Simple protection systems

As a simple protection for distribution transformers and circuit-breaker feeders, standard protection systems are available, consisting of:

- Current-transformer operated protection device with c.t.-operated release (low-energy 0.1 Ws)
  - Siemens Reyrolle 7SR45
  - Woodward/SEG WIC 1-2P, WIC 1-3P, WIP-1
- Protection device with auxiliary voltage supply with shunt release (f)
  - Siemens Reyrolle 7SR10 (Siemens SIPROTEC 7SJ46)
- Instrument transformer as
  - Cable-type current transformer (standard)
  - Three-phase current transformer as option for SIMOSEC switchgear panels type L .....

Mounting location

- In 350 mm high low-voltage compartment (option) of the circuit-breaker feeder, or in the low-voltage niche.

Application of simple protection systems

Operating voltage (kV)	Transformer rating (kVA)	
		WIC 1-2P
6	≥ 160	≥ 160
10	≥ 200	≥ 250
13.8	≥ 250	≥ 400
15	≥ 315	≥ 400
20	≥ 400	≥ 500

Multifunction protection (selection)

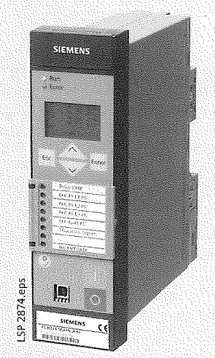
SIPROTEC Compact series
Overcurrent protection SIPROTEC 7SJ80

- 9 programmable function keys
- 6-line display
- USB port at the front
- 2 additional communication ports
- IEC 61850 with integrated redundancy (electrical or optical).

SIPROTEC 5 series, overcurrent protection SIPROTEC 7SJ82

- Directional and non-directional time-overcurrent protection with additional functions
- Time optimization of the tripping times by direction comparison and protection data communication
- Frequency protection and rate-of-frequency change protection for load shedding applications
- Overvoltage and undervoltage protection in all required variations
- Power protection, configurable as active or reactive power protection
- Control, synchrocheck and switchgear interlocking system
- Firmly integrated, electrical Ethernet port J for DIGSI
- Complete IEC 61850 (Reporting and GOOSE) via integrated port J
- Two optional, pluggable communication modules usable for different and redundant protocols (IEC 61850, IEC 60870-5-103, DNP3 (serial+TCP), MODBUS RTU Slave, protection data communication).

Reyrolle 7SR45



SIPROTEC 7SJ80

SIPROTEC 7SJ82

Other types and makes on request

Mounting location

- In the 350 mm or 550 mm high low-voltage compartment (option) of the circuit-breaker feeder.

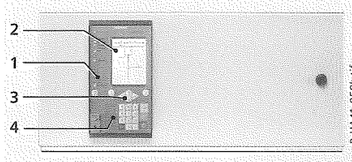
Features of low-voltage compartment (option)

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

Low-voltage cables

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

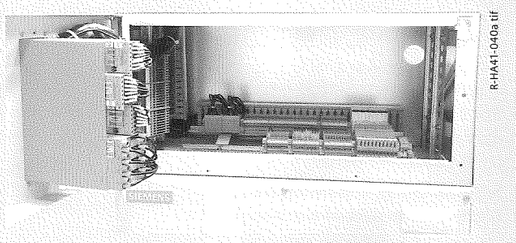
Low-voltage compartment (option)

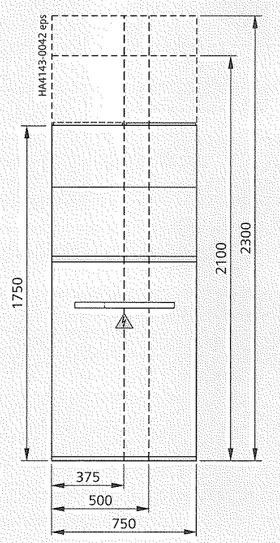


SIPROTEC 5
7SJ82:
1 LED indications
2 LCD
3 Navigation keys
4 Function keys

On circuit-breaker panel type L, L1, ...
for additional low-voltage equipment

Low-voltage compartment (example 750 x 350 mm)





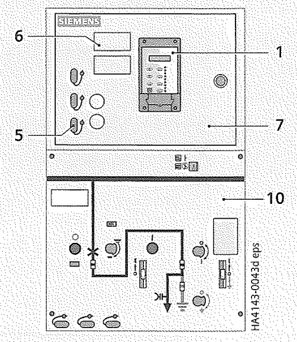
Switchgear height
1750 mm

Low-voltage niche (standard)

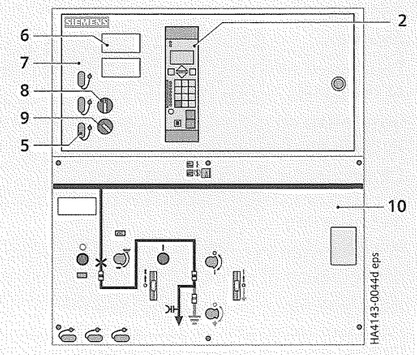
- Inside the panel
- Cover for low-voltage niche:
  – Standard: Screwed-on cover
  – With door (option)
- For accommodation of terminals and standard protection devices, e.g. in circuit-breaker panels combined with frame cover for panels
  – Protection relays (with max. 75 mm wide mounting frame), e.g.
    – Type 7SR45, 7SR10: For type L and L1
    – Make Woodward / SEG, type WIC1: For type L and L1

  On request:
    – 7SJ80
    – Make Woodward / SEG, WIP-1
- 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 IP3X (standard).

Low-voltage niche (examples)



In circuit-breaker panel type L (500 mm) (with CB-f NAR*))

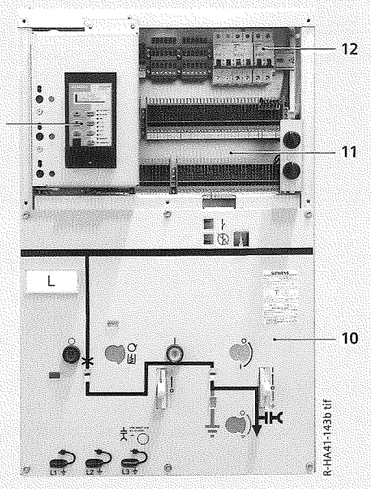


In circuit-breaker panel type L1 (750 mm)

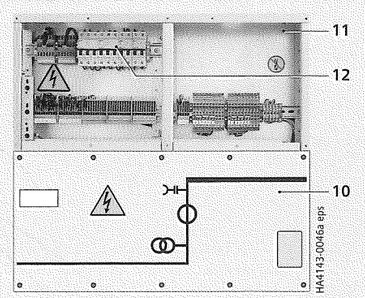
Protection relay as option:

1 Protection relay type 7SR45
2 On request: Protection relay type 7SJ80 in LV niche
3 Protection relay make Woodward (SEG), type WIC
4 On request: Multifunction protection relay SIPROTEC 4 type 7SJ61 on swing-out frame

5 Option: Sockets for capacitive voltage detecting system for busbar
6 Short-circuit/earth-fault indicator
7 Frame cover of low-voltage niche (can be unscrewed)
Option: as door
8 Option: Local-remote switch for three-position switch-disconnector
9 Option: Momentary-contact rotary control switch ON-OFF for motor operating mechanism of the three-position switch-disconnector
10 Panel front
11 Low-voltage niche open
12 Option: Installed equipment



In circuit-breaker panel type L (500 mm)



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

*) AR = Automatic reclosing
NAR = Non automatic reclosing

Room planning

Switchgear installation

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

Room dimensions

See opposite dimension drawings.

Door dimensions

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

Switchgear fastening

- For floor openings and fixing points of the switchgear, see pages 66 to 68
- Foundations:
  – Steel girder construction
  – Steel-reinforced concrete.

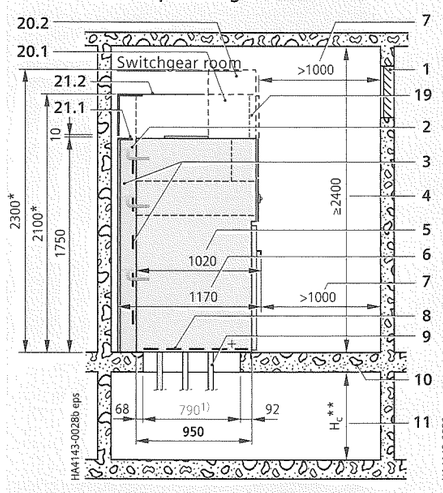
Panel dimensions

See pages 60 to 65

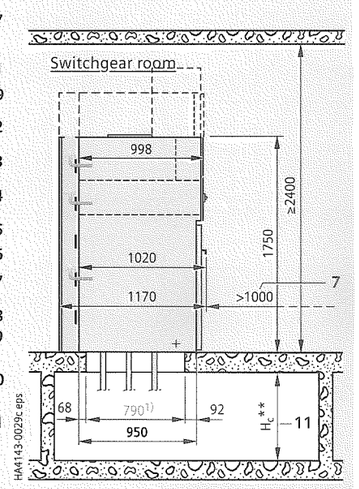
Weight

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 69.

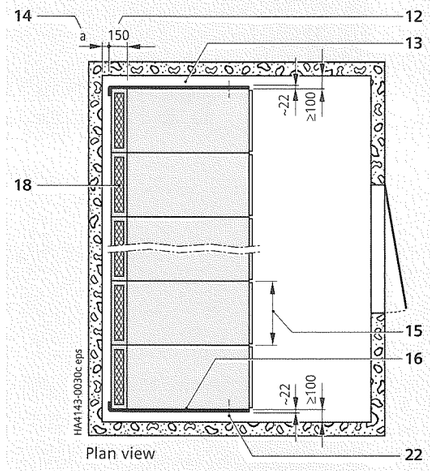
Room planning



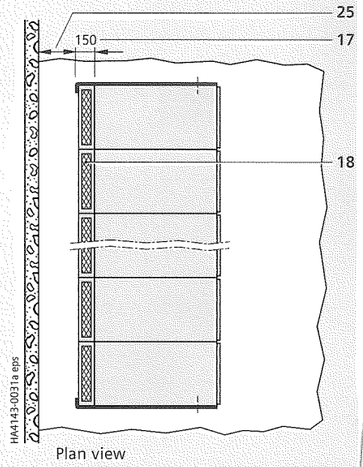
Wall-standing arrangement (side view)



Free-standing arrangement (side view)



Plan view



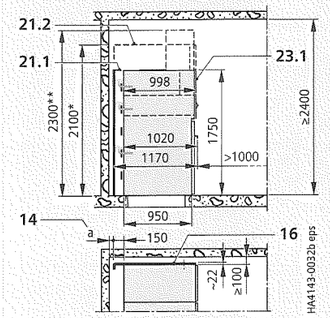
Plan view

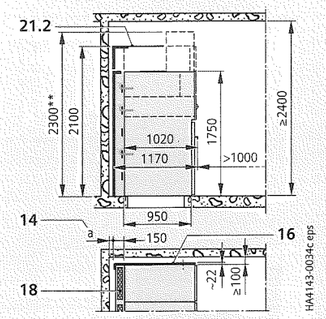
1) Floor opening
△) Panel type L, L1, L(1), L1(T) with VCB type 3AH569: Panel depth: 1080 mm, switchgear depth: 1230 mm
*) Switchgear height 2100 mm if height of low-voltage compartment 350 mm; switchgear height 2300 mm if height of low-voltage compartment 550 mm
**) Cable fixing in the panel,
– without deep floor cover (for version without current transformer on the cable)

1 Relief opening
2 Direction of pressure relief
3 Pressure relief of switchgear
4 Room height
5 Individual panel depth △)
6 Panel depth including end wall △)
7 Depending on national requirements: Control aisle ≥ 1000 mm recommended (in Germany ≥ 800 mm). When extending or replacing panels, it might be necessary – depending on the room dimensions – to disassemble the respective adjacent panels.
8 Option: Floor cover (optionally deeper)
9 Cable
10 Foundation
11 Height of cable basement depending on (recommendation for $H_{c\ inside}$):
– Bending radius of cable ≥ 600 mm**... ≥ 1400 mm
– Cable fixing underneath the panel (in cable basement) ≥ 1400 mm
– Use of deep floor cover ≥ 1400 mm
12 Wall distance, dimension of pressure relief duct (= option)
13 Side wall distance
14 Wall distance a (see also page 59)
15 Panel width

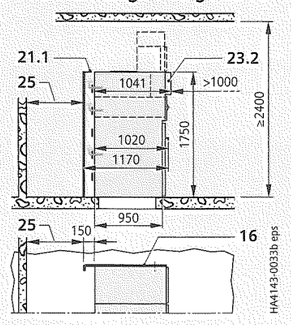
Continued on next page

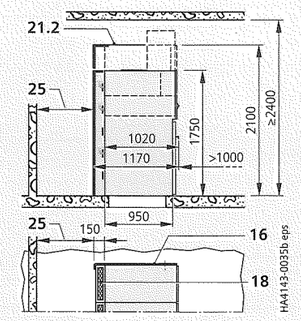
Wall-standing arrangement





Free-standing arrangement





Design of switchgear

Type of installation	IAC	Rear pressure relief duct	Switchgear height in mm	Recommended height for switchgear room
Wall-standing	–	–	1750	≥ 2400
Free-standing	–	– △)	1750	≥ 2400

Floor cover: Available as option

Wall-standing	IAC A FL 16 kA, 1 s	●	2100	≥ 2400
	IAC A FL 21 kA, 1 s	●	2100	≥ 2400
Free-standing	IAC A FLR 16 kA, 1 s	●	2100	≥ 2400
	IAC A FLR 21 kA, 1 s	●	2100	≥ 2400

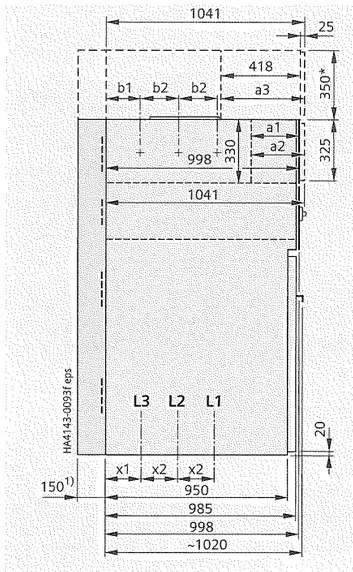
Floor cover: Available as option

Continued from page 57

16 End wall
17 Depth of pressure relief duct
18 Option: Pressure relief duct for each panel, for wall-standing or free-standing arrangement
19 Option: Front cover (panel without low-voltage compartment)
20.1 Option: Low-voltage compartment: 350 mm high
20.2 Option: Low-voltage compartment: 550 mm high
21.1 End wall: 1750 mm high
21.2 End wall: 2100 mm high (standard for IAC design, option without IAC = 2100 mm high)
22 Earthing terminal
23 Cover for low-voltage niche
23.1 Standard: Cover screwed-on (panel depth: 998 mm)
23.2 Option: Door (= 45 mm, panel depth: 1041 mm)
25 Distance to rear wall: ≥ 800 mm (for free-standing arrangement)

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

For standard dimensions and IAC design, see also page 59



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

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

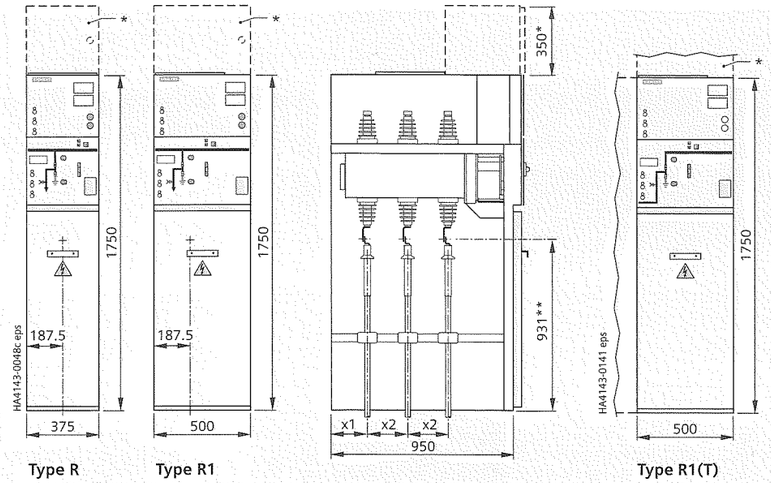
Rated voltage U_r	Dimensions in mm	
Position of cables △)	x1 △)	x2 △)
Up to 17.5 kV	187	210
24 kV	187	210
Position of busbar	b1	b2
Up to 24 kV	187	210

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

Standard dimensions of switchgear

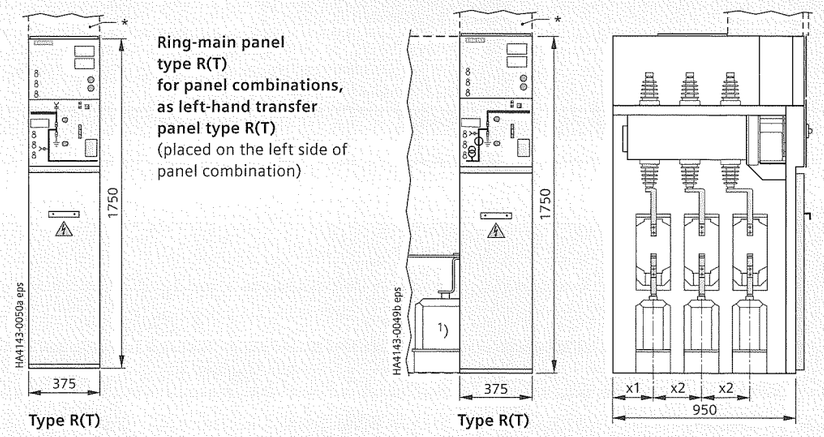
IAC – Design of switchgear	Pressure relief duct (add to panel depth)	Direction of pressure relief	Panel depth *)	Switchgear depth	Switchgear height	Switchgear arrangement	Distance "a" from switchgear to rear wall of switchgear room
	Depth: 150 mm		in mm	in mm	in mm		in mm
• without IAC (= standard)	without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

*) Panel depth depends on panel type and panel design:
– Low-voltage niche with door (= option) (instead of screwed front cover): 1041 mm
– Low-voltage niche with door: 1041 mm
**) In addition, a low-voltage compartment can be selected optionally. The switchgear height is changed respectively



Type R Type R1 Type R1(T)

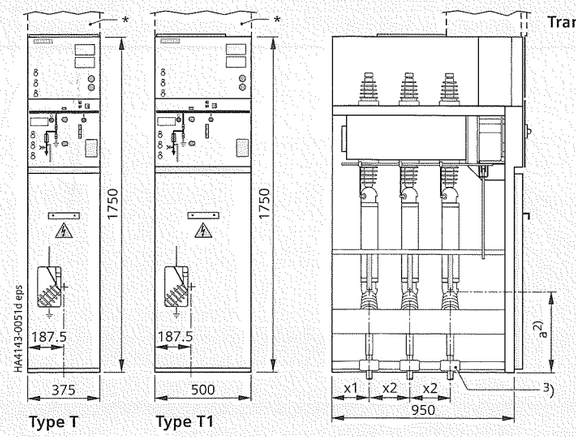
Ring-main panels



Type R(T) Type R(T)

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

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



Type T Type T1

Transformer panels

*) Option:
Low-voltage compartment

** For panel design with 4MA block-type current transformer, the cable connection height is reduced

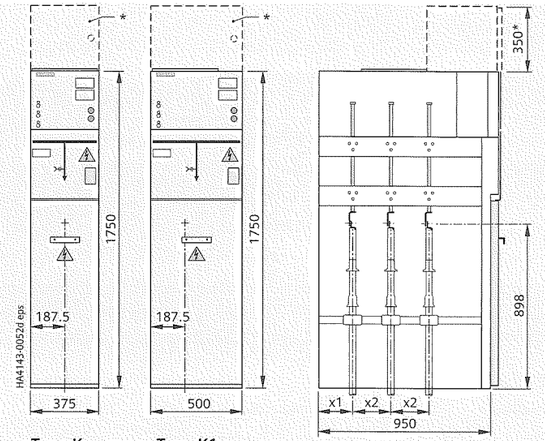
1) Location of voltage transformer in left-hand panel

Panel type T:

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

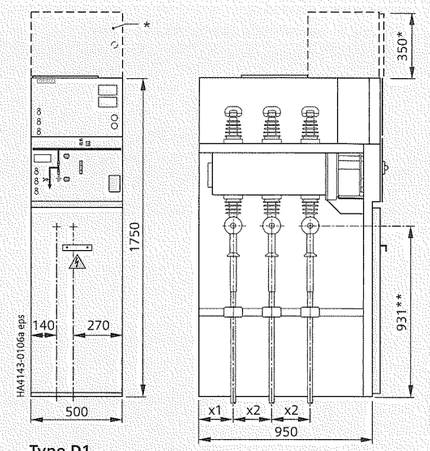
3) Panel types T and T1 with a rated voltage of 24 kV: deeper cable fixing underneath the panel

Dimensions x1 and x2:
See pages 59 and 66



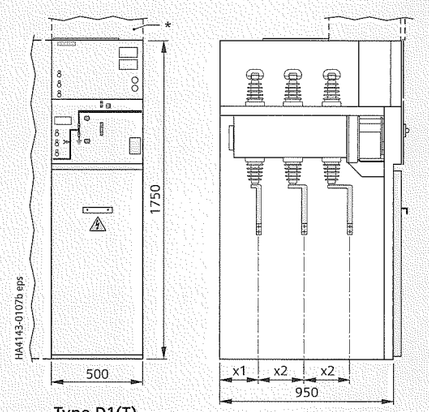
Type K Type K1

Cable panels



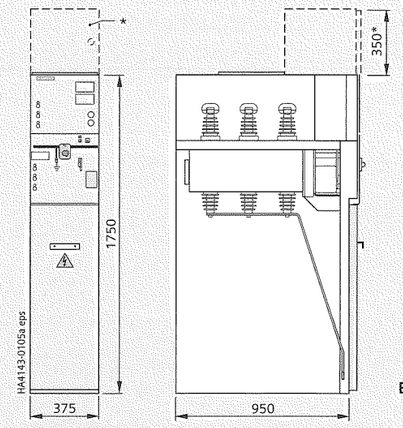
Type D1

Disconnector panel type D1 for cable connection



Type D1(T)

Disconnector panel type D1(T) for panel combinations [e.g. metering panel type M or L1(T)]



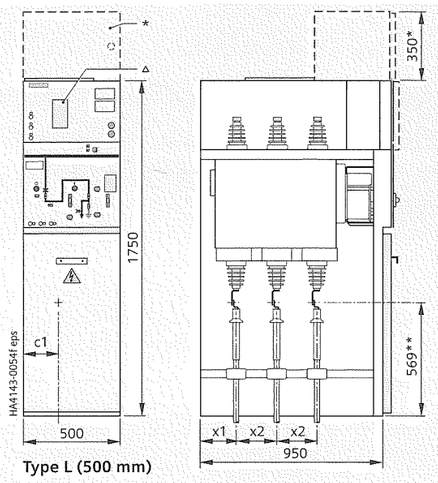
Type E

Earthing panel

*) Option:
Low-voltage compartment

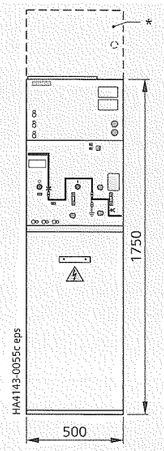
**) For panel design with 4MA block-type current transformer, the cable connection height is reduced

Dimensions x1 and x2:
See pages 59 and 66

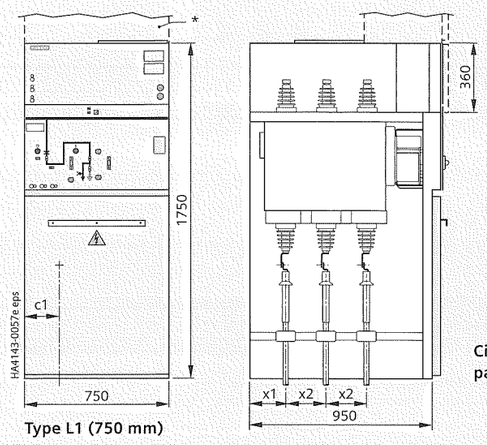


Type L (500 mm)

Circuit-breaker panel 630 A

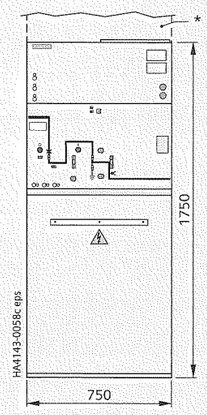


Type L(T)
as transfer panel to the right



Type L1 (750 mm)

Circuit-breaker panel 630 A, 1250 A



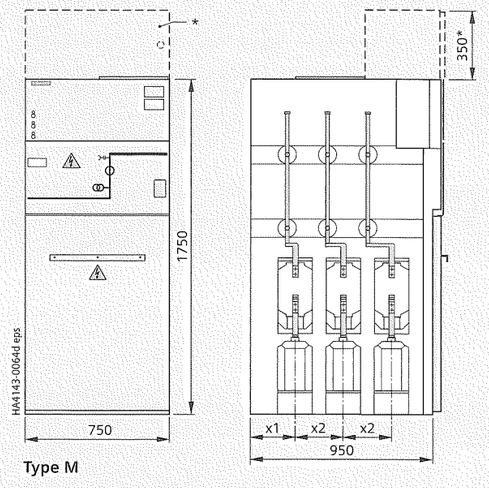
Type L1(T)
as transfer panel to the right

*) Option:
Low-voltage compartment
**) For panel design with 4MA block-type current transformer, the cable connection height is reduced
△) Option: Protection relay

Position of L1, L2 and L3: See page 59
Dimensions x1 and x2: See pages 59 and 66

Panel design

M

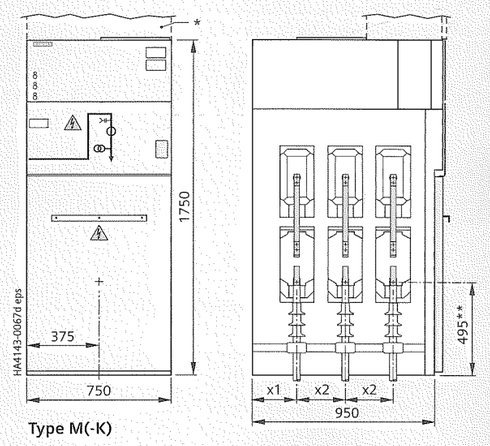


Type M

Metering panel type M (standard)

Panel design

M(-K)

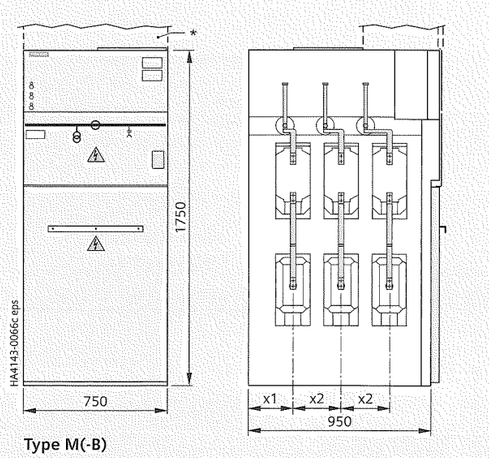


Type M(-K)

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

Panel design

M(-B)

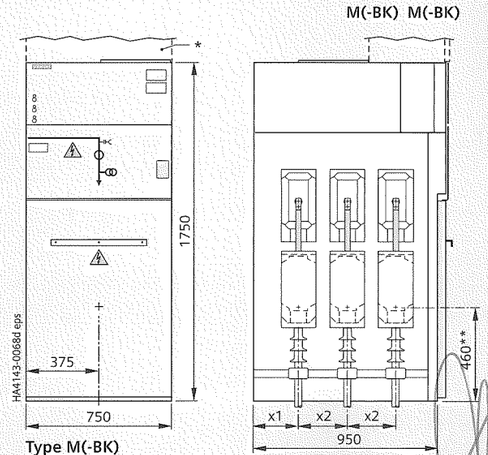


Type M(-B)

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

Panel design

M(-BK) M(-BK)



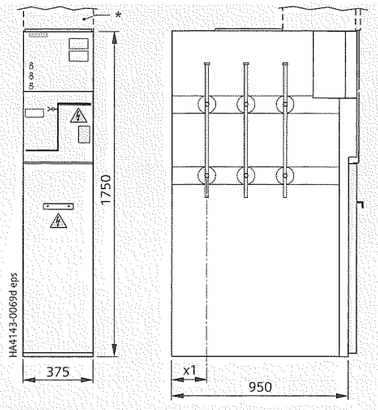
Type M(-BK)

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

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

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

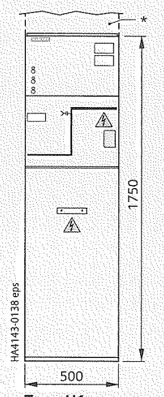
Dimensions x1 and x2 for cable connection: See pages 66 and 67



Bus riser panel

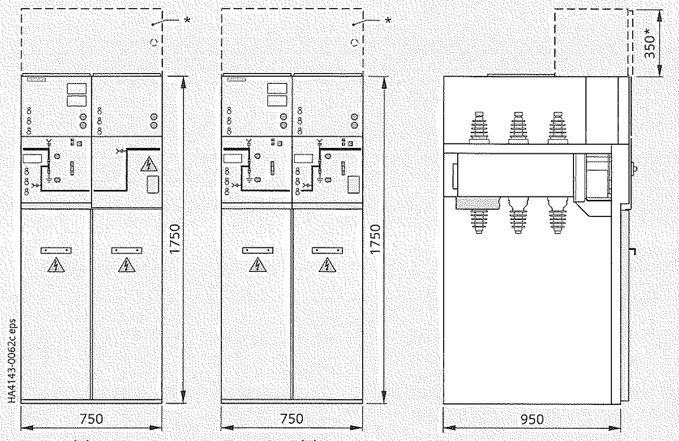
U_r	Dimensions in mm
	x1
Up to 17.5 kV	187
24 kV	187

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



Metering panel
and/or
bus riser panel

Type H1,
for transfer to the right

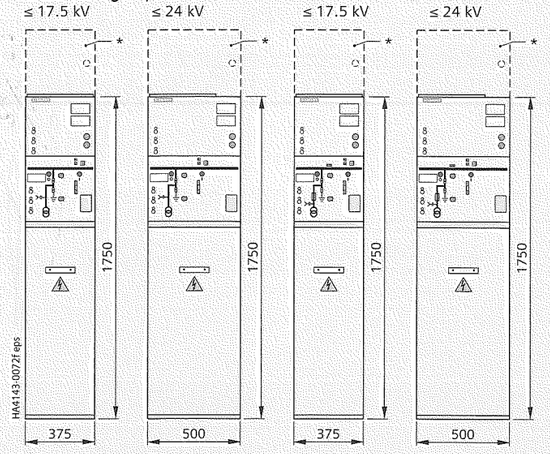


Type R(T) + H **Type 2x R(T)**

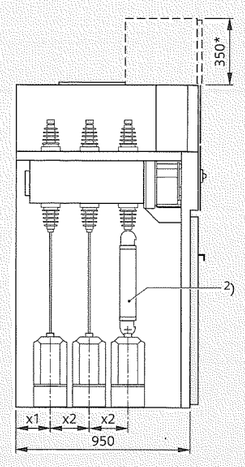
Ring-main transfer panel type R(T)
and
bus riser panel type H
without transformers

Rated voltage U_r:

≤ 17.5 kV ≤ 24 kV ≤ 17.5 kV ≤ 24 kV



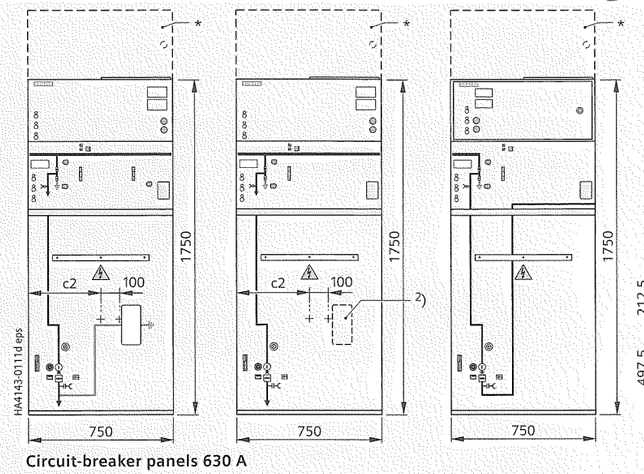
Type M(VT) **Type M1(VT)** **Type M(VT-F)** (with fuses) **Type M1(VT-F)** (with fuses)



Busbar voltage metering panels

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

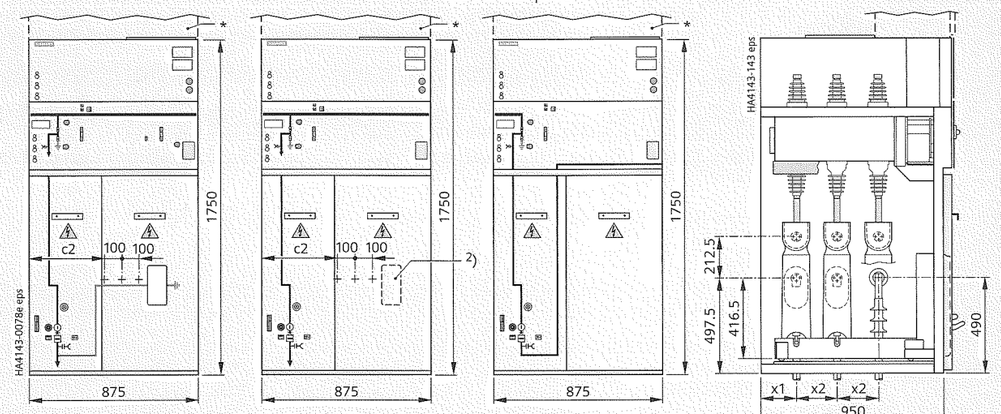
*) Option:
Low-voltage compartment
2) Option: Fuses



*) Option:
Low-voltage compartment
2) Earthing of the feeder via the vacuum circuit-breaker
Option:
Inspection window

Dimensions x1, x2 and c2 for cable connection:
See pages 66 and 67

Circuit-breaker panels 630 A
Type L1(r) **Type L1(r)** **Type L1(r, T) 2)**
as transfer panel



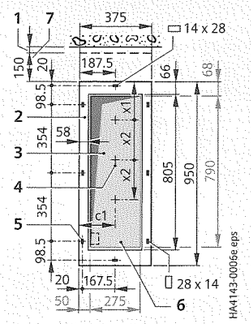
Circuit-breaker panels 1250 A
Type L2(r) **Type L2(r)** **Type L2(r, T) 2)**
as transfer panel

Panel combination *)	Rated normal current of TC	Total width of TC (in mm)	Serial no. of TC
R(T) - H	630 A, 800 A	750	TC-1
H - R(T)	630 A	750	TC-2
R(T) - R(T)	630 A, 800 A	750	TC-3
R(T) - M	630 A, 800 A	1125	TC-4
R(T) - M(-K)	630 A, 800 A	1125	TC-6
L(T) - H	630 A	875	TC-11
L(T) - M	630 A	1250	TC-13
L(T) - M(-K)	630 A	1250	TC-15
L(T) - R(T)	630 A	875	TC-17
L1(T) - H	630 A	1125	TC-21

Panel combination *)	Rated normal current of TC	Total width of TC (in mm)	Serial no. of TC
L1(T) - M	630 A	1500	TC-23
L1(T) - M(-K)	630 A	1500	TC-25
L1(T) - R(T)	630 A	1125	TC-27
D1(T) - H	1250 A	875	TC-45
L1(r,T) - H1	630 A	1250	TC-61
L1(r,T) - R1(T)	630 A	1250	TC-62
L2(r,T) - H1	1250 A	1375	TC-63
L2(r,T) - D1(T)	1250 A	1375	TC-64
R(TM) - L(TM)	630 A	1500	TC-57
R(TM) - L1(TM)	630 A	1750	TC-58

*) Current and voltage transformer installation in the "TC": Depending on the type of "TC" and the rated voltage (not possible everywhere)
TC = Typical combination

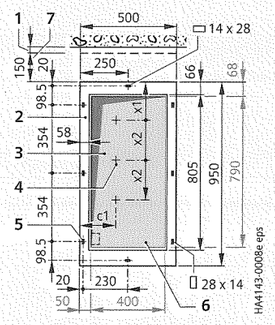
For panel width 375 mm



With cable connection

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

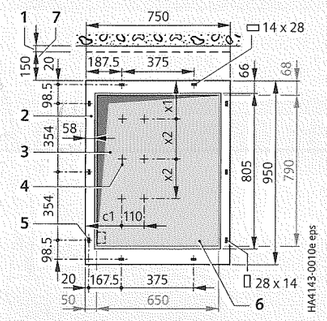
For panel width 500 mm



With cable connection

For panel type	Position of cables [1]					
	Dimensions in mm					
	x1	x1	x2		c1	
	17.5 kV	24 kV	17.5 kV	24 kV	17.5 kV	24 kV
R1, D1	187	187	210	210	187.5	187.5
K1	187	187	210	210	187.5	187.5
T1	187	187	210	210	187.5	187.5
L	187	187	210	210	187.5	187.5
L with CTs, VTs	187	235	210	230	250	300

For panel width 750 mm



With cable connection

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

With cable connection

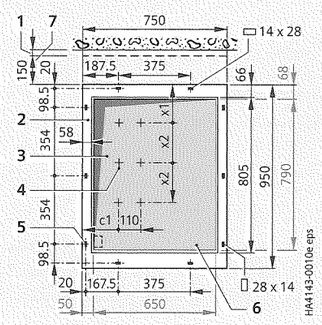
1 Wall distance (see page 59)
2 Fixing frame (base) of an individual panel or panel block
3 Floor opening for high-voltage cables and, where applicable, control cables

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

4 Position of the led-in cables for the feeder [1]
5 Fixing points
6 Floor opening if required for panels without cable connection
7 Option: Pressure relief duct

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

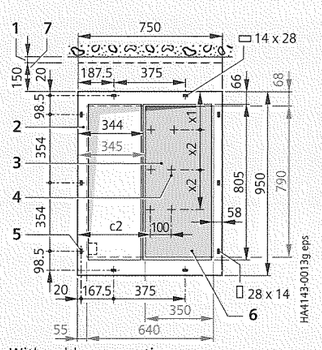
Metering panels: Panel width 750 mm



With cable connection

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

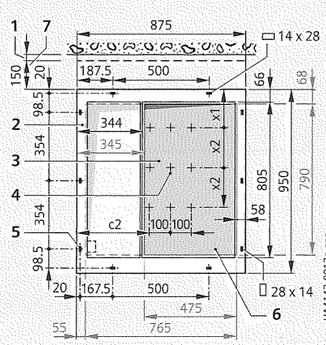
For panel type L1(r), width 750 mm



With cable connection

For panel type	Position of cables [1]						
	Dimensions in mm						
	Number of cables	x1	x1	x2		c2	c2
		17.5 kV	24 kV	17.5 kV	24 kV	17.5 kV	24 kV
L1(r)	1	187	235	210	230	377	377
	2	187	235	210	230	377	377

For panel type L2(r), width 875 mm



With cable connection (up to 3 cables)

For panel type	Position of cables [1]						
	Dimensions in mm						
	Number of cables	x1	x1	x2		c2	c2
		17.5 kV	24 kV	17.5 kV	24 kV	17.5 kV	24 kV
L2(r)	1	187	235	210	230	377	377
	2	187	235	210	230	377	377
	3	187	235	210	230	377	377

1 Wall distance (see page 59)
2 Fixing frame (base) of an individual panel or panel block
3 Floor opening for high-voltage cables and, where applicable, control cables

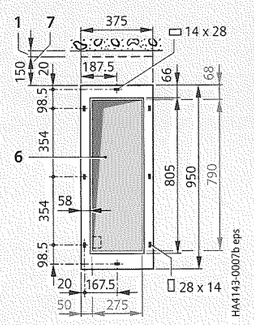
Note:
Connection of double cables: Depending on the panel type and version of the sealing end, the cable distance is approx. 110 mm, or 100 mm.

4 Position of the led-in cables for the feeder [1]
5 Fixing points
6 Floor opening if required for panels without cable connection
7 Option: Pressure relief duct

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

Floor openings (dimensions in red) and fixing points

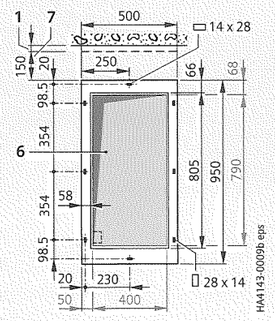
For panel width 375 mm



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

Without cable connection

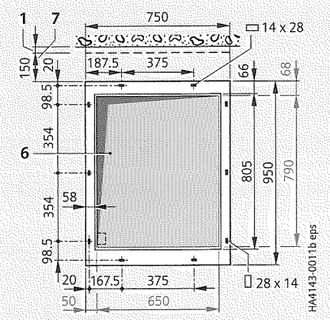
For panel width 500 mm



For panel type:
R1(T), E1
M1(VT), M1(VT-F)
L(T)
D1(T)
H1

Without cable connection

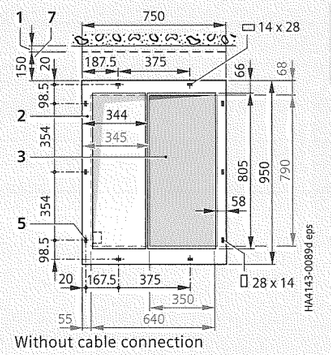
For panel width 750 mm



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

Without cable connection

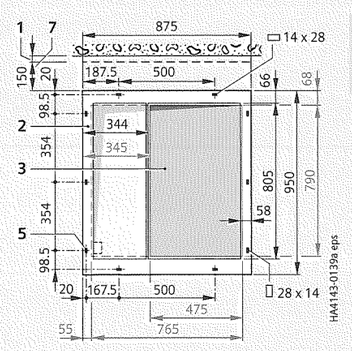
For panel width L1(r, T), width 750 mm



For panel type:
L1(r, T)

Without cable connection

For panel type L2(r, T), width 875 mm



For panel type:
L2(r, T)

1 Wall distance (see page 59)
2 Fixing frame (base) of an individual panel or panel block
3 Floor opening for high-voltage cables and, where applicable, control cables

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

4 Position of the led-in cables for the feeder [1]
5 Fixing points
6 Floor opening if required for panels without cable connection
7 Option: Pressure relief duct

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

Shipping data, transport

Individual panels or combinations thereof for standard switchgear	Panel type	Panel or panel combination		Transport unit "TU" (including packing) for standard panels (without / with pressure relief duct, option)				
		Width **B1** mm	Net weight [1] approx. kg without / with LV C*) / LV C*)	Width **B2** m	Height H △) of "TU" m without / with LV C*) / LV C*)	Depth **T2** m	Volume m³ without / with LV C*) / LV C*)	Gross weight [1][4] approx. kg without / with LV C*) / LV C*)
Transport of individual panels ○)								
Ring-main panel	R	375	160 / 220	1.08	1.95/2.3	1.40	2.95/3.48	220 / 280
	R1	500	180 / 240	1.08				240 / 300
Ring-main transfer panel	R(T)	375	250 / 310	1.08				310 / 370
Transformer panel	T	375	180 / 240	1.08				240 / 300
	T1	500	200 / 260	1.08				260 / 320
Cable panel	K	375	140 / 200	1.08				200 / 260
	K1	500	150 / 210	1.08				210 / 270
Cable panel with make-proof earthing switch	K	375	150 / 210	1.08				210 / 270
	K1	500	170 / 220	1.08				230 / 330
Circuit-breaker panel (fixed-mounted circuit-breaker type "CB-f")	L	500	300 / 360	1.08				360 / 420
	L1	750	340 / 400	1.08				400 / 460
	L(T)	500	300 / 360	1.08				360 / 420
	L1(T)	750	340 / 400	1.08				400 / 460
Circuit-breaker panel (removable circuit-breaker)	L1(r)	750	350 / 410	1.08				410 / 470
	L2(r)	875	380 / 440	1.08				440 / 500
Disconnector panel	D1	500	180 / 240	1.08				240 / 300
Disconnector transfer panel	D1(T)	500	250 / 310	1.08				310 / 370
Metering panel	M; M(-K)	750	270 / 330	1.08				340 / 390
	M(-B); M(-BK)	750	270 / 330	1.08				340 / 390
Metering panel	M(KK)	750	270 / 330	1.08				340 / 390
Busbar voltage metering panel	M(VT)	375	210 / 270	1.08				270 / 330
	M(VT-F)	375	230 / 290	1.08				290 / 350
	M1(VT)	500	240 / 300	1.08				310 / 370
	M1(VT-F)	500	250 / 310	1.08				330 / 390
Bus riser panel	H	375	170 / 230	1.08				230 / 290
	H [3]	375	280 / 340	1.08				340 / 400
Busbar earthing panel	E	375	180 / 240	1.08				240 / 300
Panel combinations					1.95/2.3	1.40	2.95/3.48	
Bus sectionalizer panel (with circuit-breaker)	L(T) + H	875	470 / 570	1.08				530 / 630
Bus sectionalizer panel (with circuit-breaker)	L(T) + R(T)	875	500 / 600	1.08				560 / 660
Bus sectionalizer panel (1 three-position switch-disconnector)	R(T) + H	750	250 / 350	1.08				310 / 410
	R(T) + H [3]	750	350 / 450	1.08				410 / 510
Bus sectionalizer panel (2 three-position switch-disconnectors)	R(T) + R(T)	750	310 / 410	1.08				370 / 470
	R(T) + R(T) [3]	750	420 / 520	1.08				480 / 580

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

*) 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

△) Other heights "H" of "TU" possible (depending on the equipment of the panel type and the packing type)

○) Depending on the delivering factory

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

3) Panel types including CTs and VTs: Weight per CT or VT as cast-resin design: Approx. 20 kg (example: 3 CTs and 3 VTs approx. additionally 120 kg per panel)

4) Add additional weight for pressure relief duct (according to table values)

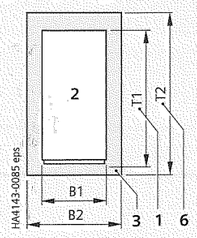
Individual panels or combinations thereof for standard switchgear	Panel type	Panel or panel combination		Transport unit "TU" (including packing) for standard panels (without / with pressure relief duct, option)				
		Width **B1** mm	Net weight [1] approx. kg	Width **B2** m	Height H [Δ] of "TU" m	Depth **T2** m	Volume m³	Gross weight [1] approx. kg
			without / with LV C*) / LV C*)		without / with LV C*) / LV C*)		without / with LV C*) / LV C*)	without / with LV C*) / LV C*)

Transport dimensions [○] for combinations of different individual panels

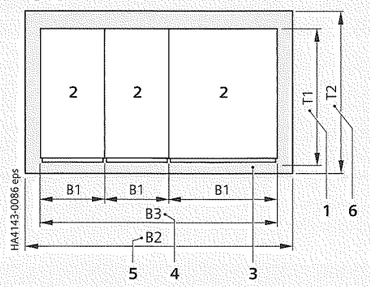
Transport unit "TU":	Max. width of switchgear unit "B3"	B2		T2		
– Standard: As individual panels arranged side by side and not screwed together	On request	0.70	1.95/2.3	1.40	1.91/2.25	
– Option: As multi-panel transport unit, panels screwed together	≤ 875 mm	1.08	1.95/2.3	1.40	2.95/3.48	[2] + 70 **)
	≤ 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	≤ 2125 mm	2.33	1.95/2.3	1.40	6.36/7.50	[2] + 120 **)
– Sea transport, airfreight						
Container packing, standard	≤ 875 mm	1.10	1.95/2.3	1.40	3.00/3.50	[2] + 80 **)
(other dimensions on request)	≤ 2000 mm	2.20	1.95/2.3	1.40	6.00/7.10	[2] + 120 **)

Transport unit "TU" (CN):	Max. width of switchgear unit "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	1.050	1.95/2.3	1.40	2.95/3.48	[2] + 70 **)
	≤ 1125 mm	1.290	1.95/2.3	1.40	3.08/3.70	[2] + 80 **)
Standard packing for:	≤ 1500 mm	1.680	1.95/2.3	1.40	4.64/5.47	[2] + 100 **)
– Truck	≤ 2000 mm	2.200	1.95/2.3	1.40	6.00/7.10	[2] + 120 **)
– Sea transport						
– Container transport (other packing on request)						

Transport units (= TU) for shipping (plan view)



For individual panel



For 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
6 T2 = Depth of the transport unit

*) 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

*** On request: Max. panel width "B3" ≤ 1125 mm (e.g. for 3 x 375 mm)

Δ) Other heights "H" of "TU" possible (depending on the equipment of the panel type and the packing type)

○) Depending on the delivering factory (CN, PT)

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

Packing types (examples)

For size and weight of the transport units, see page 69.

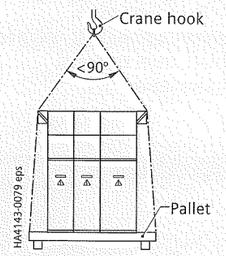
Place of destination and means of transport	Examples for packing ○)
China / Europe by rail and truck	Type: Open PE protective foil pulled over the switchgear, with wooden base
Overseas by seafreight	Type: Seaworthy crate (standard) Welded PE protective foil, with closed wooden crate, with desiccant bag
	Type: Open for container PE protective foil pulled over the switchgear, with wooden base
Overseas by airfreight	Type: Open PE protective foil pulled over the switchgear, with wooden base and lattice or cardboard cover

Transport

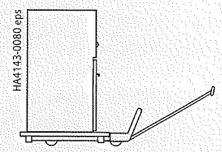
SIMOSEC switchgear is completely delivered in transport units. Please observe the following:

- Transport facilities on site
- Transport dimensions and weights
- Size of door openings in building
- Switchgear with low-voltage compartment: Please observe other transport dimensions and weights.

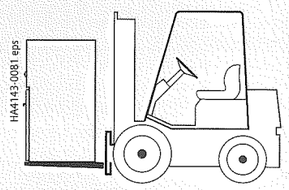
Types of transport (examples)



Crane transport with pallet



Transport with lifting truck
with or without pallet



Transport with fork-lift truck, standing

○) Depending on the delivering factory

Standards

SIMOSEC switchgear complies with the relevant standards and specifications applicable at the time of type tests.
In accordance with the harmonization agreement reached by the countries of the European Union, their national specifications conform to the IEC standard.

Overview of standards (2018)

		IEC standard	VDE standard	EN standard	GB standard
Switchgear	SIMOSEC	IEC 62271-1	VDE 0671-1	EN 62271-1	GB/T 11022
		IEC 62271-200	VDE 0671-200	EN 62271-200	GB 3906
Devices	Circuit-breakers	IEC 62271-100	VDE 0671-100	EN 62271-100	GB 1984
	Disconnectors and earthing switches	IEC 62271-102	VDE 0671-102	EN 62271-102	GB 1985
	Switch-disconnectors	IEC 62271-103	VDE 0671-103	EN 62271-103	GB 3804
	Switch-disconnector/fuse combination	IEC 62271-105	VDE 0671-105	EN 62271-105	GB 16926
	HV HRC fuses	IEC 60282-1	VDE 0670-4	EN 60282-1	GB 15166.2
	Voltage detecting systems Voltage presence indicating systems	IEC 61243-5 IEC 62271-206	VDE 0682-415 VDE 0671-206	EN 61243-5 EN 62271-206	DL/T 538-2006 (acc. to IEC 61958-2008, similar to Chinese standard)
Degree of protection	IP code	IEC 60529	VDE 0470-1	EN 60529	GB 4208
	IK code	IEC 62262	VDE 0470-100	EN 50102	
Insulation	–	IEC 60071	VDE 0111	EN 60071	GB/T 311.2
Transformers	Instrument transformers: General requirements	IEC 61869-1	VDE 0414-9-1	EN 61869-1	
	Current transformers	IEC 61869-2	VDE 0414-9-2	EN 61869-2	GB 1208
	Voltage transformers	IEC 61869-3	VDE 0414-9-3	EN 61869-3	GB 1207
Power installations	Common rules	IEC 61936-1	VDE 0101-1	EN 61936-1	–
	Earthing of power installations	–	VDE 0101-2	EN 50522	–
Insulating gas SF_6	Specification for sulfur hexafluoride (SF_6)	IEC 60376	VDE 0373-1	EN 60376	–

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.

Dielectric strength

- The dielectric strength 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 and GB 11022 (see table "Dielectric strength").
- The rated values are referred to sea level and to normal atmospheric conditions (1013 hPa, 20 °C, 11 g/m³ humidity in accordance with IEC 60071 and VDE 0111).
- The dielectric strength 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 dielectric strength 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.

Table – Dielectric strength

Rated voltage (r.m.s. value)	kV	7.2	12	15	17.5	24
Rated short-duration power-frequency withstand voltage (r.m.s. value)						
– Across the isolating distances	kV	23	32	48 *)	39	45	60
– Between phases and to earth	kV	20	28	42 *)	36	38	50
Rated lightning impulse withstand voltage (peak value)						
– Across the isolating distances	kV	70	85	105	110	145
– Between phases and to earth	kV	60	75	95	95	125

Current carrying capacity

- According to IEC 62271-200 or IEC 62271-1, VDE 0671-200 or VDE 0671-1, the rated normal current refers to the following ambient air temperatures:
  – Maximum of 24-hour mean + 35 °C
  – Maximum + 40 °C
- The current carrying capacity of the panels and busbars depends on the ambient air temperature outside the enclosure.

Internal arc classification

- Protection of operating personnel by means of tests for verifying the internal arc classification
- Internal arcing tests must be performed in accordance with IEC 62271-200 or VDE 0671-200
- Definition of criteria:
  – Criterion 1:
  Correctly secured doors and covers do not open, limited deformations are accepted
  – Criterion 2:
  No fragmentation of the enclosure, no projection of small parts above 60 g
  – Criterion 3:
  No holes in accessible sides up to a height of 2 m
  – Criterion 4:
  No ignition of indicators due to hot gases
  – Criterion 5:
  The enclosure remains connected to its earthing point.

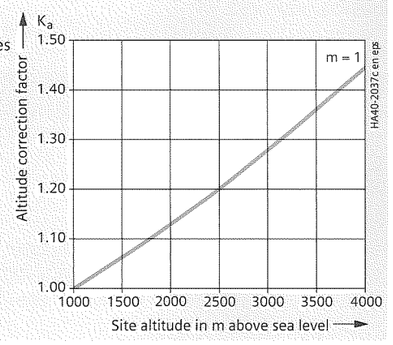
*) Value according to GB standard

Resistance to internal faults (option)

In SIMOSEC switchgear, the appearance of internal faults (internal arcs) is less compared with earlier designs due to:
– Use of gas-insulated switching-device vessels
– Use of metal-enclosed switching-device vessels
– The fact that maloperation is practically excluded due to logical arrangement of operating elements and use of logical mechanical interlocks
– Short-circuit-proof feeder earthing by means of the three-position switch (make-proof earthing switch) or the circuit-breaker.

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-duration power-frequency withstand voltage for site altitudes > 1000 m to be selected

≥ Rated short-duration power-freq. withstand volt. 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 1:
3000 m site altitude above sea level
17.5 kV switchgear rated voltage
95 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

Example 2:
2750 m site altitude above sea level
7.2 kV switchgear rated voltage
60 kV rated lightning impulse withstand voltage
Rated lightning impulse withstand volt. to be selected 60 kV · 1.25 = 75 kV
Result:
According to the above table, a switchgear for a rated voltage of 12 kV with a rated lightning impulse withstand voltage of 75 kV is to be selected.

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, e.g. for rated voltages up to 17.5 kV can be subjected to cable tests at a max. DC test voltage of 38 kV according to VDE. The voltage at the busbar may be 17.5 kV in this case
- SIMOSEC switchgear for rated voltages up to 24 kV can be subjected to cable tests at a max. DC test voltage of 72 kV or according to VDE at 70 kV, 15 min. The voltage at the busbar may be 24 kV in this case.
- For cable testing

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

must be observed.

Test voltages:

Rated voltage	U_0 / U (U_m)	Max. test voltage applied to the connected cable		
		VLF [1], 0.1 Hz	acc. to IEC	VDE 0278
		3 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

Color of the switchgear

Panel front:
RAL 7035 (light grey)
End walls:
Standard: Steel (sendzimir galvanized)
Option: Painted, color according to panel front.

Terms

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

Climate and environmental influences

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

- Temperature: –5 °C up to +55 °C
  –25 °C up to +55 °C [3]
  (optional, with panel heating)
- Relative air humidity: Mean value over 24 h [3]: ≤ 95 %
  Mean value over 1 month: ≤ 90 %
- Condensation: Occasionally use a heater as anti-condensation protection (in the panel)
- Site altitude: Altitude correction to be considered (see page 73)

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

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

Climate classes:

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

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

- Environmental influences

– Natural foreign materials
– Chemically active pollutants
– Small animals

Recycling

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

*) For standards, see page 72
1) VLF = very low frequency
2) Referred to: U_0/U (U_m = 6.35/11 (12) kV)
3) Secondary devices (e.g. protection devices, meters, measuring transducers, etc.) must be suitable for the given operating conditions.

PM

Metallic partition according to IEC 62271-200 (3.109.1). Metallic partitions between open, accessible compartments and live parts.
The SIMOSEC switchgear is suitable for application in indoor installations under normal operating conditions as defined in the standard IEC 62271-1.

Protection against solid foreign objects, electric shock and water

SIMOSEC switchgear fulfills according to the standards *)

IEC 62271-1	EN 62271-1	VDE 0671-1
IEC 62271-200	EN 62271-200	VDE 0671-200
IEC 60529	EN 60529	VDE 0470-1
IEC 62262	EN 50102	VDE 0470-100

the following degrees of protection
(for explanations, see opposite table):

Degree of protection "IP"	Type of protection
IP2X (standard)	for switchgear enclosure
IP3X (option)	for switchgear enclosure (optional)
IP3XD (option on request)	for switchgear enclosure (on request)
IP65	for parts of the primary circuit of switching-device vessels under high voltage

Degree of protection IK	Type of protection
IK 07	for switchgear enclosure

For secondary devices in the low-voltage door, the stipulations of the IP degree of protection apply according to the definitions for the switchgear enclosure.

IEC/EN 60529:

Type of protection	Degree of protection
Standard:	IP 2X
Protection against solid foreign objects	
Protected against solid foreign objects of 12.5 mm diameter and greater (the object probe, sphere of 12.5 mm diameter, shall not fully penetrate)	
Protection against access to hazardous parts	
Protected against access to hazardous parts with a finger (the jointed test finger of 12 mm diameter, 80 mm length, shall have adequate clearance from hazardous parts)	
Protection against water	
No definition	
Option:	IP 3X
Protection against solid foreign objects	
Protected against solid foreign objects of 2.5 mm diameter and greater (the object probe, sphere of 2.5 mm diameter, shall not penetrate at all)	
Protection against access to hazardous parts	
Protected against access to hazardous parts with a tool (the access probe of 2.5 mm diameter shall not penetrate)	
Protection against water	
No definition	
Option on request:	IP 3XD
Protection against solid foreign objects	
Protected against solid foreign objects of 2.5 mm diameter and greater (the object probe, sphere of 2.5 mm diameter, shall not penetrate at all)	
Protection against water	
No definition	
Protection against access to hazardous parts	
Protected against access with a wire (the access probe of 1.0 mm diameter, 100 mm length, shall have adequate clearance from hazardous parts)	
	IP 65
Protection against solid foreign objects	
Dust-tight (No ingress of dust)	
Protection against access to hazardous parts	
Protected against access to hazardous parts with a wire (the access probe of 1.0 mm diameter shall not penetrate)	
Protection against water	
Protected against water jets (water projected in jets against the enclosure from any direction shall have no harmful effects)	

*) For standards, see page 72

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