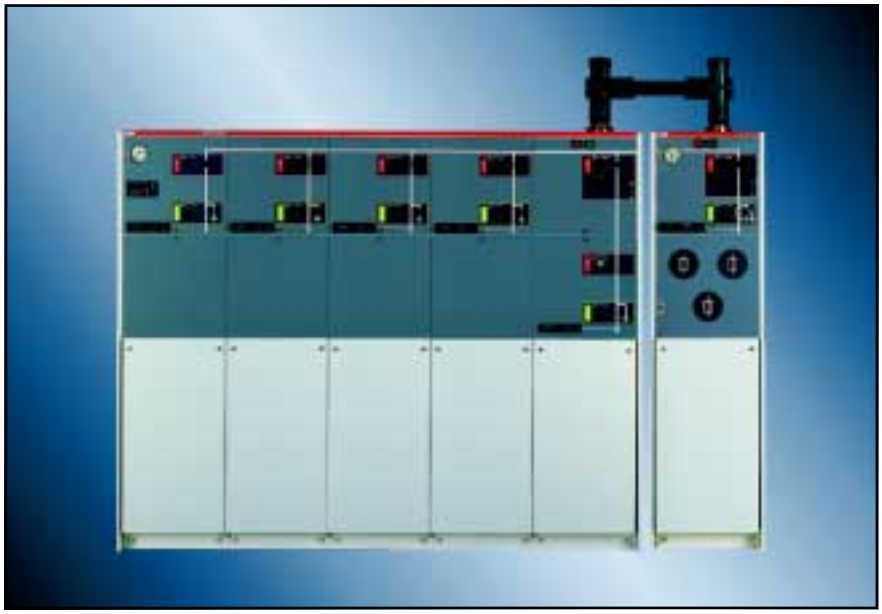
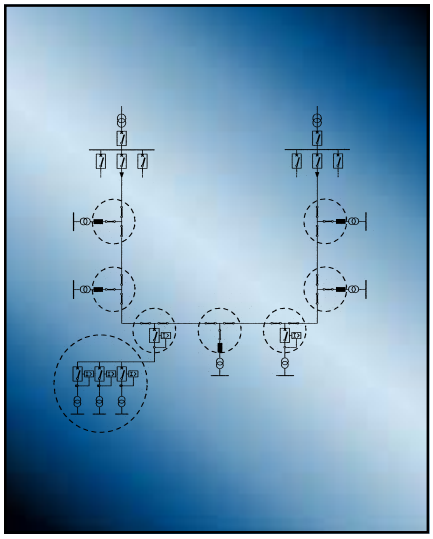
SafeRing / SafePlus

SF_6 insulated ring main unit and compact switchgears
Instruction





Type test report

检 验 报 告

国家高压电器质量监督检验中心
西安高压电器研究所　高压电器实验室

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General introduction

A large number of area secondary substation 12/24 kV are required to distribute power to end customer in urban and rural area. The safety and reliability of distribution equipment will directly affect the stability of distribution system.

With computer simulation combining design and manufacture experience for long time, ABB have developed the new type SF_6 gas insulated M.V. switchgears: SAFE series switchgear. The products include the fixed combination type (SafeRing) and flexible extension type (SafePlus). They represent a complete solution for 12/24 kV distribution networks. The SafeRing and SafePlus have identical interfaces

SAFE series switchgear is a completely sealed system with a stainless steel tank containing all the live parts and switching function, A sealed tank with constant atmosphere conditions ensures a high reliability as well as personnel safety and a virtually maintenance free. The selection of external busbars may meet any combination to obtain full modularity. The external busbars are fully insulated and screened to ensure a high reliability and safety. SAFE series switchgear can be provided with automation equipment to form intellectual switchgears concept. The installation, adjustment and test in site are reduced to minimum.

SafeRing can be supplied in a number of combinations from 2 to 5 ways, Other options can be added according to customer requirement. SafePlus have excellent flexibility due to its fully modular and semi-modular combination and expansibility

SAFE series switchgears conform to IEC 298 standard. The design life for indoor use (20˚C) is 30 years (IEC 298 Annex GG).

SAFE products are applicable to following conditions:

Compact secondary substation

Small factory

Wind power plant

Hotel, shopping center, official building, commercial center

Light mining equipment, tunnel and subway

Technical features

*** Harmony and unification of fixed and flexible expansion:**

SafeRing is the ring main unit structure. SafeRing can contain 5 modules in one SF_6 insulated tank at most. SafeRing provides 15 fixed combinations to meet customers' requirement. The combination type of SafeRing is as followed: DF, CF, CCC, CCF, CFC, FCC, CCCC, CCCF, CCFF, CFFC, CCVV, CCCCC, CCFFF, CCCFF, CCCCF.

SafePlus is compact switchgear. SafePlus can contain 5 modules in one SF_6 insulated tank at most. For switchgears with more than 5 modules, the switchgears may be connected with external busbars to obtain semi-modular configuration and the external busbar may be used between every two modules to obtain full modular configuration also. The distribution project from simple to complex may be obtained through nine kinds of functional module combinations to meet various arrangement requirements of secondary substation and switching station. The module type of SafePlus are: C, D_e, D, F, V, S_L, S_V, B_e, M, CB.

*** 3D modeling and simulating optimization product design:**

The Pro/Engineer 3D CAD system of Parametric technology from United State of American is used to establish 3D model showing the relation of the parts. The simulating software of ABB is combined to carry out the simulations of the mechanical and insulating strengths as well as the electromechanical analogy under short circuit current to find weak points in order to optimize the construction design for the product.

*** Compact construction:**

The width of all modules are 325mm only except metering and CB panels. The width of metering cubicle is 695mm. The heights of the bushings are identical and suitable for assembling.

General introduction

*** Climatic independence:**

All the live parts are contained in a stainless steel tank. The tank is sealed by welding. The SF_6 pressure is 1.4bar at 20˚C. The protection class of tank is IP67. SAFE series switchgear is applicable to humid, severe sand and dust blown by the wind, salt pollution conditions, mines, compact substations and where surface flashover due to air pollution may be occurred without taking special preventing measures. The protection class of the fuse cabinet is IP67 also. The external busbar is fully insulated and shielded, climatically independent and is the maintenance free solution.

*** High reliability for personal safety:**

All the live parts are sealed in SF_6 gas tank, the switch has reliable pressure relief route and passed 20kA/1s internal arcing test, the load switch and earthing switch is the three position switch so that the interlocking is simplified. The cover of the cable compartment and the load switch have reliable mechanical interlocking. The arc suppresser can be installed in the incoming unit. In this case, the SF_6 gas pressure relief route for the switch is not necessary.

*** An intelligent ring main unit (IRMU):**

SAFE can be provided with effective protection, remote control and monitoring system and the distribution system automation RTU factory solution of pluggable type may be provided. The control box is not necessary. All the electronic elements, batteries and modem are installed in a alone box behind the standard cover plate.

*** SAFE provide two choices for transformer protection:**

The switch-fuse combination and circuit breaker with relay protection. The switch-fuse combination is applicable to the transformer of 1600kVA and below, the circuit breaker with relay protection may be used for the various capacity transformer protection.

*** Environment protection:**

The Environment protection policy is implemented in course of the development, production and operation during whole life of the product. The materials are favorable to the environment protection, the leakless clean procedure and lifelong seal for the product are used by ABB. After the products are scrapped, 90%~95% of the materials may be reclaimed.

We assure:

- We observe all applicable relative laws and regulations for the environment protection, our all activities will be carried out according to environment protection principle, and our management system will be continuously modified.
- The unfavorable effect to the environment will be reduced and prevented as possible in course of manufacture, selling, usage, handle and dispose of the waste materials.
- We will educate and train the staff and workers to raise the environment protection consciousness, encourage the staff and workers to participate actively the environment protection.
- The recommendation relative environment protection in course of the operation, management and maintenance for the product will be provided for the customer.


SGS

E54254

ABB High Voltage Switchgear Co.Ltd., Beijing

ISO 14001

ISO 14001

Technical parameter

* Normal environment condition:

  SafeRing / SafePlus are operated in general indoor condition in according to IEC 60694.

  Ambient temperature

Max.	+40˚C
Max.	+35˚C (average in 24h)
Min.	–25˚C

  Humidity

Maximum average relative humidity	
Measured in 24h	≤95%
Measured in one month	≤90%
Altitude	≤1000m

* SF_6 gas pressure: 1.4bar at 20˚C (absolute)
* Leakage rate: 0.25‰/year
* Submersion test: applying pressure 0.3bar under water for 24h, 24kV
* Arcing test: 20kA 1s (with arc suppresser), 16kA 1s (without arc suppresser)
* Cable bushing standard: DIN 47636 T1 and T2 / EDF HN 525-61
* Protection class:

SF_6 gas tank:	IP 67
Fuse cabinet:	IP 67
Cover of switchgear:	IP 3X

* Busbar

Main busbar:	400mm^2 Cu
Earthing busbar:	160mm^2, bolt M10

* Thickness of stainless steel housing for gas tank: 3.0mm
* Color:

  Front plate for switchgear: RAL 7012

  Side plate and front cover plate for cable compartment: RAL 7035

Special condition:

According to IEC 60694, if the conditions are different from the normal operating condition, the agreement between manufacturer and customer must be reached.

For special severe operating condition, the customer shall consulted with supplier and the manufacturer. If electrical equipment are installed in altitude above 1000m, the manufacturer shall be informed in order to adjust pressure during manufacturing.

Technical parameter

		C module	F module	V module		CB module	
		Load switch	Combination	Vacuum switch	Isolator / earthing switch	Vacuum circuit breaker	Isolator / earthing switch
Rated voltage	kV	12/24	12/24	12/24	12/24	12/24	12/24
Power frequency withstand voltage	kV	42/50	42/50	42/50	42/50	42/50	42/50
Lightning impulse withstand voltage	kV	95/125	95/125	95/125	95/125	95/125	95/125
Rated current	A	630/630	note 1)	630/630		1250/630	
Breaking capacity:							
Closed ring breaking current	A	630/630					
Breaking cable charging current	A	135/135					
Breaking 5% rated active load current	A	31.5/-					
Breaking earthing fault current	A	200/150					
Breaking cable charging current at earthing fault	A	115/87					
Short circuit breaking current	kA		note 2)	20/16		25/20	
Making capacity	kA	63/52.5	note 2)	50/40	50/40	63/50	63/50
Short time withstand current(2s)	kA	25/-					
Short time withstand current(3s)	kA	-/21		20/16	20/16	25/20	25/20
Mechanical life	Times	5000	3000	5000	2000	5000	5000

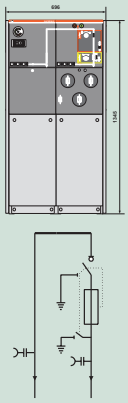
Note: 1) according to rated current of fuse; 2) limited by H.V. fuse

SafeRing ring main unit / SafePlus compact switchgear conform to IEC 60056, IEC 60129, IEC 60265, IEC 60298, IEC 60240 and IEC 60694.

SafeRing standard combination

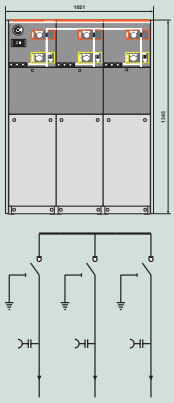
SafeRing provide following 18 kinds of combinations

DF



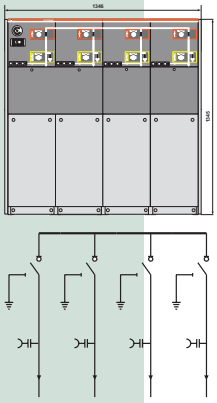
DF (260 kg)

CCC



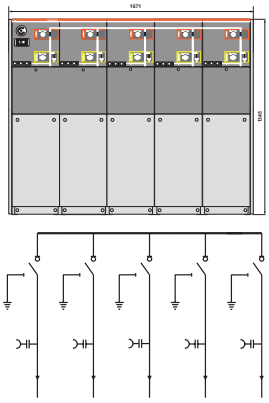
CCC (300 kg)

CCCC



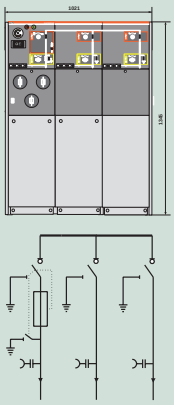
CCCC (390 kg)

CCCCC



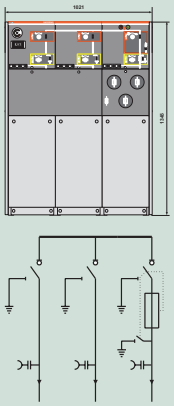
CCCCC (480kg)

FCC



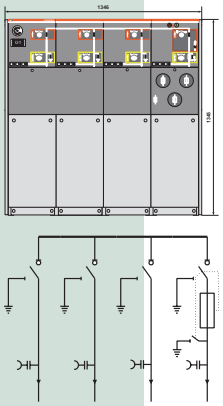
FCC (320 kg)

CCF



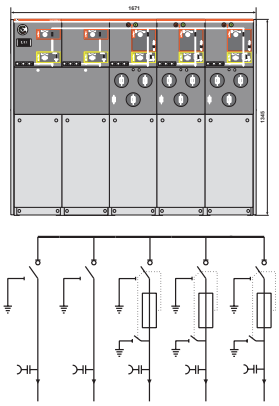
CCF (320 kg)

CCCF



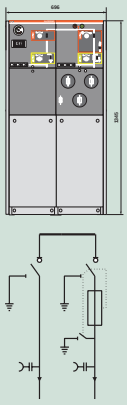
CCCF (410 kg)

CCFFF



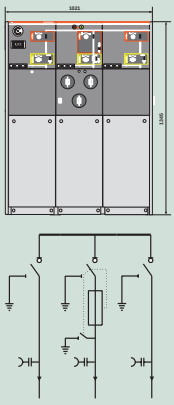
CCFFF (540kg)

CF



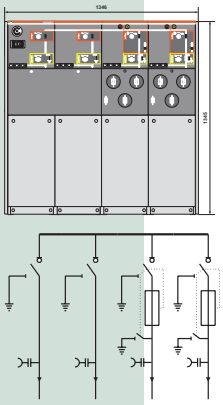
CF (270kg)

CFC



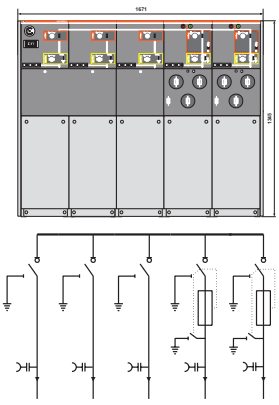
CFC (320kg)

CCFF



CCFF (430kg)

CCCFF



CCCFF (520kg)

Each module of SafeRing has the following arrangements

D cubicle configuration
See standard arrangement and feature in "SafePlus module - direct cable connecting module without earthing switch".

C cubicle configuration
See standard arrangement and feature in "SafePlus module - cable switch module ".

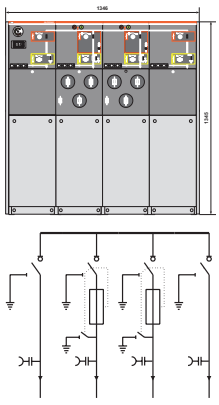
F cubicle configuration
See standard arrangement and feature in "SafePlus module - switch-fuse combination module".

V cubicle configuration
See standard arrangement and feature in "SafePlus module - vacuum breaker module V".

SafeRing standard combination will provide the following options

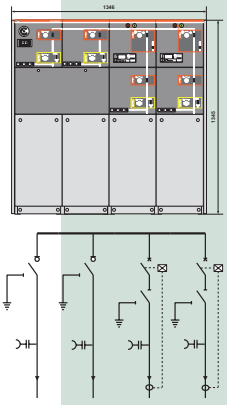
* Capacitive voltage indicator
* SF_6 gas pressure meter for monitoring SF_6 gas density for each gas tank
* Lifting lug
* Operating handle

CFFC



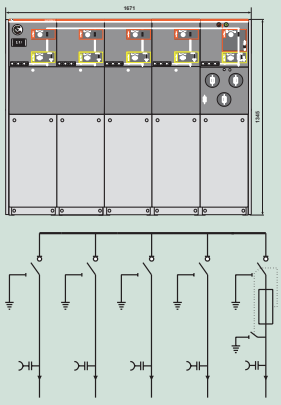
CFFC (430kg)

CCVV



CCVV (411kg)

CCCCF



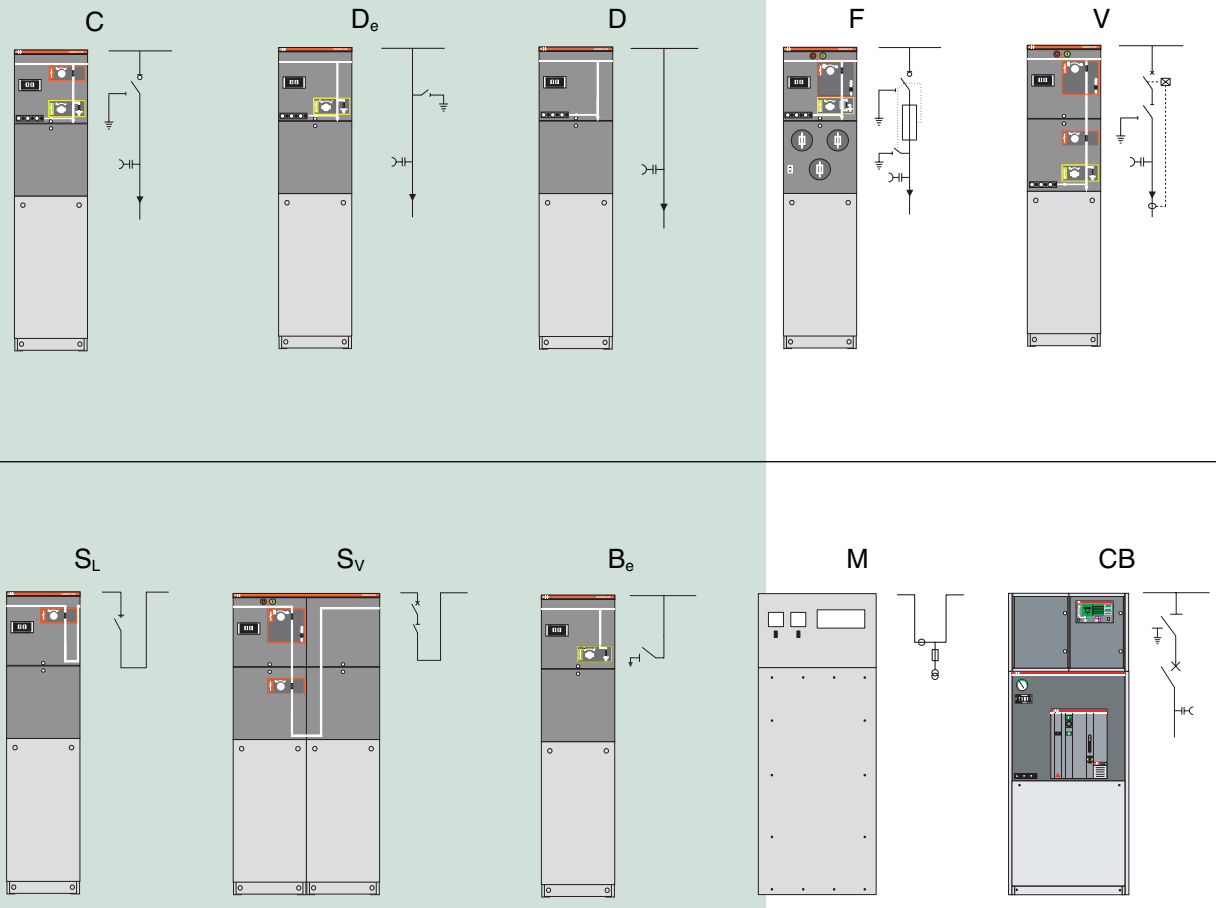
CCCCF (500kg)

SafePlus module

SafePlus available modules:

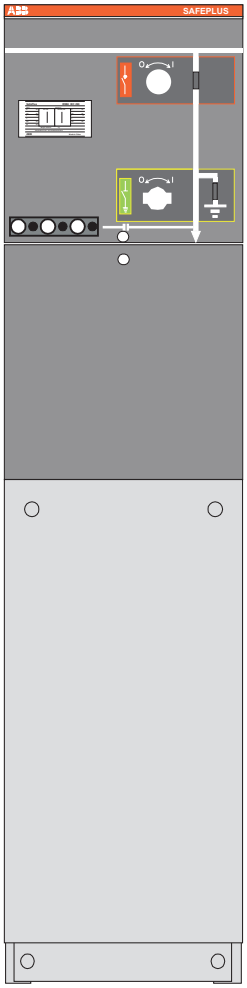
C	Cable switch module	Width=325mm
D_e	Direct cable connecting module with earthing switch	Width=325mm
D	Direct cable connecting module without earthing switch	Width=325mm
F	Switch-fuse combination module	Width=325mm
V	Vacuum switch module	Width=325mm
S_L	Busbar sectionalizer module (load switch)	Width=325mm
S_v	Busbar sectionalizer module (vacuum breaker)	
	S_v is always together with busbar raiser module	Total width=650mm
B_e	Busbar earthing module	Width=325mm
M	Metering module	Width=696mm
CB	Vacuum circuit breaker module	Width=696mm

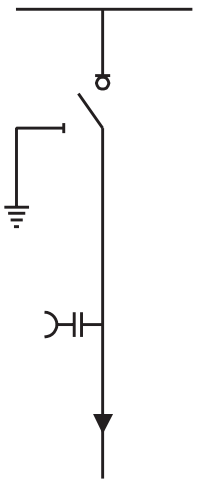
Note: A single SafePlus module must be used with busbar extension



SafePlus weight table (accessories are not included)

* Standard 1 way 130kG
* 5 ways about 480-660kg
* 2-3 and 4 ways are similar to SafeRing
* M metering cubicle about 250kg





Standard feature

* 630 A busbar
* Three position load break switch/earthing switch
* Three position single spring operating mechanism with separate operating shafts for load switch and earthing switch.
* Position indicators for load switch and earthing switch
* Bushings horizontal in front, 630A, 400 series bolted type with integrated sensors
* Capacitive voltage indicator
* Padlocks on front plate for all switching functions
* Pressure meter for SF_6 gas (only one for each tank)
* Earthing busbar

Optional feature

* Busbar extension for future
* External busbar
* Interlocking between earthing switch and front plate of cable compartment
* Motor for load switch 24V/48V DC, 110V/220V DC/AC
* Ring core current transformer and current meter for measuring
* MWD surge arrester or double cable terminals may be installed on incoming bushing
* Key interlocking (e.g. Ronis lock)
* Auxiliary contacts
  - Load switch position: 2NO+2NC
  - Earthing switch position: 2NO+2NC
  - Pressure indicator: 1NO
  - Arc suppresser: 1NO
* Secondary device can be installed in
  - Low voltage box
  - Low voltage compartment.
* Fault indicators for short circuit and earthing faults.

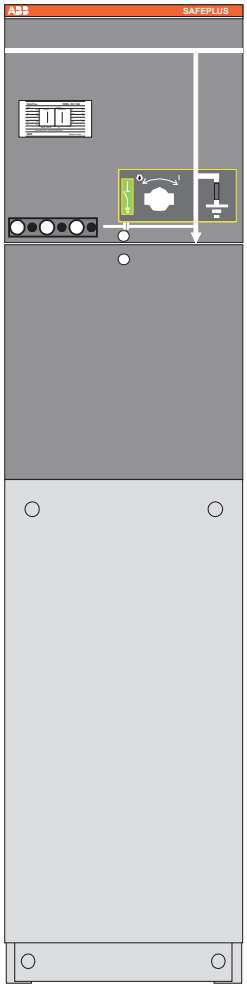
SafePlus module-direct cable connecting module with earthing switch module D_e

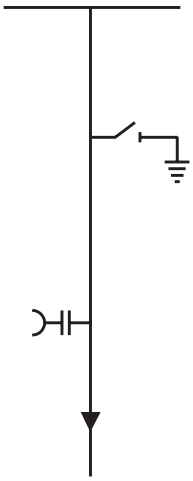
Standard feature

* 630 A busbar
* Earthing switch
* Two position single spring operating mechanism
* Position indicators for earthing switch
* Bushings horizontal in front, 630A, 400 series bolted type with integrated sensors
* Capacitive voltage indicator
* Padlocks on front plate for all switching functions
* Pressure meter for SF_6 gas (only one for each tank)
* Earthing busbar

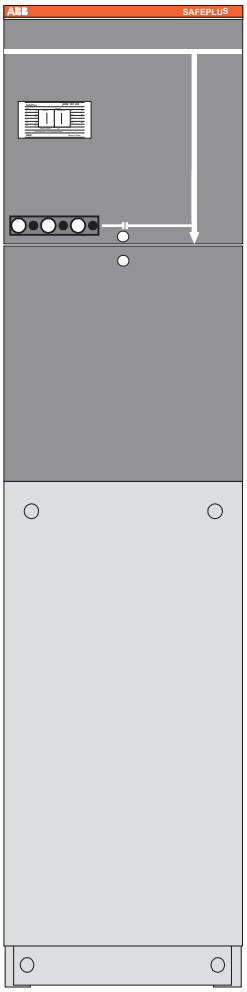
Optional feature

* Busbar extension for future
* External busbar
* Interlocking between earthing switch and front cover of cable compartment
* Fault indicators for short circuit and earthing faults
* Ring core current transformer and current meter for measuring
* MWD surge arrester or double cable terminals may be installed on incoming bushing.
* Key interlock (e.g. Ronis lock)
* Auxiliary contacts
  - Earthing switch position: 2NO+2NC
  - Pressure indicator: 1NO
  - Arc suppresser: 1NO
* Secondary device may be installed in
  - Low voltage box
  - Low voltage compartment.





SafePlus module-direct cable connecting module without earthing switch module D



Standard feature

* 630 A busbar
* Bushings horizontal in front, 630A, 400 series bolted type with integrated sensors
* Capacitive voltage indicator
* Pressure meter for SF_6 gas (only one for each tank)
* Earthing busbar

Optional feature

* Busbar extension for future
* External busbar
* Fault indicators for short circuit and earthing faults
* Ring core current transformer and current meter for measuring
* MWD surge arrester or double cable terminals may be installed on incoming bushing.
* Secondary device may be installed in
  - Low voltage box
  - Low voltage compartment.

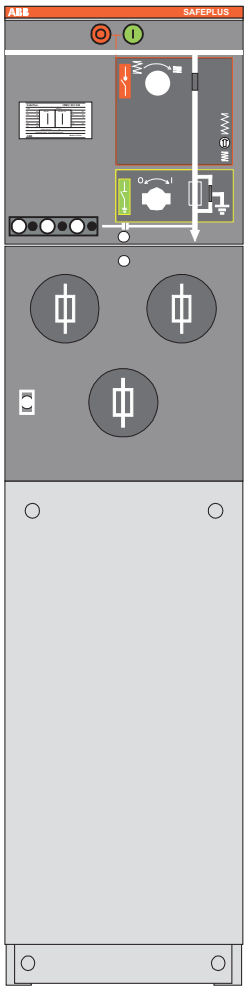
SafePlus module-switch-fuse combination module F

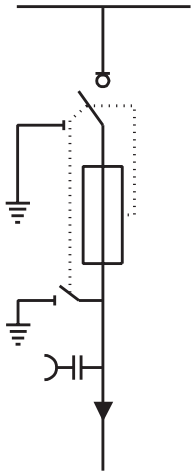
Standard feature

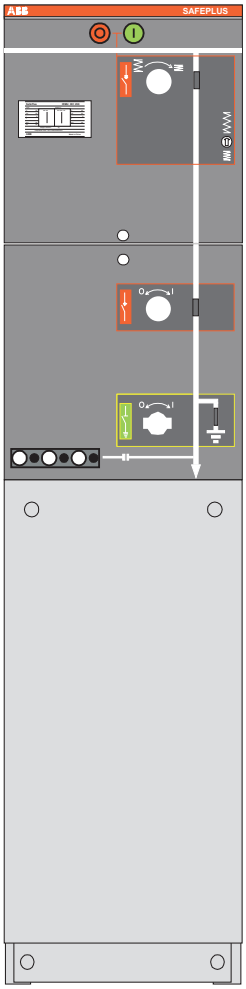
* 630 A busbar
* Three position load switch
* Three position double spring operating mechanism with two separate operating shafts for load switch and earthing switch respectively
* Position indicators for load switch and earthing switch
* Fuse canister for DIN type fuse
* Fuse at horizontal position
* Indicator for the blown
* Bushings in horizontal position in front, 200A, 200 series plug in type
* Capacitive voltage indicator
* Padlocks on front plate for all switching functions
* Pressure meter for SF_6 gas (only one for each tank)
* Earthing busbar
* Fuse parameters for transformer protection
  - L.V. Voltage box
  - L.V. Voltage compartment.

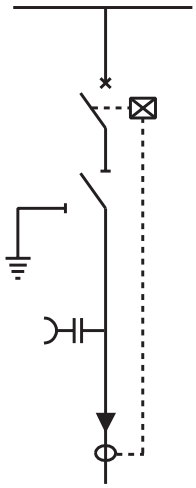
Optional feature

* Busbar extension for future
* External busbar
* Interlocking between earthing switch and front cover of cable compartment
* Motor for load switch 24V/48V DC, 110V/220V DC/AC
* Shunt trip coil 24V/48V DC, 110V/220V DC/AC
* Shunt close coil 24V/48V DC, 110V/220V DC/AC
* Ring core current transformer and current meter for measuring
* Auxiliary contacts
  - Load switch position 2NO+2NC
  - Earthing switch position 2NO+2NC
  - Fuse blown 1NO
  - Pressure indicator 1NO
  - Arc suppresser 1NO
* Secondary device may be installed in
  - Low voltage box
  - Low voltage compartment.









Standard feature

* 630 A busbar
* Vacuum switch for transformer/line protection
* Two position double spring operating mechanism for vacuum breaker
* Three position isolator/earthing switch in downstream vacuum breaker
* Three position single spring operating mechanism for isolator/earthing switch
* Mechanical interlocking for three position isolator/earthing switch and vacuum switch
* Position indicator for three position isolator/earthing switch and vacuum switch
* Self-energizing type electronic protection relay WIC1 (with protection CT)
* Trip coil (for relay operation)
* Bushings horizontal in front, 630A, 400 series bolted type with integrated sensors
* Capacitive voltage indicator
* Padlocks on front plate for all switching functions
* Pressure meter for SF_6 gas (only one for each tank)
* Earthing busbar

Optional feature

* Busbar extension for future
* External busbar
* Interlocking between earthing switch and front cover of cable compartment
* Motor for vacuum switch 24V/48V DC, 110V/220V DC/AC
* Shunt trip coil 24V/48V DC, 110V/220V DC/AC
* Shunt close coil 24V/48V DC, 110V/220V DC/AC
* Ring core current transformer and current meter for measuring
* Key interlocking (e.g. Ronis lock)
* Auxiliary contacts
  - Vacuum switch position 2NO+2NC
  - Disconnecting switch position 2NO+2NC
  - Earthing switch position 2NO+2NC
  - Relay tripping signal 1NO
  - Pressure indicator 1NO
* Secondary device may be installed in
  - Low voltage box
  - Low voltage compartment.
* Other relay e.g. SPAJ140

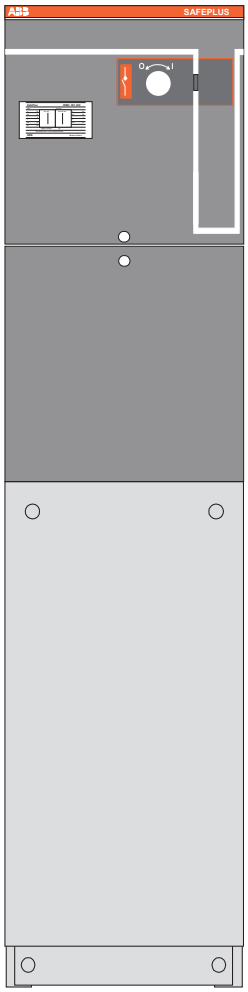
SafePlus module-busbar sectionalizer module (load switch) S_L

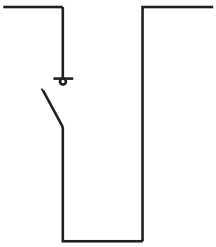
Standard feature

* 630 A busbar
* Three position load switch / earthing switch (isolator)
* Three position single spring operating mechanism with separate operating shafts for load switch and earthing switch.
* Position indicators for all switches
* Padlocks on front plate for all switching functions
* Pressure meter for SF_6 gas (only one for each tank)
* Earthing busbar

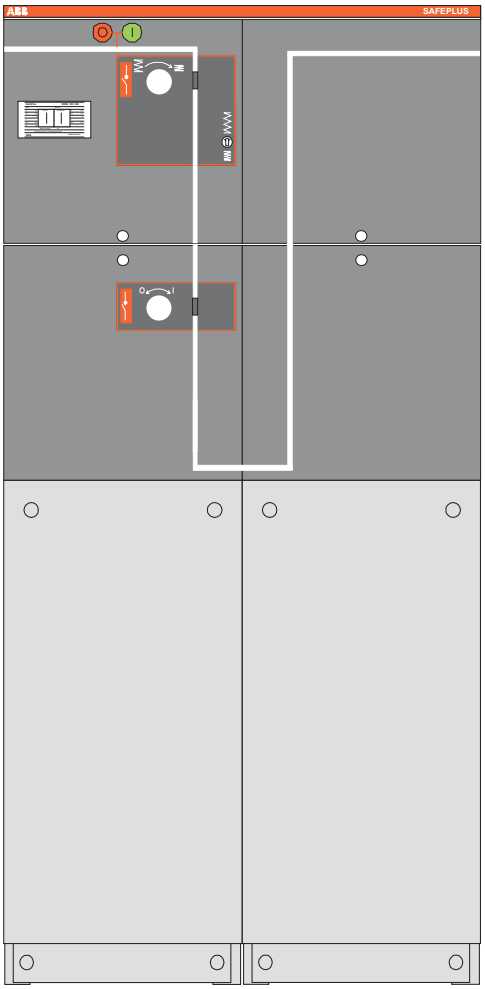
Optional feature

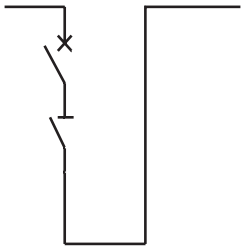
* Busbar extension for future
* External busbar
* Motor for load switch 24V/48V DC, 110V/220V DC/AC
* Key interlocking (e.g. Ronis lock)
* Auxiliary contacts
  - Load switch position 2NO+2NC
  - Earthing switch position 2NO+2NC
* Secondary device may be installed in:
  - Low voltage box
  - Low voltage compartment.





SafePlus module-busbar sectionalizer module (vacuum breaker) S_V





Standard feature

* 630 A busbar
* 630 A vacuum breaker
* Two position double spring operating mechanism for vacuum breaker
* Isolator
* Three position single spring operating mechanism for isolator
* Mechanical interlocking for isolator and vacuum breaker
* Position indicator for isolator and vacuum breaker
* Padlocks on front plate for all switching functions
* Pressure meter for SF_6 gas (only one for each tank)
* S_V is always connection with busbar riser module

Optional feature

* Busbar extension for future
* External busbar
* Motor for vacuum switch 24V/48V DC, 110V/220V DC/AC
* Shunt trip coil 24V/48V DC, 110V/220V DC/AC
* Shunt close coil 24V/48V DC, 110V/220V DC/AC
* Key interlocking (e.g. Ronis lock)
* Auxiliary contacts
  - Vacuum switch position 2NO+2NC
  - Disconnecting switch position 2NO+2NC
  - Earthing switch position 2NO+2NC
* Secondary device may be installed in:
  - Low voltage box
  - Low voltage compartment.
* Relay : SPAJ140

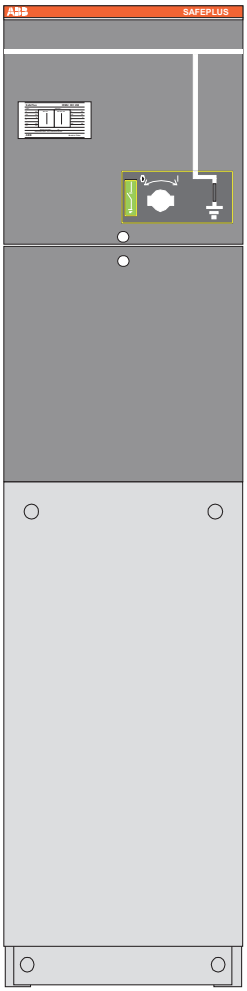
SafePlus module-busbar earthing module B_e

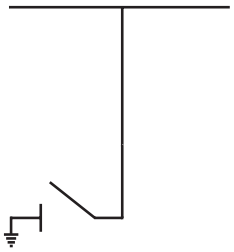
Standard feature

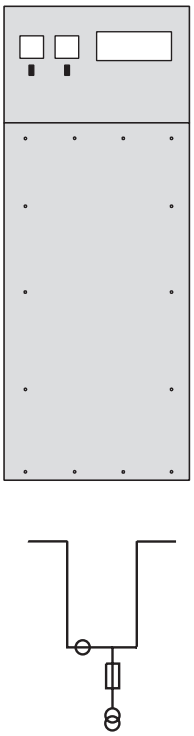
* 630 A busbar
* Earthing switch
* Two position single spring operating mechanism
* Position indicator for earthing switch
* Padlocks on front plate for all switching functions
* Pressure meter for SF_6 gas (only one for each tank)
* S_V is always connection with busbar raiser module

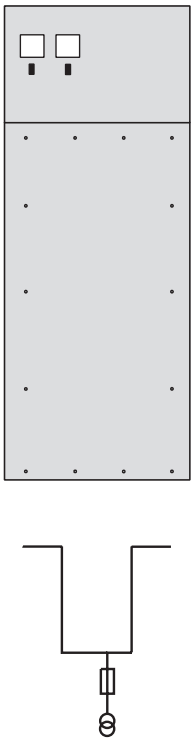
Optional feature

* Busbar extension for future
* External busbar
* Key interlocking (e.g. Ronis lock)
* Auxiliary contacts
  - Earthing switch position 2NO+2NC
  - Pressure 1NO
* Secondary device may be installed in:
  - Low voltage box
  - Low voltage compartment.









Metering cubicle

Standard feature

* Two AS 12 type current transformers
* Two UNZ 10 type voltage transformers
* Six 400 series type bushings for SafePlus external busbar connection
* Fuse for PT protection
* One voltage meter with position switch
* One current meter with position switch

Optional feature

* Three AS 12 type current transformers
* Three REL 10 type voltage transformers
* MWD type surge arrester
* Capacitive voltage indicator
* One KW•h meter
* One KVar•h meter

PT cubicle

Standard feature

* Cable incoming/outgoing lines in bottom
* Two UNZ 10 type voltage transformers
* Fuse for PT protection
* One voltage meter with position switch

Optional feature

* Three REL 10 type voltage transformers
* MWD type surge arrester
* Capacitive voltage indicator

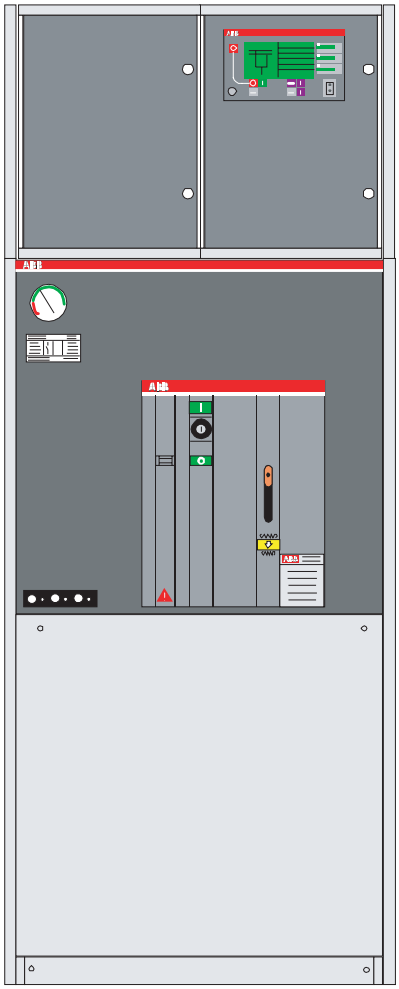
SafePlus module-vacuum circuit breaker module CB

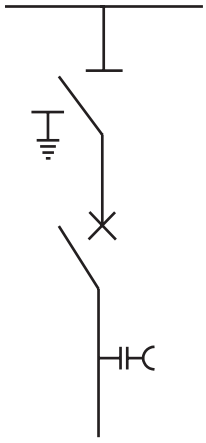
Standard feature

* 1250A/630A busbar
* 1250A/630A vacuum circuit breaker for line protection
* VD4X0 motor operating mechanism for vacuum circuit breaker
* UX0 motor operating mechanism for three position isolator/earthing switch on vacuum circuit breaker top
* REF 542 plus protection and control unit (with protection CT)
* Tripping coil 110V/220V DC
* Closing coil 110V/220V DC
* Bushings for outgoing line in horizontal position in front part, 400 series bolted type bushing for 1250A/800A/600A.
* Capacitive voltage indicator showing live bushing
* 1250A/800A/600A future busbar expansion
* Pressure meter for SF_6 gas (only one for each tank)
* W/H/D = 695/1806/800mm
* Operating cycle: O-0.3s-CO-180s-CO

Optional feature

* Arc suppresser
* Arc proof cable compartment





Feature for compact substation

Compact substation is constructed by the SF_6 RMU SafeRing & SafePlus and outdoor enclosure.

* The all material of outdoor enclosure is aluzinc and zinc, the thickness of steel plate is not less than 1.5mm, and have a strong corrosion resistant capacity. The parts of outdoor enclosure are the sheet metal material, the bolting or riveting are used for connection between parts and not welding that is easily deformable.
* The removable fixing auxiliaries are not in outdoor enclosure surface and are good burglar-proof. The protection class of outdoor enclosure is IP33 and good rainproof.
* The roof is double-layer construction with interlayer and ventilation holes, the inlet with removable filter is located on front plate of outdoor enclosure and the outlet is located on top of outdoor enclosure and under eaves. The air convection from top to bottom is formed, so, the outdoor enclosure have good heat insulation and ventilation effects. The slope angle for 3˚ for draining off water is located on top cover.
* The cable inlets with sealed bottom plates are locked the bottom of outdoor enclosure to prevent moisture from cable channel into case body.
* The doors and lugs are sealed with sealing strips, the locks for doors is a rainproof construction. The limiting hook is installed on door, when door is opened, to make door fix.
* The switch in the outdoor enclosure is a full sealing construction. The heating device is not necessary and is not condensation.
* The switchgears according to following table are installed in the case body at factory, the fixed lifting lugs for transportation are installed to prevent from shift during transportation. The outdoor enclosure is required only to lift to required position in site, so the installation is simple, the volume of outdoor enclosure and area to be used are small.
* The colors for the outdoor enclosure may be selected as following:
    1) RAL 7024 (frame), RAL 7032 (plate)
    2) RAL 7032
    3) RAL 6005

If other colors are required, please contact with ABB High Voltage Switchgear Co. Ltd., Beijing.

Dimension and weight for compact substation

Our company can supply some standard compact substation as following:

L x W x H=1350 x 1000 x 1650 (2150)	applicable to 3 units and below
L x W x H=1700 x 1000 x 1650 (2150)	applicable to 4 units
L x W x H=2000 x 1000 x 1650 (2150)	applicable to 5 units
L x W x H=2300 x 1000 x 1650 (2150)	applicable to 6 units
L x W x H=2300 x 1350 x 2050 mm	applicable to metering cubicle + 4 units
L x W x H=2700 x 1350 x 2050 mm	applicable to metering cubicle + 5 units
L x W x H=3000 x 1350 x 2050 mm	applicable to 4 units + metering cubicle + 2 units
L x W x H=3000 x 1854 x 2150 mm	free configuration with indoor passage
L x W x H=3500 x 1854 x 2150 mm	free configuration with indoor passage
L x W x H=4000 x 1854 x 2150 mm	free configuration with indoor passage
L x W x H=4500 x 1854 x 2150 mm	free configuration with indoor passage

If other size of compact substations are required, please contact with ABB High Voltage Switchgear Co. Ltd., Beijing.

Remote control and monitoring unit

Equipped with RTU (remote termination unit), the SafeRing & SafePlus series switchgear can implement intelligent application. Connecting all the IRMUs by communication network, it enable to monitor and control the switchgear remotely, locate and isolate fault automatically as well as the system recovery. This will dramatically reduce the affected area and duration of blackout, and realize the high reliability and excellent power quality.

The SafeRing & SafePlus series switchgear units works with ABB's IDS distribution grid automation systems featuring standard-based open architecture and consisting of substations and automation terminal modules. The automation terminals employ distributed modular design, and feature high reliability. Meanwhile, the compact form factor allows the easy installation in a compact switchgear unit .

The automation system of IDS is available in two configurations, IDS-MMI and IDS-DAS.

The remote termination unit (RTU) of IDS is also available in two configurations, IDS-F86 and IDS-A814 are two kinds of IDS.

Integrated Control and Monitor Unit (ICMU)

The Safe series switchgear units may implement intelligent upgrading through the built-in IDS terminal modules (F86 and A814).

The RTU of IDS can be mounted in the RTU bay of Safe or in the low voltage cabinet on top of the Safe switchgear unit. Every RTU module includes a RS232 interface and a RS485 interface photoelectrically isolated each other. The RS232 interface is provided for field testing and RS485 for remote communication. MODBUS or IEC60870-5-101 (DL/T634-1997) protocol may be leveraged in the communication with any remote site.

IDS-F86

Standard feature set:

* 16 binary input, 1500 VDC of isolation voltage
* 8 anolog input, including 4 current values (AC5A), 4 voltage values (1*24VDC, 3*100VAC/220VAC)
* 6 binary output (remote control, for up to 3 switching actions), C- form relay, 250VAC8A/30VDC8A
* 1*RS485 interface for remote communication up to 1,200m
* 4 alternative baudrates: 9,600bps, 4,800bps, 1,200 bps and 600bps
* 64 SOEs
* Operating temperature: -25~+70℃
* Operating voltage: 24VDC ± 20%, 4W

Optional:

* Energy counters
* 4 telemetry counters (digit adjustable)
* BCD code analyzer
* Double telemetry

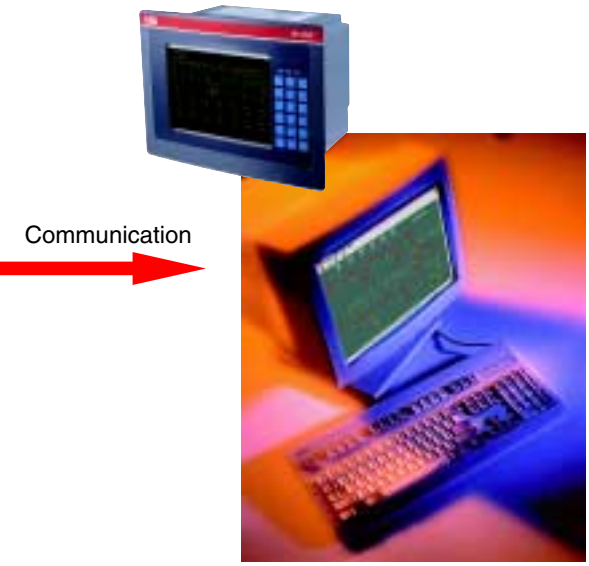
IDS-A814

Standard feature set:

* 8 binary input, 1500 VDC of isolation voltage
* 4 current inputs (5AAC), 4 voltage inputs (1*24VDC, 3*100VAC/220VAC)
* 4 binary output for (remote control). C-form relays, 250VAC8A/30VDC8A
* 1*RS485 interface for remote communication up to 1,200m
* 4 alternative baudrates: 9,600bps, 4,800bps, 1,200 bps and 600bps
* 64 SOEs
* Operating temperature: -25~+70℃
* Operating voltage: 24VDC ± 20%, 5W

Optional:

* alculation for feeder's P, Q, kWh, kVarh, and F
* Statistics of quality of power quality (loss of voltage, overvoltage, mutation, fluctuation) (including time stamp)
* Current protection (single definite time, preset trigger), which can be applied in switching value output or communication output



Intelligent substation IDS-MMI

Features:

* PC104 busbar architecture
* 100MHz, 32-bit CPU
* VxWORKS real-time embedded OS
* Software and hardware watchdog
* 2*RS232 interfaces for communication with upper-level management system
* 4*RS485 interfaces for communication with lower-level management system
* Communication protocol: DL/T451-91, IEC60870-5-101, MODBUS, SPA
* Real-time multi-task processing
* BIT at power-on
* Automatic fault location, isolation, and restructuring of 2 typical single rings
* 6.4-inch color LCD hard connected to PC
* LCD automatic/manual turn-on/off
* Keypad, mouse, floppy disk drive, etc.
* 4 alternative baudrates: 9,600bps, 4,800bps, 1,200 bps and 600bps
* Nonvolatile SOE
* Operating temperature: 0~+55℃
* Operating voltage: 24VDC ± 20%, 25W (excluding monitor)

Optional:

* additional RS485 communication interfaces
* LCD featuring wide temperature range: 50W, -25~+70℃
* No LCD: -25~+70℃
* SNMP trap (RTU cooperation needed)
* Other communication protocols
* 2*MMIs cascading
* Automation of 2 additional rings
* Inter-MMI ring control

Multi-function Substation IDS-DAS

Features:

* Standard industry processor
* Windows 2000 OS
* Software and hardware watchdog
* 2*RS232 interfaces for communication with upper-level management system
* 12*RS485 interfaces for communication with lower-level management system
* Communication protocols: DL/T451-91, IEC60870-5-101, MODBUS, SPA
* Real-time multi-task processing
* Automatic fault location, isolation, restructuring of 8 typical single rings
* 4 alternative baudrates: 9,600bps, 4,800bps, 1,200 bps and 600bps
* Nonvolatile SOE
* Operating temperature: 0~+40℃
* Operating voltage: 24VAC ± 10%, 200W

Optional:

* NMP trap (RTU cooperation needed)
* Other communication protocols
* Cascading of two substations

Transformers / lines protection

SafeRing offers a choice between switch-- fuse combination and circuit breaker with relay for transformer protection.

Switch – fuse combination

When switch fuse combinations is chosen for transformer protection, the fuse canister is positioned behind a separately interlocked cover in front of the unit. The spring operating mechanism is used for load switch, this mechanism may be triggered by striker of fuse.

The operating handle may be used to dismount cover of fuse canister in order to replace fuse easily. The tripping device is located at the front and ensure water-proof feature for entire system.

The fuse should be HRC type according to IEC publication 282-1

The dimensions are in accordance with DIN43625 and the length in the fuse canister is based on fuse length e=442mm. Fuse with shorter length should be compensated by fuse adapter.

Please note: when insertion the fuse link into the conister, the strike-pin must always face outwards against the fuse bolder. Fuse adapter to be fixed to the fuse link contact part that face inwards in the fuse conister.

Table of fuse for F

100%	Transformer rated capacity (kVA)																CEF
UN(kV)	25	50	75	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	
3	16	25	25	40	40	50	50	80	100	125	160	160					
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			7.2kV
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	
11	6	6	10	16	16	25	25	25	25	40	50	50	63	80	100	125	12kV
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	
15	6	6	10	10	16	16	16	25	25	25	40	40	50	63	80	100	17.5kV
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	
22	6	6	6	6	10	10	16	16	16	25	25	25	40	50	50	63	24kV
24	6	6	6	6	10	10	16	16	16	25	25	25	40	40	50	63	

—The data of this table is based on using ABB CEF type fuse and under normal operating condition without overload.
—Ambient temperature –25˚C~+40˚C

120%	Transformer rated capacity (kVA)																CEF
UN(kV)	25	50	75	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	
3	16	25	25	40	40	50	63	80	100	125	160						
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				7.2kV
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		
11	6	6	10	16	16	25	25	25	25	40	50	50	80	80	100	125	12kV
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	
15	6	6	10	10	16	16	16	25	25	25	40	40	50	63	80	100	17.5kV
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		
22	6	6	6	6	10	10	16	16	16	25	25	25	40	50	50	63	24kV
24	6	6	6	6	10	10	16	16	16	25	25	25	40	40	50	63	

—The data of this table is based on using ABB CEF type fuse and under normal operating condition with 20% overload
—Ambient temperature –25˚C~+40˚C

Vacuum switch / vacuum breaker modules

Vacuum switches/vacuum breakers equipped with protective relays and current transformers are used to protect transformers or lines. When vacuum switches/ vacuum breakers are used for the protection, SEG-WIC1-2PE relays should be standard in the Safe series.

This type of relays are based on digital technology. Powered by the internal current transformer, this protection system features time overcurrent protection and earth fault protection.

WIC1-2PE is a CT self-powered protective relay with inverse time overcurrent protection and definite time overcurrent protection. This series of relays are easy to connect and adjust. Featuring high EMC, it is widely applicable to switchgear units of different capacity.

Weight: 700g. Dimension: [L × W × H] 170 × 125 × 40mm.

Protection implemented by WIC1-2PE relays

* Optional three-phase inverse time overcurrent protection and definite time short-circuit fault protection;
* Three-phase definite time overcurrent protection and short-circuit fault protection with adjustable action time;
* Definite time ground overcurrent protection through internal algorithm.

Overcurrent protection I>:

Definite time trip current: 0.9~2.5 × Is
action time: 0.04~300 s

Inverse time overcurrent protection trip current 0.9~2.5 × Is
N-INV, V-INV, E-INV, LI-INV, NI-INV, HV-FUSE trip mode

Short-circuit fault protection I>>:

definite time trip current: 1~20 × Is action time: 0.04s~3s

Ground fault protection Ie>:

definite time trip current 0.2~2.5 × Is action time: 0.1s~20s

WIC1-2PE

WIC1 protection systems can be configured with CTs with 4 ranges as follows:

CT	Range of rated primary current
WIC1-W2	16~56A
WIC1-W3	32~112A
WIC1-W4	64~224A
WIC1-W5	128~448A

Protection systems adopting WICI relays provides MTBF up to 25 years.

Safe may also work with other kinds of relays, such as SPAJ140 and REF. These relays must be installed in the low voltage compartment on top of the switchgear units. Refer to their specifications for details.

SPAJ140C overcurrent/short-circuit/earth fault protection relays

Voltage range: AC (18-265V) or DC (80-265V)
ASG ringcore CT: 5A of secondary current
Numerically displayed setting, current measurement and event log
Setting buttons or PC-based setting
Providing various sections of passive signal nodes
Consecutive BIT and alarm output of internal fault (software and hardware)

SPAJ 140

Low-set overcurrent stage I>

definite time characteristic	0.5...5.0x I_n
inverse time characteristic	0.5...2.5x I_n
operate time	0.05...300s

High-set overcurrent stage I>>

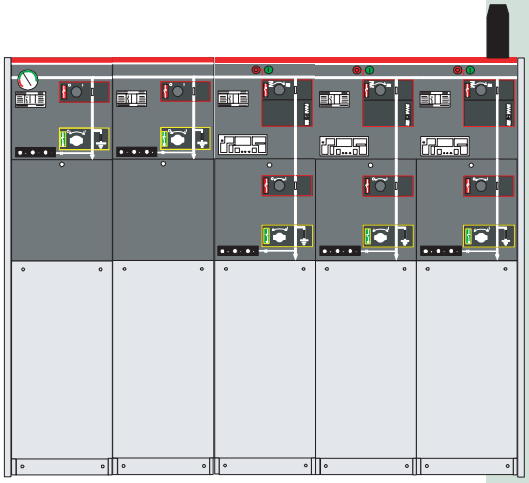
start current I>>	0.5-40.0x I_n or ∞, infinite
operate time	0.04...300s

Low-set earth fault stage I_0>>

start current I_0>>	0.1-0.8x I_n
operate time	0.05...300s

Low-set overcurrent stage I>

definite time characteristic	0.5...5.0x I_n
inverse time characteristic	0.5...2.5x I_n
operate time	0.05...300s



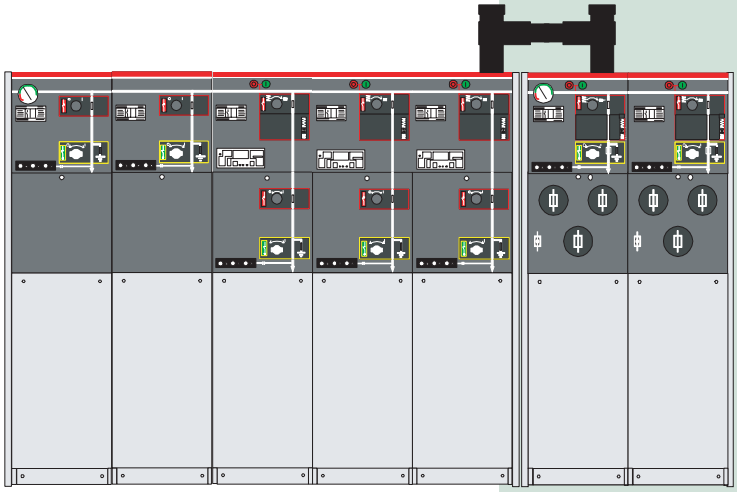
SafePlus prepared for future exension on right hand side.

On the top of all SafeRing and SafePlus switchgears it is possible as an option to have bushings for connection of external busbars on the leftmost and the rightmost module.

For a SafePlus switchgear consisting of only one module (which is both leftmost and rightmost in one module), only one set of bushings on the top is necessary.

When bushings are mounted on the top, you will have these possibilities:

1. When adding a dead end receptacle to each of these bushings, SafeRing/SafePlus will be prepared for future busbar extension.

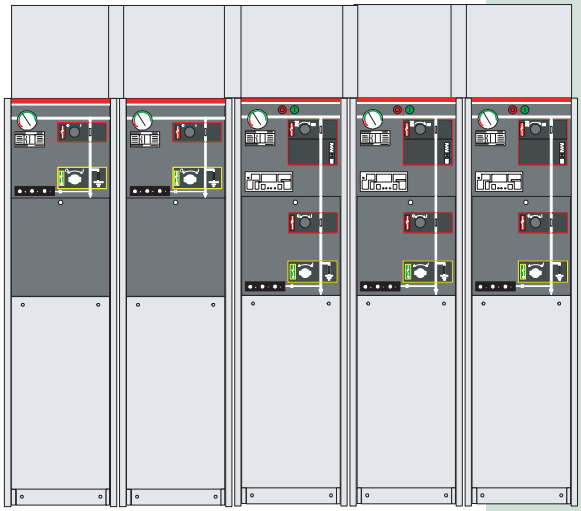


SafePlus cousisting of two sections connected to each other by means of external busbar kit,

2. With a special designed external busbars kit, it will be possible to connect two or more sections.

Since a 5-ways switchgear is the maximum size within one common SF_6 tank, the busbar kit allows a configuration with more than 5 modules.

The installation of the external busbars has to de done on site.



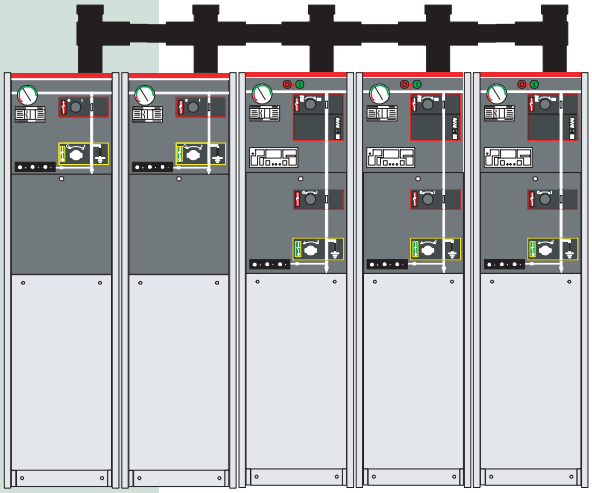
SafePlus with external busbars cover

Both dead end receptacles and the external busbar kit are fully screened and insulated with EPDM.
This means that these parts are touchproof and protection covers are not required.
However protection covers are available as an option.

Projects explanation

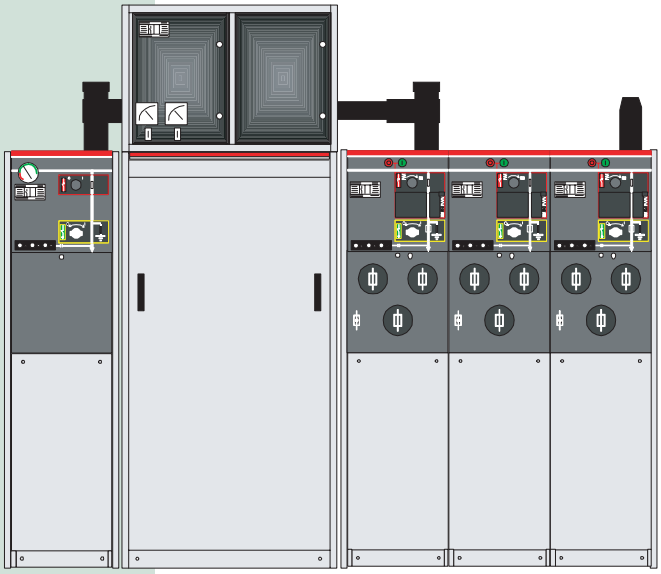
SafePlus switchgear can also be configured fully modular. This gives 1250 A busbar rating.

The busbars between the modules and the end adapters used on the leftmost and rightmost module are identical to the parts used in the previous example. For the three modules in the middle a special cross adapter is used.

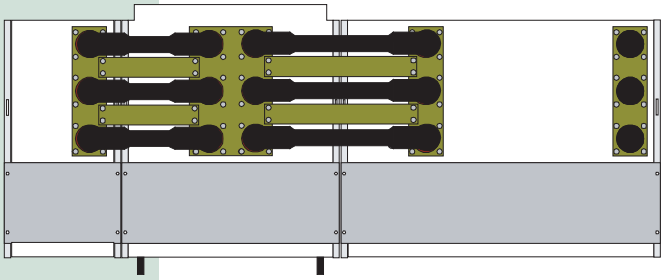


SafePlus with a fully modular design

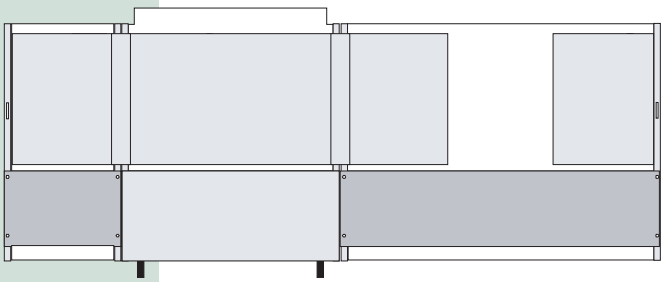
All external busbars have identical lengths except those used for extension between a Metering module with a switchgear on the right hand side.



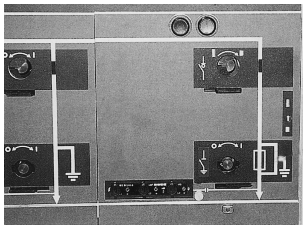
SafePlus with one incomer (C- module), one Metering module (M-module) and three fused T-offs (F-modues), which are prepared for future extension.



Top view

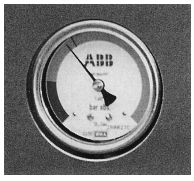


Top view with busbar cover mounted



Capacitive voltage indicator

Cable connection



Pressure indicator

Accessories

1. Auxiliary contact

2NO+2NC indicating switching position may be equipped in all load switch and circuit breaker. One shunt trip coil may be equipped in Safe-F/ Safe-V. Low voltage control parts are located in back of front plate.

2. Remote control and monitoring unit

SAFE may be equiped with integrated remote control and monitoring unit (left fig.). This unit is a prefabricated product and may be assembled in to a complex or new solution, or directly accomplished by factory.

The identical equipment may be used for SafePlus, provided a low voltage box is added to top of switchgear.

3. Voltage indication

Capacitive voltage indicator show if bushing is live, plug-hole may use for phase comparison.

4. Short circuit / earthing fault indicator

To easily locate fault, the short circuit / earthing fault indicator may be installed in switch module to carry out simple fault location.

5. Motor operating mechanism

Manual operating mechanism is standard configuration for cable switch unit and transformer unit. The motor operating mechanism is the additional selection.

The operation are carried out to use the mechanism located back of front plate for cable switch, vacuum switch and earthing switch. All switch and circuit breaker may be operated by handle (standard project) or equipped with motor operating mechanism (accessories). The earthing switch may be manual operated only and equipped with mechanism having fault making capacity.

Motor operating mechanism is easily retrofit.

6. Cable connection

SAFE is equiped with bushing according to DIN 47636. The distance to ground is identical for all bushing. The bushing is protected by cover of cable compartment. The cover is interlocking with earthing switch. The cover of special double cable compartment may be provided for double cable incoming usage.

7. Pressure indicator

SafeRing/SafePlus normally equip with pressure indicator i.e. pressure meter. The electrical contact may be installed to pressure drop also.

8. Ronis Key interlock

As an option all load break switches except the one for switch fuse module, earthing switches and disconnectors may be equipped with Ronis key interlock type EL11AP. Ronis may be mounted according to the customer's specification to prevent closing or opening of the switch.

Accessories

9. Arc suppresser

All SafeRing ring main units may install with arc suppresser. The arc suppresser will automatically close on the bushing of incoming line when internally arcing. All cable modules of SafeRing and SafePlus including D, De and V module may be equiped with one Arc suppresser. The Arc suppresser and unit must be provided at same time and not changed.

The electrical contact in SF_6 cubicle are lead to terminal on back of front plate in order to show operation of arcing extinguishing device.

10. External busbar

SafeRing and SafePlus may be equiped with external busbar.

11. Base frame

SafeRing / SafePlus can be installed on the additional base frame. The base frame has openings for cable entry from bottom and from both sides. It is delivered as kit.

Two optional heights are 272mm and 450mm.

12. Low voltage box / low voltage compartment

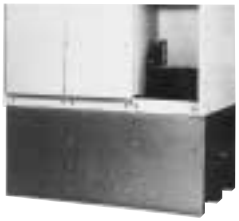
SafeRing / SafePlus may be equiped with low voltage box or low voltage box located on top of switchgear.

Low voltage box is used to install current meter (with or without selector switch). The low voltage compartment is used to install SPAJ140C, REF relays and current meter (with or without selector switch).

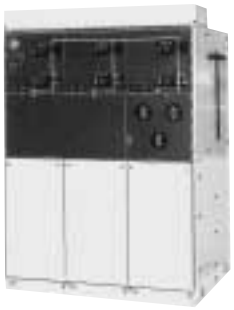
13. Surge arrester

For SafeRing / SafePlus, the MWD surge arrester can be install in cable terminals of incoming and outgoing modules for cables, for SafePlus, MWD surge arrester may be install on busbar or in M cubicle. In principle, 12kV select MWD 15 and 24kV select MWD 22.

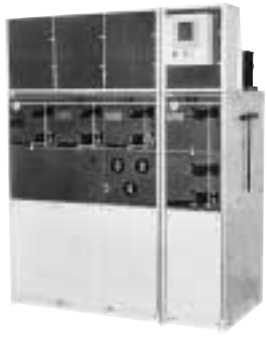
External busbar



Stand

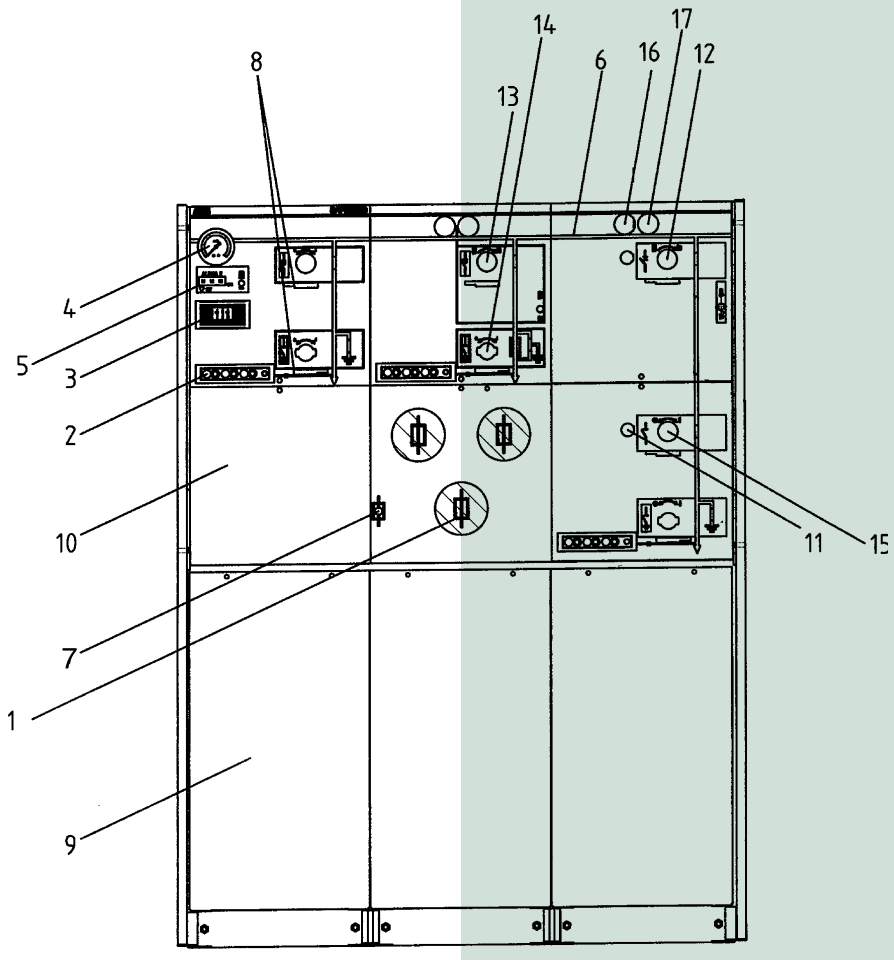


Secondary circuit cabinet
located in top of switchgear

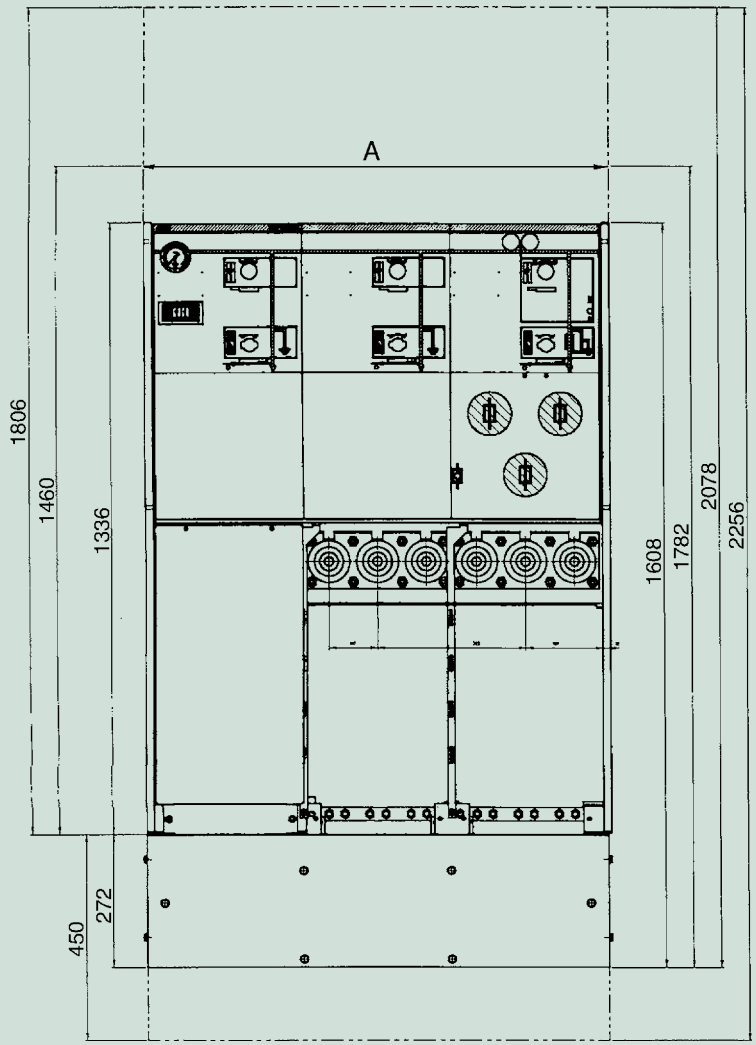


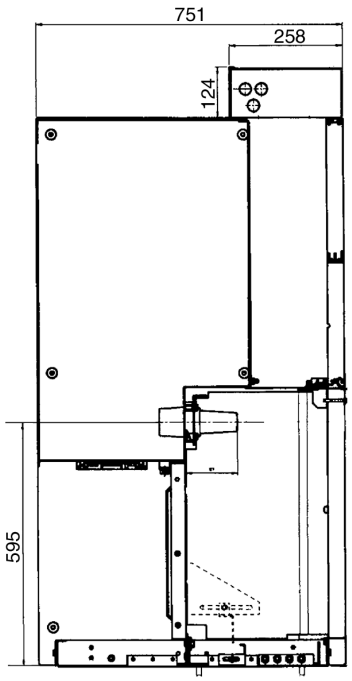
Low voltage box located
in top of switchgear

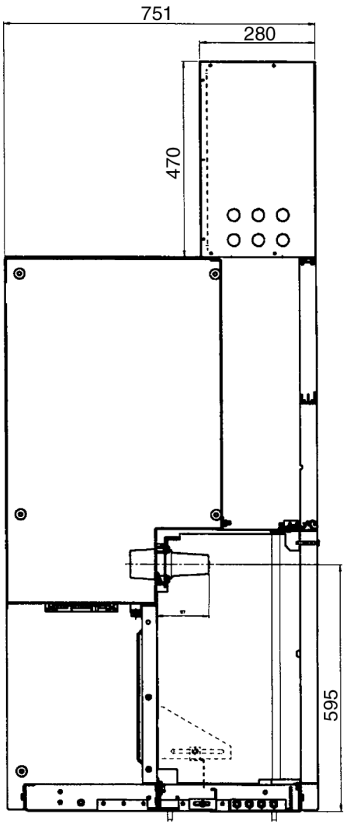
1. Fuse cabinet
2. Capacitive voltage indicator
3. Short circuit / earthing fault indicator (accessories)
4. Pressure meter
5. Name plate with series number
6. Simulated line diagram
7. Fuse operating indicator
8. Padlock position on front plate
9. Cable compartment
10. RTU211 installation compartment
11. Ronis lock (accessories)
12. Operating hole for circuit breaker
13. Operating hole for load switch
14. Operating hole for earthing switch
15. Operating hole for isolator switch
16. Button for tripping
17. Button for closing



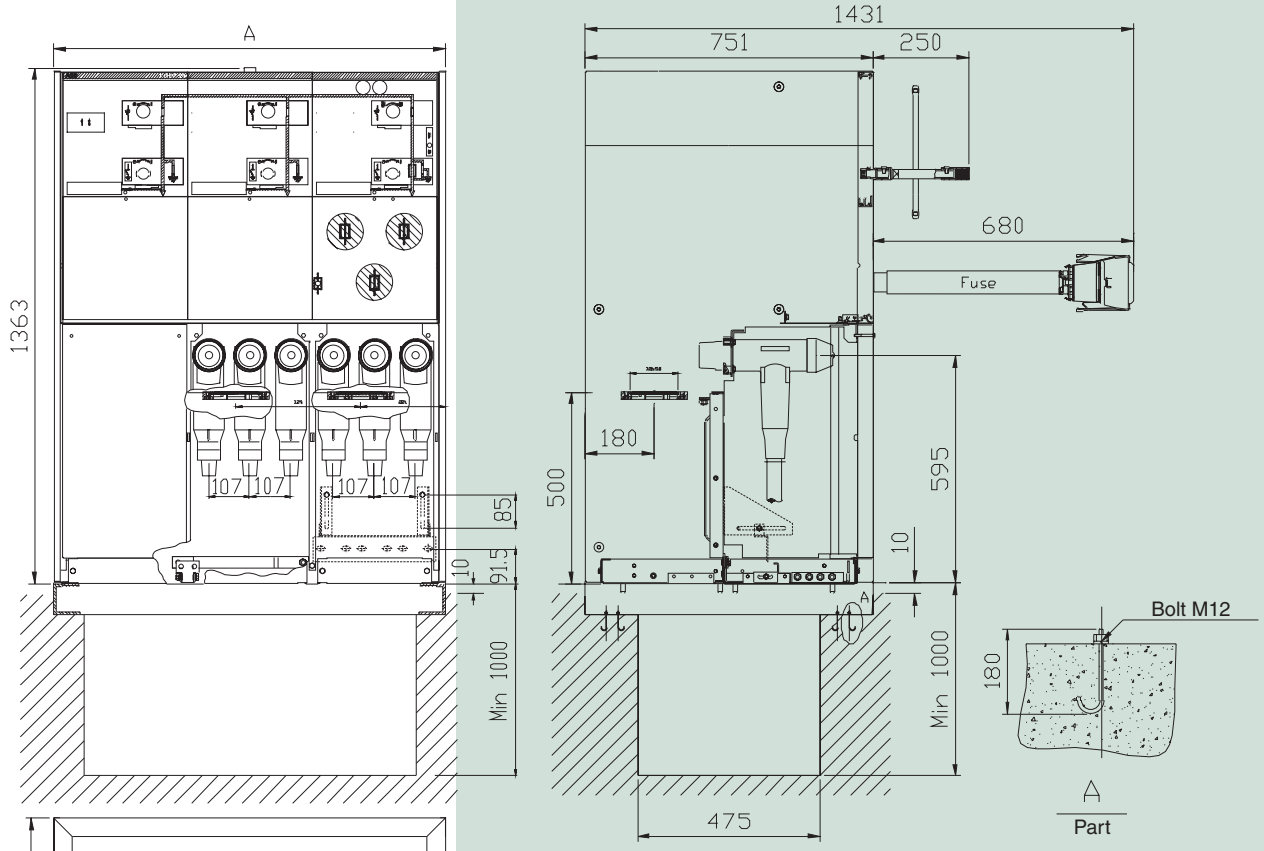
SAFE dimension diagram

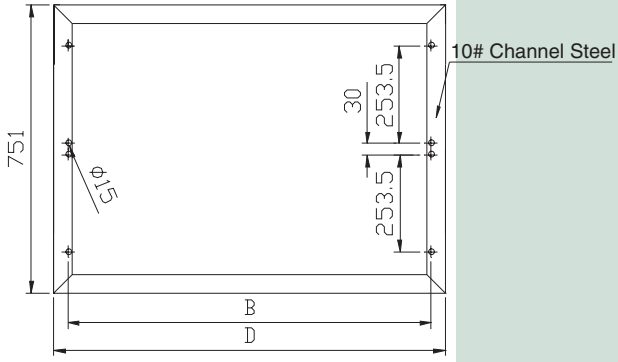




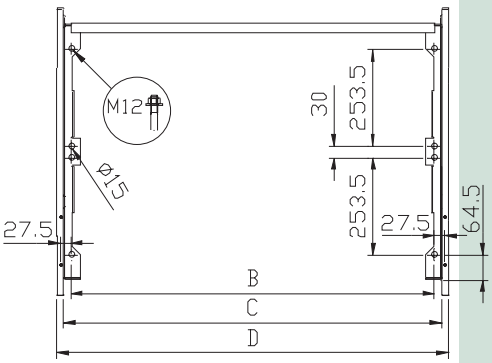


Unit	A
1 unit	371
2 units	696
3 units	1021
4 units	1346
5 units	1671

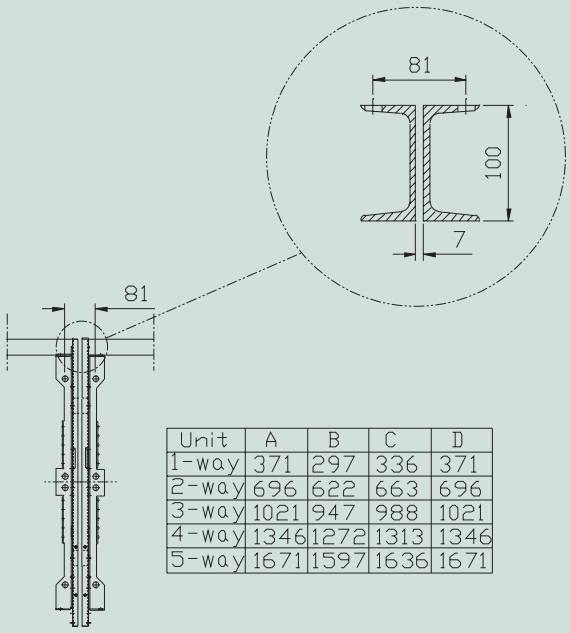




Foundation Channel Steel Planform



Support Bottom Planform

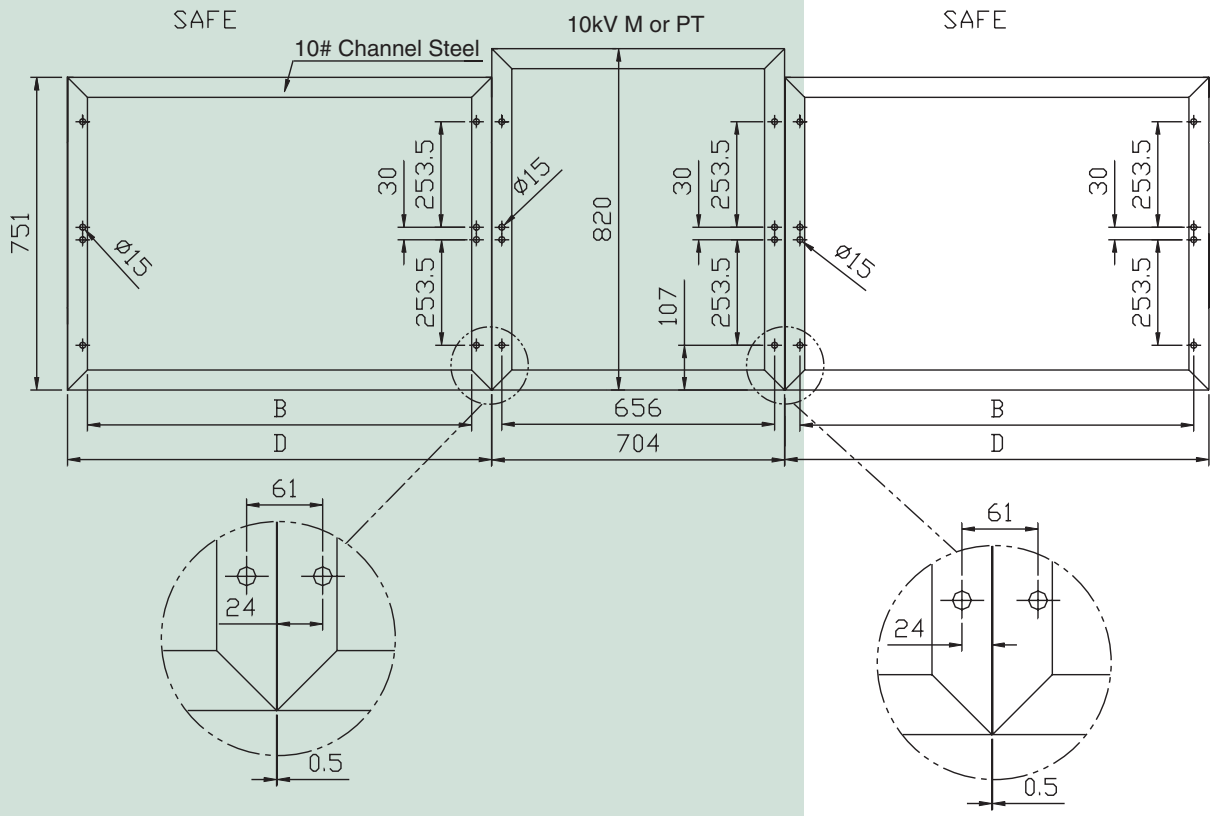


Unit	A	B	C	D
1-way	371	297	336	371
2-way	696	622	663	696
3-way	1021	947	988	1021
4-way	1346	1272	1313	1346
5-way	1671	1597	1636	1671

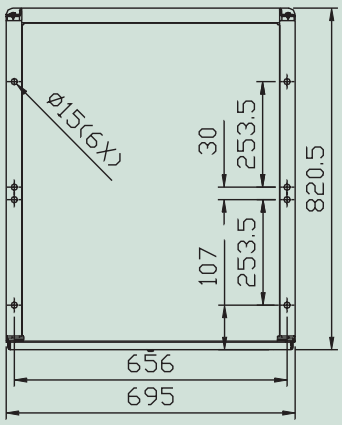
SafePlus Connection Drawing

Note: When using 3-core cable, which section area is over 240mm², to install CT, cable is supposed to be parted in cable channel and fixed.

Foundation

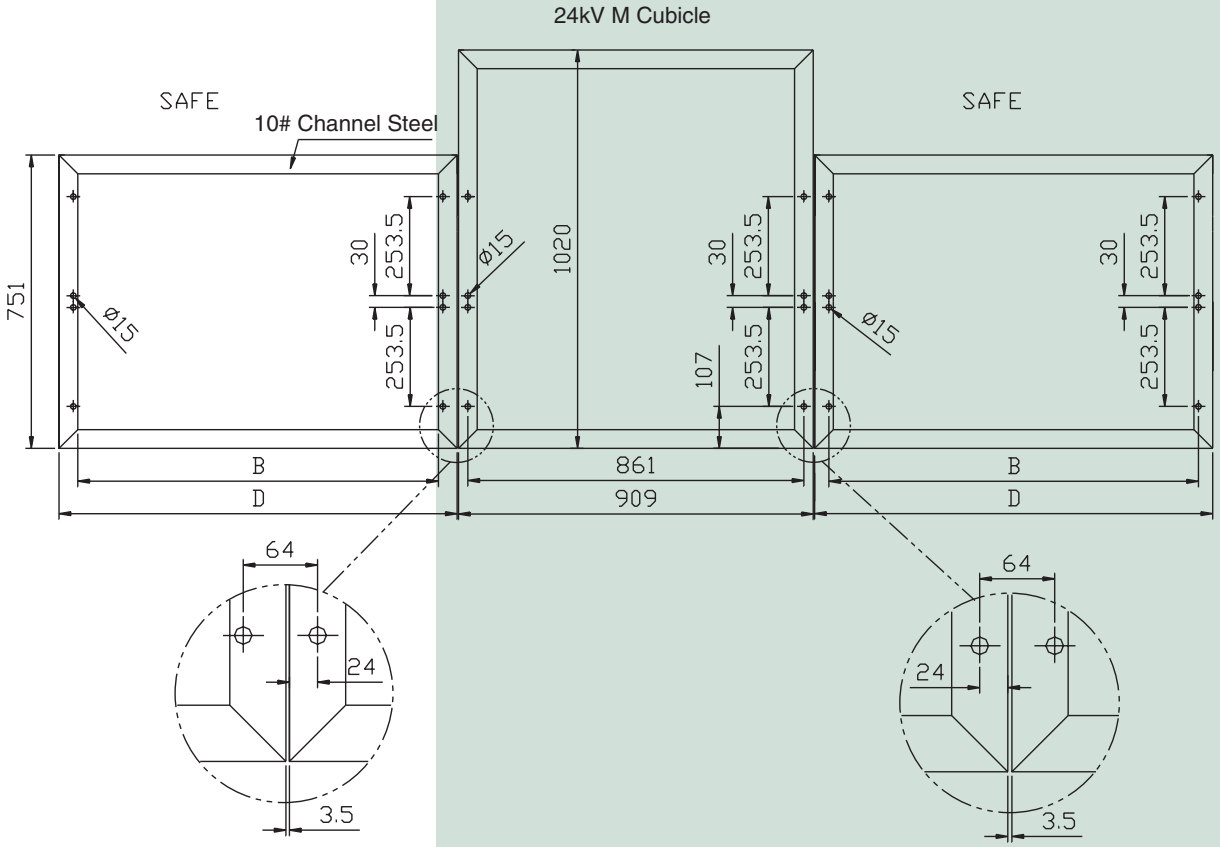


Planform of foundation channel steel for SafePlus connected with 10kV M cubicle or PT cubicle.

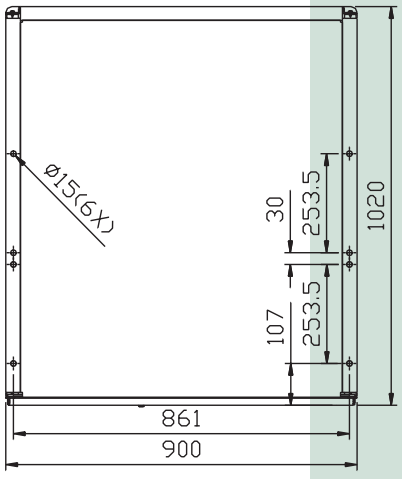


Bottom Assembling Drawing of 10kV M or PT

Foundation of SafePlus connected with 10kV M or PT.



Planform of foundation channel steel for SafePlus connected with 24kV M cubicle



Bottom Assembling Drawing of 24kV M

Foundation of SafePlus connected with 24kV M

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