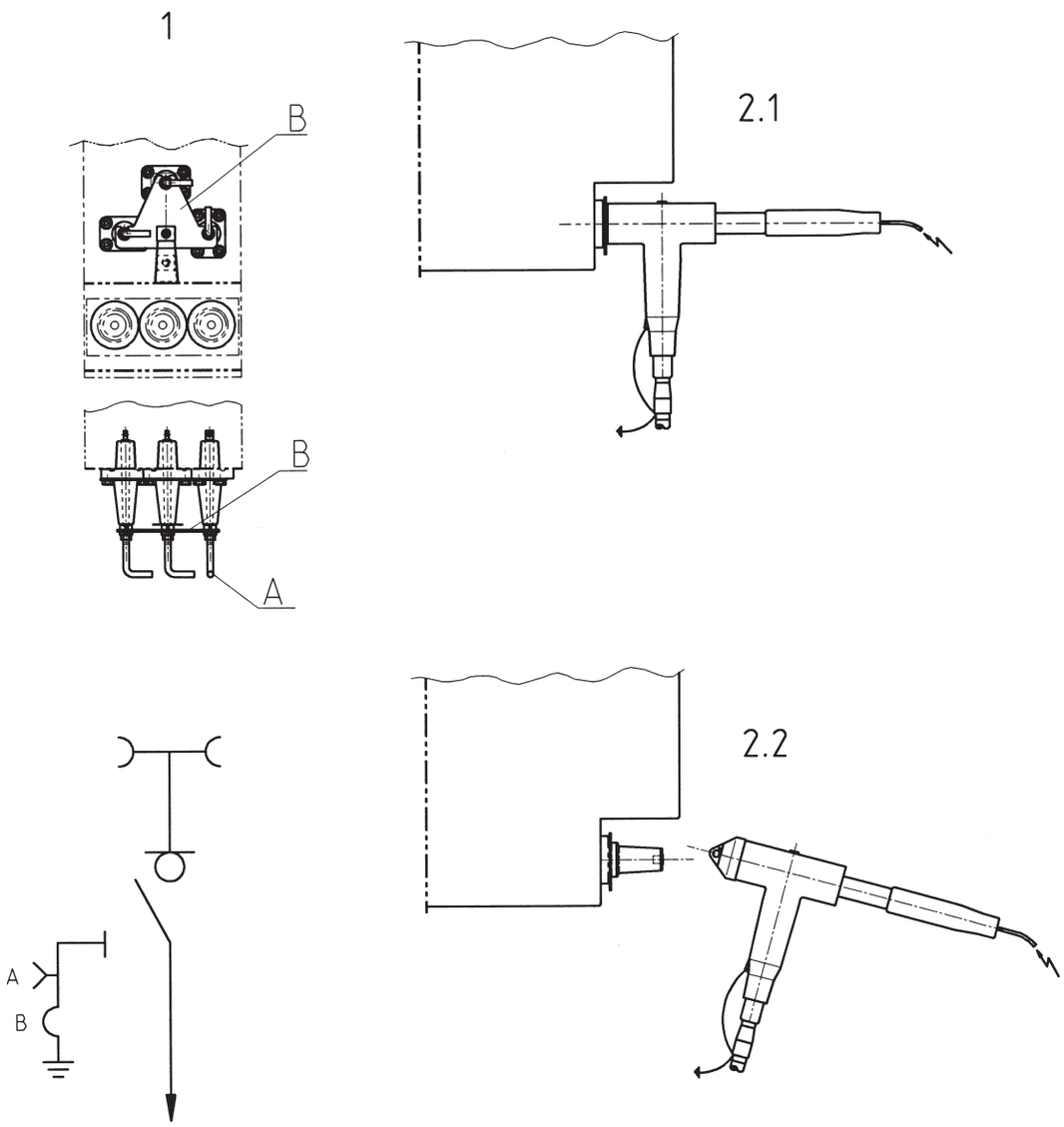
Voltage testing and locating cable faults can be performed in two ways:

1. Directly at the testing points (A) if they are fitted on the unit. Proceed as follows: engage the earthing switch. Connect the testing equipment on top of the testing points which hold the earth bar (B). Remove the earth bar and perform the test. Refit the earth strip before the testing equipment is disconnected

2. Directly at the cable connectors which are designed for test ing the voltage of the cable.
   Follow the supplier's instructions.

   2.1. Cable connector connected

   2.2. Cable connector dismounted



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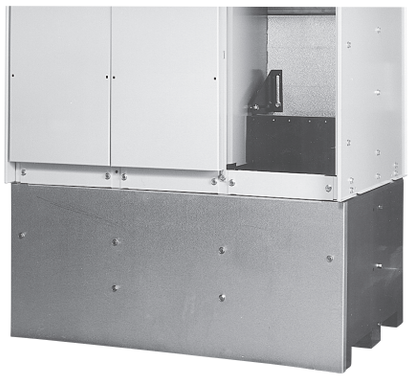


Base frame

Top entry box low voltage cables

6.7 EXTERNAL BUSBAR
SafeRing and SafePlus can be equiped with an external busbar. See seperate instruction manual NOPOWSP 6006 GB.

6.8 ARC-SUPPRESSOR
An arc-suppressor can be fitted on all cable modules for SafeRing and C, D, De and V-modules on SafePlus. They must be ordered together with the unit and cannot be retrofitted.
The tripped of an arc-suppressor is indicated by means of a electric contact in the SF_6 tank, wired to the terminal strip behind the top front panel. (This requires aux. voltage supply.)

6.9 PRESSURE INDICATOR
SafeRing / SafePlus is always supplied with a pressure indicator in the form of a manometer. Additionally it is possible to fit device for an electric signal if the pressure is low. This requires aux. voltage supply.

6.10 BASE FRAME
SafeRing/ SafePlus can be installed on a separate base frame. The base frame is designed for cable entry from both sides or from the back.
Two different heights 290 mm and 450 mm.

6.11 RONIS KEY INTERLOCK
SafeRing / SafePlus can be supplied with a RONIS, EL 11 AP key interlocking system for breakers, switches and earthing switches

6.12 TOP ENTRY BOX FOR LOW VOLTAGE CABLES
SafeRing/SafePlus can be supplied with top entry box for low voltage cables.

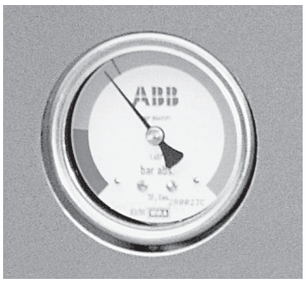
6.13 LOW VOLTAGE COMPARTMENT
SafePlus can be supplied with low voltage compartment for protection relays, metering and other secondary equipment.

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 substain 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 lubricant is 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 manometer should always be checked prior to operation.

7.2 ENVIRONMENTAL CERTIFICATION

1. LIFE EXPECTANCY OF PRODUCT

The product is developed in compliance with the requirements denoted by IEC 298. The design incorporates a life span under indoor service conditions exceeding 30 years (IEC 298 annex GG).
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* throughout its designed life span. *) at 20°C.

2. RECYCLING CAPABILITY

Raw Material	Weight	% of total weight – 320kg	Re-cycle	Environmental effects & recycle/reuse processes
Iron	132,80 kg	42,53%	Yes	Separate, utilise in favour of new source (ore)
Stainless steel	83,20 kg	24,93%	Yes	Separate, utilise in favour of new source (ore)
Copper	43,98 kg	14,09%	Yes	Separate, utilise in favour of new source (ore)
Brass	2,30 kg	0,74%	Yes	Separate, utilise in favour of new source (ore)
Aluminium	8,55 kg	2,74%	Yes	Separate, utilise in favour of new source (ore)
Zinc	3,90 kg	1,25%	Yes	Separate, utilise in favour of new source (ore)
Silver	0,075 kg	0,024	Yes	Electrolysis, utilise in favour of new source
Thermoplastic	5,07 kg	1,63%	Yes	Make granulate, re-use or apply as energy superior additive in refuse incineration
Epoxy incl. 60% quartz	26,75 kg	8,35 %	Yes	Grind to powder and use as high-grade energy additive in cement mill
Rubber	1,35 kg	0,42 %	Yes	High-grade energy additive in refuse incineration
Dielectric oil	0,21 kg	0,066 %	Yes	Reclaim or use as High-grade energy additive in refuse incineration
SF_6 gas	3,24 kg	1,04%	Yes	ABB AS in Skien reclaims used SF_6 gas.
Total for recycling	**311,44kg**	**97,25 %**		
Not specified *	9,00 kg			*Stickers, Film-foils, powder coating, screws, nuts, tiny components, grease ….
Total weight **	320,00 kg	100 %		
Packing foil	0,2 kg		Yes	High-grade energy additive in refuse incineration
Wooden pallet	21,5 kg		Yes	Re-use or use as energy additive in refuse incineration

**)All figures are collected from CCF 3-way unit with arc suppresser.

3. END-OF-LIFE

ABB AS, Power Products Division, is committed to the protection of the environment and adhere to ISO 14001 standards. It is our obligation to facilitate end-of-life recycling for our products.
There exist no explicit requirements for how to handle discarded switchgears at end-of-life. ABB's recycling service is according to IEC 1634 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 recommend ABB's website : http://www.abb.com/sf6 .

ABB AS, Power Products Division in Skien is equipped to reclaim SF_6 gas from discarded switchgears.

Text and illustrations are not binding.
The right to make alterations is reserved.

ABB AS
Power Products Division
P. O. Box 108, Sentrum
N-3701 SKIEN
Norway

Tel: +47 35 58 20 00
Fax: +47 35 52 41 08
www.abb.com

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