



Catalog
HA 41.43 ·
2022

MEDIUM-VOLTAGE SWITCHGEAR

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

[siemens.com/SIMOSEC](https://www.siemens.com/SIMOSEC)

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Application

Typical uses



Transfer switchgear with integrated low-voltage niche



Utilities transfer substation for industrial plants



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[siemens.com/medium-voltage-switchgear](https://www.siemens.com/medium-voltage-switchgear)

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Contents

Page

Application, requirements

Features	4
Features, classification, standards	6

Technical data

Electrical data of the switchgear	7
Technical data, switching capacity and classification of switching devices	9

Product range

Product range overview	11
Ring-main panels, cable panels, busbar earthing panels	12
Transformer panels, disconnecter panels	13
Metering panels as billing metering panels	14
Busbar voltage metering panels, bus riser panels	15
Circuit-breaker panels	16

Design

Panel design (examples)	17
-------------------------	----

Components

Busbars	19
Selection data for various cable sealing ends	20
Cable cross-sections and instrument transformer combination	21
Cable fixing	22
Current transformers, voltage transformers	23
Low-voltage niche	24
Low-voltage compartment	25

Dimensions

Room planning	26
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The products and systems described in this catalog are manufactured and sold according to a certified management system (acc. to ISO 9001, ISO 14001 and BS OHSAS 18001).

Application, requirements

Features

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

Typical uses

SIMOSEC switchgear is used for power distribution in distribution systems with busbar currents up to 1250 A.

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

Modular design

- Individual panels, for free combination and extension
- Option: Low-voltage compartments can be supplied in two overall heights
- Circuit-breaker panels for various applications.

Reliability

- Type- and routine-tested *
- Reduced dielectric stress thanks to stainless steel switching-device vessel
- Standardized and manufactured using numerically controlled machines
- Quality management system according to DIN EN ISO 9001
- More than 100,000 switchgear components in operation worldwide for many years.

Personal safety

- All switching operations can be performed with closed panel front
- Metal-enclosed LSC 1 / LSC 2 panels
- HV HRC fuses and cable sealing ends are only accessible when the outgoing feeders are earthed
- Logical interlocks
- Capacitive voltage detecting system to verify safe isolation from supply
- Earthing of outgoing feeders by means of make-proof earthing switches.

Compact design

Thanks to the use of gas-insulated switching-device vessels, 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 and vacuum circuit-breakers proven for years
- LSC 1 / LSC 2 panels:
 - Panels with metal partition (metal-clad) between busbar and switching device as well as between switching device and cable compartment (R, T, L)
 - Panels with metal partition between switching device and busbar compartment
- Metal-enclosed switching-device vessel with three-position switch, gas-insulated
 - Welded switching-device vessel, sealed-for-life
 - 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 interlocks.

Re-availability

- Three-position switch-disconnector with gas-insulated, maintenance-free quenching principle
- Metal partition between busbar compartment, switching devices and cable compartment.

* For standards, see page 6

Cost-efficiency

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

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

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 service conditions, the expected service life of air-insulated switchgear 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 switching devices installed:

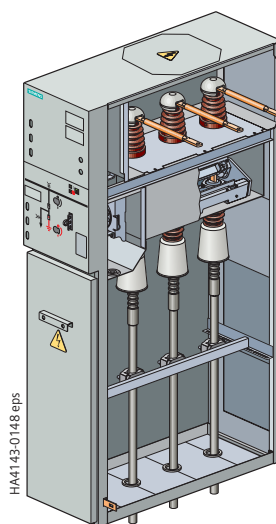
- For circuit-breakers, according to the endurance class defined in IEC 62271-100
- For three-position disconnectors and earthing switches, according to the endurance class defined in IEC 62271-102
- For three-position switch-disconnectors, according to the endurance class defined in IEC 62271-103.

Insulating system

- Switching-device vessel filled with SF₆ gas
- Features of SF₆ 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 SF₆ gas in the switching-device vessel (absolute values at 20 °C):
 - Rated filling level: 140 kPa
 - Design pressure: 180 kPa
 - Design temperature of the SF₆ gas: 80 °C
 - Operating pressure of bursting disc: ≥ 270 kPa
 - Bursting pressure: ≥ 550 kPa
 - Gas leakage rate: < 0.1 % per year.

General design

- Air-insulated indoor switchgear
- Gas-insulated, maintenance-free switching functions for the three-position switch as switch-disconnector
- Three-pole primary enclosure
- Phases arranged one behind the other
- Three-position switch, metal-enclosed, with air-insulated primary terminals and gas-insulated switching functions
- Vacuum circuit-breaker up to 1250 A, metal-enclosed, fixed-mounted in gas-insulated switching-device vessel or as removable design: easy to remove after loosening the fixing bolts
- Hermetically welded, stainless-steel switching-device vessels
 - for switching devices
 - with insulating gas SF₆ (fluorinated greenhouse gas)
- Factory-assembled, type-tested
- Metal-enclosed, with metal partitions
- Pressure relief
 - to the rear and upwards
 - separately for each compartment.



Compartments	Insulation
Busbar	Air
Switching-device vessel	SF ₆
Cable connection	Air

Application, requirements

Features, classification, standards

Electrical features

- Rated voltages up to 24 kV
- Rated short-time withstand current up to 25 kA
- Rated continuous current of feeders
 - Up to 800 A, e.g. for ring-main panels, metering panels
 - Up to 1250 A, for circuit-breaker panels
 - Up to 1250 A, for bus sectionalizer panels
- Rated continuous current of busbar up to 1250 A.

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

SIMOSEC switchgear is a factory-assembled, type-tested, metal-enclosed switchgear for indoor installation. SIMOSEC switchgear is classified according to IEC 62271-200.

Design and construction	
Partition class	PM (metal partition)
Loss of service continuity category for panels: <ul style="list-style-type: none"> – With HV HRC fuses (T, ...) – Without HV HRC fuses (R, L, D, ...) – Metering panels type M... or cable panels type K 	LSC 2 LSC 2 LSC 1
Accessibility to compartments (enclosure) <ul style="list-style-type: none"> – Busbar compartment – Switching-device compartment – Switching-device compartment with removable circuit-breaker – Low-voltage compartment (option) – Cable compartment for panels: <ul style="list-style-type: none"> – Without HV HRC fuses (R, L, ...) – With HV HRC fuses (T, ...) – Cable panel (K) – Metering panels (air-insulated) (M, ...H) 	<ul style="list-style-type: none"> – 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:	Rated voltage 7.2 kV to 24 kV:
– Wall-standing arrangement	IAC A FL, I_{sc} , t
– Free-standing arrangement	IAC A FLR, I_{sc} , t
Type of accessibility: A	Switchgear in closed electrical service location, access for authorized personnel only (according to IEC 62271-200)
– F	Front
– L	Lateral
– R	Rear (for free-standing arrangement)
Arc test current I_{sc}	Up to 21 kA
Test duration t	1 s

Standards

SIMOSEC switchgear complies with the relevant standards and specifications applicable at the time of type tests.

In accordance with the harmonization agreement reached by the countries of the European Union, their national specifications conform to the IEC standards.

Overview of standards			
		IEC standard	EN standard
Switchgear	SIMOSEC	IEC 62271-1	EN 62271-1
		IEC 62271-200	EN 62271-200
Devices	Circuit-breakers	IEC 62271-100	EN 62271-100
	Disconnectors and earthing switches	IEC 62271-102	EN 62271-102
	Switch-disconnectors	IEC 62271-103	EN 62271-103
	Switch-disconnector/fuse combination	IEC 62271-105	EN 62271-105
	HV HRC fuses	IEC 60282-1	EN 60282-1
	Voltage detecting systems	IEC 61243-5	EN 61243-5
	Voltage presence indicating systems	IEC 62271-206	EN 62271-206
Degree of protection	IP code	IEC 60529	EN 60529
	IK code	IEC 62262	EN 50102
Insulation	–	IEC 60071	EN 60071
Instrument transformers	General requirements	IEC 61869-1	EN 61869-1
	Current transformers	IEC 61869-2	EN 61869-2
	Voltage transformers	IEC 61869-3	EN 61869-3
Power installations	Common rules	IEC 61936-1	EN 61936-1
	Earthing of power installations	–	EN 50522
Insulating gas SF ₆	Specification for sulfur hexafluoride (SF ₆)	IEC 60376	EN 60376

Common electrical data												
Rated insulation level		Rated voltage U_r	kV	7.2	12	17.5	24					
		Rated short-dur. power-frequency withstand voltage U_d										
		– phase-to-phase, phase-to-earth, open contact gap	kV	20	28, 42	38	50					
		– across the isolating distance	kV	23	32, 48	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 continuous current I_r for busbar		Standard	A	630								
		Option	A	800, 1250								
50 Hz	Rated short-time withstand current I_k	for rated duration of short-circuit $t_k = 1$ s, 2 s	up to kA	21	25	21	25	21	25	16	20	25
		for rated duration of short-circuit $t_k = 3$ s (20 kA/4 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, 2 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 ambient air temperature depends on the secondary equipment used)		Operation	Standard	°C	–5 to +55							
			Option (if panel heating available)	°C	–25							
		Storage/transport	Standard	°C	–5 to +55							
			Option	°C	–25, +70							
			Option	°C	–40							
			Option	°C	–40							
Degree of protection		for gas-filled switching-device vessel	IP65									
		for switchgear enclosure	IP2X/IP3X									
		for low-voltage compartment	IP3X/ IP4X									

Technical data

Electrical data of the switchgear

Common electrical data of the switchgear panels														
Rated insulation level		Rated voltage U_r	kV	7.2		12		17.5		24				
Ring-main panel types R, R1, R(T), R1(T), cable panel types K and K1, disconnecter panel types D1, D1(T)														
Rated continuous current I_r		Standard	A	630									→	
		D1, D1(T), K1	A	1250									→	
50 Hz	Rated short-time withstand current I_k	for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}$	up to kA	21	25	21	25	21	25	16	20	25		
		for rated duration of short-circuit $t_k = 3 \text{ s}$ (4 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}		for ring-main feeders	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 $t_k = 1 \text{ s}, 2 \text{ s}$	up to kA	21	25	21	25	21	25	16	20	25		
		for rated duration of short-circuit $t_k = 3 \text{ s}$	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}		for ring-main feeders	up to kA	55	65	55	65	55	65	42	52	65	
Circuit-breaker panel types L, L1, L(T), L1(T), L1(r), L1(r, T), metering panel types M, bus riser panel types H, H1														
Rated continuous current I_r		L, L(T), L1, L1(T), L1(r), L1(r, T), M, M(-K), M(-B), M(-BK), M(KK), H, H1	A	630									→	
		L1, L1(T), L2(r), L2(r, T), M, M(-K), M(-B), M(-BK), H, H1	A	1250									→	
50 Hz	Rated short-time withstand current I_k	for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}$	up to kA	21	25	21	25	21	25	16	20	25		
		for rated duration of short-circuit $t_k = 3 \text{ s}, 4 \text{ s}$	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}		for circuit-breaker panel L, L1.....	up to kA	52.5	63	52.5	63	52.5	63	40	50	63	
60 Hz	Rated short-circuit breaking current I_{sc}		for circuit-breaker panel L, L1.....	up to kA	21	25	21	25	21	25	16	20	25	
	Rated short-time withstand current I_k	for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}$	up to kA	21	25	21	25	21	25	16	20	25		
		for rated duration of short-circuit $t_k = 3 \text{ s}$	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		
60 Hz	Rated short-circuit making current I_{ma}		for circuit-breaker panel L, L1.....	up to kA	55	65	55	65	55	65	42	52	65	
	Rated short-circuit breaking current I_{sc}		for circuit-breaker panel L, L1.....	up to kA	21	25	21	25	21	25	16	20	25	
Busbar voltage metering panel types M(VT), M1(VT), M(VT-F), M1(VT-F), transformer panel types T, T1, busbar earthing panel type E														
Rated continuous current I_r		Standard (except busbar earthing panel type E)	A	200									→	
50 Hz	Rated short-time withstand current I_k	for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}$	up to kA	21	25	21	25	21	25	16	20	25		
		for rated duration of short-circuit $t_k = 3 \text{ s}, 4 \text{ s}$	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 $t_k = 1 \text{ s}, 2 \text{ s}$	up to kA	21	25	21	25	21	25	16	20	25		
		for rated duration of short-circuit $t_k = 3 \text{ s}, 4 \text{ s}$	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		

Switch-disconnector/fuse combination

Switch-disconnector/fuse combination according to IEC/EN 62271-105									
Rated voltage U_r		kV	7.2	12	17.5	24			
Rated continuous current I_r		A	200 ¹⁾						→
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 fuses									
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				→		

Make-proof earthing switch (air-insulated, arrangement on the cable feeder) [e.g. for circuit-breaker panel types L1(r), L2(r)]

Technical data									
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	20	25	20	25	20	25
		for rated duration of short-circuit $t_k = 3$ s	up to kA	20	–	20	–	20	–
	Rated short-circuit making current I_{ma}		up to kA	50	63	50	63	50	63
	Rated peak withstand current I_p		up to kA	50	63	50	63	50	63
60 Hz	Rated short-time withstand current I_k	for rated duration of short-circuit $t_k = 1$ s	up to kA	20	25	20	25	20	25
		for rated duration of short-circuit $t_k = 3$ s	up to kA	20	–	20	–	–	–
	Rated short-circuit making current I_{ma}		up to kA	52	65	52	65	52	65
	Rated peak withstand current I_p		up to kA	52	65	52	65	52	65

Number of operating cycles, classification

Three-position switch-disconnector, with functions: load breaking (CLOSE-OPEN) and earthing (EARTH)									
Rated voltage U_r		kV	7.2	12	17.5	24			
General-purpose switches according to IEC/EN 62271-103	Number of mechanical operating cycles		n	1000					
			n	2000 (on request)					
	Classification	Mechanical endurance		M1					
	Number of electrical operating cycles with I_{load}		n	100					
	Classification	Electrical endurance		E3					
	Number of short-circuit making operations with I_{ma}		n	5					
Disconnectors according to IEC/EN 62271-102									
	Number of mechanical operating cycles		n	2000 (on request)					
	Classification	Mechanical endurance		M1					
Earthing switches according to IEC/EN 62271-102	Number of mechanical operating cycles		n	1000					
	Classification	Mechanical endurance		M0					
	Number of short-circuit making operations with I_{ma}		n	5					
	Classification	Electrical endurance		E2					
Earthing switches, arranged on feeder side, downstream from HV HRC fuses, for typical: T, T1, M(VT-F)	Number of short-circuit making operations with I_{ma}		n	5					
	Classification			E1					
	Number of mechanical operating cycles		n	1000					
	Classification	Mechanical endurance		M0					

1) Depending on HV HRC fuse-link (depending on the let-through current of the HV HRC fuse-link)

Technical data

Technical data, switching capacity and classification of switching devices

Number of operating cycles, classification (continued)

Three-position disconnector, with functions: disconnecting (CLOSE-OPEN) and earthing (OPEN-EARTH)							
Rated voltage U_r			kV	7.2	12	17.5	24
Disconnectors according to IEC/EN 62271-102	Number of mechanical operating cycles		n	1000			
	Classification	Mechanical endurance		M0			
	Number of mechanical operating cycles		n	2000 (on request)			
	Classification	Mechanical endurance		M1 (on request)			
Earthing switches according to IEC/EN 62271-102	Number of mechanical operating cycles		n	1000			
	Classification	Mechanical endurance		M0			
	Number of short-circuit making operations with I_{ma}		n	5			
	Classification	Electrical endurance		E2			

Earthing switch according to IEC/EN 62271-102 (air-insulated, arrangement on the cable feeder in panel types L1(r), L2(r))						
Earthing switch according to IEC/EN 62271-102	Number of mechanical operating cycles		n	1000		
	Classification	Mechanical endurance		M0		
	Number of short-circuit making operations with I_{ma}		n	5		
	Classification	Electrical endurance		E1		

Vacuum circuit-breaker

Classification and number of operating cycles for circuit-breaker ¹⁾ according to IEC/EN 62271-100							
Rated voltage U_r			kV	7.2	12	17.5	24
Circuit-breaker CB-f NAR	Number of mechanical operating cycles		n	2000			
	Classification	Mechanical endurance		M1			
	Number of electrical operating cycles		n	2000			
	Classification	Electrical endurance		E2			
		Capacitive switching operation		C1			
	Number of short-circuit breaking operations with I_{sc} for CB-f NAR		n	20			
	Rated operating sequence			O – 3 min – CO – 3 min – CO			
Circuit-breaker CB-f AR, CB-r (SION L)	Number of mechanical operating cycles		n	10,000			
	Classification	Mechanical endurance		M2			
	Number of electrical operating cycles		n	10,000			
	Classification	Electrical endurance		E2			
		Capacitive switching operation		C2			
	Number of short-circuit breaking operations with I_{sc} for CB-f AR		n	30 or 50			
	Number of short-circuit breaking operations with I_{sc} for CB-r (SION L)		n	30			
	Rated operating sequence	CB-f		O – 0.3 s – CO – 3 min – CO			
CB-f			O – 0.3 s – CO – 30 s – CO				
CB-r (SION L)			O – 0.3 s – CO – 15 s – CO				

1) Definition of the different types of vacuum circuit-breakers (= VCB):				
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 disconnecter	CB-f NAR	CB-f AR
L1(r), L2(r)	CB-r (SION L)	air-insulated, removable, separate three-position disconnecter		CB-r AR

Definition of the different types of vacuum circuit-breakers (= VCB):
VCB version: without auto-reclosing with auto-reclosing

Standard panels (examples)



Ring-main panel, type R



Transformer panel, type T

Circuit-breaker panel



Circuit-breaker panel, type L with CB type "CB-f NAR" 2) (500 mm)



Circuit-breaker panel L1(r)

Panel designation	Panel type	Panel width mm	Rated current	LSC category (Loss of service continuity category)
Application as: Cable feeder panels				
Ring-main panel ¹⁾	R	375	630 A, 800 A	LSC 2
	R1	500	630 A, 800 A	
Transformer panel ¹⁾	T	375	200 A	LSC 2
	T1	500	200 A	
Cable panel	K	375	630 A	LSC 1
	K1	500	630 A, 1250 A	
Circuit-breaker panel (fixed-mounted CB-f AR/NAR) ¹⁾	L	500	630 A	LSC 2
	L1	750	630 A, 1250 A	
Circuit-breaker panel (removable CB-r (SION L))	L1(r)	750	630 A	LSC 2
	L2(r)	875	1250 A	
Disconnecter panel ¹⁾	D1	500	1250 A	LSC 2
Application as: Transfer panels				
Ring-main transfer panel ¹⁾	R(T)	375	630 A, 800 A	–
Ring-main transfer panel ¹⁾	R1(T)	500	630 A	–
Circuit-breaker transfer panel ¹⁾	L(T)	500	630 A	–
Circuit-breaker transfer panel ¹⁾	L1(T)	750	630 A, 1250 A	–
Circuit-breaker transfer panel	L1(r, T)	750	630 A	–
	L2(r, T)	875	1250 A	
Disconnecter transfer panel ¹⁾	D1(T)	500	1250 A	–
Application as: Metering panels and other panel types				
Metering panel as billing metering panel	M	750	630 A, 800 A, 1250 A	–
Metering panel with cable connection	M(-K)	750	630 A, 800 A, 1250 A	LSC 1
Metering panel with busbar connection	M(-B)	750	630 A, 800 A, 1250 A	LSC 1
Metering panel with busbar and cable connection	M(-BK)	750	630 A, 800 A, 1250 A	
Metering panel with cable connection: individual panel	M(KK)	750	630 A, 800 A	LSC 1
Busbar voltage metering panel	M(VT)	375	200 A	
Busbar voltage metering panel	M1(VT)	500	200 A	–
Busbar voltage metering panel with fuses	M(VT-F)	375	200 A	–
Busbar voltage metering panel with fuses	M1(VT-F)	500	200 A	–
Bus riser panel	H	375	630 A, 800 A, 1250 A	–
Metering panel / bus riser panel	H1	500	630 A, 1250 A	–
Application as: Busbar earthing panel				
Busbar earthing panel	E	375	–	–

1) Panel design with metal partitions (metal-clad)

2) Type designation of vacuum circuit-breaker

Product range

Ring-main panels, cable panels, busbar earthing panel



Three-position
switch-disconnector



Make-proof
earthing switch



Fixed earthing point



Capacitive voltage
detecting system



Cable-type current
transformer, e.g.
4MC703 . . .



Block-type current
transformer 4MA,
cast-resin insulated



Three-phase
current transformer
4MC63 . . .



Voltage transformer,
e.g. 4MR, 1-pole,
cast-resin insulated



Cable connection
for 1, 2 or 3 cables
per phase



2nd cable



2nd cable, 3rd cable

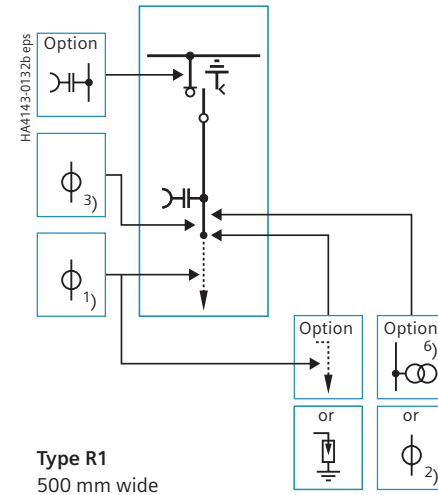
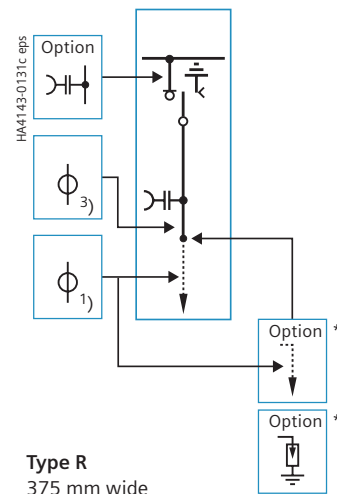


Surge arrester

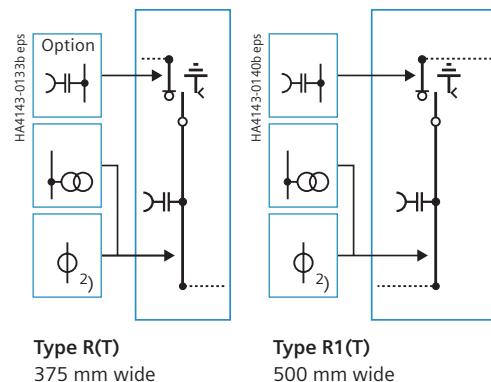
* Option: Up to $U_n=17.5$ kV

Installation options for block-type
CTs, VTs are dependent on rated
voltages and rated currents

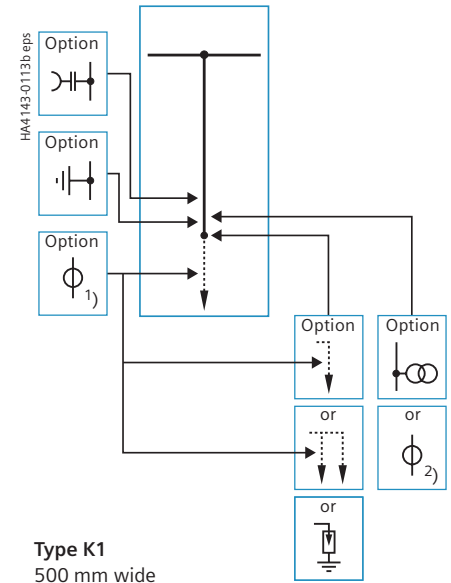
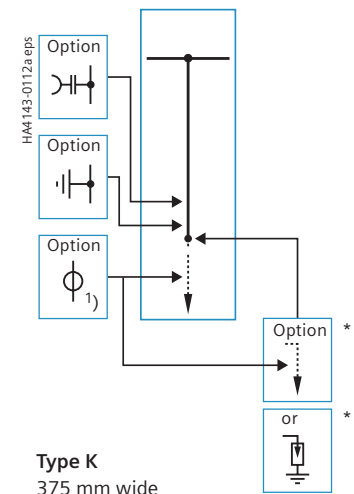
Ring-main panels as feeder panels



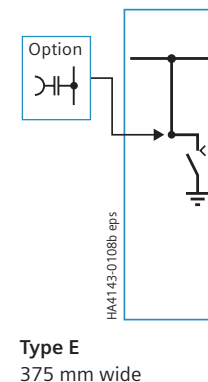
Ring-main panel as transfer panel for attachment to panel types M, M(-K), H types L1(r, T)



Cable panels as feeder panels, 1250 A



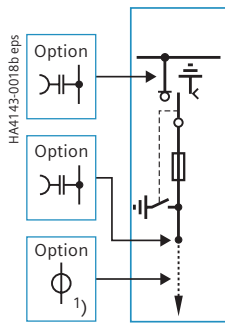
Busbar earthing panel



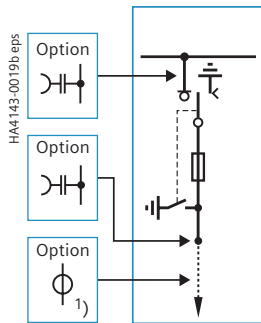
Product range

Transformer panels, disconnector panels

Transformer panels as feeder panels

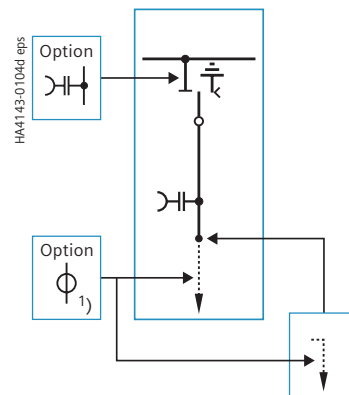


Type T
375 mm wide

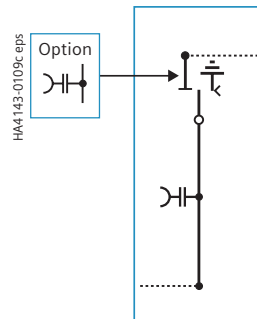


Type T1
500 mm wide

Disconnector panels as feeder panels



Type D1
500 mm wide



Type D1(T)
500 mm wide

as transfer panel for attachment to
panel types D1(T)-D1(T), D1(T)-H,
D1(T)-M, D1(T)-M(-K), L1(T)-D1(T),
L2(r,T)-D1(T)



Three-position
switch-disconnector



Three-position
disconnector



Discharge switch



HV HRC fuse



Capacitive voltage
detecting system



Cable-type current
transformer,
e.g. 4MC703 . . .



Cable



2nd cable

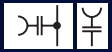


Surge arrester

Installation options for block-type
CTs, VTs are dependent on rated
voltages and rated currents

Product range

Metering panels as billing metering panels



Capacitive voltage detecting system



Fixed earthing point



Block-type current transformer 4MA, cast-resin insulated



Voltage transformer, e.g. 4MR, 1-pole, cast-resin insulated



Cable



2nd cable



Surge arrester

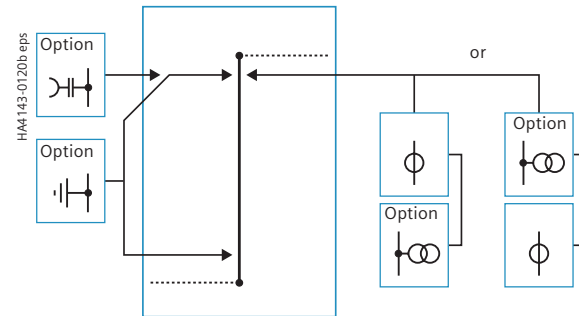
Option:



Individual metering panel type M(KK)

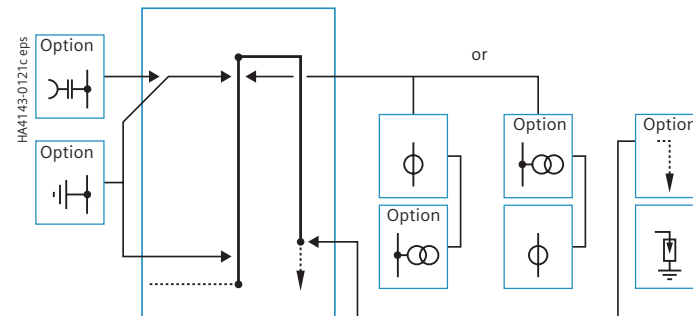
Installation options for block-type CTs, VTs are dependent on rated voltages and rated currents

Billing metering panels 630 A, 800 A, 1250 A Standard



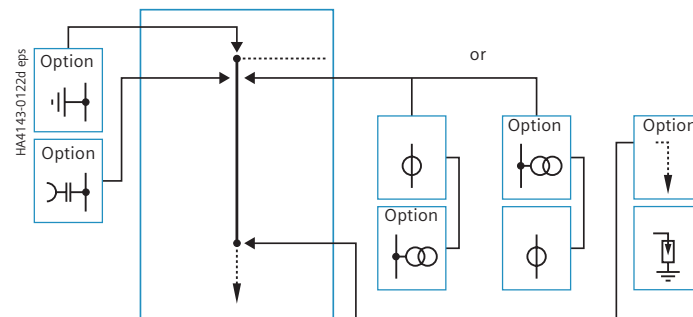
Type M 750 mm wide

Billing metering panels 630 A, 800 A, 1250 A for cable connection



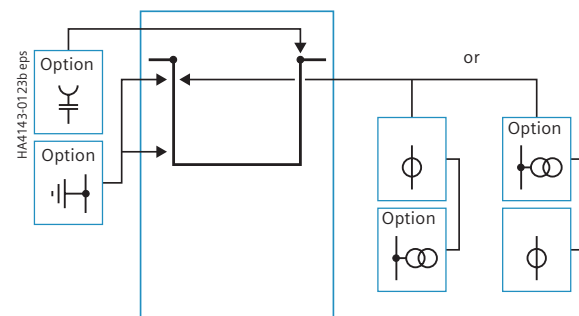
Type M(-K) 750 mm wide

Billing metering panels 630 A, 800 A, 1250 A for busbar connection



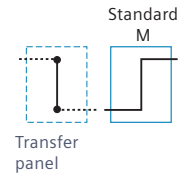
Type M(-BK) 750 mm wide

Billing metering panels 630 A, 800 A, 1250 A for busbar connection



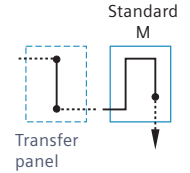
Type M(-B) 750 mm wide

Panel design M



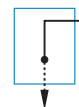
Standard:
For transfer to the right

Panel design M(K)



Standard:
For transfer to the right

Panel design M(-BK)



Panel design M(-B)

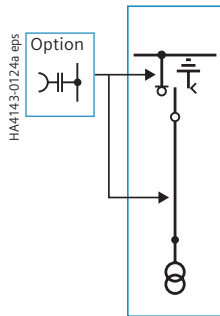


Product range

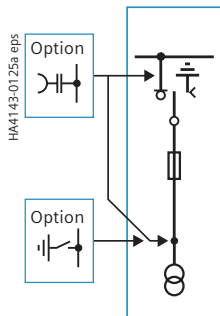
Busbar voltage metering panels, bus riser panels

Busbar voltage metering panels

up to 17.5 kV

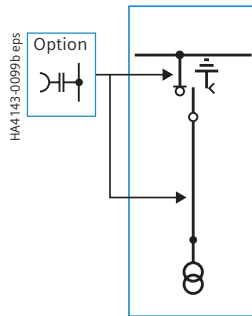


Type M(VT)
375 mm wide

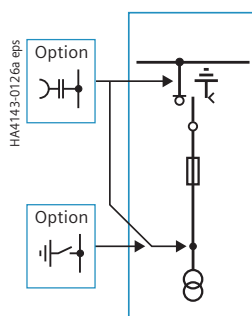


Type M(VT-F)
375 mm wide

up to 24 kV

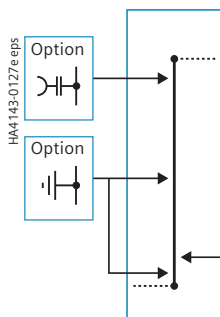


Type M1(VT)
500 mm wide



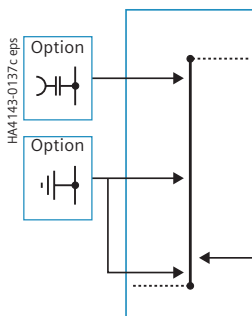
Type M1(VT-F)
500 mm wide

Metering panel and/or bus riser panels



Type H, 630 A, 800 A, 1250 A
375 mm wide

as transfer panel for attachment
to panel types R(T)-H, L(T)-H, L1(T)-H, D1(T)-H



Type H1, 630 A, 1250 A
500 mm wide

as transfer panel for attachment
to panel types L1(r,T)-H1, L2(r,T)-H1



Three-position
switch-disconnector



Capacitive voltage
detecting system



Fixed earthing point



HV HRC fuse



Voltage transformer,
e.g. 4MR, 1-pole,
cast-resin insulated



Discharge switch



Block-type current
transformer 4MA,
cast-resin insulated



Voltage transformer,
e.g. 4MR, 1-pole,
cast-resin insulated

Installation options for block-type
CTs, VTs are dependent on rated
voltages and rated currents

Product range

Circuit-breaker panels



Three-position disconnecter



Vacuum circuit-breaker (type 3AH5 (CB-f) fixed-mounted)



Vacuum circuit-breaker (type 3AE6 (CB-r) removable)



Make-proof earthing switch



Capacitive voltage detecting system



Fixed earthing point



Cable-type current transformer, e.g. 4MC703 . . .



Block-type current transformer 4MA, cast-resin insulated



Three-phase current transformer 4MC63 . . .



Voltage transformer, e.g. 4MR, 1-pole, cast-resin insulated



Cable



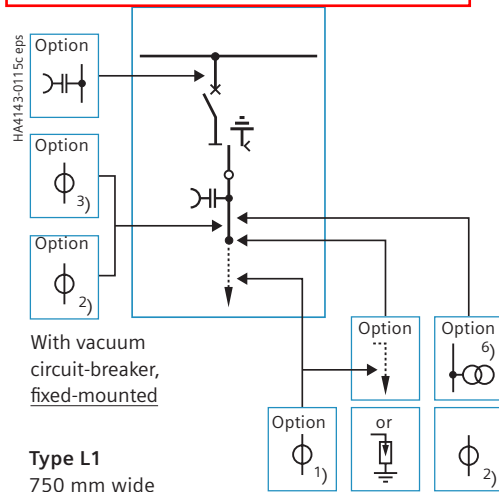
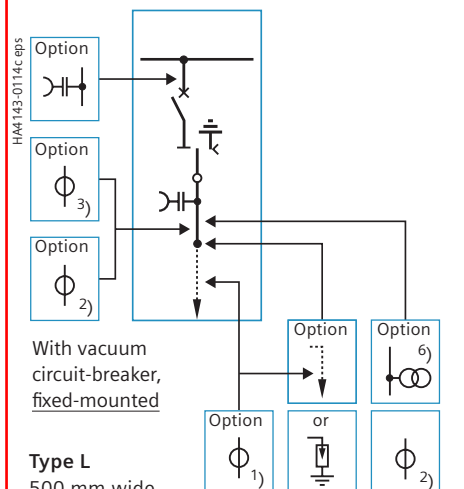
2nd cable



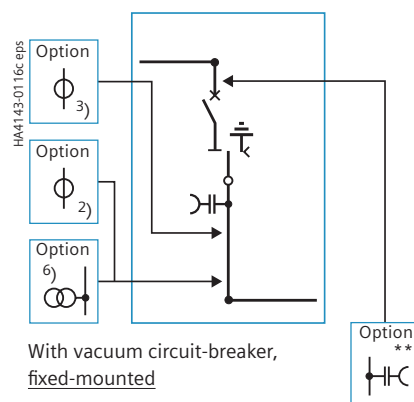
Surge arrester

Installation options for block-type CTs, VTs are dependent on rated voltages and rated currents

Circuit-breaker panels 630 A as feeder panels



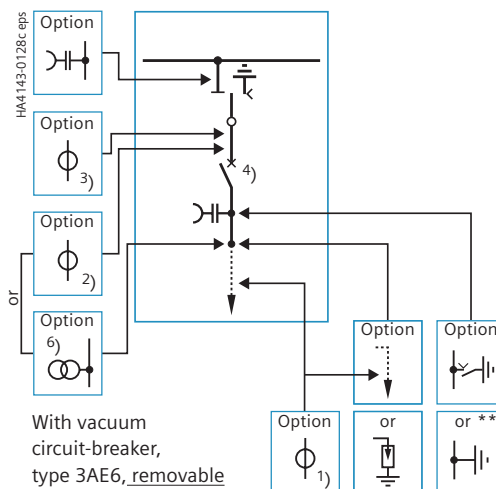
as transfer panel for attachment to panel types M, M(-K) or H or R(T), D1(T)



Type L1(T)
750 mm wide

Type L(T):
500 mm wide

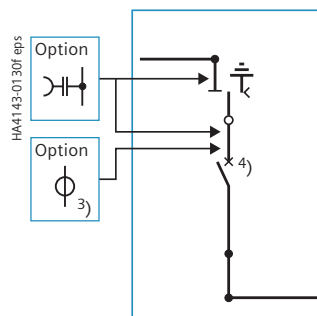
Circuit-breaker panels 630 A, 1250 A as feeder panels



Type L1(r), 630 A
750 mm wide, 1–2 cables per phase

Type L2(r), 1250 A
875 mm wide, 2–3 cables per phase

as transfer panel for attachment to panels (see types in the table below)



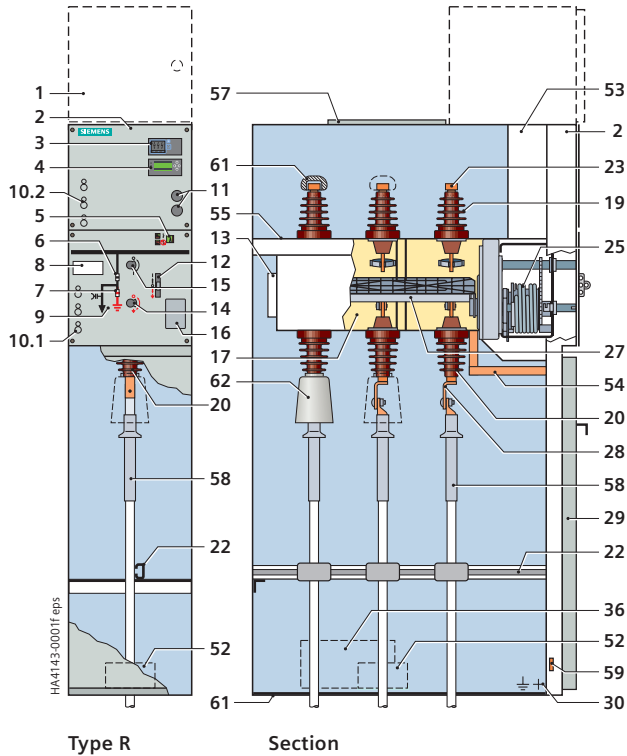
Type L1(r, T), 630 A
750 mm wide

Type L2(r, T), 1250 A
875 mm wide

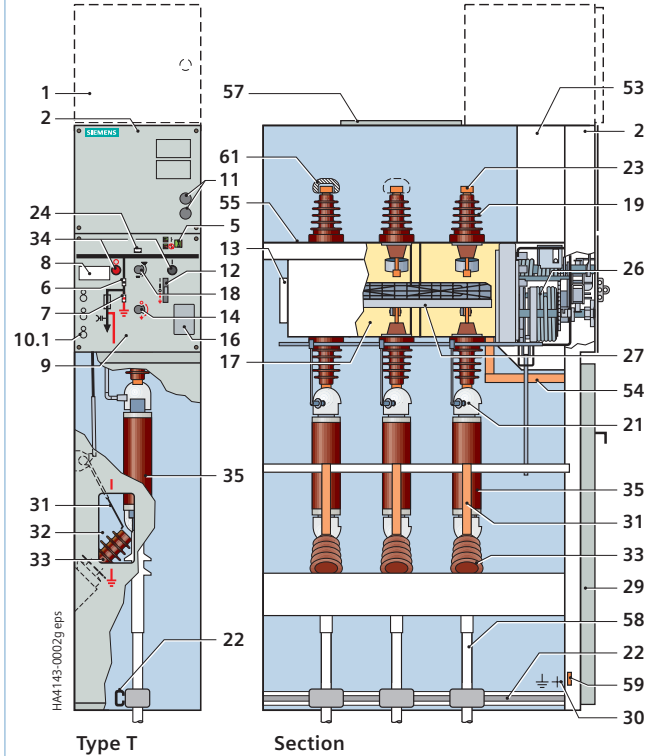
** Standard: Feeder earthing via the vacuum circuit-breaker type 3AE6 (with interlocks, without earthing switch)

Panel combinations	Design	Rated current
L1(r, T) + H1	Standard	630 A
L1(r, T) + R1(T)	Standard	630 A
L2(r, T) + D1(T)	Standard	1250 A
L2(r, T) + H1	Standard	1250 A

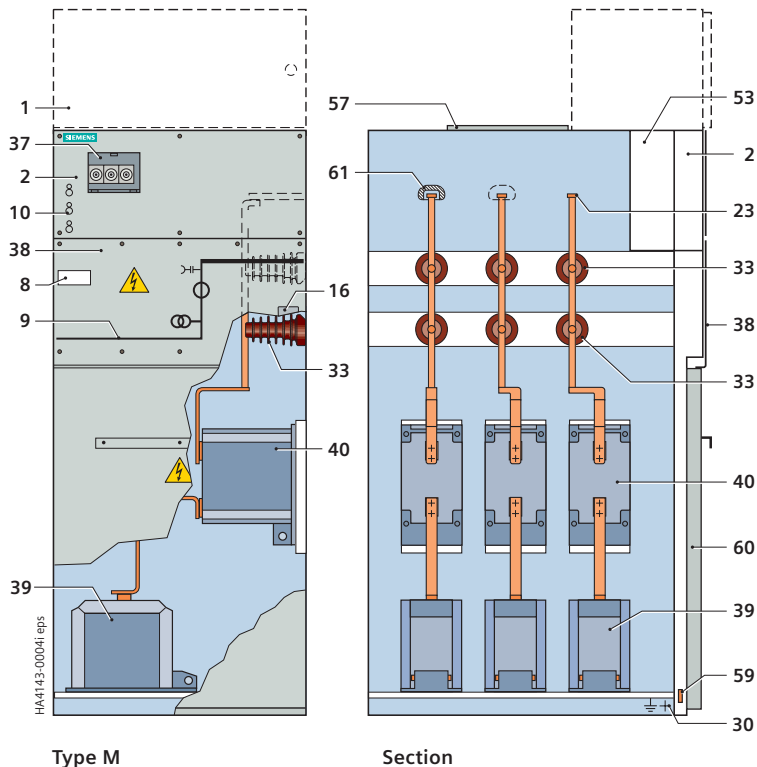
Ring-main panel as feeder



Transformer panel as feeder



Billing metering panel



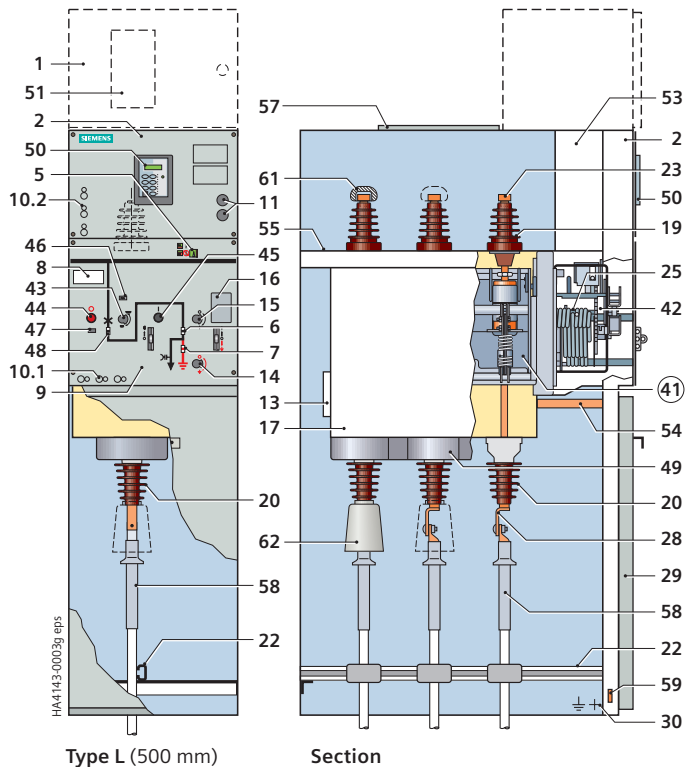
Legend for pages 17 and 18 (continued on page 18)

- 1 Option: Low-voltage compartment
- 2 Niche for optional low-voltage equipment, cover can be unscrewed
- 3 Option: CAPDIS-Sx voltage detecting system
- 4 Option: Short-circuit/earth-fault indicator
- 5 Option: Ready-for-service indicator for switching device
- 6 Position indication for load-break function "CLOSE – OPEN"
- 7 Position indication for earthing function "OPEN – EARTHED"
- 8 Feeder designation label
- 9 Mimic diagram
- 10 Option: Sockets for capacitive voltage detecting system (depending on arrangement)
- 10.1 for feeder
- 10.2 for busbar
- 11 Option: Momentary-contact rotary control switch "CLOSE – OPEN" for motor operating mechanism with local-remote switch for three-position switch-disconnector
- 12 Option: Locking device for three-position switch-disconnector
- 13 Pressure relief device for switching device
- 14 Manual operation for the mechanism of the earthing function
- 15 Manual operation for the mechanism of the load-break or disconnecting function in L panels
- 16 Nameplate
- 17 Gas-insulated vessel for switching device (contains fluorinated greenhouse gas SF₆)
- 18 Manual operation for mechanism, "spring charging"
- 19 Bushing-type insulator for busbar

Design

Panel design (examples)

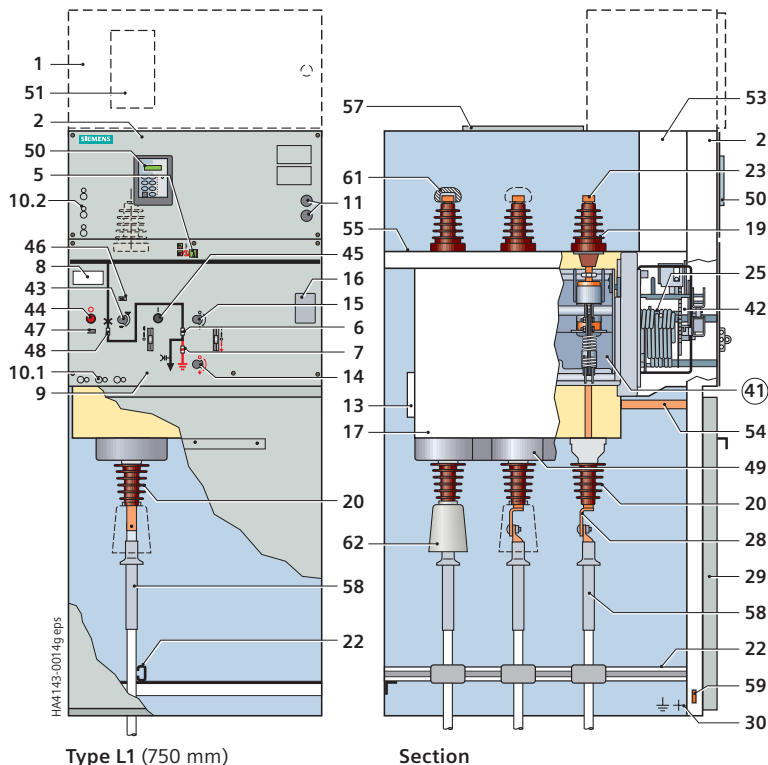
Circuit-breaker panel (with vacuum circuit-breaker type CB-f NAR)



Legend for pages 17 and 18

- 20 Bushing-type insulator for feeder
- 21 Terminal for HV HRC fuse assembly (with tripping)
- 22 Cable bracket with cable clamps (option) for cable fixing
- 23 Busbar
- 24 "Spring charged" indicator for stored-energy "OPEN"
- 25 Spring-operated mechanism for three-position switch-disconnector
- 26 Spring-operated / stored-energy mechanism for three-position switch-disconnector
- 27 Three-position switch-disconnector
- 28 Cable connection
- 29 Cable compartment cover
- 30 Earthing connection (for location, see dimensional drawings)
- 31 Earthing switch for cable connection
- 32 Inspection window
- 33 Post insulator
- 34 Operation for stored-energy mechanism
 - stored-energy "OPEN" (red)
 - stored-energy "CLOSED" (black)
- 35 Option: HV HRC fuse-link (e = 292 mm or 442 mm)
- 36 Option: Heater in the panel
- 37 Option: Secondary protection for voltage transformer
- 38 Cover, screwed on
- 39 Voltage transformer 4MR
- 40 Block-type current transformer 4MA7

Circuit-breaker panel (with vacuum circuit-breaker type CB-f NAR)



Vacuum circuit-breaker:

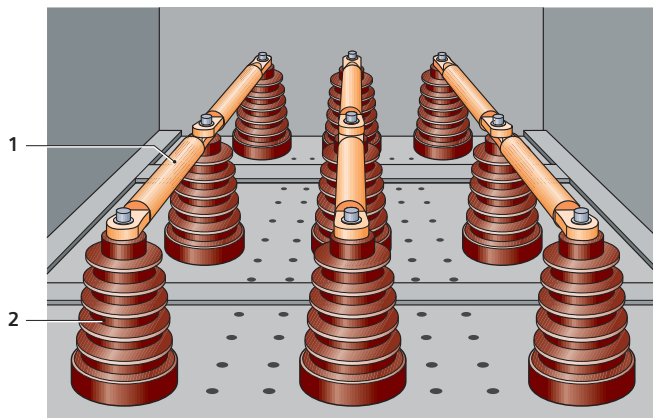
- 41 Vacuum circuit-breaker (VCB), fixed-mounted
- 42 Operating mechanism box
- 43 Manual operation for "spring charging"
 - for closing with manual operating mechanism
 - for emergency operation with motor operating mechanism
- 44 Mechanical "OFF" pushbutton
- 45 Mechanical "ON" pushbutton (not supplied in case of spring-operated mechanism)
- 46 "Spring charged" indicator
- 47 Operation counter (option for VCB type: CB-f NAR)
- 48 Position indicator
- 49 Option: Three-phase current transformer 4MC63
- 50 Option: Time-overcurrent protection relay (type 7SR45 or similar)
- 51 Option: Multifunction protection relay SIPROTEC 5 7SJ82
- 52 Cable-type current transformer
- 53 Niche provided for control cables and/or bus wires
- 54 Option: Additional earthing busbar for switching-device vessel
- 55 Metal partition of busbar compartment
- 57 Busbar compartment cover for panel extension
- 58 Cable sealing end (not included in scope of supply)
- 59 Earthing busbar
- 60 Cover for instrument transformer connection compartment
- 61 Insulating cap on the busbar (for $U_r > 17.5$ kV)
- 62 Insulating cap for cable connection (for $U_r > 17.5$ kV)

Busbars

- Safe-to-touch due to metal enclosure
- Busbar compartment with metal partitions
- Three-pole design, can be bolted together from panel to panel
- Easy switchgear extension
- Made of copper: round E-Cu.

Busbar compartment extending over 3 panels

(example ≤ 17.5 kV)

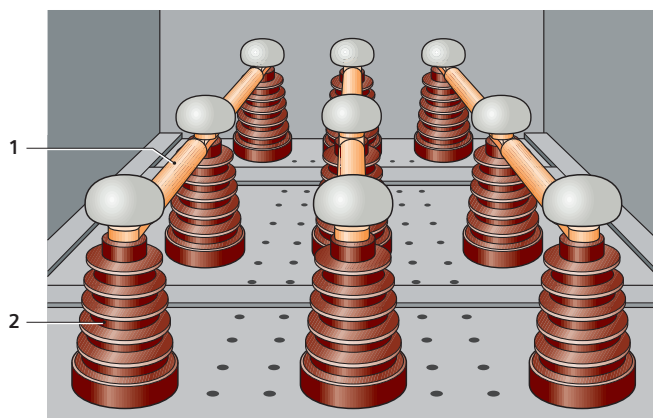


Side view

- 1 Busbar
- 2 Bushing-type insulator for busbar

Busbar compartment extending over 3 panels

(example 24 kV)



Side view

- 1 Busbar
- 2 Bushing-type insulator for busbar

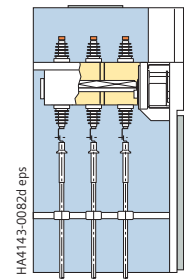
Components

Selection data for various cable sealing ends

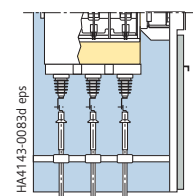
Cable sealing ends for all feeder types with cable connection

Make	Type	Cross-section in mm ²
Single-core thermoplastic-insulated cables for ≤ 12 kV (6/10 kV); acc. to IEC standard		
Euromold	AIN 10, AFN 10	25–300 (500)
	AIS, AIP	150–300; 50–300
	12 MONOi	25–300 (500)
Prysmian Kabel und Systeme	ELTI-1C-12	25–300
TE Connectivity	IXSU-F	16–300 (500)
	MVTI-31xx-	25–240 (300)
	EPKT	16–300
3M	92-EB 6x-1	35–300 (400)
Südkabel	SEHDI 10.2	35–300 (500)
nkt cables	TI 12	25–240
	TO 12	25–300 (500)
Three-core thermoplastic-insulated cables for ≤ 12 kV (6/10 kV); acc. to IEC standard		
Euromold	AIN 10, AFN 10	25–300 (500)
	12 MONOi	35–300 (500)
Prysmian Kabel und Systeme	ELTI-3C-12	25–300
TE Connectivity	IXSU-F33xx	16–300 (500)
Single-core thermoplastic-insulated cables for > 12 kV to ≤ 24 kV (12/20 kV)		
Euromold	AIN 20, AFN 20	25–300 (630)
	AIS, AIP	70–300; 25–300
	ITK-224	25–240
Prysmian Kabel und Systeme	ELTI mb-1C-24	35–240
	ELTI-1C-24	25–300
TE Connectivity	IXSU-F	25–300 (500)
	MVTI-51xx-	25–300
	EPKT	16–300 (500)
Lovink-Enertech	IAEM 20	25–300
	IAES 20	25–300 (500)
3M	93-EB 6x-1	50–300 (400)
Südkabel	SEHDI 20.2	35–300 (500)
	SEI 24	25–240
nkt cables	TI 24	25–240
	TO 24	25–300 (500)
Three-core thermoplastic-insulated cables for > 12 kV to ≤ 24 kV (12/20 kV)		
Lovink-Enertech	GHKI	25–300 (500)
TE Connectivity	on request IXSU-F53xx	on request

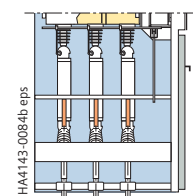
Examples for cable connection in R, L and T:



Panel type R ...



Panel type L ...



Panel type T ...

Note:

For cable connections, the manufacturer information about the sealing end and the design of the cable must be taken into account (e.g. operating voltage, rated power-frequency withstand voltage, cable type, core material). Depending on make and type, the termination of the cable sealing end (= shield earth) for the cables and the fitted cable clamps may be located underneath the panel in the cable basement. This must be taken into account in panels with floor cover (option).

Cable cross-sections and instrument transformer combination

Panel type	Panel width in mm	Feeder current	Max. cables per phase			Cable connection height (+/- 10 mm)	Instrument transformer combination in the connection compartment			
			12 kV	17.5 kV	24 kV		4MC63	4MC70	4MA	4MR
K	375	630 A	1–2		1	931 mm	–	x	–	–
K1	500	630 A	1–3			931 mm	–	x	–	–
			1			450 mm	–	x	x	–
		1250 A				313 mm	–	*	–	x
			2–3			931 mm	–	x	–	–
R	375	630 A	1–2		1	931 mm	–	x	–	–
						854 mm	x	x	–	–
R1	500	630 A	1–2			931 mm	–	x	–	–
		630 A				854 mm	x	x		
		630 A	1			450 mm	–	x	x	–
		630 A				313 mm	–	*	–	x
D1	500	1250 A	2			931 mm	–	x	–	–
T	375	200 A	1	–		384 mm	–	**	–	–
			–	1		534 mm	–	**	–	–
T1	500	200 A	1	–		384 mm	–	**	–	–
			–	1		534 mm	–	**	–	–
L	500	630 A	1–3			646 mm	–	x	–	–
			1			215 mm	–	*	x	–
			1	–		646 mm	–	x	–	x
			1–3			569 mm	x	x	–	–
			1			130 mm	x	*	x	–
			1	–		569 mm	x	x	–	x
L1	750	630 A	1–2			646 mm	–	x	–	–
						460 mm	–	x	x	–
						646 mm	–	x	–	x
						460 mm	–	x	x	x
		1250 A	2–4			646 mm	–	x	–	–
			2–3			460 mm	–	x	x	–
						646 mm	–	x	–	x
			2–3	2		460 mm	–	x	x	x
		630 A				569 mm	x	x	–	–
			1–2			460 mm	x	x	x	–
						569 mm	x	x	–	x
						460 mm	x	x	x	x
		1250 A	2–4			569 mm	x	x	–	–
			2–3			460 mm	x	x	x	–
						569 mm	x	x	–	x
			2–3	2		460 mm	x	x	x	x
L1(r)	750	630 A	1–2			494 mm	x	x	–	–
							x	x	x	–
							x	x	–	x
L2(r)	875	1250 A	2–3			494 mm	x	x	–	–
							x	x	x	–
							x	x	–	x
M(-K)	750	630 A / 1250 A	2			495 mm	–	–	x	x
			3			368 mm ***	–	–	x	x
							–	–	x	x
M(-BK)	750	630 A	2–3			590 mm	–	–	x	x
		1250 A	2				–	–	x	x
			3			460 mm	–	–	x	x
M(KK)	750	630 A / 800 A	1–2	–		590 mm	–	–	x	x
			–	1–2		460 mm	–	–	x	x

* Mounting possible underneath the panel

** Mounting possible underneath the panel. For 17.5 kV also possible in the panel

*** Depending on the transfer combination

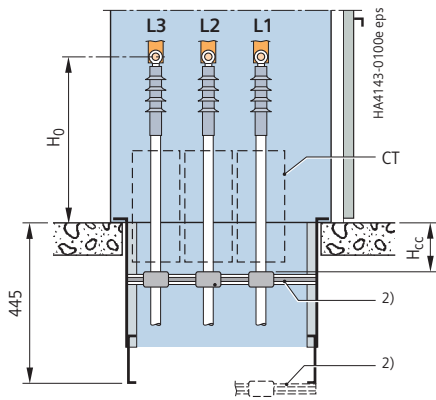
Components

Cable fixing

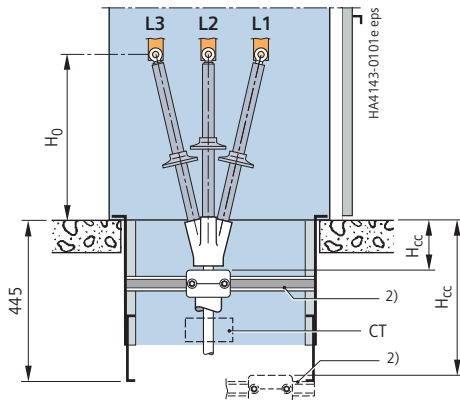
Cable fixing

Depending on the cable type, the panel type, and the panel components, the cables may also be fixed in the cable basement. This must be taken into account for the room planning.

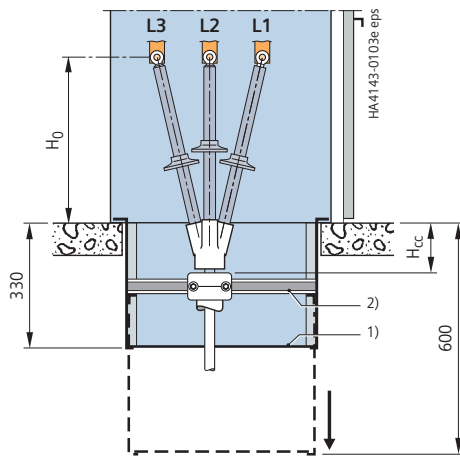
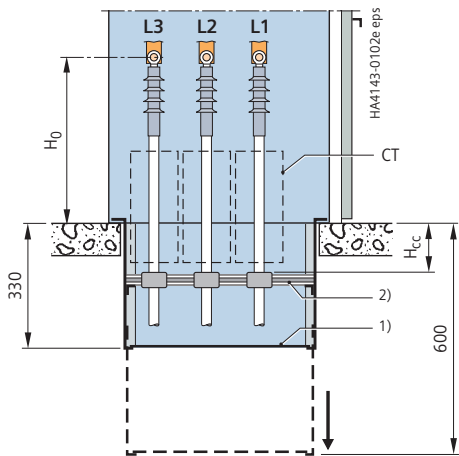
1-core cable



3-core cable



Optionally, a deep floor cover is also possible:



Max. dimensions H_{cc} in mm	Cable design	
	1-core	3-core
Standard	435	425
Option: With additional floor cover	469	459
Height of cable clamp (= option)	60	77

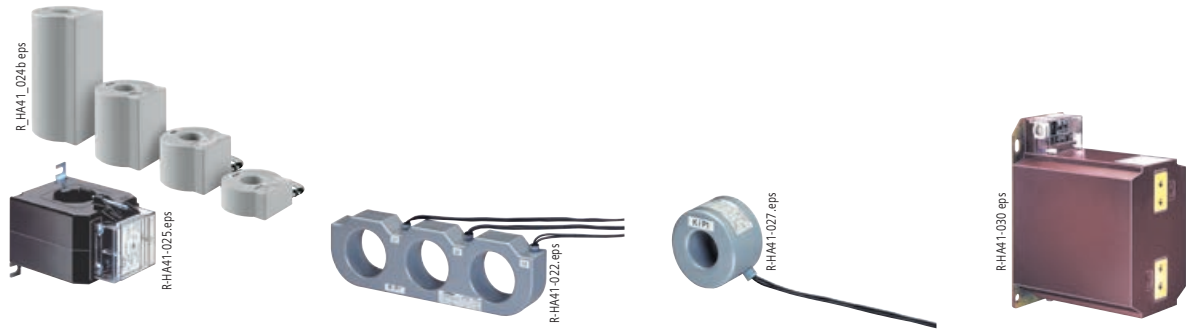
H_{cc} = Height available for cable connection, from the mounted cable clamp

1) Deep floor cover

2) Cable bracket, additionally movable downwards

H_0 = Height of cable connection in the panel

Current transformers according to IEC/EN 61869-1 and -2



Type	Cable-type current transformers 4MC7033 and 4MC7031 (single-pole)	Three-phase current transformer 4MC63 (three-pole)	Bus/cable-type current transformer 4MC7032 (single-pole)	Current transformer 4MA7 (single-pole)
Features	<ul style="list-style-type: none"> Designed as ring-core current transformers Insulation class E Inductive type Free of dielectrically stressed cast-resin parts (due to design) 			<ul style="list-style-type: none"> Dimensions according to DIN 42600-5 Insulation class E Cast-resin insulated Designed as an indoor block-type current transformer Secondary connection by means of screw-type terminals
Installation	<ul style="list-style-type: none"> Arranged on the cable at the panel connection For shielded cables Current transformers factory-assembled on a mounting plate Final assembly on the cables on site 	<ul style="list-style-type: none"> Arranged outside the switching-device vessel at the bushings Mounted at the factory 	<ul style="list-style-type: none"> Arranged on the cable at the panel connection For shielded cables Current transformers factory-assembled on a mounting plate Final assembly on the cables on site 	<ul style="list-style-type: none"> For installation at various positions depending on the panel type

Voltage transformer according to IEC/EN 61869-1 and -3



Type	4MR (single-pole or, as an option, two-pole)
Features	<ul style="list-style-type: none"> Dimensions according to DIN 42600-9 (small model) Designed as an indoor voltage transformer Cast-resin insulated Insulation class E Secondary connection by means of screw-type terminals
Installation	<ul style="list-style-type: none"> For installation at various positions depending on the panel type

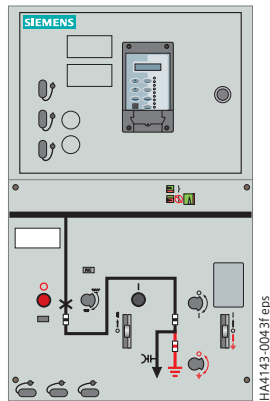
Components

Low-voltage niche

Low-voltage niche (standard)

- Inside the panel
- Cover for low-voltage niche:
 - Standard: Screwed-on cover
 - With door (option)
- For accommodation of terminals and standard protection devices, e.g. in circuit-breaker panels
- Protection relays, e.g.
 - Type 7SR45, 7SR10
 On request:
 - Type 7SJ82, 7SX800
- For bus wires and / or control cables; niche open at the side to the adjacent panel
- Partitioned safe-to-touch from the high-voltage part of the panel
- Degree of protection IP3X (standard).

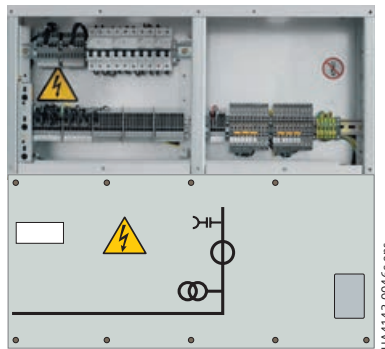
Low-voltage niche (examples)



In circuit-breaker panel
type L (500 mm)



In circuit-breaker panel
type L1(T) (750 mm)



In metering panel
type M (750 mm)
(low-voltage niche open)

Low-voltage compartment (option)

- Available heights
 - 350 mm
 - 550 mm
- Partitioned safe-to-touch from the high-voltage part of the panel
- Installation on the panel possible per feeder
- Customer-specific equipment
For accommodation of protection, control, measuring and metering equipment
- Overall height depends on the panel-specific configuration of primary and secondary devices
- Door with hinge on the left (standard)
Option: Door with hinge on the right.

Low-voltage cables

- Control cables of the panel to the low-voltage compartment via multi-pole, coded module plugs
- Option: Plug-in bus wires from panel to panel inside the low-voltage niche, or optionally in the separate wiring duct on the panel.

Low-voltage compartment door (example 750 x 350 mm)



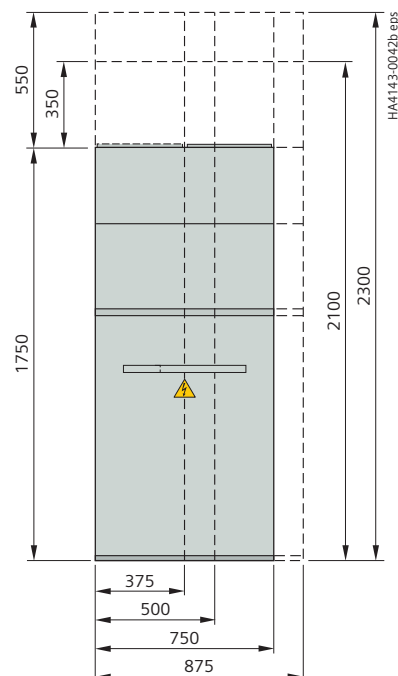
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Low-voltage compartment (example 750 x 350 mm)



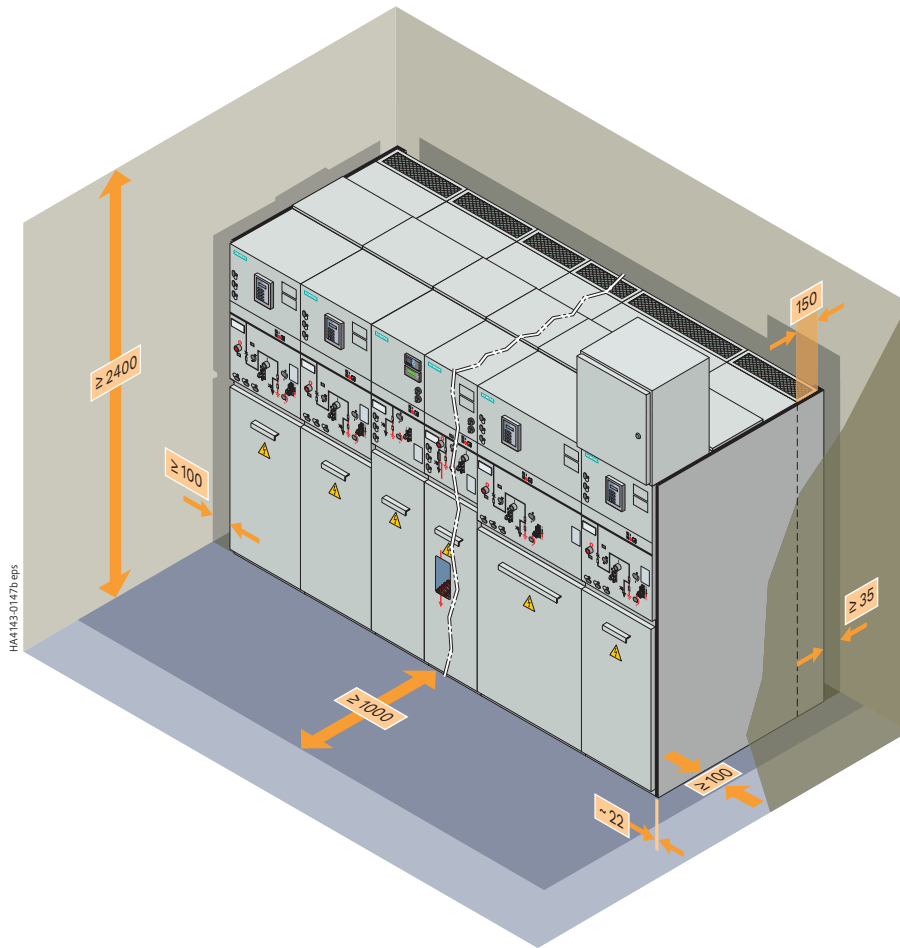
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Overall panel dimensions



Dimensions

Room planning



Switchgear installation

Wall-standing arrangement, free-standing arrangement

- 1 row
- 2 rows (for face-to-face arrangement).

Room dimensions

See dimensional drawing.

Room door dimensions

The door dimensions depend on:

- Number of panels in a transport unit
- Design with or without low-voltage compartment.

Switchgear fastening

- Foundations:
 - Steel girder construction
 - Steel-reinforced concrete.

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**Medium-
Voltage
Switchgear**



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