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Switchgear Based On Type SIMOSEC, up to 24 kV, Air-Insulated, Extendable

Medium-Voltage Switchgear • Catalog HN-MV-0518

Contents

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Based on type SIMOSEC switchgear is a factory-assembled, type-tested, three-phase, metal-enclosed, indoor switchgear according to IEC 62271-200 for single busbars.

Typical uses

Based on type SIMOSEC switchgear is used for power distribution in distribution systems.

The modular, space saving design enables application in

- Substations, customer transfer substations, distribution substations and switching substations of power supply and public utilities
- Public buildings, such as high-rise buildings, railway stations, hospitals
- Industrial plants.

Typical applications

- Wind power stations
- High-rise buildings
- Airports
- Underground railway stations
- Sewage treatment plants
- Port facilities
- Traction power supply systems
- Automobile industry
- Petroleum industry
- Chemical industry
- Unit-type heating power stations
- Textile, paper and food industries
- Emergency power supply installations
- Shopping centers and data centers.

Modular design

- Individual panels, for free combination and extension
- Circuit-breaker panels for various applications.

Reliability

- Type and routine-tested
- No cross insulation between phases

Personal safety

- All switching operations can be performed with closed panel front
- Metal-enclosed LSC 2 panels
- HV HRC fuses and cable sealing ends are only accessible when the outgoing feeders are earthed
- Logical mechanical interlocking
- Capacitive voltage detecting system for verification of safe isolation from supply
- Earthing of outgoing feeders by means of make-proof earthing switches
- Partition class: **PM** (metallic partition).

Compact design

Thanks to the use of gas-insulated switching-device vessel compact dimensions are possible.
Thus:

- Existing switchgear rooms can be used effectively
- New constructions cost little
- Costly city-area space is saved.

Security of operation

- Components, e.g. operating mechanisms, three-position switches, vacuum circuit-breakers proven for years
- LSC 2 panels:
  - Panels with metallic partition (metal-clad) between busbar and switching device and between switching device and cable compartment (R, T, L)
  - Panels with metallic partition between switching device and busbar compartment
- Metal-enclosed switching-device vessel with three-position switch, gas-insulated
  - Welded sealed-for-life switching-device vessel
  - No cross insulation between phases
  - With welded-in rotary bushings for operation
  - Three-position switch-disconnector with gas-insulated switching functions
  - Three-position disconnector, gas-insulated
  - Switching functions CLOSE-OPEN-EARTH
- Operating mechanisms of switching devices accessible outside the switching-device vessel
- Maintenance-free operating mechanism parts (IEC 62271-1)
- Mechanical position indication integrated in mimic diagram
- Switchgear interlocking system with logical mechanical interlocks
- Partition class: **PM** (metallic partition).

Reavailability

- Three-position switch-disconnector with gas-insulated, maintenance-free quenching principle
- Metallic partition between busbar compartment, switching devices and cable compartment
- Separate pressure relief for each compartment
- Cable testing without the need to isolate the busbar
- Mounting location of three-phase current transformer for selective disconnection of circuit-breaker feeders.

Cost-efficiency

Low “lifecycle costs“ and high availability throughout the entire product service lifecycle as a result of:

- Minimum space requirement
- Easy switchgear extension, without gas work
- Maintenance-free gas-insulated switching functions of the three-position switch (gas-insulated quenching principle)
- Vacuum circuit-breaker
- Modular product range and design, e.g. circuit-breaker panels
- Low maintenance
- Option: Numerical multifunction protection relay

Quality and environment

- Quality and environmental management system according to DIN EN ISO 9001 and DIN EN ISO 14001
- Easy switchgear extension, without gas work on site
- Minimum space requirements.

Service life

Under normal operating conditions, the expected service life of air-insulated switchgear based on type SIMOSEC is at least 35 years, probably 40 to 50 years, taking the tightness of the hermetically welded switching-device vessel into account. The service life is limited by the maximum number of operating cycles of the switchgear devices installed:

- For circuit-breakers, according to the endurance class defined in IEC 62271-100
- For three-position disconnectors and earthing switches, according to the endurance class defined in IEC 62271-102
- For three-position switch-disconnectors, according to the endurance class defined in IEC 62271-103.

Technology

- Air-insulated indoor switchgear
- Gas-insulated, maintenance-free switching functions for the three-position switch as switch-disconnector
- Partition class: PM (metallic partition)
- Three-pole primary enclosure
- Phases arranged one behind the other
- No cross insulation between phases
- Busbar system at the top
- Air-insulated busbar and cable connection system
- Three-position switch, metal-enclosed, with air-insulated primary terminals and gas-insulated switching functions
- Vacuum circuit-breaker, metal-enclosed, fixed-mounted in gas-insulated switching-device vessel
- Hermetically-sealed by welded, stainless-steel switching-device vessel

– For switching devices
– With insulating gas SF_6 (fluorinated greenhouse gas).

Insulating system

- Switching-device vessel filled with SF_6 gas
- Features of SF_6 gas:

– Non-toxic
– Odorless and colorless
– Non-inflammable
– Chemically neutral
– Heavier than air
– Electronegative (high-quality insulator)
– Global Warming Potential GWP = 22,800

- Pressure of SF_6 gas in the switching-device vessel (absolute values at 20 °C):

– Rated filling level: 140 kPa
– Design pressure: 180 kPa
– Design temperature of the SF_6 gas: 80 °C
– Operating pressure of bursting disc: ≥ 270 kPa
– Bursting pressure: ≥ 550 kPa
– Gas leakage rate: < 0.1 % per year.

Panel design

- Factory-assembled, type-tested
- Metal-enclosed, with metallic partitions
- LSC 2 panels, LSC 1 panels (without isolating distance)
- Pressure relief

– To the rear and upwards
– Separately for each compartment

- Air-insulated cable connection system for conventional cable sealing ends
- Integrated low-voltage niche (standard) for installation of, e.g.

– Terminals, MCBs, pushbuttons
– Protection devices

- Option: Top-mounted low-voltage compartment
- Option: Panel heating for severe ambient conditions, e.g. condensation.

Common electrical data

					7.2		12		17.5		24		
Rated insulation level		Rated voltage U_r		kV									
		Rated short-dur. power-frequency withstand voltage U_d											
		– phase-to-phase, phase-to-earth, open contact gap		kV	20		28		38		50		
		– across the isolating distance		kV	23		32		45		60		
		Rated lightning impulse withstand voltage U_p											
		– phase-to-phase, phase-to-earth, open contact gap		kV	60		75		95		125		
		– across the isolating distance		kV	70		85		110		145		
Rated frequency f_r				Hz	50/60 →								
Rated normal current I_r **) for busbar		Standard		A	630 →								
50 Hz	Rated short-time withstand current I_k	for rated duration of short-circuit t_k = 1 s		up to kA	21	25	21	25	21	25	16	20	25
		for rated duration of short-circuit t_k = 3 s		up to kA	21	–	21	–	21	–	16	20	–
	Rated peak withstand current I_p			up to kA	52.5	63	52.5	63	52.5	63	40	50	63
60 Hz	Rated short-time withstand current I_k	for rated duration of short-circuit t_k = 1 s		up to kA	21	25	21	25	21	25	16	20	25
		for rated duration of short-circuit t_k = 3 s		up to kA	21	–	21	–	21	–	16	20	–
	Rated peak withstand current I_p			up to kA	55	65	55	65	55	65	42	52	65

Pressure values, temperature

Pressure in gas-insulated switching-device vessel for SF_6 gas-insulated switching devices (pressure values at 20 °C)	Rated filling level for insulation p_{re} (absolute)			kPa	140 →								
	Minimum functional level for insulation p_{me} (absolute)			kPa	120 →								
	Signal of filling level for insulation p_{ae} (absolute)			kPa	120 →								
	Minimum functional level for switching p_{sw} (absolute)			kPa	120 →								
Ambient air temperature T (minimum/maximum air temperature depends on the secondary equipment used)	Operation:	Standard		°C	–5 to +55 [1] →								
		Option		°C	–25 [1] □ →								
	Storage/transport	Standard		°C	–5 to +55 [1] →								
		Option		°C	–25, +70 [1] →								
Degree of protection	for gas-filled switching-device vessel				IP65 →								
	for switchgear enclosure				IP2X/IP3X →								
	for low-voltage compartment				IP3X/IP4X →								

**)The rated normal currents apply to ambient air temperatures of max. 40 °C.
The 24-hour mean value is max. 35 °C (according to IEC 62271-1/VDE 0671-1)

1)Depending on the secondary equipment used

□)If panel heating available

Technical Data

Electrical data of the switchgear

Design and construction

Partition class	PM (metallic partition)
Loss of service continuity category Panels – With HV HRC fuses [T, M(VT-F), ...] – Without HV HRC fuses (R, L, ...) – Metering panels type M or H1 or bus riser panel type H	 LSC 2 LSC 2 LSC 1
Accessibility to compartments (enclosure) – Busbar compartment – Switching-device compartment – Switching-device compartment with removable circuit-breaker – Low-voltage compartment (Option) – Cable compartment for panels: – Without HV HRC fuses (R, L, ...) – With HV HRC fuses (T, ...) – Cable feeder (K) – Metering panel (air-insulated) (M, ...H)	 – Tool-based – Non-accessible – Interlock-controlled – Tool-based – Interlock-controlled – Interlock-controlled – Tool-based – Tool-based

Internal arc classification (option)

The following internal arc classifications are fulfilled: IAC A FL(R), I_{sc}, t	
IAC	= Internal arc classification
IAC class for – Wall-standing arrangement – Free-standing arrangement	Rated voltage 7.2 kV to 24 kV: IAC A FL, I_{sc}, t IAC A FLR, I_{sc}, t
Type of accessibility: A – F – L – R	Switchgear in closed electrical service location, access “for authorized personnel only” (according to IEC 62271-200) Front Lateral Rear (for free-standing arrangement)
Arc test current I_{sc}	Up to 21 kA
Test duration t	1 s

Common electrical data of the switchgear panels

Rated insulation level		Rated voltage U_r	kV	7.2		12		17.5		24		
Circuit-breaker panel [2] types L, L1, L(T), L1(T)												
Rated normal current I_r **)		Standard: L, L(T), L1, L1(T)	A	630 →								
50 Hz	Rated short-time withstand current I_k	for rated duration of short-circuit t_k = 1 s	up to kA	21	25	21	25	21	25	16	20	25
		for rated duration of short-circuit t_k = 3 s	up to kA	21	–	21	–	21	–	16	20	–
	Rated peak withstand current I_p		up to kA	52.5	63	52.5	63	52.5	63	40	50	63
	Rated short-circuit making current I_{ma}		up to kA	52.5	63	52.5	63	52.5	63	40	50	63
	Rated short-circuit breaking current I_{sc}		up to kA	21	25	21	25	21	25	16	20	25
60 Hz	Rated short-time withstand current I_k	for rated duration of short-circuit t_k = 1 s	up to kA	21	25	21	25	21	25	16	20	25
		for rated duration of short-circuit t_k = 3 s	up to kA	21	–	21	–	21	–	16	20	–
	Rated peak withstand current I_p		up to kA	55	65	55	65	55	65	42	52	65
	Rated short-circuit making current I_{ma}		up to kA	55	65	55	65	55	65	42	52	65
	Rated short-circuit breaking current I_{sc}		up to kA	21	25	21	25	21	25	16	20	25
Metering panel types M, bus riser panel types H, H1												
Rated normal current I_r **) for: M, M(-K), M(-B), M(-BK), H, M(KK), H1		Standard	A	630 →								
50 Hz	Rated short-time withstand current I_k	for rated duration of short-circuit t_k = 1 s	up to kA	21	25	21	25	21	25	16	20	25
		for rated duration of short-circuit t_k = 3 s	up to kA	21	–	21	–	21	–	16	20	–
	Rated peak withstand current I_p		up to kA	52.5	63	52.5	63	52.5	63	40	50	63
60 Hz	Rated short-time withstand current I_k	for rated duration of short-circuit t_k = 1 s	up to kA	21	25	21	25	21	25	16	20	25
		for rated duration of short-circuit t_k = 3 s	up to kA	21	–	21	–	21	–	16	20	–
	Rated peak withstand current I_p		up to kA	55	65	55	65	55	65	42	52	65

• possible
– not possible

**) The rated normal currents apply to ambient air temperatures of max. 40 °C.
The 24-hour mean value is max. 35 °C (according to IEC 62271-1/VDE 0671-1)

2) With vacuum circuit-breaker in gas-filled switching-device vessel (maintenance-free under normal ambient conditions according to IEC 62271-1)

Common electrical data of the switchgear panels

Rated insulation level		Rated voltage U_r	kV	7.2		12		17.5		24		
Busbar voltage metering panel types M(VT-F), M1(VT-F)												
Rated normal current I_r **)		Standard	A	200 →								
50 Hz	Rated short-time withstand current I_k 1)	for rated duration of short-circuit t_k = 1 s	up to kA	21	25	21	25	21	25	16	20	25
		for rated duration of short-circuit t_k = 3 s	up to kA	21	–	21	–	21	–	16	20	–
	Rated peak withstand current I_p 1)		up to kA	52.5	63	52.5	63	52.5	63	40	50	63
60 Hz	Rated short-time withstand current I_k 1)	for rated duration of short-circuit t_k = 1 s	up to kA	21	25	21	25	21	25	16	20	25
		for rated duration of short-circuit t_k = 3 s	up to kA	21	–	21	–	21	–	16	20	–
	Rated peak withstand current I_p 1)		up to kA	55	65	55	65	55	65	42	52	65
	Dimension of HV HRC fuse-link	Standard: For HV HRC fuse-link		application of fuses for voltage transformer protection →								
		On request: Option: For HV HRC fuse-link according to IEC / EN 60282-1 / VDE 0670-4 and DIN 43625	e = 292 mm	•		•		•		•		
			e = 442 mm	–		–		–		–		
Busbar voltage metering panel types M(VT), M1(VT)												
Rated normal current I_r **)		Standard	A	200 →								
50 Hz	Rated short-time withstand current I_k 1)	for rated duration of short-circuit t_k = 1 s	up to kA	21	25	21	25	21	25	16	20	25
		for rated duration of short-circuit t_k = 3 s	up to kA	21	–	21	–	21	–	16	20	–
	Rated peak withstand current I_p 1)		up to kA	52.5	63	52.5	63	52.5	63	40	50	63
60 Hz	Rated short-time withstand current I_k 1)	for rated duration of short-circuit t_k = 1 s	up to kA	21	25	21	25	21	25	16	20	25
		for rated duration of short-circuit t_k = 3 s	up to kA	21	–	21	–	21	–	16	20	–
	Rated peak withstand current I_p 1)		up to kA	55	65	55	65	55	65	42	52	65
Busbar earthing panel type E												
50 Hz	Rated short-time withstand current I_k	for rated duration of short-circuit t_k = 1 s	up to kA	21	25	21	25	21	25	16	20	25
		for rated duration of short-circuit t_k = 3 s	up to kA	21	–	21	–	21	–	16	20	–
	Rated peak withstand current I_p		up to kA	52.5	63	52.5	63	52.5	63	40	50	63
	Rated short-circuit making current I_{ma}		up to kA	52.5	63	52.5	63	52.5	63	40	50	63
60 Hz	Rated short-time withstand current I_k	for rated duration of short-circuit t_k = 1 s	up to kA	21	25	21	25	21	25	16	20	25
		for rated duration of short-circuit t_k = 3 s	up to kA	21	–	21	–	21	–	16	20	–
	Rated peak withstand current I_p		up to kA	55	65	55	65	55	65	42	52	65
	Rated short-circuit making current I_{ma}		up to kA	55	65	55	65	55	65	42	52	65

- • possible
- – not possible

**) The rated normal currents apply to ambient air temperatures of max. 40 °C.

1) Busbar

Three-position switch-disconnector

Rated insulation level	Rated voltage U_r		kV	7.2		12		17.5		24			
	Rated short-duration power-frequency withstand voltage U_d – phase-to-phase, phase-to-earth, open contact gap – across the isolating distance		kV kV	20 23		28 32		38 45		50 60			
	Rated lightning impulse withstand voltage U_p – phase-to-phase, phase-to-earth, open contact gap – across the isolating distance		kV kV	60 70		75 85		95 110		125 145			
Rated frequency f_r			Hz	50/60 →									
Rated normal current I_r **)	Standard:		A	630 →									
50 Hz	Rated short-time withstand current I_k	for rated duration of short-circuit t_k = 1 s	up to kA	21	25	21	25	21	25	16	20	25	
		for rated duration of short-circuit t_k = 3 s	up to kA	21	–	21	–	21	–	16	20	–	
	Rated peak withstand current I_p		up to kA	52.5	63	52.5	63	52.5	63	40	50	63	
	Rated short-circuit making current I_{ma}		up to kA	52.5	63	52.5	63	52.5	63	40	50	63	
60 Hz	Rated short-time withstand current I_k	for rated duration of short-circuit t_k = 1 s	up to kA	21	25	21	25	21	25	16	20	25	
		for rated duration of short-circuit t_k = 3 s	up to kA	21	–	21	–	21	–	16	20	–	
	Rated peak withstand current I_p		up to kA	55	65	55	65	55	65	42	52	65	
	Rated short-circuit making current I_{ma}		up to kA	55	65	55	65	55	65	42	52	65	

Switching capacity for general-purpose switches according to IEC/EN 62271-103

Test duty TD_{load}	Rated mainly active load-breaking current I_{load}	100 operations I_{load} [I_1]	A	630 →									
		20 operations 0.05 I_{load} [I_1]	A	31.5 →									
Test duty TD_{loop}	Rated closed-loop breaking current I_{loop} [I_{2a}]		A	630 →									
Test duty TD_{cc}	Rated cable-charging breaking current I_{cc} [I_{4a}]		A	68 →									
Test duty TD_{lc}	Rated line-charging breaking current I_{lc} [I_{4b}]		A	68 →									
Test duty TD_{ma}	Rated short-circuit making current I_{ma}	50 Hz	up to kA	52.5	63	52.5	63	52.5	63	40	50	63	
		60 Hz	up to kA	55	65	55	65	55	65	42	52	65	
Test duty TD_{ef1}	Rated earth-fault breaking current I_{ef1} [I_{6a}]		A	200 →									
Test duty TD_{ef2}	Rated cable-charging breaking current and line-charging breaking current under earth-fault conditions I_{ef2}		A	115 →									
Number of mechanical operating cycles / M-classification			n	1000 / M1 →									
Number of electrical operating cycles with I_{load} / Classification			n	100 / E3 →									
Number of short-circuit making operations with I_{ma}			n	5	5	5	5	5	5	5	5	5	
Classification				E3	E3	E3	E3	E3	E3	E3	E3	E3	
C-classification	for general-purpose switch (no restrikes, TD: I_{cc}, I_{lc})			C2	C2	C2	C2	C2	C2	C2	C2	C2	

Classification for disconnectors according to IEC/EN 62271-102/VDE 0671-102

Number of mechanical operating cycles			n	1000 →									
M-classification				M0 →									

Technical data and switching capacity for earthing switch according to IEC/EN 62271-102/VDE 0671-102

Rated short-time withstand current I_k		50 Hz	up to kA	21	25	21	25	21	25	16	20	25	
Rated short-circuit making current I_{ma}		50 Hz	up to kA	52.5	63	52.5	63	52.5	63	40	50	63	
Rated short-time withstand current I_k		60 Hz	up to kA	21	25	21	25	21	25	16	20	25	
Rated short-circuit making current I_{ma}		60 Hz	up to kA	55	65	55	65	55	65	42	52	65	
Number of mechanical operating cycles / M-classification			n	1000 / M0 →									
Number of short-circuit making operations with I_{ma}			n	5	5	5	5	5	5	5	5	5/2 [1]	
Classification				E2	E2	E2	E2	E2	E2	E2	E2	E2/E1 [2]	

Switch-disconnector/fuse combination according to IEC/EN 62271-105/VDE 0671-105

Rated voltage U_r	kV	7.2	12	17.5	24		
Rated normal current I_r **)	A	200 →					
Rated transfer current $I_{transfer}$	A	1750	1750	1500	1400		
Maximum transformer rating	kVA	800	1600	1600	2500		

Switching capacity for make-proof earthing switch, arranged on feeder side, downstream from HV HRC fuse, for typical: T, T1, M(VT-F)

Rated short-time withstand current t_k = 1 s		kA	2 →				
Rated short-circuit making current I_{ma}	50 Hz	kA	5 →				
	60 Hz	kA	5.2 →				
Number of short-circuit making operations with I_{ma} / E-classification		n	5/E2	5/E2	5/E2	5/E2	
Number of mechanical operating cycles / M-classification		n	1000/M0 →				

Footnotes:

**) The rated normal currents apply to ambient air temperatures of max. 40 °C.
The 24-hour mean value is max. 35 °C (according to IEC 62271-1/VDE 0671-1)

1) The following values apply to 60 Hz: 2 resp. E1

Make-proof earthing switch

Technical data and switching capacity for earthing switch according to IEC/EN 62271-102/VDE 0671-102 (for panel types: R, D, E)

Rated voltage U_r			kV	7.2		12		17.5		24		
50 Hz	Rated short-time withstand current I_k	for rated duration of short-circuit t_k = 1 s	up to kA	21	25	21	25	21	25	16	20	25
		for rated duration of short-circuit t_k = 3 s	up to kA	21	–	21	–	21	–	16	20	–
	Rated short-circuit making current I_{ma}		up to kA	52.5	63	52.5	63	52.5	63	40	50	63
60 Hz	Rated short-time withstand current I_k	for rated duration of short-circuit t_k = 1 s	up to kA	21	25	21	25	21	25	16	20	25
		for rated duration of short-circuit t_k = 3 s	up to kA	21	–	21	–	21	–	–	20	–
	Rated short-circuit making current I_{ma}		up to kA	55	65	55	65	55	65	42	52	65
Number of mechanical operating cycles/M-classification			n	1000/M0 →								
Number of short-circuit making operations with I_{ma}			n	5	5	5	5	5	5	5	5	5
Classification				E2	E2	E2	E2	E2	E2	E2	E2	E2

Vacuum circuit-breaker

Switching capacity according to IEC / EN 62271-100 / VDE 0671-100

Type CB-f [1) 4)], combined with three-position disconnector, in gas-insulated switching-device vessel [4)]

Rated voltage U_r			kV	7.2		12		17.5		24		
Rated normal current I_r **) for circuit-breaker type		CB-f	A	630 →								
Rated frequency f_r			Hz	50 / 60 →								
50 Hz	Rated short-time withstand current I_k	for rated duration of short-circuit t_k = 1 s	up to kA	21	25	21	25	21	25	16	20	25
		for rated duration of short-circuit t_k = 3 s	up to kA	21	–	21	–	21	–	16	20	–
	Rated peak withstand current I_p		up to kA	52.5	63	52.5	63	52.5	63	40	50	63
	Rated short-circuit breaking current I_{sc}		up to kA	21	25	21	25	21	25	16	20	25
	Rated short-circuit making current I_{ma}		up to kA	52.5	63	52.5	63	52.5	63	40	50	63
60 Hz	Rated short-time withstand current I_k	for rated duration of short-circuit t_k = 1 s	up to kA	21	25	21	25	21	25	16	20	25
		for rated duration of short-circuit t_k = 3 s	up to kA	21	–	21	–	21	–	16	20	–
	Rated peak withstand current I_p		up to kA	55	65	55	65	55	65	42	52	65
	Rated short-circuit breaking current I_{sc}		up to kA	21	25	21	25	21	25	16	20	25
	Rated short-circuit making current I_{ma}		up to kA	55	65	55	65	55	65	42	52	65

Classification and number of operating cycles for circuit-breaker according to IEC / EN 62271-100 / VDE 0671-100

Circuit-breaker: CB-f NAR [3)]

Mechanical	Number of operating cycles		2000 →
	Class		M1 →
Electrical	Number of operating cycles with I_r: 2000		Class E2 →
	Breaking of capacitive currents		Class C1 →
	Number of short-circuit breaking operations with I_{sc}	n	20 →
			Class S1 →
Rated operating sequence	CB-f NAR		O – 3 min – CO – 3 min – CO →

Circuit-breaker: CB-f AR [1) 3)]

Mechanical	Number of operating cycles	n	10 000 →
	Class		M2 →
Electrical	Number of operating cycles with I_r: 10,000		Class E2 →
	Breaking of capacitive currents		Class C2 →
	Number of short-circuit breaking operations with I_{sc} for CB-f AR	n	30 or 50 →
			Class S2 →
Rated operating sequence	CB-f		O – 0.3 s – CO – 3 min – CO
	CB-f		O – 0.3 s – CO – 30 s – CO

Classification for disconnector according to IEC / EN 62271-102 / VDE 0671-102 (for panel types L, L1, ...)

Number of mechanical operating cycles	n	1000 →
M-classification		M0 →

Classification for earthing switch according to IEC / EN 62271-102 / VDE 0671-102 (for panel types L, L1, ...)

Number of mechanical operating cycles / M-classification	n	1000 / M0 →								
Number of short-circuit making operations with I_{ma}	n	5	5	5	5	5	5	5	5	5
Classification		E2	E2	E2	E2	E2	E2	E2	E2	E2

**) The rated normal currents apply to ambient air temperatures of max. 40 °C.
The 24-hour mean value is max. 35 °C (acc. to IEC 62271-1 / VDE 0671-1)

1)

Definition of the different types of vacuum circuit-breakers (= VCB):			VCB version: without AR [3)]	with AR [3)]
Panel type	VCB type	Vacuum circuit-breaker – Design:	CB-...NAR	CB-...AR
L, L1	CB-f	fixed-mounted in gas-insulated switching-device vessel, combined with three-position disconnector	CB-f NAR	CB-f AR

3) AR = Automatic reclosing; NAR = Non-automatic reclosing

4) VCB in switching-device vessel (maintenance-free under normal ambient conditions according to IEC 62271-1)

Product Range

Product range overview

Standard panels (examples)

Ring-main panel, type R

Transformer panel, type T

Panel designation		Panel type	Panel width mm
Column No.			
Ring-main panel [1]	as feeder	R R1	375 500
	as transfer	R(T) R1(T)	375 500
Transformer panel [1]	as feeder	T T1	375 500
Cable panel	as feeder	K K1	375 500
Circuit-breaker panel [1] with CB type "CB-f" [2]	as feeder	L L1	500 750
	as transfer	L(T) L1(T)	500 750
Metering panels (as billing metering panel)	standard	M M(-B)	750 750
	as end panel	M(-K) M(-BK)	750 750
Metering panel	as individual panel	M(KK)	750
Busbar voltage metering panel [1]		M(VT)	375
		M1(VT)	500
		M(VT-F)	375
		M1(VT-F)	500
Bus riser panel		H	375
Metering panel / bus riser panel		H1	500
Busbar earthing panel		E	375

1) Panel type: Metal-clad

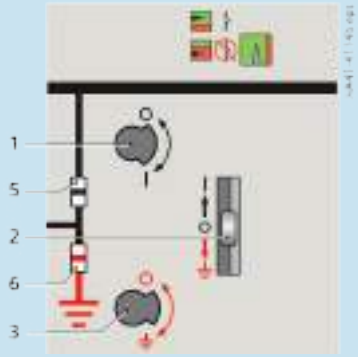
2) Type designation of vacuum circuit-breaker

- ● Basic equipment
- ○ Additional equipment (option), further additional equipment on request
- – Not available

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Panel type
●[1]	●	–	●	●	–	●	○	○	○	○	–	–	○	–	○	○	–	–	○	○	○	○	○	○	R R1
●	●	–	–	●	–	●	○	○	○	○	–	–	○	–	–	○	–	–	○	–	○	○	○	–	R(T) R1(T)
●	●	–	●[6]	●	○	●	○	○	○	○	–	●	○	○	●	○	–	–	○	–	○	○	○	○	T T1
–	–	●	●	●	–	–	–	–	–	–	–	–	–	–	○	○	–	–	–	○	○	○	○	○	K K1
●[2]	●	–	●	●	○	●	○	○	○	○	●	–	○	–	○	○	○	○	○	○	○	○	○	○	L L1
●[2]	●	–	–	●	○	●	○	○	○	○	●	–	○	–	–	○	○	○	○	–	○	○	○	–	L(T) L1(T)
–	–	●	–	●	–	–	–	–	–	–	–	–	–	–	○	○	–	–	–	–	○	○	○	–	M M(-B)
–	–	●	●	●	–	–	–	–	–	–	–	–	–	–	○	○	–	–	–	–	○	○	○	○	M(-K) M(-BK)
–	–	●	●	●	–	–	–	–	–	–	–	–	–	–	○	○	–	–	–	–	○	○	○	○	M(KK)
●[1]	●	–	–	●	–	●	○	○	○	○	–	–	–	○	_	○	–	–	○	–	○	○	○	–	M(VT)
●[1]	●	–	–	●	–	●	○	○	○	○	–	–	–	○	_	○	–	–	○	–	○	○	○	–	M1(VT)
●[1]	●	–	–	●	–	●	○	○	○	○	–	–	–	○	○	○	–	–	○	–	○	○	○	–	M(VT-F)
●[1]	●	–	–	●	–	●	○	○	○	○	–	–	–	○	○	○	–	–	○	–	○	○	○	–	M1(VT-F)
–	–	●	–	●	–	–	–	–	–	–	–	–	–	–	–	○	–	–	–	–	○	○	○	–	H
–	–	●	–	●	–	–	–	–	–	–	–	–	–	–	–	○	–	–	–	–	○	○	○	–	H1
●	–	●	–	●	–	●	○	○	–	–	–	–	–	–	○	○	–	–	○	–	○	○	○	–	E
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Panel type

1) Three-position switch as three-position switch-disconnector
2) Three-position switch as three-position disconnector
4) In special cases, deeper floor cover for panels with cable feeder required. Design of floor cover: Depending of direction of pressure relief
5) Or for earthing switch in panel type E
6) For panel type T with a rated voltage of 24 kV: Deeper cable fixing located underneath the panel

Operation of three-position switch

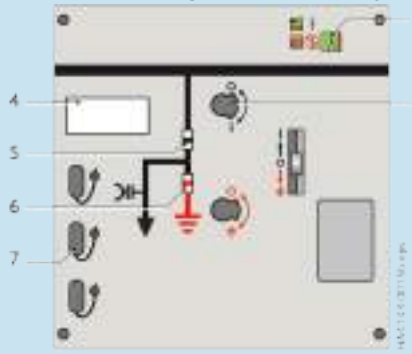


Operating levers

1 Manual operation of load-break function (R, T) or disconnecting function (L)
2 Locking function (option for ring-main feeders)
3 Manual operation of earthing function
4 Panel designation label
5 Position indicator for switch-disconnector
6 Position indicator for earthing switch
7 Sockets of capacitive voltage detecting system
8 “Fuse tripped” indicator
9 ON pushbutton for transformer or circuit-breaker function
10 OFF pushbutton for transformer or circuit-breaker function
11 Manual operation for “spring charging”
12 “Spring charged” indicator
13 Position indicator for circuit-breaker
14 Ready-for-service indicator
15 Operations counter
16 Preselection for manual charging of circuit-breaker panels

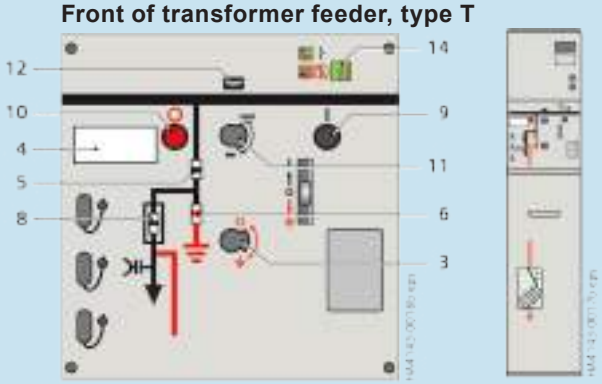
*) AR = Automatic reclosing
NAR = Non automatic reclosing

Front of ring-main feeder, type R



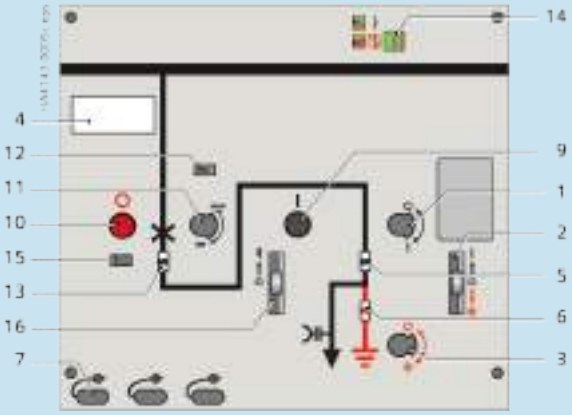
Panel width: 375 mm

Front of transformer feeder, type T

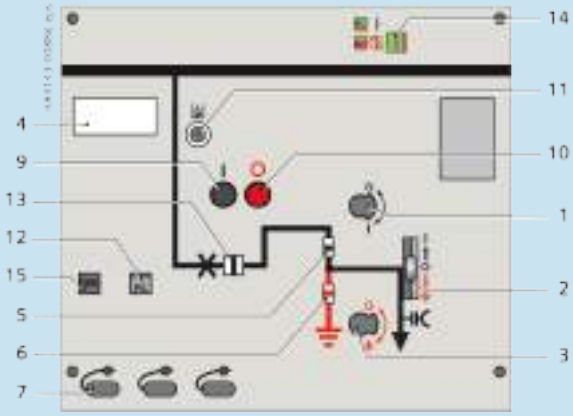


Panel width: 375 mm

Front of circuit-breaker feeder, type L



Panel width: 500 mm, with circuit-breaker type CB-f NAR *)



Panel width: 500 mm, with circuit-breaker type CB-f AR *)

Features

- Switch positions:
  CLOSED – OPEN – EARTHED
- Switching functions as general-purpose switch-disconnector (class E3) according to
  – IEC / EN 62271-103 / VDE 0671-103
  – IEC / EN 62271-102 / VDE 0671-102
- Designed as a three-position switch with the functions
  – Switch-disconnector and
  – Make-proof earthing switch
- Operation via rotary bushing welded gas-tight into the front of the switching-device vessel
- Climate-independent contact in the gas-filled switching-device vessel
- Maintenance-free according to IEC / EN 62271-1 / VDE 0671-1
- Individual secondary equipment
- No cross insulation between phases.

Mode of operation

The operating shaft forms one unit together with the three contact blades. Due to the arrangement of the fixed contacts (earth – busbar), it is not necessary to interlock the CLOSE and EARTHING functions.

Closing operation

During the closing operation, the operating shaft with the moving contact blades changes from the “OPEN” to the “CLOSED” position.
The force of the spring-operated mechanism ensures a high closing speed and a reliable connection of the main circuit.

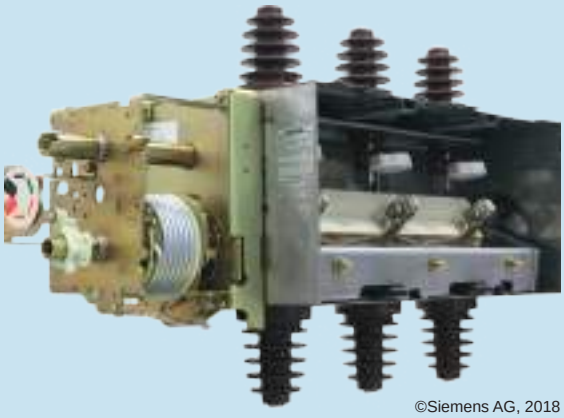
Opening operation

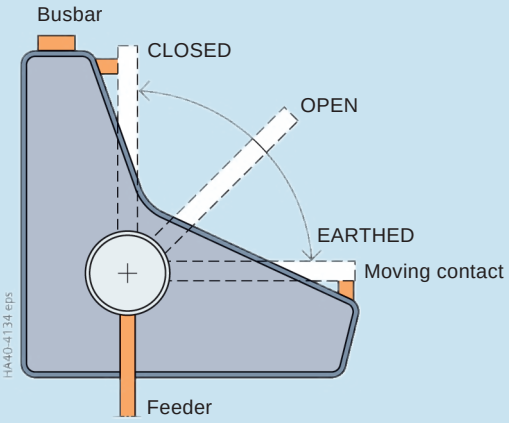
During the opening operation, the arc is caused to rotate by the arc-suppression system. This rotation movement prevents the development of a fixed root.
The isolating distance in gas established after breaking fulfills the conditions applicable to isolating distances in accordance with
– IEC / EN 62271-102 / VDE 0671-102
and
– IEC / EN 62271-1 / VDE 0671-1.
Due to the arc rotation caused by the arc-suppression system, both load currents and minor no-load currents are safely interrupted.

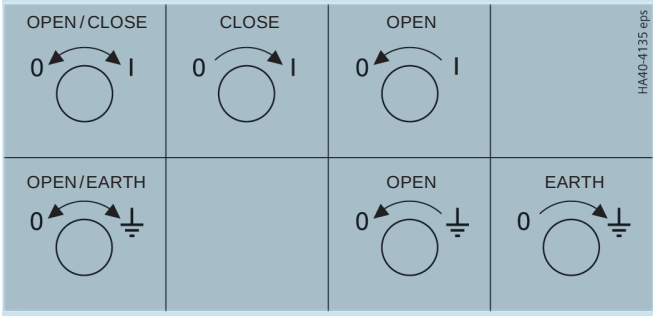
Earthing operation

The EARTHING operation is implemented by changing from the “OPEN” to the “EARTHED” position.

Three-position switch-disconnector







Switch positions:	CLOSED	OPEN	Feeder EARTHED
as three-position switch-disconnector up to 630 A			

Features

- Mechanical endurance of more than 1000 operating cycles
- Parts subjected to mechanical stress are highly corrosion-proof
- Manual operation with the help of a slip-on operating lever
- Option: Motor operation
- Control board with accordingly cut-out switching gate prevents the three-position switch-disconnector from being switched directly from the “CLOSED” via the “OPEN” to the “EARTHED” position
- Two separate actuating openings are provided for unambiguous selection of the DISCONNECTING and EARTHING functions
- Operation via rotary movement, operating direction according to IEC / EN 60447 / VDE 0196.

Spring-operated mechanism

The switching movements are performed independently of the operating speed.

Spring-operated / stored-energy mechanism

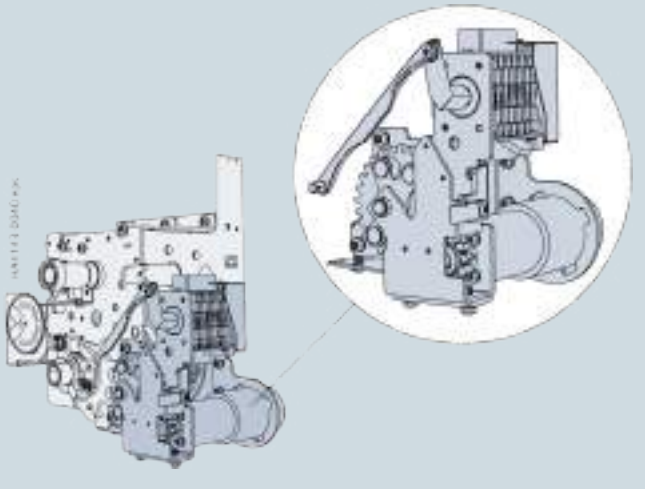
The switching movements are performed independently of the operating speed.
During the charging process, the closing and opening springs are charged. This ensures that the switch-disconnector / fuse combination can switch off all types of faults reliably even during closing.
Closing and opening is done via pushbuttons, and is therefore identical with the operation of circuit-breaker operating mechanisms.
An energy store is available for tripping by means of an operating HV HRC fuse or via a shunt release (f-release).
After tripping, a red bar appears on the position indicator.

- **Motor operating mechanism** (option)

The manual operating mechanisms of based on type SIMOSEC switchgear can be equipped with motor operating mechanisms for the three-position switch-disconnector. Retrofitting is possible.
Operating voltages for motor operating mechanisms:
– 24, 48, 60, 110, 220 V DC
– 110 and 230 V AC, 50 / 60 Hz.

Operation:
- Local operation by momentary-contact rotary control switch (option)

Motor unit with auxiliary switch block



- Remote operation (standard) applied to terminal.

Shunt release (option)
(f-release)

Spring-operated / stored-energy mechanisms can be equipped with a shunt release. Remote electrical tripping of the three-position switch-disconnector is possible via the magnet coil of the shunt release, e.g. transformer overtemperature tripping.
To avoid thermal overloading of the shunt release in the event of a continuous signal that may be applied, the shunt release is switched off via an auxiliary switch which is mechanically coupled with the three-position switch-disconnector.

Assignment of operating mechanism type of three-position switch to panel types

Panel type	R, L	E	T, M(VT-F), M(VT)	
Function	Switch-disconnector (R) Disconnector (L)	Earthing switch	Switch-disconnector (T, T1) Disconnector [M(VT), M(VT-F)]	Earthing switch
Type of operating mechanism	Spring-operated	Spring-operated	Stored-energy	Spring-operated
Operation	Manual Motor (option)	Manual	Manual Motor (option)	Manual

Legend

E = Earthing panel
L = Circuit-breaker feeder
R = Ring-main feeder
T = Transformer feeder
M(VT), M(VT-F) = Busbar voltage metering panel

Features

- According to IEC/EN 62271-100/VDE 0671-100/GB 1984
- Application in hermetically welded switching-device vessel in conformity with the system
- Climate-independent vacuum interrupter poles in the gas-filled switching-device vessel
- Operating mechanism located outside the switching-device vessel in the front operating mechanism box
- Maintenance-free for indoor installation according to IEC/EN 62271-1/VDE 0671-1
- Individual secondary equipment.

Operating mechanism functions

The closing spring is charged by means of the operating lever or the hand crank supplied, or by the motor (option), until the latching of the closing spring is indicated ("spring charged" indicator). Then, the vacuum circuit-breaker can be closed manually or electrically.
In operating mechanisms provided for automatic reclosing (AR), the closing spring can be recharged manually or automatically in case of motor operating mechanism. Thus, the "closing option" is available again.

Operating mechanism

The operating mechanism assigned to a circuit-breaker feeder consists of the following components:

- Operating mechanism for circuit-breaker
- Operating mechanism for three-position disconnector
- Motor operating mechanism (optional)
- Position indicators
- Pushbuttons for CLOSING and OPENING the circuit-breaker
- Operations counter (optional)
- Interlocking between circuit-breaker and disconnector.

Assignment of operating mechanism type

Panel type	L, L1, L(T), L1(T)		
Function	Circuit-breaker	Three-position disconnector	
		Disconnector	Earthing switch
Type of operating mechanism	Stored-energy	Spring-operated	Spring-operated
Operation	Manual/motor	Manual/motor	Manual

Trip-free mechanism

The vacuum circuit-breaker is fitted with a trip-free mechanism according to IEC/EN 62271-100/VDE 0671-100. In the event of an opening command being given after a closing operation has been initiated, the moving contacts return to the open position and remain there even if the closing command is sustained. This means that the contacts are momentarily in the closed position, which is permissible according to the mentioned standard.

Technical data of the vacuum circuit-breaker

Vacuum circuit-breaker Type	CB-f AR *)	CB-f NAR *)
Short-circuit breaking current	up to 25 kA	up to 25 kA
Rated operating sequence:		
– O – 0.3 s – CO – 3 min – CO	•	–
– O – 0.3 s – CO – 30 s – CO	•	–
– O – 3 min – CO – 3 min – CO	–	•
Number of breaking operations I_r	10 000	2 000
Number of short-circuit breaking operations I_{SC}	30 Option: 50	20
Individual panel type L ...: 500 mm	L	L
Individual panel type L1...: 750 mm	L1	L1

Explanations:
- • Design option
- – Not available
- *) AR = Automatic reclosing; NAR = Non automatic reclosing

Vacuum circuit-breaker type CB-f

The vacuum circuit-breaker consists of a vacuum interrupter unit with integrated three-position disconnector located in the switching-device vessel, and the associated operating mechanisms.

Circuit-breaker secondary equipment

Circuit-breaker	Type CB-f AR	Type CB-f NAR
Motor operating mechanism	○	○
Closing solenoid	●	○
Shunt release	○	○
C.t.-operated release	○	○
Low-energy magnetic release	–	○
Undervoltage release	○	○
Anti-pumping	●	o.r.
Circuit-breaker tripping signal	●	○
Varistor module	for ≥ 60 V DC	for ≥ 60 V DC
Auxiliary switch		
6 NO + 6 NC	●	●
free contacts thereof 1)	1 NO + 2 NC + 2 changeover	1 NO + 1 NC + 2 changeover
11 NO + 11 NC	○	–
free contacts thereof 1)	6 NO + 7 NC + 2 changeover	–
Position switch	●	●
Mechanical interlocking	●	●
Operations counter	●	○

● = Standard
○ = Option
o.r. = on request

Abbreviations:
NO = Normally open contact
NC = Normally closed contact

1) Depending on the selected secondary components

Motor operating mechanism (option)

Operating voltages for motor operating mechanisms:
- 24, 48, 60, 110, 220 V DC
- 110 and 230 V AC, 50/60 Hz.

Further values on request.
Motor rating for circuit-breaker operating mechanism at:

CB-f AR: *)
– Maximum 500 W
– Maximum 650 VA

CB-f NAR: *)
– Maximum 80 W
– Maximum 80 VA.

Secondary components

The scope of the secondary equipment of the vacuum circuit-breaker depends on the type of application and offers a wide range of possible variations, allowing almost every requirement to be satisfied.

Closing solenoid

- For electrical closing.

Shunt release

- Standard: Magnet coil
- Option: Magnet coil with energy store
- Tripping by protection relay or electrical actuation.

C.t.-operated release

- For tripping pulse 0.1 Ws in conjunction with suitable protection systems, e.g. protection system 7SJ45, make Woodward/SEG type WIC; other designs on request
- Used if external auxiliary voltage is missing, tripping via protection relay.

Low-energy magnetic release (for CB-f NAR)

- For tripping pulse 0.02 Ws, tripping via transformer monitor (IKI-30).

Undervoltage release

- Comprising:
– Energy store and unlatching mechanism
– Electromagnetic system, which is permanently connected to voltage while the vacuum circuit-breaker is closed; tripping is initiated when this voltage drops
- Connection to voltage transformers possible.

Anti-pumping (standard for CB-f AR) *)
(mechanical and electrical)

Function: If constant CLOSE and OPEN commands are present at the vacuum circuit-breaker at the same time, the vacuum circuit-breaker will return to the open position after closing. It remains in this position until a new CLOSE command is given. In this manner, continuous closing and opening (= pumping) is avoided.

Circuit-breaker tripping signal

- For electrical signaling (as pulse > 10 ms), e.g. to remote control systems, in the case of automatic tripping (e.g. protection)
- Via limit switch and cutout switch.

Varistor module

- To limit overvoltages to approx. 500 V for protection devices (when inductive components are mounted in the vacuum circuit-breaker)
- For auxiliary voltages ≥ 60 V DC.

Auxiliary switch

- For electrical position indication.

Position switch

- For signaling “closing spring charged”.

Mechanical interlocking

- Dependent on the type of operating mechanism
- Logical mechanical interlock between the three-position disconnector and the circuit-breaker
(option: Closing lock-out for the three-position disconnector in circuit-breaker panels)
- Option: Operating mechanism with mechanical interlocking as
– Spring-operated mechanism: Opening for operating crank is blocked
– Stored-energy mechanism with closing solenoid and pushbutton: The pushbutton operated by the mechanical interlock prevents a continuous command to the closing solenoid
- During operation of the three-position disconnector from CLOSED to OPEN, the vacuum circuit-breaker cannot be in CLOSED position.

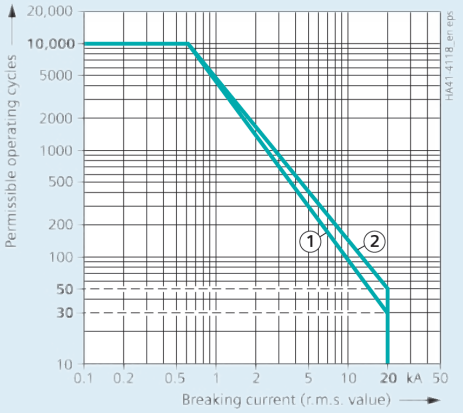
Operations counter

- As numeric indicator, 5 digits, mechanical.

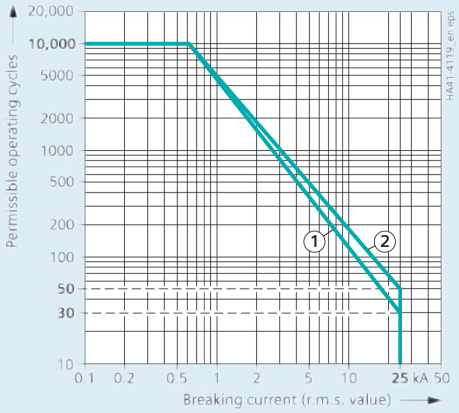
*) AR = Automatic reclosing
NAR = Non automatic reclosing

Electrical service life

Vacuum circuit-breaker type CB-f AR *)



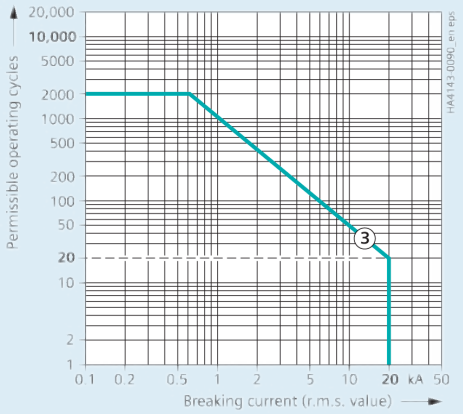
Rated short-circuit breaking current 20 kA



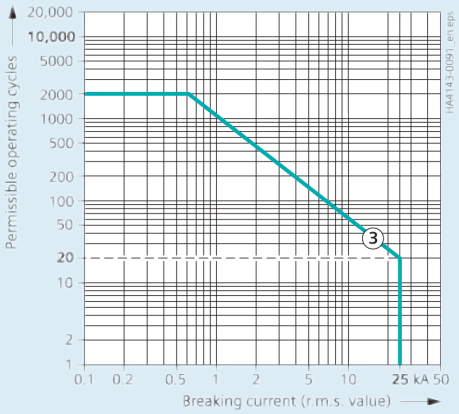
Rated short-circuit breaking current 25 kA

Max. number of short-circuit breaking operations:
1) n = 30, 2) n = 50

Vacuum circuit-breaker type CB-f NAR *)



Rated short-circuit breaking current 20 kA



Rated short-circuit breaking current 25 kA

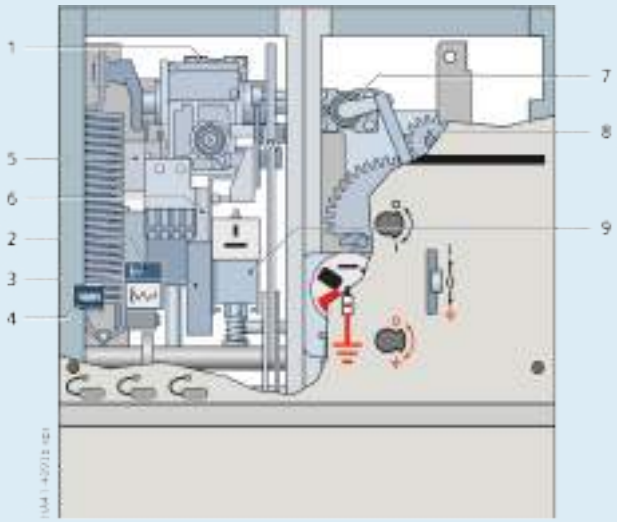
Max. number of short-circuit breaking operations:
3) n = 20

*) AR = Automatic reclosing
NAR = Non automatic reclosing

Components

Secondary equipment of the vacuum circuit-breaker

Vacuum circuit-breaker type CB-f AR *)



Maximum secondary equipment

1 Auxiliary switch at the circuit-breaker
2 Position switch “spring charged”
3 2nd release
4 Operations counter
5 1st release
6 Motor operating mechanism, circuit-breaker
7 Auxiliary switch at the three-position disconnector
8 Motor operating mechanism, three-position disconnector
9 Closing solenoid, circuit-breaker

*) AR: Automatic reclosing

Ready-for-service indicator

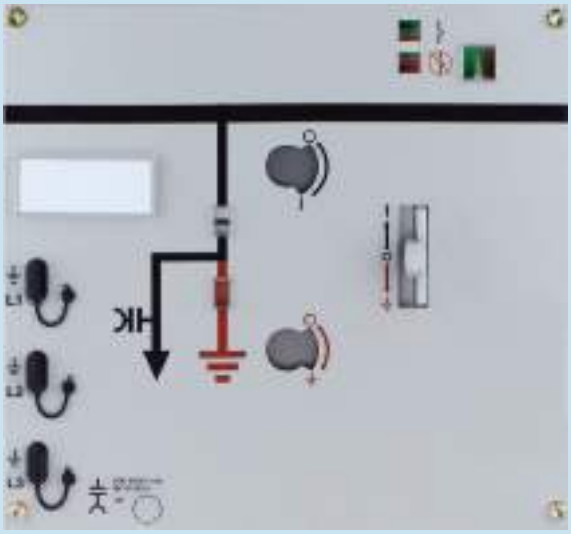
Features

- Self-monitoring; easy to read
- Independent of temperature and pressure variations
- Independent of the site altitude
- Only responds to changes in gas density
- Option: Alarm switch “1 NO” for remote electrical indication.

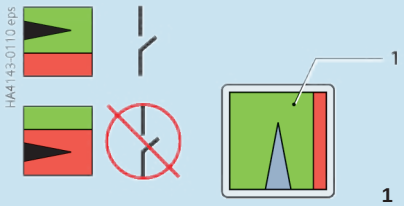
Mode of operation

For the ready-for-service indicator, a gas-tight measurement box is installed inside the switching-device vessel. A coupling magnet, which is fitted to the bottom end of the measurement box, transmits its position to an outside armature through the non-magnetizable stainless-steel switching-device vessel. This armature moves the ready-for-service indicator of the switchgear.
While changes in the gas density during the loss of gas, which are decisive for the dielectric strength, are displayed, temperature-dependent changes in the gas pressure are not. The gas in the measurement box has the same temperature as that in the switching-device vessel. The temperature effect is compensated via the same pressure change in both gas volumes.

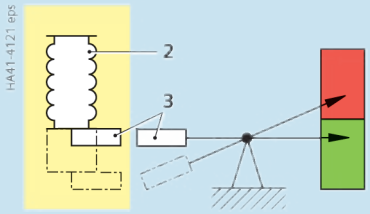
Ready-for-service indicator



Gas monitoring



1 Green indication:
Ready for service
(red indication:
Not ready for service)



Stainless-steel vessel filled with SF_6 gas

Ready-for-service indicator

Principle of operation of gas monitoring with ready-for-service indicator

2 Measurement box
3 Magnetic coupling

Room planning

Switchgear installation

Wall-standing arrangement, free-standing arrangement
– 1 row
– 2 rows (for face-to-face arrangement).

Room dimensions

See opposite dimension drawings.

Door dimensions

The door dimensions depend on the
– Number of panels in a transport unit
– Design with or without low-voltage compartment.

Switchgear fastening

- For floor openings and fixing points of the switchgear, see pages 30 and 31
- Foundations:

– Steel girder construction
– Steel-reinforced concrete.

Panel dimensions

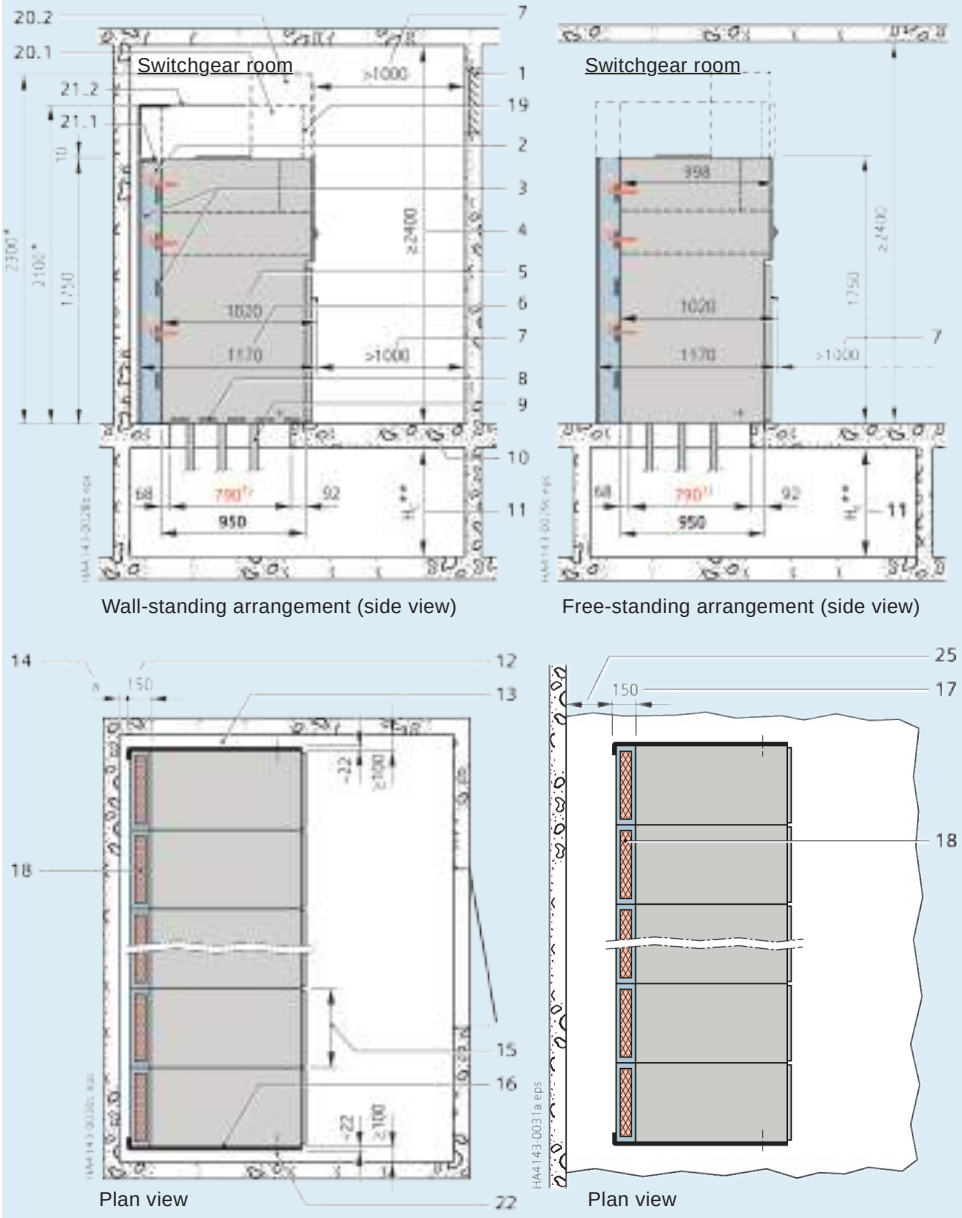
See pages 25 to 29

Weight

The weight of a panel depends on the extent to which it is equipped (e.g. with motor operating mechanism, voltage transformer).

1) Floor opening
*) Switchgear height 2100 mm if height of low-voltage compartment 350 mm; switchgear height 2300 mm if height of low-voltage compartment 550 mm
**) Cable fixing in the panel,
– without deep floor cover (for version without current transformer on the cable)

Room planning



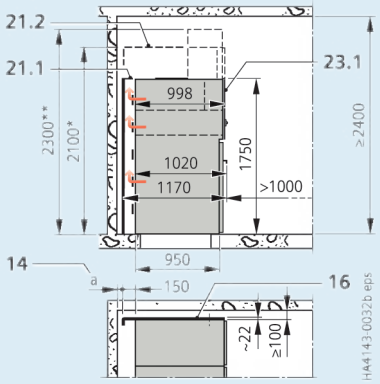
Wall-standing arrangement (side view)

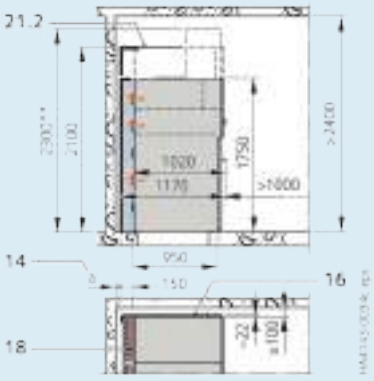
Free-standing arrangement (side view)

1 Relief opening
2 Direction of pressure relief
3 Pressure relief of switchgear
4 Room height
5 Individual panel depth △)
6 Panel depth including end wall △)
7 Depending on national requirements:
Control aisle ≥ 1000 mm recommended (in Germany ≥ 800 mm).
When extending or replacing panels, it might be necessary – depending on the room dimensions – to disassemble the respective adjacent panels.
8 Option: Floor cover (optionally deeper)
9 Cable
10 Foundation
11 Height of cable basement depending on (recommendation for $H_{c\ inside}$):
– Bending radius of cable
≥ 600 mm**... ≥ 1400 mm
– Cable fixing underneath the panel (in cable basement)
≥ 1400 mm
– Use of deep floor cover
≥ 1400 mm
12 Wall distance,
dimension of pressure relief duct (= option)
13 Side wall distance
14 Wall distance a (see also page 24)
15 Panel width

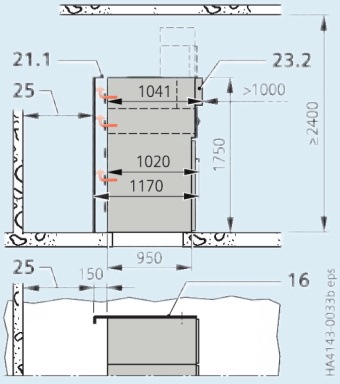
Continued on next page

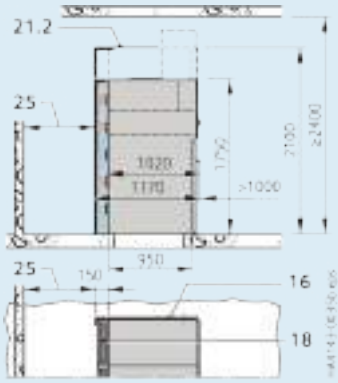
Wall-standing arrangement





Free-standing arrangement





Design of switchgear

Type of instal-lation	IAC	Rear pressure relief duct	Switch-gear height in mm	Recom-mended height for switchgear room
Wall-standing	–	–	1750	≥ 2400
Free-standing	–	– △)	1750	≥ 2400
Floor cover: Available as option				
Wall-standing	IAC A FL 16 kA, 1 s	●	2100	≥ 2400
	IAC A FL 21 kA, 1 s	●	2100	≥ 2400
Free-standing	IAC A FLR 16 kA, 1 s	●	2100	≥ 2400
	IAC A FLR 21 kA, 1 s	●	2100	≥ 2400
Floor cover: Available as option				

Continued from page 22

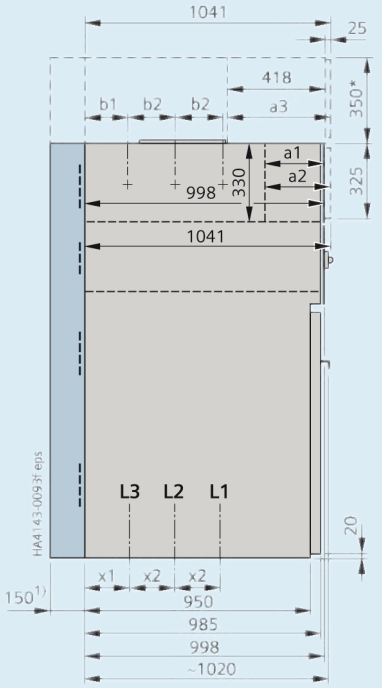
16 End wall
17 Depth of pressure relief duct
18 Option: Pressure relief duct for each panel, for wall-standing or free-standing arrangement
19 Option: Front cover (panel without low-voltage compartment)
20.1 Option: Low-voltage compartment: 350 mm high
20.2 Option: Low-voltage compartment: 550 mm high
21.1 End wall: 1750 mm high
21.2 End wall: 2100 mm high (standard for IAC design, option without IAC = 2100 mm high)
22 Earthing terminal
23 Cover for low-voltage niche
23.1 Standard: Cover screwed-on (panel depth: 998 mm)
23.2 Option: Door (= 45 mm, panel depth: 1041 mm)

△) Option: Rear pressure relief duct
● As standard
*) Panel height: 2100 mm, height of low-voltage compartment: 350 mm
**) Option: Panel height: 2300 mm, height of low-voltage compartment : 550 mm

For standard dimensions and IAC design, see also page 24

Dimensions

Switchgear installation



Compartment	Dimensions for: “Available mounting depth for low-voltage equipment”	in mm approx.
LV niche – with front cover	a_1	201
LV niche – with door (option)	a_2	246
LV compartment (option)	a_3	443

*) Option: Low-voltage compartment or front cover available in two heights: 350 mm or 550 mm

1) Option: Pressure relief duct

Rated voltage U_r	Dimensions in mm	
Position of cables △)	x1 △)	x2 △)
Up to 17.5 kV	187	210
24 kV	187	210
Position of busbar	b1	b2
Up to 24 kV	187	210

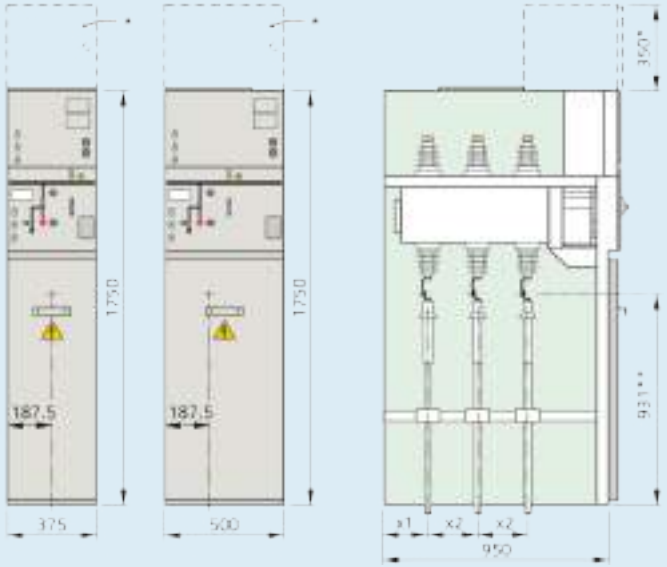
△) The position of the cables in the panel depends on the panel type and the additional, optional built-in panel components (e.g. current and voltage transformers). Therefore, the dimensions x1 and x2 may be different.

Standard dimensions of switchgear

IAC – Design of switchgear	Pressure relief duct (add to panel depth) Depth: 150 mm	Direction of pressure relief	Panel depth *) in mm	Switchgear depth in mm	Switchgear height in mm	Switchgear arrangement	Distance “a” from switchgear to rear wall of switchgear room in mm
• without IAC (= standard)	without	to the rear / upwards	1020, 1041	1170	1750 **)	wall-standing	–
		to the rear				free-standing	–
	with	upwards	1020, 1041	1170	1750 **)	free-standing	approx. ≥ 35 mm
• IAC A FL or IAC A FLR	with (duct is standard)	upwards	1020, 1041	1170	≤ 16 kA: ≥ 2100 ≤ 21 kA: ≥ 2100 (incl. front cover or low-voltage compartment)	wall-standing	approx. ≥ 35 mm
						free-standing	approx. ≥ 800 mm

*) Panel depth depends on panel type and panel design:
– Low-voltage niche with door (= option) (instead of screwed front cover): 1041 mm

**) In addition, a low-voltage compartment can be selected optionally. The switchgear height is changed respectively



Type R **Type R1**

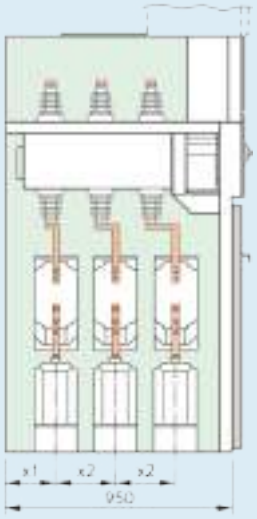
Type R1(T)

Ring-main panels

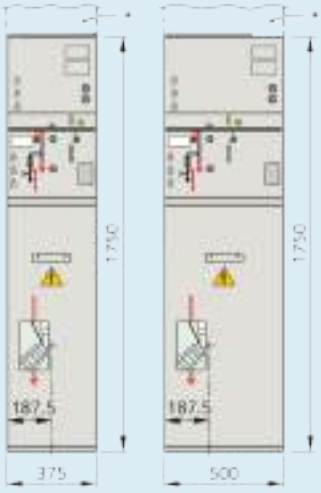
Type R(T)

Ring-main panel type R(T) for panel combinations, as left-hand transfer panel type R(T) (placed on the left side of panel combination)

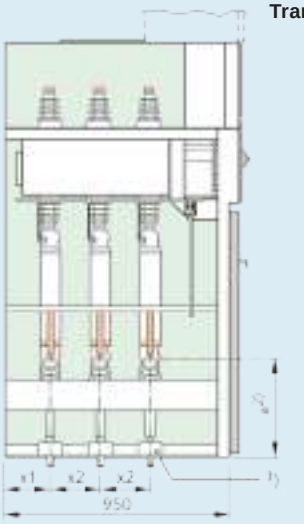
Type R(T)



Ring-main panel type R(T) for panel combinations, as right-hand transfer panel type R(T) (placed on the right side of panel combination)



Type T **Type T1**



Transformer panels

*) Option:
Low-voltage compartment

1) Location of voltage transformer in left-hand panel

Panel type T:

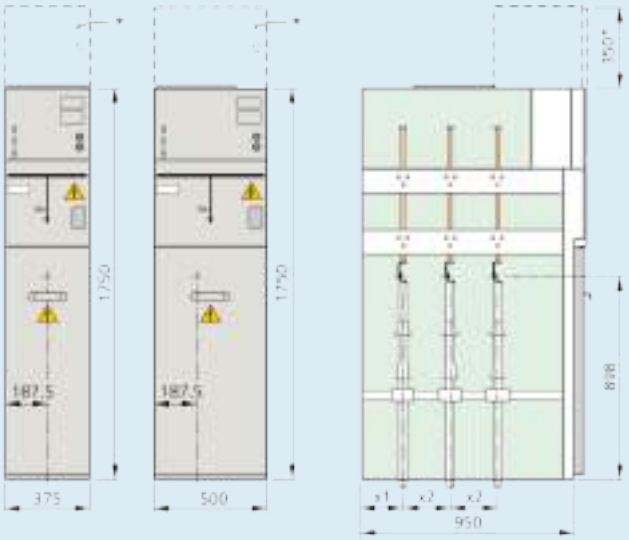
2) Dimension a
~ 384 mm: for fuses with e = 442 mm
~ 534 mm: for fuses with e = 292 mm

3) Panel types T and T1 with a rated voltage of 24 kV: deeper cable fixing underneath the panel

Dimensions x1 and x2:
See pages 24 and 30

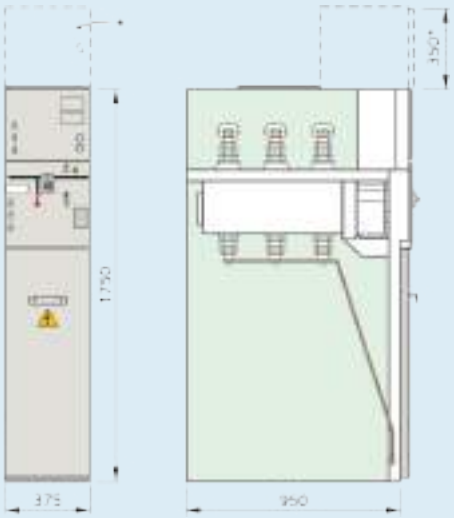
Dimensions

Cable panels, disconnector panels, earthing panel



Type K **Type K1**

Cable panels

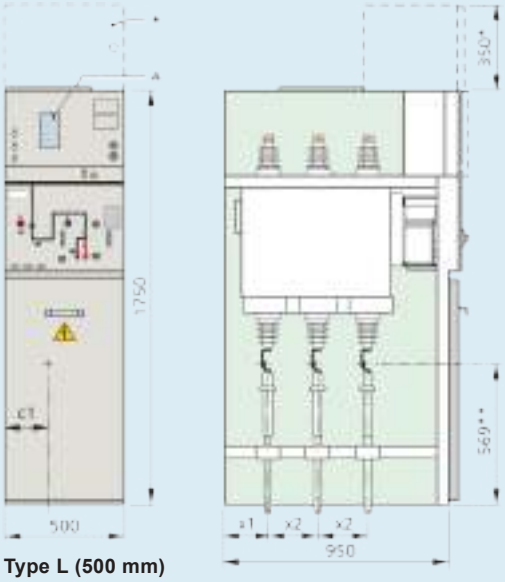


Type E

Earthing panel

*) Option:
Low-voltage compartment

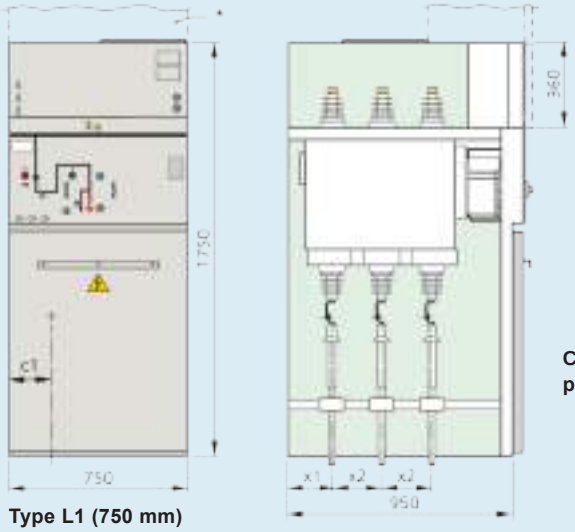
Dimensions x1 and x2:
See pages 24 and 30



Type L (500 mm)

Circuit-breaker panel 630 A

Type L(T)
as transfer panel to the right



Type L1 (750 mm)

Circuit-breaker panel 630 A, 1250 A

Type L1(T)
as transfer panel to the right

*) Option:
Low-voltage compartment
△) Option: Protection relay

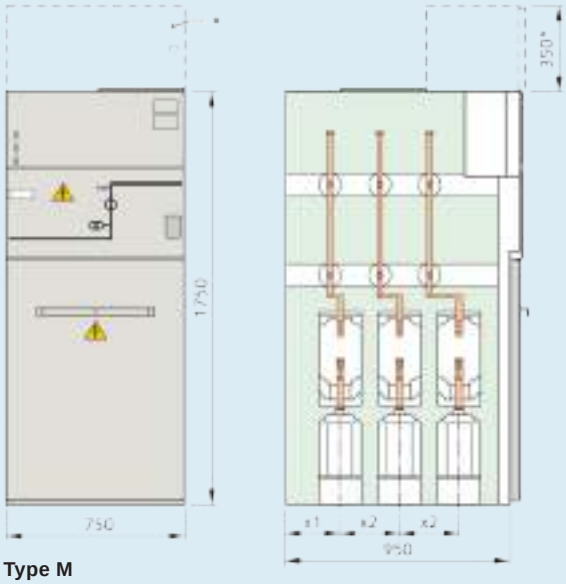
Position of L1, L2 and L3: See page 24
Dimensions x1 and x2: See pages 24 and 30

Dimensions

Metering panels, as billing metering panel

Panel design

M

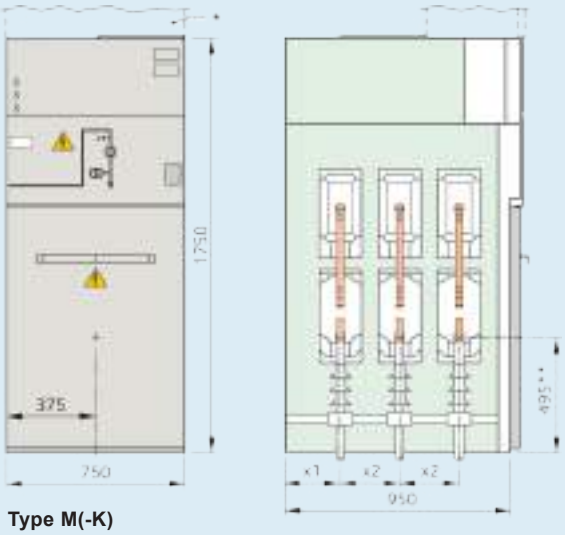


Type M

Metering panel type M (standard)

Panel design

M(-K)

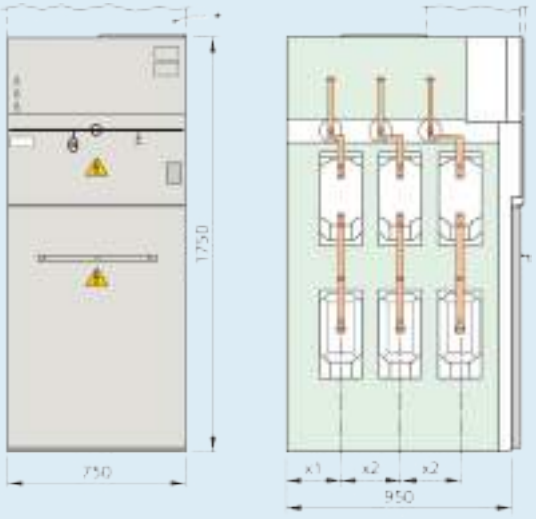


Type M(-K)

Metering panel type M(-K) (for cable connection)

Panel design

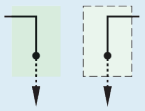
M(-B)



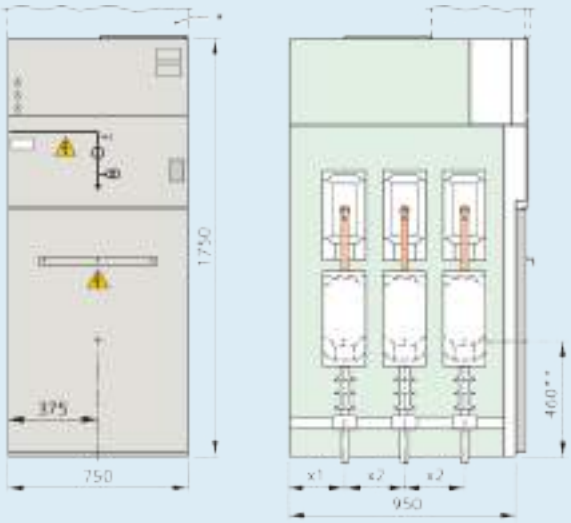
Type M(-B)

Metering panel type M(-B)
(for busbar connection)

Panel design



M(-BK) M(-BK)



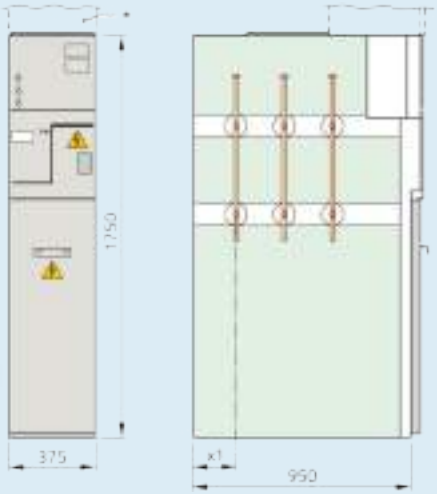
Type M(-BK)

Metering panel type M(-BK)
(for cable connection)

U_r	Dimensions in mm	
	x1	x2
Up to 17.5 kV	187	210
24 kV	215	250

Dimensions x1 and x2 for cable connection: See pages 30 and 31

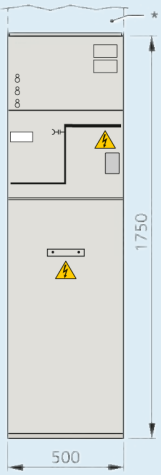
*) Option:
Low-voltage compartment
**) The cable connection height depends on the rated voltage, the transformer design and the number of cable connections



Type H,
for transfer to the right (without transformers)

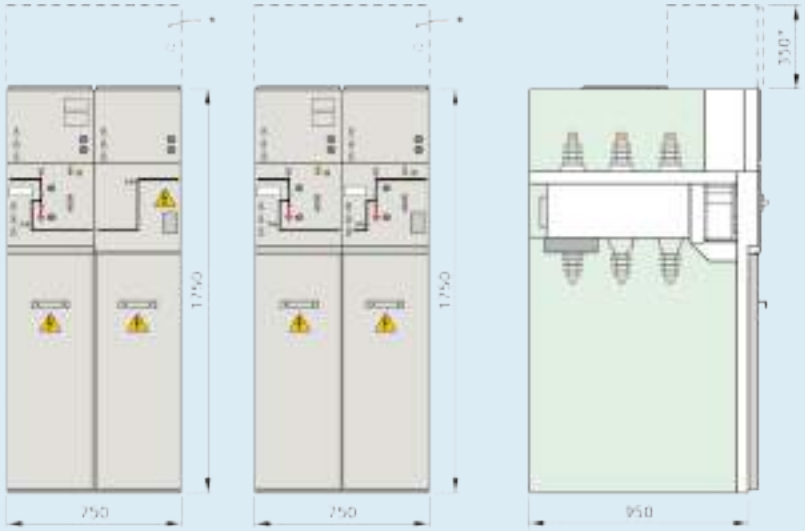
Bus riser panel

U_r	Dimensions in mm
	x1
Up to 17.5 kV	187
24 kV	187



Type H1,
for transfer to the right

Metering panel
and / or
bus riser panel



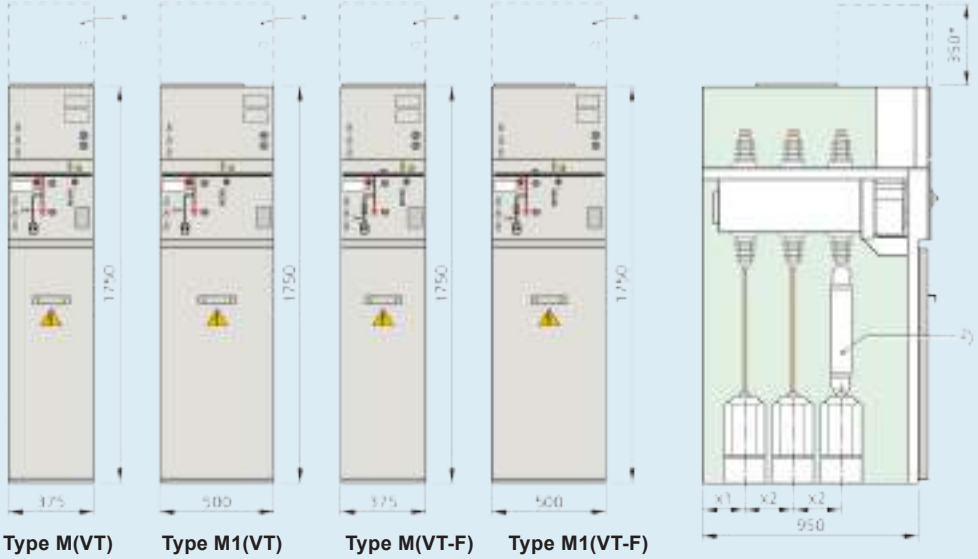
Type R(T) + H

Type 2x R(T)

Ring-main transfer panel type R(T)
and
bus riser panel type H
without transformers

Rated voltage U_r:

≤ 17.5 kV ≤ 24 kV ≤ 17.5 kV ≤ 24 kV



Type M(VT) **Type M1(VT)** **Type M(VT-F)** (with fuses) **Type M1(VT-F)** (with fuses)

Busbar voltage metering panels

U_r	Dimensions in mm	
	x1	x2
Up to 17.5 kV	187	210
24 kV	215	250

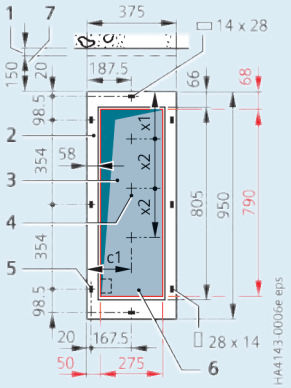
*) Option:
Low-voltage compartment

2) Option: Fuses

Dimensions

Floor openings (dimensions in red) and fixing points

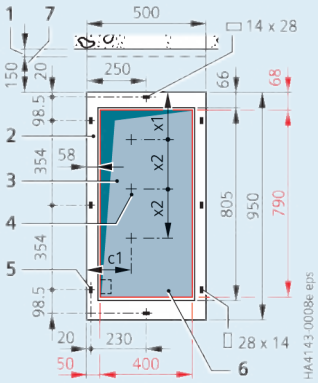
For panel width 375 mm



With cable connection

For panel type	Position of cables [1]					
	Dimensions in mm					
	x1	x1	x2		c1	
	17.5 kV	24 kV	17.5 kV	24 kV	17.5 kV	24 kV
R	187	187	210	210	187.5	187.5
K	187	187	210	210	187.5	187.5
T	187	187	210	210	187.5	187.5

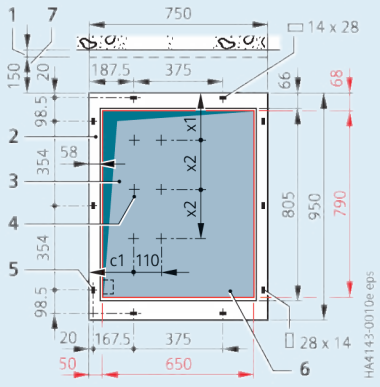
For panel width 500 mm



With cable connection

For panel type	Position of cables [1]					
	Dimensions in mm					
	x1	x1	x2		c1	
	17.5 kV	24 kV	17.5 kV	24 kV	17.5 kV	24 kV
R1	187	187	210	210	187.5	187.5
K1	187	187	210	210	187.5	187.5
T1	187	187	210	210	187.5	187.5
L	187	187	210	210	187.5	187.5
L with CTs, VTs	187	235	210	230	250	300

For panel width 750 mm



With cable connection

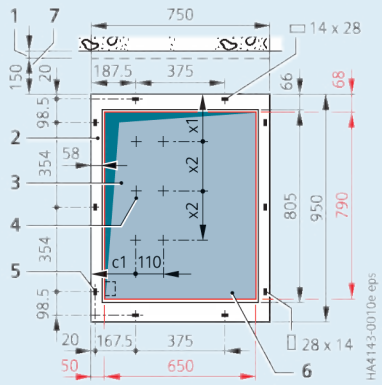
For panel type	Position of cables [1]						
	Dimensions in mm						
	Number of cables	x1	x1	x2		c1	c1
		17.5 kV	24 kV	17.5 kV	24 kV	17.5 kV	24 kV
L1	1	187	187	210	210	187.5	187.5
	2	187	187	210	210	172.5	172.5
L1 with CTs, VTs	1	187	215	210	250	235	335
	2	187	215	210	250	235	335

1 Wall distance (see page 24)
2 Fixing frame (base) of an individual panel or panel block
3 Floor opening for high-voltage cables and, where applicable, control cables
4 Position of the led-in cables for the feeder [1]
5 Fixing points
6 Floor opening if required for panels without cable connection
7 Option: Pressure relief duct

Note:
Connection of double cables: Depending on the panel type and version of the sealing end, the cable distance is approx. 110 mm.

1) The position of the cables in the panel depends on the additional built-in panel components, e.g. current and voltage transformers. Therefore, the dimensions x1, x2, c1, c2 may be different.

Metering panels: Panel width 750 mm



With cable connection

For panel type	Position of cables [1]						
	Dimensions in mm						
	Number of cables	x1	x1	x2		c1	c1
		17.5 kV	24 kV	17.5 kV	24 kV	17.5 kV	24 kV
M(-K)	1	187	215	210	250	375	375
M(-BK)	1	187	215	210	250	375	375

1 Wall distance (see page 24)
2 Fixing frame (base) of an individual panel or panel block
3 Floor opening for high-voltage cables and, where applicable, control cables
4 Position of the led-in cables for the feeder [1]
5 Fixing points
6 Floor opening if required for panels without cable connection
7 Option: Pressure relief duct

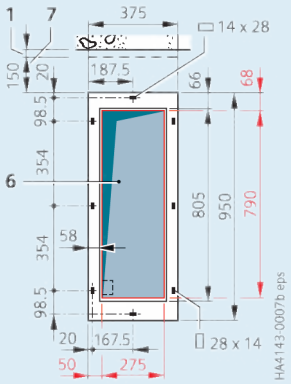
Note:
Connection of double cables: Depending on the panel type and version of the sealing end, the cable distance is approx. 110 mm, or 100 mm.

1) The position of the cables in the panel depends on the additional built-in panel components, e.g. current and voltage transformers. Therefore, the dimensions x1, x2, c1, c2 may be different.

Dimensions

Floor openings (dimensions in red) and fixing points

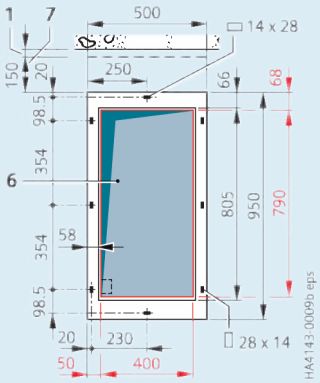
For panel width 375 mm



For panel type:
R(T)
M(VT), M(VT-F)
H, E

Without cable connection

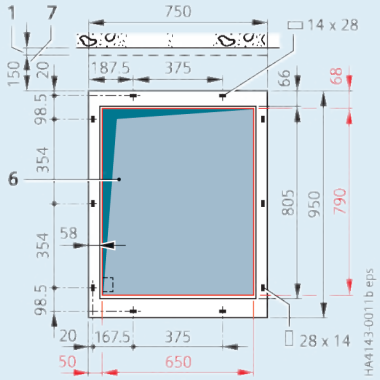
For panel width 500 mm



For panel type:
R1(T), E1
M1(VT), M1(VT-F)
L(T)
H1

Without cable connection

For panel width 750 mm



For panel type:
L1(T)
M, M(-B)

Without cable connection

1 Wall distance (see page 24)
2 Fixing frame (base) of an individual panel or panel block
3 Floor opening for high-voltage cables and, where applicable, control cables
4 Position of the led-in cables for the feeder [1)]
5 Fixing points
6 Floor opening if required for panels without cable connection
7 Option: Pressure relief duct

Note:
Connection of double cables: Depending on the panel type and version of the sealing end, the cable distance is approx. 110 mm.

1) The position of the cables in the panel depends on the additional built-in panel components, e.g. current and voltage transformers. Therefore, the dimensions x1, x2, c1, c2 may be different.

Cable testing

- For circuit-breaker and switch-disconnector feeders
- DC voltage test
  Before the test:
  Remove or disconnect any voltage transformers at the cable connection in based on type SIMOSEC switchgear
- Based on type SIMOSEC switchgear, e.g. for rated voltages up to 17.5 kV can be subjected to cable tests at a max. DC test voltage of 38 kV according to VDE. The voltage at the busbar may be 17.5 kV in this case
- Based on type SIMOSEC switchgear for rated voltages up to 24 kV can be subjected to cable tests at a max. DC test voltage of 72 kV or according to VDE at 70 kV, 15 min. The voltage at the busbar may be 24 kV in this case.
- For cable testing

– the installation and operating instructions of the switchgear
– the standards IEC 62271-200/VDE 0671-200 Clause 5.105
– the information on manufacturer-dependent cable sealing ends
– the cable version (e.g. paper-insulated mass-impregnated cables, PVC cables or XLPE cables) must be observed.

Test voltages:

Rated voltage	U_0 / U (U_m)	Max. test voltage applied to the connected cable		
		VLF [1], 0.1 Hz	acc. to IEC	VDE 0278
		3 xU_0 U_{LF}	U =	6 x U_0, 15 min max. U =
U_r (kV)	(kV)	AC (kV)	DC (kV)	DC (kV)
12	6/10 (12)	19	24	38 [2]
24	12/20 (24)	38	48	70

Terms

“Make-proof earthing switches” are earthing switches with short-circuit making capacity according to
– IEC 62271-102

Climate and environmental influences

Indoor installation:
Based on type SIMOSEC switchgear is suitable for application in indoor installations under normal operating conditions as defined in the standard IEC 62271-1:

- Temperature: –5 °C up to +55 °C
  –25 °C up to +55 °C [3]
  (optional, with panel heating)
- Relative air humidity: Mean value over 24 h [3]: ≤ 95 %
  Mean value over 1 month: ≤ 90 %
- Condensation: Occasionally use a heater as anti-condensation protection (in the panel)
- Site altitude: Altitude correction to be considered

Based on type SIMOSEC switchgear is largely insensitive to climate and environmental influences by virtue of the following features:

- No cross insulation for isolating distances between phases
- Metal enclosure of switching devices (e.g. three-position switch) in gas-filled stainless-steel switching-device vessel
- Dry-type bearings in operating mechanism
- Essential parts of the operating mechanism made of corrosion-proof materials
- Use of climate-independent three-phase current transformers.

Climate classes:

– The climate classes are defined according to IEC 60721-3-3.
– Based on type SIMOSEC switchgear has been subjected to a climatic test according to IEC 60932, Level 2, and is suitable for operating conditions according to “Design Class 1”. This test also meets the requirements of IEC 62271-304 for “Design Class 1”.

Based on type SIMOSEC switchgear may be used, subject to possible additional measures – e.g. panel heaters or floor covers – under the following environmental influences and climate classes:

- Environmental influences

– Natural foreign materials
– Chemically active pollutants
– Small animals

Recycling

The switchgear can be recycled in ecological manner in compliance with existing legislation. Auxiliary devices such as short-circuit indicators have to be recycled as electronic scrap. Batteries have to be recycled professionally. Insulating gas SF_6 has to be evacuated professionally as a reusable material and recycled (SF_6 must not be released into the environment).

1) VLF = very low frequency
2) Referred to: U_0/U (U_m = 6.35/11 (12) kV)
3) Secondary devices (e.g. protection devices, meters, measuring transducers, etc.) must be suitable for the given operating conditions.

HAINAM AUTOMATION TECHNOLOGY JSC.

HEAD OFFICE

Lot I-10-6, R. No. 7, Hi-Tech Park, D.9, HCMC., Viet Nam
Tel.: (+84) 28 7109 9904 / Fax: (+84) 28 7109 9905
Tel.: (+84) 28 7109 9905 / Fax: (+84) 28 3873 4067

BRANCH

HO CHI MINH CITY
Lot No. C32, R. No. 9, Hiep Phuoc IP. HCMC, Vietnam
Tel.: (+84) 28 3873 4066 / Fax: (+84) 28 3873 4067

HA NOI
Lot No. 45, Quang Minh IP, Me Linh, Ha Noi City, Viet Nam
Tel.: (+84) 24 3813 3011 / Fax: (+84) 24 3813 3010

CAMBODIA
Street #30m (Nation Road #3), PreyKeyKor Village,
PongToek Commune, DangKor Dist., Phnom Penh City, Kingdom of Cambodia
Tel.: (+855) 2398 2161 / Fax: (+855) 2398 2162

MYANMAR
No. 18 Kyaik Khaut Pagoda Road, Thanlyin Township, Yangon, Myanmar
Tel.: (+95) 562 3177 / (+95) 925 324 7697 (Myanmar)
(+84) 948 676 068 (Viet Nam)

Email: hainam-panel@hainamswitchboards.com
Website: www.hainamswitchboards.com