SIEMENS



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Selection and application guide

Type SIMOSEC metal-enclosed interrupter switchgear up to 27.6 kV

Answers for infrastructure and cities.


SIEMENS
CS 1
FS 2

Selection and application guide

This selection and application guide for the type SIMOSEC air-insulated metal-enclosed switchgear up to 27.6 kV presents you the features, benefits, ratings and dimensions of the equipment.

Siemens' experience gained in over 50 years of supplying metal-enclosed load-interrupter switchgear in the U.S. has been captured in the type SIMOSEC design. The objective has been to incorporate features designed to provide safety, while simplifying operation, maintenance and minimizing installation cost.

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Application requirements

Features

SIMOSEC switchgear is factory-assembled, type tested, three-phase, metal-enclosed, indoor switchgear according to ANSI/IEEE C37.20.3.

Typical uses

SIMOSEC switchgear is used for power distribution in distribution systems with feeder currents up to 600 A, with main copper bus bars 1,200 A.

Modular space-saving design allows use in:

- Substations, distribution stations and switching stations
- Public buildings, such as high-rise buildings, rail stations, hospitals
- Industrial plants.

Typical examples:

- Office parks
- Airports
- Underground railway stations
- Sewage treatment plants
- Schools
- Shopping centers
- Petroleum facilities
- Chemical plants
- Industrial plants.

Modular design:

- Individual panels
- Lineups.

Technical features:

- Air-insulated indoor switchgear
- Gas-insulated, maintenance-free switching functions for the two/three-position switch
- Three-pole primary enclosure
- Phases arranged one behind the other
- No cross-insulation between phases
- Main bus at the top or bottom, as required by application
- Air-insulated busbar and cable connection system
- Main bus bar insulation (optional) using Raychem or 3M heat shrink tubing - bus joints uninsulated
- Hermetically-sealed (welded) stainless-steel switch vessel for two-/three-position switch:
  - With welded-in epoxy-resin bushings (for electrical connections and mechanical components)
  - With insulating gas SF_6
- Metal-enclosed design to ANSI/IEEE C37.20.3
- Air-insulated cable connection system for conventional cable lugs
- Available three-phase current transformer, factory-assembled on the feeder bushings
- Integrated low-voltage niche (standard) for installation of low-voltage devices (for example, terminals, selector switches, miniature circuit breakers (MCB))
- Option: Space heaters along with thermostat or humidstat as required by application.

Reliability:

- Design (type) tested with third-party witness
- Standardized and manufactured using numerically controlled machines
- Quality management system according to ISO 9001
- More than 500,000 switchgear panels in operation worldwide
- No cross-insulation between phases.

Personal safety:

- All switching operations can be performed with closed panel front
- Metal-enclosed switchgear
- High-voltage current-limiting (HV CL) fuses and cable terminations are only accessible when the outgoing feeder is grounded using three-position switch, or outgoing feeder is OPEN using two-position switch
- Grounding of outgoing feeders by means of make-proof grounding switches (for three-position switch only)
- Logical mechanical interlocking
- Capacitive voltage detection system for verification of safe isolation from supply.

Life-cycle cost-efficiency:

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

- Two/three-position switch with gas-insulated quenching principle
- Minimum space requirement
- Easy switchgear extension.

Electrical features:

- Rated voltages up to 27.6 kV
- Rated short-circuit current (fused) up to 63 kA at 15 kV and below, and 25 kA at 26.4 kV
- Rated short-time withstand current (2 seconds) unfused, up to 20 kA (for 26.4 kV) or 25 kA (for up to 15 kV)
- Rated normal current of feeders
  - Up to 600 A unfused
  - Fused - see fuse application table on page 26
- 1,200 A main bus continuous current.

Security of operation:

- Components, e.g., operating mechanisms, three-position switches field proven over many years
- Metal-enclosed panels plus metal compartmentalization between main bus and switching device and between switching device and cable connection compartment
- Two/three-position switch metal-enclosed with gas switching functions
  - Welded sealed-for-life switch vessel
  - No cross-insulation between phases
  - With welded-in bushings for cable connection, main bus connections and operating mechanism
- Switch operating mechanism outside switch vessel
- Maintenance-free operating mechanism parts
- Mechanical switch position indications integrated in mimic diagram
- Switchgear interlocking system with logical mechanical interlocks.



Technical data

Complete switchgear

Rated insulation level	Rated voltage U_r	kV	5.0	15.0	27.6[7]
	Rated short-duration (one minute) power-frequency withstand voltage	kV	19	36	60
	Rated lightning impulse withstand voltage $U_{p'}$ peak	kV	60	95	125
Rated frequency f_r		Hz	50/60	50/60	50/60
Rated continuous current I_r of main bus[1] (where applicable)	Standard	A	1,200	1,200	1,200
Rated short-circuit current	For switchgear with all feeders fused (panel type FS)	kA (sym)	63	63	25
		kA (asym)	101	101	40
		kA (peak)	164	164	65
Rated short-time withstand current I_k[6]	For switchgear with t_k = 2 s rated duration	up to kA	20/25	20/25	20
Rated peak withstand current I_p[6]		up to kA	52/65	52/65	52
Rated filling pressure p_{re}[2]		psi (kPa) at 68 °F (20 °C) (absolute)	21.8 (150)	21.8 (150)	21.8 (150)
Minimum operating pressure p_{me}[2]			18.9 (130)	18.9 (130)	18.9 (130)
Ambient temperature T	For panels without secondary equipment	°F (°C)	-22 to +104 (-30 to +40)	-22 to +104 (-30 to +40)	-22 to +104 (-30 to +40)

Footnotes (applicable to pages six and seven):

1. The rated continuous currents apply to ambient temperatures of up to 104 °F (40 °C).
2. Pressure values (absolute) for SF_6 insulated vessels.
3. The fuse assembly is designed for a reference dimension "e" = 21.1" (537 mm). With reference dimension "e" = 17.4" (442 mm), an extension tube (3.7" (95 mm)) is required.
4. Depending on the high-voltage current-limiting fuse links.
5. Fused.
6. Without fuses.
7. Maximum system voltage 26.4 kV.
8. See page 26 for permissible continuous current for various fuse selections.

Cable switch panel type CS, cable connection panel type CC, cable grounding panel type CG

Rated voltage U_r		**kV**	5.0	15.0	27.6[7]
Rated continuous current I_r[1]	**For panel type CS, CG**	**A**	600	600	600
	Only for panel type CC	**A**	600/1,200	600/1,200	600/1,200
Rated fault closing current I_{ma}[6]	**Only for panel type CS**	**kA (asym)**	32/40	32/40	32
		kA (peak)	52/65	52/65	52

Fuse panel types FS, FU

Rated voltage U_r		**kV**	5.0	15.0	27.6[7]
Rated continuous current I_r[1,4]	**For feeder**	**A**	200/600	200/600	200/600
Rated peak withstand current I_p[5]		**up to kA**	164	164	65
Rated fault closing current I_{ma}[5]	**Only for panel type FS**	**kA (asym)**	101	101	40
		kA (peak)	164	164	65
Reference dimension "e"[3]	**For high-voltage current-limiting fuses**	**inches (mm)**	17.4 (442)	up to 100E 17.4 (442); 125E and over 21.1 (537)	21.1 (537)
Maximum fuse rating[8]	**For panel FS-1**	**A**	450E	200E	65E
	For panel FS-2	**A**	Two 450E per phase	Two 200E per phase	Two 65E per phase
	For panel FS-3	**A**	Three 300E per phase	Three 200E per phase	Three 65E per phase

Main bus grounding panel type BG

Rated voltage U_r	**kV**	5.0	15.0	27.6[7]
Rated fault closing current I_{ma}[5]	**kA (asym)**	32/40	32/40	32
	kA (peak)	52/65	52/65	52

Main bus metering switch panel type MS3

Rated voltage U_r	**kV**	5.0	15.0	27.6[7]
Rated peak withstand current I_p[5]	**up to kA**	52/65	52/65	52
Rated fault closing current I_{ma}[5]	**kA (asym)**	32/40	32/40	32
	kA (peak)	52/65	52/65	52

Metering panel types MT3, MC3, bus riser panel BR

Rated voltage U_r	**kV**	5.0	15.0	27.6[7]
Rated continuous current I_r[1]	**A**	600/1,200	600/1,200	600/1,200

Switchgear installation

Room planning

Switchgear installation:

- Free-standing or against a wall
- Single row
- Double row (for face-to-face arrangement).

Room dimension:

- Refer to room planning diagram.

Door dimensions:

The door dimensions depend upon:

- Number of panels in a transport unit
- Height of the panel.

Switchgear fastening:

- For floor plan with floor openings of the switchgear, refer to page 43
- Foundations:
  - Steel structure
  - Steel-reinforced concrete.

Panel dimensions

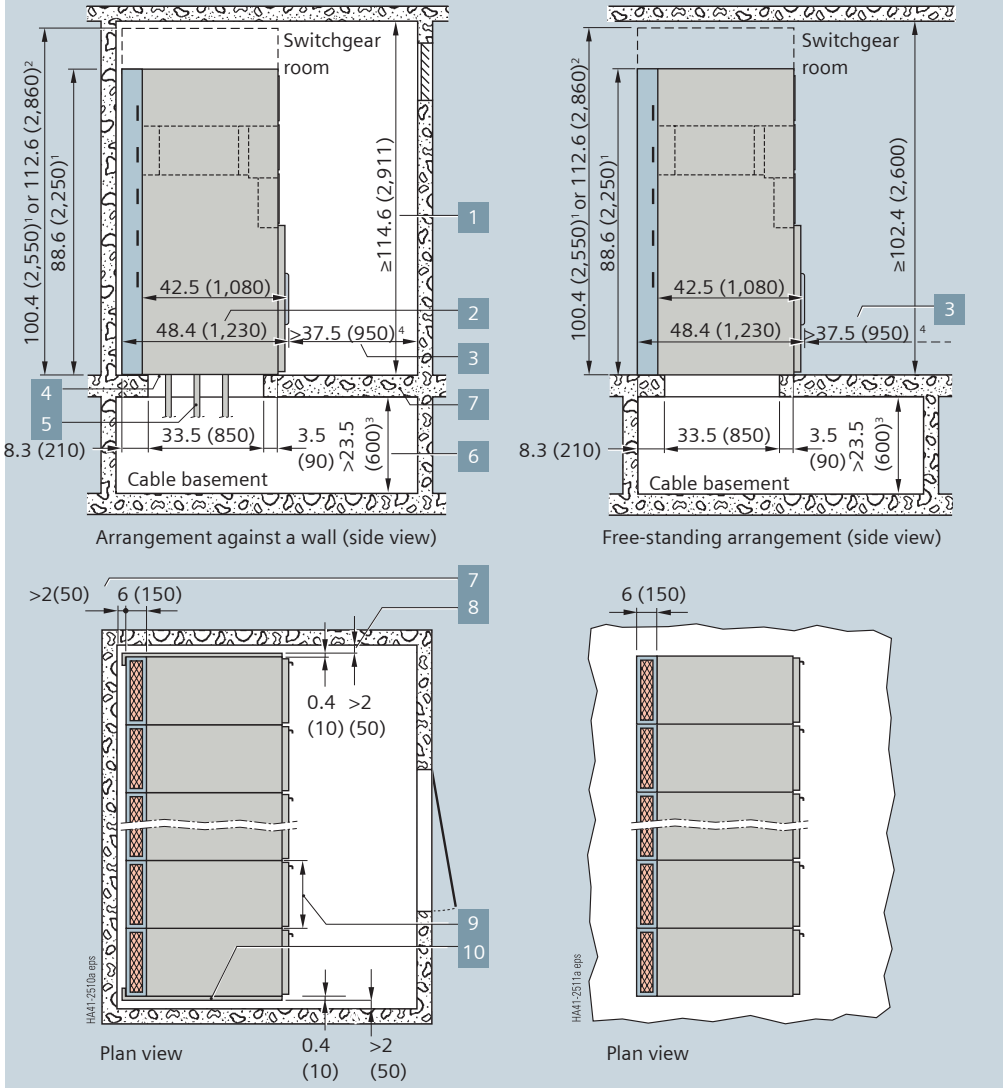
Refer to pages 33 to 43.

Weight

The weight of a panel depends upon the options with which it is equipped (for instance, with motor operating mechanism, voltage transformer). For details, please refer to page 9.

Room planning diagram

Dimensions in inches (mm)



Item	Description	Item	Description
1	Room height	6	Height of cable basement corresponding to cable bending radius
2	Individual panel depth	7	Distance to wall
3	Control aisle	8	Side wall distance
4	Optional floor cover	9	Panel width
5	Cable	10	End wall

Footnotes:

1. Switchgear height 88.6" (2,250 mm) without top hat.
2. For panels with top hat for top entrance cables, switchgear height 100.4" (2,550 mm) with 11.8" (300 mm) top hat, or 112.6" (2,860 mm) with 24.0" (610 mm) top hat.
3. Depending upon bending radius of cable.
4. 37.5" (950 mm) distance shown is the space required by the equipment. The actual space must also reflect requirements of applicable codes (for example, National Electrical Code®) or standards and regulations.

Shipping data

Transport of individual panel dimensions in inches (mm) or lb (kg)

Panel type		Weight	Width B1	Height H1	Depth T1
Cable switch panel	CS1	397 (180)	14.8 (375)	88.6 (2,250)	48.4 (1,230)
	CS2	452 (205)	19.7 (500)	88.6 (2,250)	48.4 (1,230)
	CS3	[1]	29.5 (750)	88.6 (2,250)	48.4 (1,230)
Fuse switch panel	FS1	452 (205)	14.8 (375)	88.6 (2,250)	48.4 (1,230)
	FS2	507 (230)	19.7 (500)	88.6 (2,250)	48.4 (1,230)
	FS3	551 (250)	29.5 (750)	88.6 (2,250)	48.4 (1,230)
Fuse panel	FU1	353 (160)	14.8 (375)	88.6 (2,250)	48.4 (1,230)
	FU2	408 (185)	19.7 (500)	88.6 (2,250)	48.4 (1,230)
	FU3	463 (210)	29.5 (750)	88.6 (2,250)	48.4 (1,230)
Cable connection panel	CC1	320 (145)	14.8 (375)	88.6 (2,250)	48.4 (1,230)
	CC2	375 (170)	19.7 (500)	88.6 (2,250)	48.4 (1,230)
	CC3	[1]	29.5 (750)	88.6 (2,250)	48.4 (1,230)
Cable grounding panel (=cable connection panel with grounding switch)	CG1	397 (180)	14.8 (375)	88.6 (2,250)	48.4 (1,230)
	CG2	452 (205)	19.7 (500)	88.6 (2,250)	48.4 (1,230)
Metering panel	MT3	926 (420)	29.5 (750)	88.6 (2,250)	48.4 (1,230)
Metering cable panel	MC3	926 (420)	29.5 (750)	88.6 (2,250)	48.4 (1,230)
Metering switch panel	MS3	926 (420)	29.5 (750)	88.6 (2,250)	48.4 (1,230)
Bus riser panel	BR1	320 (145)	14.8 (375)	88.6 (2,250)	48.4 (1,230)
	BR2	375 (170)	19.7 (500)	88.6 (2,250)	48.4 (1,230)
Main bus grounding panel	BG1	397 (180)	14.8 (375)	88.6 (2,250)	48.4 (1,230)

Footnote:

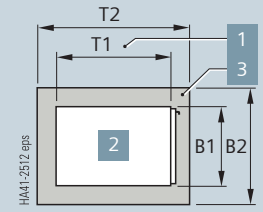
1. **Consult factory**.

Transport of individual panel combinations dimensions in inches (mm) or lb (kg)[3]

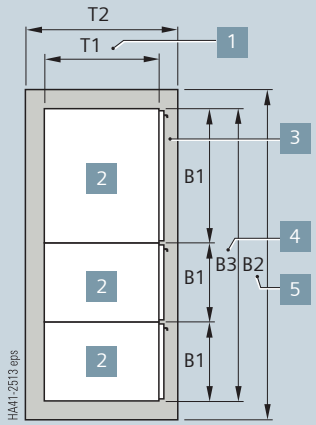
Transport unit	Overall width B3	Weight[1]	Width B2	Height H2[2]	Depth T2	Volume B2 x H2 x T2 yd³ (m³)
Transport unit	≤29.5 (750)	155 (70)	43.3 (1,100)	96.5 (2,450)	56.1 (1,400)	5.0 (3.8)
Transport unit	≤58.9 (1,750)	265 (120)	86.6 (2,200)	96.5 (2,450)	56.1 (1,400)	10 (7.7)

Footnotes:

1. Additional packing weight in lb/kg (without weight of panels).
2. Transport unit for air freight, height H2 102.8" (2,610 mm) and width B2 66.9" (1,700 mm).
3. Top hat necessary for cable top entry, and shipped loose for installation at site.



With individual panel



With combinations of different individual panel

Item	Description
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

Figure 2: Transport units for shipping (plan view)

Product range

Equipment features

Standard panels

Fuse switch panel type FS



Cable connection panel type CC



Cable switch panel type CS

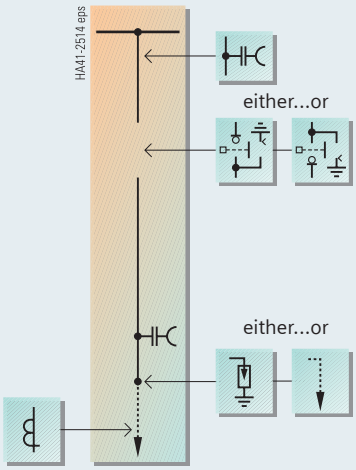


- • Basic equipment
- 0 Additional (optional) equipment
- – Not available

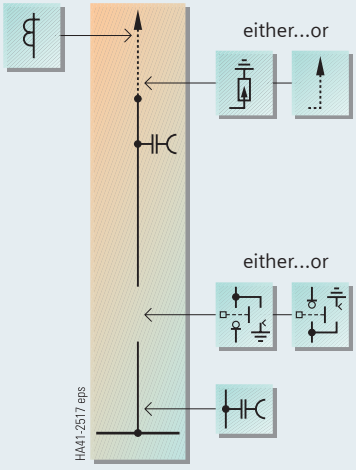
Panel type	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Two-position switch disconnector (CLOSED-OPEN)	Three-position switch disconnector (CLOSED-OPEN-GROUNDED)	Secondary cable grounding switch	Grounding switch (GROUNDED-OPEN)	Manual operating mechanism	Manual operating mechanism with stored-energy mechanism	Stored-energy mechanism operated by shunt release	Stored-energy mechanism - electrical tripping by time delay relay	Stored-energy mechanism - mechanical tripping by a device actuated by a blow fuse	Signal switch (1NO) for remote electrical ready-for-service indication	Signal switch fuse blown	Auxiliary switch (CLOSED-OPEN-GROUNDED)	Motor operating system (CLOSED-OPEN)	Local remote switch	Cable compartment cover with inspection window	Cable compartment cover with infrared window	Interlocking - de-grounding if the door is open	Interlocking - closing not possible if the door is open	Interlocking - closing the disconnector switch is only possible if the fuse is installed and intact	C-rail to support cable	C-rail with brackets to secure cable	Floor cover	Space heaters	Space heaters with thermostat	Space heaters with humidstat
CS1	•	0	–	–	•	0	0	–	–	0	–	0	0	0	0	0	–	0	–	0	0	0	0	0	0
CS2	•	0	–	–	•	0	0	–	–	0	–	0	0	0	0	0	–	0	–	0	0	0	0	0	0
FS1	•	0	0	–	•	0	0	0	0	0	0	0	0	0	0	0	0	–	0	0	0	0	0	0	0
FS2	•	0	0	–	•	0	0	0	0	0	0	0	0	0	0	0	0	–	0	0	0	0	0	0	0
FS3	•	0	0	–	•	0	0	0	0	0	0	0	0	0	0	0	0	–	0	0	0	0	0	0	0
FU1	–	–	–	–	–	–	–	–	–	–	0	–	–	–	0	0	–	–	–	0	0	0	0	0	0
FU2	–	–	–	–	–	–	–	–	–	–	0	–	–	–	0	0	–	–	–	0	0	0	0	0	0
FU3	–	–	–	–	–	–	–	–	–	–	0	–	–	–	0	0	–	–	–	0	0	0	0	0	0
CC1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0	0	–	–	–	0	0	0	0	0	0
CC2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0	0	–	–	–	0	0	0	0	0	0
CG1	–	–	–	•	•	–	–	–	–	0	–	0	0	0	0	0	–	–	–	0	0	0	0	0	0
CG2	–	–	–	•	•	–	–	–	–	0	–	0	0	0	0	0	–	–	–	0	0	0	0	0	0
MT3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0	0	0
MC3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0	0	–	–	–	0	0	0	0	0	0
MS2	–	•	–	–	–	•	–	–	–	0	–	0	0	0	–	–	–	–	–	–	–	0	0	0	0
MS3	–	•	–	–	–	•	–	–	–	0	–	0	0	0	–	–	–	–	–	–	–	0	0	0	0
BR1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0	0	0
BR2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0	0	0
BG1	–	–	–	•	•	–	–	–	–	0	–	0	–	–	–	–	–	–	–	–	–	–	0	0	0

Cable switch panel

Cable switch panel
as feeder panel



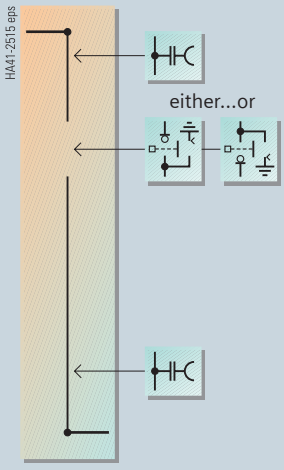
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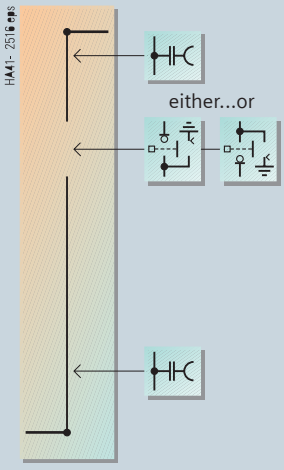
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For detailed design, please contact the factory.

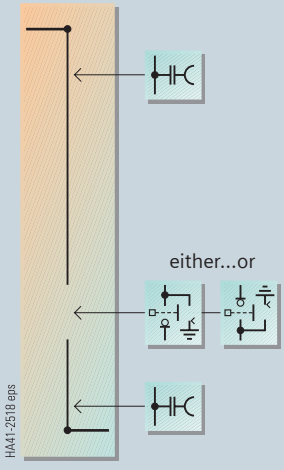
Cable switch panel
as transfer panel



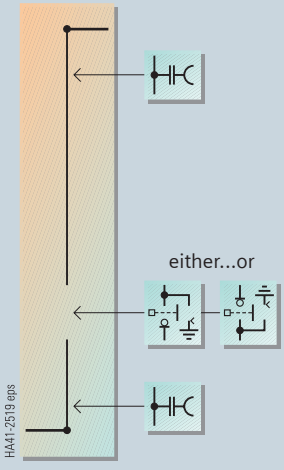
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Type CS



Type CS



Type CS

*Switch disconnector as:
- Two-position switch disconnector.
- Three-position switch disconnector.

[1] Distribution class. Intermediate or station class avaikable but may require increased panel width.



Three-position switch disconnector *



Three-position switch disconnector *



Capacitive voltage detection system (for systems ≥ 4.16 kV)



Surge arrester[1]



Cable (not included in the scope of supply)



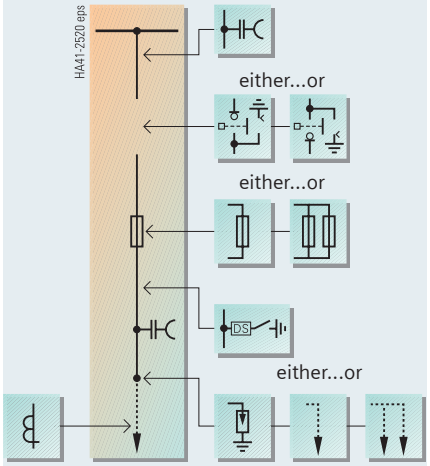
2nd cable (not included in the scope of supply)



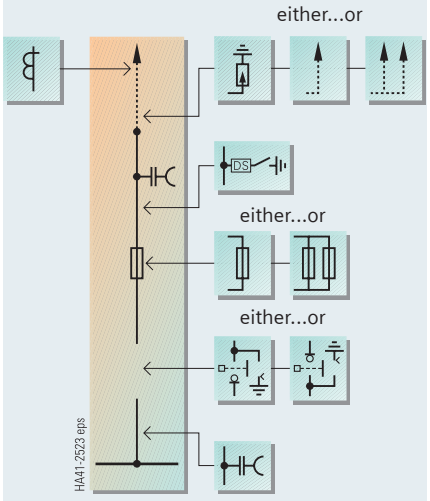
Cable-type current transformer

Fuse switch panel

Fuse switch panel
as feeder panel



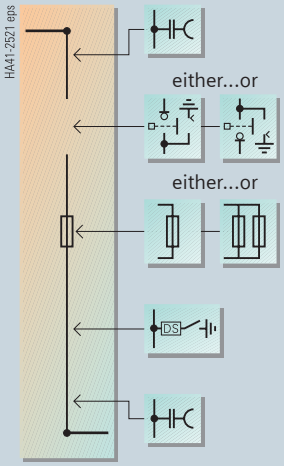
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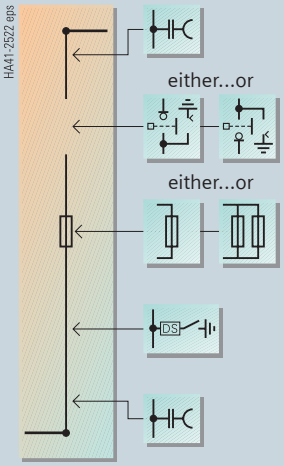
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For detailed design, please contact the factory.

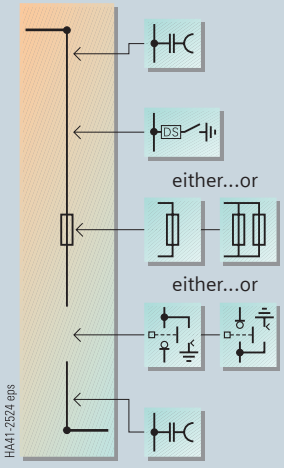
Fuse switch panel
as transfer panel



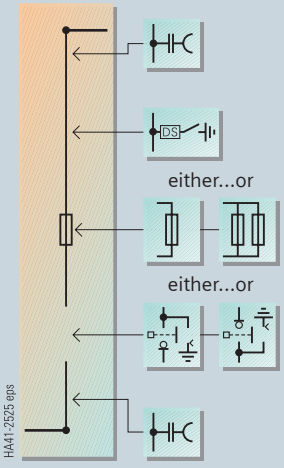
Type FS



Type FS



Type FS



Type FS

*Switch disconnector as:
- Two-position switch disconnector (with mechanical interlock).
- Three-position switch disconnector (with grounding position).

[1] Distribution class. Intermediate or station class avaikable but may require increased panel width.



Three-position switch disconnector *



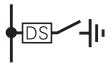
Three-position switch disconnector *



Capacitive voltage detection system (for systems ≥ 4.16 kV)



Surge arrester[1]



Discharge switch



HV CL fuse



2nd HV CL fuse



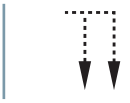
2nd and 3rd cable (not included in scope of supply)



Cable (not included in the scope of supply)



2nd cable (not included in the scope of supply)



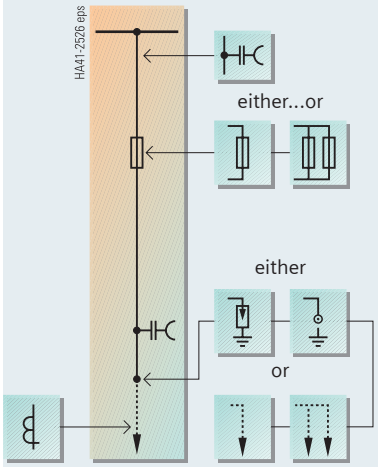
2nd and 3rd cable (not included in the scope of supply)



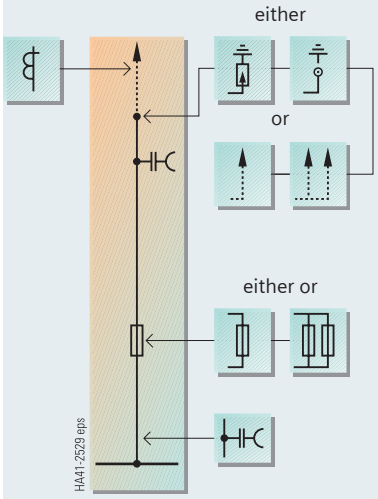
Cable-type current transformer

Fuse panel

Fuse panel
as feeder panel



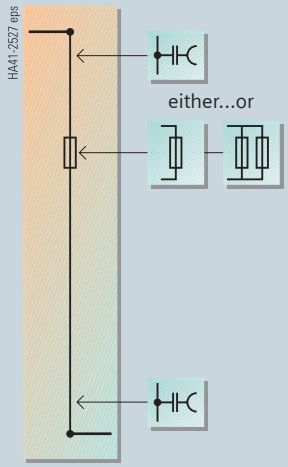
Type FU



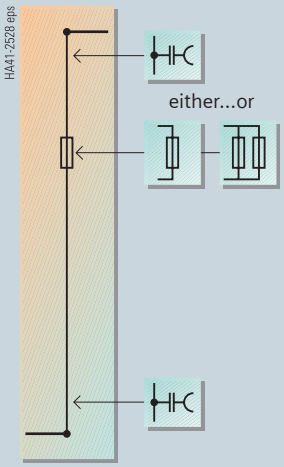
Type FU

For detailed design, please contact the factory.

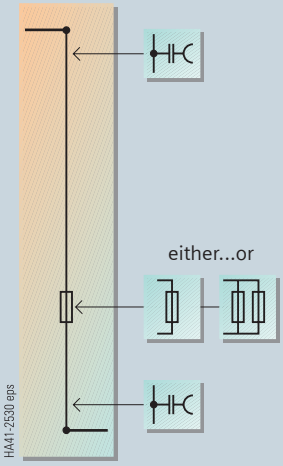
Fuse panel
as transfer panel



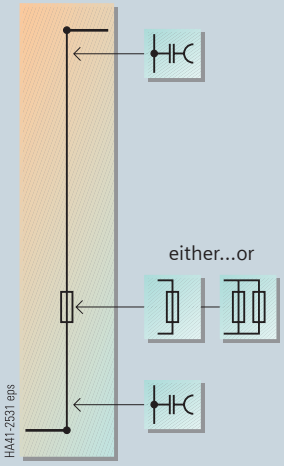
Type FU



Type FU



Type FU



Type FU

[1] Distribution class. Intermediate or station class avaikable but may require increased panel width.



Capacitive voltage detection system (for systems ≥ 4.16 kV)



Surge arrester[1]



Grounding stud



HV CL fuse



2nd HV CL fuse



2nd and 3rd cable (not included in scope of supply)



Cable-type current transformer



Cable (not included in the scope of supply)

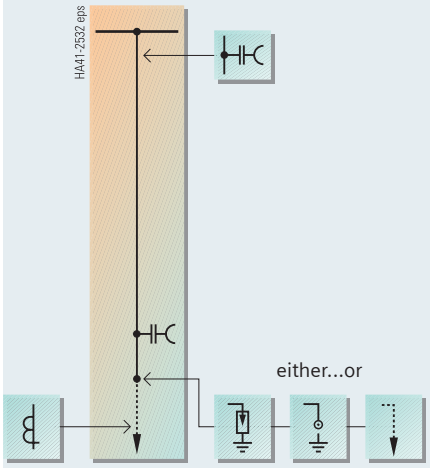


2nd and 3rd cable (not included in the scope of supply)

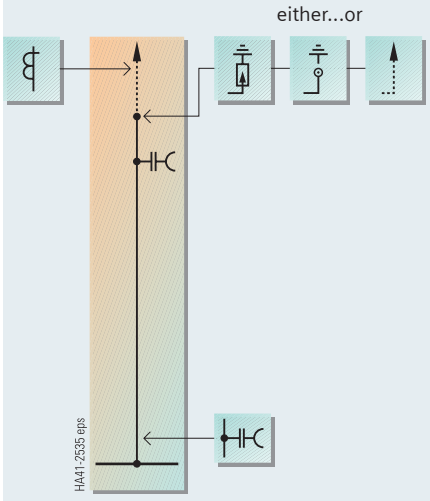
2nd cable (not included in the scope of supply)

Cable connection panel

Cable connection panel
as feeder panel



Type CC



Type CC

For detailed design, please contact the factory.

[1] Distribution class. Intermediate or station class avaikable but may require increased panel width.



Capacitive voltage detection system (for systems ≥ 4.16 kV)



Surge arrester[1]



Grounding stud



Cable (not included in the scope of supply)



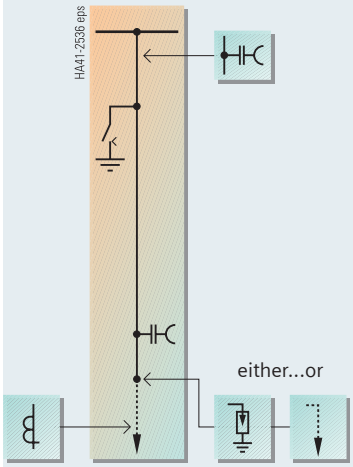
2nd cable (not included in the scope of supply)



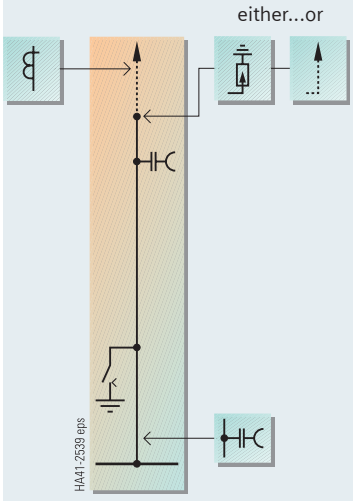
Cable-type current transformer

Cable grounding panel, main bus grounding panel

Cable grounding panel (= cable connection panel with grounding switch)



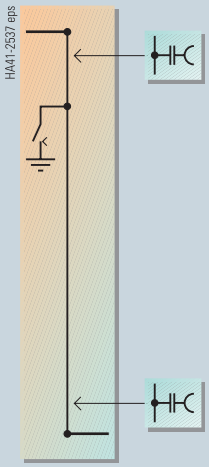
Type CG



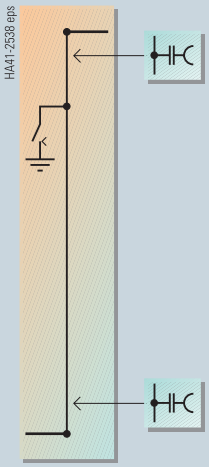
Type CG

For detailed design, please contact the factory.

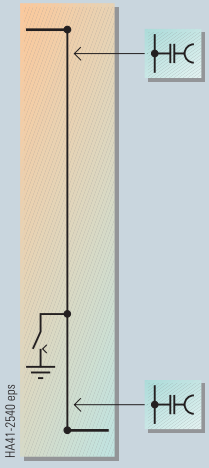
Cable grounding panel/main bus grounding panel (with grounding switch)



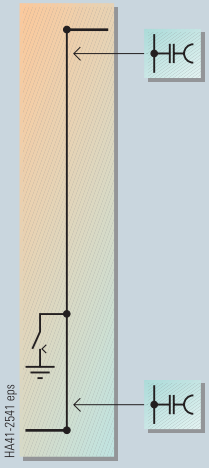
Type CG



Type CG



Type CG



Type CG

[1] Distribution class. Intermediate or station class avaikable but may require increased panel width.



Capacitive voltage detection system (for systems ≥ 4.16 kV)



Surge arrester[1]



Grounding switch



Cable (not included in the scope of supply)



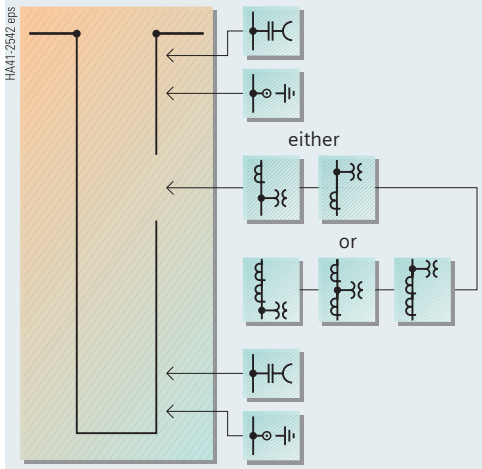
2nd cable (not included in the scope of supply)



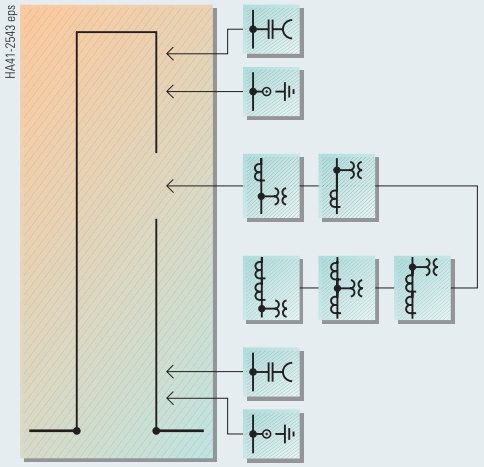
Cable-type current transformer

Metering panel

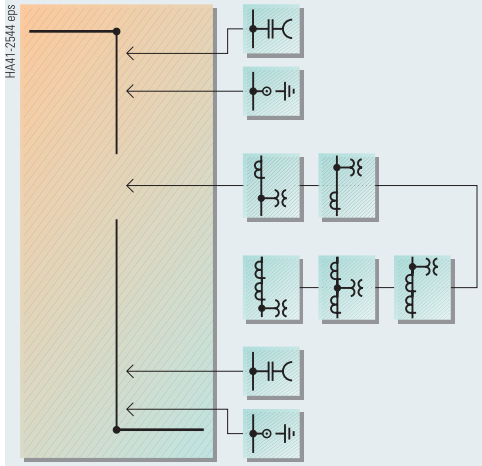
Metering panel



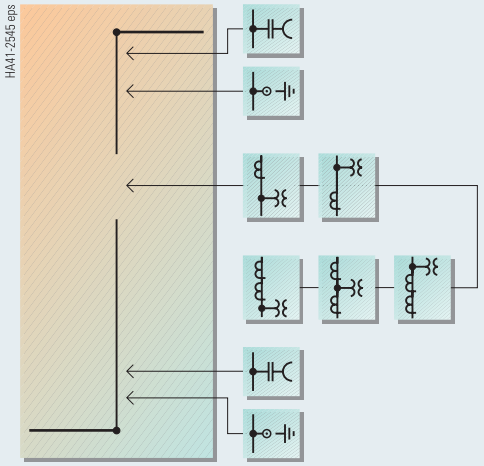
Type MT3



Type MT3



Type MT3



Type MT3

For detailed design, please contact the factory.



Capacitive voltage detection system (for systems ≥ 4.16 kV)



Grounding stud



Block-type current transformer 4MA and fused voltage transformer 4MR (both cast-resin insulated)



Block-type current transformer 4MA and fused voltage transformer 4MR (both cast-resin insulated)



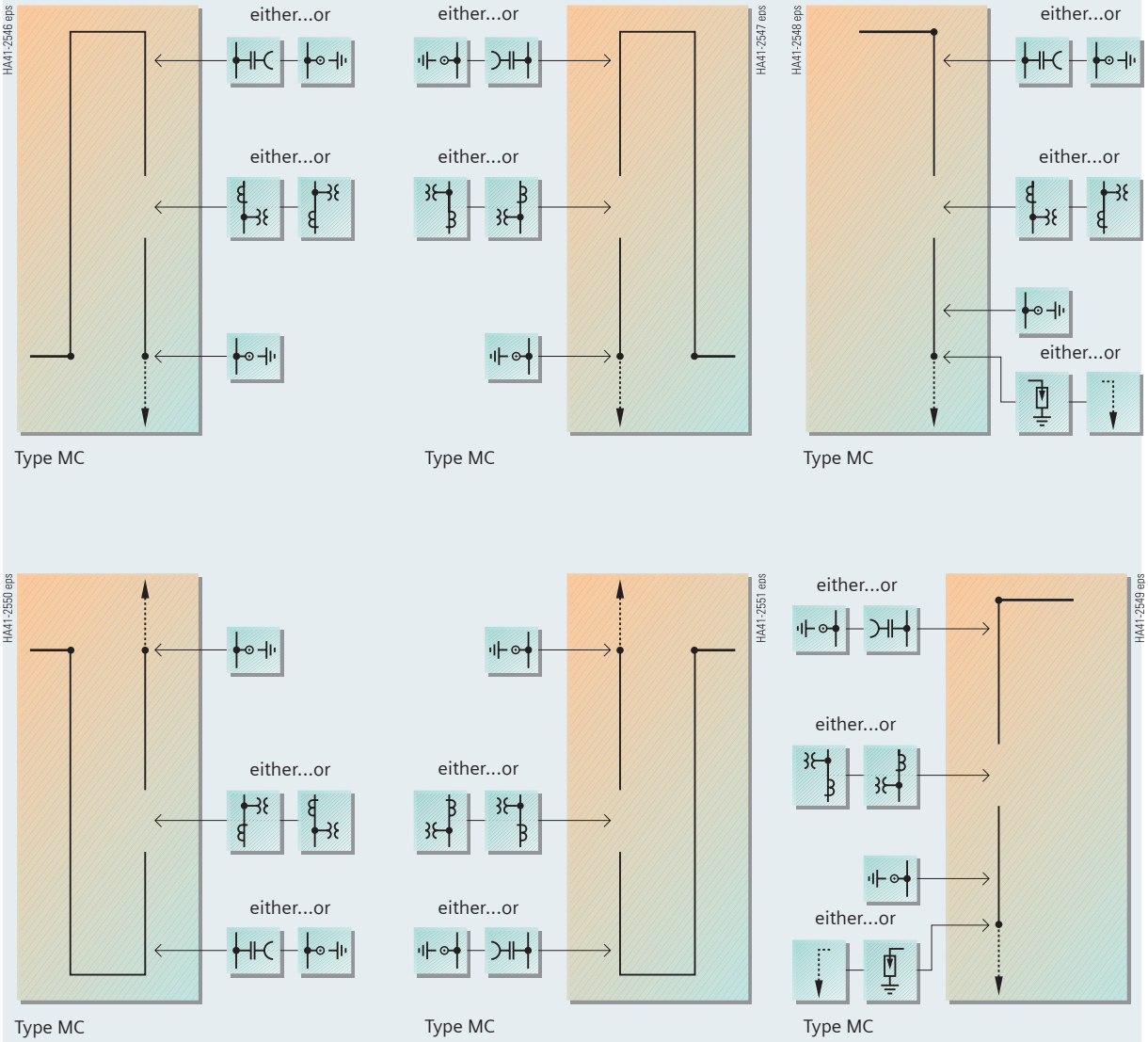
Block-type current transformer 4MA and fused voltage transformer 4MR (both cast-resin insulated)



Block-type current transformer 4MA and voltage transformer 4MR (both cast-resin insulated)

Metering panel with cable

Metering panel with cable



For detailed design, please contact the factory.

[1] Distribution class. Intermediate or station class avaikable but may require increased panel width.



Capacitive voltage detection system (for systems ≥ 4.16 kV)



Surge arrester[1]



Grounding stud



Cable (not included in the scope of supply)



2nd cable (not included in the scope of supply)



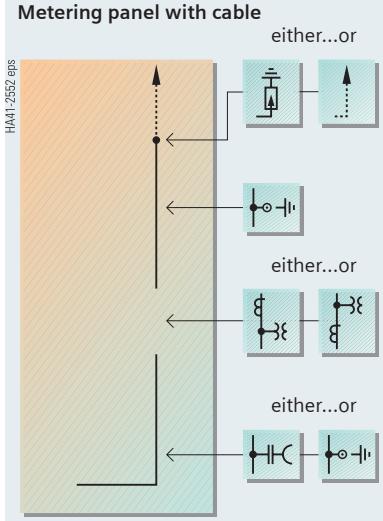
Block-type current transformer 4MA and fused voltage transformer 4MR (both cast-resin insulated)



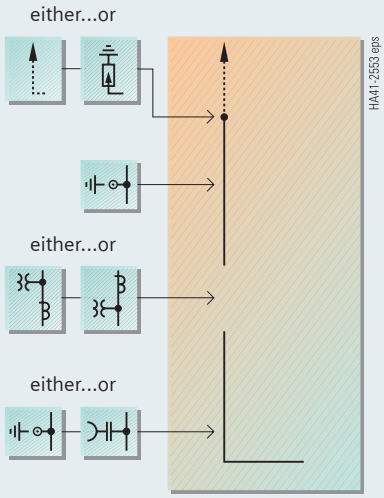
Block-type current transformer 4MA and fused voltage transformer 4MR (both cast-resin insulated)

Metering panel with cable (continued), metering switch panel

Metering panel with cable

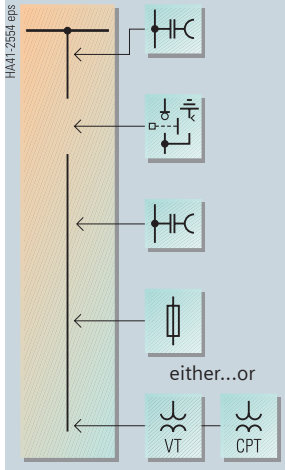


Type MC

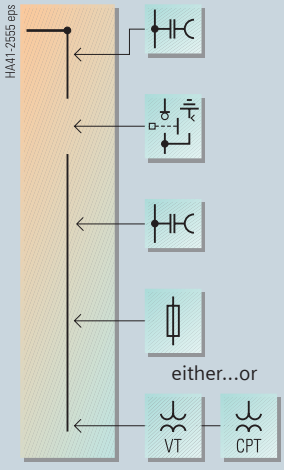


Type MC

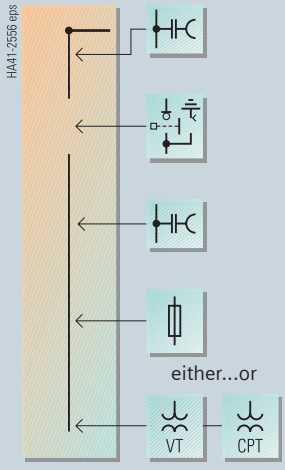
Metering switch panel



Type MS



Type MS



Type MS

For detailed design, please contact the factory.

*Switch disconnector as:
- Two-position switch disconnector.
- Three-position switch disconnector.

** Standard in combination with VT or CPT.

*** Fuses: potential transformer fuses type CAV.

[1] Distribution class. Intermediate or station class avaikable but may require increased panel width.



Voltage transformer 4MR (cast-resin insulated)



Control power transformer (CPT)



Cable (not included in the scope of supply)

2nd cable (not included in the scope of supply)



HV CL fuse***



Three-position switch disconnector



Three-position switch disconnector



Capacitive voltage detection system (for systems ≥ 4.16 kV)



Surge arrester[1]



Grounding stud



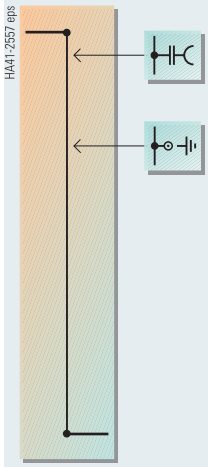
Block-type current transformer 4MA and fused voltage transformer 4MR (both cast-resin insulated)



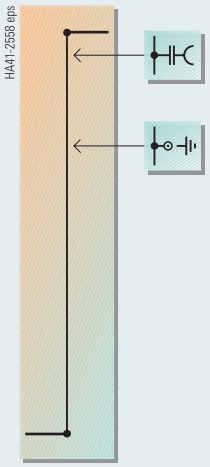
Block-type current transformer 4MA and fused voltage transformer 4MR (both cast-resin insulated)

Bus riser panel

Bus riser panel



Type BR



Type BR

For detailed design, please contact the factory.



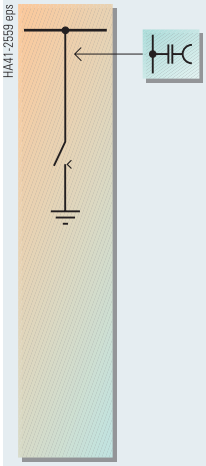
Capacitive voltage detection system (for systems ≥ 4.16 kV)



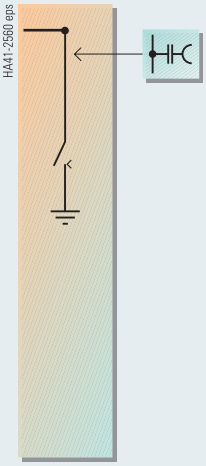
Grounding stud

Main bus grounding panel

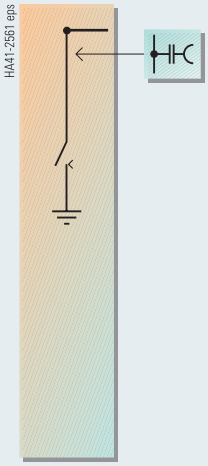
Main bus grounding panel



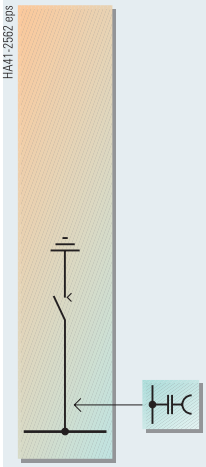
Type BG



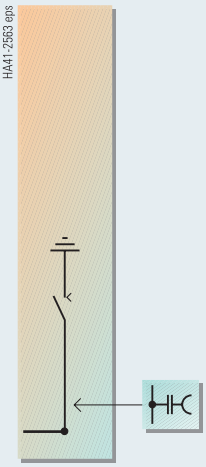
Type BG



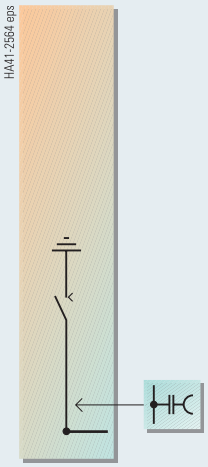
Type BG



Type BG



Type BG



Type BG

For detailed design, please contact the factory.



Capacitive voltage detection system (for systems ≥ 4.16 kV)

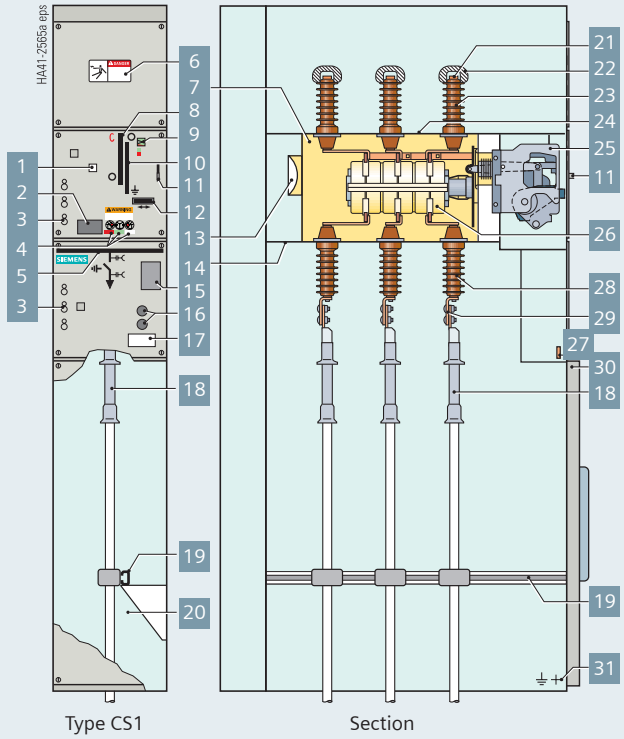


Grounding switch

Design

Panel design examples

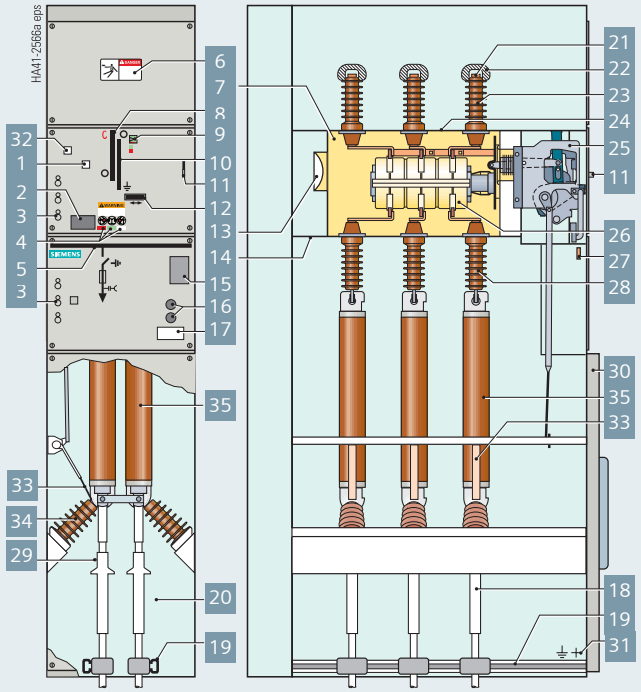
Cable switch panel type CS



Type CS1 Section

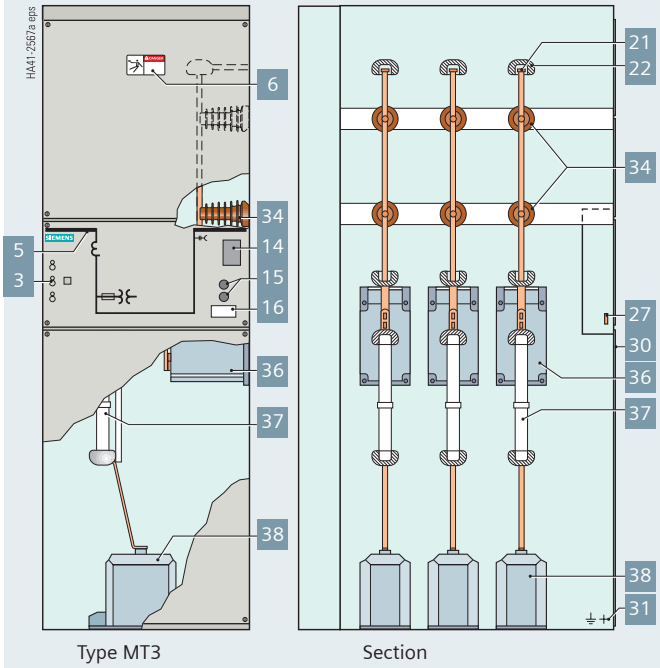
Item	Description	Item	Description
1	Switch position indicator	17	Panel designation label
2	View port for switch blade position	18	Cable termination (not included in scope of supply)
3	Sockets for capacitive voltage detection system	19	Cable bracket (cable clamps optional)
4	Information label for view port	20	Cable connection compartment
5	Mimic diagram	21	Main bus
6	Warning label	22	Insulating cap for main bus (for >15 kV)
7	Gas-insulated vessel for switch	23	Bushing-type epoxy-resin insulator for main bus
8	Manual operation for the mechanism of the load-break disconnecting function	24	Metal compartmentalization of main bus compartment
9	"Ready-for-service" indicator for switching device	25	Spring-operated mechanism for three-position switch
10	Manual operation for the mechanism of the grounding function	26	Three-position switch
11	Interlocking lever of cable compartment cover (option)	27	Grounding busbar (3/8" x 1") (10 mm x 25 mm)
12	Padlock provision for three-position switch	28	Bushing-type epoxy-resin insulator for feeder
13	Pressure relief device for switch	29	Cable connection
14	Metal compartmentalization of cable connection compartment	30	Cable compartment: as cover or door (latched or screwed on)
15	Rating and type plate	31	Grounding connection
16	Option: Local-remote switch and momentary-contact rotary control switch "CLOSED-OPEN" for the motor operating mechanism		

Fuse switch panel type FS



Type FS2 Section

Metering panel type MT

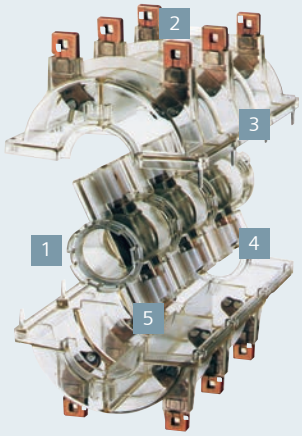


Type MT3 Section

Item	Description	Item	Description
1	Switch position indicator	20	Cable connection compartment
2	View port for switch blade position	21	Main bus
3	Sockets for capacitive voltage detection system	22	Insulating cap for main bus (for >15 kV)
4	Information label for view port	23	Bushing-type epoxy-resin insulator for main bus
5	Mimic diagram	24	Metal compartmentalization of main bus compartment
6	Warning label	25	Spring-operated mechanism for three-position switch
7	Gas-insulated vessel for switch device	26	Three-position switch
8	Manual operation for the mechanism of the load-break disconnecting function	27	Grounding busbar (3/8" x 1") (10 mm x 25 mm)
9	"Ready-for-service" indicator for switching device	28	Bushing-type epoxy-resin insulator for feeder
10	Manual operation for the mechanism of the grounding function	29	Cable connection
11	Interlocking lever of cable compartment cover (option)	30	Cable compartment: as cover or door (latched or screwed on)
12	Padlock provision for three-position switch	31	Grounding connection
13	Pressure relief device for switch	32	Indicator "fuse intact/fuse blown"
14	Metal compartmentalization of cable connection compartment	33	Grounding switch to discharge capacitance of connected cables
15	Rating and type plate	34	Post insulator - epoxy resin
16	Option: Local-remote switch and momentary-contact rotary control switch "CLOSED-OPEN" for the motor operating mechanism	35	High-voltage current-limiting fuses
17	Panel designation label	36	4MA7 block-type current transformer
18	Cable termination (not included in scope of supply)	37	Fuse holder for VT fuse
19	Cable bracket with (cable clamps optional)	38	4MR voltage transformer

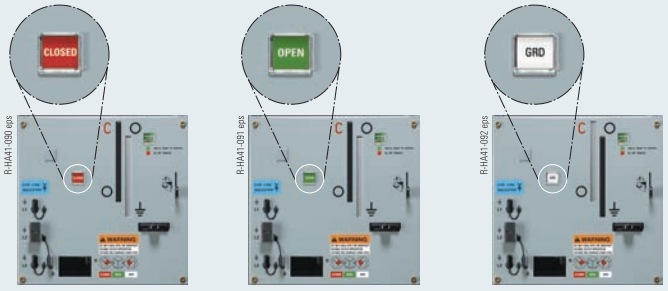
Components

Three-position switch disconnector

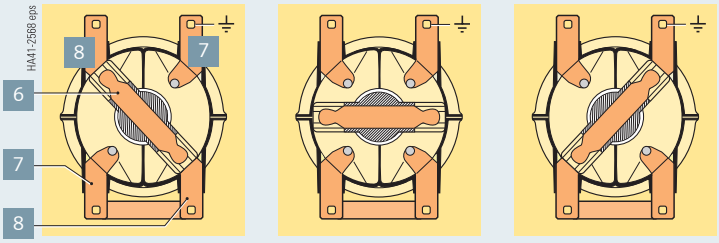


Item	Description
1	Switch shaft
2	Fixed contact
3	Arcing chamber
4	Moving contact, complete
5	Compression vane (with nozzle)
6	Moving contact
7	Fixed contact for GROUNDED
8	Fixed contact for CLOSED

Switching functions

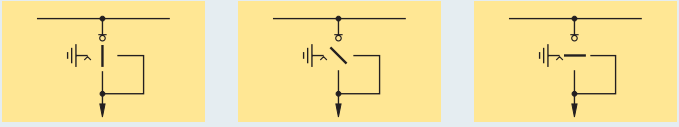


Control board with switch position indicators for detachable lever mechanism



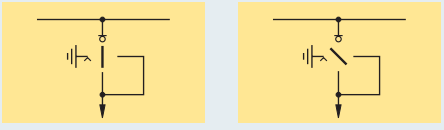
Switch positions
Three-position switch disconnector:

- CLOSED
- OPEN
- GROUNDED.



CLOSED OPEN GROUNDED

Switch positions of three-position switch disconnector



CLOSED OPEN

Switch positions of two-position switch disconnector

Switch disconnector

Characteristics:

- Switch positions:
  - CLOSED-OPEN (two position)
  - CLOSED-OPEN-GROUNDED (three position)
- Designed as a multi-chamber switch incorporating the following functions:
  - Switch disconnector
  - Make-proof grounding switch
- Operation via gas-tight welded bushing at the front of the switch vessel
- Switching functions as general purpose switch disconnector according to ANSI/IEEE C37.20.3. Refer to "Standards" on page 44.

Mode of operation

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

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 GROUNDED functions cannot be implemented simultaneously.

Switch disconnector

Common features:

- Metal-enclosed
- Located in a gas-insulated switch vessel
- Switch positions:
  - CLOSED-OPEN (two position)
  - CLOSED-OPEN-GROUNDED (three position)
- No cross insulation between phases
- Two-/three-position switch with air-insulated primary connections for main bus and feeder
- Operation via a gas-tight welded-in metal bellows in the front of the switch vessel.

View port

The visual inspection of the actual position of the two-/there-position switch is possible via a view port. View port is 2.75" x 1.77" (70 mm x 45 mm).

- Option:
  - Infrared viewing windows can be provided at incoming and outgoing cable terminations, or at main bus compartment.

Two-/three-position switch disconnector 600 A:

- Up to 600 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 or transformer panel type FS or non-fused cable switch type CS.

Interlocks:

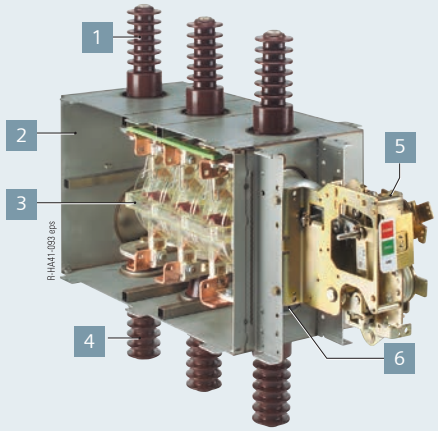
- Opening of panel cover or cable compartment cover only in GROUNDED position
- Fused two-position switches will be supplied with integrated mechanical interlock between switch and fuse compartment door, or optionally, with key interlock provisions between the switch and the fuse access door to prevent access to fuses or cables unless the switch is open.

Operating cycles:

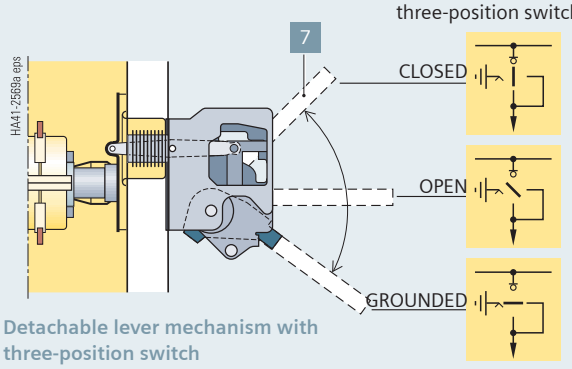
- Capable of 100 operating cycles at rated continuous current 600 A
- Mechanical endurance of 1,000 operating cycles.

Item	Description	Item	Description
1	Bushing type insulator for main bus	6	View port
2	Switch vessel with gas insulation	7	Operating lever, inserted
3	Three-position switch disconnector	8	Moving contact
4	Bushing-type insulator for feeder	9	Fixed contact for CLOSED
5	Spring-operated mechanism with detachable lever	10	Fixed contact for GROUNDED

Two-/three-position switch disconnector 600 A (side removed for photo)



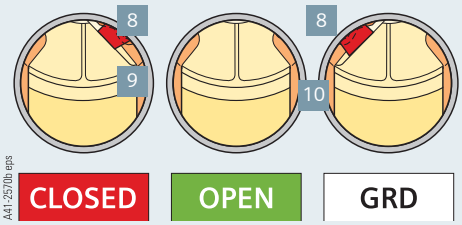
Switch positions of three-position switch:



Detachable lever mechanism with three-position switch disconnector

Switch functions of the three-position switch disconnector 600 A:

- Switching and disconnecting under load
- General purpose switching function
- Make-proof grounding function.



Item	Description	Item	Description
1	Main bus	4	Lower fuse holder
2	Bushing type epoxy-resin insulator for busbar	5	Grounding stud
3	HV CL fuse	6	Cable termination (not included in the scope of supply)

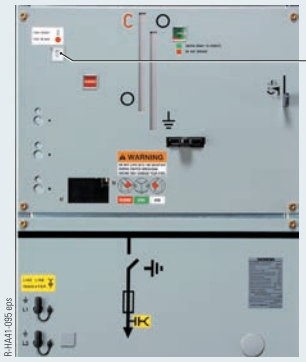
Busbars



Main bus compartment extending over two panels

Example shows side view

HV CL fuse assembly



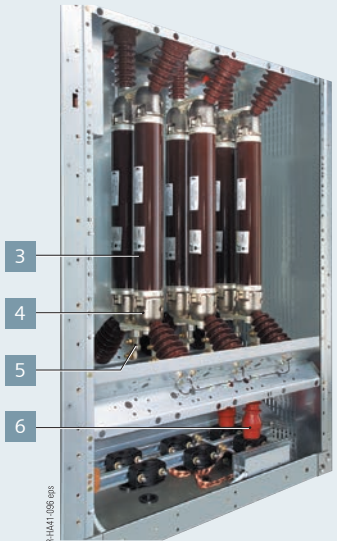
Displays

Fuse intact

Fuse blown

Control board on a fuse panel

HV CL fuses in fuse panel type FS (side view, two fuses per phase shown)



Main bus; high-voltage current-limiting (HV CL) fuse assembly

Main bus:

- Metal-enclosed, main-bus compartment
- Three-pole design, bolted from panel to panel
- Easy switchgear extension
- Made of copper round-edge for 1,200 A
- Option:
  - Heat shrink (Raychem or 3M) sleeve on main bus.

HV CL fuse assembly:

- For fuse panel type FS
- For busbar voltage metering panel type MS
- HV CL fuse links according to ANSI/IEEE C37.41/ C37.46*:
  - For short-circuit protection before transformers
  - With selectivity (depending on correct selection) to upstream and downstream connected equipment
- Requirements fulfilled as high-voltage alternating current switch fuse combination
- Selection of HV CL fuses for transformers
- Fuse replacement possible only when feeder is grounded (three-position switch) or open (two-position switch)
- Options:
  - Shunt release on operating mechanism of two-position or three-position switch disconnector
  - Blown fuse indication of two-/three-position switch disconnector in transformer feeder (transformer switch) for remote electrical indication with one normally open contact (1NO)
  - Switch tripped due to HV CL fuse operation. Following the blowing of an HV CL fuse link, the mechanism for charging the spring must be set to the OPEN position. Subsequently, grounding can be implemented by means of the three-position switch disconnector and, e.g., the fuse can be replaced.

Replacement of HV CL fuse links:

- Isolating and grounding of the transformer feeder
- Subsequent manual replacement of the HV CL fuse links
- Options:
  - Single-phase protection (blown fuse trip) can be provided to protect against operation with one or more fuses blown
  - Fuse intact/installed (FII) protection can be provided to protect against operation with a missing or blown fuse. This feature cannot be provided on switches with key interlocking.

* See standards on page 44.

HV CL fuse selection table

The table opposite shows the recommended fuse links (electrical data valid for ambient temperatures of up to 104 °F (40 °C) for the fuse protection of transformers.

Recommendation

The two-/three-position switch disconnector in the transformer feeder (transformer switch) is combined with Bussman fuse links. Dimensions according to DIN standards.

Standards

HV CL fuse links according to ANSI/IEEE C37.41/C37.46 (see Standards on page 44).

Footnotes:

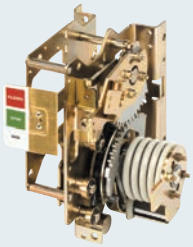
1. FS1/FU1 = Single fuse
2. FS2/FU2 = Two fuses in parallel
3. FS3/FU3 = Three fuses in parallel.

Rated maximum voltage kV	Length inches (mm)	Diameter inches (mm)	Fuse size	Power loss (W)	Panel type			Code/reference no. for SIMOSEC
					FS1/FU1 permissible A[1]	FS2/FU3 permissible A[2]	FS3/FU3 permissible A[3]	
5.0	17.4 (442)	2 (51)	10 E	8 W	10 A	----	----	55GDMSJ10E
5.0	17.4 (442)	2 (51)	15 E	11 W	15 A	----	----	55GDMSJ15E
5.0	17.4 (442)	2 (51)	20 E	11 W	20 A	----	----	55GDMSJ20E
5.0	17.4 (442)	2 (51)	25 E	15 W	25 A	----	----	55GDMSJ25E
5.0	17.4 (442)	2 (51)	30 E	17 W	30 A	----	----	55GDMSJ30E
5.0	17.4 (442)	2 (51)	40 E	27 W	40 A	----	----	55GDMSJ40E
5.0	17.4 (442)	2 (51)	50 E	36 W	50 A	----	----	55GDMSJ50E
5.0	17.4 (442)	2 (51)	65 E	44 W	65 A	----	----	55GDMSJ65E
5.0	17.4 (442)	2 (51)	80 E	53 W	80 A	----	----	55GDMSJ80E
5.0	17.4 (442)	2 (51)	100 E	69 W	100 A	----	----	55GDMSJ100E
5.0	17.4 (442)	2 (51)	125 E	94 W	120 A	----	----	55GDMSJ125E
5.0	17.4 (442)	3 (76)	150 E	103 W	150 A	----	----	55GDMSJ150E
5.0	17.4 (442)	3 (76)	175 E	121 W	164 A	----	----	55GDMSJ175E
5.0	17.4 (442)	3 (76)	200 E	126 W	183 A	327 A	----	55GDMSJ200E
5.0	17.4 (442)	3 (76)	250 E	139 W	220 A	390 A	----	55GDMSJ250E
5.0	17.4 (442)	3 (76)	300 E	147 W	241 A	429 A	598 A	55GDMSJ300E
5.0	17.4 (442)	3 (76)	350 E	161 W	269 A	478 A	----	55GDMSJ350E
5.0	17.4 (442)	3 (76)	400 E	167 W	302 A	536 A	----	55GDMSJ400E
5.0	17.4 (442)	3 (76)	450 E	183 W	325 A	575 A	----	55GDMSJ450E
15.5	21.1 (537)	3.5 (88)	175 E	177 W	167 A	310 A	420 A	155GXQSJ175E
15.5	21.1 (537)	3.5 (88)	200 E	238 W	165 A	305 A	430 A	155GXQSJ200E
17.5	17.4 (440)	2 (51)	10 E	22 W	10 A	----	----	175GDMSJ10E
17.5	17.4 (440)	2 (51)	15 E	30 W	15 A	----	----	175GDMSJ15E
17.5	17.4 (440)	2 (51)	20 E	32 W	20 A	----	----	175GDMSJ20E
17.5	17.4 (440)	2 (51)	25 E	41 W	25 A	----	----	175GDMSJ25E
17.5	17.4 (440)	2 (51)	30 E	47 W	30 A	----	----	175GDMSJ30E
17.5	17.4 (440)	3 (76)	40 E	79 W	40 A	----	----	175GDMSJ40E
17.5	17.4 (440)	3 (76)	50 E	95 W	50 A	----	----	175GDMSJ50E
17.5	17.4 (440)	3 (76)	65 E	130 W	59 A	----	----	175GDMSJ65E
17.5	17.4 (440)	3 (76)	80 E	126 W	73 A	----	----	175GDMSJ80E
17.5	17.4 (440)	3.5 (88)	100 E	169 W	85 A	----	----	175GDMSJ100E
17.5	21.1 (537)	3.5 (88)	125 E	203 W	112 A	207 A	----	175GDMSJ125E
17.5	21.1 (537)	3.5 (88)	150 E	221 W	123 A	238 A	336 A	175GDMSJ150E
26.4	21.1 (537)	2 (51)	10 E	27 W	10 A	----	----	258GDQSJ10E
26.4	21.1 (537)	2 (51)	15 E	41 W	15 A	----	----	258GDQSJ15E
26.4	21.1 (537)	2 (51)	20 E	44 W	20 A	----	----	258GDQSJ20E
26.4	21.1 (537)	2 (51)	25 E	50 W	25 A	----	----	258GDQSJ25E
26.4	21.1 (537)	2 (51)	30 E	67 W	30 A	----	----	258GDQSJ30E
26.4	21.1 (537)	3.5 (88)	40 E	87 W	40 A	72 A	----	258GDQSJ40E
26.4	21.1 (537)	3.5 (88)	50 E	103 W	50 A	90 A	120 A	258GDQSJ50E
26.4	21.1 (537)	3.5 (88)	65 E	140 W	65 A	117 A	156 A	258GDQSJ65E

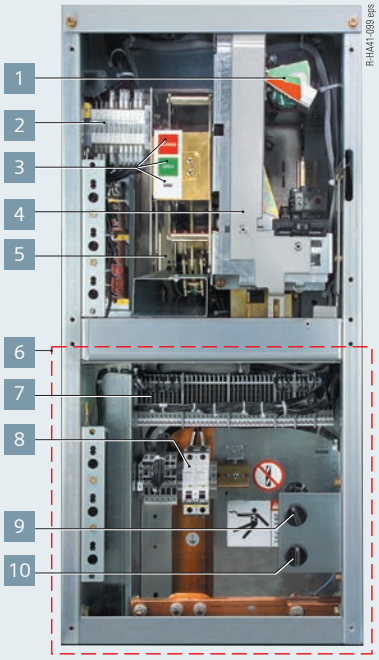
Operating mechanisms



Detachable lever mechanism as spring-operated/stored-energy mechanism



Detachable lever mechanism as spring-operated mechanism



Operating mechanism parts in panel types FS (transformer feeders)

Item	Description	Item	Description
1	Ready-for-service indicator	6	Low-voltage niche
2	Auxiliary switch	7	Terminal strip located in the low-voltage niche
3	Switch-position indicator for the three-position switch disconnector	8	Miniature circuit breaker (m.c.b.) (option) in the low-voltage niche
4	Locking device (standard for motor-operating mechanism)	9	Local-remote switch (option)
5	Operating mechanism for the three-position switch disconnector coupled with the motor operating mechanism	10	Actuation for the motor-operating mechanism of the three-position switch disconnector

Operating mechanism for two-/three-position switches

Manual operating mechanism:

- Standard as detachable lever mechanism
- Spring-operated mechanism:
  - For cable-switch panel type CS
  - For all two-/three-position switches (except in panel type FS)
- Spring-operated/stored-energy mechanism:
  - For fuse panel type FS as well for main bus voltage metering switch panel type MS.

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

Motor operating mechanism (option for OPEN-CLOSED operations only)

The manual-operating mechanisms can be equipped with motor-operating mechanisms for two-/three-position switch disconnector.

Operating voltages for motor-operating mechanisms:

- 24, 48, 60, 125 Vdc
- 120, 240 Vac.

Electrical operation:

- Standard: remote operation (wired to terminals in low-voltage niche)
- 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 two-/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 two-/three-position switch disconnector can be optionally equipped with an auxiliary switch for the switch position indication:

- Function switch (two-position or three-position) disconnector: CLOSED and OPEN: 2NO + 2NC
- Function grounding at the three-position switch: OPENED and GROUNDED: 2NO + 2NC.

Auxiliary switch technical data; breaking capacity

AC operation at 50 Hz/60 Hz		DC operation		
Operating volage	Nomral current	Operating voltage	Normal current resistive inductive	
V	A	V	A	T=20 ms A
Up to 240	10	24	10	10
		48	10	9
		60	9	7
		110	5	4
		125	5	4
		240	2.5	2

Rated switching capacity
Rated insulation voltage 250 Vac/dc
Insulation group C to VDE 0110
Continuous current 10 A
Making capacity 50 A

Indicating and measuring equipment

Ready-for-service indicator:

- 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 (1NO contact).

Mode of operation

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

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

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 measuring box has the same temperature as that in the switchgear.

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

Voltage detection systems

For voltage detection according to IEC 61 243-5 / VDE 0682-415.

Plug-in voltage detection systems[1]:

- Standard: HR system valid for ≥4.16 kV.

Features of the HR system:

- Voltage indicator HR system (standard)
- Verification of safe isolation from supply phase by phase through insertion in each socket pair
- Voltage indicator flashes if high voltage is present
- For continuous operation
- Safe-to-touch
- Measuring system and voltage indicator can be tested
- Fixed-mounted capacitive voltage divider in bushings
- Without auxiliary power.

Mounting of voltage detection systems

See Product range pages 10-20.

Verification of correct terminal-phase connections

- Possible by means of a phase comparison test unit (optional)
- Safe-to-touch handling of the phase comparison test unit by inserting it into the capacitive taps (socket pairs) of the switchgear.

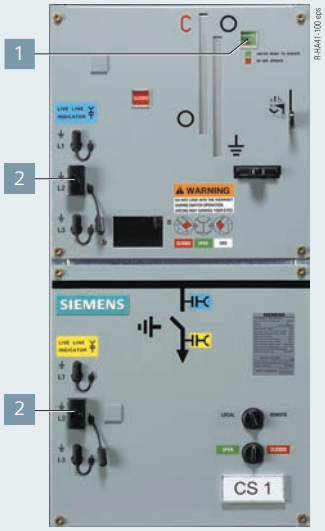
Footnote:

1. Plug-in voltage detection system not available for system voltages below 4.16 kV.

Indicating and measuring equipment (examples)

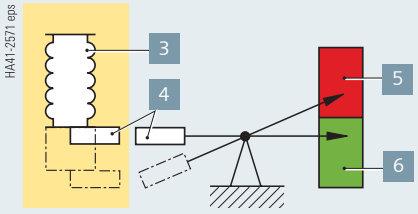
Item	Description	Item	Description
1	Mounting locations in the control board for ready-for-service indicator	4	Magnetic coupling
2	Mounting locations in the control board for voltage indicator, HR system, plugged-in (standard)	5	Red indication: not ready for service
3	Measuring box	6	Green indication: ready for service

Control board of a panel (example)





Voltage indicator, HR system (standard)



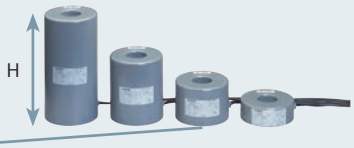
Stainless-steel vessel filled with SF_6 gas (0.5 kg), gauge pressure 50 kPA (7.25 psi) at 68 °F (20 °C).

Ready-for-service indicator

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

4MC70 33 cable-type current transformers (or similar type) on the cable at the panel connection (assembly normal under the panel floor)





4MC70 33 cable-type current transformer, four different overall heights

Technical data MC70 33 cable-type current transformer

Primary data

Item	Value
Current transformer rated voltage U_m[3]	0.6 kV
Rated primary current I_N	30 A to 600 A
Rated short-duration power-frequency withstand voltage (winding test)	3 kV
Rated thermal short-time withstand current I_{th}	25 kA
Rated continuous thermal current I_D	1.0 x I_N Option: 1.2 x I_N
Rated peak-withstand current I_{dyn}	Unlimited

Secondary data

Item		Value
Rated secondary current		5 A
Measuring core	Class*	0.3 / 0.6 / 1.2[2]
	Burden	0.2 VA to 1.8 VA[2]
Protection core	Class*	C10...C200[2]

Dimensions

Item	Value in inches (mm)
Overall height H*	1.9 (50) / 3.9 (100) / 6.7 (170) / 11.2 (285)
Outside diameter	ø 5.7 (145)
Inside diameter	ø 2.2 (55)
For cable diameter	ø 1.4...2.0 (36...50)

4MC70 33 cable-type current transformers

Application:

- For cable panel types CS, CC, CG
- For fuse panel types FS, FU.

Features:

- According to ANSI/IEEE C57.13
- 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)
- Inductive type
- Secondary connection by means of a terminal strip inside the panel.

Installation:

- Arranged on the cable at the panel connection
- Transformers mounted on a supporting plate at the factory; final assembly on the cables at site.

Footnotes:

1. Depending on the core data.
2. Accuracy class varies according to CT data.
3. Primary insulation provided by user's power cables.

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

Application:

- For metering panel types MT, MS, MC.

Features

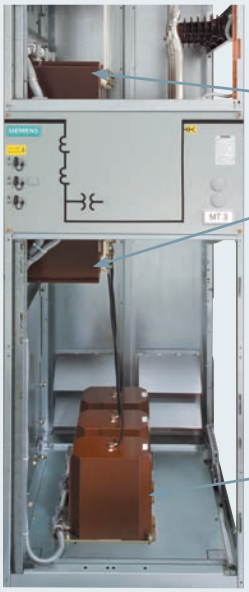
4MA7 current transformer:

- According to ANSI/IEEE C57.13
- Dimensions according to DIN 42 600-8
- Designed as a single-pole indoor block-type current transformer
- Cast-resin insulated
- Secondary connection by means of screw-type terminals.

4MR current transformer:

- According to ANSI/IEEE C57.13
- Dimensions according to DIN 42 600-9 (small model)
- Designed as an indoor voltage transformer
  - Type 4MR, single pole
  - Option: type 4MR, two pole
- Cast-resin insulated
- Secondary connection by means of screw-type terminals
- Option
  - Metering multi-functional digital-metering devices microprocessor-based units, suitable for three- or four-wire systems. Devices can be mounted on the low-voltage compartment door.

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





4MA7 block-type current transformer, single pole



4MR14 voltage transformer, single pole

Technical data 4MA7 single-pole block-type CT[5]

Primary data

Item	Value	
Rated voltage U_r	15.5 kV	27.6 kV
Rated short-duration power-frequency withstand voltage	34 kV[1] 36 kV[2]	40 kV[1] 60 kV[2]
Rated lightning-impulse withstand voltage U_p	95 kV	125 kV
Rated primary current I_n	50 A to 600 A, >600 A on request	
Rated thermal short-time withstand current I_{th}	Up to 25 kA	
Rated continuous thermal current I_d	Up to 1.0 x I_n Option: 1.2 x I_n	
Peak-withstand current I_{dyn}	Maximum 2.5 x I_{th}	

Technical data 4MR single-pole VT[5]

Item	Value			
Rated voltage U_r	5.6 kV	9.52 kV	15.5 kV	25.5 kV[4]
Rated short-duration power-frequency withstand voltage	16 kV[1] 20 kV[2]	26 kV[1] 28 kV[2]	34 kV[1] 36 kV[2]	40 kV[1] 60 kV[2]
Rated lightning-impulse withstand voltage U_p	60 kV	75 kV	95 kV	125 kV

Secondary data

Item		Value
Rated secondary current		5 A
Measuring core	Class[3]	0.3 / 0.6 / 1.2
	Burden[3]	0.2 to 1.8 VA
Protection core	Class[3]	C10...C200

Item	Value
Rated voltage	100/√3 V; 110/√3 V; 120/√3 V
Rated voltage for auxiliary winding	100/3 V; 110/3 V; 120/3 V
Accuracy	Up to 15 kV 0.3 X, 0.6 Y, 1.2 Z
	Up to 27.6 kV 0.3 X, 0.6 Y, 1.2 Z

Footnotes:

1. According to ANSI/IEEE C57.13 (standard).
2. Option: on request.
3. Accuracy class varies according to CT data.
4. On request: operating voltage U_m>25.5 kV, e.g., 26.4 kV.
5. Other values available on request.

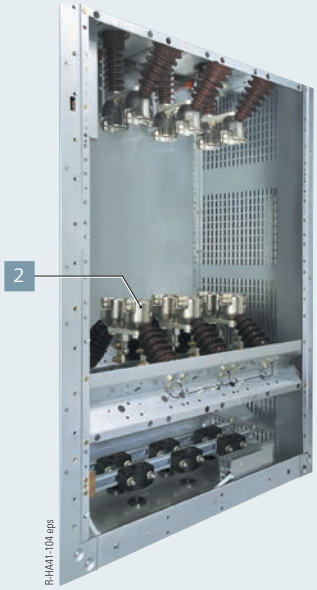
Cable connection examples



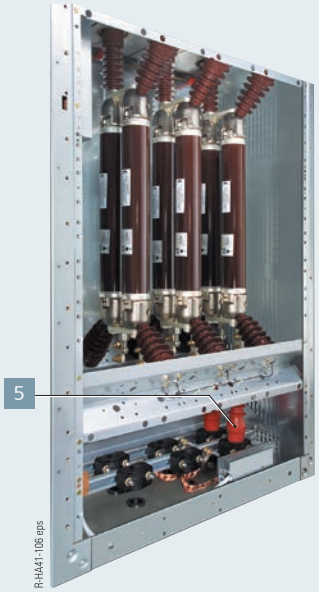
Cable switch panel type CS
Cable connection compartment as delivered



Cable connection compartment with cable termination



Fuse panel type FS
Cable connection compartment as delivered



Cable connection compartment with cable termination

Item	Description
1	As delivered condition for cable termination
2	As delivered condition, prepared for cable termination
3	Cold shrink brand 3M or equivalent
4	Cable termination brand 3M or Tyco Electronics (Raychem)
5	Cable termination brand 3M or Tyco Electronics (Raychem) (with cold shrink brand 3M)

Cable connection

General features:

- Cable termination points are arranged one behind the other
- Uniform cable connection height per panel (see dimension drawings)
- With cable bracket or cable clamps and grounding points for cable shields
- Access to the cable connection compartment only when feeder has been grounded.

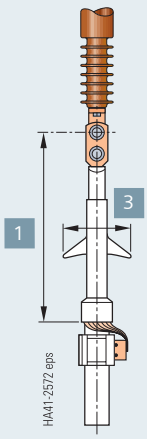
Features for cable terminals:

- For thermoplastic-insulated cables
- For paper-insulated mass-impregnated cables
- For connection cross sections (cable size) up to 300 mm² (600 kcmil) (larger connection cross sections (up to 750 kcmil) on request)
- Cable bottom entry (standard)
- Cable top entry (optional).

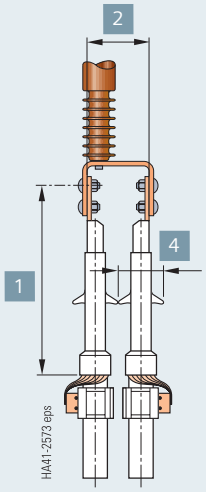
Selection data for various cable terminations

Panel type	CS1/CS2		FS1/FS2/FS3		FU1/FU2		CC1/CC2		CG1/CG2		MC3	
	Cable termination height	Panel height	Cable termination height	Panel height	Cable termination height	Panel height	Cable termination height	Panel height	Cable termination height	Panel height	Cable termination height	Panel height
Top cable entry - dimensions from top in inches (mm)												
Main switch or vertical copper bar in upper position (fuse assembly in lower position)	19.3 (490)	100.4 (2,550)	19.3 (490)	100.4 (2,550)	19.3 (490)	100.4 (2,550)	Not available		19.3 (490)	100.4 (2,550)	Not available	
Main switch or vertical copper bar in lower position (fuse assembly in upper position)	37 (940)	88.6 (2,250)	19.3 (490)	100.4 (2,550)	19.3 (490)	100.4 (2,550)	37 (940)	88.6 (2,250)	37 (940)	88.6 (2,250)	20.8 (530)	88.6 (2,250)
Bottom cable entry - dimensions from bottom in inches (mm)												
Main switch or vertical copper bar in upper position (fuse assembly in lower position)	48.8 (1,240)	88.6 (2,250)	19.3 (490)	88.6 (2,250)	19.3 (490)	88.6 (2,250)	48.8 (1,240)	88.6 (2,250)	48.8 (1,240)	88.6 (2,250)	22.8 (580)	88.6 (2,250)
Main switch or vertical copper bar in lower position (fuse assembly in upper position)	19.3 (490)	88.6 (2,250)	19.3 (490)	88.6 (2,250)	19.3 (490)	88.6 (2,250)	Not available		19.3 (490)	88.6 (2,250)	Not available	

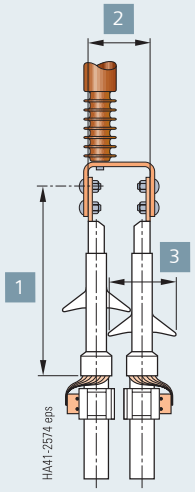
Principle of cable connection (dimensions in inches (mm))
(e.g., for panel type CS)



CS1



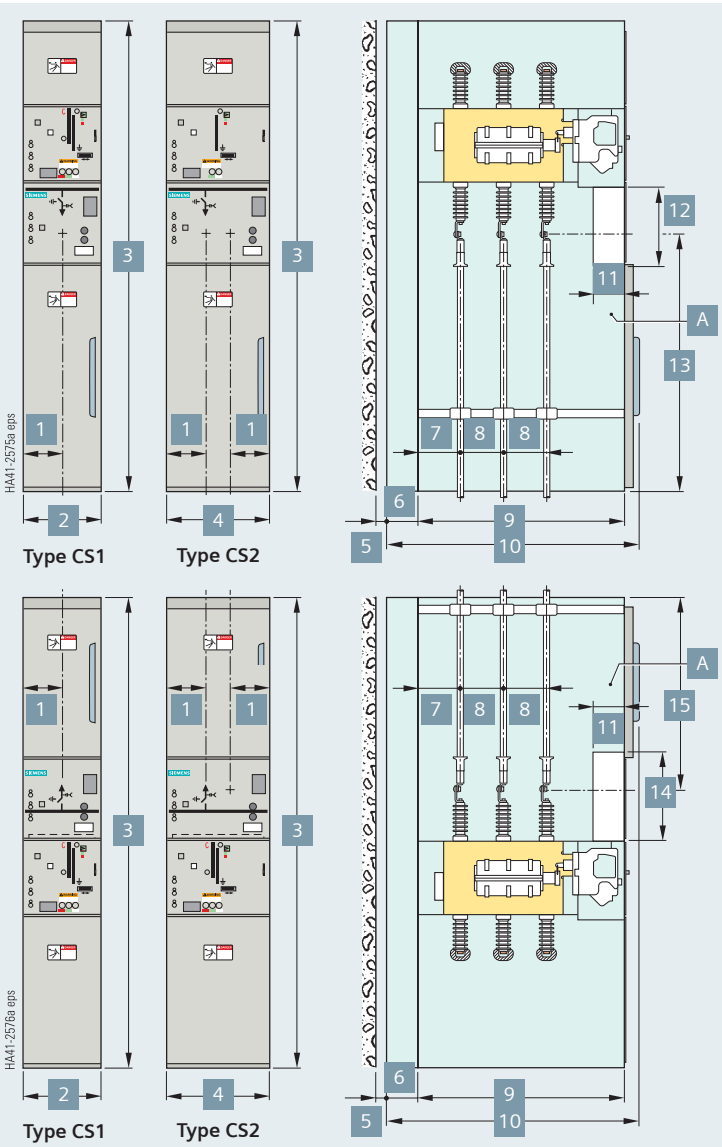
CS2



CS2

Item	Description
1	L = maximum 16.5 (420)
2	4.9 (125)
3	ø5.1 (130)
4	ø3.9 (100)

Dimensions

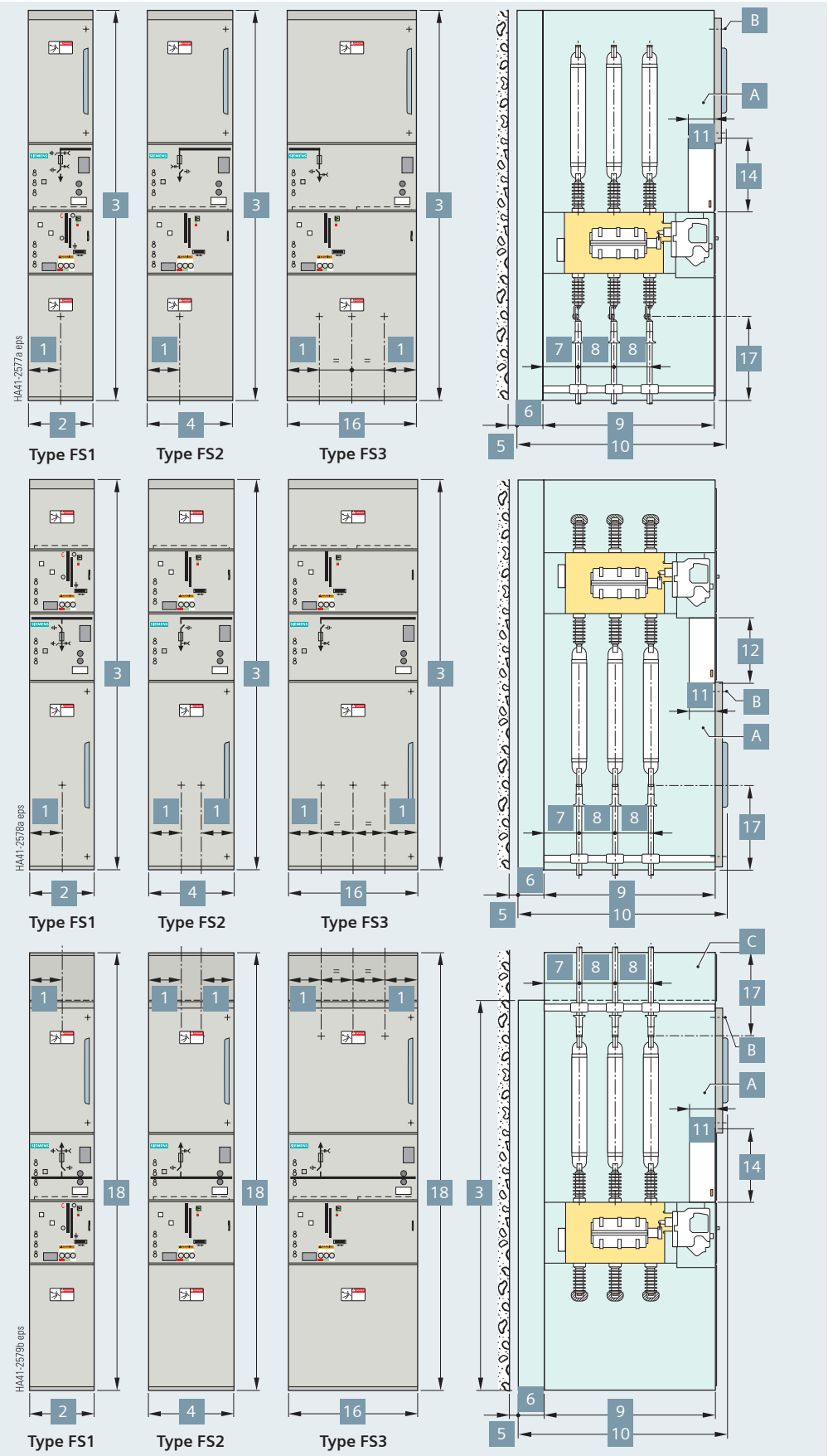


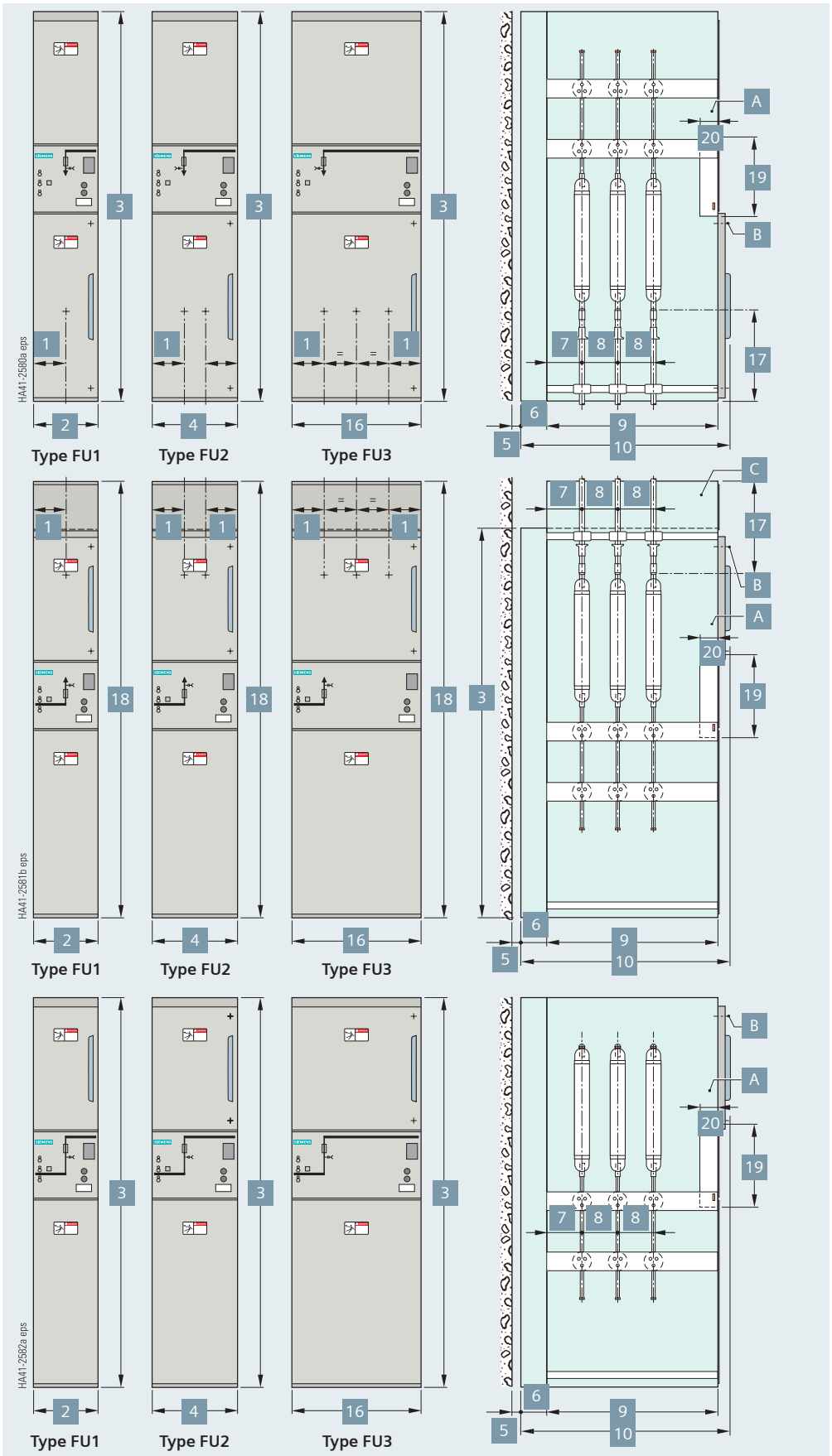
Cable switch panel types CS

Item	Dimensions in inches (mm)
1	7.4 (188)
2	14.8 (375)
3	88.6 (2,250)
4	19.7 (500)
5	2 (50)
6	5.9 (150)
7	8.1 (205)
8	8.3 (210)
9	39.4 (1,000)
10	48.4 (1,230)
11	5.8 (148)
12	14.6 (371)
13	48.8 (1,240)
14	17.4 (443)
15	37 (940)
A	Available mounting depth in the low-voltage niche

Fuse switch panel types FS

Item	Dimensions in inches (mm)
1	7.4 (188)
2	14.8 (375)
3	88.6 (2,250)
4	19.7 (500)
5	2 (50)
6	5.9 (150)
7	8.1 (205)
8	8.3 (210)
9	39.4 (1,000)
10	48.4 (1,230)
11	5.8 (148)
12	14.6 (371)
14	17.4 (443)
16	29.5 (750)
17	19.3 (490)
18	100.4 (2,550) or 112.6 (2,860)
A	Available mounting depth in the low-voltage niche
B	Door (fuse compartment) - mechanically interlocked
C	Top hat for cable-top entry 11.8" (300) or 24" (610)



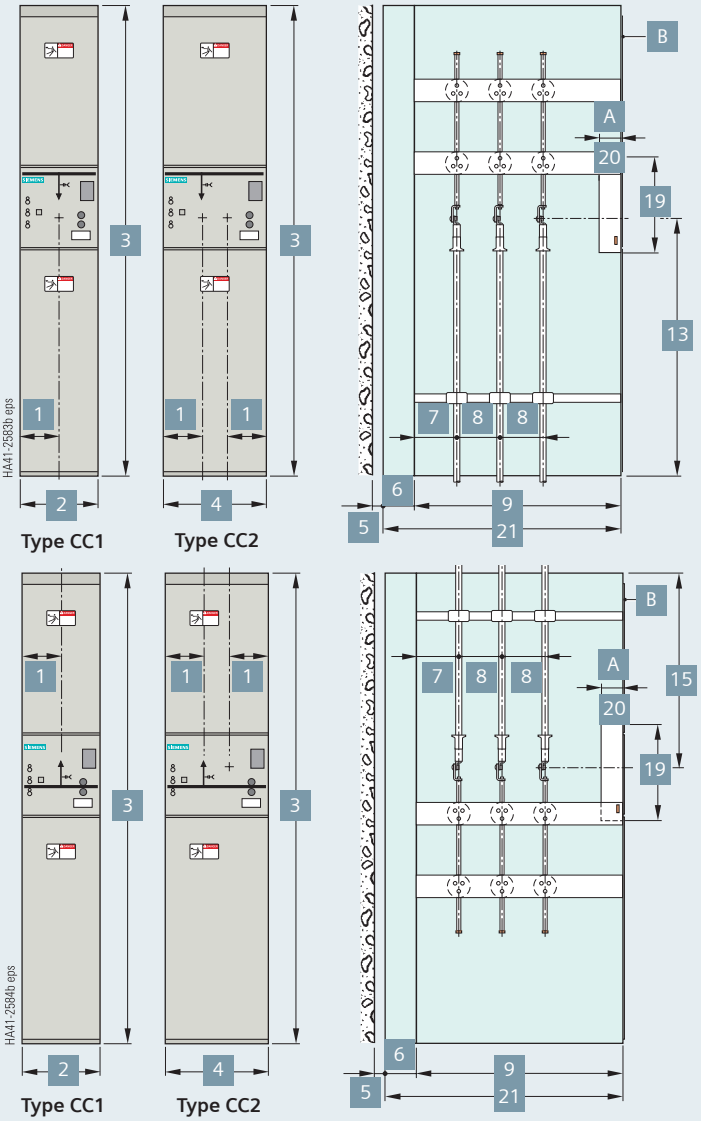


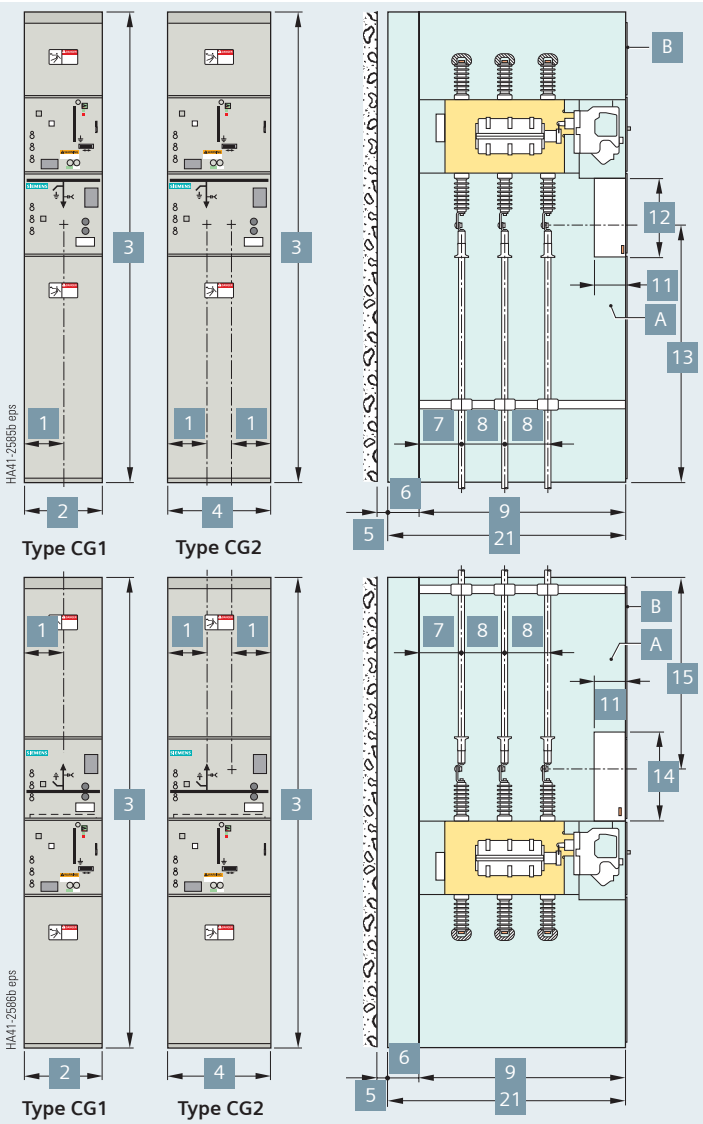
Fuse panel types FU

Item	Dimensions in inches (mm)
1	7.4 (188)
2	14.8 (375)
3	88.6 (2,250)
4	19.7 (500)
5	2 (50)
6	5.9 (150)
7	8.1 (205)
8	8.3 (210)
9	39.4 (1,000)
10	48.4 (1,230)
16	29.5 (750)
17	19.3 (490)
18	100.4 (2,550) or 112.6 (2.860)
19	18 (457)
20	4.3 (108)
A	Available mounting depth in the low-voltage niche
B	Door (fuse compartment) - key interlocked (option)
C	Top hat for cable-top entry 11.8" (300) or 24" (610)

Cable connection panel types CC

Item	Dimensions in inches (mm)
1	7.4 (188)
2	14.8 (375)
3	88.6 (2,250)
4	19.7 (500)
5	2 (50)
6	5.9 (150)
7	8.1 (205)
8	8.3 (210)
9	39.4 (1,000)
13	48.8 (1,240)
15	37 (940)
19	18 (457)
20	4.3 (108)
21	45.3 (1,150)
A	Available mounting depth in the low-voltage niche
B	Screwed-on panel



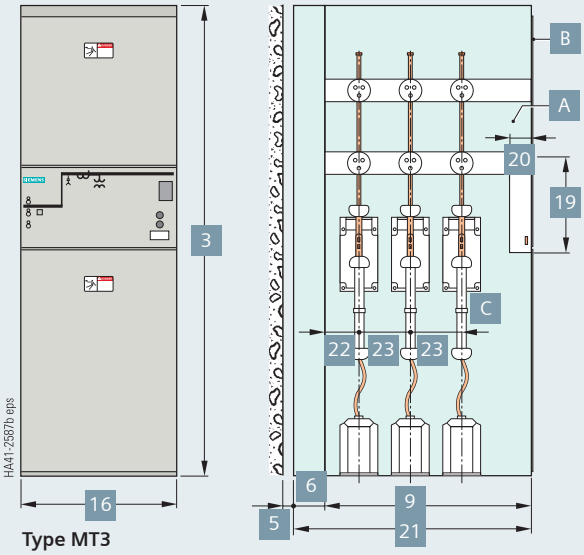


Cable grounding panel types CG

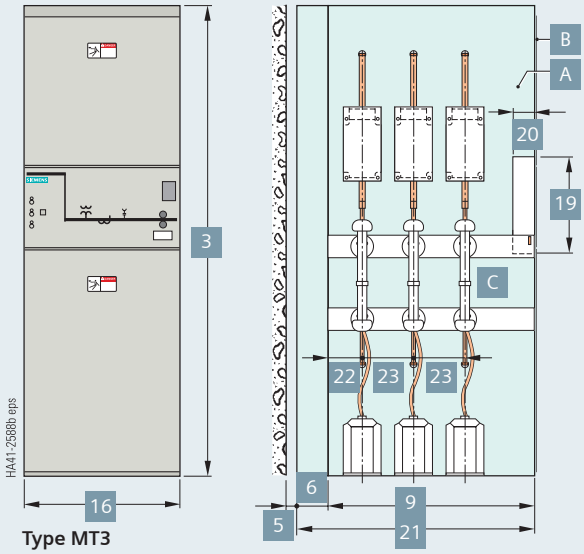
Item	Dimensions in inches (mm)
1	7.4 (188)
2	14.8 (375)
3	88.6 (2,250)
4	19.7 (500)
5	2 (50)
6	5.9 (150)
7	8.1 (205)
8	8.3 (210)
9	39.4 (1,000)
11	5.8 (148)
12	14.6 (371)
13	48.8 (1,240)
14	17.4 (443)
15	37 (940)
21	45.3 (1,150)
A	Available mounting depth in the low-voltage niche
B	Screwed-on panel

Metering panel types MT3

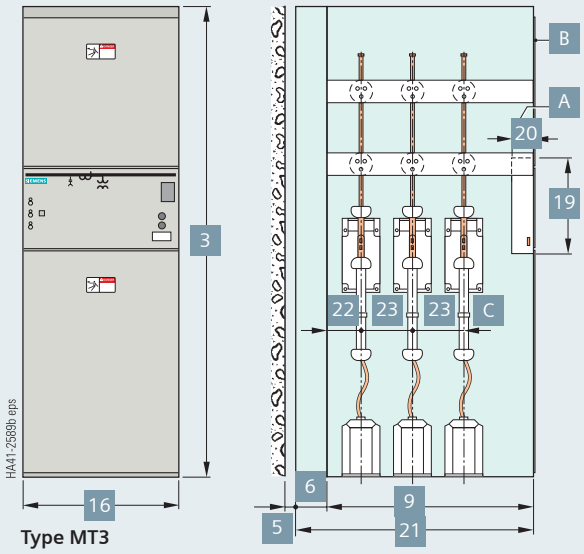
Item	Dimensions in inches (mm)
3	88.6 (2,250)
5	2 (50)
6	5.9 (150)
9	39.4 (1,000)
16	29.5 (750)
19	18 (457)
20	4.3 (108)
21	45.3 (1,150)
22	6.5 (165)
23	9.8 (250)
A	Available mounting depth in the low-voltage niche
B	Screwed-on panel
C	Fuses



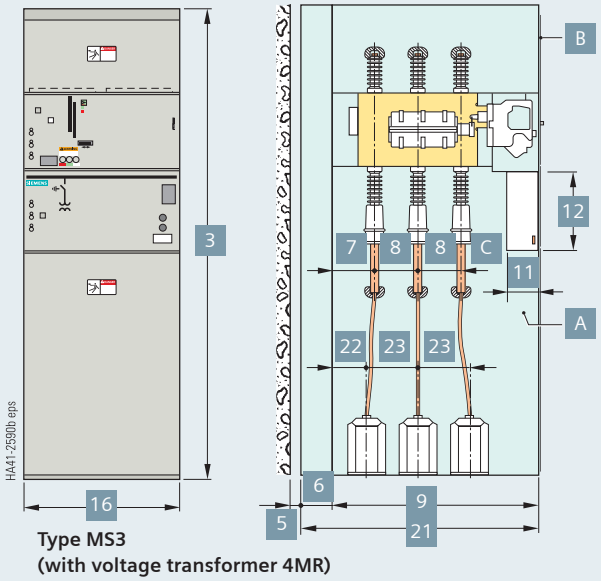
Type MT3



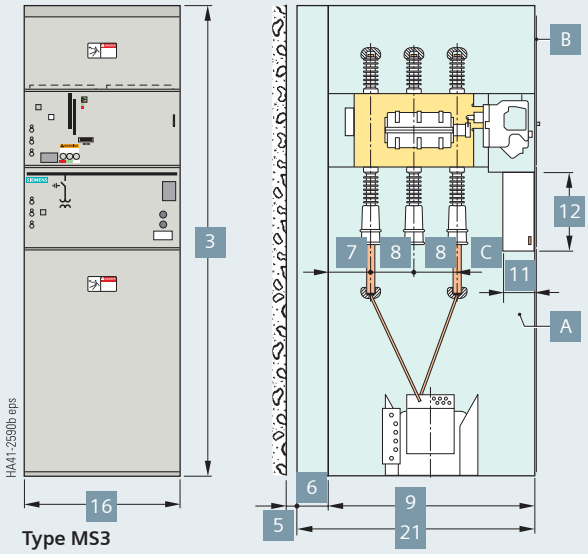
Type MT3



Type MT3



Type MS3
(with voltage transformer 4MR)



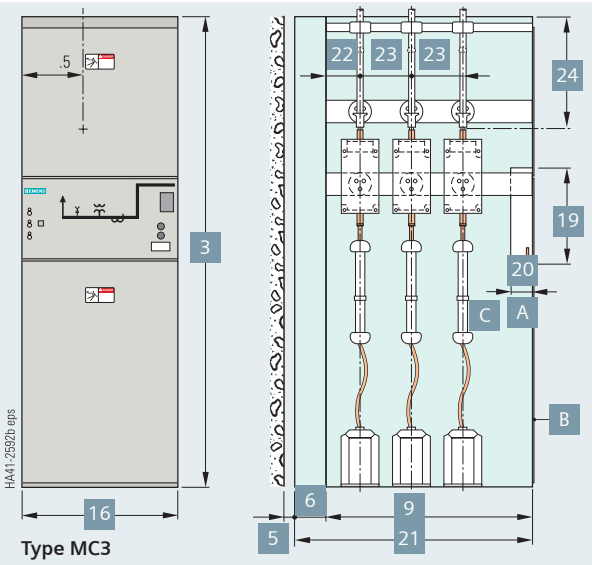
Type MS3
(with control power transformer)

Metering switch panel types MS

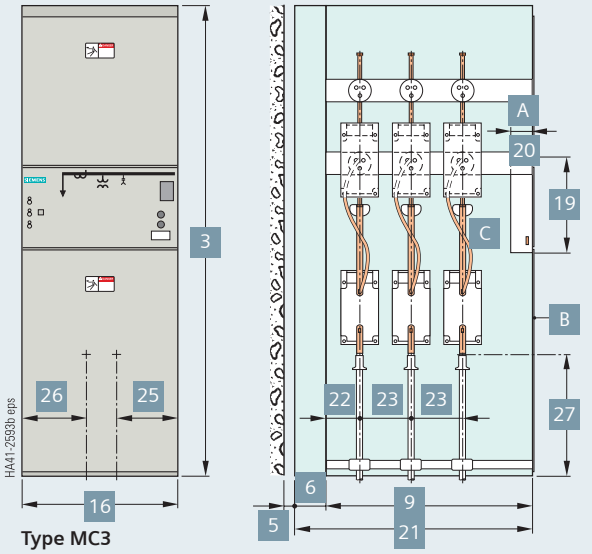
Item	Dimensions in inches (mm)
3	88.6 (2,250)
5	2 (50)
6	5.9 (150)
7	8.1 (205)
8	8.3 (210)
9	39.4 (1,000)
11	5.8 (148)
12	14.6 (371)
16	29.5 (750)
21	45.3 (1,150)
22	6.5 (165)
23	9.8 (250)
A	Available mounting depth in the low-voltage niche
B	Screwed-on panel
C	Fuses

Metering cable panel types MC3

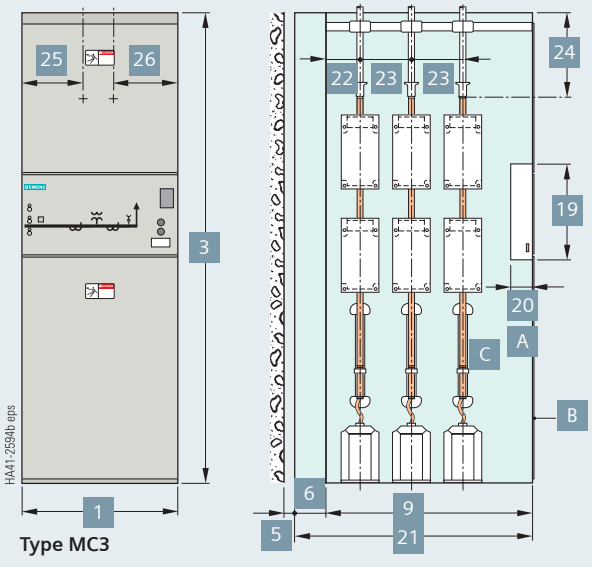
Item	Dimensions in inches (mm)
3	88.6 (2,250)
5	2 (50)
6	5.9 (150)
9	39.4 (1,000)
16	29.5 (750)
19	18 (457)
20	4.3 (108)
21	45.3 (1,150)
22	6.5 (165)
23	9.8 (250)
24	20.8 (530)
25	11.7 (298)
26	12.1 (308)
27	22.8 (580)
A	Available mounting depth in the low-voltage niche
B	Screwed-on panel
C	Fuses



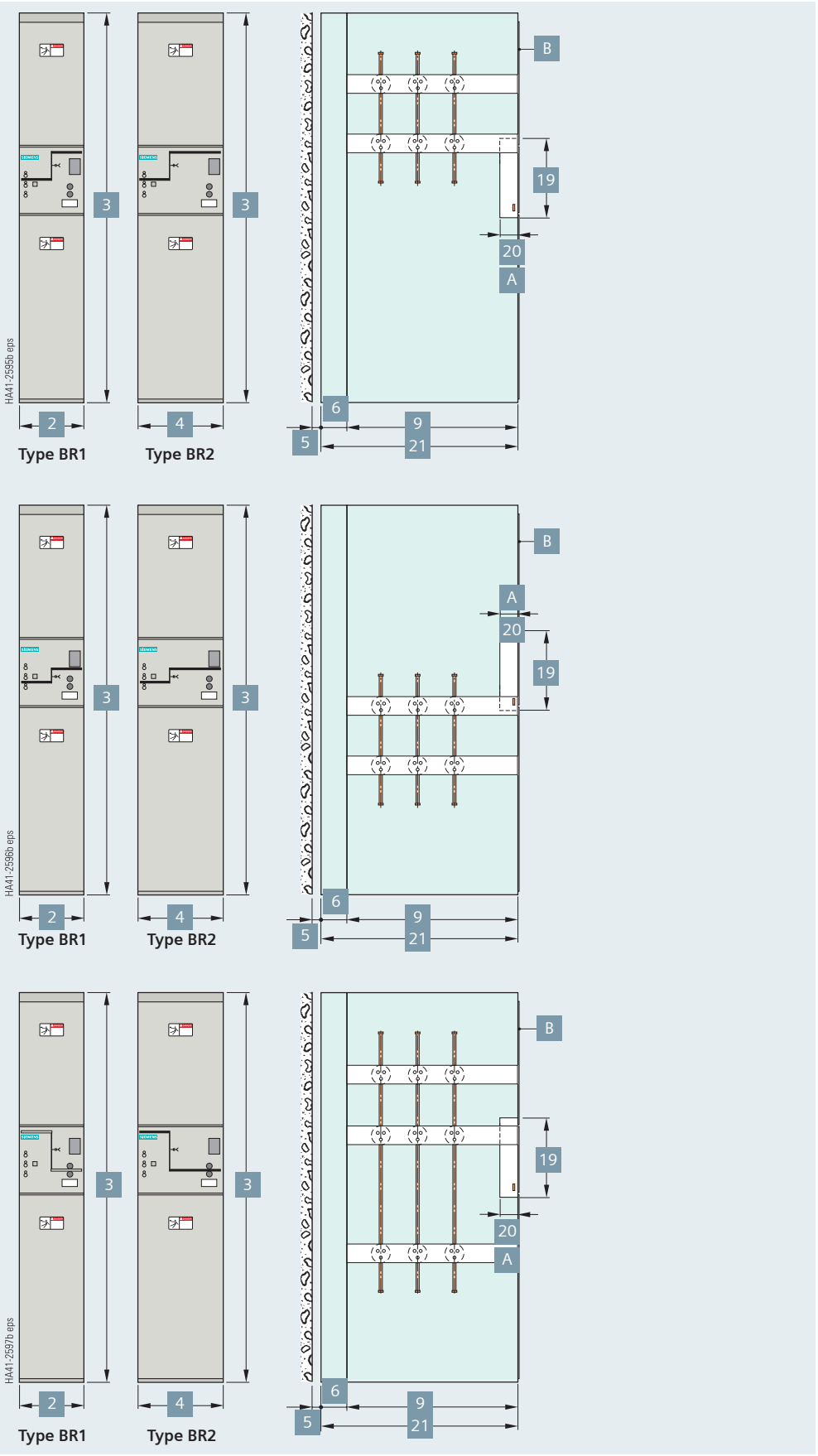
Type MC3



Type MC3



Type MC3

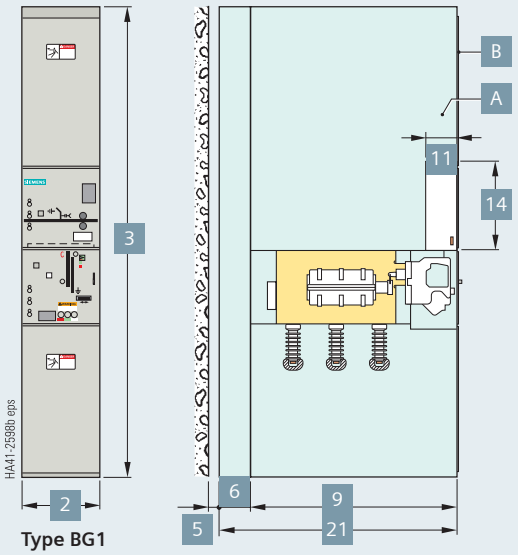


Bus riser panel types BR

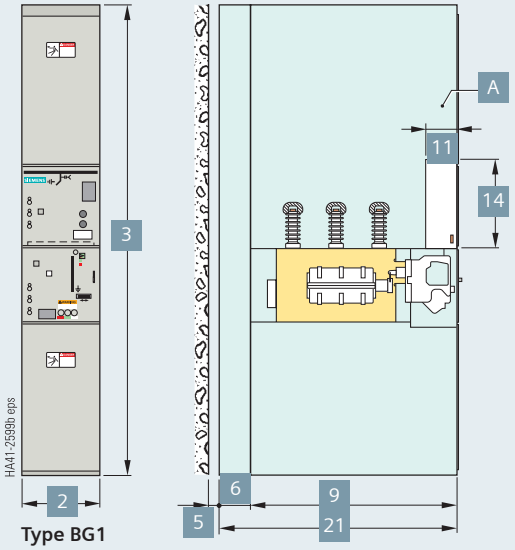
Item	Dimensions in inches (mm)
2	14.8 (375)
3	88.6 (2,250)
4	19.7 (500)
5	2 (50)
6	5.9 (150)
9	39.4 (1,000)
19	18 (457)
20	4.3 (108)
21	45.3 (1,150)
A	Available mounting depth in the low-voltage niche
B	Screwed-on panel

Busbar grounding panel types BG1

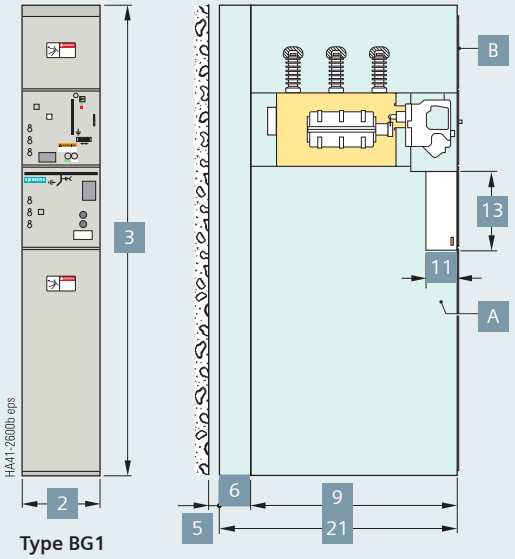
Item	Dimensions in inches (mm)
2	14.8 (375)
3	88.6 (2,250)
5	2 (50)
6	5.9 (150)
9	39.4 (1,000)
11	5.8 (148)
13	14.6 (371)
14	17.4 (443)
22	45.3 (1,150)
A	Available mounting depth in the low-voltage niche
B	Screwed-on panel



Type BG1



Type BG1

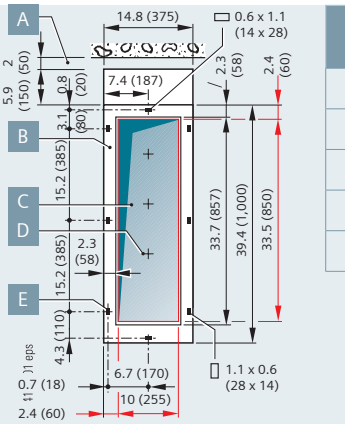


Type BG1

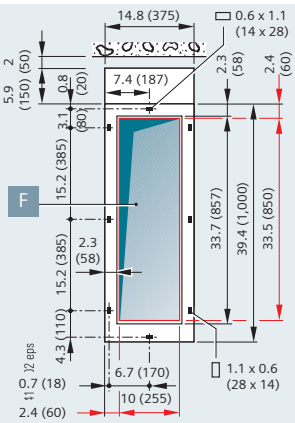
Floor plan (with floor openings in red)

Item	Description
A	Wall distance
B	Fixing frame (base)
C	Floor opening for high-voltage cables and, where applicable, control cables
D	Position of the cables for the feeder
E	Fixing points
F	Floor opening if required for panels without cable connection

For panel width 14.8" (375 mm)

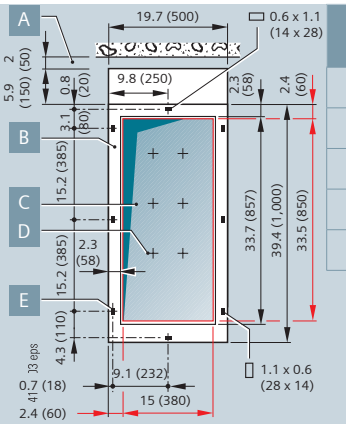


Panel type
CS1
FS1
FU1
CC1
CG1

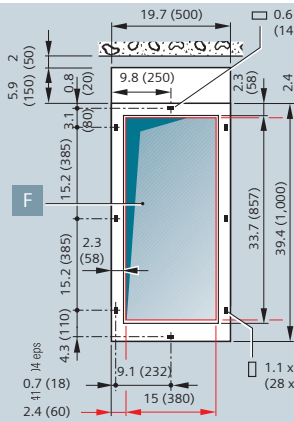


Panel type
BG1
BR1

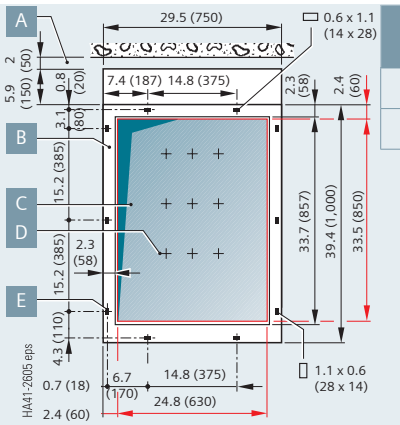
For panel width 19.7" (500 mm)



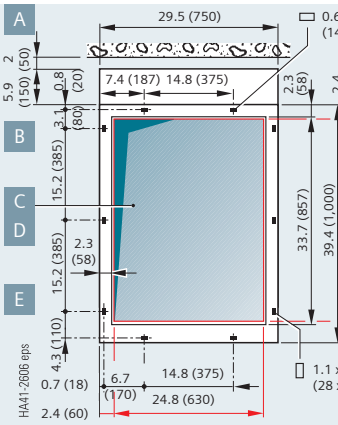
Panel type
CS2
FS2
FU2
CC2
CG2



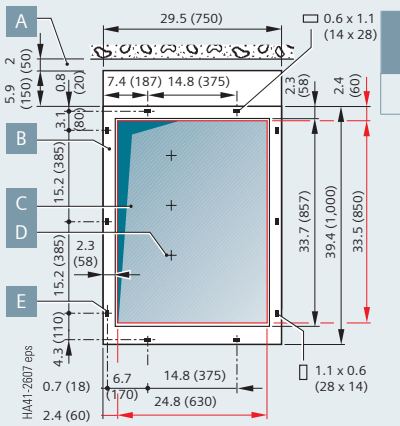
Panel type
BR2
MS2



Panel type
FS3
FU3



Panel type
MT3
MS3



Panel type
MC3

Standards

Standards, specifications, guidelines

Overview of standards

SIMOSEC switchgear complies with the following relevant standards and specifications as applicable:

- ANSI/IEEE Std. C37.20.3-2001
- ANSI/EEE Std. C37.20.4-2013
- ANSI/IEEE Std. C37.40-2003
- ANSI/IEEE Std. C37-41-2008
- ANSI/IEEE Std. 1247-2005
- ANSI C37.46-2000
- ANSI C37.57-2003
- ANSI C37.58-2003
- CSA C22.2 No. 193-M 1983
- CSA C22.2 No. 31-10
- EEMAC G11-1 (measurement of Corona)
- IEC 62 271-105.

Third-party listing

SIMOSEC is available for most configurations with UL or C-UL listing.

Terms of service location

SIMOSEC is designed for installation indoors in locations not accessible to unqualified persons.

SIMOSEC is also suitable for installation in a weatherproof enclosure (or power equipment center (PEC)), and not accessible to unqualified persons.

Terms:

- "Make-proof grounding switches" are grounding switches with short-circuit making capacity according to IEC 62 271-102
- Switch disconnector corresponds to interrupter switch
- HV CL are high-voltage current-limiting fuse links.

Insulating capacity:

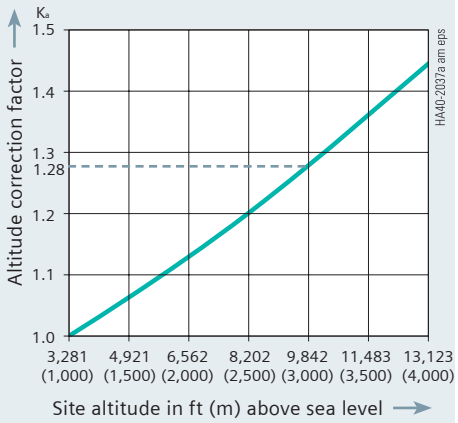
- The insulating capacity is verified by testing the switchgear with rated values of short-duration power-frequency withstand voltage and lightning-impulse withstand voltage according to IEC 62 271-1/VDE 0670-1000 and ANSI/IEEE C37.20.3
- The rated values are referred to sea level and to normal atmospheric conditions 14.7 PSI, 68 °F, 0.00068 lb/ft³ humidity in accordance with IEC 60 071/VDE 0111 and ANSI/IEEE C37.20.3
- The insulating capacity decreases with increasing altitude.
  For site altitudes above 3,281 ft (1,000 m) (above sea level) the standards do not provide any guidelines for the insulation rating. Instead, special regulations apply to these altitudes.

Insulating capacity

Rated voltage (rms value)	kV	5.0	15	27.6
Rated short-duration (1 minute) power-frequency withstand voltage (rms) value				
Across isolating distances	kV	21	39.6	66
Between phases and to ground	kV	19	36	60
Rated lightning-impulse withstand voltage (peak value)				
Across isolating distances	kV	66	105	138
Between phases and to ground	kV	60	95	125

Altitude correction factor K_a

For site altitudes above 3,281 ft (1,000 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 to be selected:

≥ Rated short-duration power-frequency withstand voltage · K_a

Rated lightning-impulse withstand voltage to be selected:

≥ Rated lightning-impulse withstand voltage · K_a

Example:

- 9,842 ft (3,000 m) site altitude above sea level
- 15 kV switchgear rated voltage
- 95.0 kV rated lightning-impulse withstand voltage
- Rated lightning impulse withstand voltage to be selected 95 kV · 1.28 = 122 kV.

Result:

According to the above table, a switchgear for a rated voltage of 27.6 kV is to be selected.

Site altitude:

- As the altitude increases, the insulating capacity of insulation in air decreases due to the decreasing air density
- For site altitudes above 3,281 ft (1,000 m) a higher insulation level must be selected. This results from the multiplication of the rated insulation level for 0 ft/0 m to 3,281 ft/ 1,000 m (above sea level) with altitude correction factor K_a.

Cable testing:

- For 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 27.6 kV can be subjected to cable tests at a max. DC test voltage of 70 kV. The voltage at the busbar may be 27.6 kV in this case
- For cable testing:
  - The installation and operating instructions of the switchgear
  - 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.

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 operating temperatures:

- Ambient conditions:
  - Natural foreign materials
  - Chemically active pollutants
  - Small animals.
- Ambient operating temperature and temperature rise.
  The operating temperatures are classified according to ANSI/IEEE C37.20.3.

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 switch vessel
- Dry-type bearings in operating mechanism
- Essential parts of the operating mechanism made of corrosion-proof materials
- Use of climate-independent cable-type current transformers
- All contacts (switch disconnector and make-proof grounding switch) are maintenance-free
- Copper bus bars - standard with silver-plated connections (option - tin-plated)
- Copper ground bar - standard non-plated (option: silver-plated or tin-plated)
- Under indoor operating conditions, SIMOSEC requires low maintenance.

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

SIMOSEC switchgear fulfills acc. to the standards ANSI/ IEEE C37.20.3 the following type of protection: All openings in the enclosure prevent the entrance of a rod with a diameter of 0.13 inch (3.2 mm).

Test voltages:

Rated voltage of switchgear	DC test voltage, maximum value	VLF* test voltage cosine-rectangular waveform rms (peak) voltage	VLF* test voltage sinusoidal waveform rms (peak) voltage
15	55 kV	22 (22) kV	16 (22) kV
27.6	72 kV	33 (33) kV	23 (33) kV

* VLF = Very Low Frequency. Refer to IEEE Standard 400.2-2004 "IEEE Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (VLF)". For cosine-rectangular waveform, the rms value is taken as equal to the peak value. For sinusoidal waveform, the rms value is 0.707 times the peak value, if distortion is less than five percent.

Seismic capacity (optional - minimum assembly size is three panels)

SIMOSEC switchgear can be upgraded for regions at risk from earthquake.

For upgrading, earthquake qualification testing has been carried out in accordance with the following standards as applicable:

- IEC 60 068-3-3, 1993
- IEC 60 068-2-6, 1195
- IABG TA13-TM-002/98 (guide)
- NFPA 5000 and IBC Level Seismic Simulation.

Within the range of the prevailing earthquake frequencies from 1 to 35 Hz, the required response spectrum to IBC 200 percent and 300 percent covers the following response spectra:

- UniformBuilding Code zone 4
- Seismic Requirements Spec. 9067; Department of Water & Power, Los Angeles
- GTS-1.1013 ENDES, Chile
- VDE 0670-111
- IABG TA13-TM-002/98 category 2.

Surge arresters:

- Distribution class arresters in standard panel widths
- Intermediate class or station-class arresters may increase panel width.

The information provided in this document contains merely general descriptions or characteristics of performance which in case of actual use do not always apply as described or which may change as a result of further development of the products. An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of contract.

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www.usa.siemens.com/mvswitchgear

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