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

Medium-Voltage Switchgear

Catalog HA 41.21 · 2008

Answers for energy.

SIEMENS

Contents

The products and systems described in this catalog are manufactured and sold according to a certified quality and environmental management system (acc. to ISO 9001 and ISO 14001).
(DQS Certificate Reg. No. DQS 003473 QM UM).
The certificate is accepted in all IQNet countries.

Application

Typical uses

Example
4-panel transfer switchgear with integrated low-voltage niche

Utilities transfer substation for industrial plants

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 feeder currents up to 1250 A.

Modular space-saving design allows use 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 examples

- 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 industry
- Emergency power supply installations

Modular design

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

Technical features

- Air-insulated indoor switchgear
- Gas-insulated, maintenance-free switching functions for the three-position switch
- 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 3AH5, metal-enclosed, up to 630 A, fixed-mounted in gas-insulated switchgear vessel
- Vacuum circuit-breaker 3AH6, air-insulated, up to 1250 A, easy to remove after loosening the fixing bolts
- Hermetically-sealed by welding, stainless-steel switchgear vessel,
  – For switching devices
  – With welded-in bushings (for electrical connections and mechanical components)
  – With insulating gas SF_6
- LSC 2 A or LSC 2 B panels
- Pressure relief
  – To the rear and upwards
  – Separately for each compartment
- Air-insulated cable connection system for conventional cable sealing ends
- Three-phase current transformer, factory-assembled on the feeder bushings
- Integrated low-voltage niche (standard) for installation of, e.g.
  – Terminals, MCBs, push-buttons
  – Protection devices
- Option: Top-mounted low-voltage compartment
- Option: Panel heating for severe ambient conditions, e.g. condensation

Reliability

- Type and routine-tested *
- Standardized and manufactured using numerically controlled machines
- Quality management system according to DIN EN ISO 9001
- More than 500,000 switchgear components in operation worldwide for many years
- No cross-insulation between phases

Personal safety

- All switching operations can be performed with closed panel front
- Metal-enclosed LSC 2 A or LSC 2 B panels
- HV HRC fuses and cable sealing ends are only accessible when the outgoing feeders are earthed
- Logical mechanical interlocking
- Capacitive voltage detection system for verification of safe isolation from supply
- Earthing of outgoing feeders by means of make-proof earthing switches

Security of operation

- Components, e.g. operating mechanisms, three-position switches, vacuum circuit-breakers proven for years
- LSC 2 B panels (metal compartmentalization (metal-clad) between busbar and switching device and between switching device and cable connection compartment)
- LSC 2 A panels with metal compartmentalization between switching device and busbar compartment
- Three-position switch metal-enclosed with gas-insulated switching functions
  – Welded sealed-for-life switchgear vessel
  – No cross-insulation between phases
  – With welded-in bushings for cable connection, busbar and operating mechanism
- Switch operating mechanisms outside switchgear vessel
- Maintenance-free operating mechanism parts (IEC 62271-1/ VDE 0671-1 *)
- Mechanical switch position indications integrated in mimic diagram
- Switchgear interlocking system with logical mechanical interlocks

Reavailability

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

Extremely low life-cycle costs and extremely high availability throughout the entire product service life cycle as a result of:

- Three-position switch with gas-insulated quenching principle
- 3AH vacuum circuit-breaker
- Minimum space requirement
- Easy switchgear extension
- Standard protection relays, e.g. multifunction protection SIPROTEC 4

Electrical features

- Rated voltages up to 24 kV
- Rated short-time withstand current up to 25 kA
- Rated normal current of feeders
  – Up to 630 A, e.g. for ring-main, metering and circuit-breaker panels
  – Up to 1250 A, for circuit-breaker and bus sectionalizer panels
- Rated normal current of busbar up to 1250 A

* Standards see page 43

Technical Data

Electrical data of panels, pressure values, temperature

Common details on electrical data, filling pressure and temperature

Rated insulation level	Rated voltage U_r	kV	**7.2**				**12**				**15**				**17.5** [3]				**24**	
	Rated short-dur. power-freq. withstand voltage U_d	kV	20				28				36				38 [3]				50	
	Rated lightning impulse withstand voltage U_p	kV	60				75				95				95				125	
Rated frequency f_r			50/60 Hz →																	
Rated normal current I_r [1] of busbar	Standard		630 A →																	
	Option		1250 A →																	
Rated short-time withstand current I_k	for switchgear with t_k = 1 s	up to kA	20	25	20	25	16	20	25	16	20	25	16	20						
	for switchgear with t_k = 3 s	up to kA	20	–	20	–	–	20	–	–	20	–	–	20						
Rated peak withstand current I_p		up to kA	50	63	50	63	40	50	63	40	50	63	40	50						
Rated filling pressure p_{re} [2]	for insulation		1500 hPa (absolute) at 20 °C →																	
Minimum operating pressure p_{me} [2]	for insulation		1300 hPa (absolute) at 20 °C →																	
Ambient temperature T	for panels without secondary equipment	on request:	Class "Minus 25 indoor" (– 25 °C to +55 °C) →																	
	for panels with secondary equipment		Class "Minus 5 indoor" (– 5 °C to +55 °C) →																	

Ring-main panel type RK and cable connection panel type K, K-E

Rated normal current I_r [1]	for feeder and transfer, panel type RK		630 A (standard), 400 A (on request) →																
	for feeder, panel type K, K-E		630 A (standard), 400 A (on request) →																
	for feeder, panel type K1, K1-E		630 A (standard), 1250 A →																
Rated short-circuit making current I_{ma}		up to kA	50	63	50	63	40	50	63	40	50	63	40	50						

Transformer panel type TR

Rated normal current I_r [1]	for feeder [5]		200 A →																
Rated peak withstand current I_p [5]		up to kA	50	63	50	63	40	50	63	40	50	63	40	50						
Rated short-circuit making current I_{ma} [5]		up to kA	50	63	50	63	40	50	63	40	50	63	40	50						
Reference dimension "e"	for HV HRC fuse links	mm	292 [4]		292		442			442			442							

Circuit-breaker panel type LS

	for feeder	for transfer	with																
Rated normal current I_r [1]	f. panel type LS1	and LS1-U	3AH5 *	630 A →															
	f. panel type LS11	and LS11-U	3AH6 *	630 A →															
	f. panel type LS31, LS32	and LS31-U	3AH6 *	1250 A →															
Rated short-circuit making current I_{ma}			up to kA	50	63	50	63	40	50	63	40	50	63	40	50				
Rated short-circuit breaking current I_{sc}	for 3AH vacuum circuit-breaker		up to kA	20	25	20	25	16	20	25	16	20	25	16	20				

Busbar earthing panel type SE

Rated short-circuit making current I_{ma}		up to kA	50	63	50	63	40	50	63	40	50	63	40	50						

Busbar voltage metering panels type ME3 and type ME31-F

Rated peak withstand current I_p [5]		up to kA	50	63	50	63	40	50	63	40	50	63	40	50						
Rated short-circuit making current I_{ma} [5]		up to kA	50	63	50	63	40	50	63	40	50	63	40	50						
Reference dim. "e" in panel type ME31-F	for HV HRC fuse links		292 mm →																	

Billing metering panels type ME1

Rated normal current I_r [1]	for transfer, panel types ME1 and ME1-H		630 A, 1250 A →																
	for feeder as cable-connection panel type ME1-K		630 A, 1250 A →																
	for busbar connection, panel type ME1-S		630 A, 1250 A →																
	for bus riser panel type HF		630 A, 1250 A →																

Bus sectionalizer panels type LT

Rated normal current I_r [1]	for panel types LT10 and HF, with 3AH5 *		630 A →																
	for panel type LT1, with 3AH5 *: On request		630 A →																
	for panel types LT11 and HF, with 3AH6 *		630 A →																
	for panel types LT2 and LT22		630 A →																
	for panel types LT31 and HF, with 3AH6 *		1250 A →																
Rated short-circuit making current I_{ma}		up to kA	50	63	50	63	40	50	63	40	50	63	40	50						
Rated short-circuit breaking current I_{sc}	for 3AH vacuum circuit-breaker	up to kA	20	25	20	25	16	20	25	16	20	25	16	20						
Electrical service life	for 3AH vacuum circuit-breaker: at rated normal current I_r [1]		10,000 operating cycles																	
	at rated short-circuit breaking current I_{sc}		50 breaking operations, 35 breaking operations on 3AH6 * with 25 kA																	

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

2) Pressure values for SF_6-insulated vessels

3) Data for Russian Federation
– Rated voltage 12 kV
– Rated short-duration power-frequency withstand voltage 42 kV

4) With reference dimension e = 192 mm, an extension tube (100 mm long) is additionally required for fuse mounting 292 mm

5) For panel types TR and ME31-F depending on the max. cut-off current of the HV HRC fuse link ($I_D \leq 25$ kA)

* Type designation of the vacuum circuit-breaker

Technical Data

Electrical data * of the switching devices

Three-position switch-disconnector

					7.2	12	15	17.5 [3]	24
Rated insulation level	Rated voltage		U_r	kV	**7.2**	**12**	**15**	**17.5** [3]	**24**
	Rated short-duration power-frequency withstand volt.		U_d	kV	20	28	36	38 [3]	50
	Rated lightning impulse withstand voltage		U_p	kV	60	75	95	95	125
Rated frequency			f_r	Hz	50/60	50/60	50/60	50/60	50/60
Rated normal current for	ring-main feeders		I_r	A	400, 630	400, 630	400, 630	400, 630	400, 630
	transformer feeders [1]		I_r	A	200	200	200	200	200
Rated short-time withstand current	for switchgear with t_k = 1 s		I_k	up to kA	25	25	25	25	20
	for switchgear with t_k = 3 s		I_k	kA	20	20	20	20	20
Rated peak withstand current			I_p	up to kA	63	63	63	63	50
Rated short-circuit making current for	transformer feeders [2]		I_{ma}	kA	25	25	25	25	25
	ring-main feeders		I_{ma}	up to kA	63	63	63	63	50
Mechanical stability (class M1)			No. of operating cycles		1000	1000	1000	1000	1000
Switching capacity of general-purpose switches (class E3) according to IEC 60265-1/VDE 0670 Part 301 (Standards see page 43)									
Test duty 1	Rated mainly active load breaking current	for 100 switching operations	I_1	A	630	630	630	630	630
		for 20 switching operations	I_1	A	31.5	31.5	31.5	31.5	31.5
Test duty 2a	Rated closed-loop breaking current		I_{2a}	A	630	630	630	630	630
Test duty 3	Rated transformer breaking current		I_3	A	40	40	40	40	40
Test duty 4a	Rated cable-charging breaking current		I_{4a} (I_C or I_6)**	A	68	68	68	68	68
Test duty 4b	Rated line-charging breaking current		I_{4b}	A	68	68	68	68	68
Test duty 5	Rated short-circuit making current		I_{ma}	up to kA	63	63	63	63	50
Test duty 6a	Rated earth-fault breaking current		I_{6a} (I_e)**	A	60	60	60	60	60
Test duty 6b	Rated cable-charging breaking current and line-charging breaking current under earth-fault conditions		I_{6b} ($\sqrt{3} \cdot I_{CL}$)**	A	35	35	35	35	35
–	Cable-charging breaking current under earth-fault conditions with superimposed load current		$I_L + \sqrt{3} \cdot I_{CL}$	A	630+50	630+50	630+50	630+50	630+50
Switching capacity of switch-disconnector/fuse combination (Standards see page 43)									
Rated transfer current			I_4	A	1150	1150	830	830	830

Earthing switch

					7.2	12	15	17.5	24
Rated voltage			U_r	kV	**7.2**	**12**	**15**	**17.5**	**24**
Make-proof earthing function of the three-position switch-disconnector	Rated short-circuit making current		I_{ma}	up to kA	63	63	63	63	50
	Rated short-time withstand current		I_k	up to kA	25	25	25	25	20
Make-proof earthing function in feeder of panels LS11, LS31 and LS32	Rated short-circuit making current		I_{ma}	up to kA	63	63	63	63	50
	Rated short-time withstand current		I_k	up to kA	25	25	25	25	20
Earthing function of the three-position disconnector	Rated short-time withstand current		I_k	up to kA	25	25	25	25	20

HA41-29a eps

3AH5 and 3AH6 vacuum circuit-breakers

					7.2	12	15	17.5	24
Rated insulation level	Rated voltage		U_r	kV	**7.2**	**12**	**15**	**17.5**	**24**
	Rated short-duration power-frequency withstand volt.		U_d	kV	20	28	36	38	50
	Rated lightning impulse withstand voltage		U_p	kV	60	75	95	95	125
Rated frequency			f_r	Hz	50/60	50/60	50/60	50/60	50/60
Rated normal current of feeders		for 3AH5	I_r	A	400, 630	400, 630	400, 630	400, 630	400, 630
		for 3AH6	I_r	A	630, 1250	630, 1250	630, 1250	630, 1250	630,1250
Rated short-time withstand current			I_k	up to kA	25	25	25	25	20
Rated short-circuit duration			t_k	s	3	3	3	3	3
Rated peak withstand current			I_p	up to kA	63	63	63	63	50
Rated short-circuit breaking current			I_{sc}	up to kA	25	25	25	25	20
Rated short-circuit making current			I_{ma}	up to kA	63	63	63	63	50
Electrical service life at rated normal current			–	–	10,000 operating cycles				

* Higher values of electrical data available on request

** Indications in parenthesis acc. to previous standards

1) Depending on the HV HRC fuse links

2) Corresponds to the max. permissible cut-off current of the HV HRC fuse

3) Data for Russian Federation
– Rated voltage 12 kV
– Rated short-duration power-frequency withstand voltage 42 kV

Technical Data

Switchgear installation

Room planning

Switchgear installation

Wall-standing arrangement, free-standing arrangement
– Single row
– Double row (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 page 42
- Foundations:
– Steel structure
– Steel-reinforced concrete

Panel dimensions

See pages 35 to 41

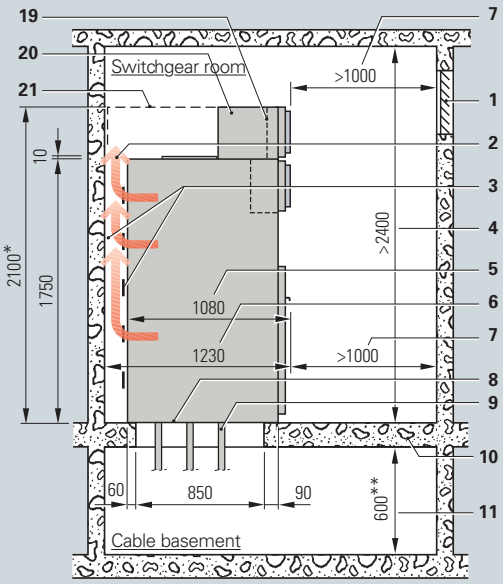
Weight

The weight of a panel depends on the extent to which it is equipped (e.g. with motor operating mechanism, voltage transformer). For details, please refer to page 7.

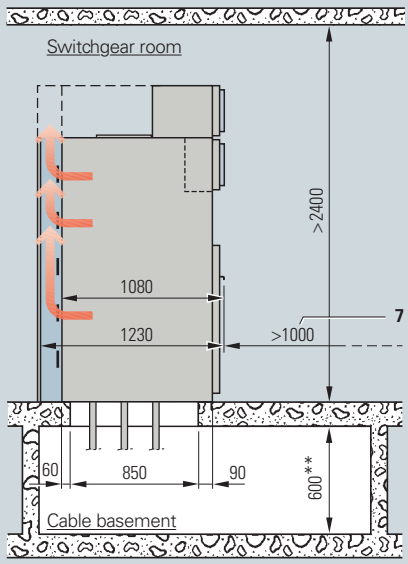
* Switchgear height 2100 mm if height of low-voltage compartment 350 mm; switchgear height 2300 mm if height of low-voltage compartment 550 mm

** Depending on bending radius of cable

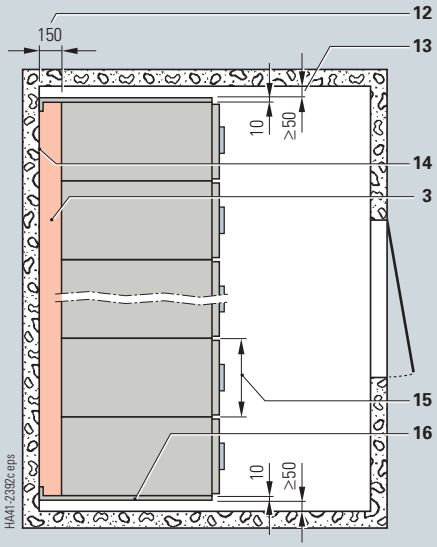
Room planning



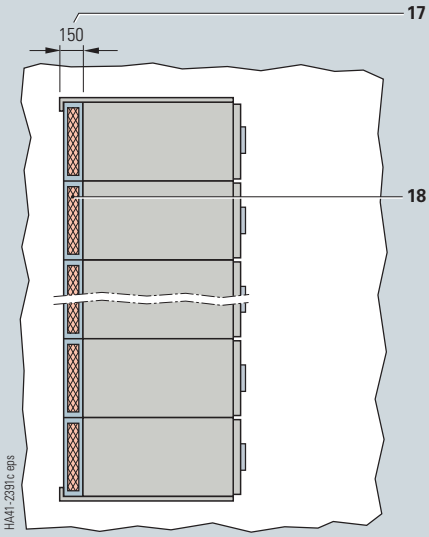
Wall-standing arrangement (side view)



Free-standing arrangement (side view)



Plan view

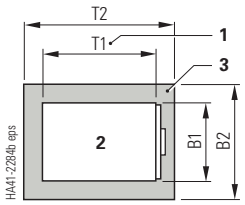


Plan view

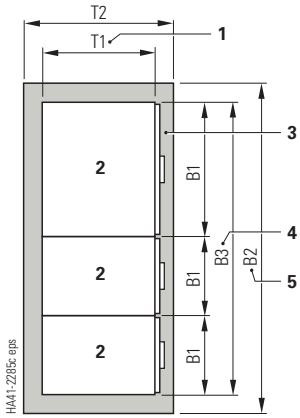
1 Relief opening
2 Direction of pressure relief
3 Pressure relief of switchgear
4 Room height
5 Individual panel depth
6 Panel depth including end wall
7 Depending on national requirements: Control aisle ≥ 1000 mm recommended (in Germany ≥ 800 mm). When extending or replacing panels, it might be necessary – depending on the room dimensions – to disassemble the respective neighbouring panels.
8 Option: Floor cover
9 Cable
10 Foundation
11 Height of cable basement corresponding to cable bending radius
12 Wall distance
13 Side wall distance
14 Installation flush with rear wall
15 Panel width
16 End wall
17 Depth of pressure relief duct
18 Option: For free-standing arrangement pressure relief duct for each panel for rated short-time withstand current $I_k \leq 20$ kA
19 Option: Front cover
20 Option: Low-voltage compartment
21 Option: High end wall

Shipping data

Transport units for shipping (plan view)



With individual panel



With combinations of different individual panels

1 T1 = Depth of individual panel

2 Individual panel dimension B1 x T1

3 Transport unit, dimension B2 x T2

4 B3 = Overall width of combination of different individual panels

5 B2 = Width of the transport unit

Individual panel or combinations thereof for standard switchgear (without pressure relief duct)	Panel type	Panel or panel combination		Transport unit (including packing) for standard panels (without pressure relief duct)				
		Width B1 mm	Net weight [1] approx. kg with- / without LVC*/LVC*	Width B2 m	Height m with- / without LVC*/LVC*	Depth T2 m	Volume m^3 with- / without LVC*/LVC*	Gross weight [1] approx. kg with- / without LVC*/LVC*
Transport of individual panels								
Ring-main panel	RK RK1	375 500	190 / 250 210 / 270	1.08 1.08	1.95 / 2.3	1.40	2.95 / 3.48	250 / 310 270 / 330
Ring-main panel for panel combinations	RK-U	375	260 / 320	1.08				320 / 380
Cable panel	K, K-E K1, K1-E	375 500	190 / 250 190 / 250	1.08 1.08				250 / 310 250 / 310
Transformer panel	TR TR1	375 500	210 / 270 230 / 290	1.08 1.08				270 / 330 290 / 350
Circuit-breaker panel 630 A	LS1, -U LS11, -U	750 750	340 / 400 340 / 400	1.08 1.08				410 / 460 410 / 460
Circuit-breaker panel 1250 A – For connection of max. 2 cables – For connection of 3 cables	 LS31 LS32	 750 875	 400 / 460 460 / 520	 1.08 1.08				 470 / 520 530 / 580
Bus sectionalizer panel 1250 A	LT31	750	450 / 510	1.08				520 / 570
Bus sectionalizer panel 630 A with vacuum circuit-breaker	LT10 LT11	750 750	320 / 380 320 / 380	1.08 1.08				390 / 440 390 / 440
Bus sectionalizer panel with 1 three-position switch-disconnector	LT2 LT2-W	750 750	250 / 310 310 / 370	1.08 1.08				320 / 370 380 / 430
Bus sectionalizer panel with 2 three-position switch-disconnectors	LT22 LT22-W	750 750	290 / 350 350 / 410	1.08 1.08				360 / 410 420 / 470
Billing metering panel	ME1.... ME1-H	750 750	270 / 330 330 / 390	1.08 1.08				340 / 390 400 / 450
Busbar voltage metering panel	ME3 ME31-F	375 500	210 / 270 270 / 330	1.08 1.08				270 / 330 330 / 390
Bus riser panel – without transformers	HF	375	170 / 230	1.08				230 / 290
Bus riser panel – with transformers	HF	375	260 / 320	1.08				320 / 380
Busbar earthing panel	SE1 SE2	375 500	190 / 250 270 / 330	1.08 1.08				250 / 310 330 / 390

For individual panel	Panel width mm	Additional weight approx. kg
Pressure relief duct for free-standing arrangement of switchgear	375	30
	500	40
	750	60
	875	70

Transport of combinations of different individual panels

Transport unit:	Overall width B3	B2		T2		
–Standard: As individual panels arranged side by side and not screwed together	On request	0.70	1.95 / 2.3	1.40	1.91 / 2.25	
–Option: As multi-panel transport unit, panels screwed together	≤ 875 mm	1.08	1.95 / 2.3	1.40	2.95 / 3.48	[2] + 70 **
	≤ 1000 mm ***	1.20	1.95 / 2.3	1.40	3.28 / 3.86	[2] + 80 **
Standard packing for:	≤ 1500 mm	1.78	1.95 / 2.3	1.40	4.64 / 5.47	[2] + 100 **
– Truck – Seaworthy crate, air freight	≤ 2125 mm	2.33	1.95 / 2.3	1.40	6.36 / 7.50	[2] + 120 **
Container packing, standard (other dimensions on request)	≤ 875 mm	1.10	1.95 / 2.3	1.40	3.00 / 3.50	[2] + 80 **
	≤ 2000 mm	2.20	1.95 / 2.3	1.40	6.00 / 7.10	[2] + 120 **

Packing, transport (examples)

Packing	Version	For supply	Transport
Panels mounted on wooden floor and covered with PE protection sheeting	Open	In Europe	Rail, truck
	For container	Overseas	Ship + truck

1) The net weight and the gross weight depend on the extent to which the panel is equipped (e.g. current transformers, motor operating mechanisms) and are therefore given as mean value

[2] Sum of the net weights of individual panels

* Low-voltage compartment, 350 mm high, weight approx. 60 kg depending on the panel type and on the extent to which it is equipped, or optionally 550 mm high

** Packing weight

*** ≤ 1125 mm on request

Product Range

Product range overview

Standard panels

Ring-main panel
type RK

Circuit-breaker panel
type LS1

Transformer panel
type TR

Circuit-breaker panel
type LS11

Cable panel
type K

Billing metering panel
type ME1

Panel designation		Panel type	Panel width
Column No.			
Ring-main panel [1]	as feeder	RK RK1	375 mm 500 mm
	as transfer	RK-U	375 mm
Transformer panel [1]	as feeder	TR TR1	375 mm 500 mm
Cable panel	as feeder	K K1	375 mm 500 mm
Cable panel [1) 2)]	as feeder	K-E K1-E	375 mm 500 mm
Circuit-breaker panel 630 A [1)] with 3AH5 [3)]	as feeder	LS1	750 mm
	as transfer	LS1-U	750 mm
Circuit-breaker panel 630 A with 3AH6 [3)]	as feeder	LS11	750 mm
	as transfer	LS11-U	750 mm
Circuit-breaker panel 1250 A with 3AH6 [3)]	as feeder	LS31 LS32	750 mm 875 mm
	as transfer	LS31-U	750 mm
Bus sectionalizer panel 630 A [1)] with 3AH5 [3)], for panel type HF		LT10	750 mm
Bus sectionalizer panel 630 A with 3AH6 [3)], for panel type HF		LT11	750 mm
Bus sectionalizer panel 1250 A with 3AH6 [3)], for panel type HF		LT31	750 mm
Bus sectionalizer panel 630 A [1)]	[4)]	LT2 LT2-W	750 mm 750 mm
	[5)]	LT22 LT22-W	750 mm 750 mm
Billing metering panel	Standard	ME1 ME1-S	750 mm 750 mm
	as end panel	ME1-K ME1-KS	750 mm 750 mm
Billing metering panel for additional current transformer		ME1-H	750 mm
Busbar voltage metering panel [1)]		ME3 ME31-F	375 mm 500 mm
Busbar earthing panel [1)]		SE1	375 mm
	[6)]	SE2	500 mm
Bus riser panel		HF	375 mm

1) Panels type LSC2B (metal-clad)
2) With additional make-proof earthing switch
3) Type designation of vacuum circuit-breaker
4) With 1 three-position switch-disconnector
5) With 2 three-position switch-disconnectors
6) With voltage transformer for busbar metering

Product Range

Equipment features

- • Basic equipment
- o Additional equipment (option), further additional equipment on request
- – Not available

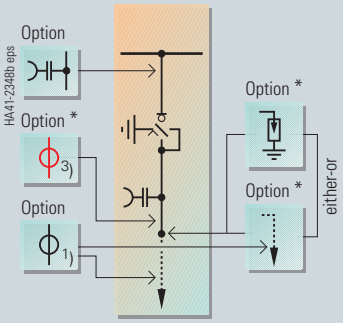
1 Manual operating mechanism for three-position switch [1)2)]	2 Interlock for cable compartment cover	3 Cable compartment cover locked in place	4 C-rail as cable bracket	5 Low-voltage niche as terminal compartment	6 Release as shunt release	7 Mechanical ready-for-service indicator for three-position switch	8 Signalling switch (1NO) for remote electrical ready-for-service indication for three-position switch [1)2)]	9 Aux. switch f. three-position switch and make-proof earthing switch Switch-disconnector and EARTHING: f. CLOSED and OPEN 2NO+2NC each [1)2)]	10 Motor operating mechanism for three-position switch [1)2)]	11 Local remote switch for motor operat. mech. of three-position switch [1)2)]	12 Interlock in circuit-breaker panel between three-position switch [1)2)] and 3AH... vacuum circuit-breaker	13 Locking device for switch position "CLOSED" of 3AH6 vacuum circuit-breaker with earthed three-position switch [1)2)]	14 Closing lock-out for three-position switch [1)2)]	15 De-earthing lock-out for make-proof earthing switch	16 Inspection window in the connection/cable compartment cover	17 Low-voltage compartment or cover	18 Motor operating mechanism for vacuum circuit-breaker	19 Release as c.t.-operated release in 3AH [3)]	20 Locking device for three-position switch [1)2)]	21 Short-circuit or earth-fault indicator	22 – Secondary equipment	23 – Floor cover [4)]	24 – Panel heating [7)]	25 Mounted cable clamps	Panel type
•	•	–	•	•	–	o	o	o	o	o	–	–	o	–	o	o	–	–	o	o	o	o	o	o	RK RK1
•	•	–	–	•	–	o	o	o	o	o	–	–	o	–	–	o	–	–	o	–	o	•	o	–	RK-U
•	•	–	•	•	o	o	o	o	o	o	–	–	–	o	•	o	–	–	o	–	o	o	o	o	TR TR1
–	–	•	•	•	–	–	–	–	–	–	–	–	–	–	o	o	–	–	–	o	o	o	o	o	K K1
•	•	–	•	•	–	o	o	o	–	–	–	–	–	–	o	o	–	–	o	o	o	o	o	o	K-E K1-E
•	•	–	•	•	–	o	o	o	o	o	o	–	o	–	o	o	o	o	o	o	o	o	o	o	LS1
•	•	–	–	•	o	o	o	o	o	o	o	–	o	–	–	o	o	o	o	–	o	•	o	–	LS1-U
•	•	–	•	•	o	o	o	o	o	o	o	o [5)]	o	–	o [6)]	o	o	o	o	o	o	o	o	o	LS11
•	•	–	–	•	o	o	o	o	o	o	o	o	o	–	–	o	o	o	o	–	o	•	o	–	LS11-U
•	•	–	•	•	o	o	o	o	o	o	•	• [5)]	o	–	o [6)]	o	o	o	o	o	o	o	o	o	LS31 LS32
•	•	–	–	•	o	o	o	o	o	o	•	•	o	–	–	o	o	o	o	–	o	•	o	–	LS31-U
•	•	–	–	•	o	o	o	o	o	o	o	o	o	–	–	o	o	o	o	–	o	•	o	–	LT10
•	•	–	–	•	o	o	o	o	o	o	o	•	o	–	–	o	o	o	o	–	o	•	o	–	LT11
•	•	–	–	•	o	o	o	o	o	o	•	•	o	–	–	o	o	o	o	–	o	•	o	–	LT31
•	•	•	–	•	–	o	o	o	o	o	–	–	o	–	–	o	–	–	o	–	o	•	o	–	LT2 LT2-W
•	•	–	–	•	–	o	o	o	o	o	–	–	o	–	–	o	–	–	o	–	o	•	o	–	LT22 LT22-W
–	–	•	–	•	–	–	–	–	–	–	–	–	–	–	o	o	–	–	–	–	o	•	o	–	ME1 ME1-S
–	–	•	•	•	–	–	–	–	–	–	–	–	–	–	o	o	–	–	–	–	o	o	o	o	ME1-K ME1-KS
–	–	•	–	•	–	–	–	–	–	–	–	–	–	–	o	o	–	–	–	–	o	•	o	–	ME1-H
•	•	–	–	•	–	o	o	o	o	o	–	–	–	o	– o	o	–	–	o	–	o	•	o	–	ME3 ME31-F
•	•	–	–	•	–	o	o	o	–	–	–	–	–	–	–	o	–	–	o	–	o	•	o	–	SE1
•	•	–	–	•	–	o	o	o	–	–	–	–	–	o	–	o	–	–	o	–	o	•	o	–	SE2
–	–	•	–	•	–	–	–	–	–	–	–	–	–	–	–	o	–	–	–	–	o	•	o	–	HF

1) Three-position switch as three-position switch-disconnector
2) Three-position switch as three-position disconnector in panel types LS31, LS31-U, LS32 and LT31
3) Type designation of the vacuum circuit-breaker
4) In special cases, deeper floor cover for panels with cable feeder required
5) Not to be applied for versions with separate feeder earthing switch in panel types LS11, LS31 and LS32
6) Inspection window is a standard equipment in panel types LS11, LS31 and LS32 for versions with separate earthing switch
7) Panel heating: wired on terminal (standard). Option: version with thermostat.

Product Range

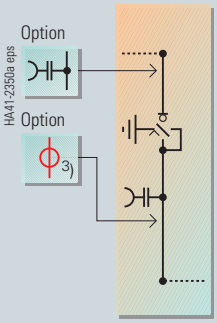
Ring-main panels

Ring-main panels
as feeder panels



Type RK
375 mm wide

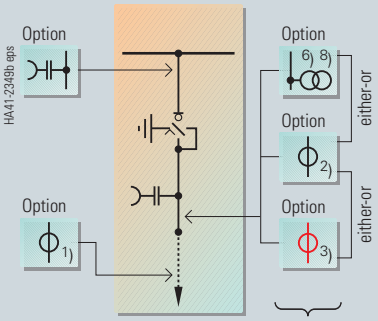
Ring-main panel
as transfer panel for attachment to panel types ME1... or ME1-H



Standard:
transfer to the right

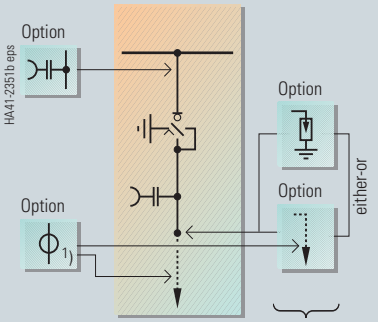
Option:
transfer to the left

Type RK-U
375 mm wide



Type RK1
500 mm wide

either:
Version with transformers

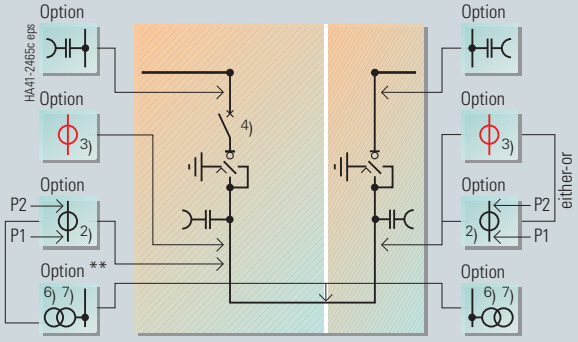


Type RK1
500 mm wide

or:
Version with connection fittings

* On request up to 12 kV

For other panel combinations



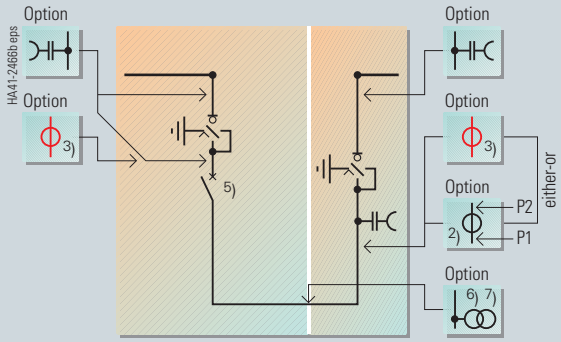
With 3AH5 vacuum circuit-breaker, fixed-mounted

Type LT10
750 mm wide

Type RK-U
375 mm wide

Bus sectionalizer panel type LT10 with ring-main transfer panel type RK-U

The ring-main transfer panel RK-U can be attached on the left or right of the bus sectionalizer panel LT10



With 3AH6 vacuum circuit-breaker, removable

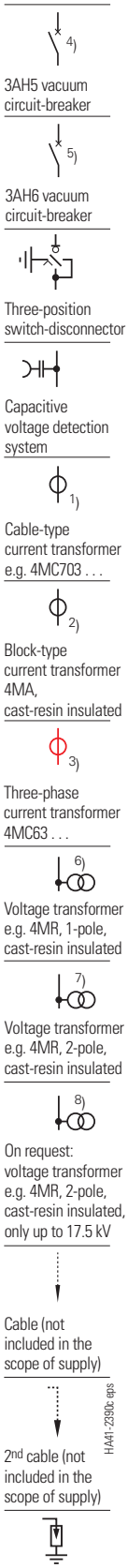
Type LT11
750 mm wide

Type RK-U
375 mm wide

Bus sectionalizer panel type LT11 with ring-main transfer panel type RK-U (non-interchangeable arrangement)

** On request: only 1 set of voltage transformers possible

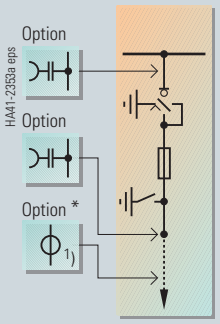
P1 and P2 are terminal designations of the current transformer



Product Range

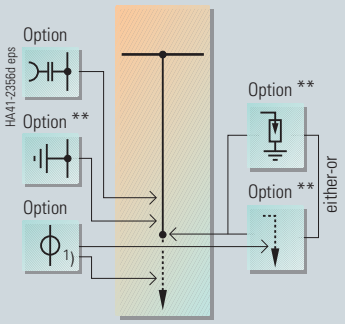
Transformer and cable panels

Transformer panels
as feeder panels



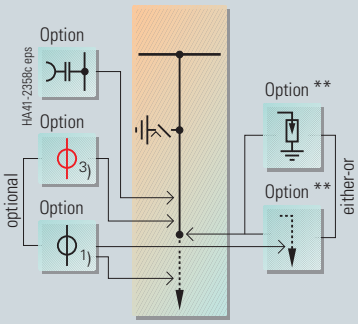
Type TR
375 mm wide

Cable panels
as feeder panels, 630 A

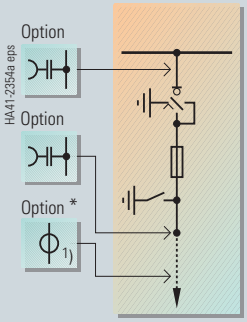


Type K
375 mm wide

Cable panels
as feeder panels, 630 A, with make-proof earthing switch

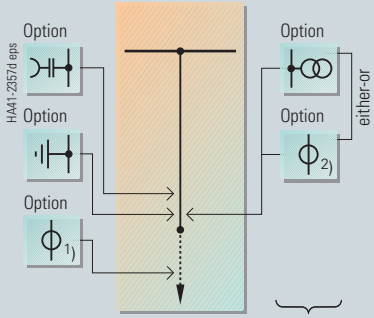


Type K-E
375 mm wide



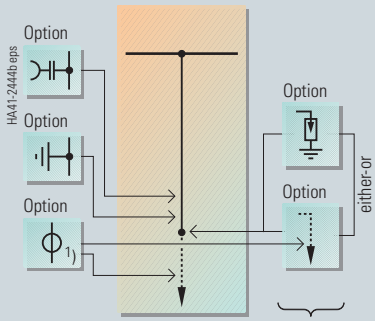
Type TR1
500 mm wide

as feeder panels
630 A and 1250 A



Type K1
500 mm wide

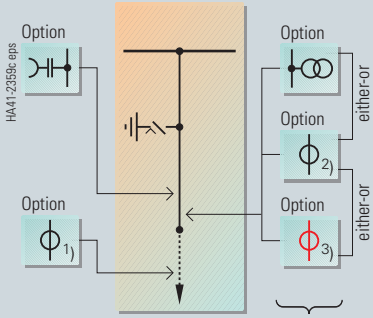
either:
Version with transformers



Type K1
500 mm wide

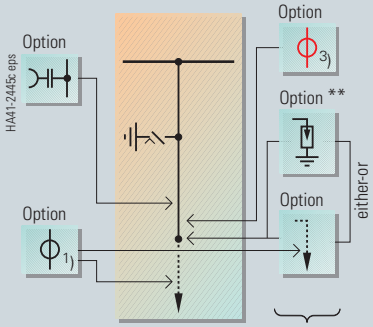
or:
Version with connection fittings

as feeder panels
630 A and 1250 A



Type K1-E
500 mm wide

either:
Version with transformers

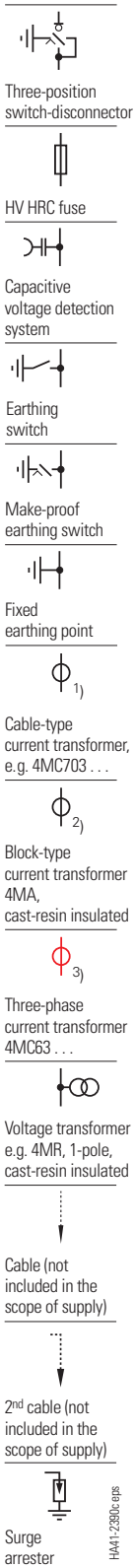


Type K1-E
500 mm wide

or:
Version with connection fittings

* Current transformer located partly underneath the panel

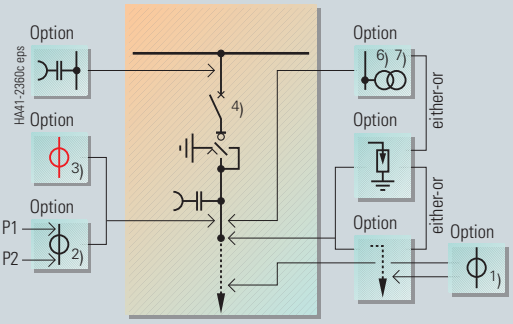
** On request up to 12 kV



Product Range

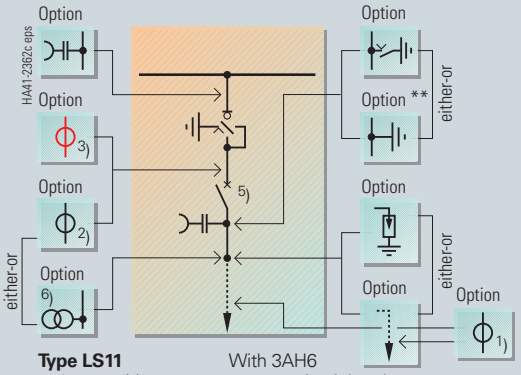
Circuit-breaker panels

Circuit-breaker panels 630 A
as feeder panels



Type LS1
750 mm wide

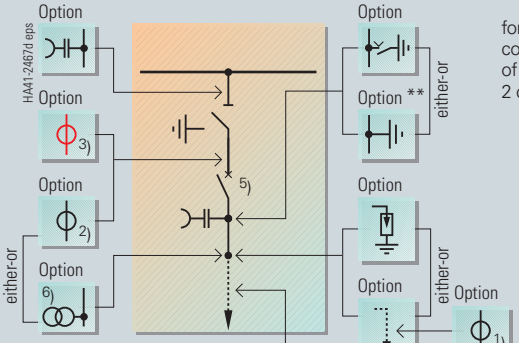
With 3AH5 vacuum circuit-breaker, fixed-mounted



Type LS11
750 mm wide

With 3AH6 vacuum circuit-breaker, removable

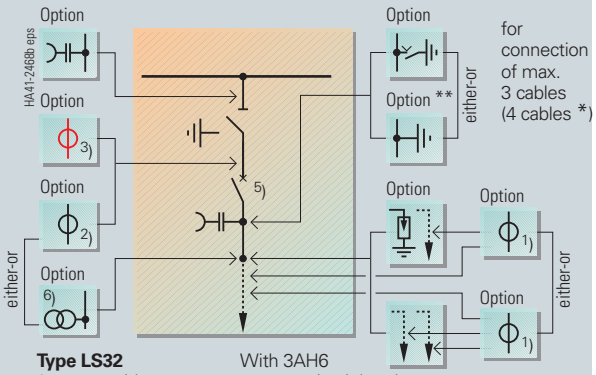
Circuit-breaker panels 1250 A
as feeder panels



for connection of max. 2 cables

Type LS31
750 mm wide

With 3AH6 vacuum circuit-breaker, removable

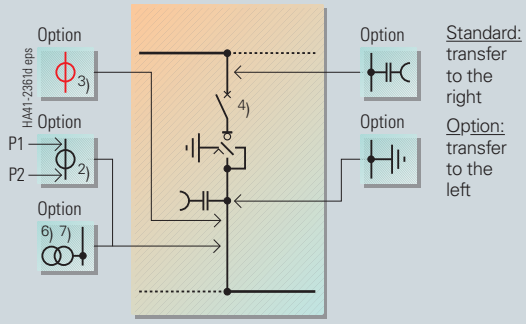


for connection of max. 3 cables (4 cables *)

Type LS32
875 mm wide

With 3AH6 vacuum circuit-breaker, removable

as transfer panels for attachment to panel types ME1... or ME1-H

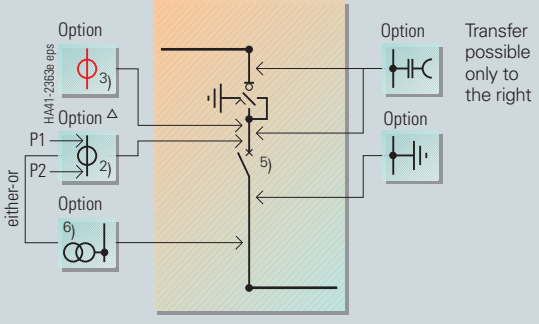


Standard: transfer to the right

Option: transfer to the left

Type LS1-U
750 mm wide

With 3AH5 vacuum circuit-breaker, fixed-mounted

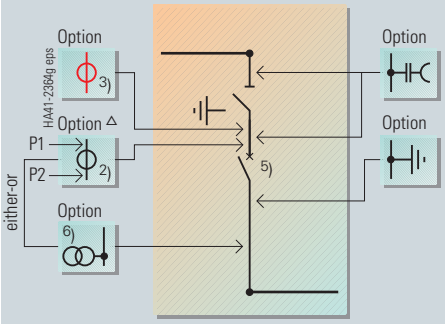


Transfer possible only to the right

Type LS11-U
750 mm wide

With 3AH6 vacuum circuit-breaker, removable

as transfer panel for attachment to panel types ME1... or ME1-H



Transfer possible only to the right

Type LS31-U
750 mm wide

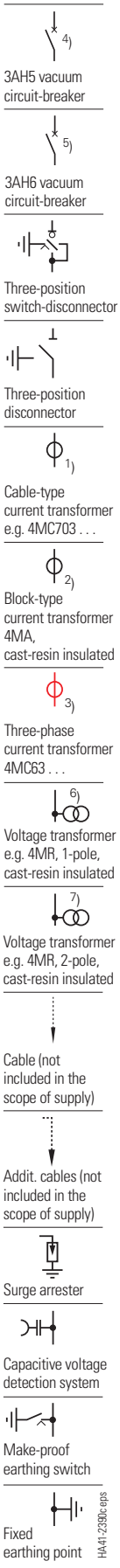
With 3AH6 vacuum circuit-breaker, removable

* On request

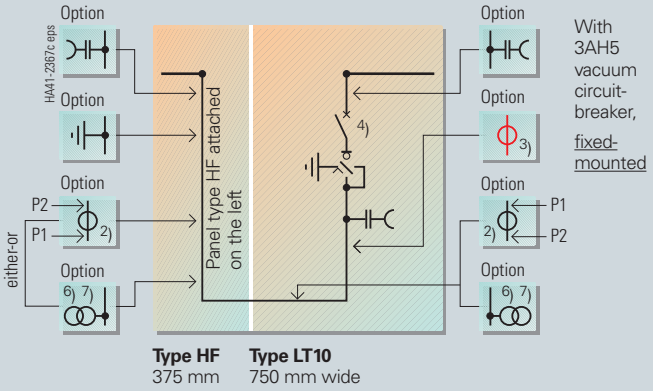
** Standard: Feeder earthing via the 3AH6 vacuum circuit-breaker with interlocks (without earthing switch)

△ Mounting position of the current transformer with terminal P1 at the top only

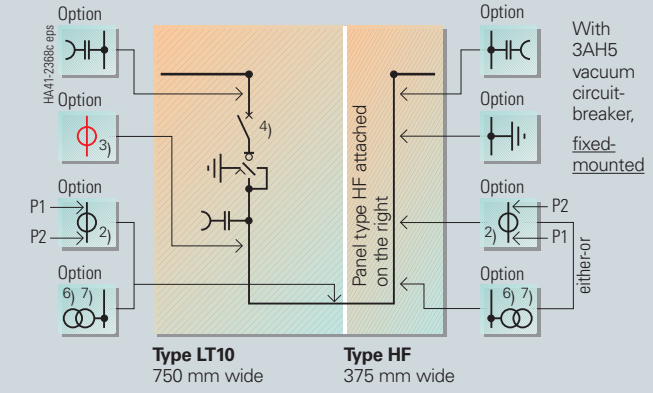
P1 and P2 are terminal designations of the current transformer



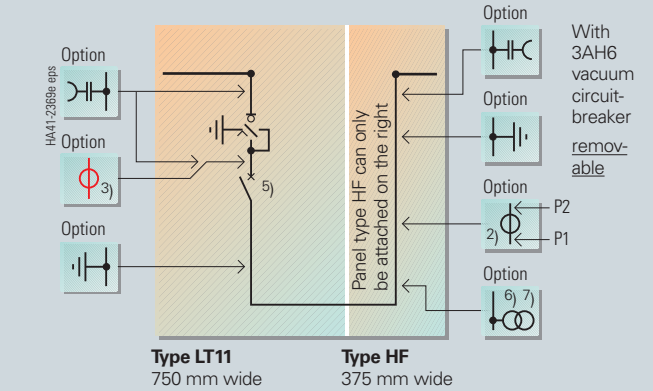
Bus sectionalizer panels 630 A
in combination with bus riser panel



Type HF 375 mm **Type LT10** 750 mm wide

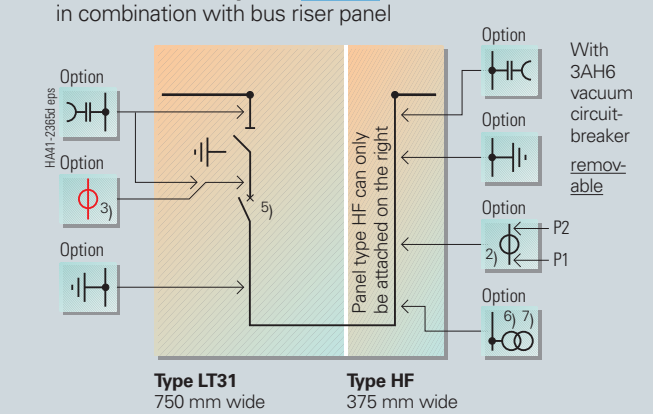


Type LT10 750 mm wide **Type HF** 375 mm wide



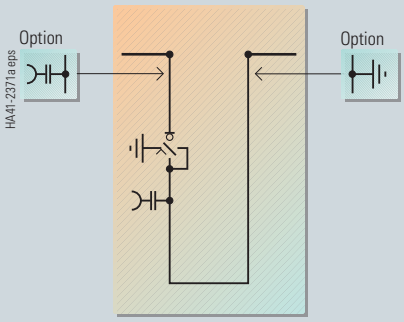
Type LT11 750 mm wide **Type HF** 375 mm wide

Bus sectionalizer panel 1250 A
in combination with bus riser panel

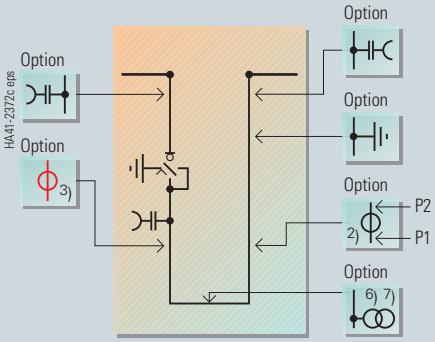


Type LT31 750 mm wide **Type HF** 375 mm wide

Bus sectionalizer panels 630 A
with 1 three-position switch-disconnector

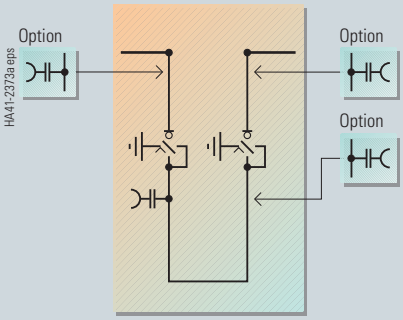


Type LT2 750 mm wide corresponds to type RK-U with type HF

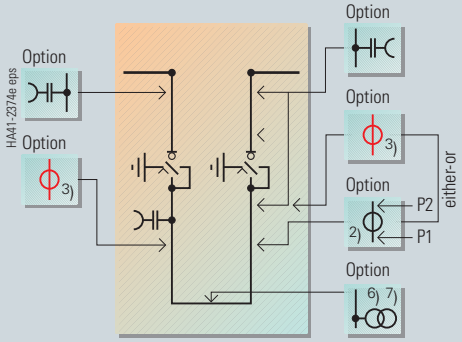


Type LT2-W 750 mm wide corresponds to type RK-U with type HF

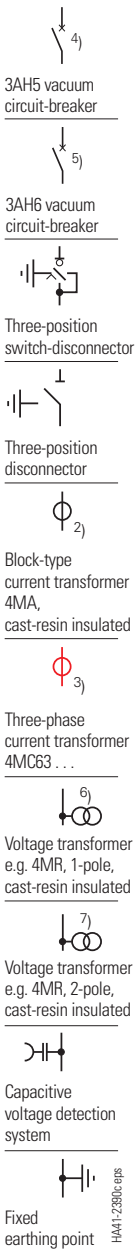
with 2 three-position switch-disconnectors



Type LT22 750 mm wide corresponds to type RK-U with type RK-U



Type LT22-W 750 mm wide corresponds to type RK-U with type RK-U

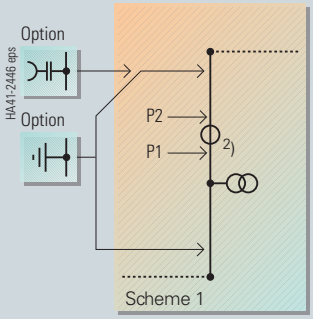


P1 and P2 are terminal designations of the current transformer

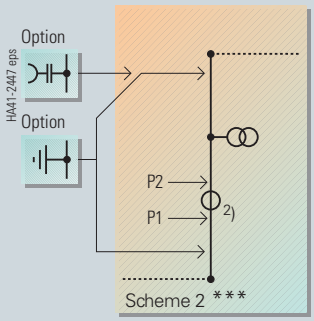
Product Range

Billing metering panels

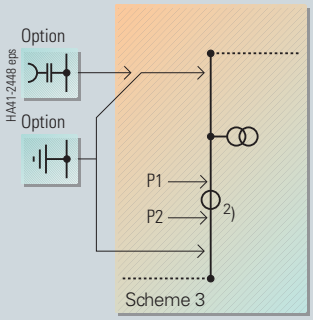
Billing metering panels 630 A and 1250 A
Standard



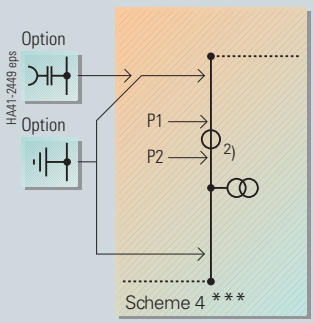
Type ME1 750 mm wide — Standard **: Transfer to the right



Type ME1 750 mm wide — Standard **: Transfer to the right

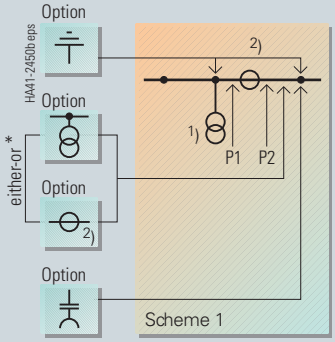


Type ME1 750 mm wide — Standard **: Transfer to the right

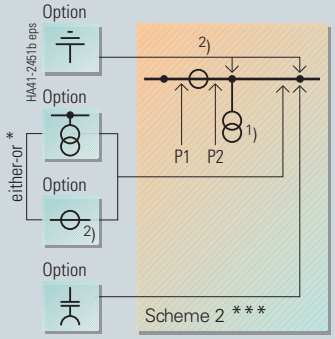


Type ME1 750 mm wide — Standard **: Transfer to the right

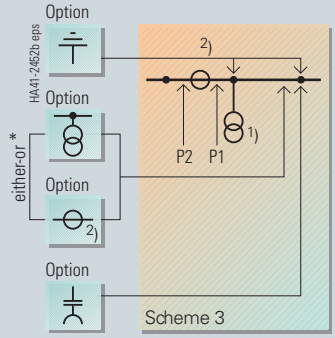
Billing metering panels 630 A and 1250 A
for busbar connection



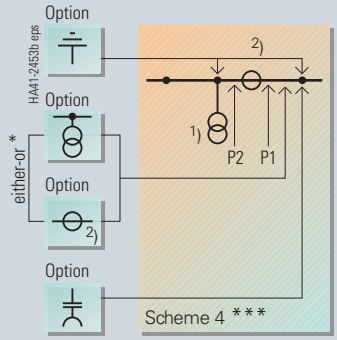
Type ME1-S 750 mm wide — Standard **: Transfer to the right



Type ME1-S 750 mm wide — Standard **: Transfer to the right

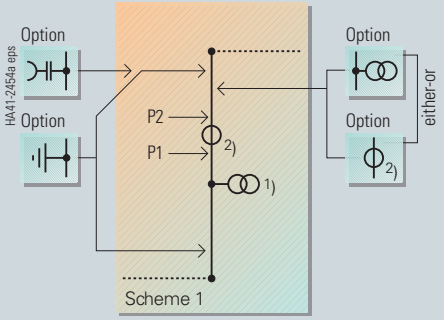


Type ME1-S 750 mm wide — Standard **: Transfer to the right

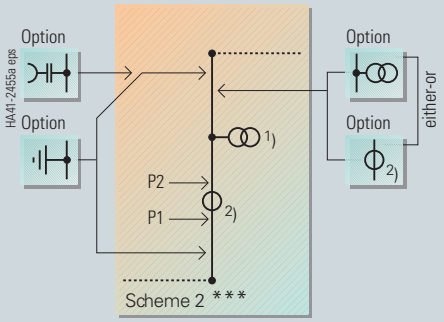


Type ME1-S 750 mm wide — Standard **: Transfer to the right

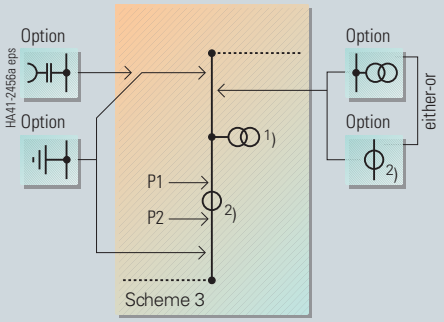
Billing metering panels 630 A and 1250 A
for additional transformer



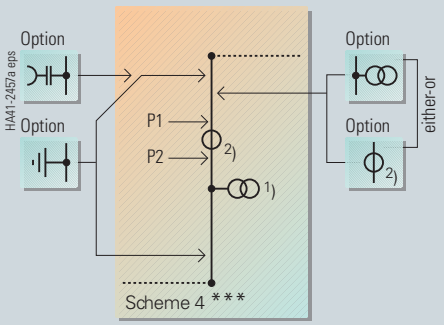
Type ME1-H 750 mm wide — Standard **: Transfer to the right



Type ME1-H 750 mm wide — Standard **: Transfer to the right



Type ME1-H 750 mm wide — Standard **: Transfer to the right



Type ME1-H 750 mm wide — Standard **: Transfer to the right

Capacitive voltage detection system

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

Voltage transformer, e.g. 4MR, 1-pole, cast-resin insulated, or on request:

Voltage transformer, e.g. 4MR, 1-pole, cast-resin insulated, mit HV HRC fuse, instead of a 2nd set of current or voltage transformers

Voltage transformer, e.g. 4MR, 1- or 2-pole, cast-resin insulated

Fixed earthing point

Fixed earthing point for busbar earthing

HA41-2390c eps

P1 and P2 are terminal designations of the current transformer

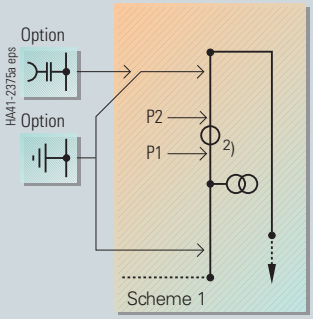
* On request

** Option: Transfer to the left

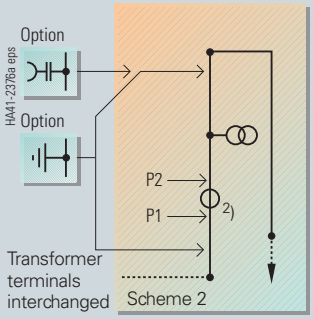
*** Transformer terminals interchanged

Billing metering panels, busbar voltage metering panels, busbar earthing panels and bus riser panels

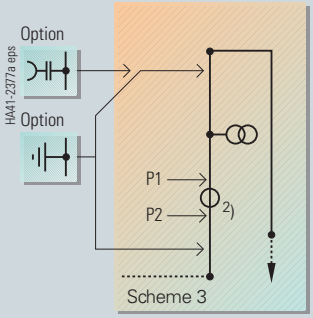
Billing metering panels 630 A and 1250 A **
for cable connection



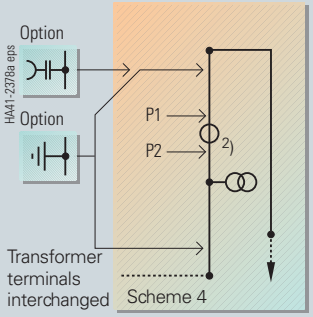
Type ME1-K Standard △):
750 mm wide Transfer to the right



Type ME1-K Standard △):
750 mm wide Transfer to the right

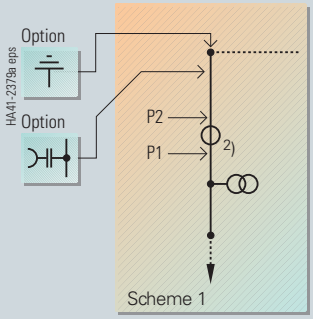


Type ME1-K Standard △):
750 mm wide Transfer to the right

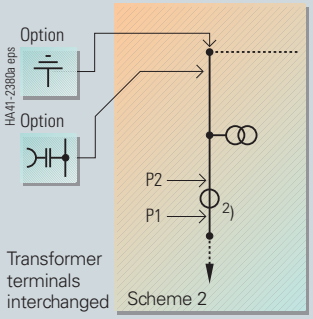


Type ME1-K Standard △):
750 mm wide Transfer to the right

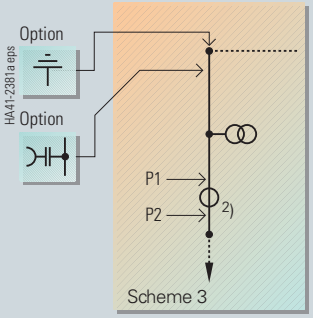
Billing metering panels 630 A and 1250 A **
for busbar connection



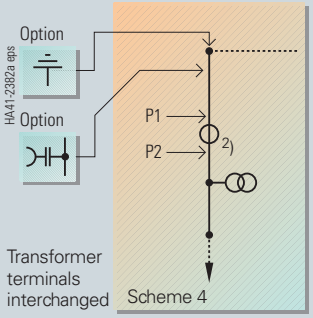
Type ME1-KS as right or left
750 mm wide end panel



Type ME1-KS as right or left
750 mm wide end panel

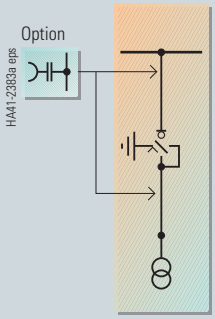


Type ME1-KS as right or left
750 mm wide end panel

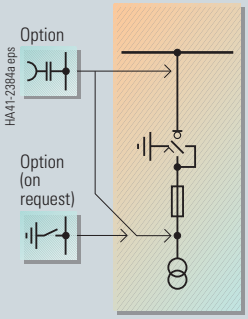


Type ME1-KS as right or left
750 mm wide end panel

Busbar voltage metering panels

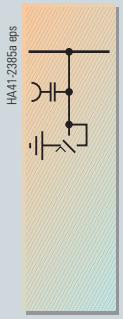


Type ME3
375 mm wide

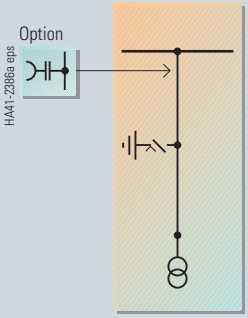


Type ME31-F
500 mm wide

Busbar earthing panels

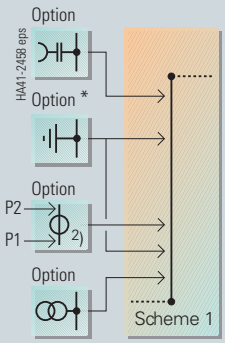


Type SE1
375 mm wide

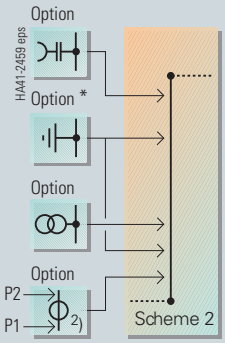


Type SE2
500 mm wide

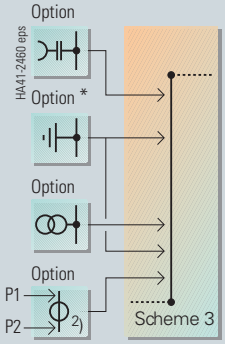
Bus riser panels 630 A and 1250 A



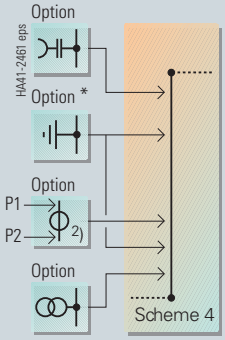
Type HF △△)
375 mm wide



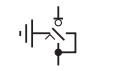
Type HF △△)
375 mm wide



Type HF △△)
375 mm wide



Type HF △△)
375 mm wide



Three-position switch-disconnector

Make-proof earthing switch

Make-proof earthing switch

Earthing switch

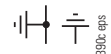
Block-type current transformer 4MA, cast-resin insulated

Voltage transformer, e.g. 4MR, 1- or 2-pole, cast-resin insulated

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

HV HRC fuse

Capacitive voltage detection system



Fixed earthing point

P1 and P2 are terminal designations of the current transformer

* On request up to 12 kV

** Connection for 3 cables possible

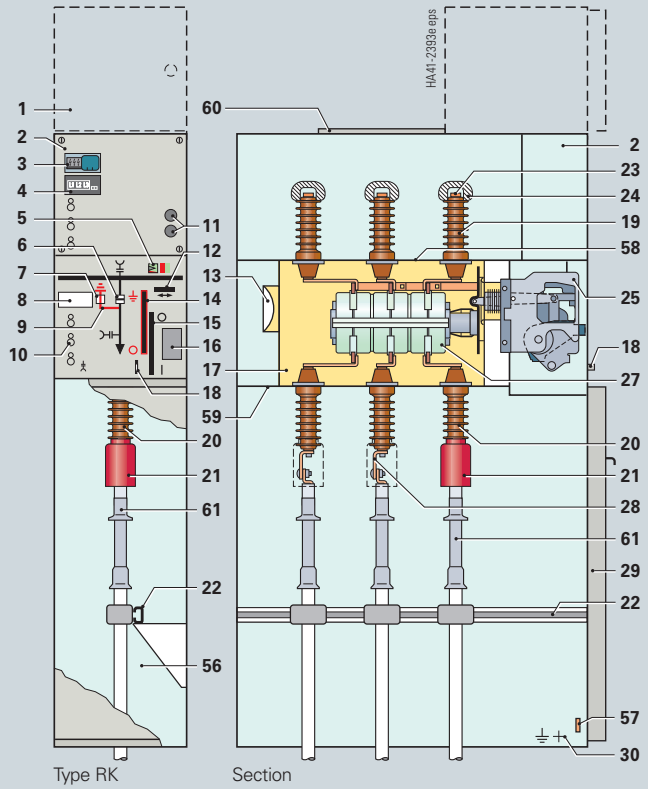
△ Option: Transfer to the left

△△ For attachment to left or right ring-main panels type RK-U

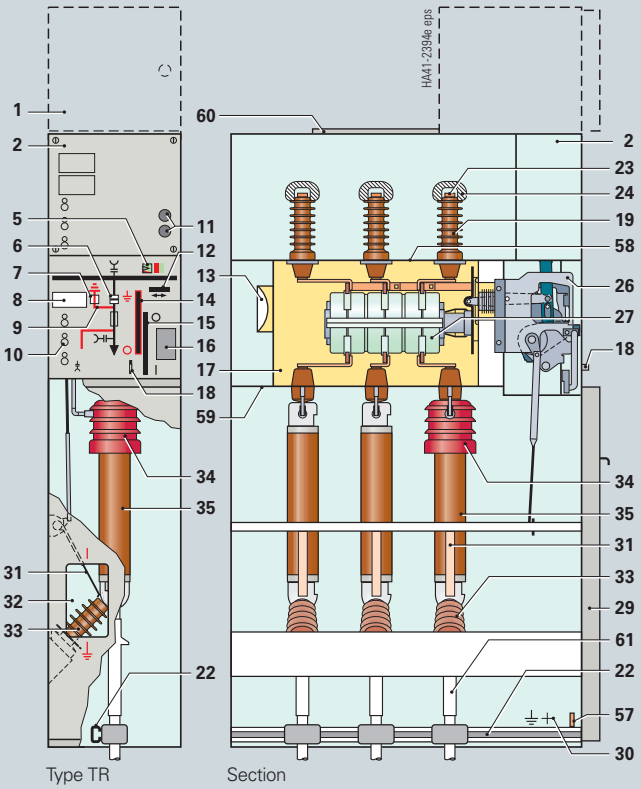
Design

Panel design (examples)

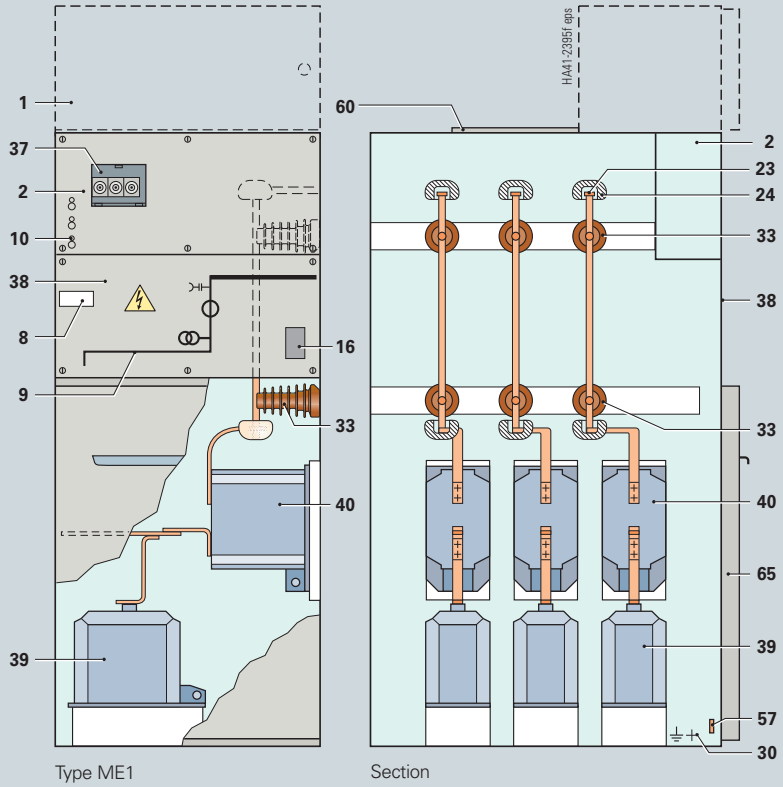
Ring-main panel as feeder



Transformer panel as feeder



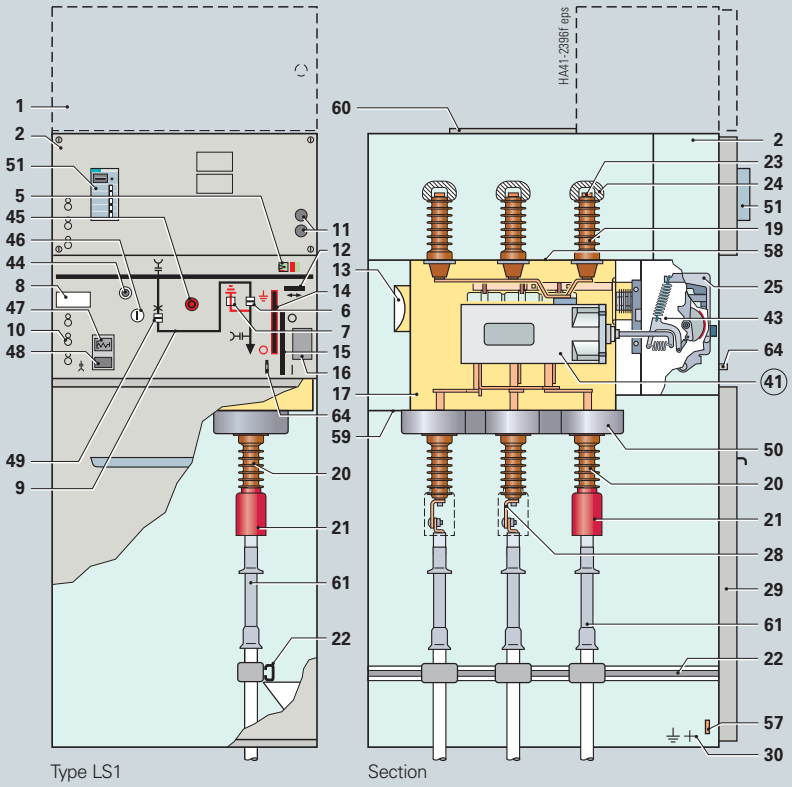
Billing metering panel



Legend for pages 16 and 17

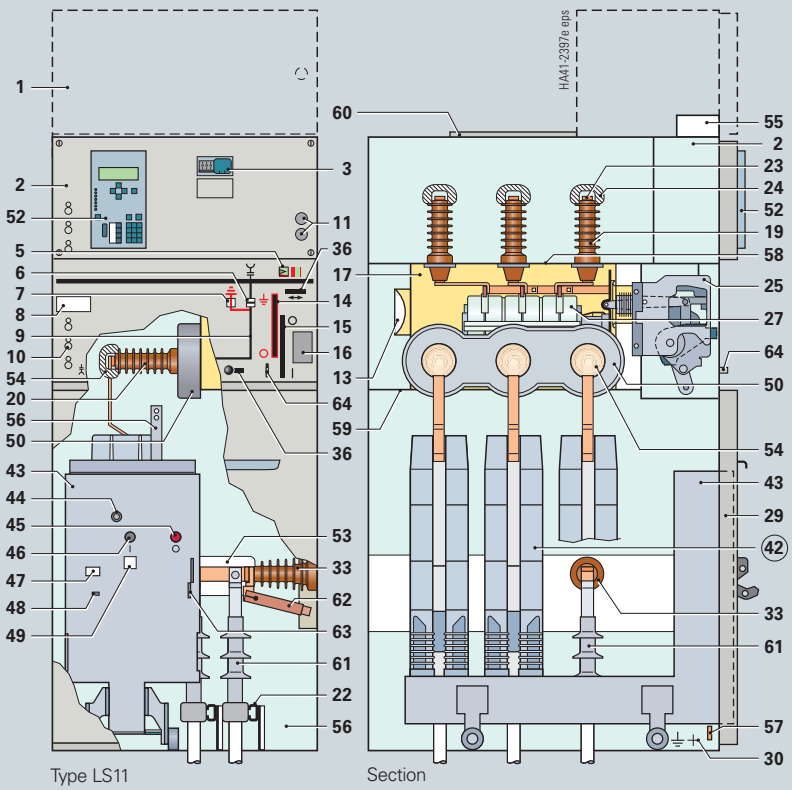
1 Option: Low-voltage compartment
2 Niche for optional low-voltage equipment, cover can be unscrewed
3 Option: CAPDIS voltage detection system
4 Option: Short-circuit/earth-fault indicator
5 Option: Ready-for-service indicator for switching device
6 Switch position indication for load-break function "CLOSED – OPEN"
7 Switch position indication for earthing function "OPEN – EARTHED"
8 Feeder designation label
9 Mimic diagram
10 Option: Sockets for capacitive voltage detection system (depending on arrangement)
11 Option: Momentary-contact rotary control switch "CLOSED – 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 function
16 Rating and type plate
17 Gas-insulated vessel for switching device
18 Interlocking of the cable compartment cover
19 Bushing-type insulator for busbar
20 Bushing-type insulator for feeder

Circuit-breaker panel (with 3AH5 vacuum circuit-breaker)



Type LS1 Section

Circuit-breaker panel (with 3AH6 vacuum circuit-breaker)



Type LS11 Section

21 Insulating sleeve (e.g. for U_p > 95 kV)
22 Cable bracket with clamps (option) for fastening cables
23 Busbar
24 Insulating cap * on busbar
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 dimension drawings)
31 Earthing switch for cable connection
32 Inspection window
33 Post insulator
34 Insulating sleeve
35 Option: HV HRC fuse link
36 Option only for panel types LS11 ... and LT11 ...: Logical mechanical interlocking between circuit-breaker "OPEN" and three-position switch-disconnector and locking device for three-position switch-disconnector
37 Option: ME1- fuse box for voltage transformer
38 Cover, screwed on
39 4MR voltage transformer
40 4MA7 block-type current transformer

Vacuum circuit-breaker:

(41) 3AH5 vacuum circuit-breaker, fixed-mounted
(42) 3AH6 vacuum circuit-breaker, removable

43 Operating mechanism box
44 Manual operation
– for closing with manual operating mechanism
– for emergency operation with motor operating mechanism
45 Mechanical "OFF" pushbutton
46 Mechanical "ON" pushbutton (not supplied with spring-operated mechanism)
47 "Spring charged" indicator
48 Operating cycle counter
49 Switch position indication

50 Option: Three-phase current transformer 4MC63 53
51 Option: Overcurrent-time protection relay SIPROTEC easy 7SJ45
52 Option: Multifunction protection relay SIPROTEC 4 7SJ62
53 Cover * for screwed gland of cable connections
54 Insulating cap * on bushing-type insulator
55 Option: Wiring duct, removable, for control cables and/or bus wires
56 Logical mechanical interlocking for three-position switch
57 Earthing busbar
58 Metal compartmentalization of busbar compartment
59 Metal compartmentalization of cable connection compartment
60 Busbar compartment cover for panel extension
61 Cable sealing end (not included in scope of supply)
62 Option: Feeder earthing via make-proof earthing switch
63 or feeder earthing via vacuum circuit-breaker (= locking device for feeder earthed when circuit-breaker "CLOSED")
64 Interlocking of cable compartment cover in circuit-breaker panels
65 Cover for transformer connection compartment

* For example for $U_p \geq 95$ kV, $U_r \geq 15$ kV

Components

3AH5 and 3AH6 vacuum circuit-breakers

Common features

- Circuit-breakers with vacuum interrupters
- Stored-energy spring-operated mechanism for 10,000 operating cycles
- Maintenance-free for indoor installation according to IEC 62271-1/ VDE 0671-1 *
- Individual secondary equipment

Switching duties and operating mechanisms

The switching duties of the vacuum circuit-breaker are dependent, among other factors, on its type of operating mechanism. Three operating mechanism versions are available:

- Motor operating stored-energy mechanism
  – For auto-reclosure (K),
  – For synchronization and rapid load transfer (U)
- Manual operating stored-energy mechanism
  – For auto-reclosure (K)
- Manual spring-operated mechanism (= spring CLOSED, stored-energy OPEN)
  – Not for auto-reclosure (K)
  – For normal closing and
  – For storage of one opening

Trip-free mechanism

- The vacuum circuit-breakers are fitted with a trip-free mechanism according to IEC 62271-100/ VDE 0671-100

* Standards see page 43

1) Removable after loosening the respective contact connections and fixing bolts

Abbreviations for switching duties and applications:

U = Synchronization and rapid load transfer (make time ≤ 90 ms)

K = Auto-reclosure

For further details, please refer also to Catalogs HG 11.03/04 "3AH3/4 Vacuum Circuit-Breakers"

3AH5 vacuum circuit-breaker

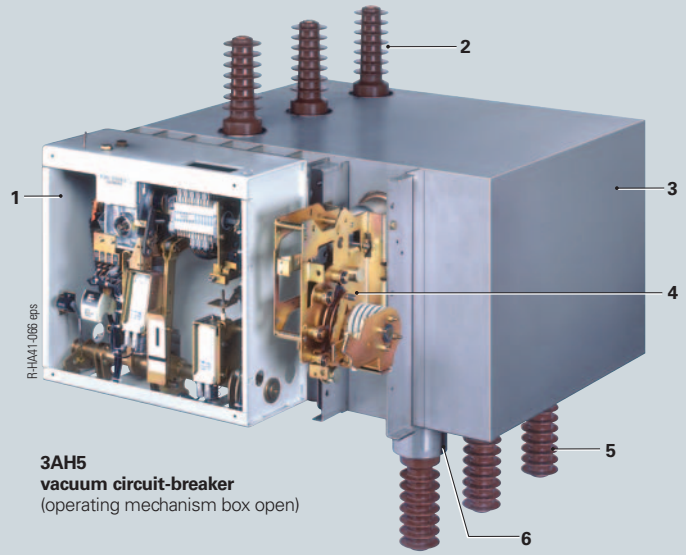
- Metal-enclosed
- Up to 630 A
- Pole parts with vacuum interrupters fixed-mounted in hermetically welded, gas-filled switchgear vessel
- System-conforming use with three-position switch in gas-insulated switchgear vessel
- Operating mechanism arranged outside the switchgear vessel and behind the control board
- Air-insulated primary terminals

Installation in metal-clad panels

- Feeder panels type LS1, panel width 750 mm
- Transfer panels type LS1-U, panel width 750 mm
- Bus sectionalizer panels type LT10 (for adjacent bus riser panel type HF), panel width 750 mm

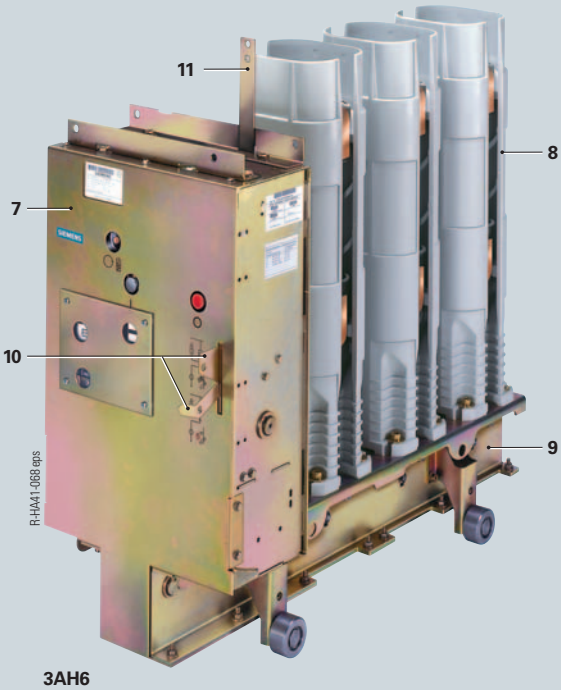
3AH6 vacuum circuit-breaker

- Removable [1] lateral-mechanism circuit-breaker, air-insulated
- Up to 1250 A
- Circuit-breaker poles arranged one behind the other
- Operating mechanism in separate box behind lower panel cover
- Logical mechanical interlocking between 3AH6 vacuum circuit-breaker and three-position switch
- Installation in:
  – Feeder panel type LS11, panel width 750 mm
  – Transfer panel type LS11-U, panel width 750 mm
  – Bus sectionalizer panels type LT11 and LT31 (for adjacent bus riser panel type HF), panel width 750 mm
  – Feeder panel type LS31 (for connection of max. 2 cables), panel width 750 mm
  – Feeder panel type LS32 (for connection of 3 cables; 4 cables on request), panel width 875 mm



3AH5
vacuum circuit-breaker
(operating mechanism box open)

1 Operating mechanism box
2 Bushing-type insulator for busbar
3 Switchgear vessel, gas-filled, with 3AH5 vacuum circuit-breaker and three-position switch-disconnector
4 Spring-operated mechanism of three-position switch-disconnector
5 Bushing-type insulator for feeder
6 Location for three-phase current transformer (option)



3AH6
vacuum circuit-breaker

7 Operating mechanism box with control elements
8 Circuit-breaker poles with vacuum interrupters
9 Truck
10 Locking device (standard when earthing the feeder with closed 3AH6 vacuum circuit-breaker) for the 3AH6 vacuum circuit-breaker in switch position "CLOSED" with three-position switch in switch position "EARTHED"
11 Logical mechanical interlocking between vacuum circuit-breaker and three-position switch (prevents switching of all three switch positions).
Option for 630 A panel types with:
3AH5: LS1, LS1-U, LT10
3AH6: LS11, LS11-U, LT11
Standard for 1250 A panel types with:
3AH6: LS31, LS31-U, LS32 and LT31.

Operating mechanism functions

Motor operating mechanism [1] (M1 *)

In the case of the motor operating mechanism, the closing spring is charged by means of a motor and latched in the charged position (the "spring charged" indication is visible). Closing is effected either by means of an ON pushbutton or a closing solenoid. The closing spring is recharged automatically (for auto-reclosure).

Manual operating stored-energy mechanism

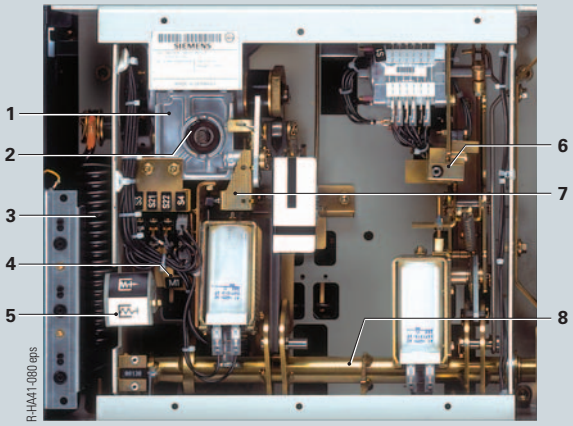
The closing spring is charged by means of the supplied hand crank until latching of the closing latch is indicated (= "spring charged" indication).

Subsequently the vacuum circuit-breaker can be closed either manually or electrically. The closing spring can be recharged manually. The "possibility to close" is thus stored once more (for auto-reclosure).

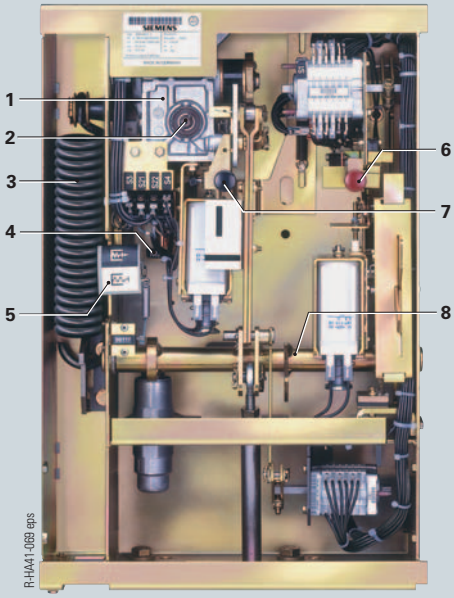
Manual spring-operated mechanism (= spring CLOSED, stored-energy OPEN)

The closing spring of the vacuum circuit-breaker is charged by means of the supplied hand crank until the vacuum circuit-breaker closes. Subsequently either manual or electrical opening is possible.

Vacuum circuit-breakers with spring-operated mechanism are not suitable for auto-reclosure.



Operating mechanism elements of the 3AH5 vacuum circuit-breaker



Operating mechanism elements of the 3AH6 vacuum circuit-breaker

Operating mechanism elements

1 Gear

2 Coupling on gear for operation with hand crank
- For closing with manual spring-operated mechanism
- For charging the closing spring with stored-energy mechanism

3 Closing spring

4 Motor (M1 *)

5 "Closing spring charged" indicator

6 Circuit-breaker "OPEN"

7 Circuit-breaker "CLOSED"

8 Operating rod

Differences between the vacuum circuit-breakers depending on the operating mechanism version

Operating mechanism version	Motor operating stored-energy mechanism	Manual operating stored-energy mechanism	Manual spring-operated mechanism
Typical uses	Utility substations and industrial plants	Classic transfer substations and substations without auxiliary voltage supply	Simple utility substations (circuit-breaker as transformer switch)
Mechanism function	Stored-energy CLOSED, stored-energy OPEN	Stored-energy CLOSED, stored-energy OPEN	Spring CLOSED, stored-energy OPEN
Mechanism operation	With motor [1], manual (emergency) operation at the panel including anti-pumping	With hand crank	With hand crank
Closing the vacuum circuit-breaker	Electrically [2] or mechanically at the panel with pushbutton	Mechanically at the panel with pushbutton, option: electrically [2]	Mechanically at the panel with hand crank (charging process)
Closing solenoid, e.g. for remote electrical closing	Always provided, with electrical signal "closing spring charged"	Option	Without
Rated switching sequence	O-*t*-CO or O-*t*-CO-*t'*-CO	O-*t*-CO	O or CO
Auto-reclosure (K)	Suitable (multiple auto-reclosure possible)	Suitable (only with closing solenoid)	–

1) Motor rating at
24 V to 220 V DC: 350 W
110 V and 220 V AC: 400 VA

2) With closing solenoid

* Equipment code

Abbreviations:

O = OPEN operation

CO = CLOSE operation with subsequent OPEN operation at the shortest internal close-open time of the vacuum circuit-breaker

t = Dead time 0.3 s

t' = Dead time 3 min

For further details, please refer also to Catalogs HG 11.03/04 "3AH3/4 Vacuum Circuit-Breakers"

Components

Secondary equipment of the 3AH5 and 3AH6 vacuum circuit-breakers

The scope of the secondary equipment of the 3AH vacuum circuit-breaker depends on the type of application and offers a wide range of variations, thus allowing even the highest requirements to be satisfied.

Closening solenoid

- Type 3AY15 10 (Y9 *)
- For electrical closing

Shunt releases

- Types:
– Standard: 3AY15 10 (Y1 *)
– Option: 3AX11 01 (Y2 *), with energy store
- Tripping by protection relay or electrical operation

Current transformer-operated release

- Type 3AX11 04 (Y6 *) for tripping pulse ≥ 0.1 Ws in conjunction with suitable protection systems, e.g. 7SJ4 protection relay, SEG relay (other designs on request)
- Used where no external auxiliary voltage is available, tripping by protection relay

Undervoltage release

- Type 3AX11 03 (Y7 *)
- Comprising:
– Energy store and unlatching mechanism
– Electromagnetic system, to which voltage is permanently applied in the CLOSED position of the vacuum circuit-breaker; tripping is initiated when this voltage drops
- Connection to voltage transformer possible

Position switch

- Type 3SE4 (S4 *)
- For signalling "closing spring charged"
- Only in conjunction with stored-energy mechanisms

Anti-pumping (standard) (mechanical and electrical)

- Function: If CLOSE and OPEN commands are applied simultaneously and continuously to the vacuum circuit-breaker, this reverts to its OPEN position after closing. The circuit-breaker remains in this position until the OPEN command is eliminated and a new CLOSE command is given. Thus continuous closing and opening (= pumping) is avoided.

Breaker tripping signal (standard)

- For electrical signalling (as pulse > 10 ms), e.g. to remote control systems, in the case of automatic tripping (e.g. protection)
- Via NO contact (S6 *) and cut-out switch (S7 *)

Varistor module

- As overvoltage protection for protection devices in conjunction with inductive devices in the vacuum circuit-breaker (limiting to approx. 500 V)
- Recommended for auxiliary voltages ≥ 60 V DC

Auxiliary switch

- Type 3SV9 (S1 *)
- Standard: 6NO+6NC, of which 2NO+2NC +2 changeover contacts are free [1)]
- Option: 12NO+12NC, of which 7NO+4NC+2 changeover contacts are free [1)]

Mechanical interlocking

- Dependent on the type of operating mechanism:
– Spring-operated mechanism or
– Stored-energy mechanism
- Option: Switchgear interlocking with the three-position switch-disconnector

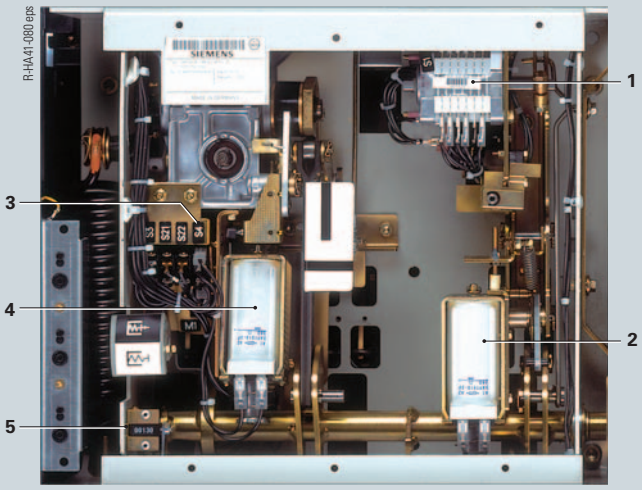
For further details concerning interlocking functions, refer to page 28.

1) For utilization by the customer

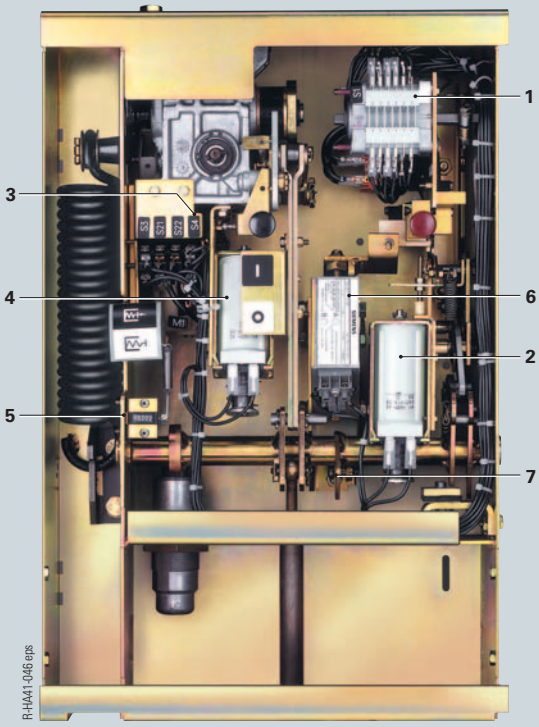
* Equipment code

Abbreviations:
NO = normally-open contact
NC = normally-closed contact

For further details, please refer also to
Catalogs HG 11.03/04 "3AH3/4 Vacuum Circuit-Breakers"



Secondary equipment of the 3AH5 vacuum circuit-breaker (typical example)



Secondary equipment of the 3AH6 vacuum circuit-breaker (typical example)

Basic equipment

1 Auxiliary switch 6NO+6NC (S1 *), option: 12NO+12NC

2 1st release (Y1 *)

Additional equipment

3 Position switch (S4 *)

4 Closing solenoid (Y9 *)

5 Operating cycle counter

6 2nd release (e.g. Y2 *, Y6 * and Y7 *)

7 Mechanical interlocking with interrogation of the three-position switch-disconnector

Three-position switches as three-position switch-disconnectors or disconnectors

Common features

- Metal-enclosed
- Located in a gas-insulated switchgear vessel
- Switch positions: CLOSED-OPEN-EARTHED
- No cross insulation between phases
- Three-position switch with air-insulated primary connections for busbar and feeder
- Operation via a gas-tight welded-in metal bellows in the front of the switchgear vessel

Mode of operation

The switch shaft with the moving contact pieces rotates inside the chamber containing the fixed contact pieces.

Compression vanes, which rotate in conjunction with the switch shaft, divide the arcing chamber into two subchambers each of which changes in conjunction with the rotation.

During the switching movement, the compression vanes generate a pressure difference between the subchambers. The SF_6 gas flows through a nozzle, causes a directional blow-out of the breaking arc and quenches it rapidly.

Interlocking is not necessary as the "CLOSED" and "EARTHED" functions cannot be implemented simultaneously.

Three-position switch-disconnector 630 A

- Up to 630 A
- With gas-insulated, maintenance-free quenching principle

Operating mechanism

- Spring-operated mechanism with detachable lever
- Manual operation with the aid of a detachable lever
- Options:
  - Mechanical ready-for-service indication
  - Auxiliary switch
  - Motor operating mechanism for switch-disconnector
  - Locking device
- Spring-operated/stored-energy mechanism for transformer panel types TR, TR1 and ME31-F

Interlocks

- Opening of lower panel cover or cable compartment cover only in "EARTHED" position
- Option: Logical mechanical interlocking of three-position switch-disconnector with vacuum circuit-breaker

Three-position disconnector 1250 A

- Up to 1250 A, for panel types LS31, LS31-U, LS32 and LT31
- Metal-enclosed

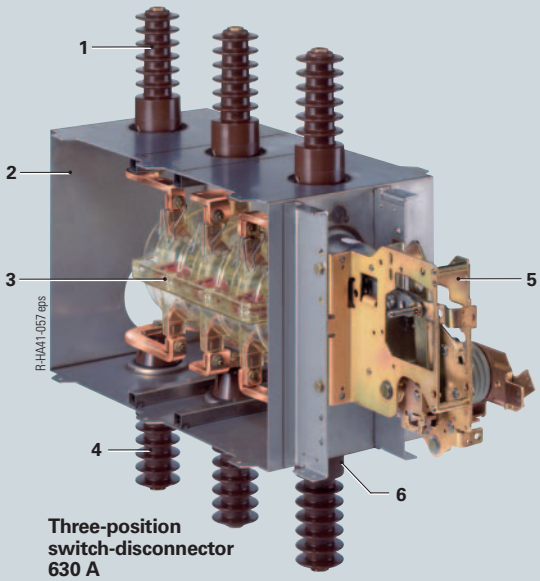
Operating mechanism

- Spring-operated mechanism with detachable lever
- Manual operation with the aid of a detachable lever
- Options:
  - Mechanical ready-for-service indication
  - Auxiliary switch
  - Motor operating mechanism for disconnector
  - Locking device

Interlocks

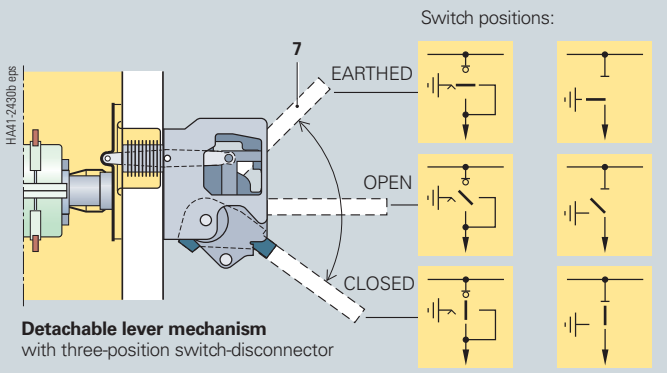
- Opening of lower panel cover or cable compartment cover only in "EARTHED" position
- Logical mechanical interlocking with vacuum circuit-breaker

Note: Standards see page 43



Three-position switch-disconnector 630 A

1 Bushing-type insulator for busbar
2 Switchgear vessel for gas insulation
3 Three-position switch-disconnector
4 Bushing-type insulator for feeder
5 Spring-operated mechanism with detachable lever
6 Mounting location for three-phase current transformer (option)



Detachable lever mechanism with three-position switch-disconnector

7 Detachable lever, inserted

Switching functions of the three-position switch-disconnector 630 A

- Switching and disconnecting under load
- Switching function as general purpose switch-disconnector (class E3 and M1) according to
  - IEC 60265-1
  - VDE 0670-301
  - IEC 62271-102
  - VDE 0671-102
- Make-proof earthing function

Switching functions of the three-position disconnector 1250 A

- Disconnecting
- Switching functions according to
  - IEC 62271-102
  - VDE 0671-102
- Earthing function
- For panel types LS31, LS31-U, LS32 and LT31

Components

Busbars, HV HRC fuse assembly

Busbars

- Safe-to-touch due to metallic enclosure
- Metal-clad busbar compartment
- Three-pole design, bolted from panel to panel
- Easy switchgear extension
- Made of copper:
  – Fl E-Cu for ≤ 630 A
  – Rd E-Cu for > 630 A to 1250 A
- Versions:
  – 630 A, > 12 kV: With insulating shrink-on sleeve
  – 1250 A, up to 24 kV: Rd E-Cu bare

HV HRC fuse assembly

- For transformer panel types TR and TR1
- For busbar voltage metering panel type ME31-F
- HV HRC fuse links acc. to DIN 43625 (main dimensions) with striker pin; version "medium" acc. to IEC 60282/ VDE 0670-4 *
  – As short-circuit protection before transformers
  – With selectivity (depending on correct selection) to upstream and downstream connected equipment
- Requirements fulfilled as HV alternating current switch fuse combination
- Selection of HV HRC fuses for transformers
- Fuse replacement possible only when feeder is earthed
- Option: Shunt release on operating mechanism of three-position switch-disconnector
- Option: "Tripped indication" of three-position switch-disconnector in transformer feeder (transformer switch) for remote electrical indication with one normally-open contact (1NO)

"HV HRC fuse tripped"

Following the tripping of an HV HRC fuse link, the mechanism for charging the spring must be set to the "OPEN" position

Subsequently, earthing can be implemented by means of the three-position switch-disconnector and e.g. the fuse can be replaced.

Replacement of HV HRC fuse links

- Isolating and earthing of the transformer feeder
- Subsequent manual replacement of the HV HRC fuse link

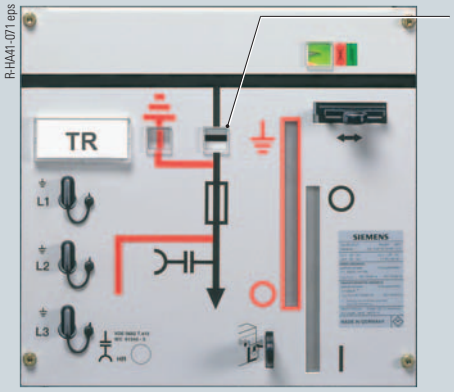
* Standards see page 43

Busbars

1 Busbar
2 Insulating cap (e.g. for U_r > 17.5 kV) on busbar
3 Bushing-type insulator for busbar

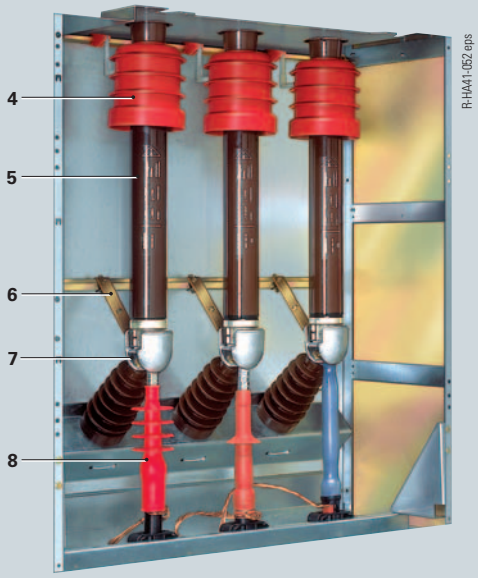
Busbar compartment extending over 3 panels (example)
Side view

HV HRC fuse assembly



"CLOSED" indication, manual or motor operation
Indication "HV HRC fuse tripped" or "shunt release tripped"
"OPEN" indication

Control board of a transformer feeder



4 Insulating sleeve
5 HV HRC fuse (not included in the scope of supply)
6 Earthing switch (rated short-circuit making current I_{ma} = 4 kA) for cable connection
7 Cover for bolted cable lug connection (e.g. for rated voltage U_r = 24 kV)
8 Cable sealing end (not included in the scope of supply)

HV HRC fuses in transformer panel type TR
Side view

Allocation of HV HRC fuses and transformers

The table opposite shows the recommended 3GD HV HRC fuse links (electrical data valid for ambient temperatures of up to 40 °C) for the fuse protection of transformers

Recommendation

The three-position switch-disconnector in the transformer feeder (transformer switch) was combined with Siemens HV HRC fuse links of type 3GD and tested *.

Standards

HV HRC fuse links with striker pin, "medium" version according to

- IEC 60282-1 */VDE 0670-4 *
- IEC 60787/VDE 0670-402
- DIN 43625 main dimensions

Rated system voltage	Transformer			Rated normal current of the HV HRC fuse	
	Rating S_N	Relative impedance voltage u_k	Rated current I_1	Lowest value	Highest value
kV	kVA	%	A	A	A
6 to 7.2	50	4	4.8	16	16
	75	4	7.2	16	16
	100	4	9.6	20	25
	125	4	12.0	25	25
	160	4	15.4	32	32
	200	4	19.2	40	40
	250	4	24.0	50	50
	315	4	30.3	50	63
	400	4	38.4	63	100
	500	4	48.0	63	100
	630	4	61.0	80	100
	800	5 to 6	77.1	on request	on request
10 to 12	50	4	2.9	10	10
	75	4	4.3	10	10
	100	4	5.8	16	16
	125	4	7.2	16	16
	160	4	9.3	20	20
	200	4	11.5	25	25
	250	4	14.5	25	32
	315	4	18.3	32	40
	400	4	23.1	40	50
	500	4	29.0	50	63
	630	4	36.4	63	80
	800	5 to 6	46.2	63	80
	1000	5 to 6	58.0	80	100
	1250	5 to 6	72.3	100	100
	1600	5 to 6	92.5	125	125
13.8	50	4	2.1	6	6
	75	4	3.2	10	10
	100	4	4.2	10	10
	125	4	5.3	16	16
	160	4	6.7	16	16
	200	4	8.4	16	20
	250	4	10.5	20	25
	315	4	13.2	25	32
	400	4	16.8	32	32
	500	4	21.0	40	50
	630	4	26.4	50	50
	800	5 to 6	33.5	50	50
	1000	5 to 6	41.9	63	63
	1250	5 to 6	52.4	80	80
15 to 17.5	50	4	1.9	6	6
	75	4	2.9	10	10
	100	4	3.9	10	10
	125	4	4.8	10	10
	160	4	6.2	16	16
	200	4	7.7	16	20
	250	4	9.7	20	25
	315	4	12.2	25	25
	400	4	15.5	32	32
	500	4	19.3	32	40
	630	4	24.3	40	50
	800	5 to 6	30.9	50	50
	1000	5 to 6	38.5	63	63
	1250	5 to 6	48.2	63	80
20 to 24	50	4	1.5	6	6
	75	4	2.2	6	6
	100	4	2.9	10	10
	125	4	3.6	10	10
	160	4	4.7	10	10
	200	4	5.8	16	16
	250	4	7.3	16	16
	315	4	9.2	20	20
	400	4	11.6	20	25
	500	4	14.5	25	32
	630	4	18.2	32	40
	800	5 to 6	23.1	32	32
	1000	5 to 6	29.0	40	40
	1250	5 to 6	36.0	50	50
	1600	5 to 6	46.5	63	80
	2000	5 to 6	57.8	80	80

* Standards see page 43

Components

Operating mechanisms for three-position switches

Manual operating mechanism

- Standard:
  As detachable lever mechanism
- Option: Different operating handles [1] for the operating mechanisms of the switch-disconnector and make-proof earthing switch
- Spring-operated mechanism
  – For ring-main panel types RK and RK1
  – For all three-position switches (except in panel types TR and TR1)
- Spring-operated/stored-energy mechanism
  For transformer panel types TR and TR1 as well as for busbar voltage metering panel type ME31-F

The three-position switch is operated via a rocker with metal bellows which is gas-tight and welded at the switchgear vessel.

Motor operating mechanism (option)

The manual operating mechanisms can be equipped with motor operating mechanisms both for the three-position switch-disconnector and for the three-position disconnector.

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

Electrical operation:

- Standard: Remote operation (applied to terminal)
- Option: Local operation by momentary-contact rotary control switch

Shunt release (option)

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 magnetic 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.

Auxiliary switch (option)

Each operating mechanism of the three-position switch-disconnector can be optionally equipped with an auxiliary switch for the switch position indication:
– Function switch-disconnector or disconnector: CLOSED and OPEN: 2NO + 2NC
– Function earthing switch at the three-position switch: CLOSED and OPEN: 2NO + 2NC
– Separate earthing switch (at the feeder): CLOSED and OPEN: 2NO + 2NC

1) According to VDN*/VDEW** recommendation

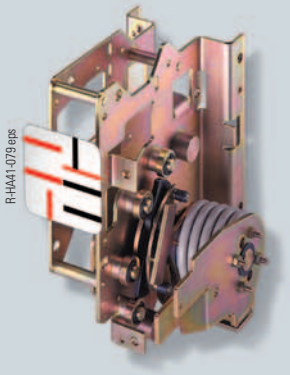
* Association of German network operators VDN e. V. in Germany (as of 2003)

** Association of German Power Stations – VDEW e. V. (until 2003)

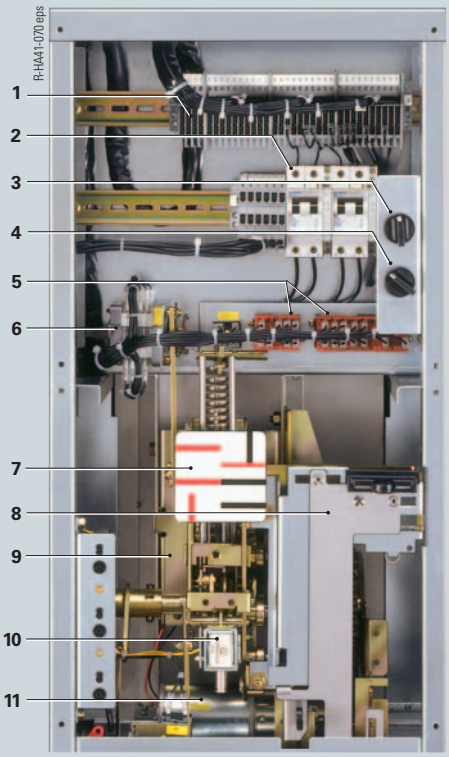
Abbreviations:

NO = normally-open contact
NC = normally-closed contact

Operating mechanisms (examples)



Detachable lever mechanism as spring-operated mechanism
for ring-main feeders



Operating mechanism parts in transformer feeder

1 Terminal strip located in the low-voltage niche (optionally in the low-voltage compartment)
2 M.c.b. (option) in the low-voltage niche
3 Local-remote switch (option)
4 Actuation for the motor operating mechanism of the three-position switch-disconnector
5 Auxiliary contactors of the motor operating mechanism for locking the motor
6 Auxiliary switch
7 Switch position indicator for the three-position switch-disconnector
8 Locking device (standard for motor operating mechanism)
9 Operating mechanism for the three-position switch-disconnector coupled with the motor operating mechanism
10 Shunt release (option)
11 Motor operating mechanism

Technical data of the auxiliary switch

Breaking capacity

AC operation at 40 Hz to 60 Hz		DC operation		
Operating voltage	Normal current	Operating voltage	Normal current resistive inductive: T=20 ms	
V	A	V	A	A
up to 230	10	24	10	10
		48	10	9
		60	9	7
		110	5	4
		240	2.5	2

Rated switching capacity

Rated insulation voltage 250 V AC/DC
Insulation group C to VDE 0110
Continuous current 10 A
Making capacity 50 A

Voltage detection systems acc. to IEC 61243-5 or VDE 0682-415

- To verify safe isolation from supply
- Detection systems
  – Standard: HR system with plug-in indicator
  – Option: LRM system with plug-in indicator
  – LRM system with integrated indicator type VOIS+, VOIS R+
  – LRM system with integrated indicator, with integrated repeat test of the interface, with integrated function test type CAPDIS-S1+
  – LRM system with integrated indicator, with integrated repeat test of the interface, with integrated function test, with integrated signalling relay type CAPDIS-S2+

HR system, LRM system

- Verification of safe isolation from supply phase by phase by insertion in each socket pair
- Indicator suitable for continuous operation
- Safe-to-touch
- Routine-tested
- Measuring system and voltage indicator can be tested
- Voltage indicator flashes when high voltage is present

VOIS+, VOIS R+

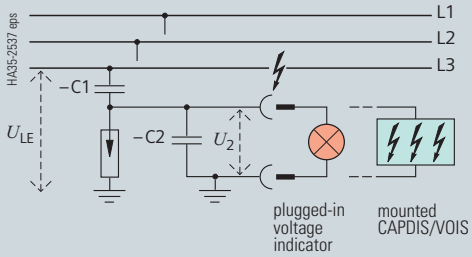
- Integrated display, without auxiliary power
- With indication "A1" to "A3", (see legend)
- Maintenance-free; repeat test required
- With integrated 3-phase test socket for phase comparison (also suitable for plug-in voltage indicator)
- Degree of protection IP 67, temperature range –25 °C to +55 °C
- With integrated signalling relay (only VOIS R+):
  – "M1": Voltage present at least at one phase L1, L2 or L3
  – "M2": Voltage not present at L1, L2 and L3

Voltage indicators and detection systems

Plug-in voltage indicator
per phase at the panel front

Integrated voltage indicator VOIS+

Integrated voltage detection system CAPDIS-S1+, -S2+

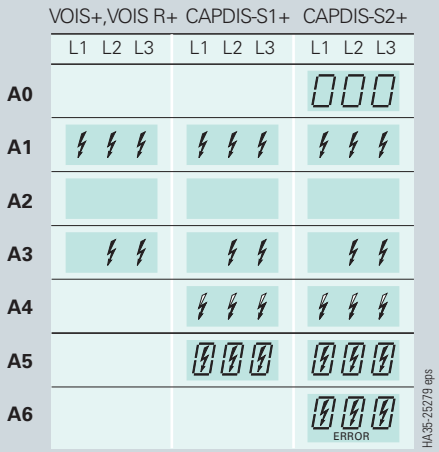


Voltage indication
with capacitive voltage divider (principle)

– C_1 Capacity integrated into bushing
– C_2 Capacity of the connection leads and of the voltage indicator to earth

$U_{LE} = U_N / \sqrt{3}$ during rated operation in the three-phase system
$U_2 = U_A$ = Voltage at the capacitive interface of the switchgear or at the voltage indicator

Symbols shown



A0 CAPDIS-S2+: Operating voltage not present
A1 Operating voltage present
A2 – Operating voltage not present
– For CAPDIS-S2+: Auxiliary power not present
A3 Failure in phase L1, operating voltage at L2 and L3 (for CAPDIS-Sx+ also indication: Earth fault)
A4 Voltage (not operating voltage) present
A5 Indication "Device-Function-Test" passed
A6 Indication "ERROR", e.g. in case of missing auxiliary voltage (see: "error indication M4")

CAPDIS-Sx+

Common features

- Maintenance-free
- Integrated display, without auxiliary power
- Integrated repeat test of the interfaces (self-testing)
- With integrated function test (without auxiliary power) by pressing the "Device-Function-Test" pushbutton
- With integrated 3-phase test socket for phase comparison (also suitable for plug-in voltage indicator)
- Degree of protection IP 54, temperature range –25 °C to +55 °C
- With circuit capacity

Features of CAPDIS-S1+

- Without auxiliary power
- With indication "A1" to "A5" (see legend)
- Without ready-for-service monitoring
- Without signalling relay (thus without auxiliary contacts)

Features of CAPDIS-S2+

- With indication "A0" to "A6" (see legend)
- Only by pressing the "Device-Function-Test" pushbutton: "ERROR" indication (A6), e.g. in case of missing auxiliary voltage
- With ready-for-service monitoring (external auxiliary power required)
- With integrated signalling relay for signalling "M1" to "M4" (auxiliary power required):
  – "M1": Voltage present at phases L1, L2, L3
  – "M2": Voltage not present at L1, L2 and L3 (= active zero indication)
  – "M3": Earth fault or voltage failure, e.g. in one phase
  – "M4": External auxiliary power missing (operating voltage present or not)

Components

Indicating and measuring equipment

Short-circuit/earth-fault indicators (option)

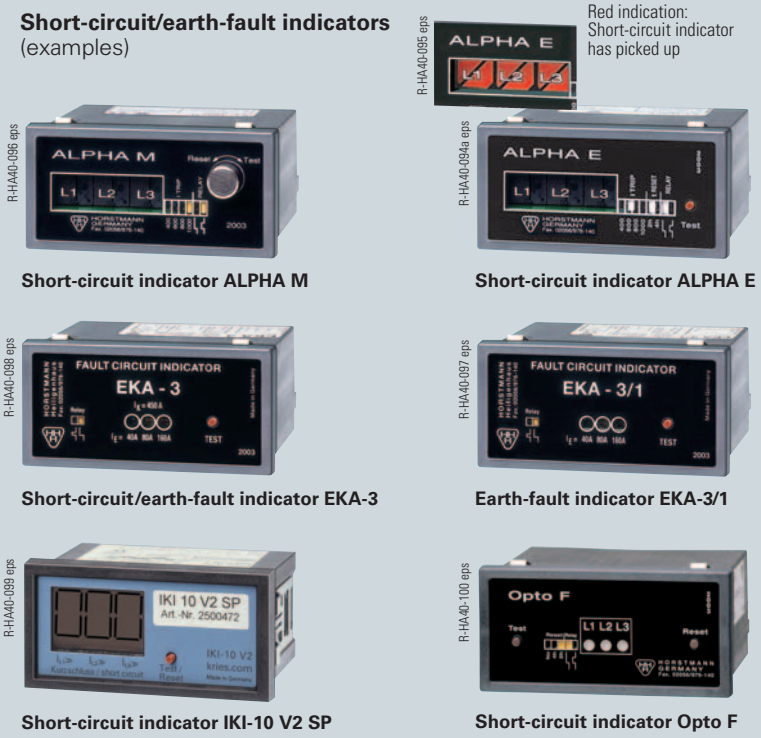
All ring-main feeders can be optionally equipped with a 3-phase short-circuit or earth-fault indicator.

Characteristics

- Use depends on network conditions
- Optical signal when a preselected pickup value is exceeded
- Depending on the type, reset
  – Manually
  – Automatically after a preset time (e.g. 2 hours)
- With ring-type sensors
- Display panel, withdrawable housing, depending on the type
- Response values settable (depending on the type of device)
- Options:
  Remote electrical indication via contact (1 NO + 1 NC) depending on the type of device settable as passing contact (W) or maintained contact (D).

Short-circuit/earth-fault indicators (examples)

Red indication: Short-circuit indicator has picked up



Short-circuit indicator ALPHA M

Short-circuit indicator ALPHA E

Short-circuit/earth-fault indicator EKA-3

Earth-fault indicator EKA-3/1

Short-circuit indicator IKI-10 V2 SP

Short-circuit indicator Opto F

Selection of short-circuit and earth-fault indicators

Indicator type [1]	Reset		Remote reset: A: by aux. voltage B: via NO contact (floating)	Automatical reset after return of power supply	Response values Short-circuit current I_K (A) Standard, other values on request	Response values Earth-fault current I_E (A) Standard, other values on request	Opt.: Remote indicat. as W (passing contact = standard) D (maintained contact = option)
	Manual	Automatical after					
Short-circuit indicator							
ALPHA M [5]	x	–	–	–	400, 600, 800, 1000	–	W, D
ALPHA E [5]	x	2 h or 4 h	A (12-60 V AC/DC)	–	400, 600, 800, 1000	–	W, D
GAMMA 5.0 [2] [5]	x	• 4 s after return of power supply • 2 h or 4 h	–	x (230 V AC, 50 Hz)	400, 600, 800, 1000	–	W, D
ALPHA – automatic [5]	x	3 h	A (12-60 V AC/DC)	–	self-adjusting, change of current with 150 A ≤ Δ i ≤ 300 A, response time: t ≤ 20 ms	–	W, D
KA-Opto F [3] [5] with 3 LED indications	x	after 2 h or 4 h	B (1NO)	–	400, 600, 800, 1000	–	W, D
IKI-10 V2 SP [6]	x	after 2 h or 4 h	B (1NO)	–	400, 600, 800, 1000	–	W, D
IKI-10 V2 L [6]	x	after 2 h or 4 h	B (1NO)	x (110-230 V AC, 50/60 Hz)	400, 600, 800, 1000	–	W, D
Earth-fault/short-circuit indicator							
EKA-3 [4] [5]	–	–	–	x (230 V AC, 50 Hz)	450	40, 80, 160	W, D
DELTA M [5]	x	–	–	–	400, 600, 800, 1000	200	W, D
DELTA E [5]	x	after 2 h or 4 h	A (12-60 V AC/DC)	–	400, 600, 800, 1000	200	W, D
KA-Opto F+E [5]	x	after 2 h or 4 h	B (1NO)	–	400, 600, 800, 1000	40, 60, 80	W, D
IKI-10 V2 SP/ES [6] [7]	x	after 2 h or 4 h	B (1NO)	–	400, 600, 800, 1000	10% or 25% of I_K	W, D
IKI-10 V2 L/ES [6] [7]	x	after 2 h or 4 h	B (1NO)	x (110-230 V AC, 50/60 Hz)	400, 600, 800, 1000	10% or 25% of I_K	W, D
Earth-fault indicator							
EKA-3/1 [4] [5]	–	–	–	x (230 V AC, 50 Hz)	–	40, 80, 160	W, D
IKI-10 V2 L/ES [6] [7]	x	after 2 h or 4 h	B (1NO)	x (110-230 V AC, 50/60 Hz)	–	30, 55, 80, 100	W, D

1) Further types and other makes available on request

2) External auxiliary voltage required (120 V AC or 240 V AC)

3) Power supply required for the LED indications (indication by means of an integrated battery or 12 V AC to 60 V AC voltage)

4) External auxiliary voltage required (230 V AC, 50 Hz), device with integrated battery

5) Make: Horstmann

6) Make: Kries Energietechnik

7) Ring-type sensor: d = 110 mm

Ready-for-service indicator

Characteristics

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

Mode of operation

For the ready-for-service indicator, a gas-tight measurement box is installed on the inside of the switchgear vessel.

A coupling magnet, which is fitted to the bottom end of the measurement box, transmits its position to an outside armature through the stainless steel switchgear vessel. This armature moves the ready-for-service indicator of the switchgear.

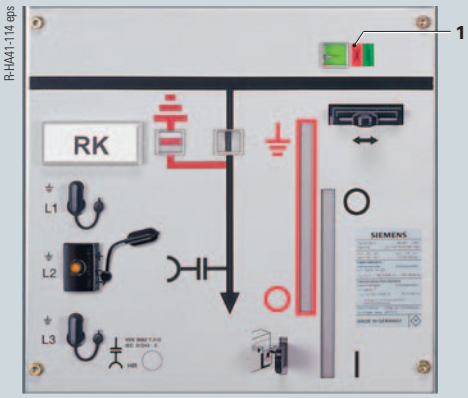
While changes in the gas density during the loss of gas, which are decisive for the insulating capacity, are displayed, temperature-dependent changes in the gas pressure are not. The gas in the measurement box has the same temperature as that in the switchgear.

The temperature effect is compensated via the same pressure change in both gas volumes.

Verification of correct terminal-phase connections

- Possible by means of a phase comparison test unit (can be ordered separately)
- Safe-to-touch handling of the phase comparison test unit by inserting it into the capacitive taps (socket pairs) of the switchgear or the feeders.

Ready-for-service indicator



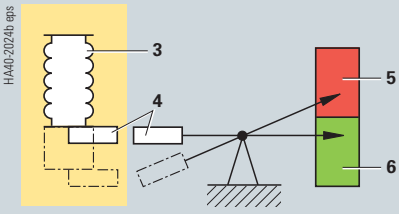
Control board of a ring-main panel (example)

Indicator on control board: Ready for service

1 Ready-for-service indicator (option)

2 Indicator green: Ready for service (indicator red: Not ready for service)

Gas monitoring



Stainless-steel vessel filled with SF_6 gas, gauge pressure 500 hPa at 20 °C

Ready-for-service indicator

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

3 Measurement box

4 Magnetic coupling

5 Red indication: Not ready for service

6 Green indication: Ready for service

Phase comparison test units

Make: Pfisterer, type EPV
– For plug-in voltage detection systems
– For integrated voltage detection systems (CAPDIS-S1+, -S2+)

Make: Horstmann, type ORION 3.0
combined test unit for
– Phase comparison
– Interface testing at switchgear
– Voltage detection for HR and LRM systems and CAPDIS-S1+, -S2+

Make: Kries, type CAP-Phase
as combined test unit (HR and LRM) for:
– Voltage detection
– Repeat test
– Phase comparison
– Phase sequence test
– Self-test
The unit doesn't require any battery

or other makes

Components

Interlocking systems and locking devices

Interlocking of connection compartment

Ring-main and circuit-breaker panel

- Access to the cable connection compartment (e.g. for cable testing) is only possible provided that the feeder is isolated and earthed (three-position switch-disconnector in "EARTHED" position)
- Option: Closing lock-out This prevents the three-position switch-disconnector from being switched from "OPEN" to "CLOSED" position, when the cable compartment cover is removed

Transformer panel

- Access to the cable connection compartment and to the HV HRC fuse compartment (e.g. for replacement of HV HRC fuse links) is only possible provided that the feeder is isolated and earthed (three-position switch-disconnector in "EARTHED" position)
- Option: De-earthing lock-out This prevents the three-position switch-disconnector from being switched from position "EARTHED" to "OPEN".

Switchgear interlocking

- Dependent on the vacuum circuit-breaker operating mechanism with
  – Spring-operated or
  – Stored-energy mechanism
- Option: Switchgear-side mechanical interlocking with three-position switch-disconnector
- Vacuum circuit-breaker cannot be closed when three-position switch-disconnector is in the "OPEN" position:
  – Spring-operated mechanism: Hand crank opening is blocked
  – Stored-energy mechanism with closing solenoid 3AY15 10: Pushbutton (S12) operated by mechanical interlock prevents continuous command to closing solenoid

Interlocking in circuit-breaker panel types LS1, LS1-U and LT10 (with 3AH5 fixed-mounted vacuum circuit-breaker)

- Option: Logical mechanical interlocking with three-position switch-disconnector
- Earthing of feeder via three-position switch-disconnector in "EARTHED" position

Interlocking in circuit-breaker panels (with 3AH6 removable vacuum circuit-breaker)

- Option: For 630 A panel types LS11, LS11-U and LT11: Logical mechanical interlocking with three-position switch-disconnector
- Standard: For 1250 A panel types LS31, LS31-U, LS32 and LT31: Logical mechanical interlocking with three-position disconnector
- Logical mechan. interlocking of cable compartment cover: Opening of cable compartment cover only possible provided that the feeder is earthed

Feeder earthing

- Standard: For panel types LS11, LS11-U, LT11, LS31, LS31-U and LS32: Earthing by switching of vacuum circuit-breaker 3AH6 [1] in position "CLOSED" and of three-position switch [2] in position "EARTHED"
- Option: For circuit-breaker panel types LS11, LS31 and LS32: Earthing by means of an additional make-proof earthing switch at the feeder with inspection window in the cable compartment cover

Locking devices

The three-position switch-disconnector can be locked on the operating mechanism side in any position (option).

Interlocking systems

Interlocking for cable compartment cover
Removed cable compartment cover with earthed bus sectionalizer panel

Locking device (option)

Locking device of the detachable lever mechanism
e.g. for padlock

1) With additional locking device – optionally with signalling switch – for securing the "CLOSED" position of the vacuum circuit-breaker for feeder "EARTHED"

2) Three-position switch as
– Switch-disconnector in panel types LS11, LS11-U and LT11
– Disconnector in panel types LS31, LS31-U, LS32 and LT31

4MC63 three-phase current transformers for panel types LS ... and LT ...

Application

- For circuit-breaker panels type LS ...
- For bus sectionalizer panels type LT ...
- Option: For ring-main panels type RK ...

Features

- According to IEC 60044-1/ VDE 0414-1
- Designed as a three-pole ring-core current transformer
- Free of dielectrically stressed cast-resin parts (due to design)
- Insulation class E
- Inductive type
- Climate-independent
- Secondary connection by means of a terminal strip inside the panel

Installation

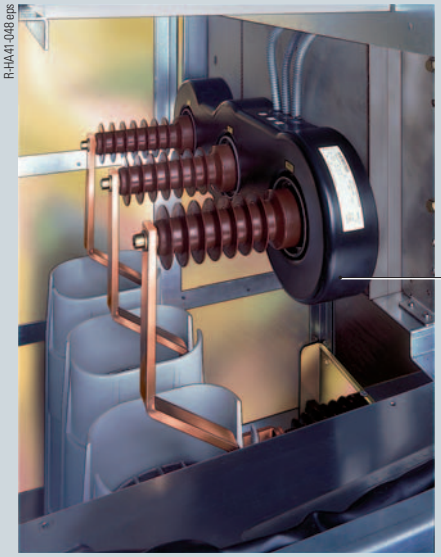
- Arranged outside the switchgear vessel on the bushings
- Factory-assembled

Other designs

(option)

Three-phase current transformers for protection equipment based on c.t. operation:

- 7SJ45 protection relay as definite-time overcurrent protection
- Definite-time overcurrent protection relay, make SEG, type WIP 1, WIC 1



4MC63 53 three-phase current transformer on the bushings of the three-position switch-disconnector

4MC63 53 three-phase current transformer

Technical data	4MC63 53 three-phase current transformer		
	for $I_N \leq 150$ A for $I_D = 630$ A	for $I_N \leq 400$ A for $I_D = 630$ A	for $I_N \leq 1000$ A for $I_D = 1250$ A
Primary data			
Max. equipment operating voltage U_m	0.72 kV	0.72 kV	0.72 kV
Rated current I_N A	150 | 100 | 75 | 50	400 | 300 | 200	1000 | 750 | 600 | 500
Rated short-duration power-frequency withstand voltage (winding test)	3 kV	3 kV	3 kV
Rated thermal short-time withstand current I_{th}	25 kA	25 kA	25 kA
Rated continuous thermal current I_D	630 A	630 A	1250 A
Transient overload current	1.5 x I_D / 1 h	2 x I_D / 0.5 h	1.5 x I_D / 1 h
Rated peak withstand current I_{dyn}	unlimited	unlimited	unlimited
Secondary data			
Rated current A	1 | 0.67 | 0.5 | 0.33	1 | 0.75 | 0.5	1 | 0.75 | 0.6 | 0.5
Rating VA	5 | 3.33 | 2.5 | 1.67	5 | 3.75 | 2.5	5 | 3.75 | 3 | 2.5
Rated current (option)	5 A	5 A	5 A
Current at I_D	4.2 A	1.575 A	1.25 A
Protection core: Class	10 P	10 P	10 P
Protection core: Overcurrent factor	10	10	10

Other values available on request

Components

4MC70 33 and 4MC70 31 cable-type current transformers

Application

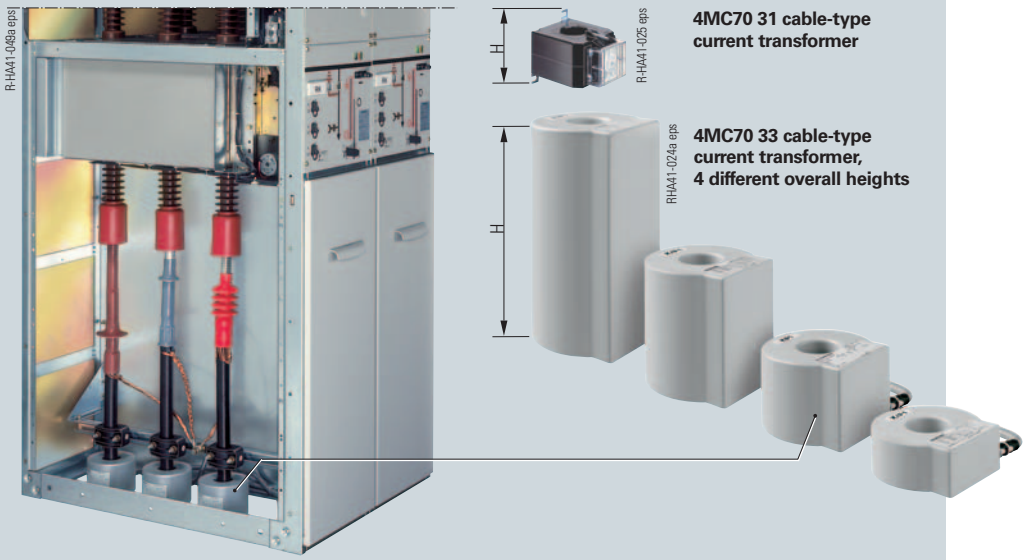
- For circuit-breaker panels type LS ...
- For ring-main panels type RK ...
- For transformer panels type TR ...

Features

- According to IEC 60044-1/ VDE 0414-1
- Designed as a single-pole ring-core current transformer
- Only for shielded cables
- Climate-independent
- Free of dielectrically stressed cast-resin parts (due to design)
- Insulation class E
- Inductive type
- Secondary connection by means of a terminal strip inside the panel

Installation

- 4MC70 33 cable-type current transformer for panel types LS ...
- 4MC70 31 cable-type current transformer: e.g. for panel types RK ..., K ... and TR ...
- Arranged on the cable at the panel connection
- Transformers mounted on a supporting plate at our factory; final assembly on the cables on site



4MC70 33 cable-type current transformers on the cable at the panel connection

Technical data	4MC70 33 cable-type current transformer	4MC70 31 cable-type current transformer
Primary data		
Max. equipment operating voltage U_m	0.72 kV	0.72 kV
Rated current I_N	30 A to 600 A	50 A to 600 A
Rated short-duration power-frequency withstand voltage (winding test)	3 kV	3 kV
Rated thermal short-time withstand current I_{th}	25 kA	25 kA
Rated continuous thermal current I_D	1.0 x I_N option: 1.2 x I_N	1.0 x I_N option: 1.2 x I_N
Transient overload current	1.5 x I_D / 1 h or 2 x I_D / 0.5 h	1.5 x I_D / 1 h or 2 x I_D / 0.5 h
Rated peak withstand current I_{dyn}	unlimited	unlimited
Secondary data		
Rated current	1 A (option: 5 A)	1 A (option: 5 A)
Meas-uring core – Class	0.2 | 0.5 | 1	1
Meas-uring core – Overcurrent factor	FS10 (option: FS5)	FS5 (option: FS10)
Meas-uring core – Rating	2.5 VA to 10 VA	2.5 VA to 10 VA
Pro-tection core – Class	10 P | 5 P	–
Pro-tection core – Overcurrent factor	10 | 10	–
Pro-tection core – Rating	2.5 VA to 10 VA	–
Option: Secondary tap	1 : 2 (e.g. 150 A – 300 A)	1 : 2
Dimensions		
Overall height H ** mm	50* | 100* | 170* | 285*	89
Outside diameter	Ø 145 mm	85 mm x 114 mm
Inside diameter	Ø 55 mm	Ø 40 mm
For cable diameter	Ø 50 mm	Ø 36 mm

Other values available on request

* Depending on the core data

** Available installation height inside panel types RK or RK1: Approx. 285 mm, depending on make, type and cross-section of sealing end

4MA7 block-type current transformers and 4MR voltage transformers

Application

- For billing metering panels type ME1 ...
- For bus riser panel type HF ...
- For mounting at the feeder

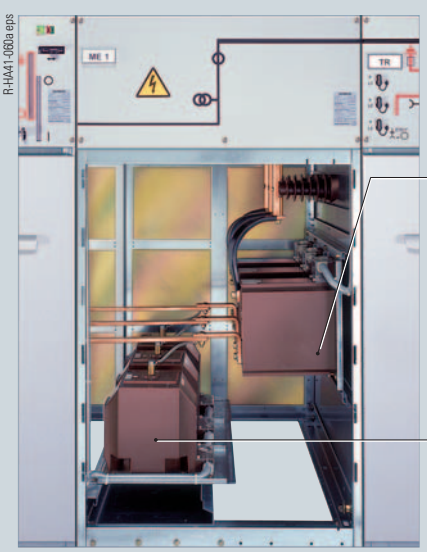
Features

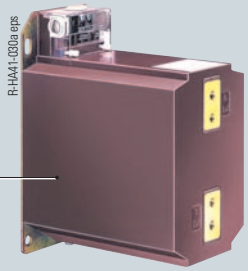
4MA7 current transformer

- According to IEC 60044-1/ VDE 0414-1
- Dimensions according to DIN 42600-8
- Designed as a single-pole indoor block-type current transformer
- Cast-resin insulated
- Insulation class E
- Secondary connection by means of screw-type terminals

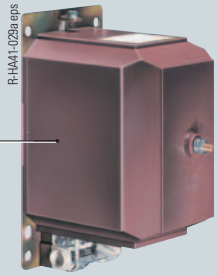
4MR voltage transformer

- According to IEC 60044-2/ VDE 0414-2
- Dimensions according to DIN 42600-9 (small model)
- Designed as an indoor voltage transformer:
  – Type 4MR, single-pole
  – Option: Type 4MR, two-pole
- Cast-resin insulated
- Insulation class E
- Secondary connection by means of screw-type terminals





4MA7 block-type current transformer, single-pole



4MR14 voltage transformer, single-pole

4MR voltage transformer and 4MA7 block-type current transformer installed in billing metering panel type ME1

Technical data

4MA7 single-pole block-type current transformer (other values on request)

Primary data

Max. equipment operating voltage U_m		kV	**3.6**	**7.2**	**12**	**17.5**	**24**
Rated short-durat. power-freq. withstand volt. U_d		kV	10	20	28	38	50
Rated lightning impulse withstand voltage U_p		kV	20	60	75	95	125
Rated current I_N		A	20 to 1250 →				
Rated thermal short-time withstand current I_{th}		kA	up to 25 →				
Rated continuous thermal current I_D			up to 1.0 x I_n (option: 1.2 x I_n) →				
Rated peak withstand current I_{dyn}			max. 2.5 x I_{th} →				
Secondary data							
Rated current		A	1 or 5 →				
Measuring core	Class		0.2; 0.5; 1 →				
	Overcurrent factor		FS5 or FS10 →				
	Rating	VA	10 to 15 →				
Protection core	Class		5 P or 10 P →				
	Overcurrent factor		10 →				
	Rating	VA	5 to 15 →				

4MR single-pole voltage transformer (other values on request)

Primary data

Max. equipment operating voltage U_m (= 1.2 x U_N)	kV	**3.6**	**7.2**	**12**	**17.5**	**24**
Rated short-durat. power-freq. withstand volt. U_d	kV	10	20	28	38	50
Rated lightning impulse withstand voltage U_p	kV	20	60	75	95	125
Rated voltage U_N	kV	$3.3/\sqrt{3}$	$3.6/\sqrt{3}$ $4.8/\sqrt{3}$ $5.0/\sqrt{3}$ $6.0/\sqrt{3}$ $6.6/\sqrt{3}$	$7.2/\sqrt{3}$ $10.0/\sqrt{3}$ $11.0/\sqrt{3}$	$13.8/\sqrt{3}$ $15.0/\sqrt{3}$	$17.5/\sqrt{3}$ $20.0/\sqrt{3}$ $22.0/\sqrt{3}$
Rated voltage factor (8h)		1.9 x U_N →				
Secondary data						
Rated voltage	V	$100/\sqrt{3}$ →				
		$110/\sqrt{3}$ (option) →				
		$120/\sqrt{3}$ (option) →				
Rated voltage for auxiliary winding (option)	V	100/3 →				
		110/3 (option) →				
		120/3 (option) →				
Rating	VA	20 | 50 | 100 →				
Class		0.2 | 0.5 | 1.0 →				

Components

Cable connection

General features

- Connecting lugs for sealing ends arranged one behind the other
- Uniform cable connection height for the respective panel types
- With cable bracket, e.g. type C40 according to DIN EN 50024
- Access to the cable connection compartment only if feeder has been isolated and earthed

Special features

– In ring-main panels
– In circuit-breaker panels
– In cable panels

- For thermoplastic-insulated cables
- For paper-insulated mass-impregnated cables with adapter systems
- For connection cross-sections up to 300 mm²
- Cable routing downwards

– In transformer panels:

- For thermoplastic-insulated cables
- For connection cross-sections up to 120 mm²: Cable lug max. 32 mm wide
- For rated normal currents of 200 A

For options see figures

Cable cross-sections

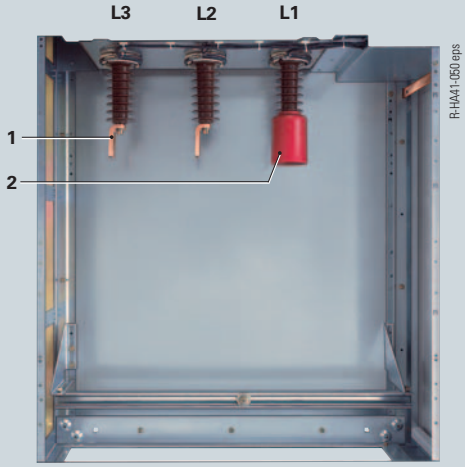
Panel type		Connectable cables x connection cross-section No. x mm² for rated voltage		
		12 kV	**17.5 kV**	**24 kV**
K	Standard	1x 300	1x 300	1x 300
	On request	2x 300	–	–
K1		2x 400	2x 400	2x 400
RK, K-E	Standard	1x 300	1x 300	1x 300
	On request	2x 300	–	–
RK1, K1-E		2x 300	2x 300	2x 300
LS1		2x 300	2x 300	2x 300
LS11, LS31		2x 400	2x 400	2x 300
LS32	Standard	3x 400	3x 400	3x 300
	Option	4x 300	4x 300	–
	On request	–	–	4x 300
ME1-K, ME1-KS		3x 400	3x 400	3x 300

1) Only with ring-main panel type RK1
2) Cable clamps with transformer panels type TR ... partly mounted underneath the panel in the cable basement
3) Make Siemens, type 3EK7, other makes on request

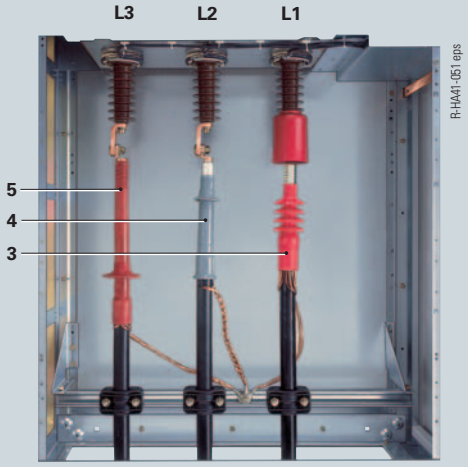
Note

Cable sealing ends and cable clamps are not included in the scope of supply

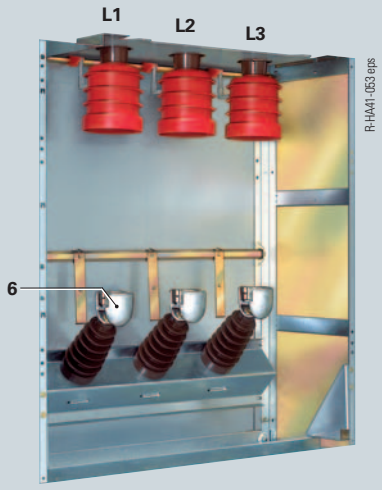
Cable connection (examples)



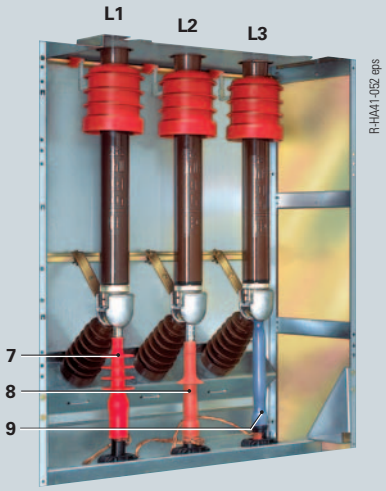
Ring-main panel type RK
Cable connection compartment as delivered



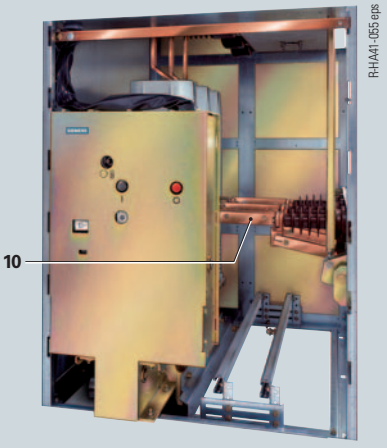
Cable connection compartment with cable sealing ends (options: A, B, C [1] and D [1], see below)



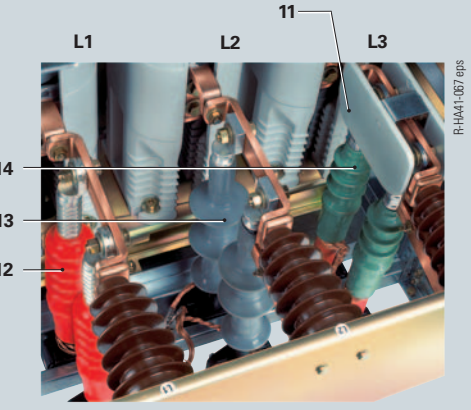
Transformer panel type TR
Cable connection compartment as delivered



Cable connection compartment with cable sealing ends (option: A [2], see below)



Circuit-breaker panel type LS11
Cable connection compartment as delivered



Cable connection compartment with cable sealing ends (options: A, B, C and D, see below)

Options

A Mounted cable clamps [2]
B Short-circuit / earth-fault indicator
C Double cable connection
D Suitable for connection of surge arresters [3]

Selection data for various cable sealing ends

Cable sealing ends
(examples)

1 As-delivered condition, e.g. for $U_p \leq 95$ kV, prepared for cable sealing end

2 As-delivered condition, e.g. for $U_p > 95$ kV, additionally with insulating sleeve, prepared for cable sealing end

3 Phase L1:
Make Lovink-Enertech
Type IAEM 20, 240 mm² (20 kV)

4 Phase L2:
Make Tyco Electronics Raychem
Type EPKT 24 C / 1X,
185 mm² (24 kV),
as shrink-on sealing end,
for severe ambient conditions

5 Phase L3:
Make Prysmian Kabel und Systeme (Pirelli Elektrik)
Type ELTI mb-1C-2h-C-T3,
240 mm² (24 kV)

6 As-delivered condition, prepared for cable sealing end

7 Phase L1:
Make Lovink-Enertech
Type IAEM 20,
95 mm² (20 kV)

8 Phase L2:
Make Tyco Electronics Raychem
Type TFTI/5131,
95 mm² (24 kV),
as push-on sealing end

9 Phase L3:
Make Euromold
Type AIN, 95 mm² (24 kV)

10 As-delivered condition, e.g. for $U_p < 95$ kV, prepared for cable sealing end

11 As-delivered condition, e.g. for $U_p \geq 95$ kV, additionally with insulating cap, prepared for cable sealing end

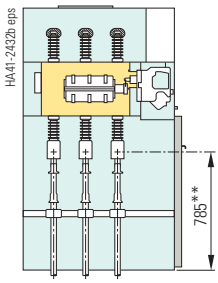
12 Phase L1:
Make Lovink-Enertech
Type IAES 20,
240 mm² (20 kV)

13 Phase L2:
Make Prysmian Kabel und Systeme (Pirelli Elektrik)
Type ELTI 1C-24-D-T3,
240 mm² (24 kV),
as indoor sealing end,
for severe ambient conditions

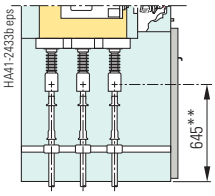
14 Phase L3:
Make Euromold
Type AIN 20,
240 mm² (24 kV)

Cable sealing end, e.g. for panel types RK..., LS1..., LS11..., LS31..., LS32 and TR ...[1] (for connection heights of cables see opposite dimension drawings)		
Make	Type	Cross-section in mm²
Single-core thermoplastic-insulated cables for ≤ 12 kV (6/10 kV)		
Euromold	AIN 10	25–300 (500*)
	35 MSC 35 MSC (option [3])	16–300 (500*) 25–300 (500*)
	ITK-212	50–300 (400*)
Prysmian Kabel und Systeme (Pirelli Elektrik)	ELTI mb-1C-12	35–240
	ELTI-1C-12	25–300
Tyco Electronics Raychem	IXSU-F	16–300 (500*)
	TFTI	25–300 (400*)
	EPKT [1]	16–300
Lovink-Enertech	IAEM 10	25–300
	IAES 10	25–300 (500*)
3M Germany	92-EB 6x-1	35–300 (400*)
Südkabel	SEHDI 10.2	35–300 (500*)
	SEI 12	70–300
nkt cables	TI 12	25–240
	AV 10 C	25–300 (500*)
	AV 10 E	25–300 (500*)
Single-core thermoplastic-insulated cables for > 12 kV to ≤ 24 kV (12/20 kV)		
Euromold	AIN 20	25–300 (630*)
	35 MSC 35 MSC (option [3])	25–70 25–185
	36 MSC [2] 36 MSC (option [3])	95–300 (500*) 95–300 (500*)
	ITK-224	25–240
Prysmian Kabel und Systeme (Pirelli Elektrik)	ELTI mb-1C-24	35–240
	ELTI-1C-24	25–300
Tyco Electronics Raychem	IXSU-F	25–300 (500*)
	TFTI	25–300 (400*)
	EPKT	16–300 (500*)
Lovink-Enertech	IAEM 20	25–300
	IAES 20	25–300 (500*)
3M Germany	93-EB 6x-1	50–300 (400*)
Südkabel	SEHDI 20.2	35–300 (500*)
	SEI 24	25–240
nkt cables	TI 24	25–240
	AV 20 E	25–300 (500*)
	AV 10 E	25–300 (500*)
Three-core thermoplastic-insulated cables for ≤ 12 kV (6/10 kV)		
Euromold	AIN 10	25–300 (500*)
	SR-DI 12	35–300 (500*)
Prysmian Kabel und Systeme (Pirelli Elektrik)	ELTI-3C-12	25–300
Tyco Electronics Raychem	IXSU-F	16–300 (500*)
Lovink-Enertech	IAES 10	25–300
	GHKI	16–300 (400*)
Three-core thermoplastic-insulated cables for > 12 kV to ≤ 24 kV (12/10 kV)		
Euromold	SR-DI 24 [2]	35–300 (500*)
Lovink-Enertech	GHKI	25–300 (500*)

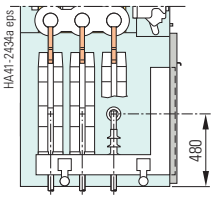
Connection height ** of cables above floor or above lower edge of panel:



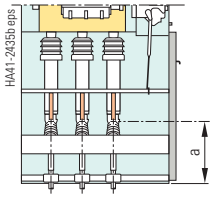
Panel type RK ...



Panel type LS1 ...



Panel type LS11 ...



Panel type TR ...

Dimension a
~ 530 mm at 12 kV
~ 380 mm at 24 kV

Note

Depending on make and type, the termination of the cable sealing end (= shield earth) for the 3-core thermoplastic-insulated cable and the fitted cable clamp (option) may be located underneath the panel in the cable basement. This must be taken into account in panels with floor cover (option).

1) Transformer panel types TR ...:
– Lower edge of sealing end below panel
– Cable lugs of sealing ends up to 32 mm width
– Owing to the various sealing end lengths, some of the mounted cable clamps are underneath the panel

2) Circuit-breaker panel types LS11, LS31 and LS32:
– Lower edge of sealing end below panel

3) Cable sealing end type with insulation shields

* On request: Max. connection cross-section of cable sealing end types

** Due to the installation of 4MA cast-resin insulated block-type current transformers in panels RK1 and LS1, the connection height of the cables is reduced to 380 mm

Components

Low-voltage equipment

Low-voltage niche
(standard)

- Screwed-on cover as
  – Cover (available mounting depth behind of approx. 184 mm)
  – Frame cover, approx. 46 mm deeper version (available mounting depth behind of approx. 230 mm)
- For accommodation of terminals and standard protection devices, e.g. in circuit-breaker panels combined with frame cover for panels
  – Type LS1: Protection relays (with max. 75 mm wide mounting frame), e.g.
  – Type 7SJ45, 7SJ46
  – Make SEG, type WIC
  On request:
  – 7SJ60
  – Make SEG, WIP1
  – Type LS11, LS31 and LS32: Protection relays (with max. 75 mm wide mounting frame), e.g. type 7SJ45, 7SJ46, 7SJ60.
  On request:
  – 7SJ61/62 (150 mm wide)
  – Make SEG, WIP1
- For bus wires and/or control cables; niche open at the side to the adjacent panel
- Safe-to-touch, separated from high-voltage part of the panel
- Degree of protection IP 3X (standard)

Low-voltage compartment
(option)

- Overall heights:
  350 mm, 550 mm
- Available mounting depth:
  442 mm
- Overall widths:
  375 mm, 500 mm, 750 mm
- For mounting on the panel
- Dependent on the panel-specific scope of the secondary equipment
- For accommodation of protection, control, measuring and metering equipment, e.g. multifunction protection relay SIPROTEC 4 7SJ61/62/63 or other makes of protection relays
- Compartment 750 mm wide for panel type LS32

Electronic functions

Multifunction protection relay SIPROTEC 4 7SJ62 or 7SJ63 with the following features:

1 User-programmable LEDs with application-specific label, for displaying any desired process and equipment data

2 LCD for process and equipment data, e.g. for:
– Measuring and metering values
– Binary information on the status of switching point and device
– Protection data
– General indications
– Alarms

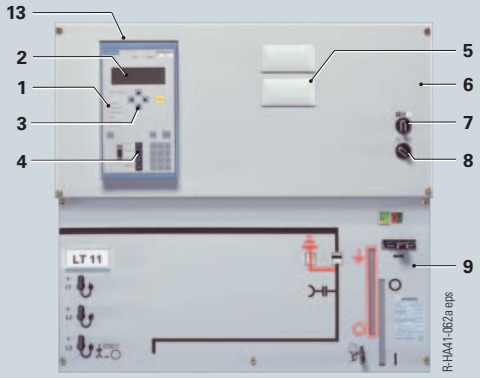
3 Keys for navigation in menus and for entering values

4 Four user-programmable function keys for frequently performed actions

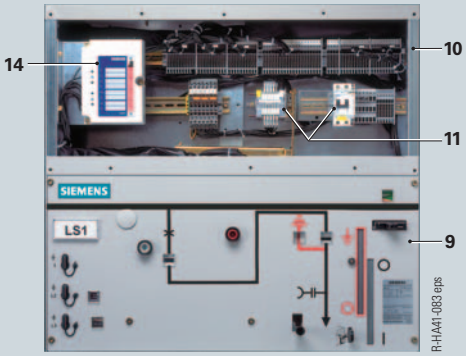
Low-voltage cables

- Control cables of the panel to the low-voltage compartment are connected via multi-pole, coded module plug connectors
- Option: Plug-in bus wires from panel to panel inside the low-voltage niches, optionally in separate cable duct on the panel

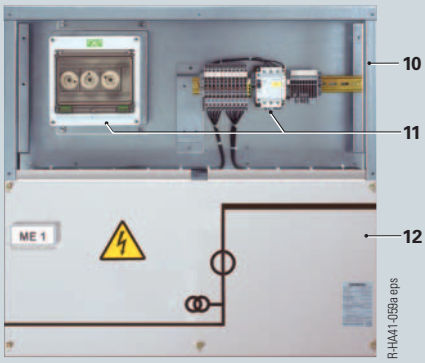
Low-voltage niche (examples)



In bus sectionalizer panel type LT11
(low-voltage niche closed)



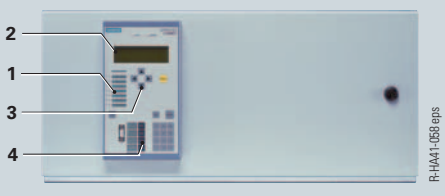
In circuit-breaker panel type LS1
(low-voltage niche open)



In billing metering panel type ME1
(low-voltage niche open)

1 LED indications
2 LCD
3 Navigation keys
4 Function keys
5 Option: Short-circuit/earth-fault indicator
6 Frame cover of low-voltage niche (can be unscrewed)
7 Momentary-contact rotary control switch ON-OFF for motor operating mechanism of the three-position switch-disconnector
8 Local-remote switch for three-position switch-disconnector
9 Control board
10 Low-voltage niche open
11 Option: Installed equipment
12 Panel front
13 Option: Multifunction protection relay SIPROTEC 4 7SJ61 on swing-out frame
14 Option: Protection device make SEG, type WIC

Low-voltage compartment (option)

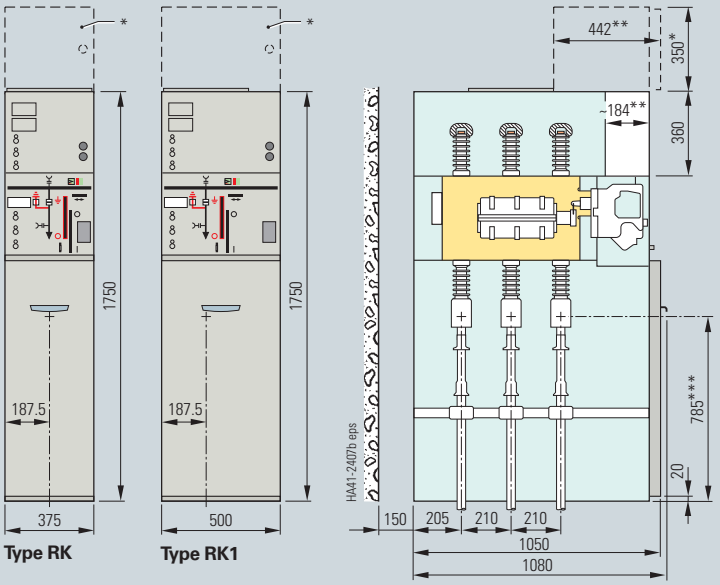


On circuit-breaker panel type LS1
for additional low-voltage equipment

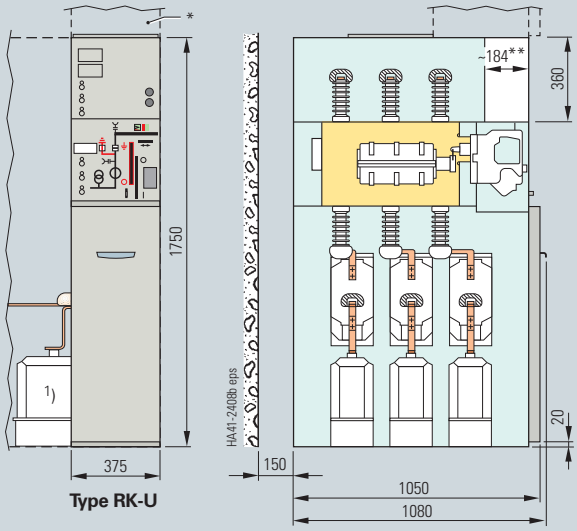
SIPROTEC 4
7SJ61:
1 LED indications
2 LCD
3 Navigation keys
4 Function keys

Dimensions

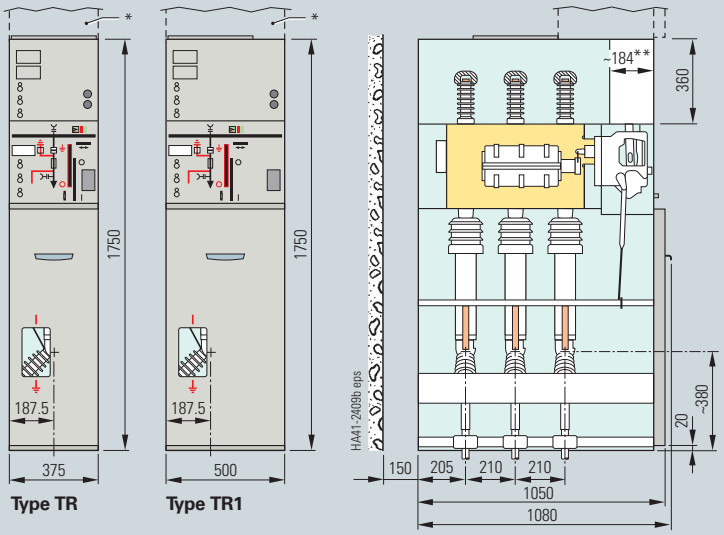
Ring-main panels, transformer panels



Ring-main panels



Ring-main panel for panel combinations



Transformer panels

1) Location of voltage transformer in left-hand panel, e.g. in panel type LT10 or LT11

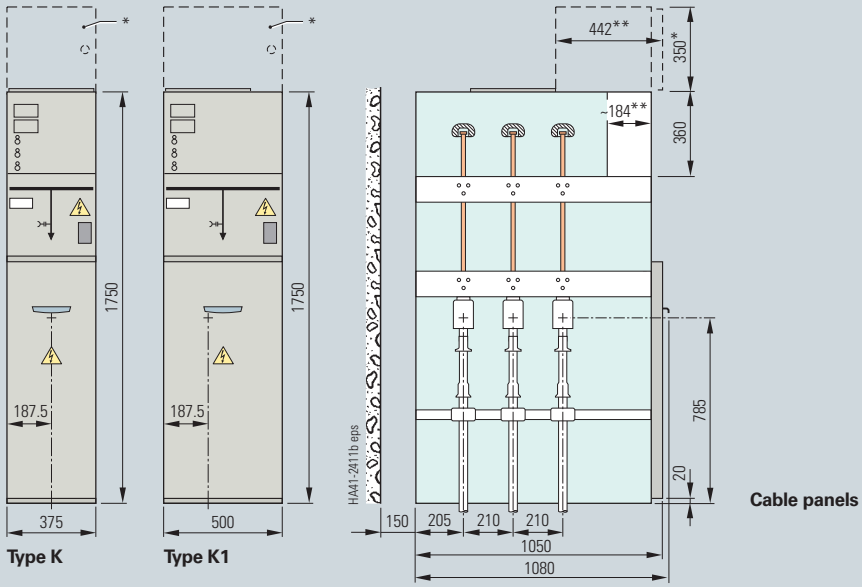
* Option:
Low-voltage compartment available in two heights: 350 mm or 550 mm

** Available mounting depth for low-voltage equipment

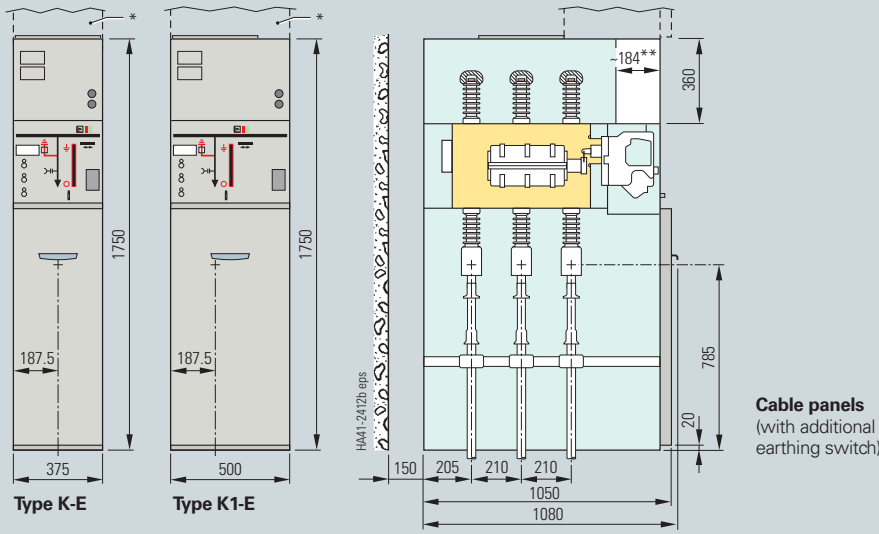
*** For panel type RK1 the cable connection height is reduced to approx. 380 mm for panel version with 4MA block-type current transformer

Dimensions

Cable panels



Cable panels



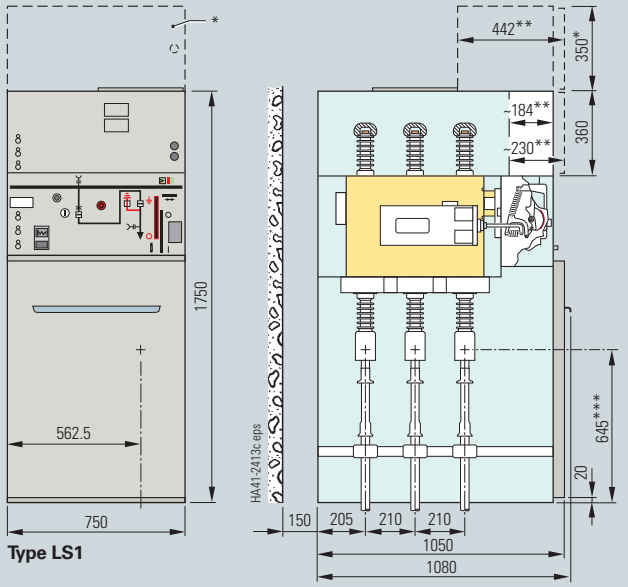
Cable panels
(with additional make-proof earthing switch)

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

** Available mounting depth for low-voltage equipment

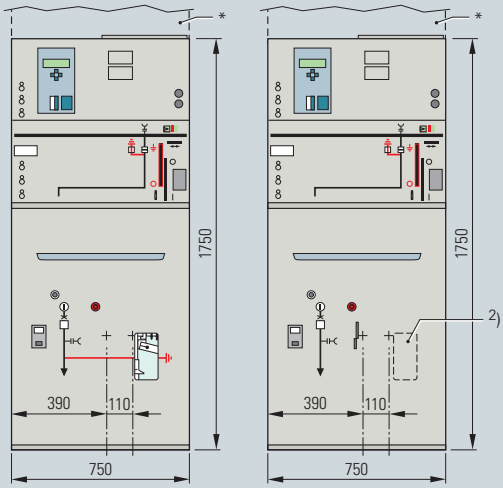
Dimensions

Circuit-breaker panels



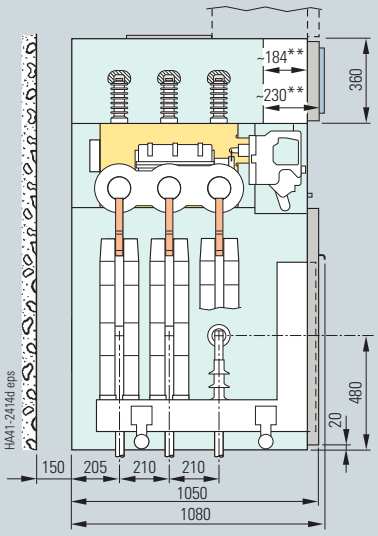
Type LS1

Circuit-breaker panel
630 A
with 3AH5 [1]

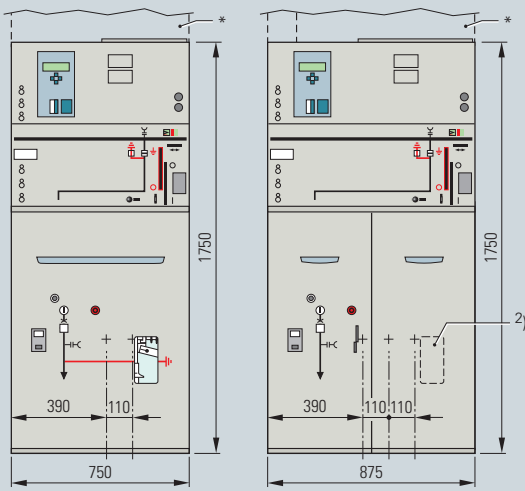


Type LS11 (with make-proof earthing switch)

Type LS11 (without earthing switch)

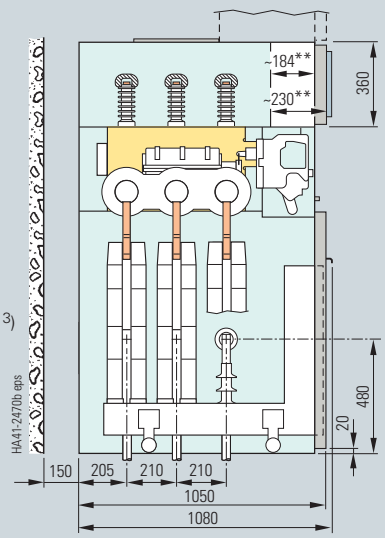


Circuit-breaker panels
630 A
with 3AH6 [1]



Type LS31 [3] (for connection of max. 2 cables)

Type LS32 [3] (for connection of 3 cables)



Circuit-breaker panels
1250 A
with 3AH6 [1]

1) Type designation of the vacuum circuit-breaker
2) Option: Inspection window
3) Option: With make-proof earthing switch

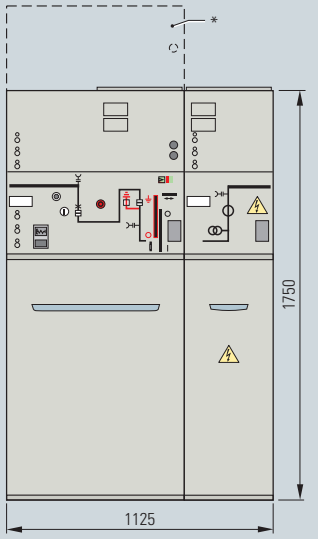
* Option: Low-voltage compartment available in two heights: 350 mm or 550 mm

** Available mounting depth for low-voltage equipment
– Approx. 184 mm with cover
– Approx. 230 mm with extended frame cover

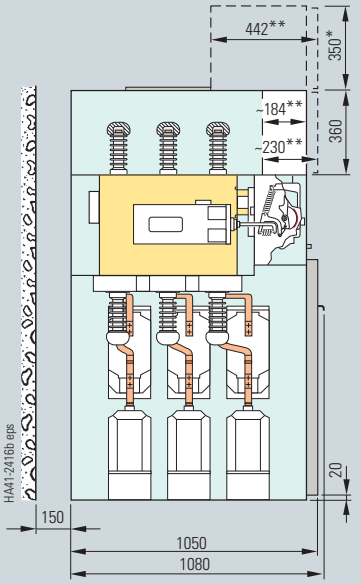
*** The cable connection height is reduced to approx. 380 mm for panel version with 4MA block-type current transformer

Dimensions

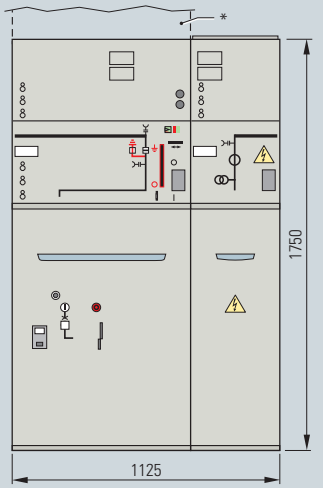
Bus sectionalizer panels with bus riser panel



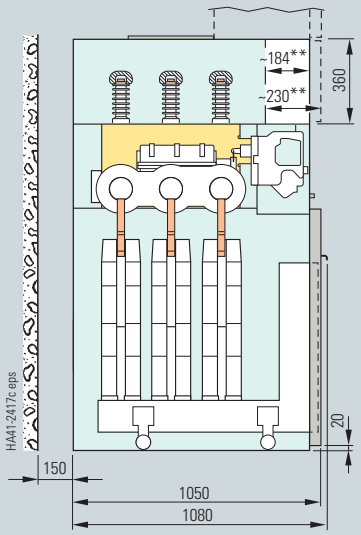
Type LT10 + type HF



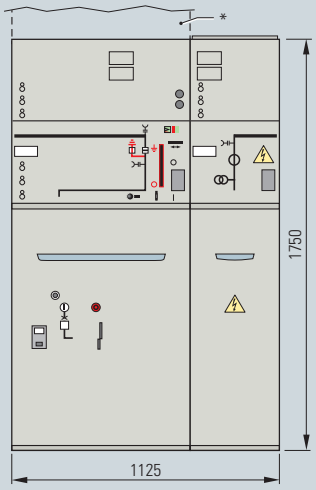
Bus sectionalizer panel
630 A
with 3AH5 1)



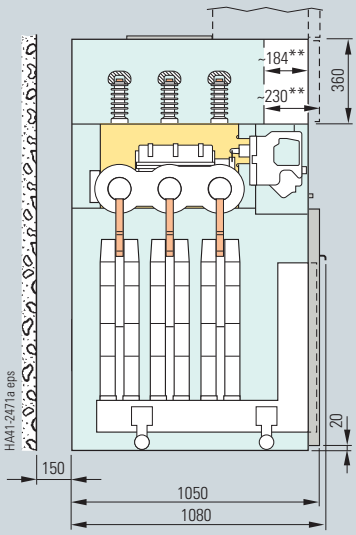
Type LT11 + type HF



Bus sectionalizer panel
630 A
with 3AH6 1)



Type LT31 + type HF



Bus sectionalizer panel
1250 A
with 3AH6 1)

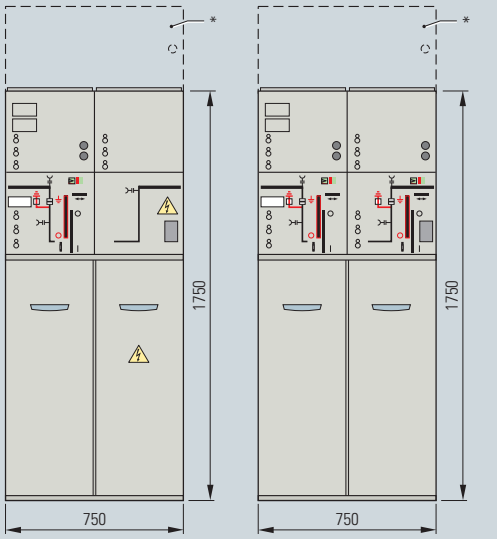
1) Type designation of the vacuum circuit-breaker

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

** Available mounting depth for low-voltage equipment
– Approx. 184 mm with cover
– Approx. 230 mm with extended frame cover

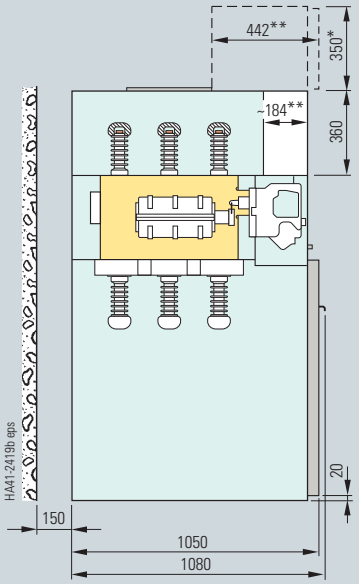
Dimensions

Bus sectionalizer panels

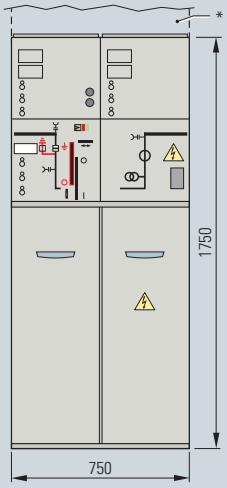


Type LT2
(≙ type RK-U with type HF)

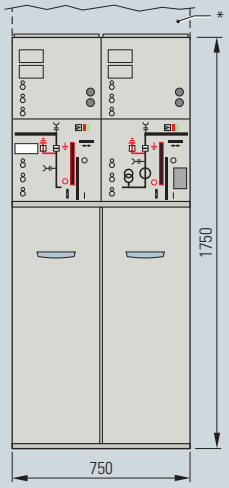
Type LT22
(≙ type RK-U with type RK-U)



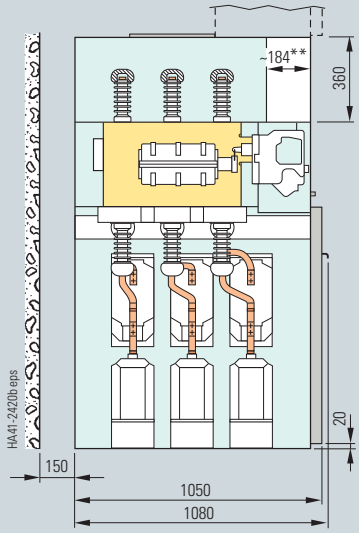
Bus sectionalizer panels without transformers



Type LT2-W



Type LT22-W



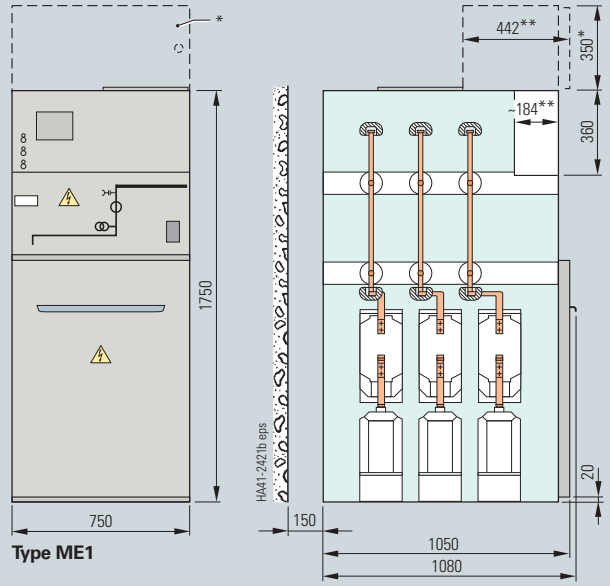
Bus sectionalizer panels with transformers

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

** Available mounting depth for low-voltage equipment

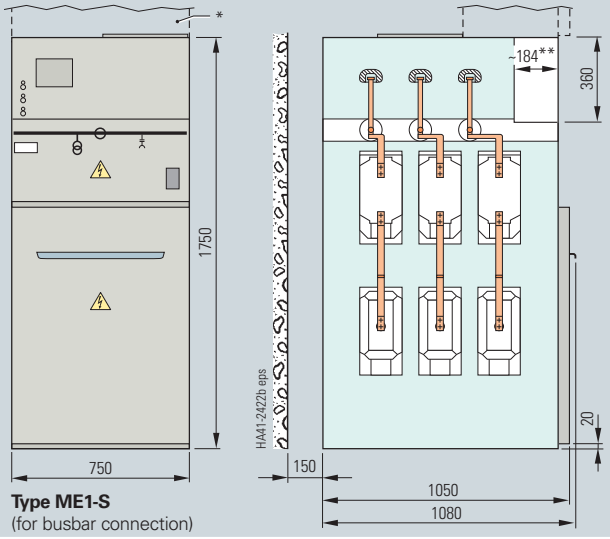
Dimensions

Billing metering panels

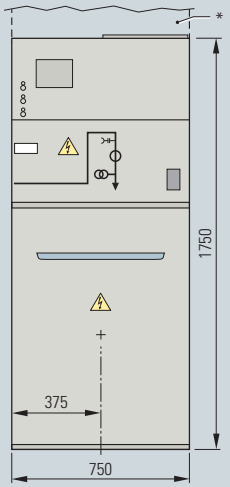


Type ME1

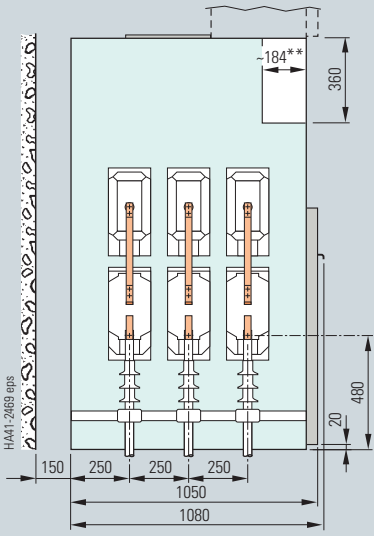
Billing metering panel
(standard)



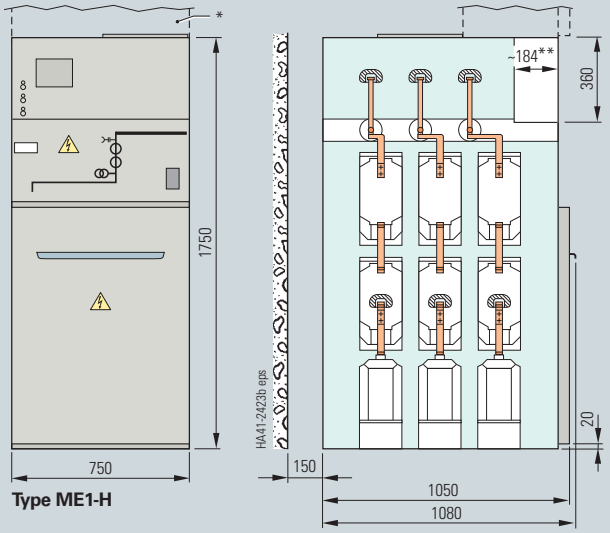
Type ME1-S
(for busbar connection)



Type ME1-K
(for cable connection)



Billing metering panels for busbar and cable connection



Type ME1-H

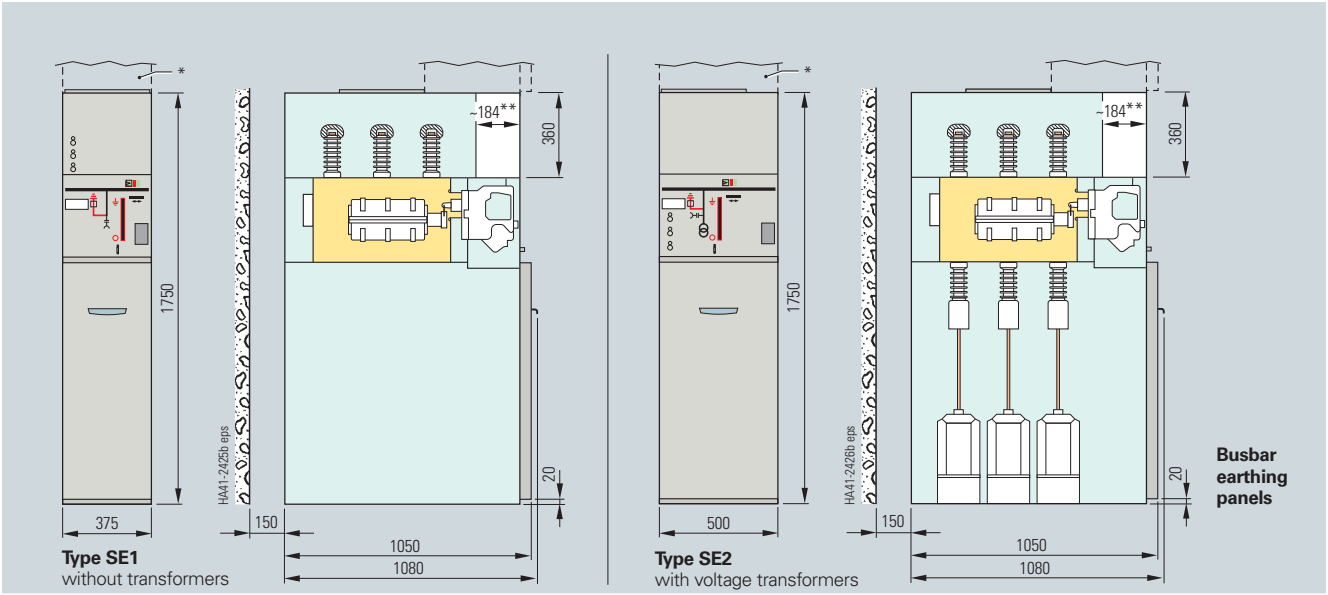
Billing metering panel for 2nd current transformer set

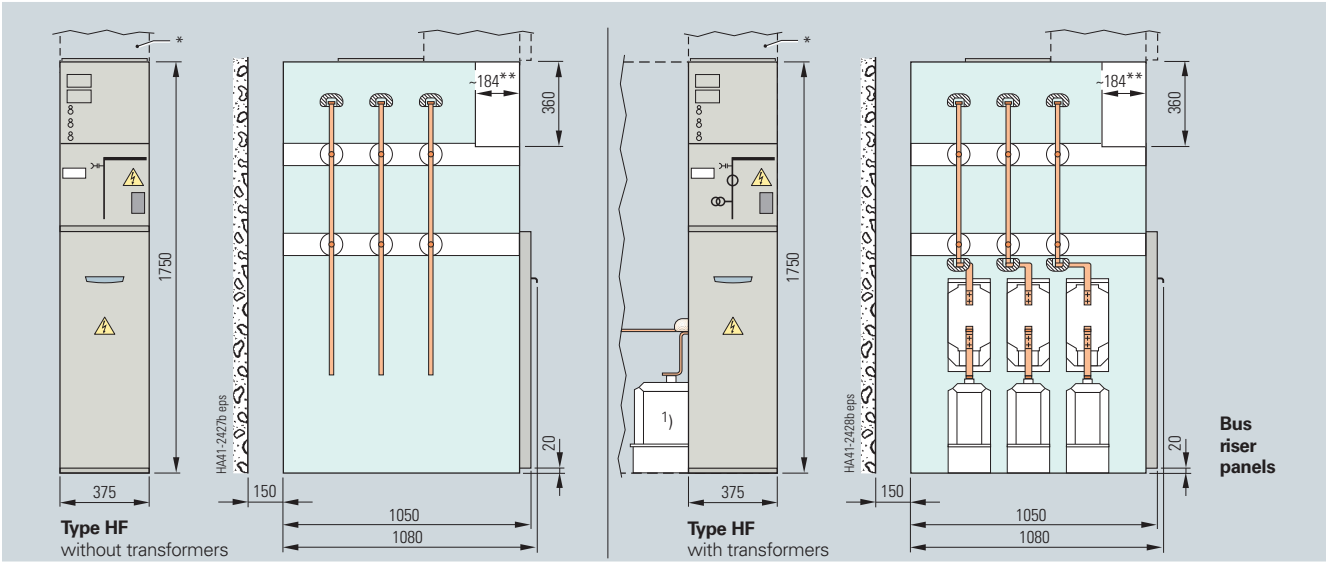
* Option:
Low-voltage compartment available in two heights: 350 mm or 550 mm

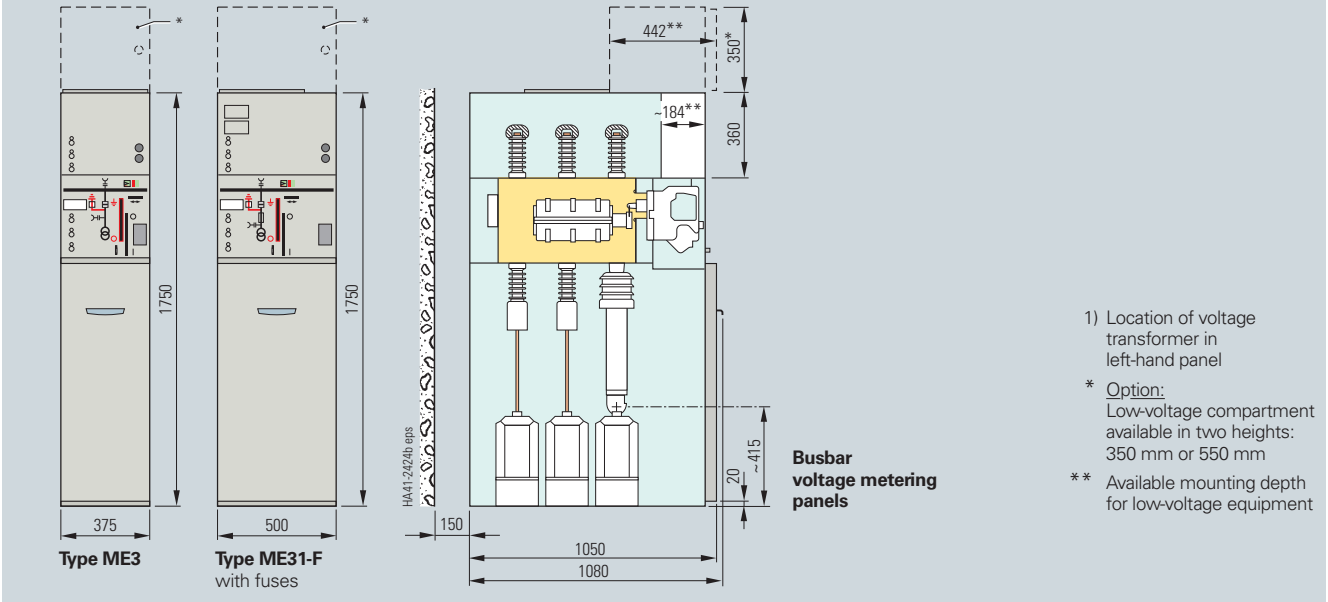
** Available mounting depth for low-voltage equipment

Dimensions

Busbar voltage metering panels, busbar earthing panels, bus riser panels







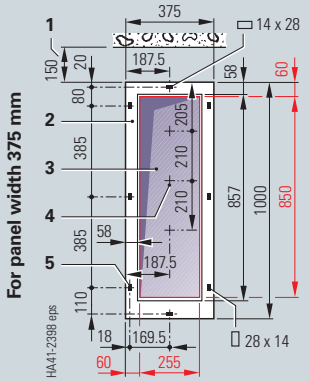
1) Location of voltage transformer in left-hand panel

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

** Available mounting depth for low-voltage equipment

Dimensions

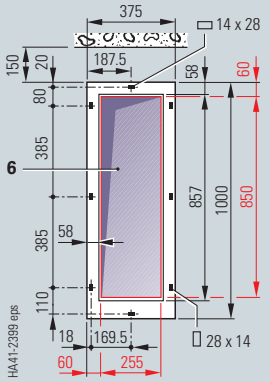
Floor openings (dimensions in red) and fixing points



With cable connection

For panel type

RK
K
K-E
TR

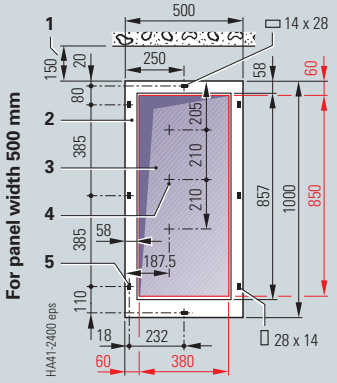


Without cable connection

For panel type

RK-U
ME3
HF
SE1

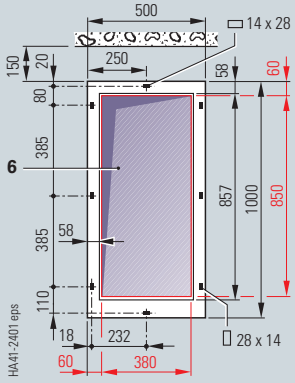
1 Wall distance
2 Fixing frame (base) of an individual panel or panel block
3 Floor opening for high-voltage cables and, where applicable, control cables; in panel types LS11, LS31 and LS31-K: floor opening also possible below floor cover
4 Position of the led-in cables for the feeder
5 Fixing points
6 Floor opening if required for panels without cable connection



With cable connection

For panel type

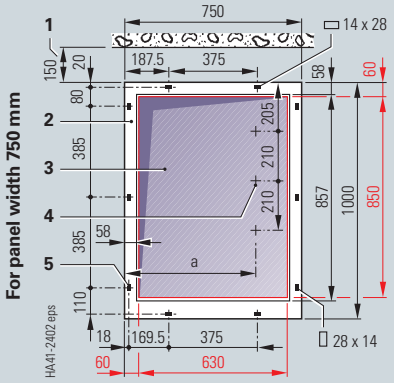
RK1
K1+
K1-E
TR1



Without cable connection

For panel type

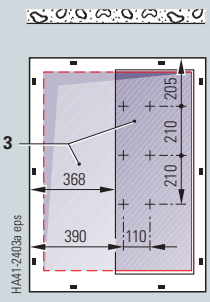
RK1-U
ME31-F
SE2



With cable connection

For panel type

LS1
(Dim. a = 562.5)
ME1-K
(Dim. a = 375)
ME1-KS
(Dim. a = 375)

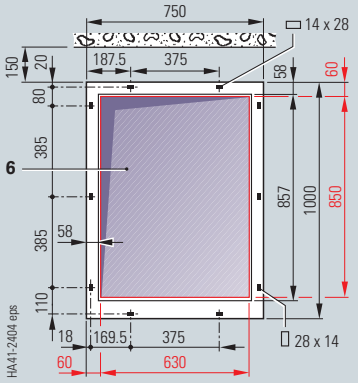


For dimensions not shown see illustration on the left

With double cable connection

For panel type

LS11
LS31

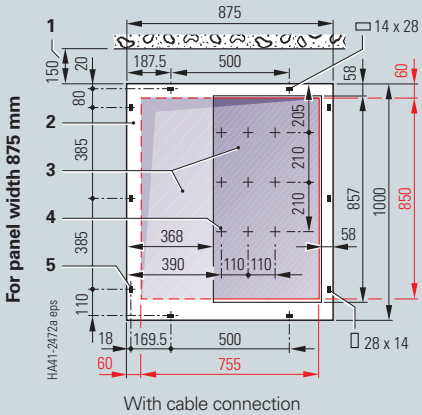


Without cable connection

For panel type

LS1-U
LS11-U
LT10
LT11
LT2
LT2-W
LT22
LT22-W
ME1
ME1-S
ME1-H

LS31-U
LT31



With cable connection

For panel type

LS32

Standards

The 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 Community, their national specifications conform to the IEC standard.

Overview of standards (May 2008)

		IEC standard	VDE standard	EN standard
Switchgear	SIMOSEC	IEC 62271-1	VDE 0671-1	EN 62271-1
		IEC 62271-200	VDE 0671-200	EN 62271-200
Devices	Circuit-breaker	IEC 62271-100	VDE 0671-100	EN 62271-100
	Disconnector and earthing switch	IEC 62271-102	VDE 0671-102	EN 62271-102
	Switch-disconnector	IEC 60265-1	VDE 0670-301	EN 60265-1
	Switch-disconnector / fuse combination	IEC 62271-105	VDE 0671-105	EN 62271-105
	HV HRC fuses	IEC 60282-1	VDE 0670-4	EN 60282
	Voltage detection system	IEC 61243-5	VDE 0682-415	EN 61243-5
Degree of protection	–	IEC 60529	VDE 0470-1	EN 60529
Insulation	–	IEC 60071	VDE 0111	EN 60071
Transformers	Current transformer	IEC 60044-1	VDE 0414-1	EN 60044-1
	Voltage transformer	IEC 60044-2	VDE 0414-2	EN 60044-2
Installation	–	IEC 61936-1	VDE 0101	–

Type of service location

SIMOSEC switchgear can be used as an indoor installation in accordance with IEC 61936 (Power installations exceeding 1 kV AC) and VDE 0101

- Outside lockable electrical service locations at places which are not accessible to the public. Enclosures of switchgear can only be removed with tools.
- Inside lockable electrical service locations. A lockable electrical service location is a place outdoors or indoors that is reserved exclusively for housing electrical equipment and which is kept under lock and key. Access is restricted to authorized personnel and persons who have been properly instructed in electrical engineering.
  Untrained or unskilled persons may only enter under the supervision of authorized personnel or properly instructed persons.

Terms

"Make-proof earthing switches" are earthing switches with short-circuit making capacity according to
– IEC 62271-102
  and
– VDE 0671-102

Colour of panel front

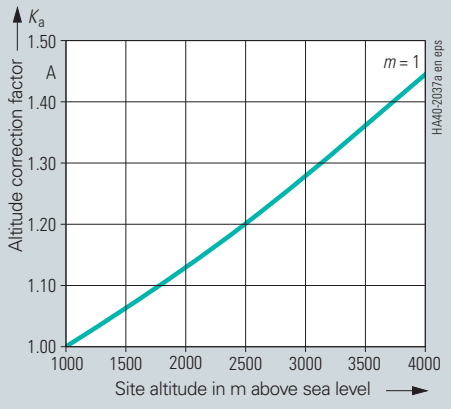
Siemens standard (SN)
47 030 G1,
colour no. 700 / light basic
(similar to RAL 7047 / grey)

Table – Insulating capacity

Rated voltage (rms value)	kV	**7.2**	**12**	**15**	**17.5**	**24**
Rated short-duration power-frequency withstand voltage (rms value)						
– Across isolating distances	kV	23	32	39	45	60
– Between phases and to earth	kV	20	28	36	38	50
Rated lightning impulse withstand voltage (peak value)						
– Across isolating distances	kV	70	85	105	110	145
– Between phases and to earth	kV	60	75	95	95	125

Altitude correction factor K_a

For site altitudes above 1000 m, the altitude correction factor K_a is recommended, depending on the actual site altitude above sea level.



Rated short-dur. power-freq. withstand volt. for site altitudes > 1000 m to be selected

≥ Rated short-duration power-frequency withstand voltage up to ≤ 1000 m · K_a

Rated lightning impulse withstand voltage for site altitudes > 1000 m to be selected

≥ Rated lightning impulse withstand voltage up to ≤ 1000 m · K_a

Example:

3000 m site altitude above sea level
17.5 kV switchgear rated voltage
95.0 kV rated lightning impulse withstand voltage

Rated lightning impulse withstand volt. to be selected: 95 kV · 1.28 = 122 kV

Result:

According to the above table, a switchgear for a rated voltage of 24 kV with a rated lightning impulse withstand voltage of 125 kV is to be selected.

Insulating capacity

- The insulating capacity is verified by testing the switchgear with rated values of short-duration power-frequency withstand voltage and lightning impulse withstand voltage according to IEC 62271-1/ VDE 0671-1 (see table "Insulating capacity").
- The rated values are referred to sea level and to normal atmospheric conditions (1013 hPa, 20 °C, 11 g/m^3 humidity in accordance with IEC 60071 and VDE 0111).
- The insulating capacity decreases with increasing altitude.
  For site altitudes above 1000 m (above sea level) the standards do not provide any guidelines for the insulation rating. Instead, special regulations apply to these altitudes.
- Site altitude

– As the altitude increases, the insulating capacity of insulation in air decreases due to the decreasing air density. This reduction is permitted up to a site altitude of 1000 m according to IEC and VDE.

– For site altitudes above 1000 m a higher insulation level must be selected. It results from the multiplication of the rated insulation level for 0 to 1000 m with the altitude correction factor K_a.

Standards

Standards, specifications, guidelines, classification

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 SIMOSEC switchgear.

  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 Section 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 cable		
		VLF [1], 0.1 Hz	acc. to IEC	VDE 0278
		3 x U_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

Internal arc classification
(option)

- Safety of operating personnel ensured by tests to verify internal arc classification
- The possibility of arc faults in SIMOSEC switchgear is much less due to:
  - Metal-enclosed and gas-insulated switching functions (e.g. of three-position switch-disconnector and 3AH5 vacuum circuit-breaker)
  - Logical arrangement of operating mechanism elements and mechanical interlocks
  - Short-circuit-proof feeder earthing by means of the three-position switch-disconnector
- The internal arc fault tests must be performed in accordance with IEC 62271-200/ VDE 0671-200 *

Criteria for internal arc faults

- Criteria according to IEC 62271-200/ VDE 0671-200 * with respect to the behaviour in case of internal arc faults
- Definitions of criteria:
  - Acceptance criterion 1
    Covers and doors remain closed. Limited deformations are accepted.
  - Acceptance criterion 2
    No fragmentation of the enclosure. No projection of small parts above 60 g weight.
  - Acceptance criterion 3
    No holes in the accessible sides up to a height of 2 m.
  - Acceptance criterion 4
    Indicators do not ignite due to the effect of hot gases.
  - Acceptance criterion 5
    The enclosure remains connected to its earthing parts.

Climate and ambient conditions

SIMOSEC switchgear may be used, subject to possible additional measures – e.g. panel heaters or floor covers – under the following ambient conditions and climate classes:

- Ambient conditions
  - Natural foreign materials
  - Chemically active pollutants
  - Small animals
- Climate classes
  The climate classes are classified according to IEC 60721-3-3

SIMOSEC switchgear is largely insensitive to climate and ambient conditions 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 switchgear 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

1) VLF = very low frequency

2) Referred to: U_0/U (U_m = 6.35/11 (12) kV)

* Standards see page 43

Classification of the SIMOSEC switchgear according to IEC 62271-200

Construction and design

Partition class	PM (metallic partition)
Loss of service continuity category [1] Panels – With HV HRC fuses, and for panel types with removable circuit-breakers type 3AH6 – Without HV HRC fuses, and for panel types without removable circuit-breakers type 3AH6 – In a SIMOSEC switchgear, panel types ME1 or HF are also part of the busbar. According to IEC 62271-200 a category is not applicable	 LSC 2A LSC 2B –
Accessibility to compartments – Busbar compartment – Switching-device compartment – Switching-device compartment with circuit-breakers type 3AH6 (removable) – Low-voltage compartment – Cable connection compartment – Without HV HRC fuses – With HV HRC fuses	 Tool-based Not accessible Accessible and interlock-based Tool-based Tool-based Interlock-based and tool-based

Internal arc classification (option)

Class – Free-standing arrangement – Wall-standing arrangement	7.2 kV to 24 kV IAC A FLR 20 kA, 1 s IAC A FL 20 kA, 1 s
Degree of accessibility A – F – L – R	Switchgear in closed electrical service location, access only for properly instructed personnel Front Lateral Rear (for free-standing arrangement)
Test current	20 kA
Test duration	1 s

1) The loss of service continuity category always refers to the complete switchgear, i.e. the panel with the lowest category determines the loss of service continuity category of the complete switchgear.

Standards

Standards, specifications, guidelines, classification

Protection against solid foreign bodies, electric shock and ingress of water

SIMOSEC switchgear fulfills acc. to the standards *

IEC 62271-1	VDE 0671-1 EN 62271-1
IEC 62271-200	VDE 0671-200
IEC 60529	EN 60529

the following degrees of protection **:

Degree of protection	Type of protection
IP 2X (standard)	Enclosure of live parts under high-voltage
	Compartments
IP 3X (option)	Enclosure of live parts under high-voltage in switchgear with locking device
IP 3XD (on request)	Enclosure of live parts under high-voltage in switchgear with locking device
IP 65	Metal enclosure of gas-filled switchgear vessels

IEC 60 529 and EN 60529:

Type of protection	Degree of protection

IP 2X

Protection against solid foreign bodies
Protected against the penetration of solid foreign bodies, diameter ≥ 12.5 mm

Protection against electric shock
Protected against access to dangerous parts by means of a finger (the distance between a test finger with a diameter of 12 mm to dangerous parts must be sufficient)

Protection against the ingress of water
No definition

IP 3X

Protection against solid foreign bodies
Protected against the penetration of solid foreign bodies, diameter ≥ 2.5 mm

Protection against electric shock
Protected against access to dangerous parts by means of a wire (the distance between a test rod with a diameter of 2.5 mm and a length of 100 mm to dangerous parts must be sufficient)

Protection against the ingress of water
No definition

IP 3XD

Protection against solid foreign bodies
Protected against the penetration of solid foreign bodies, diameter ≥ 2.5 mm

Protection against the ingress of water
No definition

Protection against electric shock
Protected against access to dangerous parts by means of a wire (the distance between a test rod with a diameter of 1 mm and a length of 100 mm to dangerous parts must be sufficient)

IP 65

Protection against solid foreign bodies
Dust-proof: no penetration of dust

Protection against electric shock
Protected against access to dangerous parts by means of a wire (test probe with a diameter of 1 mm may not penetrate)

Protection against the ingress of water
Protected against water jets, water which is directed towards the enclosure from any direction may not have a damaging effect

* Standards see page 43

** For explanations see adjacent table

Notes

If not stated otherwise on the individual pages of this catalog, we reserve the right to include modifications, especially regarding the stated values, dimensions and weights.

Drawings are not binding.

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If not stated otherwise, all dimensions in this catalog are given in mm.

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