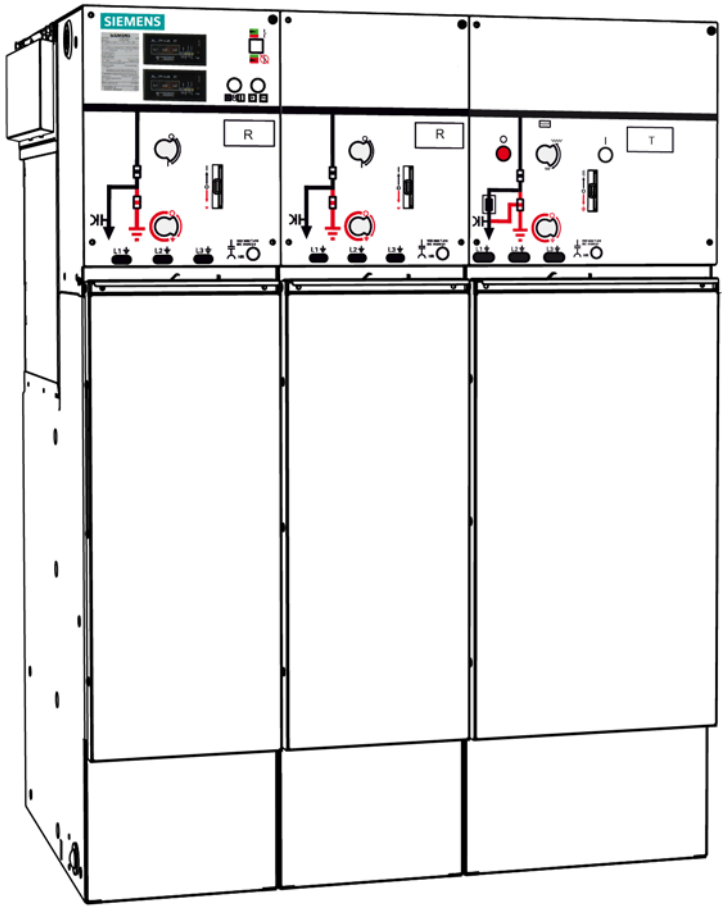
SIEMENS

Medium-Voltage Switchgear

Type 8DJH

Up to 24 kV, Gas-Insulated



INSTALLATION AND OPERATING INSTRUCTIONS

Order No.: 500-8384.9
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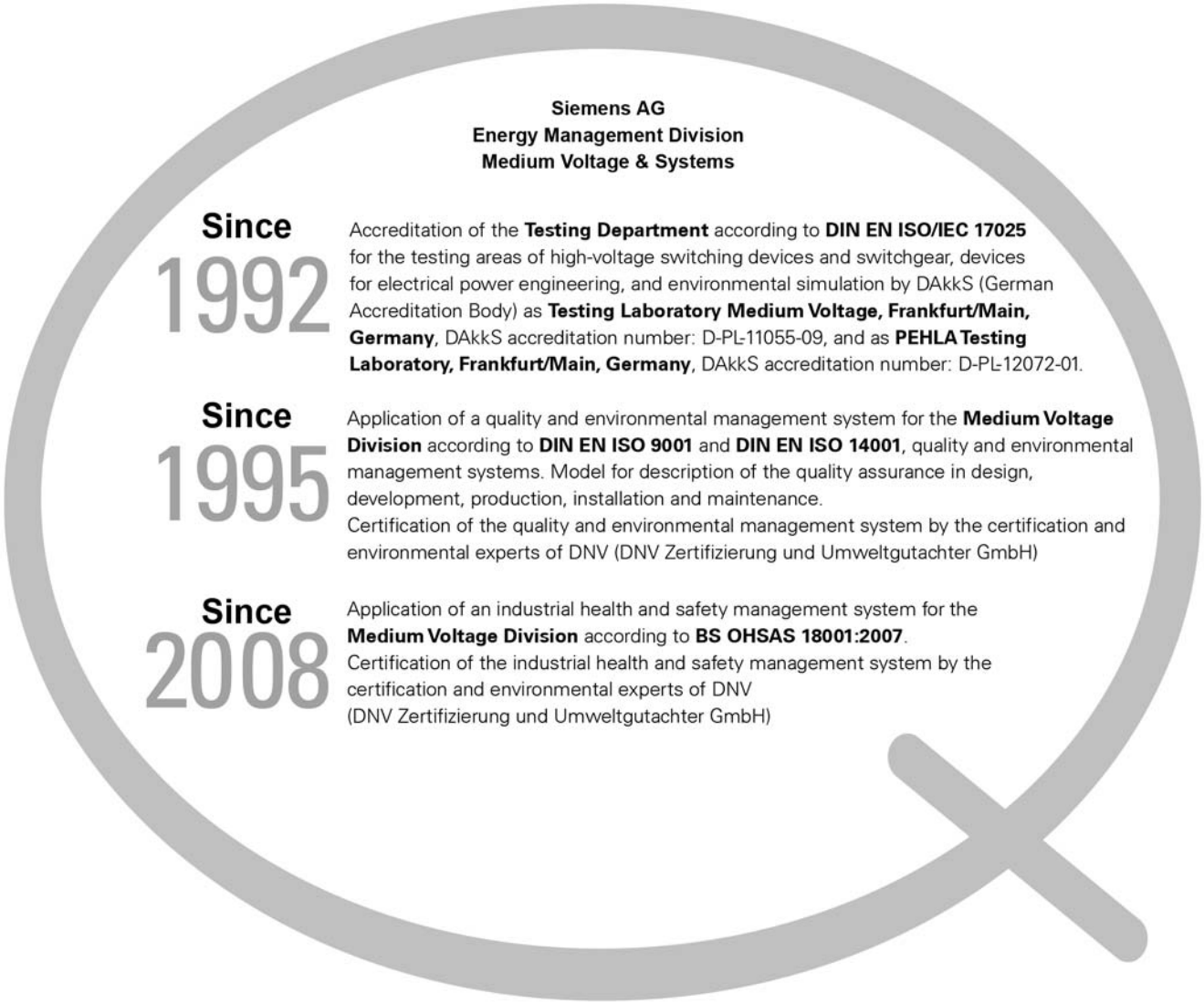


About these Instructions

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation or operation. For details about technical design and equipment like e.g. technical data, secondary equipment, circuit diagrams, please refer to the order documents. The switchgear is subject to continuous technical development within the scope of technical progress. If not stated otherwise on the individual pages of these instructions, we reserve the right to modify the specified values and drawings. All dimensions are given in mm. Should further information be desired or should particular problems arise which are not covered sufficiently by these instructions, the matter should be referred to the competent Siemens department. The contents of this instruction manual shall not become part of or modify any prior or existing agreement, commitment or relationship. The Sales Contract contains the entire obligations of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained herein do not create new warranties or modify the existing warranty.

Contents

Safety instructions

1 Signal terms and definitions

	**DANGER** as used in these instructions, this means that personal injuries can occur if the relevant precautionary measures are not taken. ⇨ Observe the safety instructions.

	**ATTENTION** as used in these instructions, this means that damage to property or environment can occur if the relevant precautionary measures are not taken. ⇨ Observe the safety instructions.

	**NOTE** as used in these instructions, this points at facilitations of work, particularities for operation or possible maloperation. ⇨ Observe the notes.

Symbols used

⇨ Operation symbol: Identifies an operation. Asks the operator to perform an operation.

✔ Result symbol: Identifies the result of an operation.

2 General instructions

Important

- The personnel must read and understand this manual before starting to work.
- Observe all safety instructions and warnings in this manual, and follow the instructions.
- Store this manual carefully, and so that it is accessible to the personnel at any time.
- This manual is a part of the product. When the switchgear is transferred, supply this manual as well.

DANGER

The perfect and safe operation of this switchgear is conditional on:

- ⇨ Observance of operating and installation instructions.
- ⇨ Qualified personnel.
- ⇨ Proper transportation and correct storage of the switchgear.
- ⇨ Correct installation and commissioning.
- ⇨ Diligent operation and maintenance.
- ⇨ Observance of the instructions applicable at site for installation, operation and safety (e.g. DIN VDE 0101/0105). (e.g. DIN VDE 0101/0105).

DANGER

Any kind of modification on the product or alteration of the product must be coordinated with the manufacturer in advance. Non-coordinated modifications or alterations can cause the expiration of warranty claims, and cause danger to life, limb and other legally protected interests. The fulfillment of the type tests (according to IEC 62271-200) may not be guaranteed anymore. This applies especially though not exclusively to the following actions, e.g in the course of maintenance or repairs:

- ⇨ Original Siemens spare parts were not used.
- ⇨ Service engineers performing replacement were not trained and certified by Siemens.
- ⇨ Parts were fitted or adjusted incorrectly.
- ⇨ Settings were not made in accordance with Siemens specifications.
- ⇨ After installation and setting, no final check was performed by a service engineer approved by Siemens, including documentation of the test results.
- ⇨ Maintenance was not done according to the operating instructions of the Siemens products.

The switchgear corresponds to the relevant laws, prescriptions and standards applicable at the time of delivery. If correctly used, it provides a high degree of safety by means of logical mechanical interlocks and shockproof metal enclosure of live parts.

Independently of the safety instructions given in these operating instructions, the local laws, ordinances, guidelines and standards for operation of electrical equipment as well as for labor, health and environmental protection apply.

The switchgear operator or owner must keep the technical documents supplied with the switchgear throughout the entire service life, and keep them up-to-date in case of modifications of the switchgear.

Five Safety Rules of Electrical Engineering

The Five Safety Rules of Electrical Engineering must be complied with during operation of the products and components described in these operating instructions:

- Isolate.
- Secure against reclosing.
- Verify safe isolation from supply.
- Earth and short-circuit.
- Cover or barrier adjacent live parts.

Hazardous substances

If hazardous substances are required to perform the work, the relevant safety data sheets and operating instructions must be observed.

Personal protective equipment (PPE)

For switchgear **with proven** internal arc classification according to IEC 62271 Part 200, **no personal protective equipment must be worn for operating the switchgear**.

For switchgear **without proof** of internal arc classification according to IEC 62271 Part 200, **personal protective equipment must be worn for operating the switchgear**.

If covers have to be removed **to work on switchgear**, personal protective equipment must be worn for protection against hot gases exhausting in case of internal arc. In case of internal arc, full personal protection is not provided, even if the personal protective equipment is worn.

To select the protective equipment, the local laws and regulations must be observed and accomplished.

The protective equipment consists of:

- Protective clothing
- Safety shoes
- Gloves
- Helmet and face protection
- Ear protection

Removing the front plate from the operating mechanism compartment

DANGER

Risk of injury by release of charged operating springs when the front cover of the operating mechanism is removed! Bruises or cuts at the hands can be the consequence.

⇨ To avoid impermissible switching operations, switch off auxiliary voltage, e.g.:
- Switch the auxiliary voltage supply of the motor.
- Trip the MCB.
- Disconnect the control cables from the low-voltage compartment.

⇨ To discharge the spring energy store in the operating mechanism, perform the following operations before removing the front cover:
- Actuate the OFF pushbutton.
- Actuate the ON pushbutton.
- Actuate the OFF pushbutton.

⇨ The spring energy store indicator must show "spring not charged".

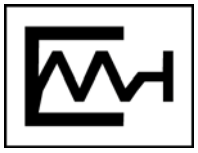


Fig. 1: "Spring not charged" indication

Fig. 2: "Spring charged" indication

3 IT security

The Siemens software is regularly checked for safety. If weak points are identified in the process, which may allow third parties to access protection devices, information thereto is distributed through the **SIPROTEC and SICAM Security Update Report Newsletter**.

The Newsletter can be subscribed to at the following website:

www.siemens.com/gridsecurity

Before commissioning the switchgear, it must be verified that the current firmware version is installed on the protection devices. The latest version of firmware can be obtained from the following website:

http://w3.siemens.com/smartgrid/global/en/products-systems-solutions/downloads/Pages/Overview.aspx

For information to updates for other makes of protection devices, please contact the respective manufacturer.

4 Due application

The factory-assembled, type-tested and metal-enclosed 8DJH switchgear for indoor installation is used for power distribution in secondary distribution systems, e.g. in transformer substations, transfer substations or industrial distribution systems.

The switchgear is designed for application under normal ambient conditions according to IEC 62271-1. The switchgear can also be used under special ambient conditions as defined individually between the operator and the manufacturer of the switchgear.

SF_6 is used as insulating gas in the switchgear vessel.

5 Qualified personnel

Qualified personnel in accordance with these instructions are persons who are familiar with transport, installation, commissioning, maintenance and operation of the product and have appropriate qualifications for their work, as e.g.:

- Training and instruction or authorization to switch on, switch off, earth and identify power circuits and equipment / systems as per the relevant safety standards.
- Instruction regarding the applicable specifications for the prevention of accidents and the care and use of appropriate safety equipment.
- Training in first aid and behavior in the event of possible accidents.

Description

6 Panel versions

Individual panels

Individual panels allow a free selection when arranging the functions within one switchgear row. In limited space conditions, individual panels can simplify switchgear installation on site.

Panel type (function)		Panel width [mm]		
		Standard	Option	
R	Ring-main panel	310	500	–
K	Cable panel	310	430	–
K(E)	Cable panel with make-proof earthing switch	430	--	--
T	Transformer panel	430	–	–
L	Circuit-breaker panel	430	500	–
S	Bus sectionalizer panel with three-position switch-disconnector	430	500	620
H	Bus sectionalizer panel with switch-fuse combination	430	–	
V	Bus sectionalizer panel with circuit-breaker	500	–	–
E	Busbar earthing panel	310	500	
M	Billing metering panel	840	–	–
M(430)	Busbar voltage metering panel with primary fuse protection M(430)	430	–	–
M(500)	Busbar voltage metering panel with disconnector M(500)	500	–	–

Panel blocks

Panel blocks can be operated with up to 4 functions in one common switchgear vessel. Combinations of transformer feeder and circuit-breaker feeder are possible via panel extensions.

Block of 2 panels		Block of 3 panels		Block of 4 panels			
Panel types	**Block width**	**Panel types**	**Block width**	**Panel types**	**Block width**	**Panel types**	**Block width**
RR	620 mm	RRR	930 mm	RRRR	1240 mm	LLRR	1480 mm
RK	620 mm	RRT	1050 mm	RRRS	1350 mm	RRLL	1480 mm
KR	620 mm	RTR	1050 mm	RRRH	1350 mm	RTRT	1480 mm
RT	740 mm	RRL	1050 mm	RRRT	1360 mm	TRTR	1480 mm
RL	740 mm	RLR	1050 mm	RRRL	1360 mm	RLRL	1480 mm
KT	740 mm	RRS	1050 mm	RRTR	1360 mm	LRLR	1480 mm
KL	740 mm	RRH	1050 mm	RTRR	1360 mm	TTTR	1600 mm
TK	740 mm	TRR	1050 mm	TRRR	1360 mm	TTRT	1600 mm
TR	740 mm	LRR	1050 mm	RRLR	1360 mm	TRTT	1600 mm
RS	740 mm	RTT	1170 mm	RLRR	1360 mm	RTTT	1600 mm
RH	740 mm	TRT	1170 mm	LRRR	1360 mm	LLLR	1600 mm
LK	740 mm	TTR	1170 mm	TRRT	1480 mm	LLRL	1600 mm
LR	740 mm	RLL	1170 mm	LRRL	1480 mm	LRLL	1600 mm
K(E)T	860 mm	LRL	1170 mm	RTTR	1480 mm	RLLL	1600 mm
K(E)L	860 mm	LLR	1170 mm	TTRR	1480 mm	TTTT	1720 mm
TT	860 mm	LLL	1290 mm	RRTT	1480 mm	LLLL	1720 mm
LL	860 mm	TTT	1290 mm	RLLR	1480 mm		

Examples for panels

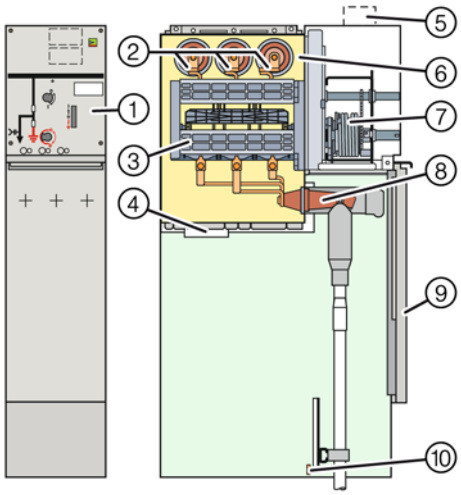


Fig. 3: Ring-main panel type R

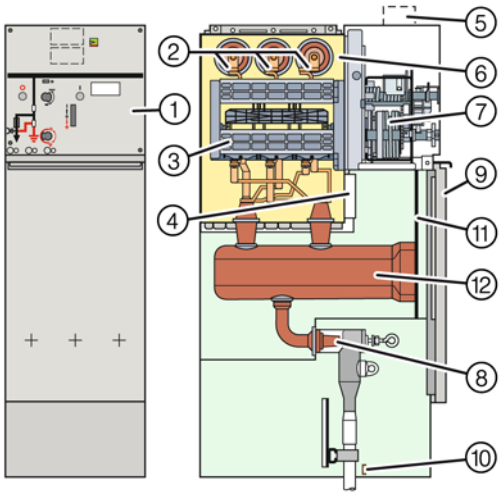


Fig. 4: Transformer panel type T

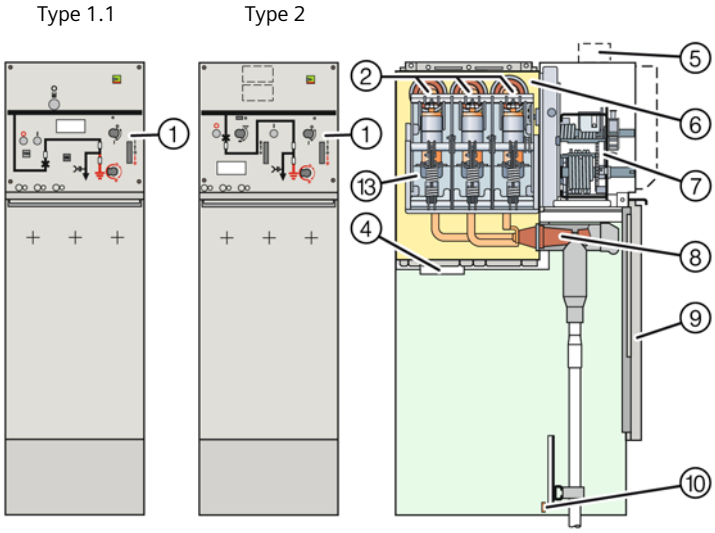


Fig. 5: Circuit-breaker panel type L

① Control board
② Busbar
③ Three-position switch-disconnector
④ Pressure relief device
⑤ Wiring duct (removable)
⑥ Switchgear vessel
⑦ Operating mechanism of switching device
⑧ Bushing for cable plug
⑨ Cable compartment cover
⑩ Earthing busbar
⑪ Partition
⑫ HV HRC fuse assembly
⑬ Vacuum circuit-breaker

7 Components

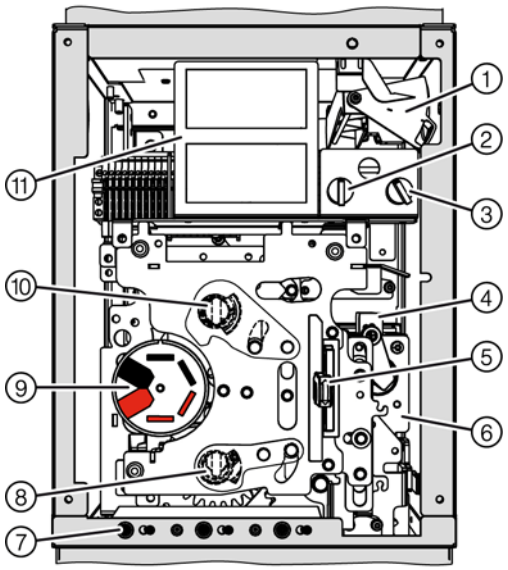
7.1 Three-position switch-disconnector

Features

- Three-position switch-disconnector for rated voltages from 7.2 kV to 24 kV
- Switching functions as switch-disconnector (class E3) according to IEC/EN 62271-103 / VDE 0671-103, IEC/EN 62271-102 / VDE 0671-102 and IEC/EN 62271-105 / VDE 0671-105
- Designed with the functions of a switch-disconnector and a make-proof earthing switch
- Switch positions CLOSED, OPEN and EARTHED
- With the switch-fuse combination, the HV HRC fuse box can be earthed from both sides (standard).

Spring-operated mechanism

The spring-operated mechanism is used for the three-position switch-disconnector in ring-main panels (as ring-main switch). The switching movements are performed independently of the operating speed.



① Ready-for-service indicator
② ON/OFF momentary-contact rotary control switch for motor operating mechanism, switch-disconnector (option)
③ Local-remote switch (option)
④ Auxiliary switch (option)
⑤ Control gate/locking device
⑥ Motor operating mechanism (option)
⑦ Sockets for capacitive voltage detecting system
⑧ Actuating opening for EARTHING
⑨ Position indicator for three-position switch-disconnector
⑩ Actuating opening for CLOSING/ OPENING
⑪ Retainer for short-circuit indicator / earth-fault indicator and voltage detecting system

Fig. 6: Front operating mechanism box of ring-main panel

Spring-operated/stored-energy mechanism

The spring-operated/stored energy mechanism is used for three-position switch-disconnectors in transformer panels (as transformer switch).

With the operating lever, the closing spring and the opening spring of the operating mechanism are charged at the same time. After that, the three-position switch-disconnector can be first closed and then opened with separate pushbuttons.

When a HV HRC fuse or the shunt release (f-release) trips, the precharged opening spring is available for the opening operation; no additional charging process is required. This ensures that the switch-fuse combination can switch off all appearing faults reliably even when the three-position switch-disconnector closes.

When a HV HRC fuse has tripped, the "fuse tripped" indicator shows a red transverse bar.

The three-position switch-disconnector can be switched to EARTHED position with the operating lever.

In order to prevent the operating lever from being left inserted accidentally, the spring-operated/stored-energy mechanism is equipped with an operating lever ejection system as standard.

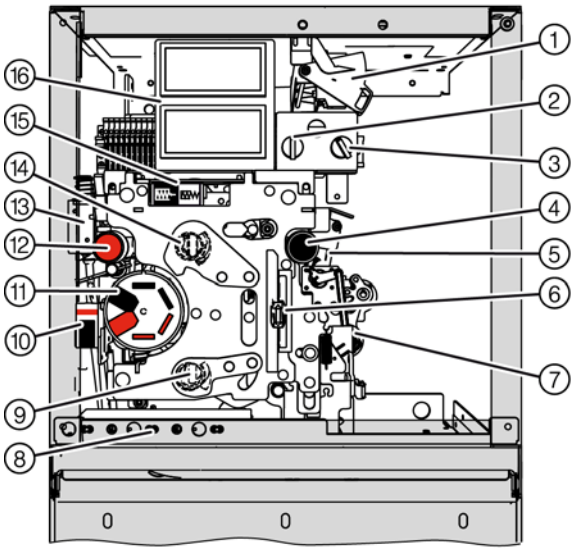


Fig. 7: Front operating mechanism box of transformer panel

① Ready-for-service indicator
② ON/OFF momentary-contact rotary control switch for motor operating mechanism, switch-disconnector (option)
③ Local-remote switch (option)
④ ON pushbutton for three-position switch-disconnector (mechanical operation)
⑤ Auxiliary switch (option)
⑥ Control gate/locking device
⑦ Motor operating mechanism (option)
⑧ Sockets for capacitive voltage detecting system
⑨ Actuating opening for EARTHING the three-position switch-disconnector
⑩ "Fuse tripped" indicator
⑪ Position indicator for three-position switch-disconnector
⑫ OFF pushbutton for three-position switch-disconnector (mechanical operation)
⑬ Shunt release (f-release, option)
⑭ Actuating opening for "spring charging" (switch-disconnector)
⑮ "Spring charged" indicator (switch-disconnector)
⑯ Retainer for short-circuit indicator / earth-fault indicator and voltage detecting system

7.2 Vacuum circuit-breaker type 2

Features

- Vacuum circuit-breaker for rated voltages from 7.2 kV to 24 kV
- According to IEC/EN 62271-100 / VDE 0671-100
- Climate-independent vacuum interrupter poles in the gas-filled switchgear vessel
- Application in hermetically welded switchgear vessel in conformity with the system
- Operating mechanism located outside the switchgear vessel in the front operating mechanism box
- Maintenance-free according to IEC/EN 62 271-1 / VDE 0671-1

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

The vacuum circuit-breaker is a circuit-breaker without automatic reclosing.

Operating function

The closing and opening spring is charged by means of the operating lever supplied, or by the motor (option), until the latching of the closing/opening spring is indicated ("spring charged" indication). Then, the vacuum circuit-breaker can be closed manually or electrically (option).

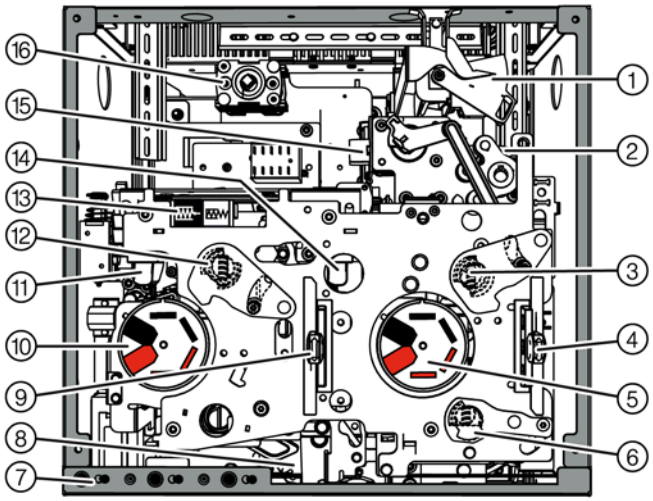


Fig. 8: Front operating mechanism box of circuit-breaker panel type 2

① Ready-for-service indicator
② Motor for three-position disconnector (option)
③ Actuating opening for CLOSING/OPENING, three-position disconnector
④ Control gate / locking device for three-position disconnector
⑤ Position indicator for three-position disconnector
⑥ Actuating opening for EARTHING, three-position disconnector
⑦ Sockets for capacitive voltage detecting system
⑧ Motor for circuit-breaker (option)
⑨ Control gate / locking device for circuit-breaker
⑩ Position indicator for circuit-breaker
⑪ OFF pushbutton for circuit-breaker (mechanical operation)
⑫ Actuating opening for "spring charging" (circuit-breaker)
⑬ "Spring charged" indicator
⑭ ON pushbutton for circuit-breaker (mechanical operation)
⑮ Auxiliary switch at the three-position disconnector (option)
⑯ Auxiliary switch at the circuit-breaker (option)

7.3 Vacuum circuit-breaker type 1.1

Features

- Vacuum circuit-breaker for rated voltages from 7.2 kV to 24 kV
- According to IEC/EN 62271-100 / VDE 0671-100
- Climate-independent vacuum interrupter poles in the gas-filled vessel
- Application in hermetically welded switchgear vessel in conformity with the system
- Operating mechanism located outside the switchgear vessel in the front operating mechanism box
- Maintenance-free according to IEC/EN 62 271-1 / VDE 0671-1

Operating function

The spring energy store is charged by means of the hand crank or by the motor (option), until the latching of the spring energy store is indicated ("spring charged" indication). Then, the vacuum circuit-breaker can be closed manually or electrically (option).

In operating mechanisms provided for automatic reclosing (AR), the closing spring can be charged by hand, or automatically in case of motor operating mechanism. Immediate reclosing is thus possible.

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

The vacuum circuit-breaker is a circuit-breaker for automatic reclosing.

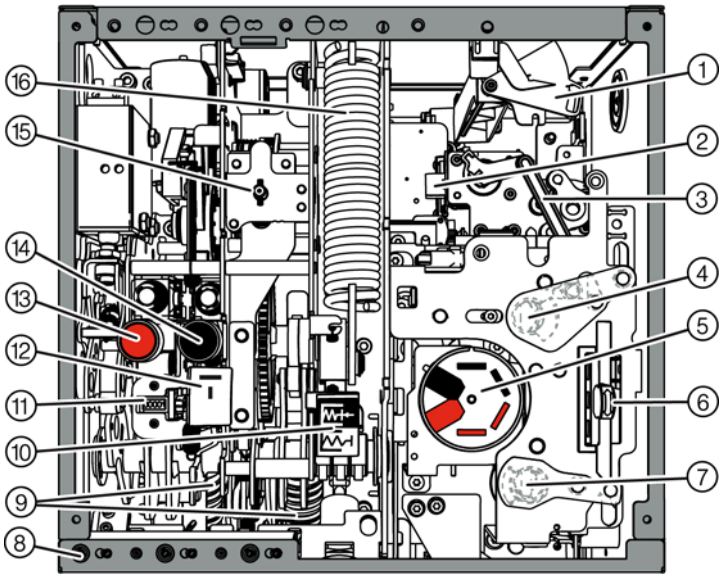


Fig. 9: Front operating mechanism box of circuit-breaker panel type 1.1

① Ready-for-service indicator
② Auxiliary switch at the three-position disconnector (option)
③ Motor for three-position disconnector (option)
④ Actuating opening for disconnector
⑤ Position indicator for three-position disconnector
⑥ Control gate / locking device for three-position disconnector
⑦ Actuating opening for earthing switch
⑧ Sockets for capacitive voltage detecting system
⑨ Opening spring
⑩ "Spring charged" indicator
⑪ Operations counter
⑫ Position indicator for circuit-breaker
⑬ OFF pushbutton for circuit-breaker (mechanical operation)
⑭ ON pushbutton for circuit-breaker (mechanical operation)
⑮ Actuating opening for "spring charging" (circuit-breaker)
⑯ Closing spring

7.4 Interlocks

Mechanical interlocks

- **Separate actuating openings for DISCONNECTING and EARTHING:**
  Switching straight from CLOSED to EARTHED position and from EARTHED to CLOSED position is not possible, as the operating lever must be re-inserted in the OPEN position.
- **Cable compartment interlock:**
  To remove the cable compartment cover, the feeder must be earthed.
- **Locking device (option):**
  The locking device of the switching gate on the three-position disconnector and three-position switch-disconnector can be padlocked in all three switch positions. The locking device can be padlocked so that **no closing, no opening** or **no earthing** is possible. The padlock can also be fitted in such a way that none of the three switching operations can be performed.

- **Closing lockout (option):**

  When the cable compartment cover is removed, the three-position disconnector / three-position switch-disconnector cannot be switched to CLOSED position. Switching from EARTHED to OPEN position is possible, e.g. to test the cables without removing the cable plugs.
- **De-earthing lockout (option):**

  When the cable compartment cover is removed, the three-position disconnector / three-position switch-disconnector cannot be switched from EARTHED to OPEN position.
- **Operating lever inserted:**

  When the operating lever is inserted, the stored-energy mechanism and the circuit-breaker operating mechanism cannot be activated or deactivated.
- **Interlocking between circuit-breaker and three-position disconnector:**
  - Circuit-breaker in OPEN position:

    The three-position disconnector can be closed and opened. As soon as one of the actuating openings of the three-position disconnector is opened, the circuit-breaker cannot be operated anymore.
  - Circuit-breaker in CLOSED position:

    No switching operations are possible with the three-position disconnector.

Availability of the mechanical interlocks

Mechanical interlocking	Panel type										
	R	T	L	K	K(E)/E	M(430)	M(500)	M(840)	S	H	V
Separate actuating openings	X	X	X	–	–	X	X	–	X	X	X
Cable compartment interlock	X	X	X	–	X	X	X	–	X	X	X
Locking device	O	X	X	–	O	X	O	–	O	X	X
Closing lockout	O	–	O	–	–	–	O	–	O	–	O
De-earthing lockout	–	X	O	–	O	X	–	–	X	X	O
Operating lever inserted	–	X	X	–	–	X	–	–	–	X	X
Interlocking between circuit-breaker and three-position disconnector	–	–	X	–	–	–	–	–	–	–	X

X Available **O** Option **–** Not available

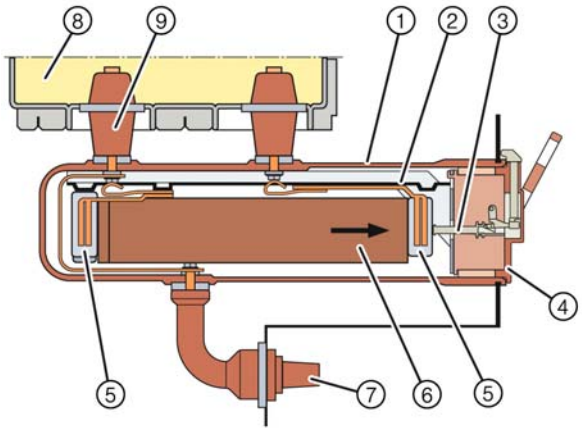
Electrical interlocking On the customer's request, different electrical interlocks can be installed.

7.5 HV HRC fuse assembly

Features

- With fuse slide for fuse replacement without tools
- HV HRC fuse-links according to DIN 43625 (main dimensions) with striker in "medium" version according to IEC/EN 60282-1
  - as short-circuit protection before transformers
  - with selectivity to upstream and downstream connected equipment
  - 1-pole insulated
- Dimension e of the fuse-links
  - U_r = 12 kV: e = 292 mm (optionally, e = 442 mm)
  - U_r = 24 kV: e = 442 mm
- Requirements according to IEC 62271-105 / VDE 0671-105 met for HV HRC fuse-links in combination with the three-position switch-disconnector
- Thermal striker tripping when the corresponding HV HRC fuse-link is used
- Climate-independent and maintenance-free, with fuse boxes made of cast resin
- Arrangement of fuse assembly below the switchgear vessel
- Fuse assembly connected to the three-position switch-disconnector via welded-in bushings and connecting bars
- Fuse replacement is only possible when the feeder is earthed

- Option for HV HRC fuse-links: "Tripped" indication for remote electrical indication with a NO contact



① Fuse box
② Fuse slide
③ Tripping pin
④ Sealing cover with seal
⑤ Cap with control electrode
⑥ HV HRC fuse-link
⑦ Cable connection (bushing)
⑧ Switchgear vessel
⑨ Fuse bushing

Fig. 10: HV HRC fuse assembly

Mode of operation

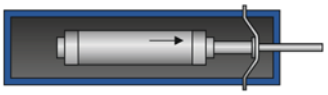
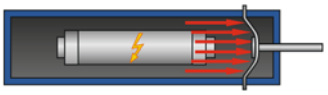
If a HV HRC fuse-link operates, the switch is tripped via an articulation which is integrated into the cover of the fuse box.

Thermal protection

If the fuse tripping fails, the sudden overpressure trips the switch via a diaphragm and the articulation situated in the cover of the fuse box.

The thermal protection works independently of the type and design of the HV HRC fuse-link used. The thermal protection is maintenance-free and independent of any outside climatic effects.

Basic scheme of fuse tripping

	HV HRC fuse-link in service condition
	Fuse tripping through striker of HV HRC fuse-link
	Fuse tripping due to sudden overpressure in the fuse box

The HV HRC fuse-links make SIBA (see page 39, "Selection of HV HRC fuse-links") release the striker depending on the temperature and trip the switch-disconnector as early as in the overload range of the fuses. Impermissible heating of the fuse box can be avoided in this way.

7.6 Cable connection

Cable connection for cable feeders, ring-main feeders and circuit-breaker feeders

Features

For the cable connection, customary cable plugs for interface type C with bolted contact M16 are used according to EN 50181/DIN EN 50181.

Available designs:

- Screened (conductive) design (standard)
- On request: insulated design, e.g. as adapter for conventional sealing ends or mass-impregnated cables (restrictions for site altitude and ambient climate)

For recommended cable plugs and possible connection cross-sections, see page 19, "Cable plugs for single cable connection (interface type C)". The installation of other makes and types is possible on request.

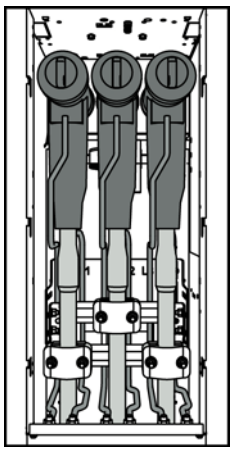


Fig. 11: Cable connection for ring-main feeder (example)

Connection possibilities for cable feeders, ring-main feeders and circuit-breaker feeders

Cable			Panel width [mm]		
			310	430	500
Thermoplastic-insulated single-core cable	1 cable per phase		X	X	X
	1 cable per phase	with surge limiter or surge arrester	O	O	O
		with voltage transformer 4MT8	–	–	O
	2 cables per phase		O	O	O
	2 cables per phase	with surge limiter or surge arrester	O	O	O
Thermoplastic-insulated three-core cable	1 cable		On request		
Mass-impregnated cable	1 cable		On request		

X Standard O Option

Option

- Mounted cable clamps on cable brackets
- Deep cable compartment cover
- Cable testing, e.g. with measuring bolt, see page 176, "Cable testing"

Cable connection for transformer feeders

Features

For the cable connection, customary cable plugs for interface type A with plug-in contact (standard), or interface type C with bolted contact M16 (option) are used according to EN 50181/DIN EN 50181.

Available designs:

- Screened (conductive) design (standard)
- 1 cable per phase

For recommended cable plugs with interface type A and possible connection cross-sections, see page 20, "Cable plugs for single cable connection (interface type A)". For cable plugs with interface type C, see page 19, "Cable plugs for single cable connection (interface type C)". The installation of further makes and types is possible on request.

Option

- Mounted cable clamps on cable bracket

Possible connection options (examples):

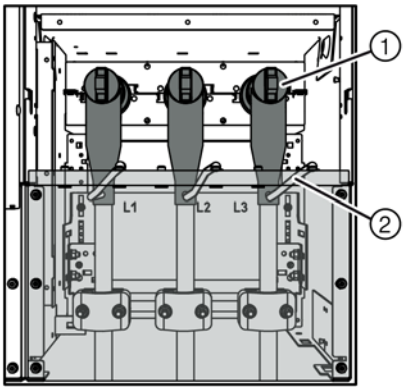


Fig. 12: Cable feeder downwards with elbow plugs (interface type A)

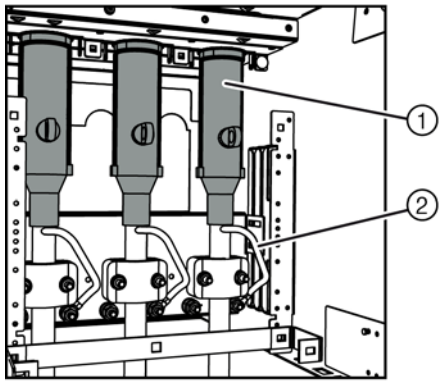


Fig. 13: Cable feeder downwards with straight plugs (interface type A)

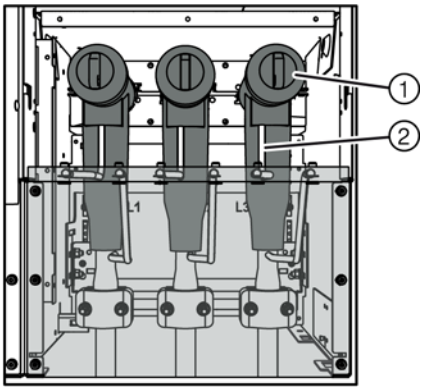


Fig. 14: Cable feeder to the front with elbow plugs or T-plugs (interface type C)

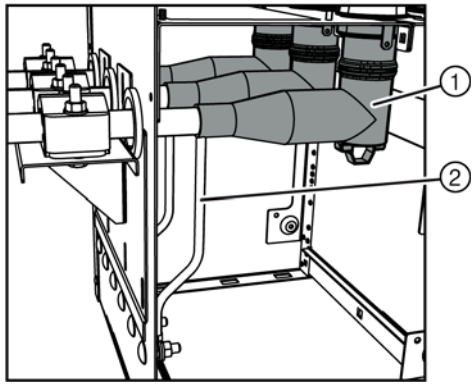


Fig. 15: Cable feeder backwards with elbow plugs (interface type A)

① Cable plug
② Earthing

Cable plugs for single cable connection (interface type C)

Cable type	Cable plug						
	Make		Ser. no.	Type	Design T/W[1, 2]	Conductor cross-section [mm²]	Design[2]
Thermoplastic-insulated cables ≤ 12 kV according to IEC / EN 60502-2 / VDE 0276-620							
1- or 3-core cable, PE and XLPE-insulated N2YSY (Cu) and N2XSY (Cu) or NA2YSY (Al) and NA2XSY (Al)"	Nexans		1	400TB/G, 430TB/G, 480TB/G	T	35...300	Screened
			2	400LB/G	W	35...300	Screened
			3	484TB/G	T	70...630	Screened
			4	440TB/G	T	185...630	Screened
	nkt cables		5	CB 24-630	T	25...300	Screened
			6	AB 24-630	T	25...300	Insulated
			7	CB 36-630 (1250)	T	300...630	Screened
	Südkabel		8	SET 12	T	50...300	Screened
			9	SEHDT 13	T	185...500	Screened
	Prysmian Kabel und Systeme (Pirelli Elektrik)		10	FMCTs-400	T	25...300	Screened
	3M Germany		11	93-EE 705-6 / -95	T	50...95	Screened
			12	93-EE 705-6 / -240	T	95...240	Screened
	TE Connectivity		13	RICS 51 ... with IXSU[3]	T	25...300	Insulated
			14	RICS 31 ... with IXSU[3]	T	25...300	Insulated
			15	RSTI-39xx	T	400...800	Screened
Thermoplastic-insulated cables 15 / 17.5 / 24 kV according to IEC / EN 60502-2 / VDE 0276-620							
1- or 3-core cable, PE and XLPE-insulated N2YSY (Cu) and N2XSY (Cu) or NA2YSY (Al) and NA2XSY (Al)	Nexans		16	K400TB/G, 430TB/G, 480TB/G	T	35...300	Screened
			17	K400LB/G	W	35...300	Screened
			18	484TB/G	T	70...630	Screened
			19	K440TB/G	T	185...630	Screened
	nkt cables		20	CB 24-630	T	25...300	Screened
			21	AB 24-630	T	25...300	Insulated
			22	CB 36-630 (1250)	T	300...630	Screened
	Südkabel		23	SET 24	T	50...240	Screened
			24	SEHDT 23.1	T	300	Screened
			25	SEHDT 23	T	185...630	Screened
	Prysmian Kabel und Systeme (Pirelli Elektrik)		26	FMCTs-400	T	25...240	Screened
	3M Germany		27	93-EE 705-6 / -95	T	25...95	Screened
			28	93-EE 705-6 / -240	T	95...240	Screened
	TE Connectivity	for 1-core cables	29	RICS 51 ... with IXSU[3]	T	25...300	Insulated
			30	RSTI-58xx	T	25...300	Screened
			31	RSTI-59xx	T	400...800	Screened
		for 3-core cables	32	RICS 51 ... with IXSU[3]	T	25...300	Insulated
			33	RSTI-58xx + RSTI-TRFxx	T	25...300	Screened
Paper-insulated mass-impregnated cables ≤ 12 kV according to IEC / EN 60055-2 / VDE 0276-621							
3-core cable, paper-insulated N(A)KLEY, N(A)KBA, N(A)KBY	TE Connectivity		34	RICS 51... with UHGK / EPKT	T	95...300	Insulated
3-core cable, paper-insulated N(A)EKBA, N(A)KLEY			35	RICS 51... with IDST 51[3]	T	50...300	Insulated
Paper-insulated mass-impregnated cables 15 / 17.5 / 24 kV according to IEC / EN 60055-2 / VDE 0276-621							
1-core or 3-core cable, paper-insulated N(A)EKBA, N(A)KLEY	TE Connectivity		36	RICS 51 ... with IDST 51[3]	T	35...240	Insulated

1 T = Cable T-plug, W= Cable elbow plug

2 Use of current transformers and current sensors in combination with insulated systems on request

3 Discontinued by the manufacturer

Cable plugs for single cable connection (interface type A)

Cable type	Cable plug					
	Make	Ser. no.	Type	Plug version G/W[1]	Conductor cross-section [mm²]	Design
Thermoplastic-insulated cables ≤ 12 kV according to IEC / EN 60502-2 / VDE 0276-620						
1-core cable, PE- and XLPE-insulated N2YSY (Cu) and N2XSY (Cu) or NA2YSY (Al) and NA2XSY (Al)	Nexans	1	158LR	W	16...120	Screened; with capacitive measuring point
		2	152SR	G	95...120	Screened; with capacitive measuring point
	nkt cables	3	EASW 10 / 250, size 2	W	25...95	Screened; option: with metal housing or capacitive measuring point
		4	EASG 10 / 250, size 2	G	25...95	Screened; option: with capacitive measuring point
		5	CE 24 – 250	W	95...120	Screened; option: with metal housing or capacitive measuring point
	Südkabel	6	SEHDG 11.1	G	25...120	Screened; option: with metal housing
		7	SEW 12	W	25...120	Screened; option: with metal housing
	Cooper Power Systems	8	DE 250 – R-C	W	16...120	Screened
		9	DS 250 – R-C	G	16...120	Screened
	Prysmian Kabel und Systeme (Pirelli Elektrik)	10	FMCE-250	W	25...120	Screened
	3M Germany	11	93-EE 605-2 / -95	W	25...95	Screened; option: with metal housing
		12	93-EE 600-2 / xx	G	25...150	Screened; option: with metal housing
	TE Connectivity	13	RSSS 52xx	G	25...95	Screened; with capacitive measuring point
		14	RSES 52xx-R	W	25...120	Screened; with capacitive measuring point
Thermoplastic-insulated cables 15 / 17.5 / 24 kV according to IEC / EN 60502-2 / VDE 0276-620						
1-core cable, PE- and XLPE-insulated N2YSY (Cu) and N2XSY (Cu) or NA2YSY (Al) and NA2XSY (Al)	Nexans	15	K158LR	W	16...120	Screened; with capacitive measuring point
		16	K152SR	G	25...120	Screened; with capacitive measuring point
	nkt cables	17	EASG 20 / 250	G	25...95	Screened; option: with metal housing
		18	CE 24 – 250	W	25...95	Screened; option: with metal housing or capacitive measuring point
	Südkabel	19	SEHDG 21.1	G	25...70	Screened; option: with metal housing
		20	SEW 24	W	25...95	Screened; option: with metal housing
	Cooper Power Systems	21	DE 250 – R-C	W	16...120	Screened
		22	DS 250 – R-C	G	16...120	Screened
	Prysmian Kabel und Systeme (Pirelli Elektrik)	23	FMCE-250	W	25...120	Screened
	3M Germany	24	93-EE 605-2 / -95	W	25...95	Screened; option: with metal housing
		25	93-EE 600-2 / xx	G	25...150	Screened; option: with metal housing
	TE Connectivity	26	RSSS 52xx	G	16...70	Screened; with capacitive measuring point
		27	RSES 52xx-R	W	16...120	Screened; with capacitive measuring point

[1] G = Straight cable plug, W = Cable elbow plug

Deep cable compartment cover (option)

For cable feeders, ring-main feeders and circuit-breaker feeders, the connection of up to 2 cables per phase (double cable connection) is possible, also in connection with surge arresters or surge limiters. Depending on the panel type, plug make or surge arrester make, a deep cable compartment can be selected to obtain a larger mounting depth of the cable compartment. For further information, see page 21, "Cable plugs for double cable connection (interface type C)", and see page 22, "Cable plugs for single cable connection and double cable connection with surge arrester (interface type C) ".

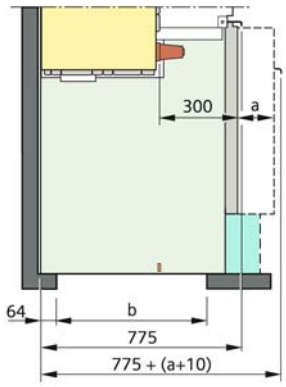


Fig. 16: Mounting depth at the panel connection for panel types R, K and L

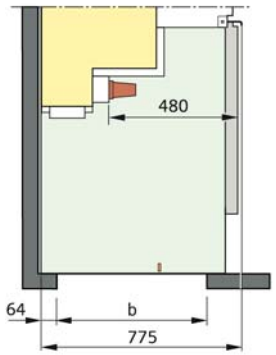


Fig. 17: Mounting depth at the panel connection for panel types R(500) and L(500)

Cable plugs for double cable connection (interface type C)

Cable plug			Connection combination			Deep cable compartment cover[1]	
Make	Ser. no.	Type	Design[2]	Arrangement of cable plug (K)	Mounting depth (mm)	Deeper by a (mm)	Depth of floor opening b (mm)
Nexans	1	(K)430TB/G + (K)300PB/G (K)480TB/G + (K)800PB/G (K)484TB/G + (K)804PB/G	Screened	K + K	290	–	635
	2	2x (K)400TB/G with coupling insert (K)400CP	Screened	K + K	505	250	860
	3	(K)400TB/G + (K)400LB/G with coupling insert (K)400CP-LB	Screened	K + K	455	250	860
	4	(K)400TB/G + (K)430TB/G with coupling insert (K)400CP	Screened	K + K	403	250	860
	5	2x (K)440TB/G with coupling insert (K)440CP	Screened	K + K	505	250	860
Südkabel	6	SET (12/24) + SEHDK (13.1/23.1)	Screened	K + K	290	–	635
	7	SEHDT 23.1 + SEHDK 23.1	Screened	K + K	290	–	635
	8	2x SEHDT 23.1 with coupling unit KU 23.2/23	Screened	K + K	363	250	860
	9	SEHDT (13/23) + SET (12/24) with coupling unit KU 23 or KU 33	Screened	K + K	451	250	860
	10	2x SET (12/24) with coupling unit KU 23.2/23	Screened	K + K	363	105	715
nkt cables	11	CB 24-630 + CC 24-630	Screened	K + K	290	–	635
	12	2x CB 24-630 with coupling unit CP 630C	Screened	K + K	370	250 105[3]	860 715
	13	AB 24-630 + AC 24-630	Insulated	K + K	290	105[3]	715
	14	2x AB 24-630 with coupling unit CP 630A	Insulated	K + K	370	250 105[3]	860 715
	15	CB 36-630 (1250) + CC 36-630 (1250)	Screened	K + K	300	–	635
TE Connectivity	16	RSTI-58xx + RSTI-CC-58xx	Screened	K + K	285	–	635
	17	RSTI-x9xx + RSTI-CC-x9xx	Screened	K + K	315	105	715
3M Germany	18	2x 93-EE705-6/xxx with coupling unit KU 23.2	Screened	K + K	363	105	715

[1] Only for 310 mm and 430 mm wide panels. For 500 mm wide panels, no deep cable compartment cover and floor opening are required. Exception: no. 2 and no. 5 with cable compartment cover deeper by 105 mm (a).
[2] Use of current transformers and current sensors in combination with insulated systems on request
[3] On request

Cable plugs for single cable connection and double cable connection with surge arrester (interface type C)

Cable plug / surge arrester			Connection combination			Deep cable compartment cover[1]
Make	**Ser. no.**	**Type**	**Design[2]**	**Arrangement[3]**	**Mounting depth [mm]**	**Deeper by a[4] [mm]**
Nexans	1	(K)430TB/G + 300SA (K)480TB/G + 800SA (K)484TB/G + 800SA	Screened	K + Ü	290	–
	2	(K)430TB/G + (K)300PB/G + 300SA	Screened	K + K + Ü	395	105
	3	(K)480TB/G + (K)800PB/G + 800SA (K)484TB/G + (K)804PB/G + 800SA	Screened	K + K + Ü	400	250
Südkabel	4	SET (12 / 24) + MUT (13 / 23)	Screened	K + Ü	302	105
	5	SEHDT 23.1 + MUT 23	Screened	K + Ü	302	105
	6	2x SET (12 / 24) + MUT (13/23) with coupling unit KU 23.2/23	Screened	K + K + Ü	476	250
	7	2x SEHDT 23.1 + MUT 23 with coupling unit KU 23.2/23	Screened	K + K + Ü	476	250
	8	SEHDT (13 / 23) + MUT 33	Screened	K + Ü	540	250
nkt cables	9	CB 24-630 + CSA 24...	Screened	K + Ü	290	–
	10	AB 24-630 + ASA 24...	Insulated	K + Ü	290	105
	11	CB 36-630 (1250) + CSA...	Screened	K + Ü	290	–
TE Connectivity	12	RICS 5139 + RDA...	Insulated	K + Ü	275	–
	13	RSTI-58xx + RSTI-CC-58SAxx	Screened	K + Ü	285	–
	14	RSTI-58xx + RSTI-CC-68SAxx	Screened	K + Ü	292	–
	15	RSTI-x9xx + RSTI-CC-58SAxx	Screened	K + Ü	295	–
	16	RSTI-x9xx + RSTI-CC-68SAxx	Screened	K + Ü	302	105
3M Germany	17	2x 93-EE705-6/xxx + MUT 23 mit with coupling unit KU 23.2	Screened	K + K + Ü	476	250

[1] Only for 310 mm and 430 mm wide panels. For 500 mm wide panels, no deep cable compartment cover and floor opening are required. Exception: no. 2 and no. 5 with cable compartment cover deeper by 105 mm (a).
[2] Use of current transformers and current sensors in combination with insulated systems on request
[3] K = Cable plug, Ü = Surge arrester
[4] For drawing, see page 21, "Deep cable compartment cover (option)".

Cable plugs for single cable connection with voltage transformer 4MT8 (interface type C)

The voltage transformer 4MT8 can be installed in ring-main feeders and circuit-breaker feeders with a panel width of 500 mm. A deep cable compartment cover is not necessary.

For connection, symmetrical cable T-plugs (see table) are required. Before performing a voltage test at the cables (on site with max. 80 % U_d), the voltage transformers must be removed.

Make	Type	Design
Nexans	(K)400TB/G	Screened
	(K)440TB/G	Screened
Prysmian	FMCTs-400	Screened
Südkabel	SEHDT (13/23)	Screened

7.7 Current and voltage transformers

Technical data The technical data of the current transformers and the voltage transformers is given in the associated order documents.

7.8 Possibilities for pressure relief

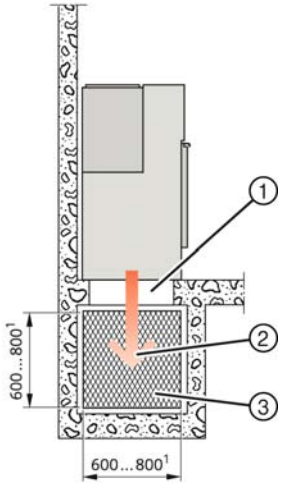
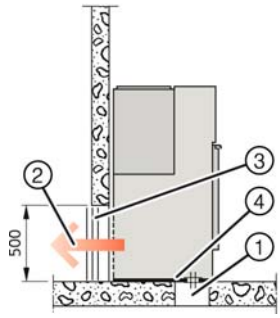
In the standard design, the pressure is relieved downwards. In the following panel blocks, the pressure can optionally be relieved to the rear:

- Panel blocks in wall-standing arrangement
- Panel blocks with an overall height of 1400 mm or 1700 mm

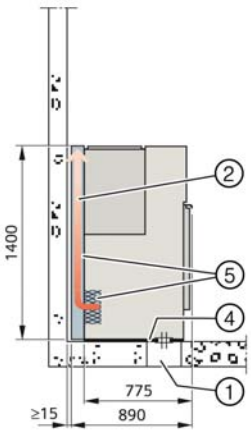
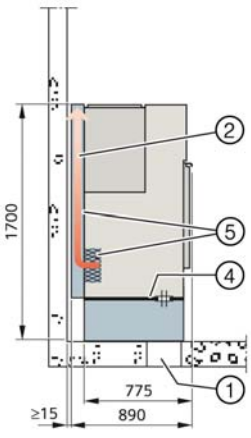
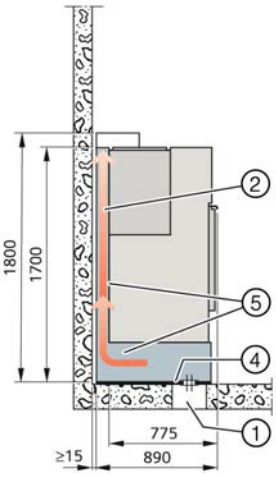
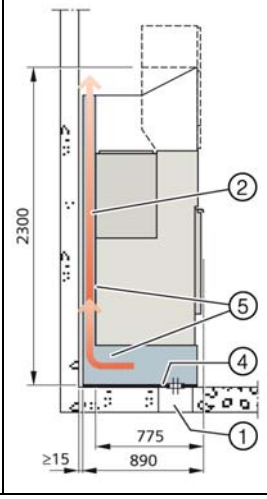
Versions with pressure relief duct and pressure absorber system are also available.

The switchgear room including the cable basement must be able to withstand the pressure stress caused by an internal arc, and must be equipped with pressure relief openings to the outside.

Pressure relief without pressure absorber system

Pressure relief downwards (standard) Individual panels and panel blocks with IAC A FL or FLR up to 21 kA/1s	**Pressure relief to the rear (option) Panel blocks with IAC A FL up to 21 kA/1s**
[1] Total opening, minimum 0.48 m^2 	

Pressure relief with pressure absorber system

With pressure relief duct at the rear (option)		**With base and pressure relief duct at the rear (option)**	
Panel blocks with IAC A FL or FLR up to 16 kA/1s		**Individual panels or panel blocks with IAC A FL or FLR up to 21 kA/1s**	
Panel height 1400 mm	Panel height 1700 mm	Panels in wall-standing arrangement (without metering panel)	Panels in free-standing arrangement and metering panels: • Wall-standing arrangement • Free-standing arrangement
			

① Floor opening
② Direction of pressure relief
③ Expanded metal (supplied by site)
④ Divided floor plate for cable insertion, local installation
⑤ Pressure absorber system with pressure relief duct directed upwards to the rear

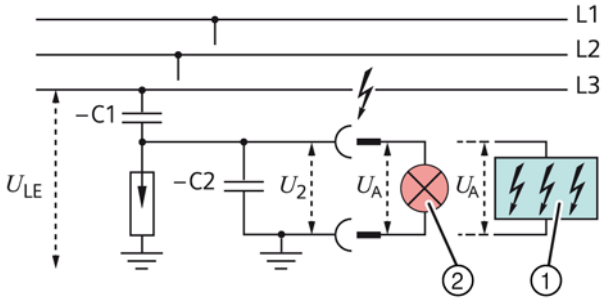
7.9 Protection and control equipment

The protection equipment and control equipment is designed customer-specifically. The devices are installed in the low-voltage compartment or in the low-voltage niche. Details are given in the respective circuit documentation.

7.10 Voltage detecting systems

For voltage detection according to IEC 61243-5 and VDE 0682 Part 415 with the following voltage detecting systems:

- Plug-in HR or LRM voltage indicator
- Integrated voltage indicators:
  - VOIS
  - CAPDIS
  - WEGA



① Integrated voltage indicator
② Plug-in HR or LRM voltage indicator

Fig. 18: Voltage detecting system via capacitive voltage divider (principle)

- -C1: Capacitance integrated into bushing
- -C2: Capacitance of the connection leads and the voltage indicator to earth
- $U_{LE} = U_N / \sqrt{3}$ during rated operation in the three-phase system
- $U_2 = U_A$ = Voltage at the interface (plug-in sockets) of the plug-in voltage indicator or the test socket of the integrated voltage indicator

7.11 Ready-for-service indicator

The switchgear vessels are filled with insulating gas and are under pressure.
The ready-for-service indicator at the operating front of the panel shows if the gas density in the gas-insulated switchgear vessel is in order.

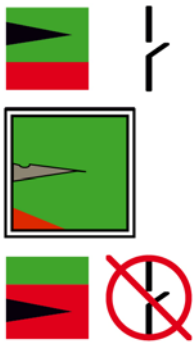
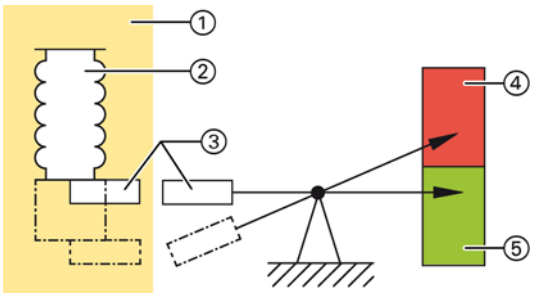


Fig. 19: Ready-for-service indicator

Features

- Self-monitoring, easy to read
- Independent of temperature and external pressure variations
- Independent of the site altitude
- Only responds to changes in gas density
- Option: Signaling switch 1°changeover contact for remote electrical indication

Mode of operation



① Switchgear vessel (filled with SF_6 gas)
② Measurement box
③ Magnetic coupling
④ Red indication: not ready for service
⑤ Green indication: ready for service

Fig. 20: Principle of gas monitoring with ready-for-service indicator

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

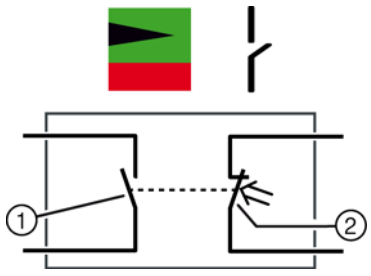
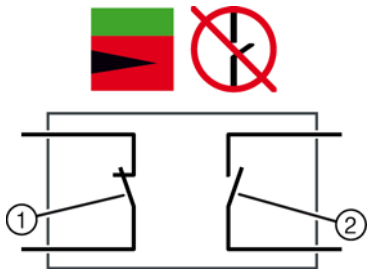
A coupling magnet, which is fitted to the bottom end of the measurement box, transmits its position to an armature outside the switchgear vessel through the non-magnetizable switchgear vessel (magnetic coupling). This armature moves the ready-for-service indicator at the operating front of the panel.

While changes in the gas density during the loss of gas, which are decisive for the dielectric strength, are displayed, changes in the relative gas pressure resulting from temperature and external pressure variations are not. The gas in the measurement box has the same temperature as that in the switchgear vessel.

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

- The switchgear operates perfectly in a range between the rated filling level of 150 kPA and the minimum functional level of 130 kPA.
- **If the gas pressure falls below** 130 kPA, the switchgear must not be operated anymore. The ready-for-service indicator changes from the green area to the red area ("not ready for service").
- If the ready-for-service indicator changes from the green area to the red area, the signaling switch (option) changes its switching state.

Functional principle of the signaling switch

State of the ready-for-service indicator in the green area	State of the ready-for-service indicator in the red area
NC contact open and NO contact closed	NC contact closed and NO contact open
	

① Normally closed contact ② Normally open contact

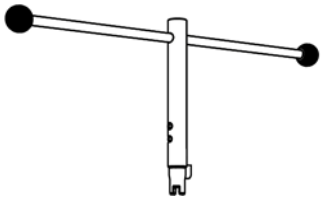
7.12 Short-circuit/earth-fault indicator

The panels can optionally be equipped with short-circuit or earth-fault indicators in different designs. Operating instructions and information on equipment features are available in the respective manufacturing documentation.

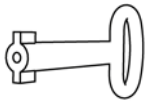
7.13 Accessories

Standard accessories (selection)

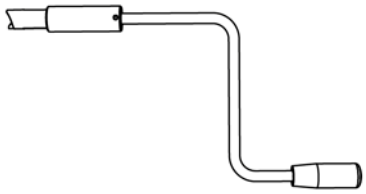
- Operating and installation instructions
- Operating lever for disconnector, switch-disconnector and circuit-breaker (different designs)



- Double-bit key with 3 mm diameter for low-voltage door (option)



- Hand crank for charging the spring energy store (only circuit-breaker panel type 1.1)



Other accessories

According to the order documents / purchase order (selection):

- Surge arresters
- Surge limiters
- Cable plugs
- HV HRC fuse-links
- Test fuses for mechanical simulation of the striker of HV HRC fuse-links in transformer feeders, with extension tube (for slide lengths 292 mm or 442 mm)

- HR or LRM voltage indicators
- Units to check the capacitive interface and the voltage indicators
- Unit to test the plug-in voltage indicators
- Phase comparison test units

7.14 Low-voltage compartment (option)

Features

- Overall height: 200, 400, 600 or 900 mm
- Installation on the panel is possible per feeder
- Customer-specific equipping of the low-voltage compartment
- Option: Wiring duct for laying the panel-overlapping wiring on panels without low-voltage compartment
- Option: Cover for switchgear fronts of the same height on panels without low-voltage compartment

Shipping data and transport data

When switchgear assemblies are delivered with low-voltage compartments, the changed transport dimensions and transport weights as well as the relocation of the center of gravity must be observed.

8 Technical data

8.1 General technical data

Rated voltage U_r			**kV**	**7.2**	**12**	**15**	**17.5**	**24**
Rated insulation level		Rated short-duration power-frequency withstand voltage U_d						
		- phase-to-phase, phase-to-earth, open contact gap	kV	20	28/42[1]	36	38	50
		- across the isolating distance	kV	23	32/48[1]	39	45	60
		Rated lightning impulse withstand voltage U_p						
		- phase-to-phase, phase-to-earth, open contact gap	kV	60	75	95	95	125
		- across the isolating distance	kV	70	85	110	110	145
		Rated frequency f_r	Hz	50/60				
Rated normal current I_r[2]		Busbar	A	630				
		Ring-main feeder	A	400 or 630				
		Circuit-breaker feeder	A	250 or 630				
		Transformer feeder	A	200[3]				
50 Hz	Rated short-time withstand current I_k	Switchgear with t_k = 1 s	up to kA	25				20/21[1]
		Switchgear with t_k = 3 s (design option)	up to kA	20/21[1]				
	Rated peak withstand current I_p		up to kA	63				50/52.5[1]
	Rated short-circuit making current I_{ma}	Ring-main feeder	up to kA	63				
		Circuit-breaker feeder	up to kA	63				
		Transformer feeder	up to kA	63				
60 Hz	Rated short-time withstand current I_k	Switchgear with t_k = 1 s	up to kA	25				20/21[1]
		Switchgear with t_k = 3 s (design option)	up to kA	20/21[1]				
	Rated peak withstand current I_p		up to kA	65				52/55[1]
	Rated short-circuit making current I_{ma}	Ring-main feeder	up to kA	65				52/55[1]
		Circuit-breaker feeder	up to kA	65				52/55[1]
		Transformer feeder	up to kA	65				52/55[1]
Filling pressure (pressure values at 20 °C)		Rated filling level p_{re} (absolute)	kPa	150				
		Minimum functional level p_{me} (absolute)	kPa	130				
Ambient air temperature T		Operation without secondary equipment	°C	-25/-40[1] to +55/+70[1]				
		Operation with secondary equipment[4]	°C	-25/-40[1] to +55/+70[1]				
		Storage and transport incuding secondary systems[4]	°C	-25 to +70				
			°C	-40 to +70 (option)				
Degree of protection		Gas-filled switchgear vessel		IP 65				
		Switchgear enclosure		IP2X / IP3X[1]				
		Low-voltage compartment		IP3X / IP4X[1]				

1 Design option

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

3 Depending on the HV HRC fuse-link

4 Depending on the secondary equipment used

8.2 Three-position switch-disconnector

Switching capacity for switch-disconnectors according to IEC/EN 62271-103 / VDE 0671-103

Rated voltage U_r					**kV**	**7.2**	**12**	**15**	**17.5**	**24**
Test duty TD_{load}	Rated mainly active load-breaking current I_{load}	100 operations	I_{load} [I_1]		A	630				
		20 operations	0.05 I_{load} [I_1]		A	31.5				
Test duty TD_{loop}	Rated closed-loop breaking current		I_{loop} [I_{2a}]		A	630				
Test duty TD_{cc}	Rated cable-charging breaking current		I_{cc} [I_{4a}]		A	68				
Test duty TD_{lc}	Rated line-charging breaking current		I_{lc} [I_{4b}]		A	68				
Test duty TD_{ma}	Rated short-circuit making current		I_{ma}	50 Hz	up to kA	63				50/52.5[1]
				60 Hz	up to kA	65				52/55[1]
Test duty TD_{ef1}	Rated earth-fault breaking current		I_{ef1} [I_{6a}]		A	200				
Test duty TD_{ef2}	Rated cable-charging breaking current and rated line-charging breaking current under earth-fault conditions		I_{ef2} [I_{6b} ($\sqrt{3} \cdot I_{4a}$) or I_{6b} ($\sqrt{3} \cdot I_{4b}$)]		A	115				
Number of mechanical operating cycles / Classification					n	1,000 / M1				
Number of electrical operating cycles with I_{load} / Classification					n	100 / E3				
Number of short-circuit making operations with I_{ma} / Classification					n	5 / E3				
C-classification	For switch-disconnectors (no restrikes, TD: I_{cc}, I_{lc})					C2				

[1] Design option

Switching capacity for make-proof earthing switches according to IEC/EN 62271-102 / VDE 0671-102

Rated voltage U_r			**7.2**	**12**	**15**	**17.5**	**24**
Rated short-circuit making current I_{ma}	50 Hz	up to kA	63				50/52.5[1]
	60 Hz	up to kA	65				52/55[1]
Number of mechanical operating cycles / Classification		n	1000 / M0				
Number of short-circuit making operations / Classification		n	5 / E2				

[1] Design option

Switching capacity for switch-fuse combination according to IEC 62271-105 / VDE 0671-105

Rated voltage U_r	**kV**	**7.2**	**12**	**15**	**17.5**	**24**
Rated normal current I_r	A	200[1]				
Rated transfer current $I_{transfer}$	A	1500		1300		
Maximum transformer rating	kVA	1000	1250	1600	1600	2000
Tripping time for striker operation	ms	≥ 50 ms				
Tripping time for release operation	ms	≥ 130 ms				
Setting time for delay at the protection device	ms	≥ 100 ms				

[1] Depending on HV HRC fuse-link

Switching capacity for make-proof earthing switches (with HV HRC fuses-links on feeder side)

Rated voltage U_r		**kV**	**7.2**	**12**	**15**	**17.5**	**24**
Rated short-circuit making current I_{ma}	50 Hz	kA	6.3				
	60 Hz	kA	6.5				
Rated short-time withstand current	I_k with t_k = 1 s	kA	2.5				

Motor operating mechanism

Rated currents of the motor protection equipment (protection equipment with tripping characteristic type C):

Rated supply voltage [V]	Recommended rated current for the protection equipment [A]
24 DC	4
48 DC	2
60 DC	1.6
DC/AC 110 (50/60 Hz)	1.0
DC 120/125	1.0
220 DC	1.0
AC 230 (50/60 Hz)	0.5

The control voltage (including releases) is protected with 8 A.

Releases

Releases trip the switch-fuse combination. The electrical opening command is transmitted to the OPEN latch via a magnet armature by unlatching an energy store. Depending on the operating mechanism used, up to 2 releases can be used.

Shunt release (-Y1, -Y3)

Shunt releases (optional) are used to trip or electrically open the switch-fuse combination. The opening command is executed by application of an auxiliary voltage (AC or DC, depending on the design option). After opening the switch-fuse combination, the release is de-energized internally.

Power consumption of the operating coils

Operating coil	Power consumption [W/VA]
	Switch-fuse combination
Shunt release (Y1, Y3)	≤ 370

8.3 Three-position disconnector

Switching capacity and classification for disconnector and make-proof earthing switch according to IEC/EN 62271-102 / VDE 0671-102:

Disconnector

Rated voltage U_r	kV	7.2	12	15	17.5	24
Rated normal current I_r	A	250, 630				
Number of mechanical operating cycles / Classification	n	1000 / M0				

Make-proof earthing switch

Rated voltage U_r		kV	7.2	12	15	17.5	24
Rated short-circuit making current I_{ma}	50 Hz	up to kA	63				50/52.5[1]
	60 Hz	up to kA	65				52/55[1]
Number of short-circuit making operations / Classification		n	5 / E2				

[1] Design option

8.4 Vacuum circuit-breaker

Switching capacity and classification of switching devices

Vacuum circuit-breaker with switching capacity according to IEC/EN 62271-100 / VDE 0671-100.

Type 1. 1 with three-position disconnector

Rated voltage U_r				**kV**	**7.2**	**12**	**15**	**17.5**	**24**
Rated normal current of feeders I_r				A	630				
50 Hz	Rated short-time withstand current I_k	Switchgear with t_k = 1 s	I_k (t_h)	up to kA	25				20/21[1]
		Switchgear with t_k = 3 s	I_k (t_h)	up to kA	20/21[1]				
	Rated peak withstand current I_p			up to kA	63				50/52.5[1]
	Rated short-circuit breaking current I_{sc}			up to kA	25				20/21[1]
	Rated short-circuit making current I_{ma}			up to kA	63				50/52.5[1]
60 Hz	Rated short-time withstand current I_k	Switchgear with t_k = 1 s	I_k (t_h)	up to kA	25				20/21[1]
		Switchgear with t_k = 3 s	I_k (t_h)	up to kA	20/21[1]				
	Rated peak withstand current I_p			up to kA	65				52/55[1]
	Rated short-circuit breaking current I_{sc}			up to kA	25				20/21[1]
	Rated short-circuit making current I_{ma}			up to kA	65				52/55[1]
Number of operating cycles for disconnector, mechanical					1,000				
Number of operating cycles for earthing switch, mechanical					1,000				
Number of operating cycles for circuit-breaker, mechanical					10,000 (2,000[2])				
Classification of circuit-breaker					M1[2], M2, E2, C2, S2				
Classification of disconnector					M0				
Classification of make-proof earthing switch					E2				
Rated operating sequence					O - 0.3 s - CO - 3 min - CO				
					O - 0.3 s - CO - 15 s - CO on request				
Number of short-circuit breaking operations				n	25 or 50				

[1] Design option
[2] Charging the spring energy store manually

Type 2 with three-position disconnector

Rated voltage U_r				**kV**	**7.2**	**12**	**15**	**17.5**	**24**
Rated normal current of feeders I_r				A	250 or 630				
50 Hz	Rated short-time withstand current I_k	Switchgear with t_k = 1 s	I_k (t_h)	up to kA	25				20/21[1]
		Switchgear with t_k = 3 s	I_k (t_h)	up to kA	20/21[1]				
	Rated peak withstand current I_p			up to kA	63				50/52.5[1]
	Rated short-circuit breaking current I_{sc}			up to kA	25				20/21[1]
	Rated short-circuit making current I_{ma}			up to kA	63				50/52.5[1]
60 Hz	Rated short-time withstand current I_k	Switchgear with t_k = 1 s	I_k (t_h)	up to kA	25				20/21[1]
		Switchgear with t_k = 3 s	I_k (t_h)	up to kA	20/21[1]				
	Rated peak withstand current I_p			up to kA	65				52/55[1]
	Rated short-circuit breaking current I_{sc}			up to kA	25				20/21[1]
	Rated short-circuit making current I_{ma}			up to kA	65				52/55[1]
Number of operating cycles for disconnector, mechanical					1,000				
Number of operating cycles for earthing switch, mechanical					1,000				
Number of operating cycles for circuit-breaker, mechanical					2,000				
Classification of circuit-breaker					M1, E2, C1, S1				
Classification of disconnector					M0				
Classification of make-proof earthing switch					E2				
Rated operating sequence					O - 3 min - CO - 3 min - CO				
Number of short-circuit breaking operations				n	6 or 20				

[1] Design option

Operating times, contacts

The time indications in the following table refer to the application of the switchgear in accordance with IEC 60721-3-3 Class 3K4. If the switchgear is operated beyond this range, the indicated times may deviate.

Designation	Component (item designation)			Unit	Time	
					Type 1.1	Type 2
Closing time	Closing solenoid		(-Y9)	ms	< 75	< 30
Opening time	1st shunt release		(-Y1)	ms	< 65	< 35
	Additional release	2nd shunt release	(-Y2)	ms	< 50	--
			(-Y3)	ms	--	< 35
		C.t.-operated release	(-Y4)	ms	< 50	--
			(-Y6)	ms	--	< 35
		Undervoltage release	(-Y7)	ms	< 50	< 35
		Low-energy release	(-Y6)	ms	--	< 35
Arcing time				ms	< 15	< 15
Break time	1st shunt release		(-Y1)	ms	< 80	< 50
	Additional release	2nd shunt release	(-Y2)	ms	< 65	--
			(-Y3)	ms	--	< 50
		C.t.-operated release	(-Y4)	ms	< 65	--
			(-Y6)	ms	--	< 50
		Undervoltage release	(-Y7)	ms	< 65	< 50
		Low-energy release	(-Y6)	ms	--	< 50
Charging time (motor)				s	< 15	< 15
Dead time				s	0.3	180
Close-open contact time	1st shunt release		(-Y1)	ms	< 80	< 65
	Additional release	2nd shunt release	(-Y2)	ms	< 60	--
			(-Y3)	ms	--	< 65
		C.t.-operated release	(-Y4)	ms	< 60	--
			(-Y6)	ms	--	< 65
		Undervoltage release	(-Y7)	ms	< 60	< 65
		Low-energy release	(-Y6)	ms	--	< 65
Minimum command duration[1]						
CLOSED		Closing solenoid	(-Y9)	ms	45	40
OPEN	1st shunt release		(-Y1)	ms	< 40	< 40
	Additional release	2nd shunt release	(-Y2)	ms	< 20	--
			(-Y3)	ms	--	< 40
		C.t.-operated release	(-Y4)	ms	< 20	--
			(-Y6)	ms	--	< 20
		Undervoltage release	(-Y7)	ms	< 20	< 20
		Low-energy release	(-Y6)	ms	--	< 20

[1] For operation of the switchgear beyond the range defined by IEC 60721-3-3 Class 3K4, a minimum command duration of 100 ms is recommended.

Closing time

The interval of time between the initiation (command) of the closing operation and the instant when the contacts touch in all poles.

Opening time

The interval of time between the initiation (command) of the opening operation and the instant when the contacts separate in all poles.

Arcing time

The interval of time from the first initiation of an arc and the instant of final arc extinction in all poles.

Break time

The interval of time between the initiation (command) of the opening operation and the instant of final arc extinction in the last-pole-to-clear (=opening time and arcing time).

Close-open contact time

The interval of time - in a make-break operating cycle - between the instant when the contacts touch in the first pole in the closing process, and the instant when the contacts separate in all poles in the subsequent opening process.

Motor operating mechanism

Power consumption of circuit-breaker motor operating mechanism

Circuit-breaker	Max. power consumption	
	DC	AC
Type 1.1	approx. 500 W	approx. 650 VA
Type 2	approx. 80 W	approx. 80 VA

Rated current for the motor protection equipment [1]

Rated supply voltage [V]	Recommended rated current for the protection equipment [A]	
	Circuit-breaker type 1.1	Circuit-breaker type 2
DC 24	16[2]	8
DC 48	10	6
DC 60	8	4
DC/AC 110 (50/60 Hz)	4	2
DC 220 / AC 230 (50/60 Hz)	2	1.6

1 M.c.b. with C-characteristic

2 Double bus wire

The supply voltage may deviate from the rated supply voltage specified in the table by max. -15% to +10%.

Breaking capacity of auxiliary switch 3SV92

Breaking capacity	Operating voltage [V]	Normal current [A]	
AC 40 Hz to 60 Hz	up to 230	10	
		Resistive load	Inductive load
DC	24	10	10
	48	10	9
	60	9	7
	110	5	4
	220	2.5	2

Closing solenoid (-Y9)

The closing solenoid closes the circuit-breaker electrically. The closing command is executed by application of an auxiliary voltage (AC or DC, depending on the design option). After closing, the closing solenoid is de-energized internally.

Releases

Releases trip the circuit-breaker. The electrical opening command is transmitted to the OPEN latch via a magnet armature by unlatching an energy store. Depending on the operating mechanism used, up to 2 releases can be used.

Shunt release (-Y1)

Shunt releases are used to trip or electrically open circuit-breakers. The opening command is executed by application of an auxiliary voltage (AC or DC, depending on the design option). After opening the circuit-breaker, the release is de-energized internally.

Shunt release (-Y2)

The shunt release (-Y2) can be operated as an additional release besides the shunt release (-Y1), and works in the same way.

Undervoltage release (-Y7)

Undervoltage releases are used to trip or electrically open circuit-breakers. During normal operation, the shunt releases are supplied with a closed-circuit current from an auxiliary voltage source (DC or AC, depending on the design option). When the auxiliary voltage falls below a specific value, or when it is interrupted, the opening operation takes place.

C.t.-operated release (-Y4)

The c.t.-operated release **3AX1102 (-Y4)** is used for protection devices with a relay output, which are supplied with instrument transformer current. The tripping circuit is supplied via auxiliary transformers for tripping. When the required tripping current (0.5 A or 1 A, depending on the design option) flows in the tripping circuit, the opening operation takes place.

C.t.-operated release (-Y6)

The low-energy c.t.-operated release **3AX1104 (-Y6)** is used for protection devices with a pulse output, which are supplied with instrument transformer current. The tripping circuit is supplied as well through the protection core of the current transformer. When a pulse of 0.1 Ws runs through the tripping circuit, the opening operation takes place.

Low-energy release (-Y6)

The low-energy release (-Y6) is provided for use in combination with the transformer monitor IKI-30 (make Kries) or the protection device 7SJ45 (make Siemens) supplied with instrument transformer current. The tripping circuit is supplied through the current sensor or current transformer. When a pulse of 0.02 Ws runs through the tripping circuit, the opening operation takes place. The low-energy release is available for the vacuum circuit-breaker type 2.

Varistor module

The varistor module limits switching overvoltages caused by tripping coils in circuits and auxiliary circuits. The varistor module is integrated in the releases.

Circuit-breaker tripping signal

When the circuit-breaker is tripped by a release (e.g. by protection tripping), there is a signal through the NO contact -S6. If the circuit-breaker is tripped with the mechanical pushbutton, this signal is suppressed by the NC contact -S7.

Power consumption of the operating coils

Operating coil	Power consumption [W/VA]	
	Circuit-breaker type 1.1	Circuit-breaker type 2
Closing solenoid (Y9)	≤ 200	≤ 370
Shunt release (Y1)	≤ 200	≤ 370
Shunt release (Y2)	≤ 200	--
C.t.-operated release (Y4)	≤ 20	--
C.t.-operated release (Y6)	≤ 30	≤ 30
Low-energy current release (Y6)	--	≤ 10
Undervoltage release (Y7)	≤ 20	≤ 20

8.5 Classification of the switchgear

8DJH switchgear is classified according to IEC/EN 62 271-200 / VDE 0671-200.

Partition class

Partition class	PM (metallic partition)

Loss of service continuity category

Switchgear panel		Loss of service continuity category
with	Three-position disconnector or three-position switch-disconnector	LSC 2
without		LSC 1

Accessibility to compartments

Compartment (enclosure)		Accessibility
Busbar compartment		Non-accessible
Switching-device compartment		Non-accessible
Low-voltage compartment (option)		Tool-based
Connection compartment for panel/module	With earthing switch	Interlock-controlled
	Cable feeder (K)	Tool-based
	Metering panel type M, air-insulated	Tool-based

Internal arc classification IAC* (option)

Type of installation of the switchgear	IAC class
Wall-standing arrangement	IAC A FL up to 21 kA, 1 s
Free-standing arrangement	IAC A FLR up to 21 kA, 1 s

Accessibility:
F Front L Lateral R Rear

* Internal Arc Classification

8.6 Standards and guidelines

The medium-voltage switchgear type 8DJH for indoor installation complies with the following prescriptions and standards:

		IEC/EN standard	VDE standard
Switchgear		62271-1	0671-1
		62271-200	0671-200
Devices	Circuit-breakers	62271-100	0671-100
	Disconnectors	62271-102	0671-102
	Earthing switches		
	Switch-disconnectors	62271-103	0671-103
	Switch-fuse combination	62271-105	0671-105
	HV HRC fuses	60282-1	0670-4
	Voltage detecting systems	61243-5	0682-415
Surge arresters		60099	0675
Degree of protection		60529	0470-1
Insulation		60071	0111
Instrument transformers	Current transformers	61869-1/-2	0414-9-1/-2
	Voltage transformers	61869-1/-3	0414-9-1/-3
	Electronic current transformers	61869-8	0414-44-8
	Electronic voltage transformers	61869-7	0414-44-7
Insulating gas SF_6		60376	0373-1
Installation and erection		61936-1 HD 637-S1	0101
Environmental conditions		60721-3-3	DIN EN 60 721-3-3

Type approval according to German X-ray regulations (RöV)

The vacuum interrupters fitted in the vacuum circuit-breakers are type-approved in accordance with the X-ray regulations of the Federal Republic of Germany. They conform to the requirements of the X-ray regulations of January 8, 1987 (Federal Law Gazette I 1987, Page 114) in the new edition of April 30, 2003 (Federal Law Gazette I 2003, No. 17) up to the value of the rated voltage stipulated in accordance with IEC/DIN VDE.

Electromagnetic compatibility (EMC)

The a.m. standards as well as the "EMC Guide for Switchgear"[1] are applied during design, manufacture and erection of the switchgear. Installation, connection and maintenance have to be performed in accordance with the stipulations of the operating instructions. For operation, the legal stipulations applicable at the place of installation have to be observed additionally. In this way, the switchgear assemblies of this type series fulfill the basic protection requirements of the EMC Directive.

[1] Dr. Bernd Jäkel, Ansgar Müller, "Medium-Voltage Systems – EMC Guide for Switchgear", Siemens AG 2012

Degrees of protection

The panels of the 8DJH fulfill the following degrees of protection according to IEC 62271-200, IEC 60529 and DIN VDE 0671-200:

- IP2X (standard) for parts under high voltage
  - for air-insulated metering panels
  - for panels with HV HRC fuses
- IP3X (option) for the switchgear enclosure of the operating front and the side walls
- IP3X (standard, option: IP4X) for low-voltage compartments
- IP65 for parts under high voltage
  - for panels without HV HRC fuses
  - for switchgear without air-insulated metering panels

Transport regulations

According to "Annex A of the European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR)" launched on September 30, 1957, Siemens gas-insulated medium-voltage switchgear does not belong to the category of dangerous goods in respect of transportation, and is exempted from special transport regulations according to ADR, Clause 1.1.3.1 b).

8.7 Dimensions and weights

The transport weight results from the switchgear weight per transport unit and the packing weight. The packing weight results from the transport dimensions and the type of transport.

Switchgear weights

The total weight of the switchgear results from the sum of the weights per functional unit. Depending in the design and the degree to which it is equipped (e.g. current transformers, motor operating mechanism or low-voltage compartment), the actual value might deviate.

Switchgear panel	Width	Gross weight for a switchgear height of			Low-voltage compartment
	[mm]	1200 mm	1400 mm	1700 mm	600 mm
		approx. [kg]	approx. [kg]	approx. [kg]	approx. [kg]
R	310	100	110	120	40
R(500)	500	140	150	170	60
K	310	100	110	120	40
K(E)	430	130	140	160	50
T	430	135	145	160	50
L	430	130	140	155	50
L (type 1.1) without 4MT3	500	210	220	240	60
L (type 2)	500	160	170	190	60
M (BC/BB/CB)	840	-	370	400	70
M(CC)	840	-	270	300	70
M(500) incl. 3x4MT3	500	230	240	260	60
S	430	130	140	160	50
S(500)	500	150	160	180	60
S(620)	620	200	220	240	45
H	430	135	145	160	50
V	500	240	250	270	60
E	310	100	110	120	40
E(500)	500	140	150	170	60

Panel block		Width	Gross weight for a switchgear height without low-voltage compartment		
		[mm]	1200 mm	1400 mm	1700 mm
			approx. [kg]	approx. [kg]	approx. [kg]
Block of 2 panels	KT, TK	740	230	250	280
	K(E)T	860	240	260	290
	KL[1] , LK	740	230	250	280
	K(E)L[1]	860	250	270	300
	RK, KR	620	200	220	240
	RT, TR	740	230	250	280
	RL[1], LR	740	230	250	280
	TT	860	270	290	320
	RR	620	200	220	240
	LL[1]	860	260	280	310
	RS	740	230	250	280
	RH	740	230	250	280
Block of 3 panels	RRT	1050	330	360	400
	RRL[1]	1050	320	350	390
	RTR	1050	330	360	400
	RLR	1050	320	350	390
	RRR	930	300	330	360
	TTT	1290	410	440	490
	LLL[1]	1290	400	430	480
	RRS	1050	320	350	390
	RRH	1050	330	360	400
Block of 4 panels	RRRT	1360	430	470	520
	RRRL[1]	1360	430	470	520
	RRRR	1240	400	440	480
	TRRT	1480	470	510	560
	LRRL	1480	460	500	550
	TTTT	1720	540	580	640
	LLLL[1]	1720	520	560	620
	RRRS	1360	420	460	510
	RRRH	1360	430	470	520

[1] Applies to design with circuit-breaker type 2

Packing weights

Maximum width of switchgear unit [mm]	Packing weight for Europe, approx. [kg]	Packing weight for overseas, approx. [kg]
850	30	90
1200	40	120
1550	50	150
1800	60	180
2000	75	225

8.8 Phase sequence

Phase sequence for all panel types 8DJH:

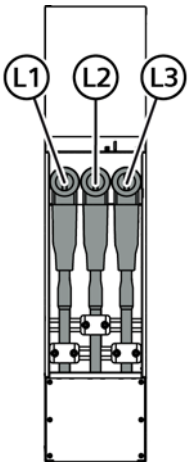


Fig. 21: View from the front

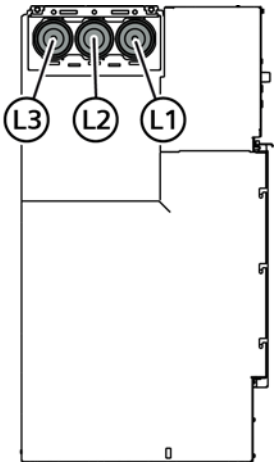


Fig. 22: View from the left

8.9 Insulating gas

The sealed pressure system of the switchgear contains the insulating gas SF_6 (fluorinated greenhouse gas, GWP 22,800).

Example for a typical amount of SF_6 gas: Panel block 8DJH RRT with 2.2 kg SF_6 (CO_2e = 50t).

The respective amount of SF_6 gas included is indicated on the rating plate of the switchgear.

Gas leakage rate

The gas leakage rate is < 0.1% per year (referred to the absolute gas pressure).

8.10 Dielectric strength and site altitude

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.
- The rated values are referred to sea level and to normal atmospheric conditions (101.3 hPa, 20 °C, 11g/m^3 humidity according to VDE 0111 and IEC 60071).
- 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, but leave this to the scope of special agreements.

All parts housed inside the switchgear vessel which are subjected to high voltage are SF_6-insulated against the earthed enclosure.

Site altitude

The gas insulation in the switchgear vessel at a relative gas pressure of 50 kPa (= 500 hPa) permits switchgear installation at an altitude of up to 2000 m above sea level without the dielectric strength being adversely affected. This also applies to the cable connection when using screened cable plugs. Site altitudes above 2000 m are possible on request.

For site altitudes of more than 1000 m (above sea level), the decrease (reduction) of the dielectric strength must be considered for panels with HV HRC fuses and air-insulated metering panels. For these site altitudes, a higher insulation level must be selected, which results from the multiplication of the rated insulation level for 0 to 1000 m with the altitude correction factor K_a.

Altitude correction factor

For site altitudes above 1000 m, the altitude correction factor K_a must be considered.

Curve m=1 for rated short-duration power-frequency withstand voltage and rated lightning impulse withstand voltage according to IEC 62271-1 / VDE 0671-1.

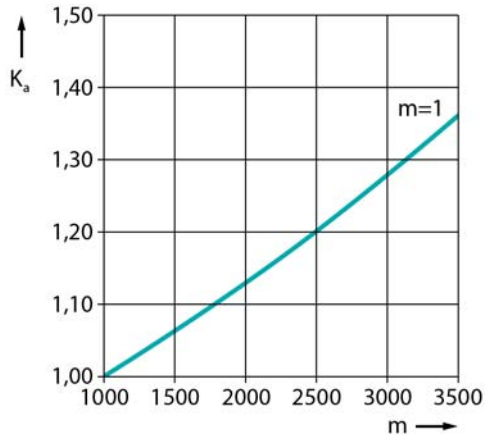


Fig. 23: Correction factor K_a as a function of the site altitude in m above sea level

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 isolating distances	kV	23	32	39	45	60
– Between phases and to earth	kV	20	28	36	38	50
Rated lightning impulse withstand voltage (peak value)						
– Across isolating distances	kV	70	85	105	110	145
– Between phases and to earth	kV	60	75	95	95	125

Calculation example

3000 m site altitude above sea level (K_a = 1.28)

17.5 rated voltage of the grid

95 kV rated lightning impulse withstand voltage (see "Dielectric strength" table, rated voltage 17.5 kV)

Rated lightning impulse withstand voltage required =

95 kV * 1.28 = 122 kV

Result:

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

8.11 Selection of HV HRC fuse-links

Note to HV HRC fuse-links

According to IEC 60282-1 (2009) Clause 6.6, the breaking capacity of HV HRC fuse-links is tested within the scope of the type test at 87% of their rated voltage.

In three-phase systems with resonance-earthed or isolated neutral, under double earth fault and other conditions, the full phase-to-phase voltage may be available at the HV HRC fuse-link during breaking. Depending on the size of the operating voltage of such a system, this applied voltage may then exceed 87% of the rated voltage.

To be observed during configuration of switching devices and selection of HV HRC fuse-links:

- Use only fuse-links satisfying the stated operating conditions.
- Use only fuse-links whose breaking capacity was tested at least with the maximum system voltage.

In case of doubt, select a suitable HV HRC fuse-link together with the manufacturer.

Allocation of HV HRC fuses and transformers

The three-position switch-disconnector in the transformer feeder (transformer switch) was combined with HV HRC fuse-links and tested in accordance with IEC 62271-105.

The following transformer protection table shows HV HRC fuse-links tested by Siemens, which are recommended for transformer protection.

The **protection table** applies to:

- Maximum ambient air temperature in the switchgear room of 40 °C according to IEC62271-1 considering the influence of the switchgear enclosure
- Requirements according to IEC 62271-105
- Protection of distribution transformers according to IEC 60787
- Rated power of transformer (no overload operation)

The specified HV HRC fuse-links make SIBA are type-tested back-up fuses according to IEC 60282-1. The dimensions conform to DIN 43625.

The HV HRC fuse-links have a thermal protection in form of a temperature-limiting striker tripping operating in case of defective HV HRC fuse-links or high overload currents.

Please contact your regional Siemens representative if you want to use HV HRC fuse-links from other manufacturers.

Basis for selection of HV HRC fuse-links:

- IEC 60282-1
- IEC 62271-105
- IEC 60787
- Recommendations and data sheets of fuse manufacturers
- Permissible power loss in the switchgear enclosure at an ambient air temperature of 40° C

	**ATTENTION**
	Please use only fuses tested by Siemens, which are listed in the following fuse tables. ⇨ The use of other fuse types must be checked by Siemens in advance. Please contact the regional Siemens representative.

Transformer protection table

The following table shows the recommended HV HRC fuse-links make SIBA and Mersen for the fuse protection of transformers.

The electrical values are valid for ambient air temperatures of up to 40 °C.

NOTE

- For switchgear with a rated voltage of up to 12 kV, observe the design of the fuse slide supplied (reference dimension e=292 mm, optionally e=442 mm)
- Impermissible fuse-links:
  - 7.2 kV fuse-links with reference dimension 192 mm
  - 24 kV fuse-links with reference dimension 292 mm

System operating voltage	Transformer			HV HRC fuse-link			Order number for HV HRC fuse-link	
U_n [kV]	S_r [kVA]	u_K [%]	I_r [A]	I_r [A]	U_r [kV]	e [mm]	Make SIBA	Make Mersen
3.3...3.6	20	4	3.5	6.3	3...7.2	292	30 098 13.6,3	–
				10	3...7.2	292	30 098 13.10	–
	30	4	5.25	10	3...7.2	292	30 098 13.10	–
				16	3...7.2	292	30 098 13.16	–
	50	4	8.75	16	3...7.2	292	30 098 13.16	–
				20	3...7.2	292	30 098 13.20	–
	75	4	13.1	20	3...7.2	292	30 098 13.20	–
				25	3...7.2	292	30 098 13.25	–
	100	4	17.5	31.5	3...7.2	292	30 098 13.31,5	–
				40	3...7.2	292	30 098 13.40	–
	125	4	21.87	31.5	3...7.2	292	30 098 13.31,5	–
				40	3...7.2	292	30 098 13.40	–
	160	4	28	40	3...7.2	292	30 098 13.40	–
				50	3...7.2	292	30 098 13.50	–
	200	4	35	50	3...7.2	292	30 098 13.50	–
				63	3...7.2	292	30 099 13.63	–
	250	4	43.74	63	3...7.2	292	30 099 13.63	–
				80	3...7.2	292	30 099 13.80	–
4.16...4.8	20	4	2.78	6.3	3...7.2	292	30 098 13.6,3	–
	30	4	4.16	10	3...7.2	292	30 098 13.10	–
	50	4	6.93	16	3...7.2	292	30 098 13.16	–
	75	4	10.4	16	3...7.2	292	30 098 13.16	–
				20	3...7.2	292	30 098 13.20	–
	100	4	13.87	20	3...7.2	292	30 098 13.20	–
				25	3...7.2	292	30 098 13.25	–
	125	4	17.35	25	3...7.2	292	30 098 13.25	–
				31.5	3...7.2	292	30 098 13.31,5	–
	160	4	22.2	31.5	3...7.2	292	30 098 13.31,5	–
				40	3...7.2	292	30 098 13.40	–
	200	4	27.75	40	3...7.2	292	30 098 13.40	–
				50	3...7.2	292	30 098 13.50	–
	250	4	34.7	50	3...7.2	292	30 098 13.50	–
				63	3...7.2	292	30 099 13.63	–
	315	4	43.7	63	3...7.2	292	30 099 13.63	–
				80	3...7.2	292	30 099 13.80	–
5.0...5.5	20	4	2.3	6.3	3...7.2	292	30 098 13.6,3	–
	30	4	3.4	6.3	3...7.2	292	30 098 13.6,3	–
				10	3...7.2	292	30 098 13.10	–
	50	4	5.7	10	3...7.2	292	30 098 13.10	–
				16	3...7.2	292	30 098 13.16	–
	75	4	8.6	16	3...7.2	292	30 098 13.16	–
				20	3...7.2	292	30 098 13.20	–
	100	4	11.5	16	3...7.2	292	30 098 13.16	–
				20	3...7.2	292	30 098 13.20	–

System operating voltage	Transformer			HV HRC fuse-link			Order number for HV HRC fuse-link	
U_n [kV]	S_r [kVA]	u_K [%]	I_r [A]	I_r [A]	U_r [kV]	e [mm]	Make SIBA	Make Mersen
5.0...5.5	125	4	14.4	20	3...7.2	292	30 098 13.20	–
				25	3...7.2	292	30 098 13.25	–
	160	4	18.4	31.5	3...7.2	292	30 098 13.31,5	–
				40	3...7.2	292	30 098 13.40	–
	200	4	23	40	3...7.2	292	30 098 13.40	–
				50	3...7.2	292	30 098 13.50	–
	250	4	28.8	40	3...7.2	292	30 098 13.40	–
				50	3...7.2	292	30 098 13.50	–
	315	4	36.3	50	3...7.2	292	30 098 13.50	–
				63	3...7.2	292	30 099 13.63	–
	400	4	46.1	63	3...7.2	292	30 099 13.63	–
				80	3...7.2	292	30 099 13.80	–
6...7.2	20	4	1.9	6.3	6...12	292	30 004 13.6,3	–
				6.3	3...7.2	292	30 098 13.6,3	–
				6.3	6...12	442	30 101 13.6,3	–
	50	4	4.8	10	3...7.2	292	30 098 13.10	–
				10	6...12	292	30 004 13.10	–
				10	6...12	442	30 101 13.10	–
				16	3...7.2	292	30 098 13.16	–
				16	6...12	292	30 004 13.16	45DB120V16PTD
				16	6...12	442	30 101 13.16	–
	75	4	7.2	16	3...7.2	292	30 098 13.16	–
				16	6...12	292	30 004 13.16	45DB120V16PTD
				16	6...12	442	30 101 13.16	–
	100	4	9.6	16	3...7.2	292	30 098 13.16	–
				16	6...12	292	30 004 13.16	–
				16	6...12	442	30 101 13.16	–
				20	3...7.2	292	30 098 13.20	–
				20	6...12	292	30 004 13.20	–
				20	6...12	442	30 101 13.20	–
				25	6...12	292	–	45DB120V25PTD
	125	4	12	20	3...7.2	292	30 098 13.20	–
				20	6...12	292	30 004 13.20	–
				20	6...12	442	30 101 13.20	–
				25	3...7.2	292	30 098 13.25	–
				25	6...12	292	30 004 13.25	45DB120V25PTD
				25	6...12	442	30 101 13.25	–
	160	4	15.4	31.5	3...7.2	292	30 098 13.31,5	–
				31.5	6...12	292	30 004 13.31,5	45DB120V32PTD
				31.5	6...12	442	30 101 13.31,5	–
	200	4	19.2	31.5	3...7.2	292	30 098 13.31,5	–
				31.5	6...12	292	30 004 13.31,5	–
				31.5	6...12	442	30 101 13.31,5	–
				40	3...7.2	292	30 098 13.40	–
				40	6...12	292	30 004 13.40	45DB120V40PTD
				40	6...12	442	30 101 13.40	–
	250	4	24	40	3...7.2	292	30 098 13.40	–
				40	6...12	292	30 004 13.40	–
				40	6...12	442	30 101 13.40	–
				50	3...7.2	292	30 098 13.50	–
				50	6...12	292	30 004 13.50	–
				50	6...12	442	30 101 13.50	–
				63	6...12	292	30 012 43.63	45DB120V63PTS2
	315	4	30.3	50	3...7.2	292	30 098 13.50	–
				50	6...12	292	30 004 13.50	45DB120V50PTD
				50	6...12	442	30 101 13.50	–
				63	6...12	292	30 012 43.63	45DB120V63PTS2
				80	6...12	292	–	45DB120V80PTS2

System operating voltage	Transformer			HV HRC fuse-link			Order number for HV HRC fuse-link	
U_n [kV]	S_r [kVA]	u_K [%]	I_r [A]	I_r [A]	U_r [kV]	e [mm]	Make SIBA	Make Mersen
6...7.2	400	4	38.4	63	6...12	292	30 012 43.63	–
				80	6...12	292	30 012 43.80	45DB120V80PTS2
				80	6...12	442	30 102 43.80	–
				63	3...7.2	292	30 099 13.63	–
				63	6...12	292	30 012 13.63	–
				63	6...12	442	30 102 13.63	–
				100	6...12	292	–	45DB120V100PTS2
	500	4	48	80	6...12	292	30 012 43.80	–
				80	6...12	442	30 102 43.80	–
				80	3...7.2	292	30 099 13.80	–
				80	6...12	292	30 012 13.80	–
				80	6...12	442	30 102 13.80	–
				100	6...12	292	30 012 43,100	45DB120V100PTS2
				100	6...12	442	30 102 43,100	45DB120V100PTS3
	630	4	61	100	6...12	442	30 102 43,100	–
				125	6...12	292	30 103 43,125	45DB120V125PTS2
				125	6...12	442	30 020 43,125	–
	800	4	77	160	6...12	442	–	45DB120V160PTS3
10...12	20	4	1.15	4	6...12	292	30 004 13.4	–
	50	4	2.9	10	6...12	292	30 004 13.10	45DB120V10PTD
				10	6...12	442	30 101 13.10	–
				10	10...17.5	292	30 255 13.10	–
				10	10...17.5	442	30 231 13.10	–
				10	10...24	442	30 006 13.10	45DB240V10PTD
	75	4	4.3	10	6...12	292	30 004 13.10	45DB120V10PTD
				10	6...12	442	30 101 13.10	–
				10	10...17.5	292	30 255 13.10	–
				10	10...17.5	442	30 231 13.10	–
				10	10...24	442	30 006 13.10	45DB240V10PTD
	100	4	5.8	16	6...12	292	30 004 13.16	–
				16	6...12	442	30 101 13.16	–
				16	10...17.5	292	30 255 13.16	–
				16	10...17.5	442	30 231 13.16	–
				16	10...24	442	30 006 13.16	45DB240V16PTD
	125	4	7.2	16	6...12	292	30 004 13.16	45DB120V16PTD
				16	6...12	442	30 101 13.16	–
				16	10...17.5	292	30 255 13.16	–
				16	10...17.5	442	30 231 13.16	–
				16	10...24	442	30 006 13.16	45DB240V16PTD
				20	10...24	442	–	45DB240V20PTD
	160	4	9.3	20	6...12	292	30 004 13.20	45DB120V20PTD
				20	6...12	442	30 101 13.20	–
				20	10...17.5	292	30 221 13.20	–
				20	10...17.5	442	30 231 13.20	–
				20	10...24	442	30 006 13.20	45DB240V20PTD
	200	4	11.5	25	6...12	292	30 004 13.25	45DB120V25PTD
				25	6...12	442	30 101 13.25	–
				25	10...17.5	292	30 221 13.25	–
				25	10...17.5	442	30 231 13.25	–
				25	10...24	442	30 006 13.25	45DB240V25PTD
	250	4	14.5	25	6...12	292	30 004 13.25	45DB120V25PTD
				25	6...12	442	30 101 13.25	–
				25	10...17.5	292	30 221 13.25	–
				25	10...17.5	442	30 231 13.25	–
				25	10...24	442	30 006 13.25	45DB240V25PTD
				31.5	6...12	292	30 004 13.31,5	–
				31.5	6...12	442	30 101 13.31,5	–
				31.5	10...17.5	292	30 221 13.31,5	–

System operating voltage	Transformer			HV HRC fuse-link			Order number for HV HRC fuse-link	
U_n [kV]	S_r [kVA]	u_K [%]	I_r [A]	I_r [A]	U_r [kV]	e [mm]	Make SIBA	Make Mersen
10...12	250	4	14.5	31.5	10...17.5	442	30 231 13.31,5	–
				31.5	10...24	442	30 006 13.31,5	45DB240V32PTD
	315	4	18.3	31.5	6...12	292	30 004 13.31,5	45DB120V32PTD
				31.5	6...12	442	30 101 13.31,5	–
				31.5	10...17.5	292	30 221 13.31,5	–
				31.5	10...17.5	442	30 231 13.31,5	–
				31.5	10...24	442	30 006 13.31,5	45DB240V32PTD
				40	6...12	292	30 004 13.40	–
				40	6...12	442	30 101 13.40	–
				40	10...17.5	292	30 221 13.40	–
				40	10...17.5	442	30 231 13.40	–
				40	10...24	442	30 006 13.40	45DB240V40PTD
	400	4	23.1	40	6...12	292	30 004 13.40	45DB120V40PTD
				40	6...12	442	30 101 13.40	–
				40	10...17.5	292	30 221 13.40	–
				40	10...17.5	442	30 231 13.40	–
				40	10...24	442	30 006 13.40	45DB240V40PTD
				50	6...12	292	30 004 13.50	–
				50	6...12	442	30 101 13.50	–
				50	10...17.5	292	30 221 13.50	–
				50	10...17.5	442	30 232 13.50	–
				50	10...24	442	30 014 13.50	45DB240V50PTS
	500	4	29	50	6...12	292	30 004 13.50	45DB120V50PTD
				50	6...12	442	30 101 13.50	–
				50	10...17.5	292	30 221 13.50	–
				50	10...17.5	442	30 232 13.50	–
				50	10...24	442	30 014 13.50	45DB240V50PTD
				63	6...12	292	30 012 43.63	45DB120V63PTS2
				63	10...24	442	30 014 43.63	45DB240V63PTD
	630	4	36.4	63	6...12	292	30 012 43.63	–
				80	10...24	442	30 014 43.80	45DB240V80PTS
				63	6...12	292	30 012 13.63	45DB120V63PTD
				63	6...12	442	30 102 13.63	–
				63	10...17.5	442	30 232 13.63	–
				80	6...12	292	30 012 43.80	45DB120V80PTS2
				80	6...12	442	30 102 43.80	–
	800	5...6	46.2	63	6...12	292	30 012 13.63	–
				80	6...12	292	30 012 43.80	45DB120V80PTS2
				80	6...12	442	30 102 43.80	–
				80	10...24	442	–	45DB240V80PTS
	1000	5...6	58	100	6...12	292	–	45DB120V100PTS2
				100	6...12	442	30 102 43,100	45DB120V100PTS3
				100	10...24	442	–	45DB240V100PTS
	1250	5...6	72.2	125	6...12	292	–	45DB120V125PTS2
				125	6...12	442	30 103 43,125	45DB120V125PTS3
				125	10...24	442	–	45DB240V125PTS
13.8	20	4	0.8	3.15	10...24	442	30 006 13.3,15	–
	50	4	2.1	6.3	10...17.5	442	30 231 13.6,3	–
				6.3	10...24	442	30 006 13.6,3	–
				10	10...24	442	–	45DB240V10PTD
	75	4	3.2	6.3	10...17.5	442	30 231 13.6,3	–
				10	10...17.5	442	30 231 13.10	–
				10	10...24	442	30 006 13.10	45DB240V10PTD
	100	4	4.2	10	10...17.5	442	30 231 13.10	–
				16	10...17.5	442	30 231 13.16	–
				16	10...24	442	30 006 13.16	45DB240V16PTD
	125	4	5.3	10	10...17.5	442	30 231 13.10	–
				16	10...17.5	442	30 231 13.16	–

System operating voltage	Transformer			HV HRC fuse-link			Order number for HV HRC fuse-link	
U_n [kV]	S_r [kVA]	u_K [%]	I_r [A]	I_r [A]	U_r [kV]	e [mm]	Make SIBA	Make Mersen
13.8	125	4	5.3	16	10...24	442	30 006 13.16	45DB240V16PTD
	160	4	6.7	16	10...17.5	442	30 231 13.16	–
				16	10...24	442	–	45DB240V16PTD
	200	4	8.4	16	10...17.5	442	30 231 13.16	–
				20	10...17.5	442	30 231 13.20	–
				20	10...24	442	30 006 13.20	45DB240V20PTD
	250	4	10.5	20	10...17.5	442	30 231 13.20	–
				25	10...17.5	442	30 231 13.25	–
				25	10...24	442	30 006 13.25	45DB240V25PTD
	315	4	13.2	25	10...17.5	442	30 231 13.25	–
				25	10...24	442	–	45DB240V25PTD
				31.5	10...17.5	442	30 231 13.31,5	–
				31.5	10...24	442	30 006 13.31,5	45DB240V32PTD
	400	4	16.8	31.5	10...17.5	442	30 231 13.31,5	–
				31.5	10...24	442	30 006 13.31,5	45DB240V32PTD
				40	10...24	442	–	45DB240V40PTD
	500	4	21	40	10...17.5	442	30 231 13.40	–
				40	10...24	442	30 006 13.40	45DB240V40PTD
				50	10...24	442	–	45DB240V50PTD
	630	4	26.4	50	10...17.5	442	30 232 13.50	–
				50	10...24	442	30 014 13.50	45DB240V50PTD
				63	10...24	442	–	45DB240V63PTD
				80	10...24	442	–	45DB240V80PTS
	800	5...6	33.5	63	10...24	442	30 014 43.63	45DB240V63PTD
				80	10...24	442	–	45DB240V80PTS
	1000	5...6	41.9	80	10...24	442	30 014 43.80	45DB240V80PTD
	1250	5...6	52.3	100	10...24	442	–	45DB240V100PTS
15...17.5	20	4	0.77	3.15	10...24	442	30 006 13.3,15	–
	50	4	1.9	6.3	10...17.5	442	30 231 13.6,3	–
				6.3	10...24	442	30 006 13.6,3	–
	75	4	2.9	6.3	10...17.5	442	30 231 13.6,3	–
				10	10...24	442	–	45DB240V10PTD
	100	4	3.9	10	10...17.5	442	30 231 13.10	–
				10	10...24	442	–	45DB240V10PTD
	125	4	4.8	16	10...17.5	442	30 231 13.16	–
				16	10...24	442	30 006 13.16	45DB240V16PTD
	160	4	6.2	16	10...17.5	442	30 231 13.16	–
				16	10...24	442	–	45DB240V16PTD
	200	4	7.7	16	10...24	442	–	45DB240V16PTD
				20	10...17.5	442	30 231 13.20	–
				20	10...24	442	30 006 13.20	–
	250	4	9.7	25	10...17.5	442	30 231 13.25	–
				25	10...24	442	30 006 13.25	45DB240V25PTD
	315	4	12.2	25	10...24	442	–	45DB240V25PTD
				31.5	10...17.5	442	30 231 13.31,5	–
				31.5	10...24	442	30 006 13.31,5	–
	400	4	15.5	31.5	10...17.5	442	30 231 13.31,5	–
				31.5	10...24	442	30 006 13.31,5	45DB240V32PTD
	500	4	19.3	31.5	10...17.5	442	30 231 13.31,5	–
				31.5	10...24	442	30 006 13.31,5	–
				40	10...17.5	442	30 231 13.40	–
				40	10...24	442	30 006 13.40	45DB240V40PTD
	630	4	24.3	40	10...17.5	442	30 231 13.40	–
				40	10...24	442	30 006 13.40	–
				50	10...17.5	442	30 232 13.50	–
				50	10...24	442	30 014 13.50	45DB240V50PTD
				63	10...24	442	30 014 43.63	–
	800	5...6	30.9	63	10...24	442	30 014 43.63	–

System operating voltage	Transformer			HV HRC fuse-link			Order number for HV HRC fuse-link	
U_n [kV]	S_r [kVA]	u_K [%]	I_r [A]	I_r [A]	U_r [kV]	e [mm]	Make SIBA	Make Mersen
15...17.5	1000	5...6	38.5	80	10...24	442	30 014 43.80	–
	1250	5...6	48.2	100	10...24	442	30 022 43,100	–
20...24	20	4	0.75	3.15	10...24	442	30 006 13.3,15	–
	50	4	1.5	6.3	10...24	442	30 006 13.6,3	–
	75	4	2.2	6.3	10...24	442	30 006 13.6,3	–
	100	4	2.9	6.3	10...24	442	30 006 13.6,3	–
				10	10...24	442	–	45DB240V10PTD
	125	4	3.6	10	10...24	442	30 006 13.10	45DB240V10PTD
	160	4	4.7	10	10...24	442	30 006 13.10	–
	200	4	5.8	16	10...24	442	30 006 13.16	45DB240V16PTD
	250	4	7.3	16	10...24	442	30 006 13.16	45DB240V16PTD
	315	4	9.2	16	10...24	442	30 006 13.16	–
				20	10...24	442	30 006 13.20	–
				25	10...24	442	–	45DB240V25PTD
	400	4	11.6	20	10...24	442	30 006 13.20	–
				25	10...24	442	30 006 13.25	45DB240V25PTD
	500	4	14.5	25	10...24	442	30 006 13.25	45DB240V25PTD
				31.5	10...24	442	30 006 13.31,5	45DB240V32PTD
	630	4	18.2	31.5	10...24	442	30 006 13.31,5	45DB240V32PTD
				40	10...24	442	30 006 13.40	45DB240V40PTD
	800	5...6	23.1	31.5	10...24	442	30 006 13.31,5	–
				40	10...24	442	30 006 13.40	45DB240V40PTD
	1000	5...6	29	50	10...24	442	30 014 13.50	45DB240V50PTS
				63	10...24	442	30 014 43.63	–
	1250	5...6	36	50	10...24	442	–	45DB240V50PTS
				80	10...24	442	30 014 43.80	–
	1600	5...6	46.5	100	10...24	442	30 022 43,100	–
	2000	5...6	57.8	140	10...24	442	30 022 43,140	–

U_n System operating voltage

S_r Rated power of transformer

U_K Relative impedance voltage of transformer

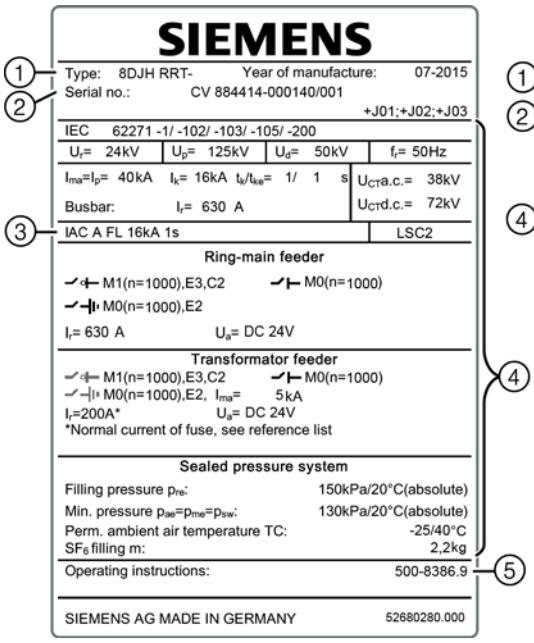
I_r Rated current of transformer

I_r Rated current of fuse

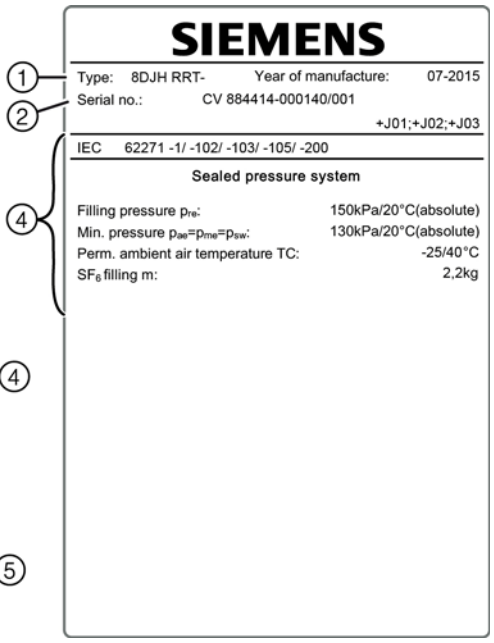
U_r Operating voltage / rated voltage of fuse

e Reference dimension of the fuse

8.12 Rating plates



Rating plate on the front (example)



Rating plate inside the operating mechanism box (example)

① Switchgear type and year of manufacture
② Serial number
③ Internal arc classification (option)
④ Technical data
⑤ Number of operating instructions

9 Switchgear maintenance

Maintenance

8DJH switchgear is maintenance-free under normal ambient conditions according to IEC 62271-1. Inspection or testing of the secondary equipment such as the capacitive voltage detecting system is done within the scope of locally applicable laws and regulations.

Checking the dew point

The dew point needs **no** checking throughout the entire service life.

Checking the gas quality

The gas quality needs **no** checking throughout the entire service life.

Test operation

A function test of the switching devices is required only at the time of commissioning, modification or retrofit at the panel.

Replacement of components

Due to the fact that all parts of this switchgear have been optimized to last the normal service life, it is not possible to recommend particular spare parts.

Information required for spare part orders of single components and devices:

- Type and serial number of the switchgear (see rating plates)
- Description or identification of the device or part on the basis of a sketch, a photo or a circuit diagram

10 End of life

	NOTE
	The equipment contains the fluorinated greenhouse gas SF_6 registered by the Kyoto Protocol with a global warming potential (GWP) of 22 800[1)]. SF_6 has to be reclaimed and must not be released into the atmosphere. ⇨ For use and handling of SF_6, IEC 62271-4: High-voltage switchgear and controlgear - Part 4: Use and handling of sulphur hexafluoride (SF6) has to be observed.

1) Source: "Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16th April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006"

SF_6 gas

Before recycling the materials, evacuate the SF_6 gas professionally and prepare it for further use. For further information, please contact the Siemens Service Hotline.

Recycling

The switchgear is an environmentally compatible product.

The components of the switchgear can be recycled in an environmentally compatible way by dismantling into sorted scrap and residual mixed scrap.

After evacuating the SF_6 gas, the switchgear mainly consists of the following materials:

- Steel (enclosure and operating mechanisms)
- Stainless steel (vessel)
- Copper (conductor bars)
- Silver (contacts)
- Cast-resin based on epoxy resin (bushings and post insulators)
- Plastic materials (switching devices and fuse tripping)
- Silicone rubber

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.

Any existing batteries have to be recycled professionally.

As delivered by Siemens, the switchgear does not contain hazardous materials as per the Hazardous Material Regulations applicable in the Federal Republic of Germany. For operation in other countries, the locally applicable laws and regulations must be observed.

For further information, please contact the Siemens Service Hotline.

Installation

11 Transport and storage

11.1 Unloading and transport to place of installation

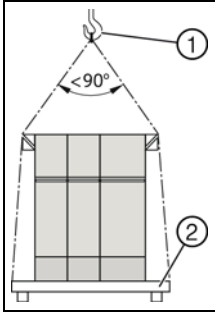
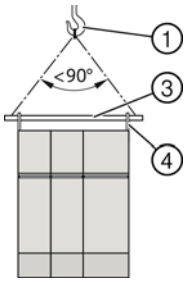
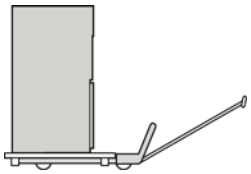
ATTENTION

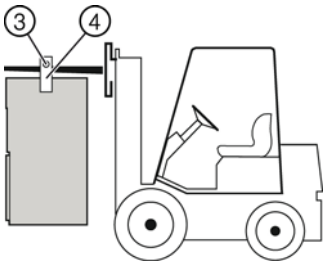
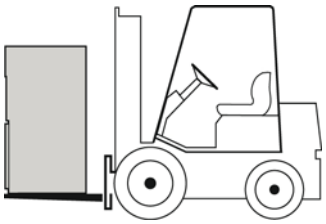
Non-observance of the following instructions can endanger people or damage the transport units while unloading.

- ⇨ Make sure that nobody is standing in the swinging area of lifted switchgear.
- ⇨ Attach ropes far enough on the hoisting tackle so that they cannot exert any forces on the panel walls under load.
- ⇨ Observe the dimensions and weights of the transport unit (delivery note).
- ⇨ Observe even weight distribution and the high center of gravity of the switchgear.
- ⇨ Ensure that the lifting tools and transport gear used meet the requirements as regards construction and load-bearing capacity.
- ⇨ Do not climb onto the roof of the panels.
- ⇨ If the low-voltage compartment is removed, do not step on the mounting plates of the low-voltage compartment.
- ⇨ Observe the instructions on the packing.
- ⇨ Unload the transport units in packed condition and leave packed for as long as possible.
- ⇨ Do not damage the PE protective foil.

- ⇨ Attach ropes far away on the hoisting tackle. The ropes must not exert any force on the panel walls under load.
- ⇨ Sling the ropes around the ends of the wooden pallets.
- ⇨ During transport to the place of installation or storage place, leave the panels on their transport base for as long as possible.
- ⇨ Set down the transport units close to the place of installation or storage place.
- ⇨ Observe the installation order of the panels during transport to the switchgear room; leave space for moving and mounting.
- ⇨ Remove the packing close to the place of installation of the panels, and not before beginning the installation process.

Transport facilities

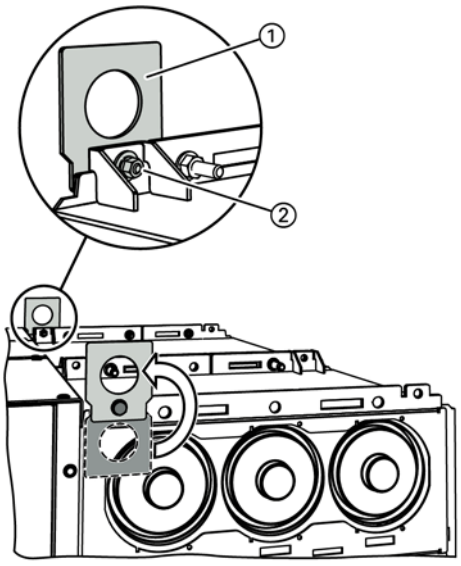
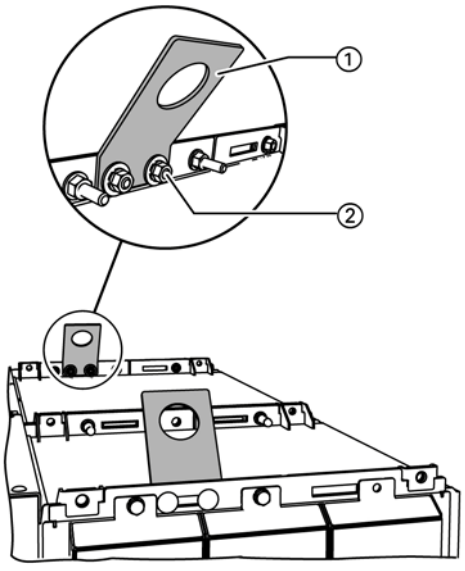
Craning with pallet	Transport with crane rod	Transport with lifting truck
		

Transport with fork-lift truck, suspended	Transport with fork-lift truck, standing
	

① Crane hook
② Transport pallet
③ Crane rod (Ø 40 mm, observe switchgear weight)
④ Lifting eye

Switchgear transport with transport eyes

The transport eyes are pre-assembled at the factory.

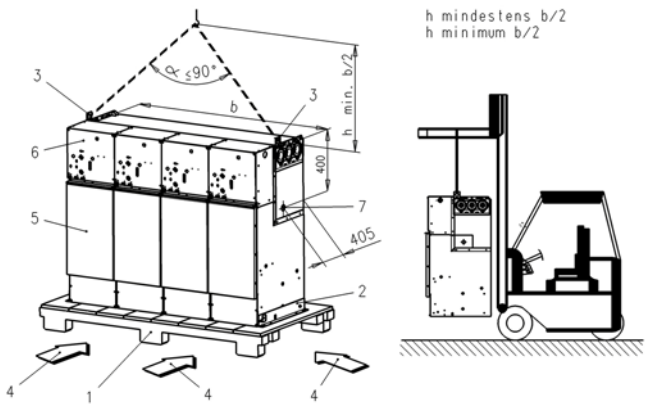
For delivery without low-voltage compartment and without pressure absorber:	For delivery with low-voltage compartment or pressure absorber:
Before transporting the switchgear, the transport eyes must be turned. ⇨ Undo the bolt-and-washer assembly ② of the transport eyes ① , and turn the transport eyes upwards by 180°. ⇨ Re-tighten the bolt-and-washer assembly ② . 	The transport eyes are fixed to the clamping plate with 2 bolt-and-washer assemblies each. 

① Lifting eye
② Bolt-and-washer assembly

⇨ Attach the lifting equipment or the rod.
⇨ Transport the switchgear.

	ATTENTION
	Danger due to transport units falling down. The center of gravity of the transport units is not always located under the fixing point. ⇨ Lift the transport units slowly. ⇨ There must be no persons standing in the swinging area of lifted transport units. ⇨ Transport only transport units with a max. width of 2.00 m or max. height of 2.60 m.

⇨ Observe the adhesive label with transport information provided on the switchgear.
- The angle between the crane chains at the lifting facility must be less than 90°.
- The distance between the transport eyes and the lifting facility must be at least half the switchgear width.



① Pallet
② Bolted joint between transport unit and pallet
③ Transport eyes
④ Clearance for fork-lift trucks
⑤ Cable compartment cover
⑥ Ready-for-service indicator
⑦ Center of gravity

Fig. 24: Adhesive label with transport information on the switchgear (example)

⇨ Lift or lower just slowly, as the switchgear will swing into the center of gravity when it is lifted.

⇨ While lifting, observe parts laid inside such as cable-type transformers, connecting cables.

11.2 Packing

The transport units can be packed as follows:
- On pallets, covered with PE protective foil
- In a seaworthy crate (switchgear is sealed with desiccant bags in PE foil)
- Other packings in special cases (e.g. latticed crate, cardboard cover for airfreight)

	ATTENTION
	Packing and consumable materials of the switchgear must be disposed of in an environmentally compatible way or recycled. ⇨ Observe local regulations for disposal and environmental protection.

Transport unit Transport units consist either of individual panels or panel blocks with max. four functions, and the switchgear accessories. The switchgear accessories are packed in the cable compartment of the first panel or in a separate transport box, depending on the extent.

11.3 Completeness and transport damage

Checking for completeness

- ⇨ Check whether the delivery is complete using the delivery notes and packing lists.
- ⇨ Compare the serial number of the switchgear printed on the delivery note with the serial number on the packing and the serial number on the rating plate.
- ⇨ Check whether the switchgear accessories are complete.

Transport damages

- ⇨ Temporarily open the packing in a weatherproof place to detect hidden damages. In order to prevent pollution of the switchgear, do not remove the PE foil completely until reaching the final mounting position.
- ⇨ Check the switchgear for transport damages.
- ⇨ Check service readiness (see page 58, "Checking service readiness").
- ⇨ Refit the packing at the best.
- ⇨ Determine and document detected defects and transport damages immediately, e.g. on the freight documents.
- ⇨ Document larger defects and transport damages photographically.
- ⇨ Please contact the regional Siemens representative in order to repair the transport damages.

11.4 Intermediate storage

DANGER

Risk of injury and damage to the storage place and the stored goods if the storage space is overloaded.

- ⇨ Observe the load-bearing capacity of the floor.
- ⇨ Do not stack the transport units.
- ⇨ Do not overload lighter components by stacking.

ATTENTION

Fire risk. The transport unit is packed in flammable materials.

- ⇨ No smoking.
- ⇨ Keep fire extinguishers in a weatherproof place.
- ⇨ Mark the location of the fire extinguisher.

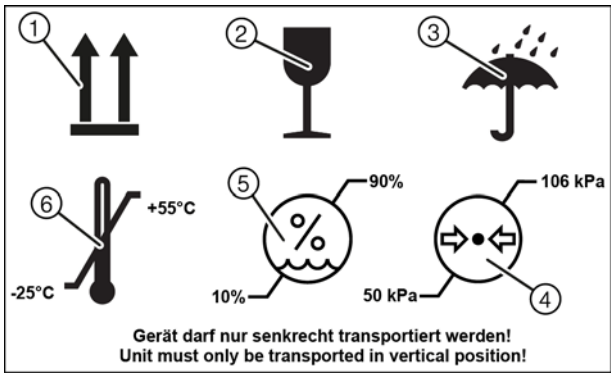
ATTENTION

If the supplied desiccant bags are not stored in the undamaged original packings, the desiccant bags lose their effectiveness.

- ⇨ Do not damage or remove packing of desiccant bags.
- ⇨ Do not unpack desiccant bags before use.

For intermediate storage of delivered switchgear, parts of the switchgear or accessories before installation, select a suitable storage place.

Observe the information provided on the switchgear packing and concerning transport and storage.



① Transport and store in vertical position
② Fragile contents
③ Protect against moisture
④ Pressure
⑤ Humidity
⑥ Storage temperature, values depending on ordered design

Fig. 25: Storage and transport information (example)

Ambient air temperatures for storage

Permissible ambient air temperatures for storage of the switchgear:

- Switchgear with secondary system: -25 °C to +55 °C (option: -40 °C to +70 °C) in accordance with the installed secondary devices
- Switchgear without secondary system: -40 °C to +70 °C

Intermediate storage of the transport units

Storage in closed rooms

- Intermediate storage is possible in the undamaged original packing including transport base (all packing types)

Outdoor storage:

- Intermediate storage is possible in the undamaged original packing including transport base, executed as seaworthy crate, for a maximum of 6 months
- Longer storage time is possible after replacement of the desiccant by expert personnel; to do this, contact the regional Siemens representative

Requirements on the storage place:

- Ground with adequate load-bearing capacity, solid, even and dry
- Ambient air temperatures always within the limit values for the switchgear
- Protected against mechanical damages, e.g. collision with vehicles, falling objects, tilting, falling over, vandalism
- Protected against humidity, e.g. rain, flooding, melting water, foam, persistent high air humidity, floor humidity
- Protected against direct solar radiation
- Protected against corrosive, dust-ridden or arenaceous ambient, and against pollution
- Protected against the wind
- Protected against vermin (e.g. rats, mice, insects), and vegetation overgrowth

Instructions for intermediate storage:

- Do not unpack small parts (to prevent corrosion and loss)
- Check packing for ingress of humidity (condensation) every 4 weeks

12 Switchgear installation

ATTENTION

During metal working, please ensure the following:

⇨ Do not drill into the vessel.

⇨ Do not leave any metal cuttings on the vessel in order to avoid rust layers.

12.1 Tools / Auxiliary means

- Standard tools such as torque wrenches (6...50 Nm), various screwdrivers (slot, Philips and Torx), various wrenches
- Shims with a thickness of 0.5... 1 mm to compensate floor unevenness

12.2 Cleaning agents and cleaning aids

DANGER

For protection of personnel and environment:

⇨ Read the instructions for use of cleaning agents and aids carefully.

⇨ Observe the warnings of the cleaning agents.

Activity	Cleaning agents or aids
Cleaning the front covers, cast-resin components, instrument transformers	Mild, customary household cleaner for general degreasing work and cleaning work **(solvent-free)**
Cleaning electrostatically stressed insulation (e.g. epoxy resin)	Dry wiping cloths; plastic cleaner containing alcohol if there is a lot of dirt
Applying and wiping off liquid cleaning agent (single use)	Lint-free cleaning paper
Removing dust	Brush
Damp cleaning, drying	Lint-free wiping cloths
Suction of drilling chips, construction waste, dust	Vacuum cleaner

12.3 Mounting paste

Use mounting paste only according to the installation instructions. Use only the supplied or released mounting paste.

12.4 Tightening torques

If not stated otherwise, the following tightening torques apply to 8DJH switchgear:

Joint	Material/material	Thread	Tightening torque
Metal joints	sheet-steel/sheet-steel	M6 (self-tapping)	12 Nm
	e. g.: front plates, top plates, etc.	M8	30 Nm
Earthing busbar	sheet-steel/copper	M8	21 Nm
	copper/copper	M8	21 Nm
	sheet-steel/copper	M10	30 Nm
Current conductor joint	copper/copper	M8	21 Nm
	copper/copper	M10	30 Nm
Switchgear earthing	sheet-steel/cable lug	M12	50 Nm*
	cable shield earthing	M10	30 Nm*
Cable plugs		M16	max. 50 Nm*

*** The tightening torque at the cable lug joint depends on:**

- Material of cable lug
- Instructions of sealing end manufacturer
- Instructions of cable manufacturer

12.5 Comments on electromagnetic compatibility

To achieve appropriate electromagnetic compatibility (EMC), some basic requirements must be observed while erecting the switchgear. This applies especially to the installation and connection of external cables and wires.

Basic measures for ensuring EMC are already taken during design and assembly of the switchgear panels. Among other things, these measures include:

- The low-voltage compartment is an integral part of the panel, which means that the protection and control devices with the internal wiring are metal-enclosed.
- Reliable earth connections of the frame parts via toothed contact washers or locking washers.
- Inside the panel, wires are laid in metal ducts.
- Spatial separation of sensitive signal wires from wires with high interference voltage levels.
- Limitation of switching overvoltages of inductive loads (e.g. relay or contactor coils, motors) by means of protective circuits with diode, varistor or RC element.
- Within the low-voltage compartment, the secondary devices are mounted in defined zones.
- Shortest possible connection between corresponding modules in subracks.
- Consideration of the magnetic leakage fields of conductor bars and cables.
- Protection of subracks and wiring backplanes against interference by perforated shielding plates.
- Large surface bonding between all modules and devices as well as bonding to the earthing conductor of the switchgear assembly.

These measures basically enable proper operation of the switchgear itself. The planner or operator of the switchgear must decide whether additional measures are required depending on the electromagnetic environment where the switchgear is installed. Such measures must be implemented by the installation company in charge.

In an environment with heavy electromagnetic interference it may be necessary to use shielded cables and wires for the external connections. This makes it possible to avoid interferences in the low-voltage compartment and thus, undesired influences on the electronic protection and control or other automation devices.

Cable shields must be electrically bonded to be able to carry high frequencies, and contacted concentrically at the cable ends.

The shields of cables and wires are connected and earthed in the low-voltage compartment.

Connect the shields to earth potential - with high electrical conductivity and all around as far as possible. Protect the contact surfaces from corrosion in case of humidity (regular condensation).

When laying cables into the switchgear assembly, separate the control, signaling and data cables and other lines with different signal and voltage levels, e.g. by laying them on separate racks or riser cable routes.

Corresponding to the different shield designs, there is a number of methods to perform connection. The planning department or site management determines which of the methods will be used, taking EMC requirements into account. The preceding points should always be taken into account.

The shield is connected to cables or wires with clamps contacting all around. If low demands are placed on EMC, it is also possible to connect the shield directly to earth potential (combine or twist the shield wires) or via short cable connections. Use cable lugs or wire-end ferrules at the connecting points.

Always keep the connecting leads of the shields as short as possible (< 10 cm).

If shields are used as protective earth conductors at the same time, the connected plastic-insulated lead must be marked green/yellow over its entire length. Non-insulated connections are inadmissible.

12.6 Preparing the switchgear room

	**ATTENTION** Please observe the following for room planning and switchgear installation: ⇨ The dimensions of the floor openings must be according to the dimension drawing in the switchgear documentation. ⇨ The height of the cable basement must at least correspond to the cable bending radius. ⇨ The pressure relief rooms must be according to the dimension drawing in the switchgear documentation.

Switchgear installation

Possible switchgear installations:

- Wall-standing arrangement
- Free-standing arrangement (option)

Switchgear dimensions

For switchgear dimensions, see page 72, "Floor openings and fixing points" or the order documents (dimension drawings, front views).

Pressure relief

In the standard design, the pressure is relieved downwards. For further information, see page 23, "Possibilities for pressure relief".

Room dimensions

The room dimensions result from the total width of the switchgear and the required wall distances.

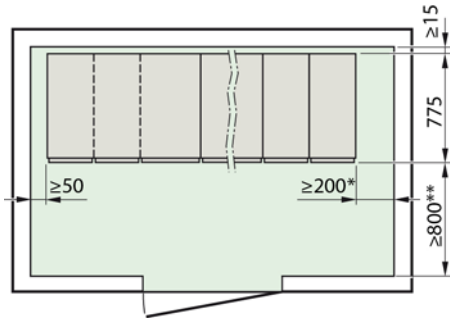


Fig. 26: Pressure relief downwards (standard)

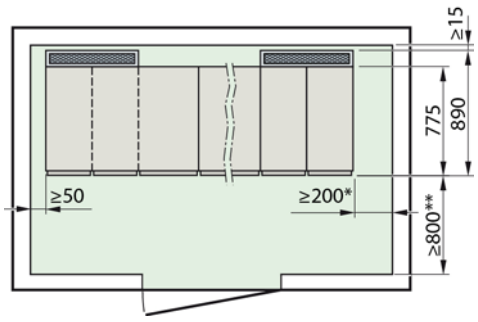


Fig. 27: Pressure relief with pressure relief duct at the rear

* For lined up switchgear

** Depending on national requirements. For extension or panel replacement, a control aisle of at least 1000 mm is recommended.

Room heights

The minimum room height required results from the height of the switchgear and possible top-mounted units, such as a low-voltage compartment or wiring duct. When a pressure absorber system is used, the room heights tested for internal arc classification according to IEC/EN 62271-200 / VDE 0671-200 are decisive:

Switchgear height [mm]	Room height [mm]
1400	≥ 2000
1700, 1800	≥ 2200
2300	≥ 2400
2600	≥ 2600

Door dimensions

The door dimensions depend on the

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

Weights

For data, see page 35, "Dimensions and weights".

12.7 Preparing the foundation

- A suitable foundation can be a false floor, a double floor or a reinforced-concrete foundation. The reinforced-concrete floor must be equipped with foundation rails for supporting the panels.
- As for design and construction of the foundation, the relevant standards DIN 43661 “Fundamentschienen in Innenanlagen der Elektrotechnik” (Foundation rails in electrical indoor installations) and DIN 18202 “Maßtoleranzen im Hochbau” (Blatt 3) (Measuring tolerances in structural engineering (Sheet 3)) apply.
- The dimensions of the floor opening and the fixing points of the switchgear frame are given in the switchgear documentation.
- Determine level differences between the installation surfaces of the panels using a measuring sheet, and compensate with shims.

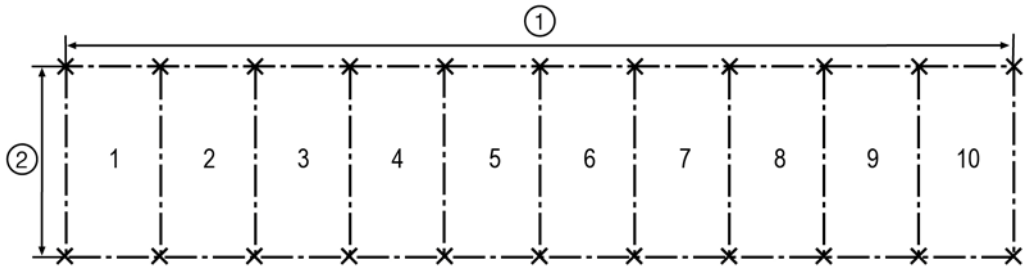


Fig. 28: Measuring sheet for the foundation

① Width of complete switchgear
② 750 mm

Stipulations for evenness and straightness

Evenness/straightness tolerance according to DIN 43661: 1 mm for 1 m length, 2 mm over the width of the complete switchgear.

12.8 Unpacking the switchgear

⇨ Remove the PE foil; if required, remove seaworthy or latticed crate before.

⇨ If necessary, remove the front cable compartment cover from the subframe of the switchgear.

⇨ Remove the fixing bolts of the transport angles and keep them for later reuse.

⇨ Remove transport angles.

If the switchgear cannot be lifted directly from the wooden pallet onto its mounting position, please proceed as follows:

⇨ Lower the transport units by means of the lateral transport angles onto roller pads (reinforced rollers) or tubes.

⇨ Lift the switchgear at the side edges with roller crowbars and slowly lower it onto the mounting position.

⇨ Remove transport angles.

Removing the transport angles

The panels are fixed on the wooden pallets with transport angles on both sides.

⇨ Unscrew all bolts of the transport angles and remove the transport angles.

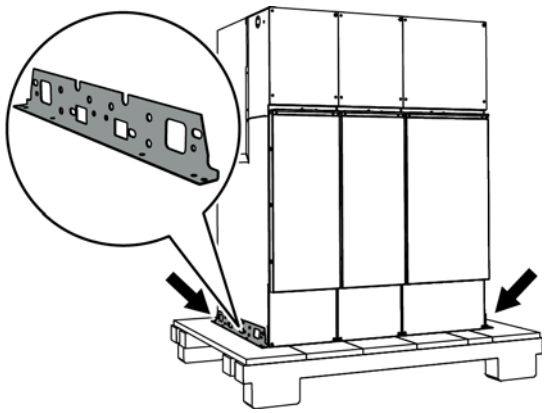


Fig. 29: Transport angle for wooden pallet

⇨ Screw the fixing bolts in again on **both sides** of the transport unit.

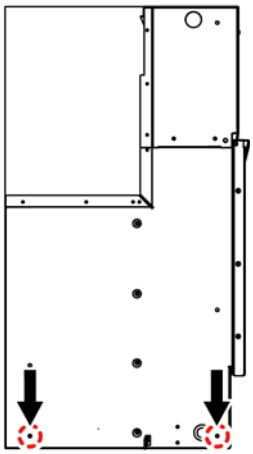


Fig. 30: Points for fixing bolts (view from the left)

12.9 Checking service readiness

The switchgear vessels are filled with insulating gas and are under pressure. Before starting installation, the gas filling of the panels must be checked by means of the ready-for-service indicator.

⇨ Read the ready-for-service indicator (see page 143, "Ready-for-service indicator").

✔ If the pointer of the ready-for service indicator is in the green area, the gas density is in order.

If the pointer of the ready-for-service indicator is in the red area:

⇨ Check the auxiliary switch of the ready-for-service indicator.

Checking the auxiliary switch

During transport, the auxiliary switch of the ready-for-service indicator can latch tight in the red area due to vibrations.

⇨ Unscrew the front cover of the switchgear. Push the roller lever of the auxiliary switch carefully towards the switch.

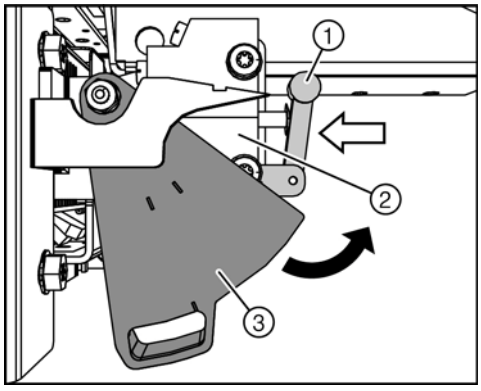


Fig. 31: Roller lever and sector disc of the ready-for-service indicator

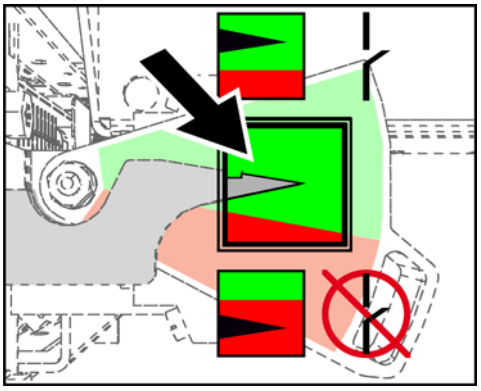


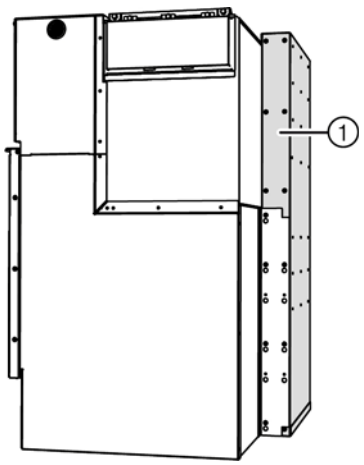
Fig. 32: Pointer position after operation of the roller lever at the auxiliary switch (example)

① Roller lever ② Auxiliary switch ③ Sector disc

✔ The sector disc must return automatically until the pointer of the ready-for-service indicator is in the green area again. If not, please stop the installation and contact the regional Siemens representative.

12.10 Installing the pressure relief duct for pressure absorber system (IAC up to 16 kA)

The pressure relief duct for panel blocks with IAC FLR up to 16 kA/1s (option) is pre-assembled at the factory as standard. The pressure relief duct can be supplied separately on request.



① Pressure relief duct

Fig. 33: Mounted pressure relief duct

Mounting the pressure relief duct

⇨ Mount 2 fixing brackets for the pressure relief duct of the switchgear on the rear wall using 6 self-tapping bolts M6 each.

⇨ Bolt the pressure relief duct together at the 2 fixing brackets using 6 self-tapping bolts M6 each.

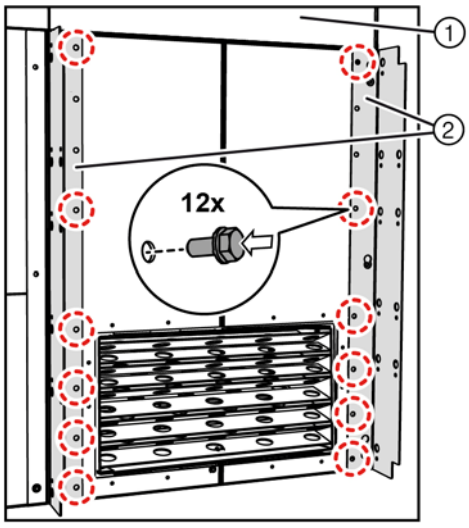


Fig. 34: Mounting the fixing brackets

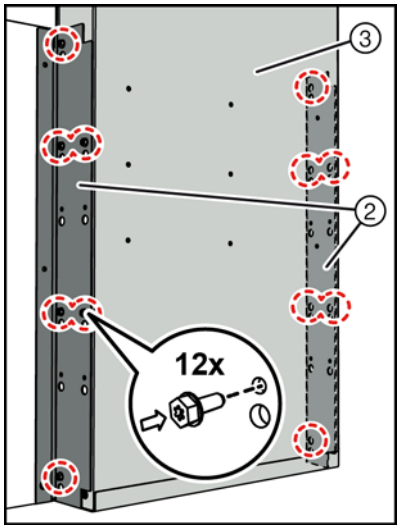
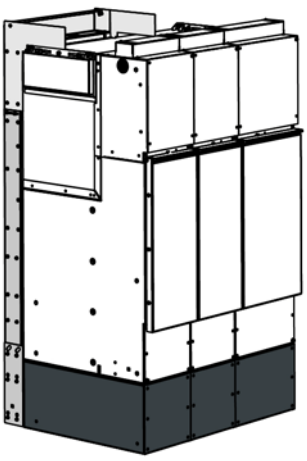
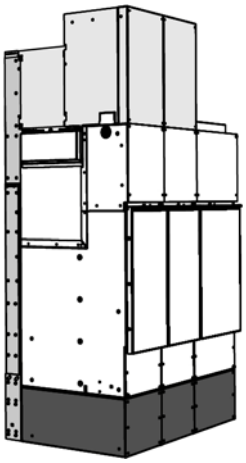
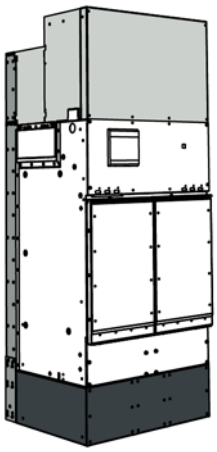


Fig. 35: Mounting the pressure relief duct

① Rear wall of frame ② Fixing bracket ③ Pressure relief duct

12.11 Installing the base and the pressure relief duct for the pressure absorber system (IAC up to 21 kA)

Switchgear installation with pressure relief duct pre-assembled at the factory or supplied separately for switchgear with IAC A FL or FLR up to 21 kA/1s.

IAC A FL up to 21 kA/1s	**IAC A FLR up to 21 kA/1s**	
Panels in wall-standing arrangement (except metering panel)	Panels in free-standing arrangement	Metering panels in wall-standing arrangement and free-standing arrangement
Height 1800 mm	Height 2300 mm	
		

For switchgear with pre-assembled base and pressure relief duct:

⇨ Set the switchgear onto the foundation or the foundation rails, align it and bolt it tight.

⇨ Install the pressure absorber top unit, see page 65, "Installing the pressure absorber top unit (IAC up to 21 kA) ".

Mounting the pressure relief duct and the base

If the pressure relief duct and the base are separate units:

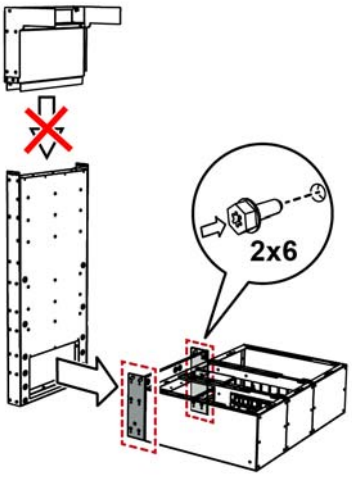
⇨ **Only for panels in free-standing arrangement or in metering panels:**

Bolt the two parts of the pressure relief duct together using 8 self-tapping bolts M6.

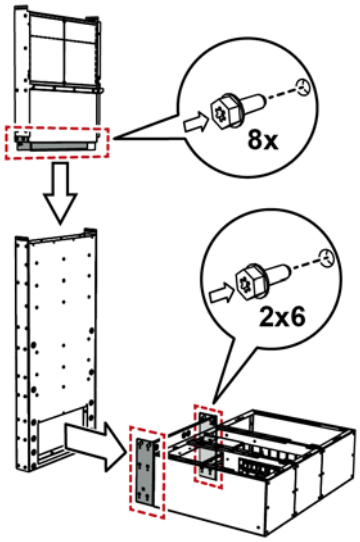
Panels in wall-standing arrangement (except metering panels): Do not mount the top unit of the pressure relief duct yet.

⇨ Bolt the pressure relief duct together with the fixing brackets on both sides of the base using 6 self-tapping bolts M6 each.

Installation for panels in wall-standing arrangement (except metering panels):



Installation for metering panels or panels in free-standing arrangement:



⇨ Install the bases of all panels and line them up.

⇨ Bolt the bases together using 2 bolts and nuts M8 each.

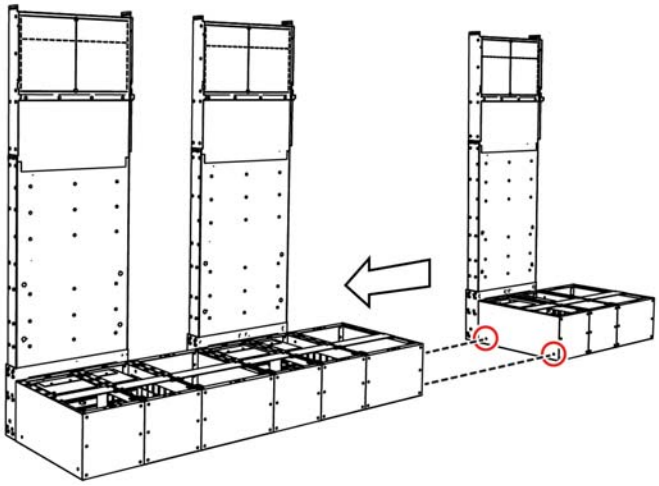


Fig. 36: Bolting the bases together (example)

⇨ Fasten the bases to the foundation using at least 4 bolts M8 per panel. In the case of bases for metering panels, all fixing points must be used.

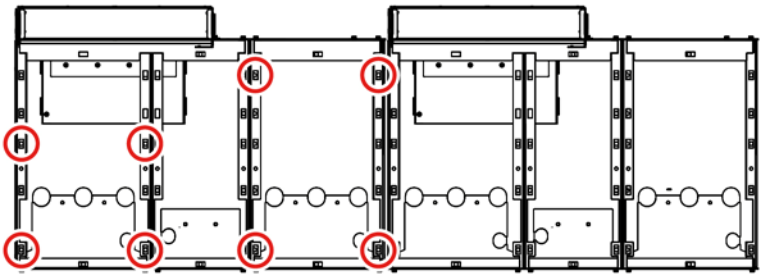


Fig. 37: Example: Fixing points of the base on the foundation

⇨ Close unused fixing points with silicone or adhesive tape.

The fixing points of the pressure relief duct and the switchgear are described in the dimension drawings of the switchgear documentation.

Mounting the panels onto the bases

	NOTE
	If felt strips are fixed onto the bases, the panels cannot be moved easily on the bases. ⇨ Do not stick felt strips on the bases.

⇨ Lift the panel onto the base and move it into position. If required, remove the cable brackets.

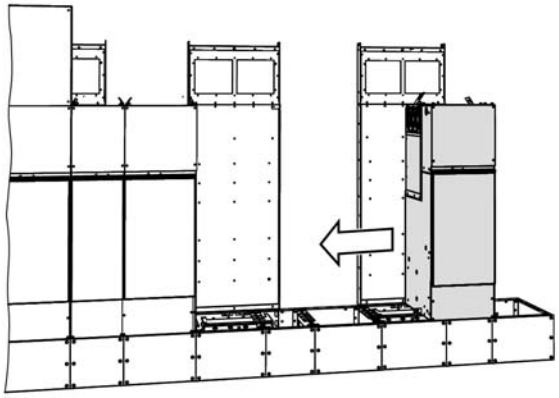


Fig. 38: Positioning the panel on the bases

⇨ Align panel and base. Observe that the bolted joints between the base and the switchgear frame are in line.

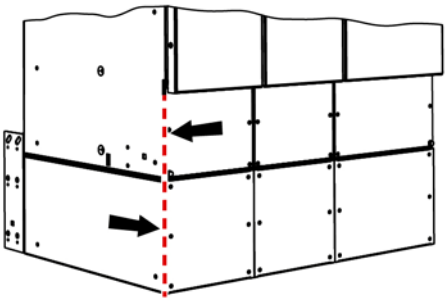


Fig. 39: Aligning the panel and the base

⇨ Remove the cable compartment cover, see page 132, "Removing and mounting the cable compartment cover".

⇨ Remove the cross member, see page 133, "Removing and mounting the cross member".

⇨ Interconnect the panels, see page 77, "Joining the panels"

Joining the base and the panel

⇨ In the front area of the cable compartment, join the switchgear frame and the base using 2 fixing clips. Mount the fixing clips with bolts M8.

⇨ In the rear area of the cable compartment, join the switchgear frame and the base using at least 4 fixing clips.

If a cooler of the pressure absorber system is mounted in the base, the two rear fixing clips cannot be mounted. In this case, mount the fixing clips at fixing points located more to the front. Mount the fixing clips with bolts M8.

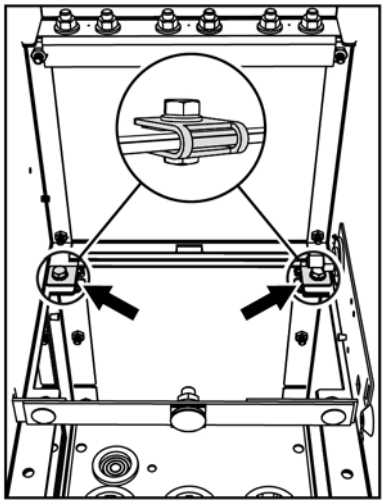


Fig. 40: Fixing clips (front)

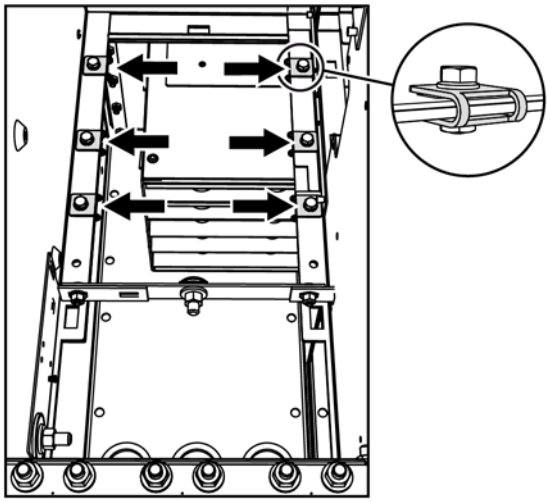
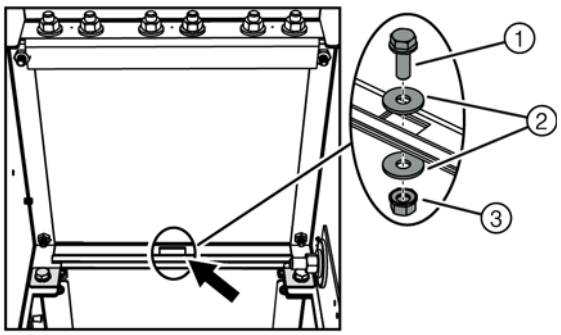


Fig. 41: Possible positions for fixing clips (rear)

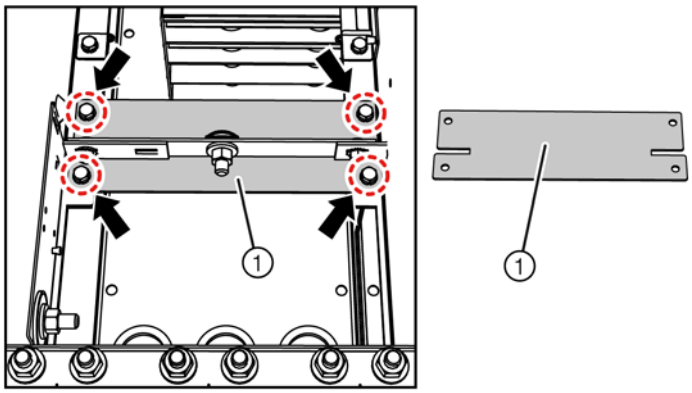
⇨ Bolt the base to the cross member using a bolt-and-washer assembly M8x25, a nut-and-washer assembly M8 and 2 conical spring washers.



① Bolt-and-washer assembly M8x25
② Conical spring washer (2x)
③ Nut-and-washer assembly M8

Fig. 42: Bolting the base to the cross member

⇨ Mount the tension brace on the base using 4 bolts M8.



① Tension brace

Fig. 43: Mounting the tension brace

Panels in wall-standing arrangement

⇨ **Only for panels in wall-standing arrangement (except metering panels):** Fasten the top unit for the pressure relief duct using 8 bolt-and-washer assemblies.

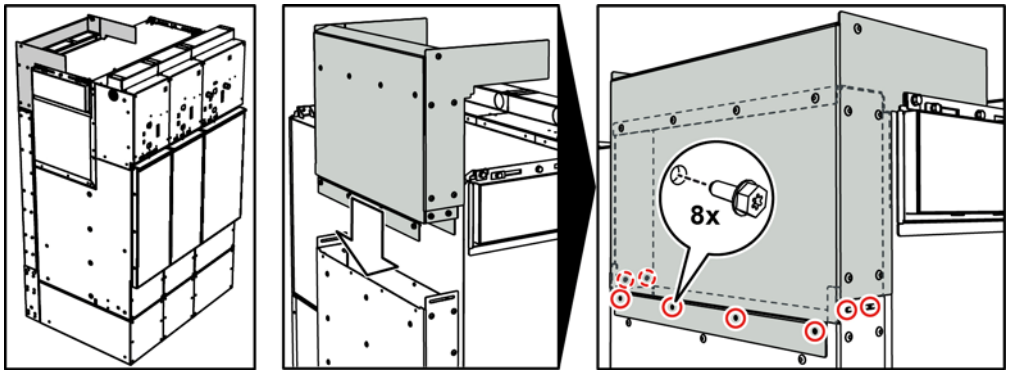


Fig. 44: Mounting the top unit

Mounting the cable bracket

⇨ Bolt the cable bracket ① , the adjustment rail and the cable clamps together using 4 self-tapping bolts M6. Tightening torque: 12 Nm.

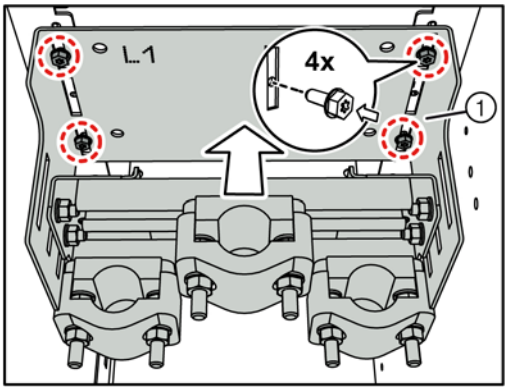


Fig. 45: Mounting the cable bracket (ring-main panel)

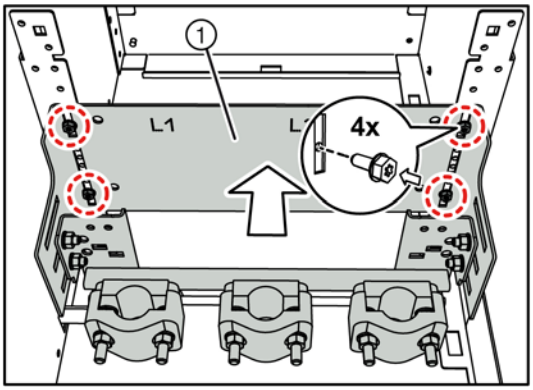


Fig. 46: Mounting the cable bracket (transformer panel)

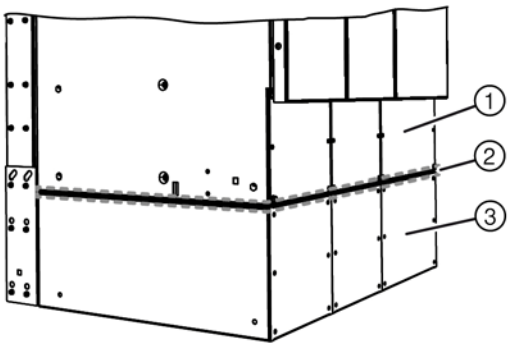
⇨ Mount the cross member, see page 133, "Removing and mounting the cross member".

⇨ Hook the cable compartment cover in, see page 132, "Removing and mounting the cable compartment cover".

⇨ From now, the high-voltage cables can be mounted.

Sealing the joint

⇨ Seal the joint between the switchgear and the base all around with silicone.

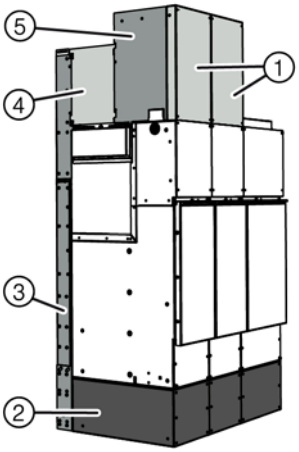
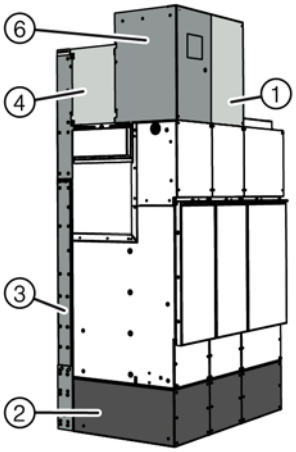
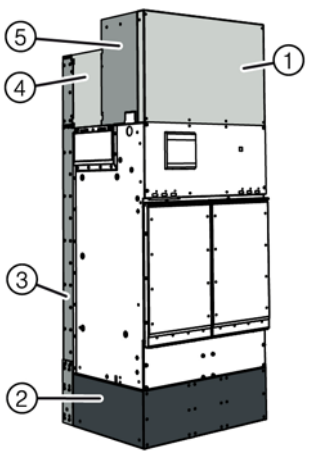


① Switchgear
② Joint
③ Base

Fig. 47: Sealing the joint

12.12 Installing the pressure absorber top unit (IAC up to 21 kA)

Versions of pressure absorber top units

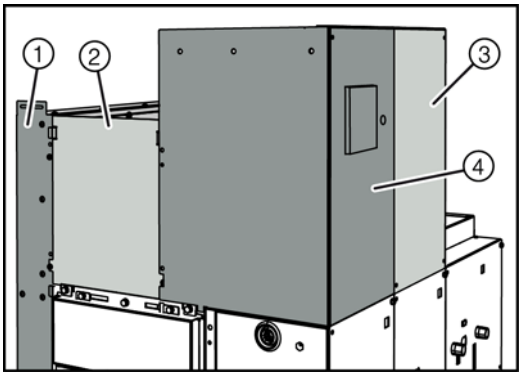
Pressure absorber top unit without low-voltage compartment	Pressure absorber top unit with low-voltage compartment	Pressure absorber top unit for metering panel
Panels in free-standing arrangement (except metering panels)		Metering panels in wall-standing and free-standing arrangement
		

① Front cover
② Base with pressure absorber
③ Pressure relief duct
④ Absorber collar
⑤ Lateral part
⑥ Low-voltage compartment (example)

Pressure absorber top unit with low-voltage compartment

If a low-voltage compartment must be mounted on the panels, then the low-voltage compartment replaces the fixing bracket, the front cover and the lateral part on the corresponding panel.

- ⇨ Remove the transport eyes and transport blocks, see page 77, "Joining the panels".
- ⇨ Install the low-voltage compartment, see page 91, "Installing the low-voltage compartment".
- ⇨ In the following assembly operations, bolt the front cover of the adjacent panel and the absorber collar together with the low-voltage compartment.



① Pressure relief duct
② Absorber collar
③ Front cover
④ Low-voltage compartment

Fig. 48: Pressure absorber top unit with low-voltage compartment (example)

Mounting the fixing bracket

⇨ Bolt the fixing brackets for the front cover to the roof plate.

Metering panels: Fasten both fixing points using 2 bolts M5.

Other panel types: Fasten only the interior fixing point using 1 bolt M5 each.

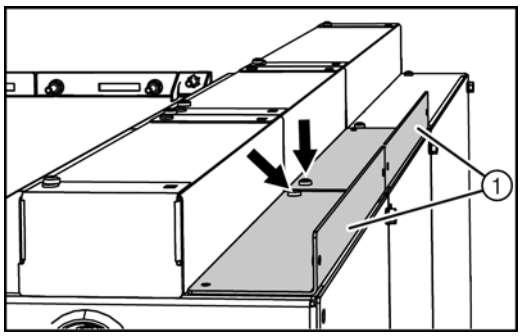


Fig. 49: Mounting the fixing bracket

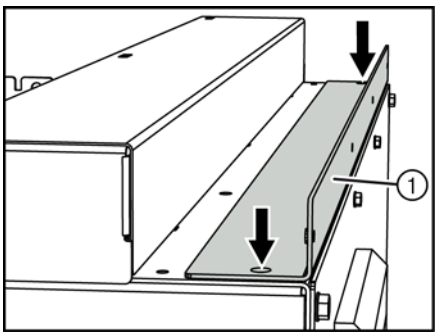


Fig. 50: Mounting the fixing bracket (metering panel)

① Fixing bracket

Mounting the front covers

For mounting the front covers, various options are possible.

Mounting the front cover on panels without low-voltage compartment (all panel types except metering panels):

⇨ Fasten the front covers and supports using one bolt M8, plain washer and hexagon nut.

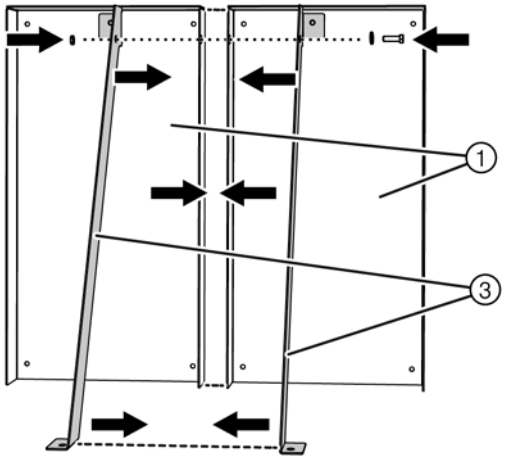


Fig. 51: Bolting the supports and the front covers together (view from the rear)

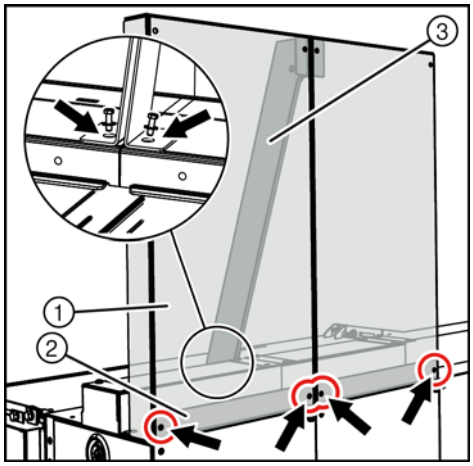


Fig. 52: Mounted front covers

① Front cover ② Fixing bracket ③ Supports

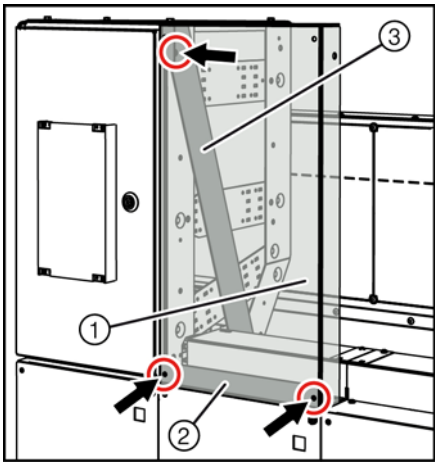
⇨ Bolt the front covers together with the fixing brackets. To do this, use 2 self-tapping bolts M6 with plastic washer each.

⇨ Fasten the supports of the front covers at the roof plate using one bolt M5 each.

Mounting the front cover to panels with low-voltage compartment (all panel types except metering panels):

⇨ Bolt the front cover together with the fixing bracket. To do this, use 2 bolts M6 with plastic washer.

⇨ Fasten the front cover and the support at the top of the low-voltage compartment using one bolt M8.

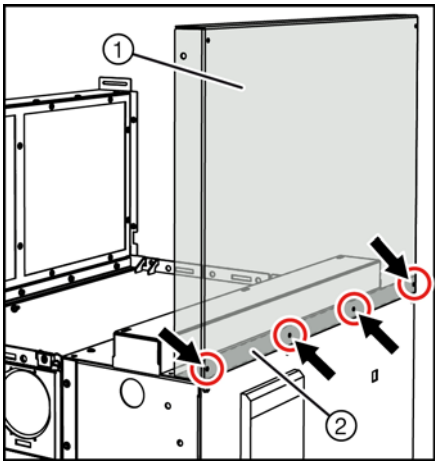


① Front cover
② Fixing bracket
③ Support

Fig. 53: Front cover mounted to panel with low-voltage compartment

Mounting the front cover on metering panels:

⇨ Bolt the front cover together with the fixing bracket. To do this, use 4 bolts M6 with plastic washer.



① Front cover
② Fixing bracket
③ Support

Fig. 54: Front cover mounted on metering panel

Mounting the front lateral parts

⇨ Fasten the front lateral parts at the left and right upper edge of the switchgear roof plate using 2 bolts M5 each. Bolt together with the respective front cover using one bolt M8.

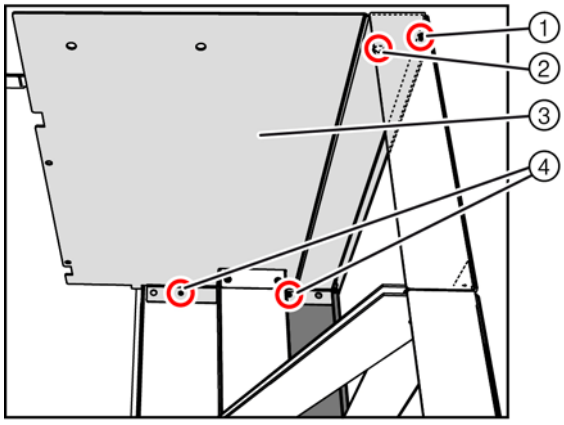


Fig. 55: Fixing points of front lateral parts

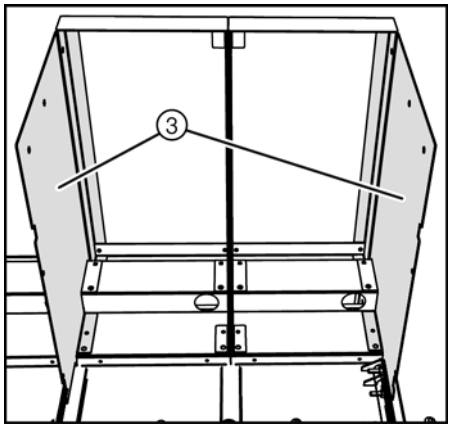


Fig. 56: Front lateral parts mounted (view from the rear)

① M6 bolt with plastic washer
② Bolt M8
③ Lateral part
④ Bolt M5 (2x)

Mounting the absorber collar

⇨ Insert the absorber collar on both sides between the pressure relief duct and the front lateral parts, and fasten with 4 bolts M6 each.

	NOTE
	If there are voltage transformers mounted on the busbar, the right-hand absorber collar ② cannot be mounted.

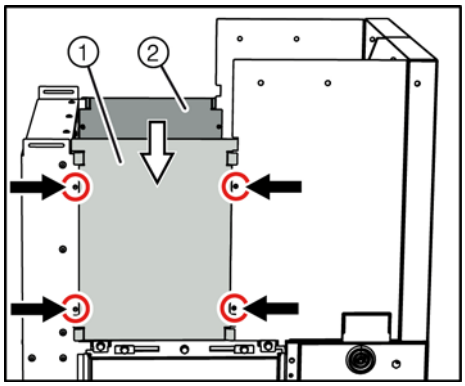


Fig. 57: Mounted absorber collar (panel width 2 x 310 mm)

① Left-hand absorber collar
② Right-hand absorber collar

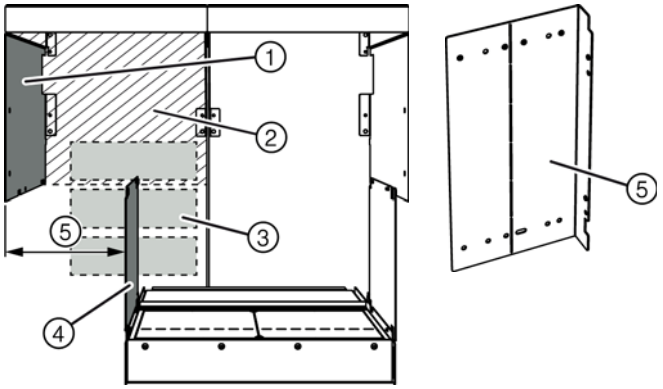
	NOTE
	If a panel group consisting of 2 panels is wider than 620 mm, there will be a gap on the right side between the absorber collar and the lateral part. In this case, fasten the right-hand absorber collar only at the fixing points located at the rear of the pressure relief duct. ⇨ To close the gap, mount offset plates between the right-hand absorber collar and the lateral part (see page 69, "Mounting the offset plates").

✔ The installation of the pressure absorber top unit on a 620 mm wide panel group is completed.

Mounting the offset plates

If a panel group consisting of 2 panels is wider than 620 mm, additional offset plates must be mounted at the pressure absorber top unit. The offset plates close the gap between the front lateral part and the absorber collar.

	NOTE
	Do not mount the offset plates: • If a low-voltage compartment ② is mounted. • If voltage transformers ③ are mounted at the busbar.



① Front lateral part
② Position of low-voltage compartment
③ Position of voltage transformer
④ Absorber collar
⑤ Installation dimension of offset plates
⑥ Offset plate (2x)

Shortening the offset plates

⇨ Measure the installation dimension ⑤ .

⇨ **If offset plates with an installation dimension between 120 mm and 190 mm are required:** Shorten both offset plates at the notches with a side cutter.

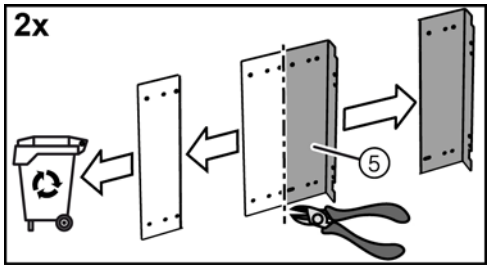


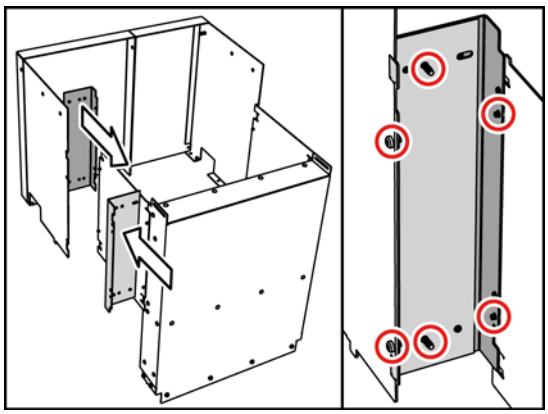
Fig. 58: Shortening the offset plates

Mounting the offset plates

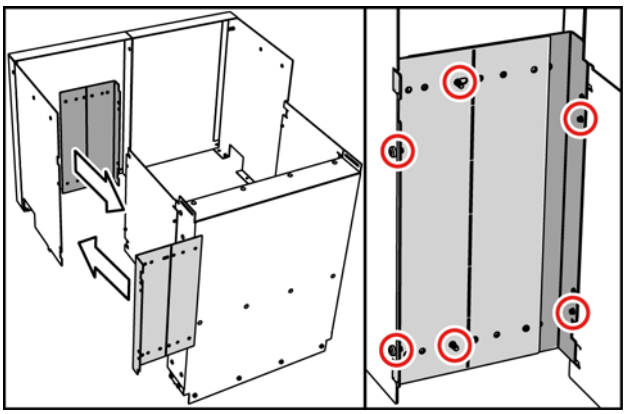
⇨ Fasten the offset plates between the absorber collar ④ and the lateral part ① using 4 self-tapping bolts M6.

⇨ Bolt the offset plates together using 2 self-tapping bolts M6.

Mounting the shortened offset plates
Installation dimension 120 mm to 190 mm



Mounting the offset plates
Installation dimension ≥ 190 mm



✔ The installation of the offset plates is completed.

12.13 Fastening the panel to the foundation

Switchgear fixing

Each panel or each panel block must be firmly bolted or welded together with the foundation of the switchgear room. The fastening and the foundation must absorb the stress arising from vibrations and faults such as a short circuit in the grid or internal arcing. The switchgear must not detach from the foundation as a result of such stress.

Depending on the type of fastening, the following work operations are required:

⇨ Bring the panel into position.

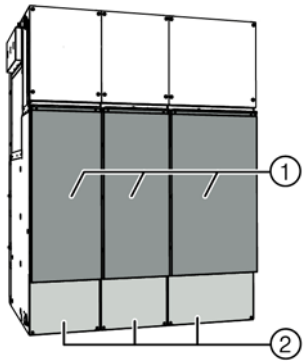
⇨ Remove the cable compartment cover, see page 132, "Removing and mounting the cable compartment cover".

ATTENTION

If the cross member was removed, the bracing required for the stability of the panel during movement is missing.

⇨ If the cross member is removed, do not move the panel.

⇨ If required, remove the cross member, see page 133, "Removing and mounting the cross member".



① Cable compartment cover
② Cross member

⇨ The panel must rest flush on the foundation; if necessary, lay shims underneath.

⇨ Prepare the foundation for fastening; e.g. mark holes and drill.

⇨ Remove pollution such as drilling dust or drilling chips.

⇨ Bolt or weld the panel to the foundation.

⇨ Protect welded seams against corrosion.

Fixing points

The panel frames have cutouts for fastening the panels, see page 72, "Floor openings and fixing points".

➪ Fasten the panels at the following fixing points using bolts M8 :

- Fasten end panels at least at 4 fixing points; 1 x at the front, 1 x at the rear, and 2 x laterally (see example).
- Fasten intermediate panels at least at 2 fixing points; 1 x at the front and 1 x at the rear (see example).
- Fasten air-insulated metering panels at **all available fixing points**.
- Fasten panels with floor covers at **all available fixing points**.

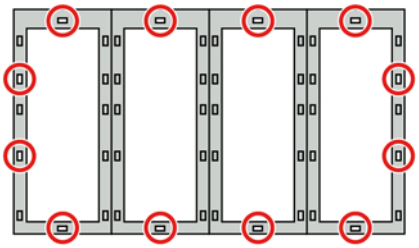


Fig. 59: Fixing points for end panels and intermediate panels (example)

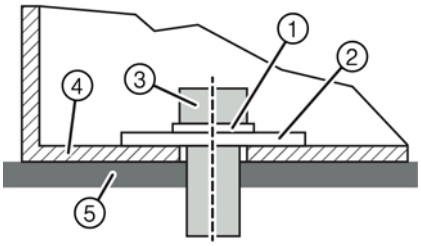


Fig. 60: Fastening the panel to the foundation

① Conical spring washer M8 (DIN 6796)
② 3D washer M10 (DIN EN ISO 7093)
③ Bolt M8
④ Panel frame
⑤ Foundation or foundation rail

12.14 Floor openings and fixing points

The following overviews show the required floor openings and fixing points for the different panel types and pressure relief methods.

Panels with a panel width of 310 mm have two recesses in the subframe for reasons of space. These recesses must be observed for planning the foundation.

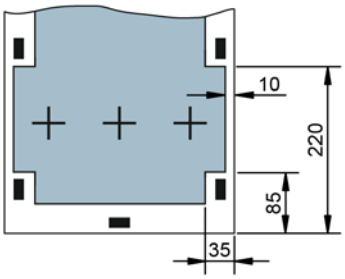
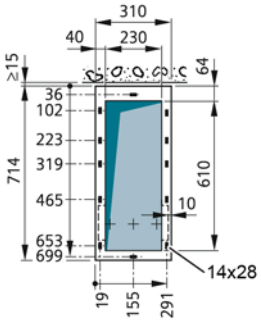
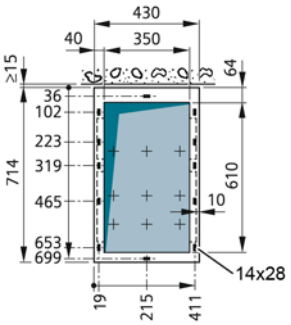
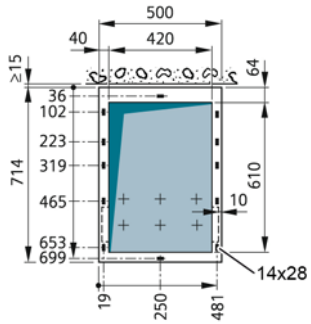
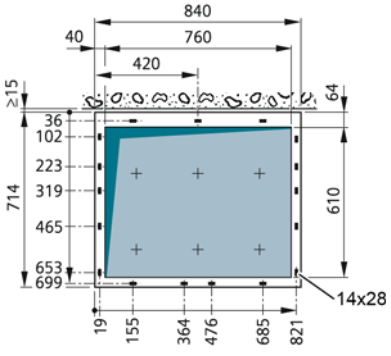


Fig. 61: Recess in the subframe

Floor openings and fixing points for standard individual panels

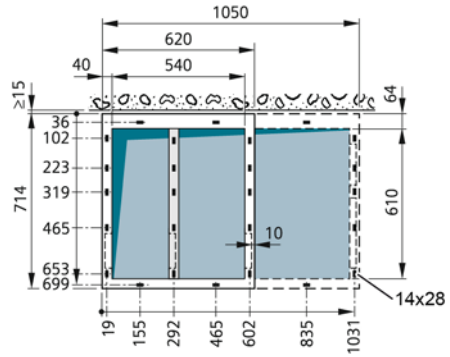
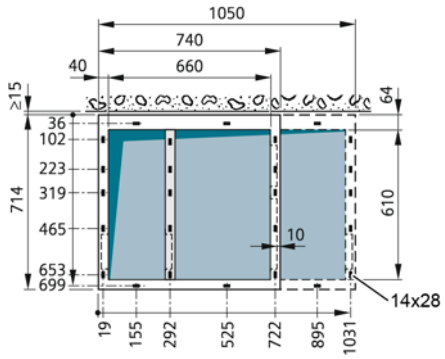
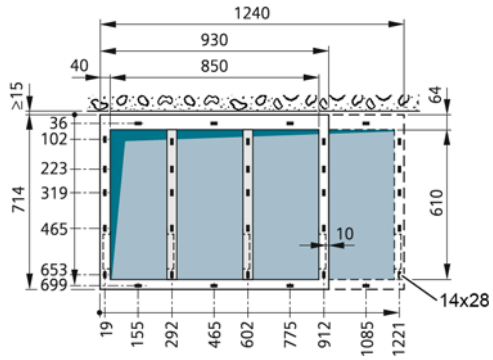
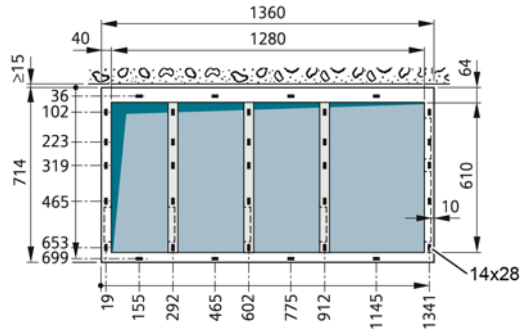
Dimension drawings for panel versions with double cables, deep cable compartment cover, or other versions can be ordered via the regional Siemens representative.

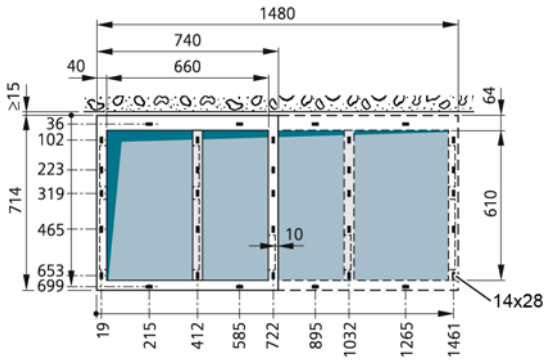
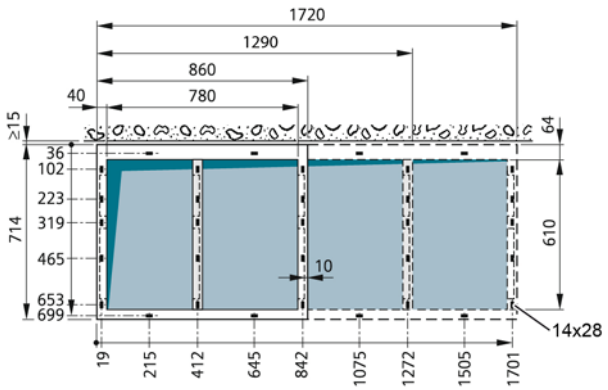
Panel width 310 mm	Panel width 430 mm
	
• Ring-main panel type R • Cable panel type K • Busbar earthing panel type E	• Cable panel with make-proof earthing switch type K(E) • Circuit-breaker panel type L • Transformer panel type T • Bus sectionalizer panel type S • Bus sectionalizer panel type H • Busbar voltage metering panel type M(430)

Panel width 500 mm	Panel width 840 mm
	
• Ring-main panel type R(500) • Circuit-breaker panel type L(500) • Busbar earthing panel type E(500) • Bus sectionalizer panel type S(500) • Bus sectionalizer panel type V • Busbar voltage metering panel type M(500)	• Billing metering panel type M

Panel blocks

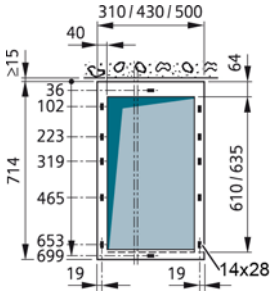
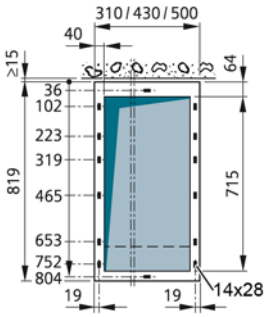
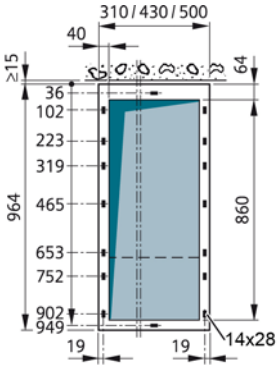
Dimension drawings for panel versions with double cables, deep cable compartment cover, or other versions can be ordered via the regional Siemens representative.

Dimension drawing	Panel block	Width
	RR RK KR	620 mm
	RRT RRL RRS RRH	1050 mm
	RT RL KT KL	740 mm
	RTR RLR	1050 mm
	RRR	930 mm
	RRRR	1240 mm
	RRRT RRRL RRRS RRRH	1360 mm

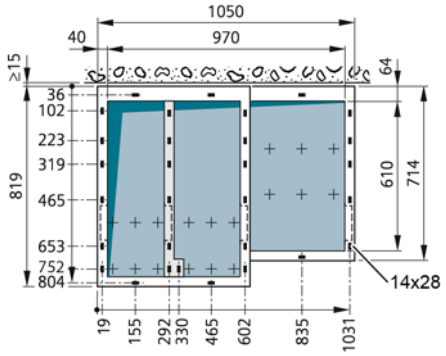
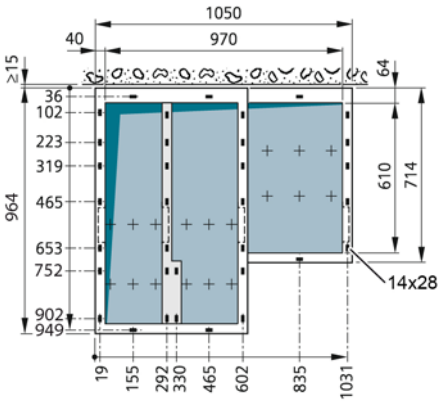
Dimension drawing	Panel block	Width
	TK LK TR LR	1480 mm
	TRRT LRRL	1290 mm
	K(E)T K(E)L TT LL	860 mm
	TTT LLL	1290 mm
	TTTT LLLL	1720 mm

Versions with deep cable compartment covers (e.g. for double cable connections)

Dimension drawings for other versions can be ordered via the regional Siemens representative.

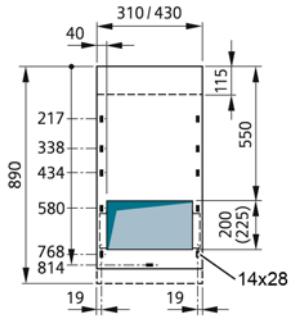
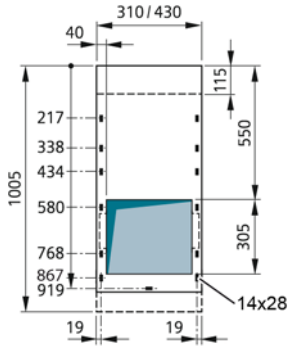
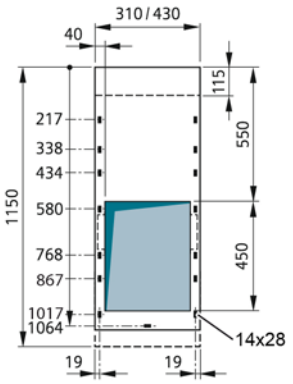
Panel width 310/430/500 mm		
Deep cable compartment cover without base extension	Deep cable compartment cover with base extension	
	Deeper by 105 mm	Deeper by 250 mm
		
	Floor opening depending on the selected cable connection/arrester	

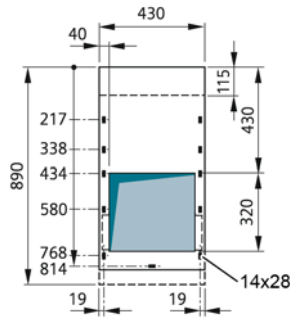
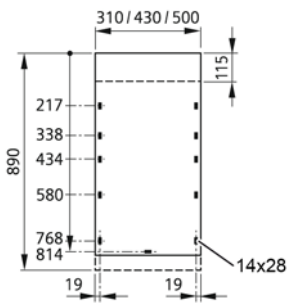
Example: Position of the floor openings and fixing points for double cable connection in panel blocks

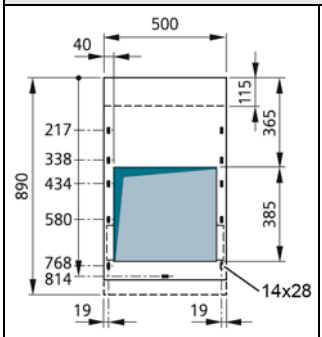
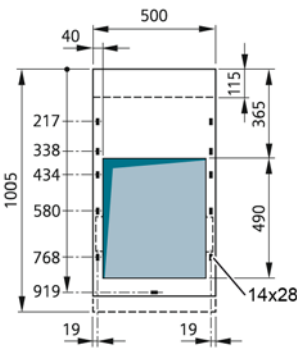
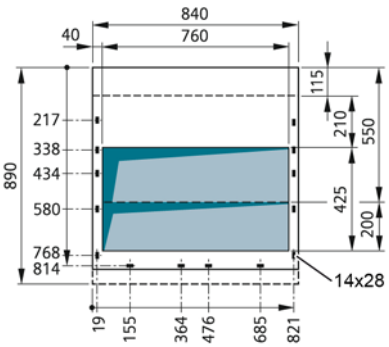
Panel width 1050 mm	
Type RRT deeper by 105 mm	Type RRT deeper by 250 mm
	

Versions combined with pressure absorbers and deep cable compartment covers

Dimension drawings for other versions can be ordered via the regional Siemens representative.

Panel width 310/430 mm		
		
• Ring-main panel type R • Cable panel type K • Cable panel with make-proof earthing switch type K(E) • Circuit-breaker panel type L		

Panel width 430 mm	Panel width 310/430/500 mm
	
• Transformer panel type T	• Panels without cable feeder, types S, H, V, M(430)/(500), E, E(500)

Panel width 500 mm		Panel width 840 mm
		
• Ring-main panel type R(500) • Circuit-breaker panel type L(500)		• Billing metering panel type M

12.15 Joining the panels

	**DANGER** High voltage! Danger! ⇨ Isolate. ⇨ Secure against reclosing. ⇨ Verify safe isolation from supply. ⇨ Earth and short-circuit. ⇨ Cover or barrier adjacent live parts.

	**DANGER** Risk of injury by release of charged operating springs when the front cover of the operating mechanism is removed! Bruises or cuts at the hands can be the consequence. ⇨ To avoid impermissible switching operations, switch off auxiliary voltage, e.g.: - Switch the auxiliary voltage supply of the motor. - Trip the MCB. - Disconnect the control cables from the low-voltage compartment. ⇨ To discharge the spring energy store in the operating mechanism, perform the following operations before removing the front cover: - Actuate the OFF pushbutton. - Actuate the ON pushbutton. - Actuate the OFF pushbutton. ⇨ The spring energy store indicator must show "spring not charged".

	**NOTE** To interconnect panels, there must be a sufficient distance between the wall and the panel to be lined up. ⇨ For necessary wall distances, see page 55, "Preparing the switchgear room".

Removing the transport eyes

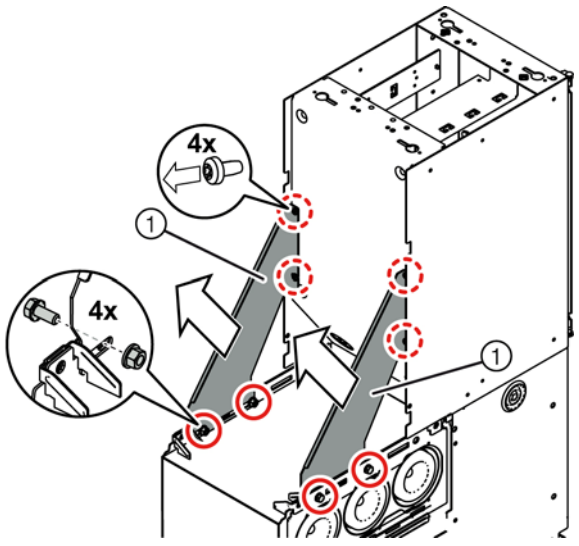
To interconnect panels, the transport eyes must be removed before.

⇨ Undo the fixing bolts of the transport eyes and remove the transport eyes.

Removing the transport blocks

On panels with pre-assembled low-voltage compartments, up to 2 transport blocks are mounted. The transport blocks can be removed for installing the switchgear.

⇨ Undo all bolts and nuts, and remove the transport blocks.



① Transport block

Fig. 62: Removing the transport blocks

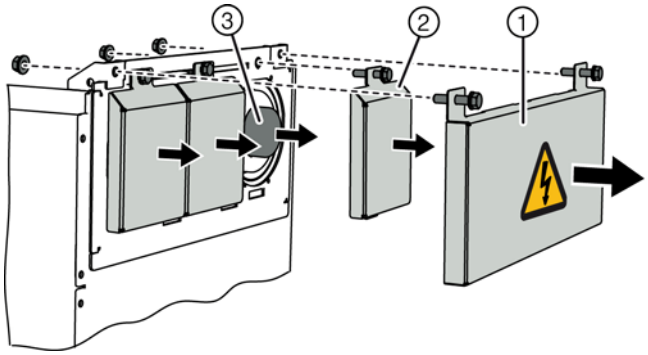
Preparing the end panel

To interconnect panels or panel blocks with an existing switchgear assembly, the following work must be executed in the respective end panel before:

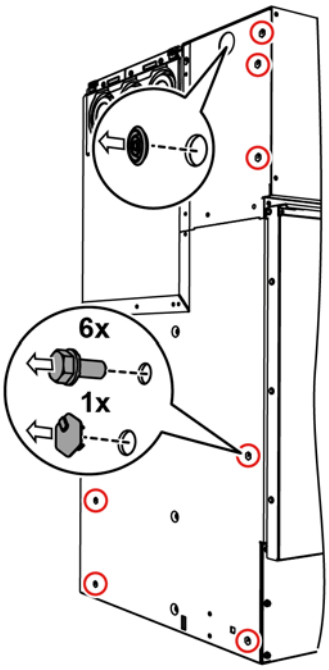
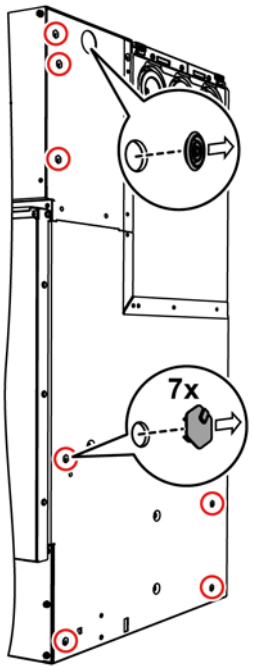
Removing the busbar termination:

⇨ Remove the busbar termination cover ① .

⇨ Remove 3 clamping covers for dummy plugs ② and silicone dummy plugs ③ .



⇨ Removing the cap, the sealing stoppers or bolt-and-washer assemblies from the side wall:

Left end panel	Right end panel
⇨ Undo 6 bolt-and-washer assemblies. ⇨ Remove 1 sealing stopper. ⇨ Remove the cap.	⇨ Remove 7 sealing stoppers. ⇨ Remove the cap.
	

Preparations for lining up

The first panel is on its mounting position and the others are placed at a small distance.

⇨ Align the first panel laterally.

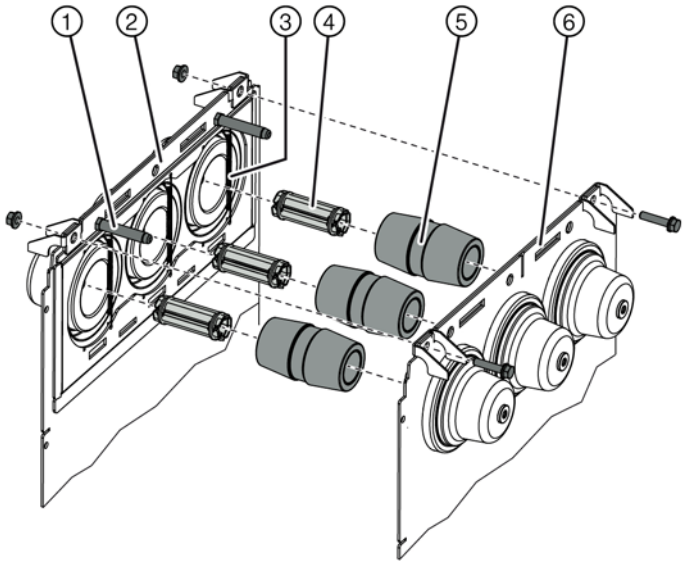
⇨ Compensate floor unevenness under the panel with shims.

✔ All panels must be in vertical position and at the same level.

	NOTE
	In panels with busbar coupling, continue with the installation here. For installation of panels **without** busbar coupling, see page 83, "Lining up panels without busbar coupling".

Lining up panels with busbar coupling

Panel interconnection is done via busbar couplings which compensate tolerances between adjacent panels by means of spherical fixed contacts and movable contact couplings.



① Guiding tension bolt
② Side wall of vessel, left-hand panel
③ Tension spring for earthing
④ Contact coupling
⑤ Silicone coupling
⑥ Side wall of vessel, right-hand panel

Fig. 63: Principle of installation for busbar coupling

	ATTENTION
	Remove the protective caps used for transport from the busbar bushes. Do not damage the busbar bushes. ⇨ Do not use any pointed or sharp-edged objects as aids to remove the protective caps. ⇨ The protective caps are only used as transport protection. **Do not use the protective caps as surge-proof caps.**

⇨ Remove the protective caps ① from the busbar bushes.

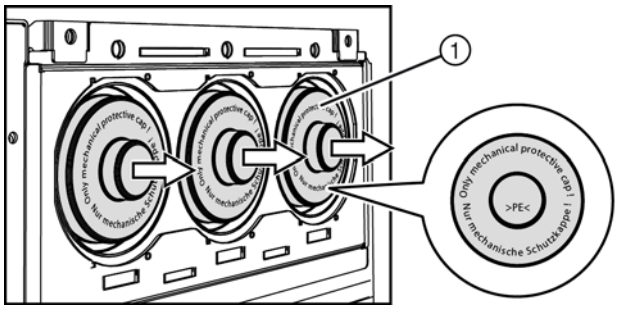
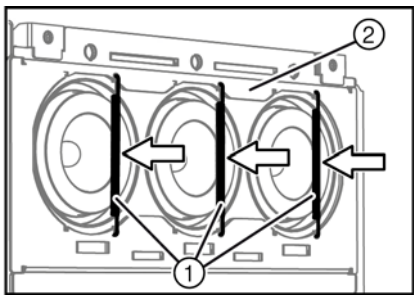


Fig. 64: Removing the protective caps

Preparing the left-hand panel

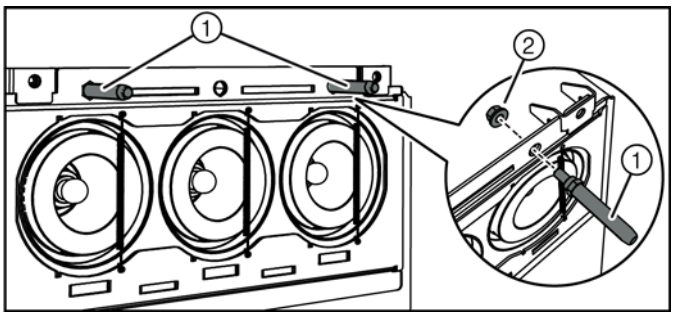
⇨ If they have not been pre-assembled at the factory, hook the tension springs for earthing into the clamping plate.



① Tension springs for earthing
② Clamping plate

Fig. 65: Mounting the tension springs for earthing

⇨ Insert the guiding tension bolts ① into the two openings in the clamping plate, and tighten with nut-and-washer assemblies ② . Tightening torque: 30 Nm.



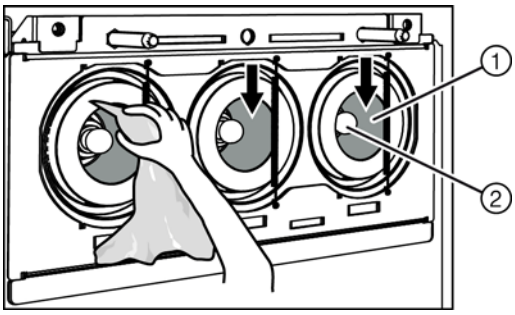
① Guiding tension bolt
② Nut-and-washer assembly

Fig. 66: Mounting the guiding tension bolts

	**ATTENTION**
	Mounting paste deteriorates the conductivity of the contact bolt. ⇨ **Do not apply mounting paste** to the contact bolt.

⇨ Clean the busbar bushes carefully inside with a lint-free wiping cloth. Use the supplied mounting paste as cleaning agent.

⇨ Clean the contact bolts carefully with a lint-free wiping cloth **without mounting paste**.



① Busbar bush
② Contact bolt

Fig. 67: Cleaning the busbar bushes

	**ATTENTION**
	Incorrectly inserted contact couplings can damage the switchgear. ⇨ Make sure that the contact couplings are seated in the busbar bush completely and centrally.

⇨ Push the 3 contact couplings ① completely into the busbar bushes as far as they will go. The contact couplings must be located centrally in the busbar bushes.

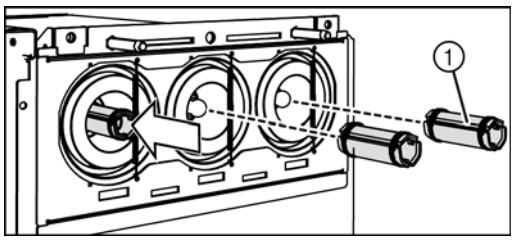


Fig. 68: Inserting the contact couplings

Fig. 69: Incorrectly inserted contact coupling

Preparing the silicone coupling

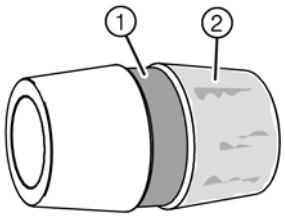
⇨ The silicone couplings are equipped with insertable sleeves at the factory.

	**ATTENTION** Observe extreme cleanliness. ⇨ Make sure that the insertable sleeves and silicone couplings are free of grease and pollution.

⇨ Clean the surfaces of the silicone couplings carefully.

⇨ Apply mounting paste evenly, thinly and all around to a high-quality joint of the silicone coupling. Apply mounting paste only to one side of the silicone coupling.

	**ATTENTION** If the electrical contact is insufficient or the high-quality joints are dirty, the busbars will be damaged during operation. ⇨ Do **not** apply mounting paste to the external layer of conductive varnish of the silicone coupling.



① External layer of conductive varnish
② High-quality joint with mounting paste

Fig. 70: Silicone coupling with mounting paste

	**NOTE** To simplify installation: ⇨ Turn the silicone coupling slightly while inserting. ⇨ Push the tension spring for earthing to the side.

Inserting the silicone couplings

⇨ Insert the silicone coupling - with the side previously coated with mounting paste - into the busbar bush as far as it will go.

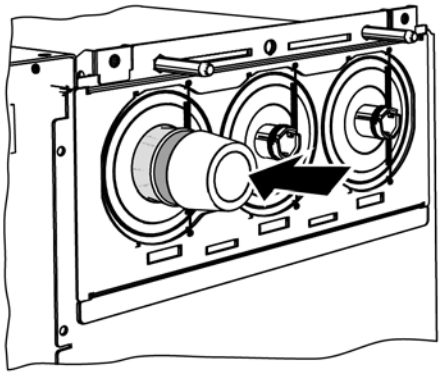


Fig. 71: Inserting the silicone coupling

⇨ The tension spring for earthing must touch the conductive layer of the silicone coupling (visual check).

⇨ Apply mounting paste on 2 other silicone couplings, and insert them into the busbar bushes in the same way.

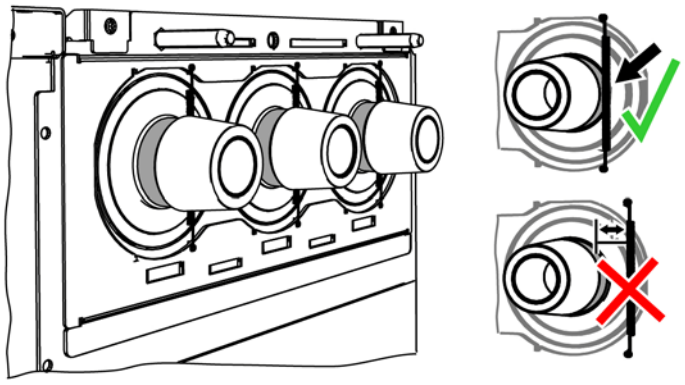


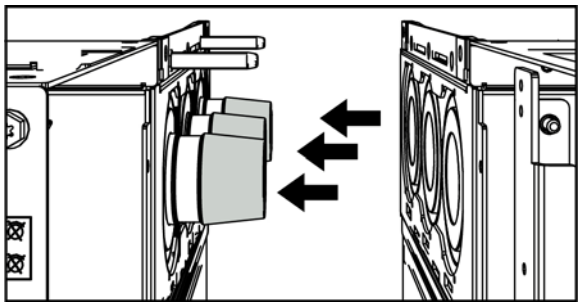
Fig. 72: Silicone couplings inserted correctly

Lining up the panel

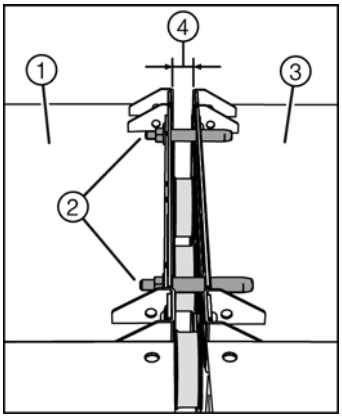
⇨ Carefully clean the busbar bushes of the panel to be lined up.

⇨ Apply mounting paste to the full surface of the high-quality joints of the silicone couplings.

⇨ Approach the panel to be lined up to the fixed-mounted panel.



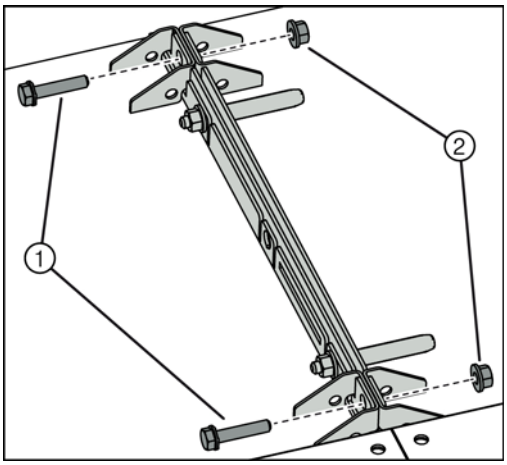
⇨ Thread the guiding tension bolts ② into the clamping plate in the panel to be lined up, until the distance ④ between the two panels is approx. 30 mm.



① Left-hand panel
② Guiding tension bolt
③ Right-hand panel
④ Distance approx. 30 mm

Fig. 73: Guiding tension bolt threaded into the clamping plate

⇨ Interconnect the two panels with 2 panel connecting bolts M8x40 at the upper panel connection, but **do not bolt tight**.



① Panel connecting bolt (bolt-and-washer assembly M8x40)
② Nut-and-washer assembly M8

Fig. 74: Fitting the upper panel connecting bolts

	NOTE
	For further installation of panels **with** busbar coupling, see page 84, "Bolting panels together".

Lining up panels without busbar coupling

Vessel adapters

For panels without busbar coupling, a gap between the side walls of the gas-filled switchgear vessels results during the interconnection. To compensate this gap, vessel adapters must be inserted between the panels. The extension kit contains 2 vessel adapters.

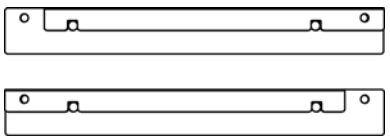


Fig. 75: Vessel adapters

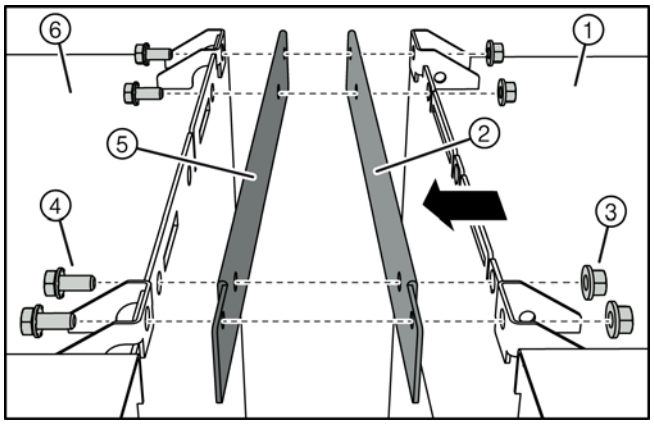
⇨ If **one** of the panels is equipped with a switchgear vessel, insert **one** vessel adapter between the panels.

⇨ If **both** of the panels are equipped with a switchgear vessel, insert **both** vessel adapters between the panels.

Mounting position of the vessel adapter: The folded edge of the vessel adapter must point towards the switchgear vessel.

Lining up the panel

⇨ Approach the panel to be lined up to the fixed-mounted panel.



① Right-hand panel
② Vessel adapter for right-hand panel (option)
③ Nut-and-washer assembly M8 (4x)
④ Bolt-and-washer assembly M8x40 (4x)
⑤ Vessel adapter for left-hand panel (option)
⑥ Left-hand panel

Fig. 76: Lining up the panel

⇨ Interconnect the panels with 4 panel connecting bolts (bolt-and-washer assemblies M8x40) at the upper panel connection, **but do not bolt tight yet**.

If required, bolt the vessel adapter tight between the two panels.

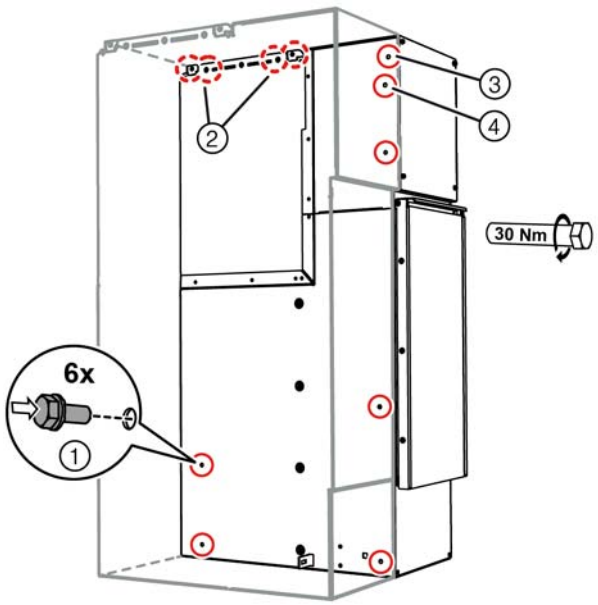
Bolting panels together

	**ATTENTION**
	Setnuts may be fastened at the bolted joints in the left-hand panel. ⇨ Remove the setnuts before bolting the panels together.

⇨ Tighten the 6 panel connecting bolts ① evenly together with the panel connecting bolts at the clamping plate ② until both panels are joined without any gaps (tightening torque: 30 Nm).

Screw each of the panel connecting bolts from the left-hand panel to the right-hand panel into the setnuts provided for this purpose.

Make sure that there is a uniform distance between the panels.



Panel connecting bolts
① Bolt-and-washer assemblies M8x20 (6x)
② Bolt-and-washer assemblies M8x40 at the clamping plate (2x or 4x)
③ Only bolt together in case of circuit-breaker panel type L1.1
④ Bolt together in all panel types except for circuit-breaker panel type L1.1

Bolted joint

Fig. 77: Bolted joints for the panel interconnection

⇨ If available, bolt the bases for the pressure absorber system together (see page 60, "Mounting the pressure relief duct and the base").

⇨ If available, bolt the low-voltage compartments of adjacent panels together using 4 bolt-and-washer assemblies and nut-and-washer assemblies M8.

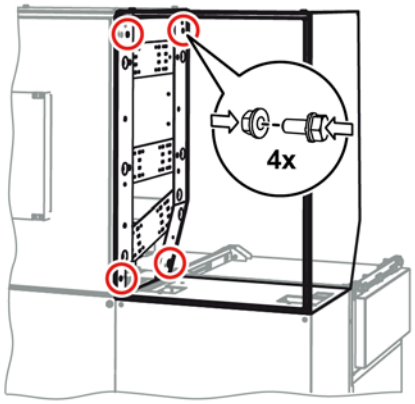


Fig. 78: Bolting the low-voltage compartments together

⇨ Interconnect the earthing busbars of the panels, see page 90, "Interconnecting the earthing busbars".

⇨ Bolt the lined up panel to the foundation, see page 55, "Preparing the switchgear room".

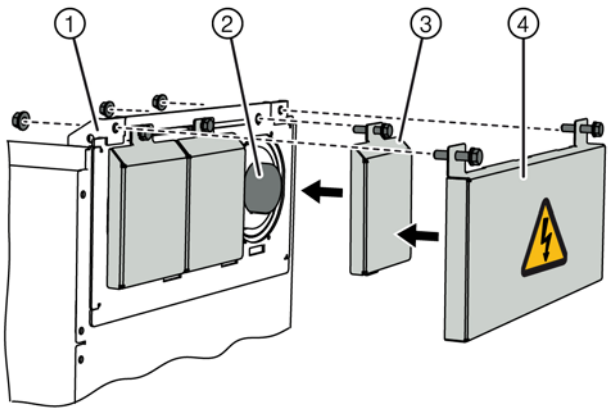
⇨ Hook the removed cable compartment covers in, see page 132, "Removing and mounting the cable compartment cover".

⇨ Interconnect all other panels in the same way.

✔ The panels are interconnected.

12.16 Installing the busbar termination

On free busbar ends, screened silicone dummy plugs are inserted, each of which is pressed on through a clamping cover for dummy plugs. A busbar termination cover is fastened over all three dummy plugs.



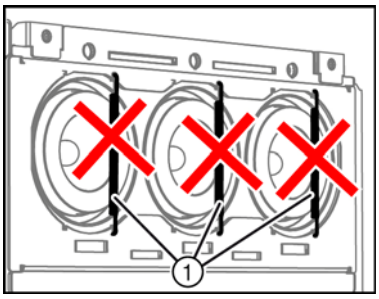
① Side wall of vessel
② Silicone dummy plug
③ Clamping cover for dummy plugs
④ Busbar termination cover

Fig. 79: Principle of installation for busbar termination

Preparing installation

The busbar couplings can be equipped with tension springs for earthing.

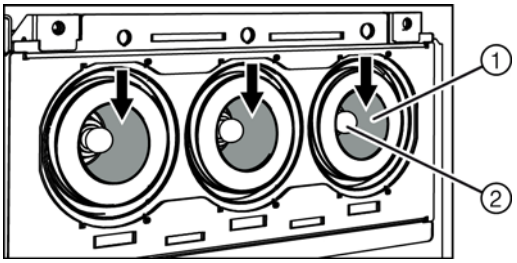
⇨ Remove the tension springs for earthing on all 3 phases.



① Tension springs for earthing

⇨ Clean the busbar bushes carefully inside with a lint-free wiping cloth. Use the supplied mounting paste as cleaning agent.

⇨ Clean the contact bolts carefully with a lint-free wiping cloth without mounting paste.



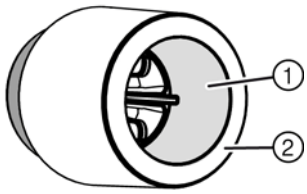
① Busbar bush
② Contact bolt

Preparing the silicone dummy plugs

⇨ The silicone dummy plugs are equipped with insertable sleeves at the factory.

	**ATTENTION**
	Observe extreme cleanliness. ⇨ The insertable sleeve and the silicone dummy plug must be free of pollution and grease.

⇨ Clean the surface of the silicone dummy plug and the insertable sleeve carefully.

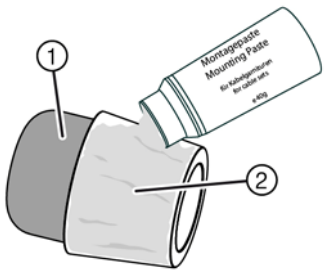


① Insertable sleeve
② Silicone dummy plug

Fig. 80: Silicone dummy plug with insertable sleeve

	**ATTENTION**
	If the electrical contact is insufficient or the contact surfaces are dirty, the semi-conductive layer of the silicone dummy plug loses its conductivity. This can damage the silicone dummy plug during operation. ⇨ Do **not** apply mounting paste to the layer of conductive varnish ① of the silicone dummy plug.

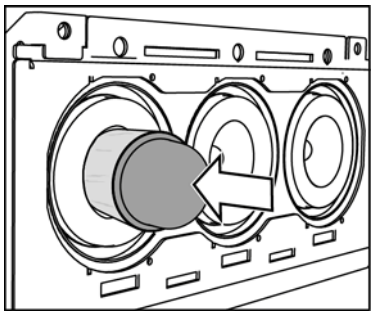
⇨ Apply the **supplied** mounting paste uniformly to the high-quality joint of the silicone dummy plug.



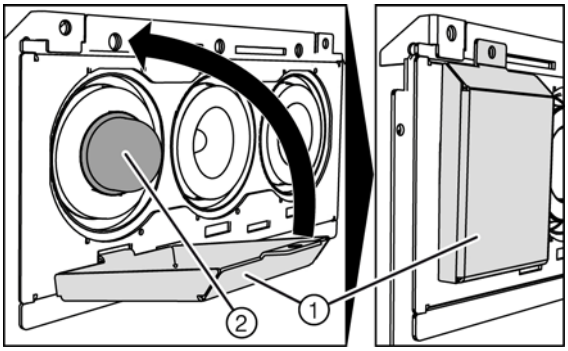
① Layer of conductive varnish
② High-quality joint

Closing the busbar in a surge-proof way

⇨ Insert the silicone dummy plug into the busbar bush with a slight rotary movement, and hold it.



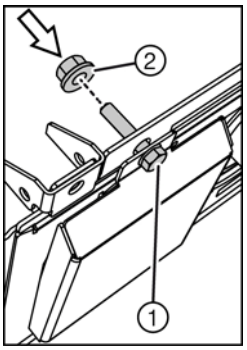
⇨ Hook the clamping cover for dummy plugs into the clamping plate at the bottom.



① Clamping cover for dummy plugs
② Silicone dummy plug

Fig. 81: Mounting the clamping cover for dummy plugs

⇨ Press the clamping cover for dummy plugs onto the clamping plate, and fix it with the nut-and-washer assembly M8 and the bolt-and-washer assembly M8x20.



① Bolt-and-washer assembly M8x20
② Nut-and-washer assembly M8

Fig. 82: Fastening the clamping cover for dummy plugs

⇨ Bolt the clamping cover for dummy plugs tight (tightening torque: 30 Nm); the dummy plug will be fixed at the same time.

⇨ Mount the dummy plugs and the clamping covers for dummy plugs on the other two phases analogously.

⇨ Mount the busbar termination cover on the clamping plate (tightening torque: 30 Nm).
Hook the busbar termination cover into the clamping plate at the bottom, and fasten it at the top.

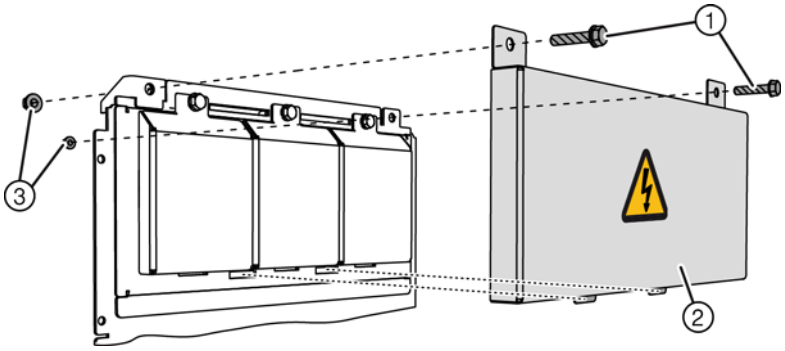
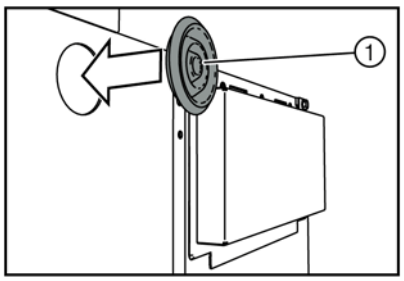


Fig. 83: Mounting the busbar termination cover

① Bolt-and-washer assembly M8x30
② Busbar termination cover
③ Nut-and-washer assembly M8

Inserting the cap

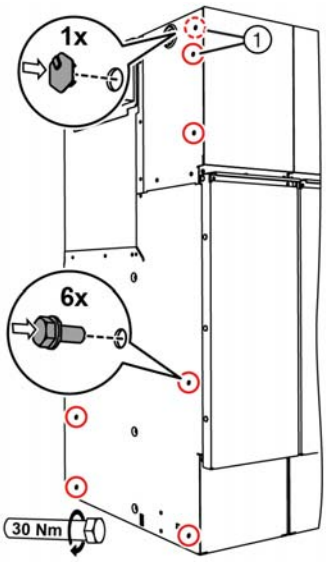
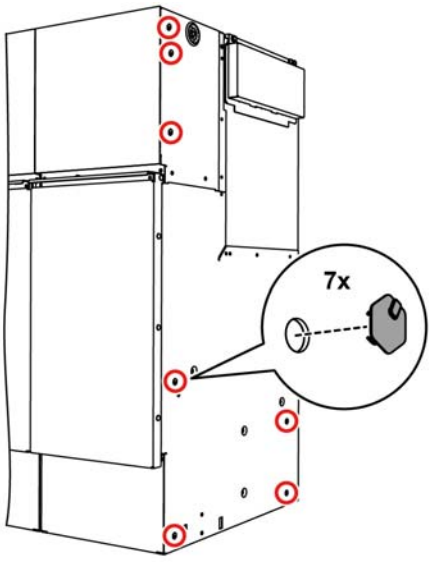
⇨ Insert the cap into the opening of the side wall.



① Cap

Completing installation

⇨ Depending on the position of the end panel, close the openings with sealing stoppers or bolt-and-washer assemblies.

Left end panel	Right end panel
⇨ Screw 6 bolt-and washer assemblies M8x20 into the side wall (tightening torque: 30 Nm). ⇨ Insert a sealing stopper into the side wall. **NOTE:** For circuit-breaker panel type L1.1, mount the bolt-and-washer assembly and the sealing stopper inversely at position ① .	⇨ Insert 7 sealing stoppers into the side wall.
	

✔ The installation of the busbar termination is completed.

12.17 Earthing the switchgear

Non-extendable switchgear

A non-extendable switchgear is connected to the substation earth through an earthing point.

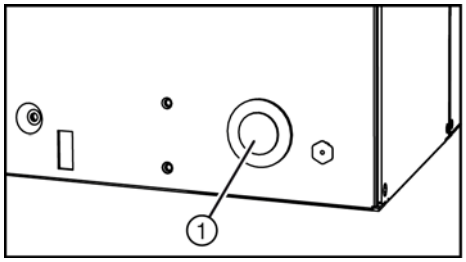


Fig. 84: Earthing point (view from outside)

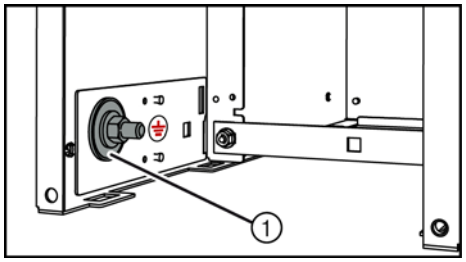
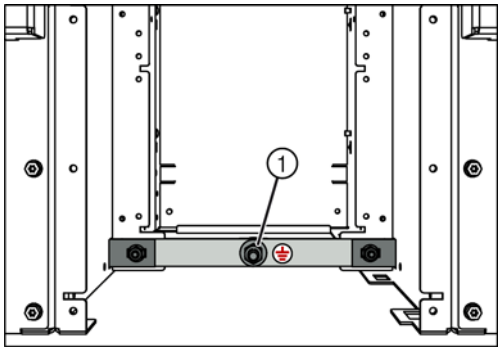


Fig. 85: Earthing point (view into cable compartment)

① Earthing point (earthing bolt M12)

Extendable switchgear

In extendable switchgear assemblies, earthing is done via one of the earthing points at the earthing busbar.



① Earthing point (earthing bolt M12)

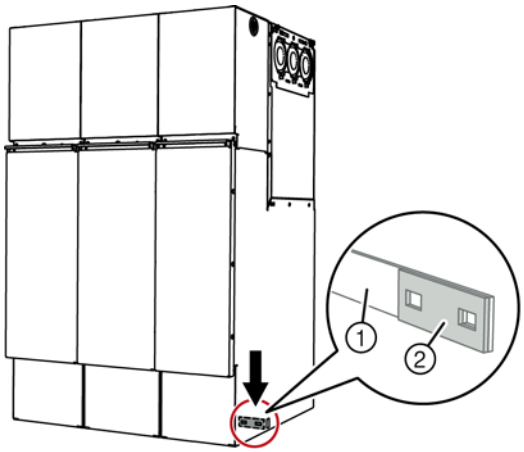
Fig. 86: Earthing point at the earthing busbar

- ⇨ Connect the earthing point ① with the substation earth.
- ⇨ Connect each panel block or panel group of max. 4 panels once with the substation earth.
- ⇨ In panel groups comprising more than 4 panels, connect each fifth panel with the substation earth.
- ⇨ Bolt together all units of the earthing busbars in the complete switchgear assembly (see page 90, "Interconnecting the earthing busbars").

12.18 Interconnecting the earthing busbars

The units of the earthing busbar must be interconnected at the joints of the panel blocks or individual panels.

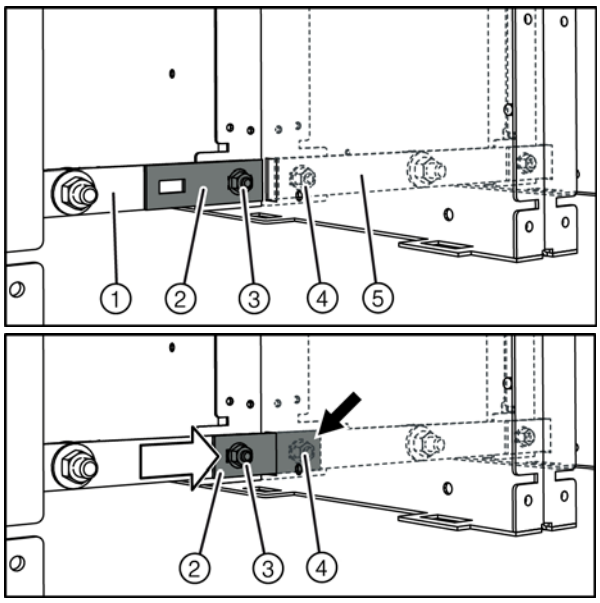
The earthing busbars are interconnected with a link. The link is pre-assembled on the earthing busbar as standard.



① Earthing busbar
② Link

Fig. 87: Position of the earthing busbar

Interconnecting the earthing busbars



① Earthing busbar (left-hand panel)
② Link
③ Bolted joint of the link (left-hand panel)
④ Bolted joint of the link (right-hand panel)
⑤ Earthing busbar (right-hand panel)

Fig. 88: Interconnecting the earthing busbars

⇨ Remove the bolted joints ③ and ④ of the link.

⇨ Brush the oxidized copper surfaces or the earthing busbars ① and ⑤ , and apply a thin film of the supplied mounting paste.

⇨ Push the link ② through the opening in the side wall, and bolt it together with both units of the earthing busbar.

⇨ Bolt together all other units of the earthing busbar of the complete switchgear assembly in the same way.

✔ The earthing busbars of the complete switchgear assembly are interconnected.

⇨ Install the removed cable brackets in all panels again.

12.19 Installing the low-voltage compartment

As standard, the low-voltage compartment is pre-assembled on the associated panel. Depending on the design of the respective panel, the low-voltage compartment can also be delivered separately.

Low-voltage compartment delivered separately

Before setting down the low-voltage compartment on the panel roof:

⇨ Lead the low-voltage cables into the low-voltage compartment through the cutouts in the panel roof.

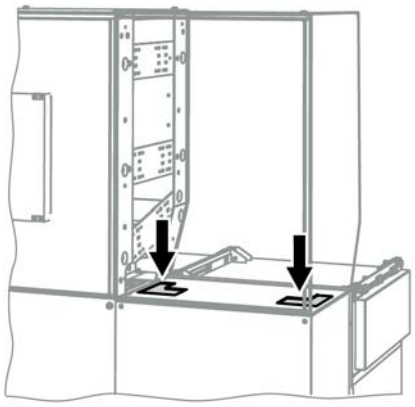


Fig. 89: Cutouts for low-voltage cables

⇨ Place the low-voltage compartment onto the roof of the associated panel.

⇨ Bolt the low-voltage compartment onto the roof plate of the panel using 4 bolt-and-washer assemblies M8.

⇨ Bolt the low-voltage compartment together with the low-voltage compartment in the adjacent panel using 4 bolt-and-washer assemblies and nut-and-washer assemblies M8.

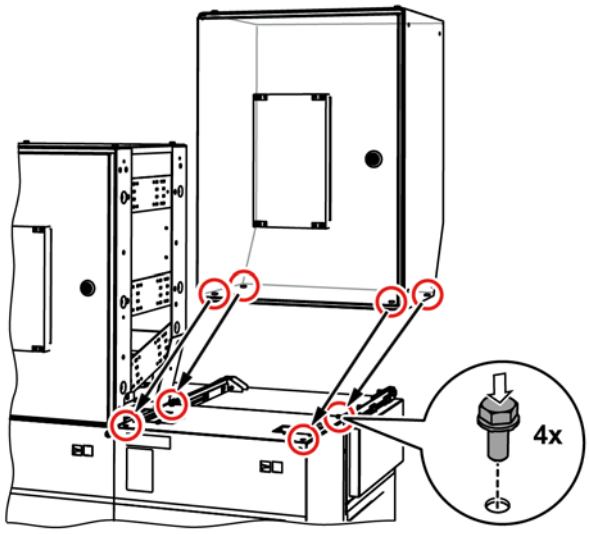


Fig. 90: Bolting the low-voltage compartment together with the panel

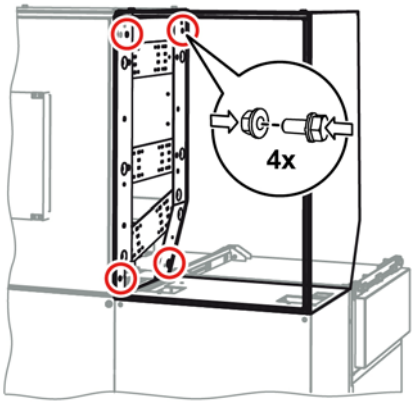


Fig. 91: Bolting the low-voltage compartments together

⇨ Connect the low-voltage cables according to the circuit diagram.

13 Installation of billing metering panel type M

13.1 Overview: Possibilities of connection for current and voltage transformers in the billing metering panel type M

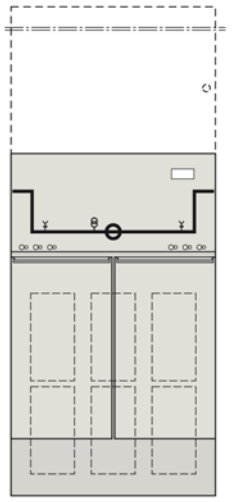


Fig. 92: Metering panel type busbar-busbar

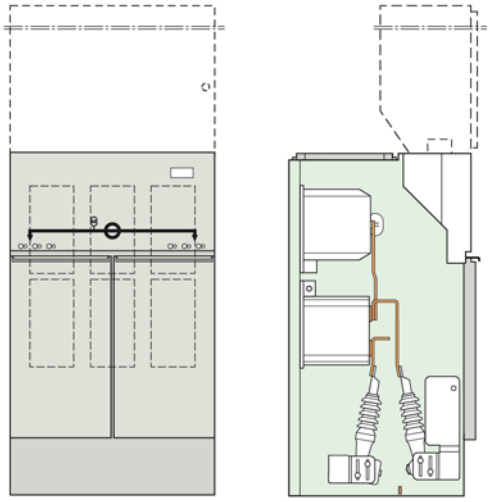


Fig. 93: Metering panel type cable-cable

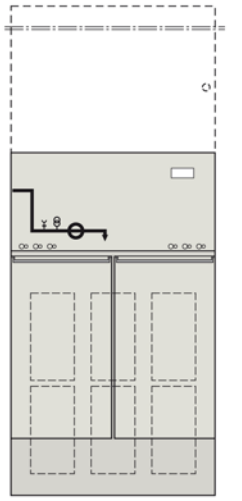


Fig. 94: Metering panel type busbar-cable

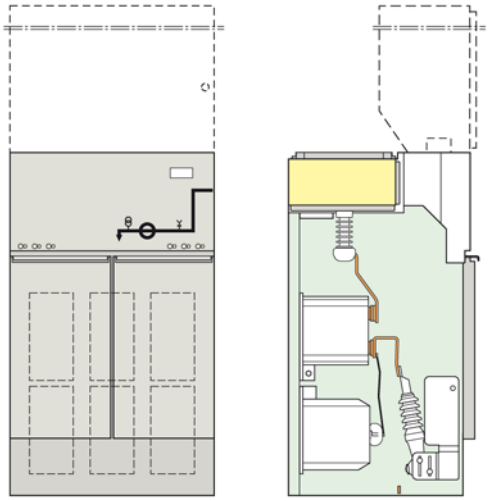
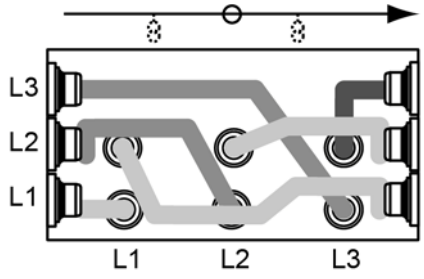
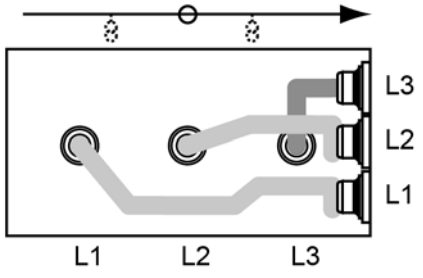
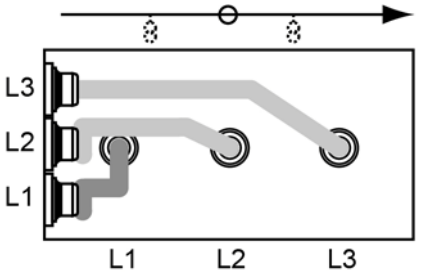


Fig. 95: Metering panel type cable-busbar

13.2 Routing of currents and bars in the metering panel

The direction of the current flow in the metering panel is from the left to the right side of the switchgear. The voltage transformers can be connected upstream or downstream from the current transformers.

Top view into the open vessel with the bushings and the busbars		
Metering panel type **busbar-busbar**	Metering panel type **cable-busbar**	Metering panel type **busbar-cable**
		

13.3 Installing instrument transformers in the metering panel

	**ATTENTION** To avoid personal and material damages, only instrument transformers complying with the following standards may be used untested: ⇨ Dimensions according to DIN 42600-8 for current transformers 4MA7 ⇨ Dimensions according to DIN 42600-9 for voltage transformers 4MR

Removing the cable compartment cover

⇨ Remove the cable compartment covers in the metering panel, see page 132, "Removing and mounting the cable compartment cover".

Removing the cross member

⇨ Remove the cross member in the metering panel, see page 133, "Removing and mounting the cross member".

Mounting the C-rail

⇨ Bolt 2 Z-angles to the C-rail at the sides. The mounting position of the Z-angles depends on the switchgear version:

- Switchgear version for 12 kV: Mount Z-angle turned to the front (①).
- Switchgear version for 24 kV: Mount Z-angle turned to the rear (②).

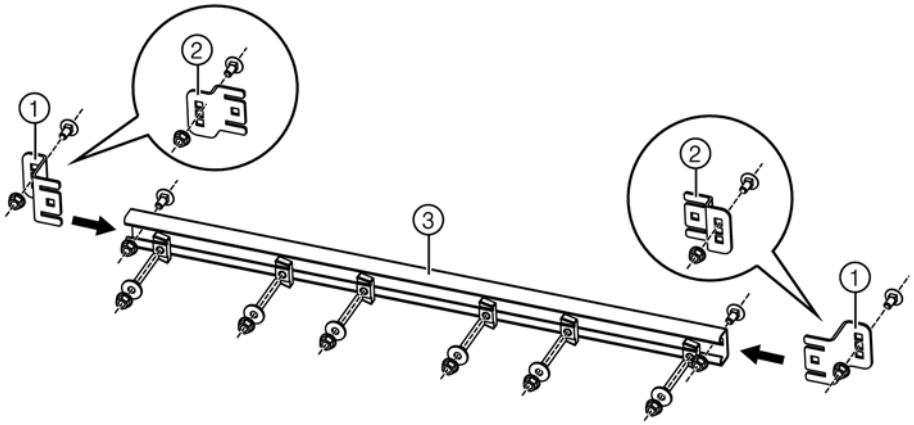
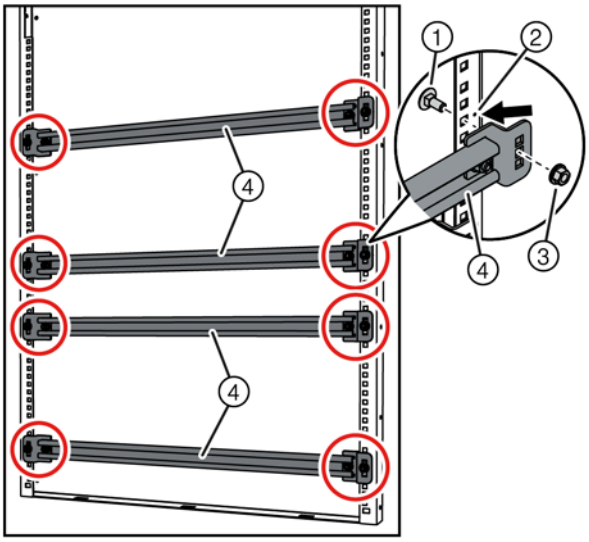


Fig. 96: Mounting position of the C-rail

① Mounting position of the Z-angle for 12 kV
② Mounting position of the Z-angle for 24 kV
③ C-rail

	**NOTE** The prick-punch point at the switchgear rear wall only applies to small instrument transformer types according to DIN 42600-8 and DIN 42600-9. For other instrument transformer types, the specified dimensions and mounting positions must be observed (see page 95, "Dimensions and mounting positions of instrument transformers in the metering panel").

⇨ Fasten the 4 C-rails to the rear wall of the switchgear at the sides using Z-angles. The position of the C-rail is marked at the side of the switchgear rear wall by means of a prick-punch point.



① Cup head square neck bolt M8
② Prick-punch point for the C-rail position
③ Nut-and-washer assembly M8
④ C-rail with Z-angle

Fig. 97: Mounting the C-rails

Mounting the instrument transformers on the C-rails

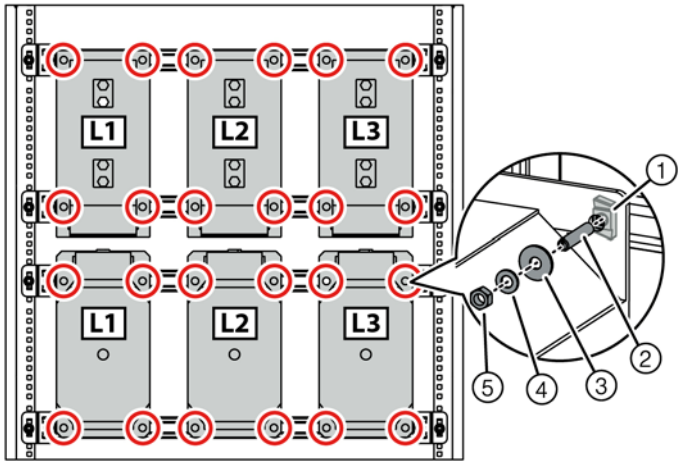
	**ATTENTION**
	Risk of injury due to high weight of the voltage transformer. ⇨ Use an appropriate lifting tool for lifting the voltage transformers. ⇨ If required, lift the voltage transformer together with several persons. ⇨ Secure the voltage transformer against falling down.

Order of assembly: First, fasten the current transformer and voltage transformer for phase L2 in the center of the C-rails. Then, fasten the instrument transformers for phases L1 and L3 on the left and right at a distance of 250 ±2 mm.

Fasten each transformer at 4 points, 2 times at the upper C-rail, 2 times at the lower C-rail.

⇨ For each instrument transformer, insert 2 sliding nuts with setscrew into the C-rail. Insert the sliding nuts in upright position.

⇨ Fasten each instrument transformer to the C-rails using 4 hexagon nuts M10, conical spring washers and washers (3D washers) each.

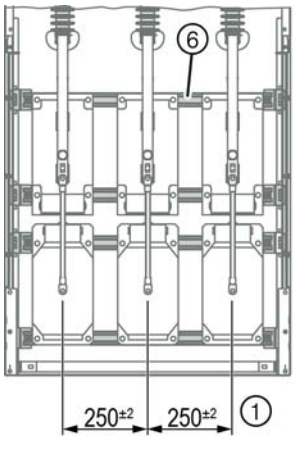


① Sliding nut
② Setscrew M10x60
③ Plain washer (3D washer)
④ Conical spring washer
⑤ Hexagon nut M10

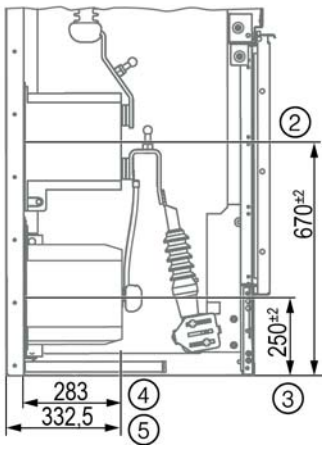
Fig. 98: Mounting the instrument transformers

Dimensions and mounting positions of instrument transformers in the metering panel

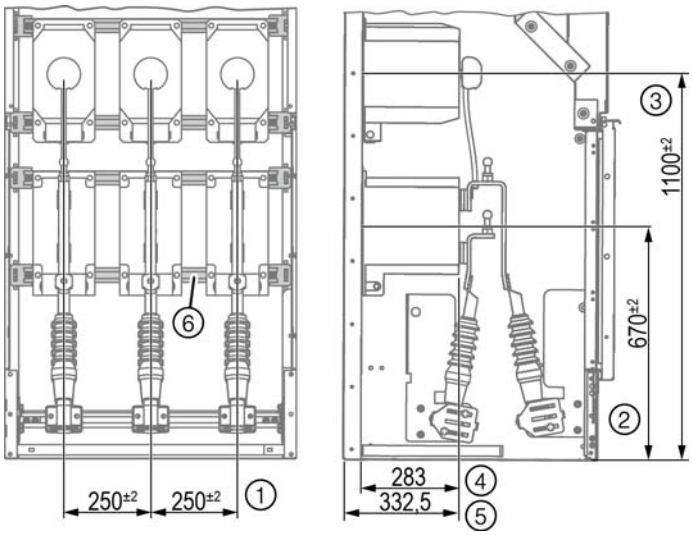
Metering panel type busbar-busbar



Metering panel type busbar-cable



Metering panel type cable-cable



① Transformer distance (centrally)
② Mounting height of current transformer
③ Mounting height of voltage transformer
④ Mounting depth of instrument transformer
⑤ Distance from transformer to switchgear rear wall
⑥ C-rail

Connecting the current transformers

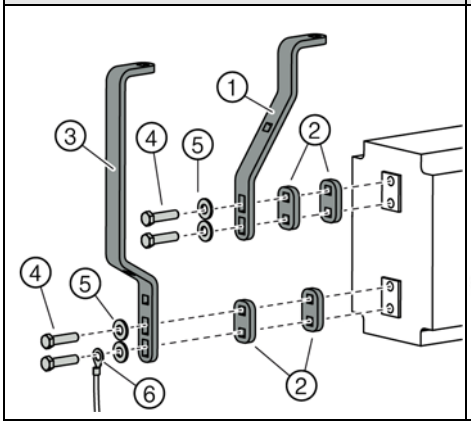
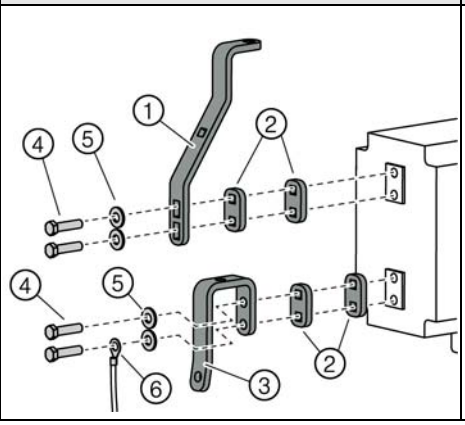
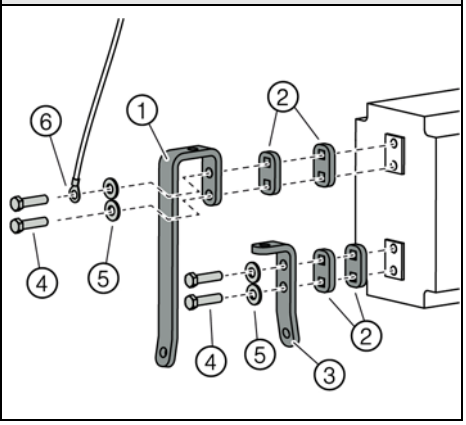
	**ATTENTION** Insufficient electrical contact increases the contact resistance. ➪ Clean oxidized contact points. ➪ Do not damage contact surfaces. ➪ Mount the busbar without distortions and gaps.

	**ATTENTION** Polluted vessel bushings will cause flashovers. ➪ Clean the vessel bushings with cleaning agent and a lint-free wiping cloth, see page 53, "Cleaning agents and cleaning aids".

	**ATTENTION** Low insulation at the busbar will cause damages at the switchgear due to flashovers. ➪ Mount the control cap at the vessel bushing. ➪ Check the control cap insulation for bad spots.

Connecting the current transformers in the metering panel

⇨ Mount the spacers and connection bars on the current transformer (tightening torque: 40 Nm).

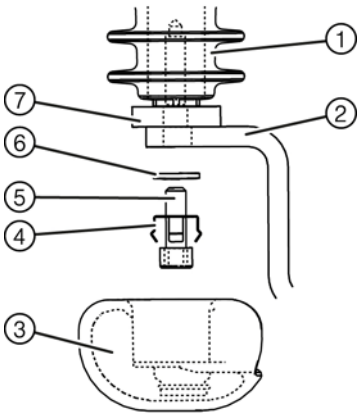
Metering panel type busbar-busbar	Metering panel type busbar-cable (cable-busbar)	Metering panel type cable-cable
		

① Connection bar at the top
② Spacer* (4x)
③ Connection bar at the bottom
④ Hexagon head bolt M12 (4x)
⑤ Conical spring washer (2x)
⑥ Connecting cable with cable lug

* Depending on the current transformer used

Connecting the busbar

⇨ Clean the vessel bushing ① with cleaning agent and a lint-free wiping cloth, and rub dry.
⇨ Install the spacer ⑦ between the vessel bushing and the connection bar ② .
⇨ Push the fixing bracket ④ and the conical spring washer ⑥ onto the cheese head bolt ⑤ .
⇨ Bolt the connection bar and the spacer together with the cheese head bolt at the vessel bushing of the busbar (tightening torque: 40 Nm).
⇨ Put the control cap ③ on the fixing bracket.
⇨ Verify firm seat of control cap.



① Vessel bushing
② Connection bar of instrument transformer
③ Control cap of vessel bushing
④ Fixing bracket
⑤ Hexagon socket head cap bolt M10
⑥ Conical spring washer
⑦ Spacer

Fig. 99: Connecting the busbar

⇨ Perform the installation for the other two phases in the same way.
✔ The transformer is connected with the busbar.

Connecting the voltage transformers

	**ATTENTION** Risk of flashover if the minimum distances between the connecting cables of the current and voltage transformers are too small. ⇨ Cut the connecting cables between the current and voltage transformers in a suitable way, so that the requested minimum distances to live parts are guaranteed during operation. ⇨ The deflection of the connecting cable between the current and the voltage transformer may not be more than 10 mm in every direction.

	**ATTENTION** Risk of flashover if the minimum distances between live parts and the flexible metal tubes provided for wire routing are too small. ⇨ If flexible metal tubes are used in the cable compartment for wire routing: Lay the flexible metal tube keeping enough minimum distance to live parts.

In metering panels type busbar-busbar, busbar-cable and cable-busbar, the voltage transformers are pre-assembled in the metering panels **below** the current transformers at the factory. In the metering panel type cable-cable, the voltage transformers are pre-assembled in the metering panels **above** the current transformers at the factory.

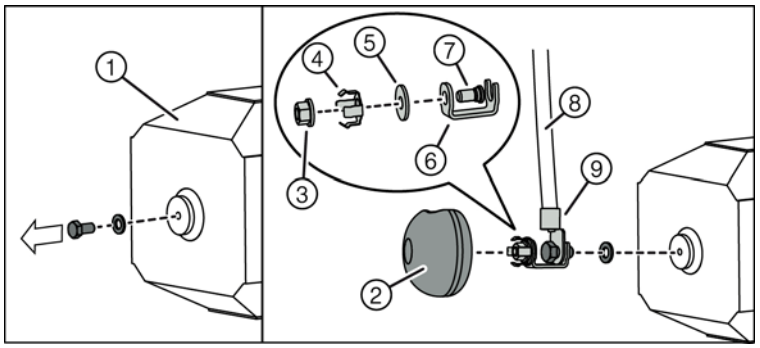
The voltage transformers must be connected to the current transformers on site with the connecting cables which are either pre-assembled or supplied with the supplementary equipment.

The voltage transformers can be connected either at the lower or upper terminals of the current transformers, depending on the circuit diagrams.

Mounting the control cap

⇨ Undo the hexagon head bolt and conical spring washer at the voltage transformer.

⇨ Mount the control cap together with the connecting cable onto the voltage transformer.



① Voltage transformer
② Control cap
③ Nut-and-washer assembly M8
④ Fixing bracket for control cap
⑤ Plain washer
⑥ Fixing bracket
⑦ Threaded stud M8
⑧ Connecting cable
⑨ Cable lug

Fig. 100: Mounting the control cap

Connecting the connecting cable

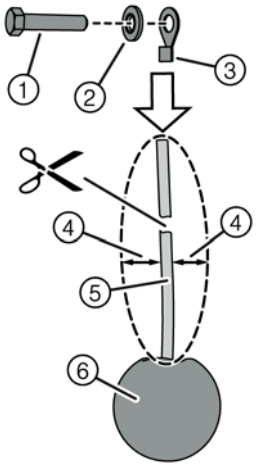
The deflection of the connecting cable between the current transformer and the voltage transformer may not be more than 10 mm in every direction.

It is permissible for the flexible connecting cable to touch parts of the same phase.

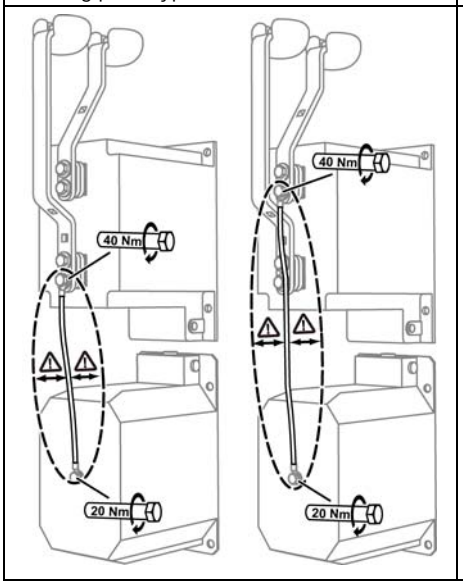
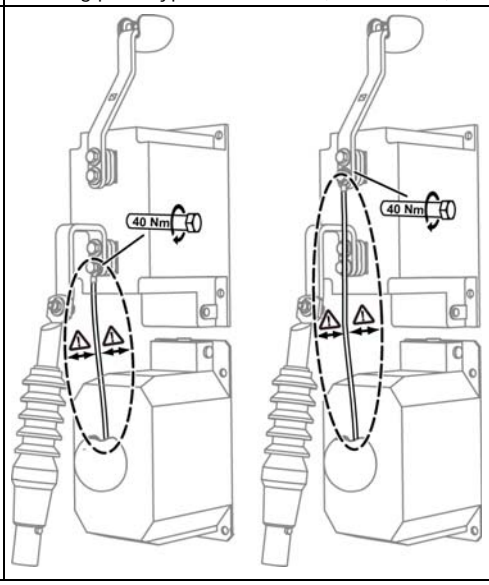
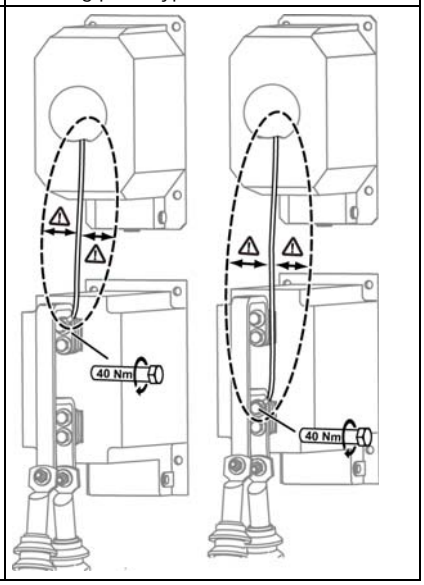
⇨ Cut the connecting cable to suit the distance between the current transformer and voltage transformer terminal.

⇨ Strip the insulation of the connecting cable and press the cable lug on.

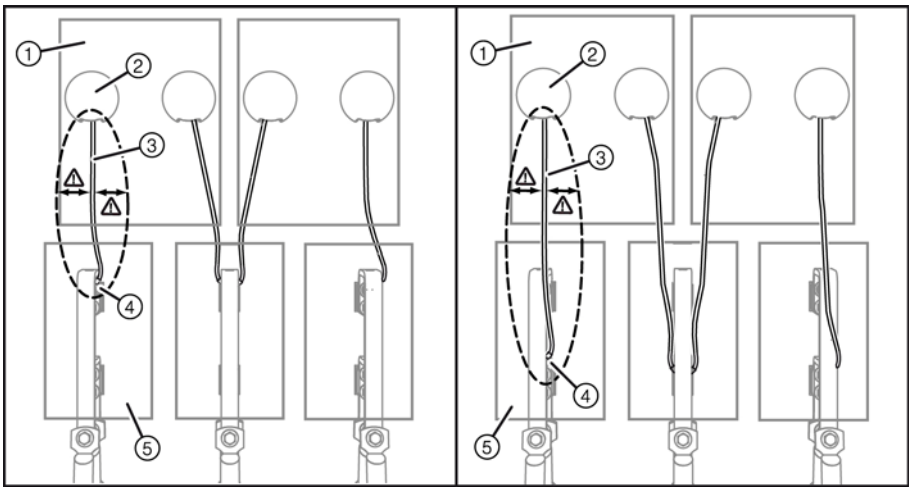
⇨ Connect the connecting cable to the current transformer and voltage transformer according to the circuit diagrams.



① Hexagon head bolt M12x50
② Conical spring washer M12
③ Cable lug
④ Deflection of connecting cable ≤ 10 mm
⑤ Connecting cable between voltage transformer and current transformer
⑥ Control cap

Connection possibilities for voltage transformers at the current transformers		
Metering panel type busbar-busbar	Metering panel type busbar-cable (cable-busbar)	Metering panel type cable-cable
		

2-pole voltage transformer Cut the connecting cable between the 2-pole voltage transformer and the current transformer to length:



① 2-pole voltage transformer
② Control cap
③ Connecting cable
④ Cable lug
⑤ Current transformer

Fig. 101: Connecting cables for 2-pole voltage transformer

Connecting high-voltage cables in the metering panel

	**ATTENTION**
	When connecting the cable ends, please observe the following: ⇨ Mount the sealing end according to the manufacturer's stipulations. ⇨ If the manufacturer of the cable lugs, sealing ends or plugs has not made any stipulations, the bolted joints must be tightened with max. 50 Nm.

Minimum distances for cable connections

The following minimum distances must be adhered to for connection of high-voltage cables in metering panels.

	**ATTENTION**
	Risk of flashover if the minimum distances between high-voltage cables and live or earthed parts are too small. ⇨ Minimum distances according to IEC 61936/VDE 0101 must be observed and checked during installation of the high-voltage cables, and verified: - For 24 kV, the minimum distance is ≥ 220 mm - For 12 kV, the minimum distance is ≥ 120 mm ⇨ If the minimum distances are too small, it must be proved by means of a dielectric test that there is no risk of flashover.

Minimum distances of the cable connections in the metering panel (dimensions given in mm):

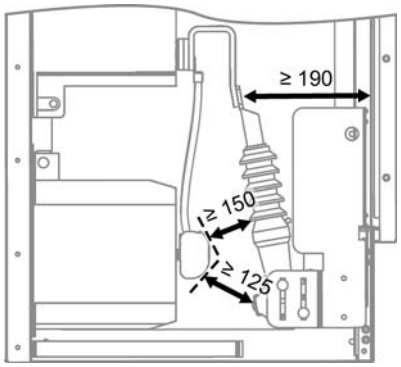


Fig. 102: Metering panel type busbar-cable and cable-busbar

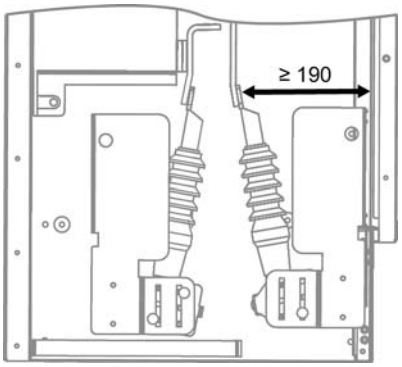
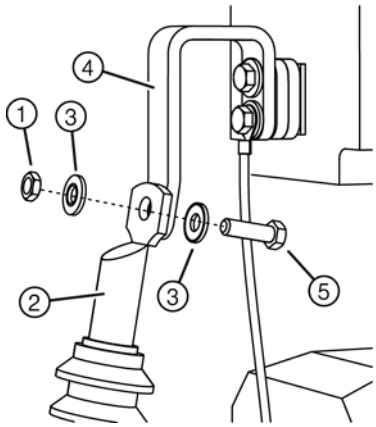
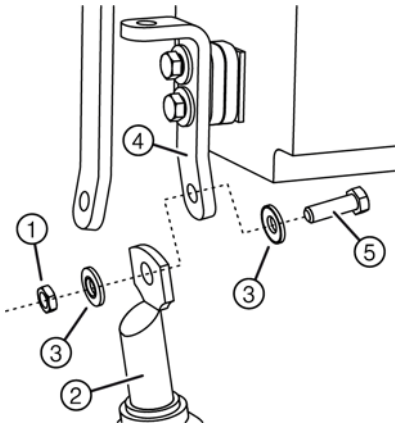
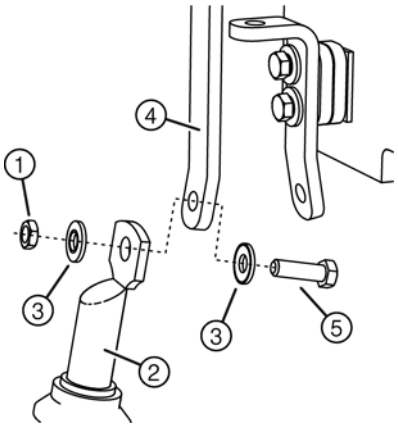


Fig. 103: Metering panel type cable-cable

Mounting the high-voltage cables

⇨ Mount the high-voltage cables at the current transformer connections.

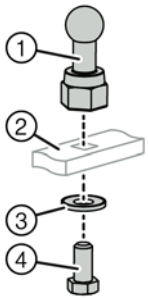
Metering panel type busbar-cable (cable-busbar)	**Metering panel type cable-cable**	
Current transformer terminal, bottom	Current transformer terminal, bottom	Current transformer terminal, top
		

① Hexagon nut M12
② High-voltage cable
③ Conical spring washer M12
④ Connection bar of current transformer
⑤ Hexagon head bolt M12x40

Mounting the spherical connection bolts

To earth the busbars or the high-voltage cables when the current transformers are removed, spherical connection bolts must be mounted on the connection bars. The spherical connection bolts are available as accessories.

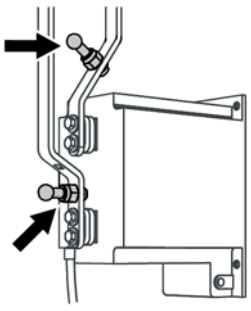
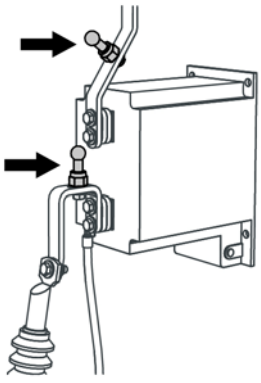
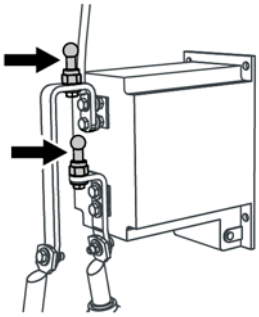
⇨ Mount the spherical connection bolts on the connection bars (tightening torque: 50 Nm).



① Spherical connection bolt
② Connection bar (metering panel)
③ Conical spring washer M12
④ Hexagon head bolt M12x25

Fig. 104: Mounting the spherical connection bolts

Mounting positions of the spherical connection bolts

Metering panel type busbar-busbar	Metering panel type busbar-cable (cable-busbar)	Metering panel type cable-cable
		

	**ATTENTION** Risk of flashover if the minimum distances between the spherical connection bolts and live parts are too small. ⇨ Minimum distances according to IEC 61936/VDE 0101 must be observed and checked during installation of the spherical connection bolts. - For 24 kV, the minimum distance is ≥ 220 mm - For 12 kV, the minimum distance is ≥ 120 mm

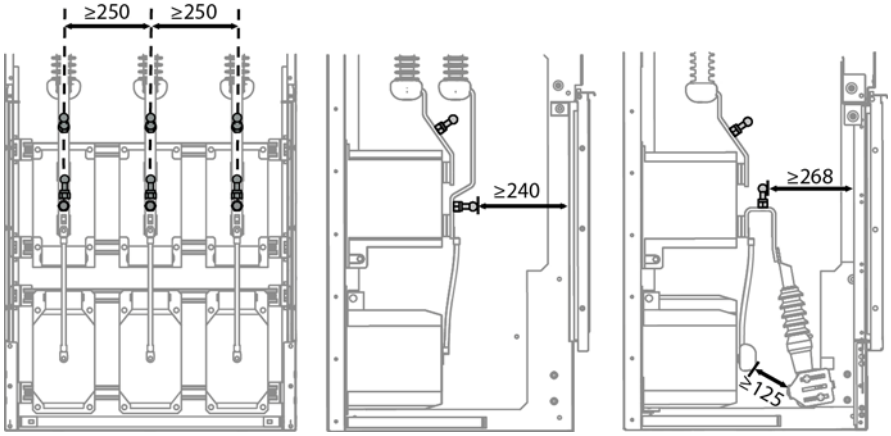


Fig. 105: Minimum distances of the spherical connection bolts in metering panels type busbar-busbar and busbar-cable (cable-busbar)

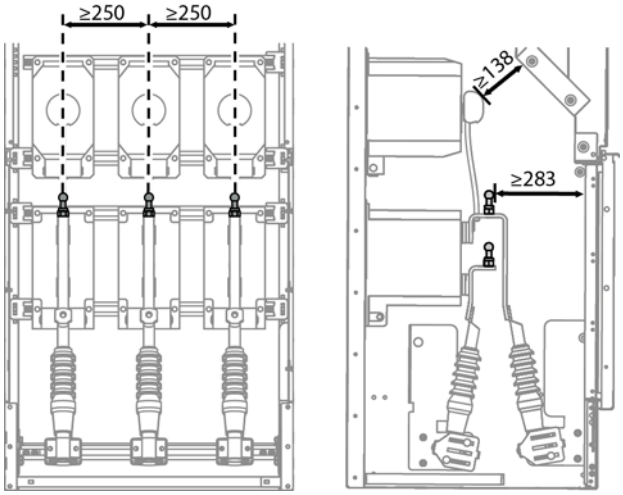


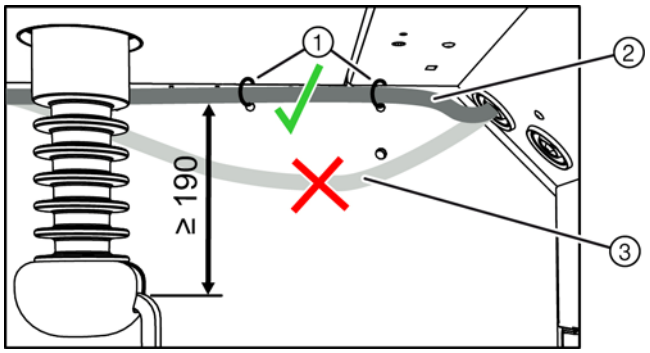
Fig. 106: Minimum distances of the spherical connection bolts in metering panels type cable-cable

Laying wires of secondary equipment

	**ATTENTION** Risk of flashover if the distances are too small. Between the wires for the secondary equipment and live primary parts, a minimum distance must be observed. ⇨ Observe the minimum distance ≥ 190 mm for laying the wires, and verify it.

⇨ The wires for the secondary equipment are integrated into a flexible metal tube and led into the metering panel.

⇨ Fasten the flexible metal tube with cable straps at the lateral plastic plate. Holes for the cable straps are prepared in the plastic plate.



① Cable strap
② Flexible metal tube laid correctly
③ Flexible metal tube laid incorrectly:
Minimum distance not observed

Fig. 107: Minimum distance for wires of secondary equipment

Mounting the cross member

⇨ Mount the cross member in the metering panel, see page 133, "Removing and mounting the cross member".

Mounting the cable compartment covers

⇨ Mount the cable compartment covers in the metering panel, see page 132, "Removing and mounting the cable compartment cover".

13.4 Mounting earthing accessories in the metering panel type M

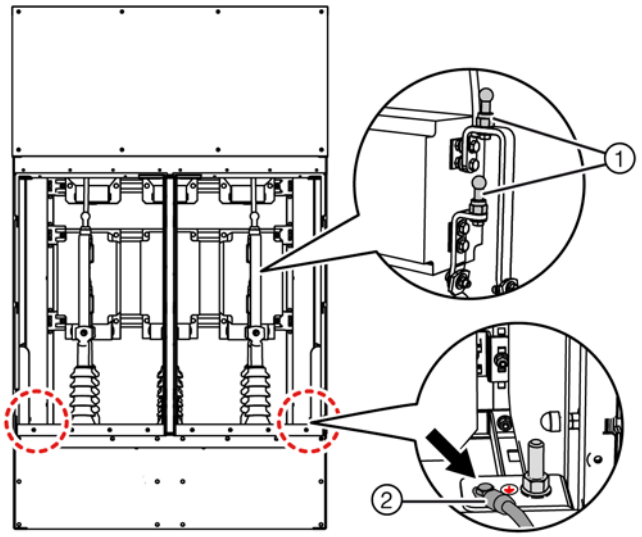
DANGER

High voltage! Danger!

- ⇨ Isolate.
- ⇨ Secure against reclosing.
- ⇨ Verify safe isolation from supply.
- ⇨ Earth and short-circuit.
- ⇨ Cover or barrier adjacent live parts.

NOTE

Before mounting the earthing accessories, observe the manufacturer's assembly instructions.



① Spherical connection bolts at the upper or lower connection bar

② Earthing connection for earthing accessories on the right and left side of the metering panel

Fig. 108: Connection possibilities for earthing accessories

ATTENTION

If the connecting element of the earthing accessories is not bolted flush to the earthing connection, the current-carrying capacity of the earthing is not sufficient.

- ⇨ Bolt the connecting element of the earthing accessories flush to the earthing connection.

The earthing connection offers different fixing options for the earthing accessories. If the earthing accessories are fastened in another way, this can make installation difficult or diminish the accessibility to the metering panel.

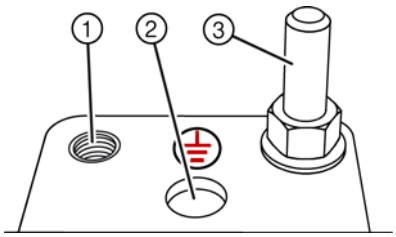


Fig. 109: Connection for earthing accessories

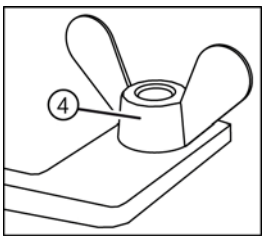


Fig. 110: Connection with wing nut

Connection possibility for:

① Threaded stud M12

② Push-through bolt

③ Bolt with nut M12

④ Earthing accessories with wing nut

	**NOTE** Earthing accessories with wing nuts ④ can be bolted to the earthing point at position ③. To do this, remove the nut M12 and the washer before.

⇨ Mount the earthing accessories **first** at the earthing connection in the metering panel.

⇨ Mount the earthing accessories at the spherical connection bolts (see page 100, "Mounting the spherical connection bolts") on all 3 phases.

Type of earthing accessories

The earthing accessories are not supplied by the factory.

	**DANGER** High voltage, danger! Please observe the manufacturer information and suitability of the earthing accessories. ⇨ The earthing accesssories must be designed for the short-circuit currents of the respective grid configuration. ⇨ The connections of the earthing accesssories must be suitable for installation at the switchgear.

At the air-insulated metering panel, the installation of earthing accessories was tested with the following components:

No.	Maximum short-circuit current/ duration	Type	Description	
1	13.8 kA / 1 s for straight spherical connection bolt with a sphere diameter of 20/25 mm **Version number: VK6ESW9**[1]	EKV3+1 70R	3-pole earthing and short-circuiting facility according to EN/IEC 61230 (DIN VDE 0683-100)	• Cross-section of rope: 70 mm^2 / 35 mm^2 • Length of rope, phase side: 600 mm • Length of rope, earthing side: 1800 mm
		UK 25 SK	Universal terminal (art. no. 773 034)	• For straight spherical connection bolt • Sphere diameter 20/25 mm • Spindle with hexagon
		EAS EK FM 12	Earthing connection unit M12 (art. no. 775 621)	• With wing bolt
	Accessories	ES SK 1500	Earthing rod (art. no. 761 015)	• Length: 1500 mm • Spindle with hexagon (SW19)
2	18.7 kA / 1 s for straight spherical connection bolt with a sphere diameter of 20 mm **Version number: V5DYR2W**[1]	EKV3+1 95R	3-pole earthing and short-circuiting facility according to EN/IEC 61230 (DIN VDE 0683-100)	• Cross-section of rope: 95 mm^2 / 35 mm^2 • Length of rope, phase side: 600 mm • Length of rope, earthing side: 1800 mm
		KKH 20 D SK	Universal terminal (art. no. 772 330)	• For straight spherical connection bolt • Sphere diameter 20 mm • Spindle with cross-pin
		EAS EK FS 12	Earthing connection unit M12 (art. no. 775 626)	• With wing bolt
	Accessories	ES SK 1000	Earthing rod (art. no. 761 010)	• Length: 1000 mm • Spindle with hexagon (SW19)

No.	Maximum short-circuit current/ duration	Type	Description	
3	18.7 kA / 1 s for straight spherical connection bolt with a sphere diameter of 25/30 mm **Version number: VSU7LDJ[1]**	EKV3+1 95R	3-pole earthing and short-circuiting facility according to EN/IEC 61230 (DIN VDE 0683-100)	• Cross-section of rope: 95 mm^2 / 35 mm^2 • Length of rope, phase side: 600 mm • Length of rope, earthing side: 1800 mm
		UK 30 SK	Universal terminal (art. no. 773 130)	• For straight spherical connection bolt • Sphere diameter 25/30 mm • Spindle with hexagon
		EAS EK FS 12	Earthing connection unit M12 (art. no. 775 626)	• With wing bolt
	Accessories	ES SK 1500	Earthing rod (art. no. 761 015)	• Length: 1500 mm • Spindle with hexagon (SW19)
4	23.7 kA / 1 s for straight spherical connection bolt with a sphere diameter of 25/30 mm **Version number: VE6X4KZ[1]**	EKV3+1 120R	3-pole earthing and short-circuiting facility according to EN/IEC 61230 (DIN VDE 0683-100)	• Cross-section of rope: 120 mm^2 / 50 mm^2 • Length of rope, phase side: 600 mm • Length of rope, earthing side: 1800 mm
		UK 30 SQ	Universal terminal (art. no. 773 330)	• For straight spherical connection bolt • Sphere diameter 25/30 mm • Spindle with cross-pin
		EAS EK FS 12	Earthing connection unit M12 (art. no. 775 626)	• With wing bolt
	Accessories	ES SQ 1500	Earthing rod (art. no. 761 016)	• Length: 1500 mm • Spindle with hexagon (SW19)

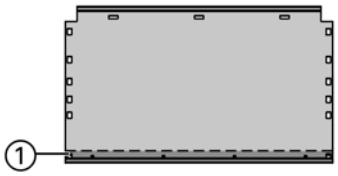
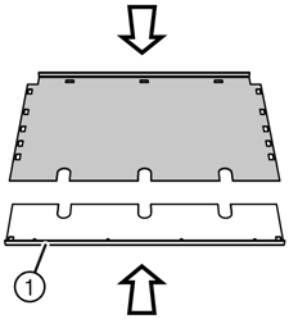
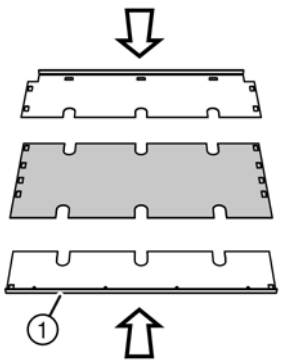
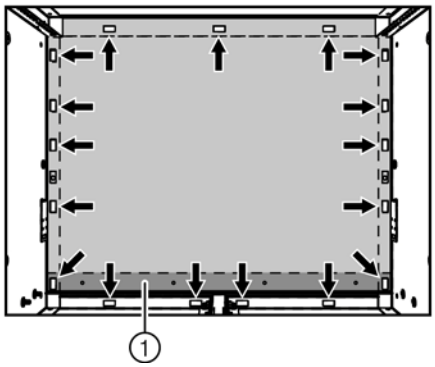
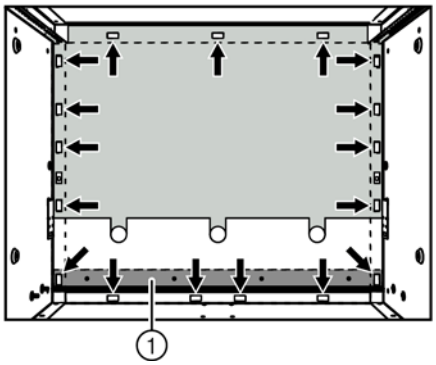
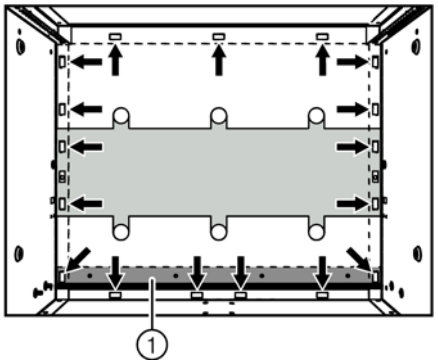
1) Manufacturer: DEHN + SÖHNE GmbH + Co. KG, Hans Dehn-Str. 1, Postfach 1640, 92306 Neumarkt, Germany, www.dehn.de

13.5 Installing the protection against small animals in metering panels

In metering panels, floor plates made of expanded metal can be installed as protection against small animals.

⇨ Install the floor plate with the screwed-on bracket ① towards the switchgear front.

⇨ Elongated holes are provided in the floor plates for fastening to the foundation. Bolt the floor plates to the foundation together with the subframe.

Mounting the floor plates		
Panel without cable feeder	**Panel with one cable feeder (combination of two plates)**	**Panel with two cable feeders (combination of three plates)**
		
Mounting position and fixing points:		
		

13.6 Interconnecting metering panels with other panels

For instructions to interconnect metering panels with other panels, see page 77, "Joining the panels".

14 Electrical connections

In the instructions given in the following sections it is assumed that a new switchgear is being installed which has not yet been connected to the mains, and is not live.

For extending or replacing parts of an existing switchgear, the Five Safety Rules must be observed:

	**DANGER**
	High voltage! Danger! ⇨ Isolate. ⇨ Secure against reclosing. ⇨ Verify safe isolation from supply. ⇨ Earth and short-circuit. ⇨ Cover or barrier adjacent live parts.

14.1 Connecting high-voltage cables

For common features and suitable cable plugs, see page 17, "Cable connection".

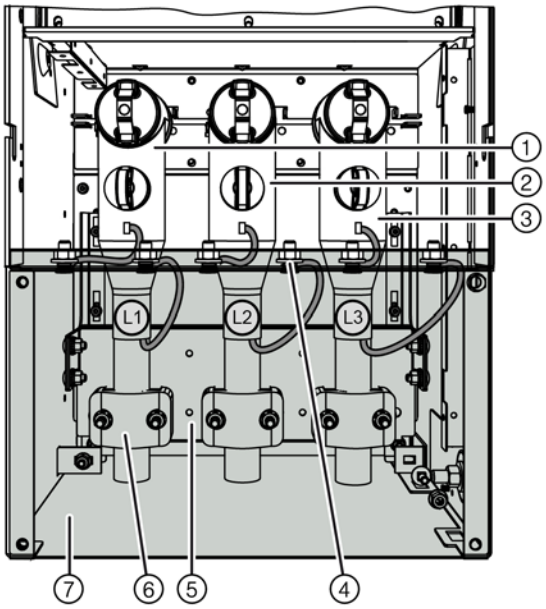
	**ATTENTION**
	Surfaces of high-quality joints at the bushings can be damaged by incorrect handling. ⇨ Observe extreme cleanliness. ⇨ Avoid damages caused by the threaded stud while pushing on.

	**ATTENTION**
	In case of spare feeders without connected cables, please observe the following: ⇨ Switch the three-position disconnector or three-position switch-disconnector to EARTHED position, and lock it. ⇨ Alternatively: Mount surge-proof caps.

	**ATTENTION**
	For perfect installation of the cable plugs, the following must be observed: ⇨ Mount the cable plugs according to the manufacturer's stipulations. ⇨ If there are no stipulations by the cable plug manufacturer, please contact the regional Siemens representative.

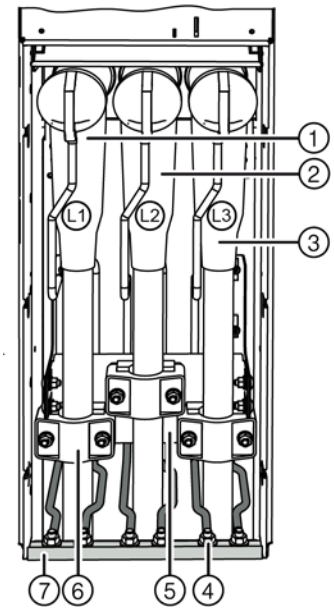
Cable connection type A

For transformer feeders



Cable connection type C

For ring-main feeders and circuit-breaker feeders



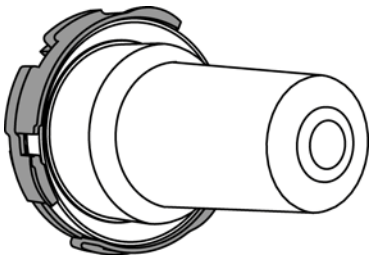
① Phase L1 with cable T-plug *
② Phase L2 with cable T-plug *
③ Phase L3 with cable T-plug *
④ Earthing connection for the cable shield and the plug housing
⑤ Cable bracket
⑥ Cable clamp
⑦ Cross member (removable)
* Plug types can be ordered via the accessories.

A white plastic protection ring may be factory-assembled on the outside-cone bushing type C. This ring serves as a stop for the plug, and protects the connection of the capacitive voltage detecting system at the bushing from damages when the cable plugs are mounted.

ATTENTION

Disassembling the protection ring can cause damages at the connection of the capacitive voltage detecting system.

⇨ Do not remove the protection ring.



⇨ Remove the cable compartment cover, see page 132, "Removing and mounting the cable compartment cover".

⇨ The cross member ⑦ can be removed to swing in the cables, see page 133, "Removing and mounting the cross member".

⇨ Remove the upper part of the cable clamps ⑥ .

⇨ Pre-adjust the cable bracket ⑤ and the lower part of the cable clamps ⑥ .

⇨ **Optionally:** Mount cable-type current transformers (see page 114, "Cable connection with cable-type current transformers").

⇨ Fit the cable plugs on the conductor ends according to the manufacturer's instructions.

⇨ **Optionally:** Mount ring-core current sensors (see page 117, "Installing ring-core current sensors at the cable connection").

⇨ **Optionally:** Mount voltage sensors (see page 118, "Installing voltage sensors").

⇨ Carefully coat the push-on surfaces (high-quality joints) of the cable plugs and the bushings with the delivered mounting paste (see scope of supply of the cable plugs).

⇨ Push the cable plugs ① to ③ onto the bushings and mount them according to the manufacturer's instructions. Observe the phase sequence.

NOTE: A too high torque can cause damage to the bushing. Tighten the cable plug with a torque according to the manufacturer's instructions (max. 50 Nm).

⇨ Mount the upper part of the cable clamps ⑥ .

⇨ Align the cable bracket and bolt it tight.

⇨ Refit the cross member, see page 133, "Removing and mounting the cross member".

⇨ Connect the earthing cables of the plug housings and the cable shield at the cross member ⑦ .

⇨ Hook the cable compartment cover in again, see page 132, "Removing and mounting the cable compartment cover".

✔ The cable connection is completed.

Double cables and surge arresters

Double cables and surge arresters can be connected to the following panel types using the corresponding plug-in cable systems:

- Ring-main panel
- Cable panel
- Circuit-breaker panel

Please observe the following:

- Depending on their type, double cable connections require a deep cable compartment cover and larger floor openings.
- Depending on their type, surge arresters also require a deep cable compartment cover.

For further information, see page 17, "Cable connection".

14.2 Installing cable plugs type Raychem RICS5xxx with RDA

⇨ Remove the upper cross member at the panel. To do this, remove 4 self-tapping bolts M6 ① .

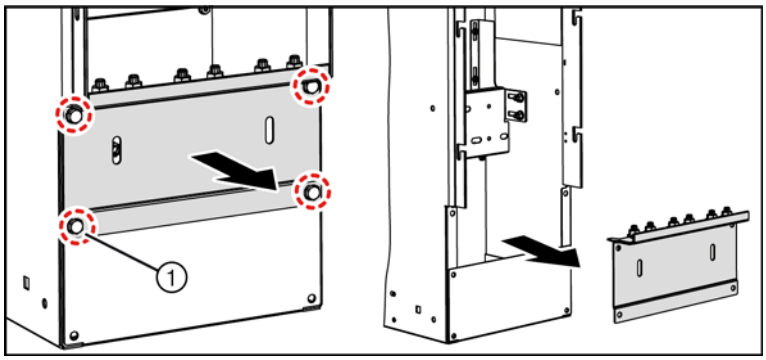


Fig. 111: Removing the upper cross member

⇨ Mount cable plug type Raychem RICS5xxx with surge arrester RDA. Observe the installation instructions of the cable plug and surge arrester manufacturer (see order documents).

⇨ Push the surge arrester plate ② between the hexagon nuts of the adapter feet, and tighten. Use hexagon nuts M12 ① with conical spring washers ③ .

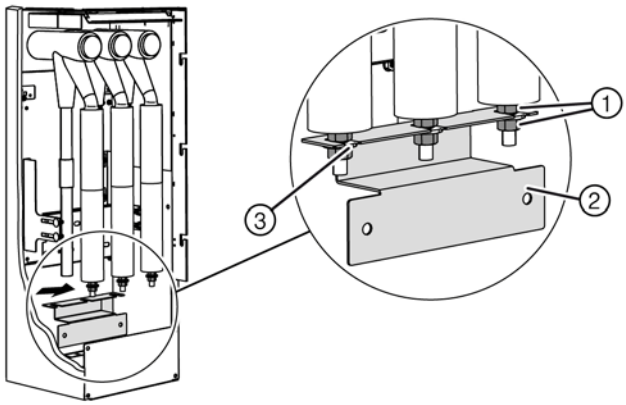


Fig. 112: Mounting the surge arrester plate and the adapter feet

⇨ Fasten the upper cross member with 4 self-tapping bolts M6 ① .

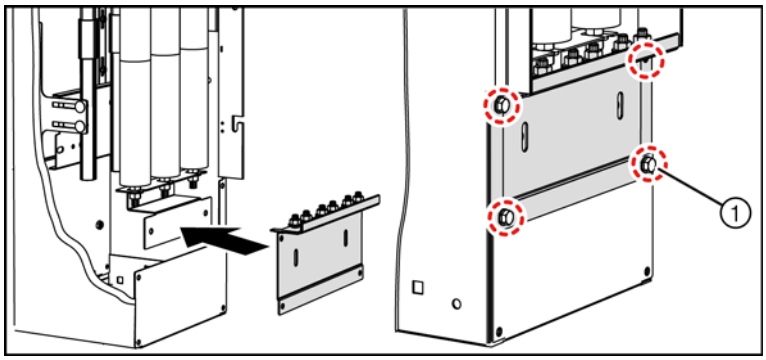


Fig. 113: Mounting the upper cross member

⇨ Fasten the surge arrester plate with 2 hexagon head bolts M8x16 ① and plain washers ② to the upper cross member.

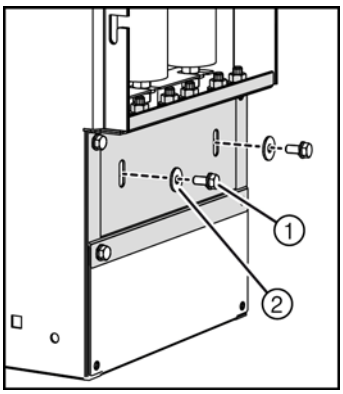
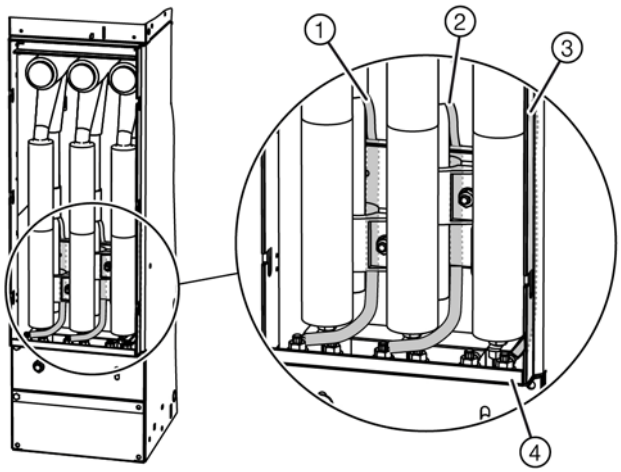


Fig. 114: Fastening the surge arrester plate

⇨ Earth the cable shields with cable lugs and earthing bolts M10 at the upper cross member.



① Cable shield, phase L1
② Cable shield, phase L2
③ Cable shield, phase L3
④ Upper cross member

Fig. 115: Earthing the cable shields

⇨ Observe the minimum distances according to the manufacturer's instructions while connecting non-screened cable plugs or surge arresters.

The use of RICS5xxx cable plugs with RDA in panels with a width of 310 mm is allowed under normal ambient conditions despite the reduced distance (according to IEC 62271-1).

✔ The installation of the Raychem RICS5xxx cable plug with RDA is completed.

14.3 Cable installation in switchgear with pressure absorber (IAC up to 16 kA and 21 kA)

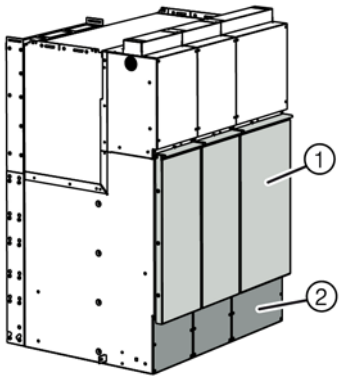


Fig. 116: Switchgear with pressure absorber for IAC up to 16 kA (example)

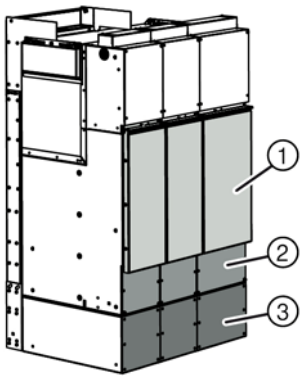


Fig. 117: Switchgear with pressure absorber for IAC up to 21 kA (example)

① Cable compartment cover
② Cross member
③ Front plate of base

Preparing cable installation

⇨ Remove the cable compartment cover ① (see page 132, "Removing and mounting the cable compartment cover").

⇨ Remove the cross member ② (see page 133, "Removing and mounting the cross member").

⇨ **Only for switchgear with pressure absorber (IAC up to 21 kA):** Remove the front plate ③ of the base; to do this, remove the 6 self-tapping bolts M6x16.

The front floor plate ⑧ can be mounted with the recess for the control cables on the left side or on the right side.

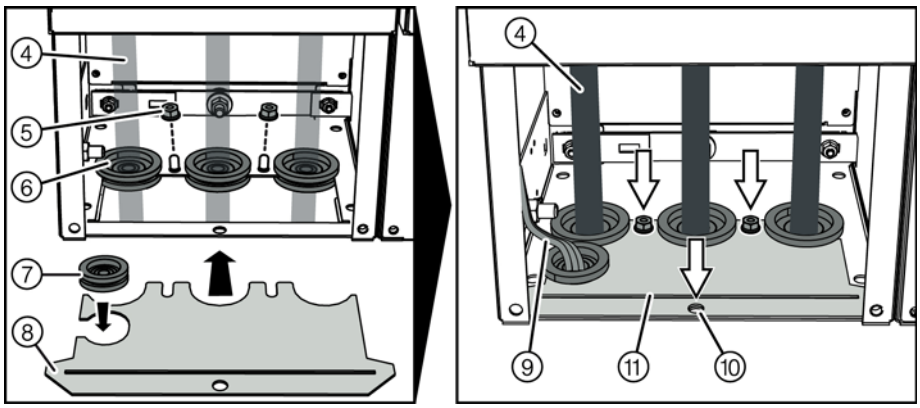


Fig. 118: Cable installation in switchgear with pressure absorber (IAC up to 16 kA)

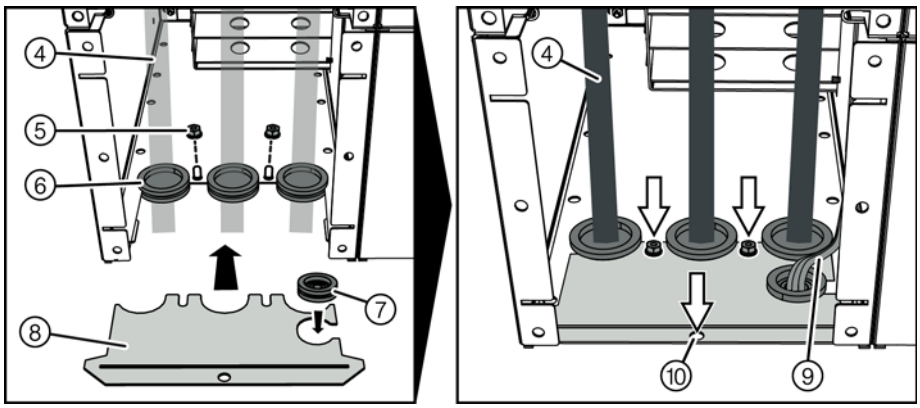


Fig. 119: Cable installation in switchgear with pressure absorber (IAC up to 21 kA)

④ High-voltage cable
⑤ Nut-and-washer assembly M8 (2x)
⑥ Rubber sleeve with a diameter of 70 mm (3x), for high-voltage cables
⑦ Rubber sleeve with a diameter of 56 mm (1x), for control cables
⑧ Front floor plate
⑨ Control cables
⑩ Fixing point of foundation
⑪ Slot for the lug of the cross member

- ⇨ Undo the 2 nut-and-washer assemblies M8 ⑤ and the bolted joint at the fixing point of the foundation ⑩ .
- ⇨ Take the front floor plate ⑧ out of the panel.

Installing the cables

- ⇨ Lead the high-voltage cabled ④ into the cable compartment.
- ⇨ With a knife, cut an opening into the rubber sleeves ⑥ and ⑦ that fits the diameter of the cable.
- ⇨ Push the rubber sleeves ⑥ onto the high-voltage cables.
- ⇨ Lead the control cables through the rubber sleeve ⑦ .
- ⇨ Insert the rubber sleeves ⑥ and ⑦ into the recesses provided for that purpose in the floor plates.
- ⇨ Install the high-voltage cables and the cable plugs according to the manufacturer's instructions, see page 107, "Connecting high-voltage cables".

Final operations

Switchgear with pressure absorber (IAC up to 16 kA):

- ⇨ Mount the cross member ② (see page 133, "Removing and mounting the cross member").
- ⇨ Insert the front floor plate ⑧ into the switchgear. The front floor plate must be seated in then grooves of the rubber sleeves ⑥, and the lug of the cross member must penetrate into the slot ⑪ of the front floor plate.
- ⇨ Bolt the front floor plate ⑧ together with the rear floor plate using 2 nut-and-washer assemblies M8 ⑤ .
- ⇨ Fasten the front floor cover together with the switchgear frame at the fixing point ⑩ of the foundation.
- ⇨ Hook the cable compartment cover ① in (see page 132, "Removing and mounting the cable compartment cover").
- ✔ Cable installation is completed.

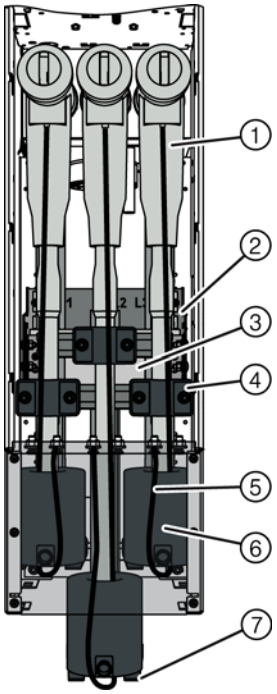
Switchgear with pressure absorber (IAC up to 21 kA):

- ⇨ Insert the front floor plate ⑧ into the switchgear. The front floor plate must be seated in then grooves of the rubber sleeves ⑥ .
- ⇨ Bolt the front floor plate ⑧ together with the rear floor plate using 2 nut-and-washer assemblies M8 ⑤ .
- ⇨ Fasten the front floor cover together with the switchgear frame at the fixing point ⑩ of the foundation.
- ⇨ Mount the front plate of the base ③ using 6 self-tapping bolts M6x16.
- ⇨ Mount the cross member ② (see page 133, "Removing and mounting the cross member").
- ⇨ Hook the cable compartment cover ① in (see page 132, "Removing and mounting the cable compartment cover").
- ✔ Cable installation is completed.

14.4 Cable connection with cable-type current transformers

Mounting position of cable-type current transformers

The transformer mounting plates are pre-assembled on the cable bracket at the factory. The cable-type current transformers are supplied in the cable compartment and must be mounted on the high-voltage cables on site.



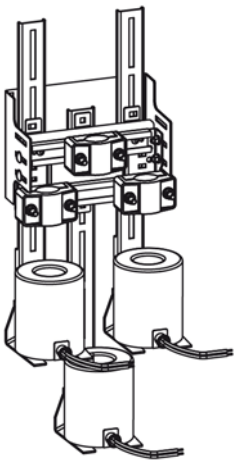
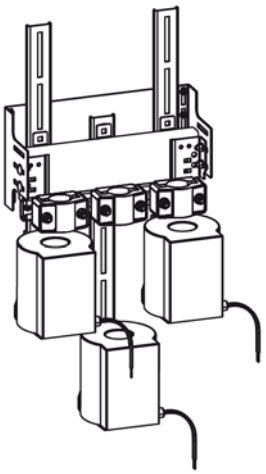
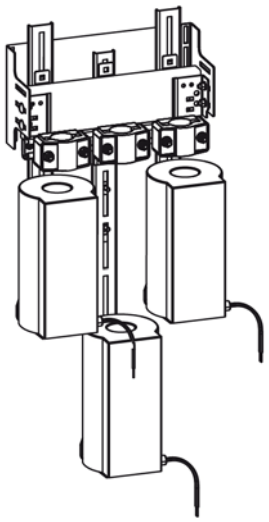
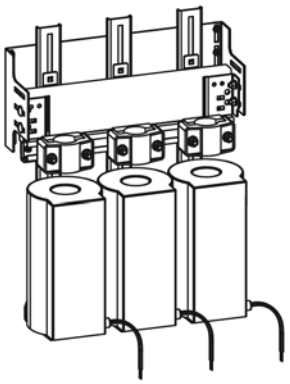
① Cable plug
② Adjustment rail
③ Cable bracket
④ Cable clamp
⑤ Cable shield
⑥ Cable-type current transformer
⑦ Transformer mounting plate

Fig. 120: Cable connection with cable-type current transformers

Mounting the cable-type current transformers

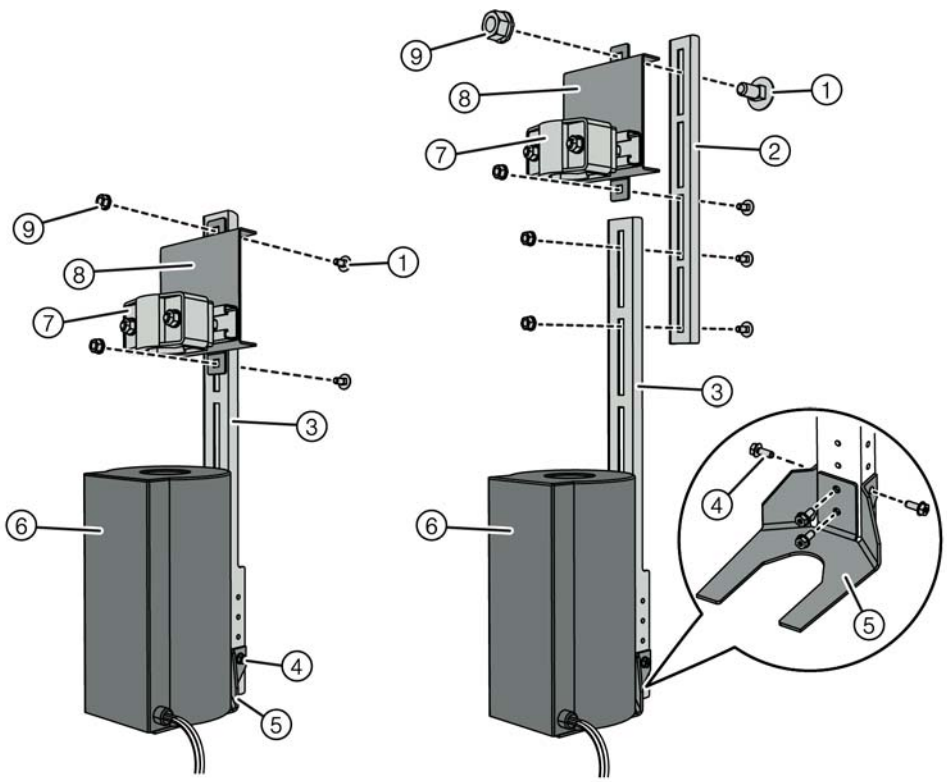
- ⇨ Remove the cable compartment cover (see page 132, "Removing and mounting the cable compartment cover").
- ⇨ Remove the cross member, if required (see page 133, "Removing and mounting the cross member").
- ⇨ Take the supplied current transformers out of the cable compartment.
- ⇨ Push the current transformers onto the high-voltage cables.
- ⇨ Mount the cable plugs according to the manufacturer's stipulations.
- ⇨ Adjust the position of the transformer mounting plates or of the adjustment rails at the cable bracket according to the current transformer type. There must be enough space available for mounting the current transformers.
- ⇨ Lead the cable shield back through the current transformer. Fix the cable shield at the earthing connection point.
- ⇨ Swing the high-voltage cables in together with the cable-type current transformers, and connect the cable plugs to the cable feeder (see page 107, "Connecting high-voltage cables").
- ⇨ Install the current transformers.

Installation of cable-type current transformers 4MC7032 and 4MC7033

Transformer type	4MC7032	4MC7033		
Panel width	310 mm	430 mm	430 mm	500 mm
Transformer height	80/150 mm	65/110/170 mm	285 mm	285 mm
Mounting position				

NOTE

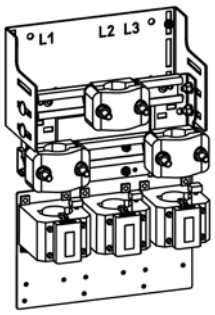
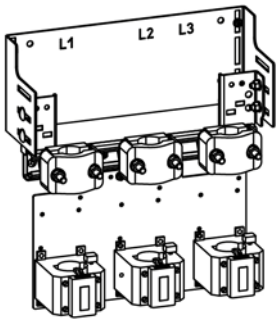
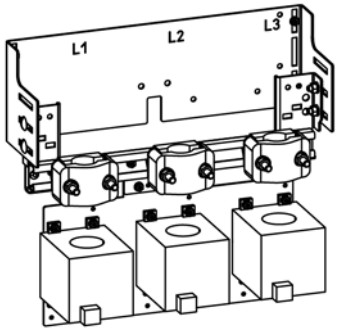
- ⇨ To provide enough space for the transformer cables, place the current transformers slightly turned on the transformer mounting plate.
- ⇨ Due to their height, mounted instrument transformers can reach into the cable basement.



① Cup head bolt M8x20
② Extension of adjustment rail (optional)
③ Adjustment rail
④ Self-tapping Torx bolt M6x16
⑤ Transformer mounting plate
⑥ Current transformer
⑦ Cable clamp
⑧ Cable bracket
⑨ Nut-and-washer assembly M8

Fig. 121: Principle of installation for 4MC7032 and 4MC7033

Installation of cable-type current transformers 4MC7031 and WIC1

Transformer type	4MC7031		WIC1
Panel width	310 mm	430/500 mm	430/500 mm
Transformer height	89 mm	89 mm	130 mm
Mounting position			

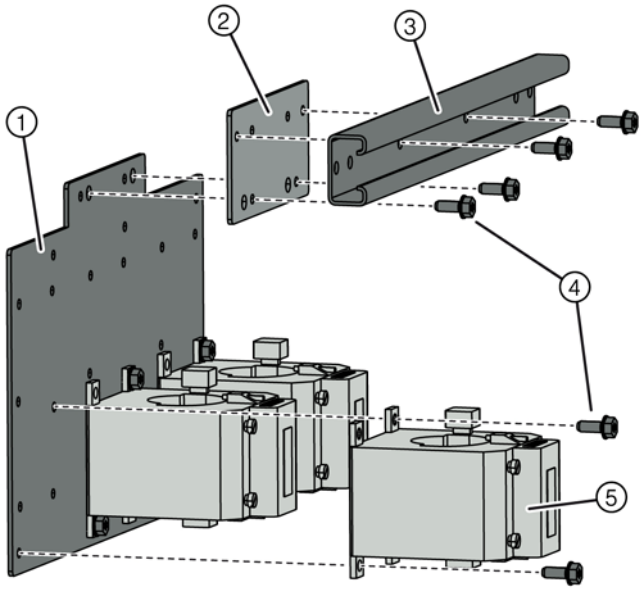


Fig. 122: Principle of installation for 4MC7031 current transformers

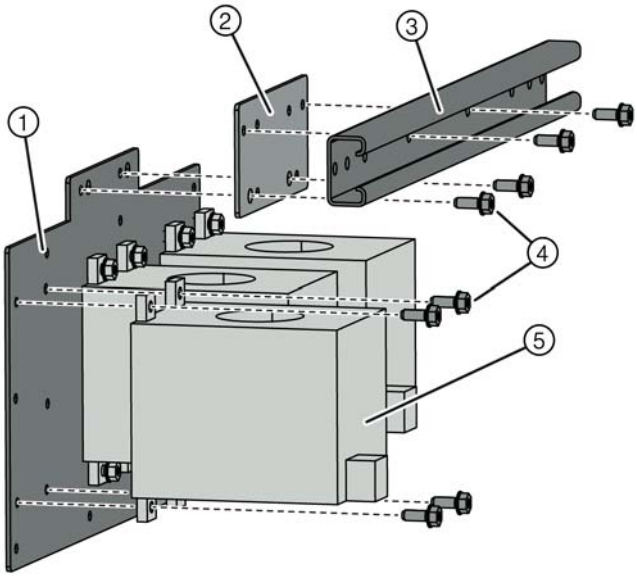


Fig. 123: Principle of installation for WIC1 current transformers

① Transformer mounting plate
② Holder for transformer mounting plate
③ C-rail
④ Self-tapping Torx bolt M6x16
⑤ Current transformer

Completing the installation of the cable-type current transformers

⇨ Mount the cross member (see page 133, "Removing and mounting the cross member").
⇨ Hook the cable compartment cover in (see page 132, "Removing and mounting the cable compartment cover").

14.5 Installing ring-core current sensors at the cable connection

Ring-core current sensors are mounted on the cable plug during installation of the high-voltage cables. The following current sensors can be mounted:

- Individual ring-core current sensors
- 3-phase ring-core current sensors

➪ Mount the cable plugs on the high-voltage cables according to the manufacturer's stipulations, see page 107, "Connecting high-voltage cables".

➪ Push the ring-core current sensors ① or the 3-phase ring-core current sensor ③ onto the cable plugs ② .

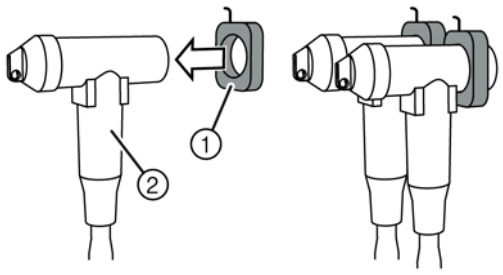


Fig. 124: Individual ring-core current sensors

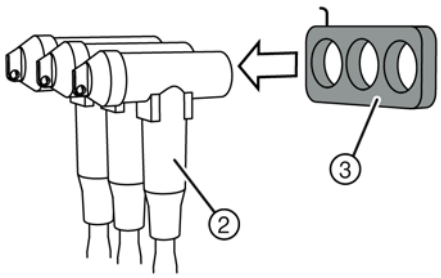


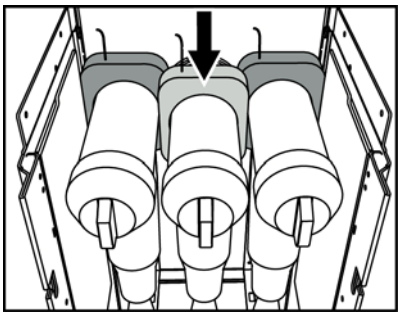
Fig. 125: 3-phase ring-core current sensor

NOTE

In panels with a width of 310 mm, there is not sufficient space for 3 individual ring-core current sensors next to each other.

➪ Mount the cable plugs together with the ring-core current sensors on phases L1 and L3.

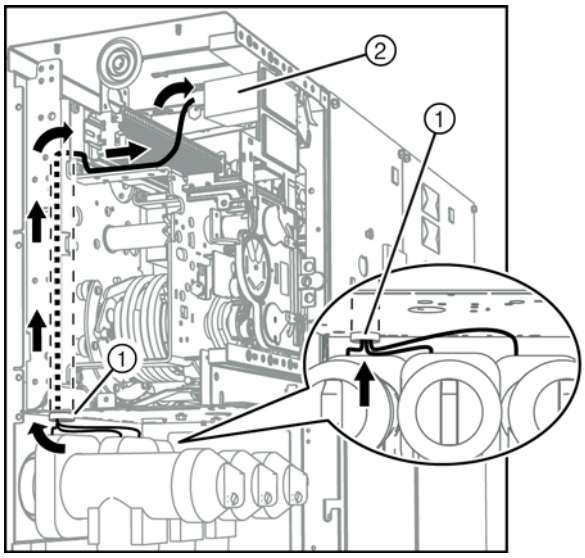
➪ Push the ring-core current sensor on phase L2 further onto the cable plug, and position it **in front of** the two other ring-core current sensors.



➪ Connect the cable plugs together with the ring-core current sensors at the bushings, see page 107, "Connecting high-voltage cables".

Laying the connection cables

⇨ If they have not been pre-assembled at the factory, lead the connection cables of the ring-core current sensors through the cable tube ① upwards into the low-voltage compartment or the operating mechanism compartment. Connect the connection cables to the secondary devices ② according to the circuit diagram.



① Cable tube
② Secondary device

✔ The installation of the ring-core current sensors is completed.

14.6 Installing voltage sensors

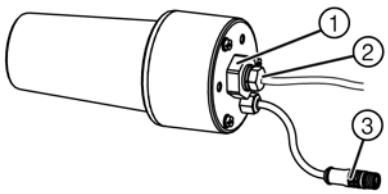
Voltage sensors are mounted on the cable plug instead of the sealing stopper during cable installation.

	NOTE
	⇨ Observe the installation instructions of the voltage sensor manufacturer.

Voltage sensors and cable plugs for use

Make	Type	Description	Insulation level U [kV]	Cable plug	
				Make	Type
Zelisko	SMVS-UW1001	Voltage sensor for cone according to EN 50180	24/50/125[1]	Nexans	(K) (M) 440TB
				Cellpack	CTS-S
	SMVS-UW1002	Voltage sensor with shortened cone	24/50/125[1]	nkt cables	CB-24
					CC-24
				TE Connectivity	RSTI-58xx
					RSTI-CC58xx

[1] Rated voltage / rated power-frequency withstand voltage / lightning impulse withstand voltage



① Cast-resin hexagon (key size 24)
Tightening torque: 30 Nm max.
② Connection of earthing cable
Conductor cross-section: min. 6 mm^2
Tightening torque: 6 Nm max.
③ Plug connection of the measuring lead

Fig. 126: Voltage sensor (example)

⇨ Mount the cable plugs according to the manufacturer's instructions. Do not mount the sealing stopper of the cable plug.

⇨ Clean the cone of the voltage sensor and the cable plug with a lint-free wiping cloth.

⇨ Coat the cone of the voltage sensor with the mounting paste recommended by the plug manufacturer.

⇨ Screw the voltage sensor into the cable plug at the cast-resin hexagon ① .

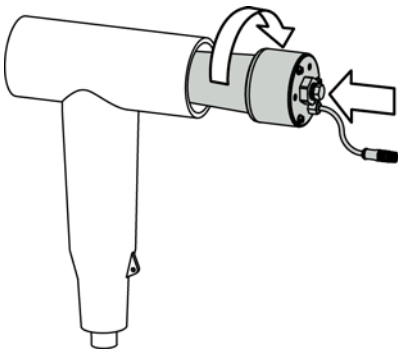


Fig. 127: Mounting the voltage sensor (example)

⇨ Mount the earthing cable at the earthing connection ② , and connect it to the cross member.

⇨ Connect the measuring lead ③ with the connection cables.

⇨ If they have not been pre-assembled at the factory, lead the connection cables of the voltage sensors through the cable tube upwards into the low-voltage compartment or the operating mechanism compartment. Connect according to the circuit diagram. For wire routing, see page 117, "Installing ring-core current sensors at the cable connection".

14.7 Connecting voltage transformers 4MT8 at the cable feeder

	**DANGER** High voltage. Risk of reverse voltages. ⇨ Separate the secondary leads of the voltage transformers from any voltage sources before executing the installation work.

	**DANGER** Risk of injury! Voltage transformers are very heavy. ⇨ Lift the voltage transformer with an appropriate lifting tool.

Precondition Necessary cable T-plugs for installation with voltage transformer 4MT8, see page 22, "Cable plugs for single cable connection with voltage transformer 4MT8 (interface type C)".

Preparations

⇨ Remove the cable compartment cover (see page 132, "Removing and mounting the cable compartment cover").

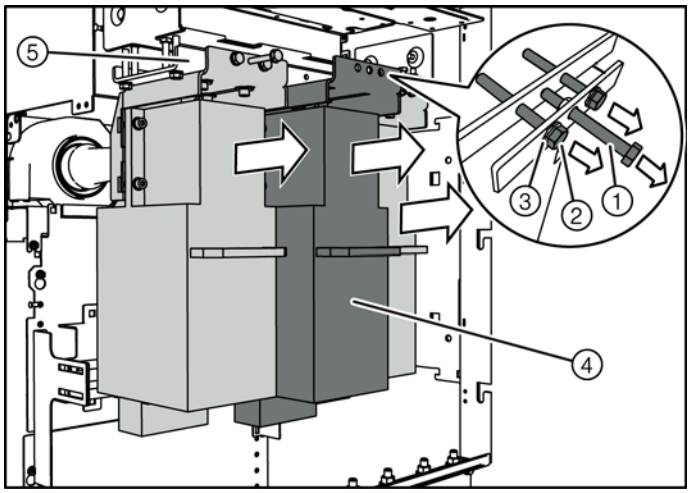
If the voltage transformers are pre-assembled in the panel when delivered:

⇨ Undo the transport fixing of the transformer connection leads.

⇨ Remove the 3 hexagon head bolts (① , ②) and contact washers ③ at one of the voltage transformers.

⇨ Lift the voltage transformer ④ together with the holder carefully out of the panel.

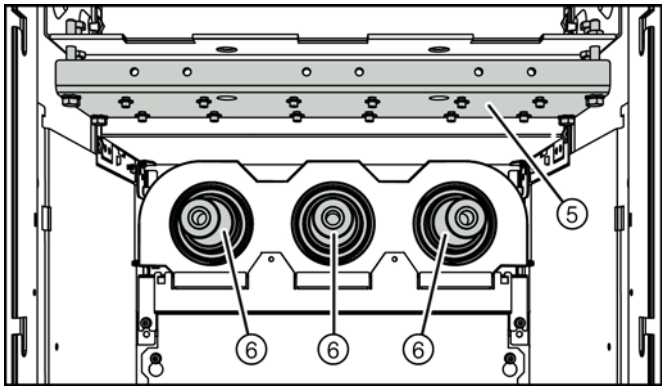
⇨ Take the other two voltage transformers out of the panel in the same way.



① Hexagon socket head bolt M8x40
② Hexagon head bolt M8x70 (2x)
③ Contact washer (2x)
④ Voltage transformer 4MT8 (3x)
⑤ Transformer mounting plate

Fig. 128: Removing the voltage transformers

⇨ Remove the protective caps of the bushings ⑥ (if available).



⑤ Transformer mounting plate
⑥ Bushing

Fig. 129: Bushings and transformer mounting plate

Checking the voltage transformer alignment

⇨ Screw the centering bolt ⑦ into the right-hand bushing ⑥ .
The centering bolt serves as adjustment aid for correct positioning of the voltage transformers, and must be removed again before connecting the voltage transformers.

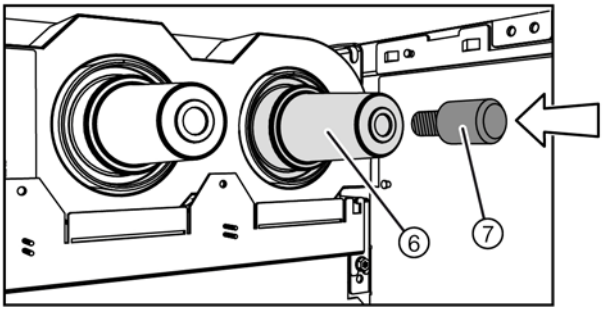


Fig. 130: Screwing the centering bolt into the bushing

	ATTENTION
	The voltage transformer may be damaged while being pushed onto the transformer mounting plate. The voltage transformer may touch the cable clamps or the cable bracket. ⇨ Push the voltage transformer carefully onto the transformer mounting plate. ⇨ Avoid touching the cable bracket or the cable clamps. If necessary, correct the position of the cable bracket.

⇨ Push the voltage transformer ④ together with the transformer slide ⑧ carefully onto the transformer mounting plate ⑤ . It must be easy to push the voltage transformer bushing onto the centering bolt ⑦ .

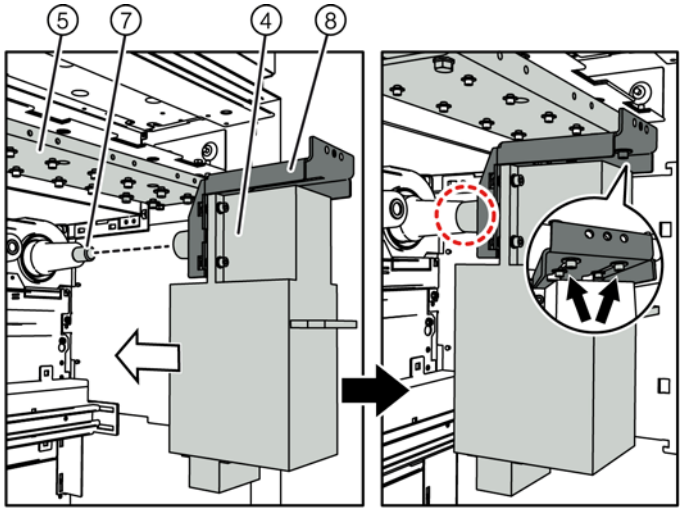


Fig. 131: Pushing the transformer onto the centering bolt

Correcting the voltage transformer alignment

If the voltage transformer cannot be pushed onto the centering bolt, the voltage transformer alignment on the transformer slide must be corrected.

⇨ Undo the 4 hexagon socket head bolts ⑨ at the voltage transformer.

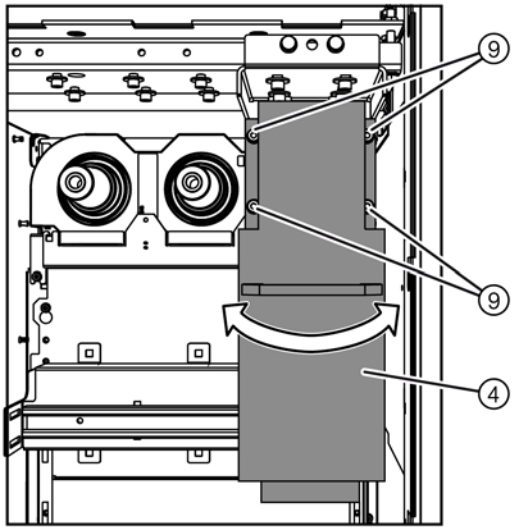


Fig. 132: Correcting the voltage transformer alignment

⇨ Correct the voltage transformer alignment and push the voltage transformer again onto the centering bolt.

⇨ Fasten the voltage transformer in the corrected alignment.

Readjusting the transformer mounting plate

The position of the transformer mounting plate can be readjusted in order to establish the correct position of the voltage transformer.

⇨ Undo the 2 hexagon head bolts ⑪ located inside.

⇨ Change the position of the transformer mounting plate ⑤ by readjusting the front and rear bolted joint ⑩ .

⇨ Refasten the transformer mounting plate with the 2 hexagon head bolts ⑪ located inside.

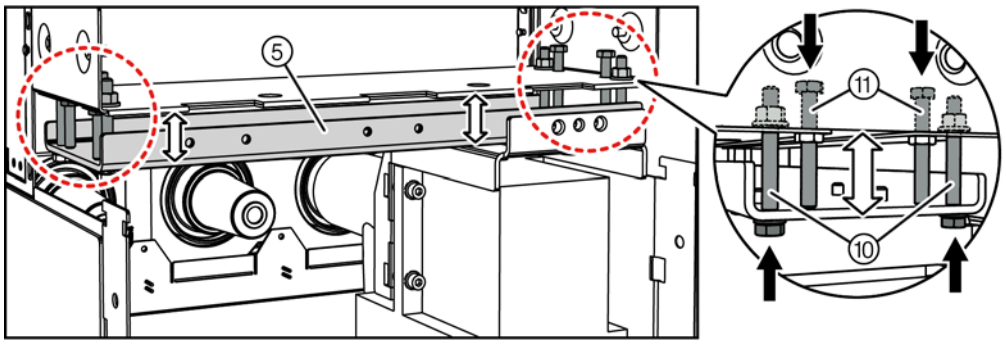


Fig. 133: Correcting the position of the transformer mounting plate

⇨ Remove the voltage transformer ⑤ together with the transformer slide ⑨ again.

⇨ Screw the centering bolt ⑧ into the left-hand bushing and adjust in the same way.

⇨ Screw the centering bolt ⑧ into the central bushing and adjust in the same way.

⇨ Remove the centering bolt ⑧ .

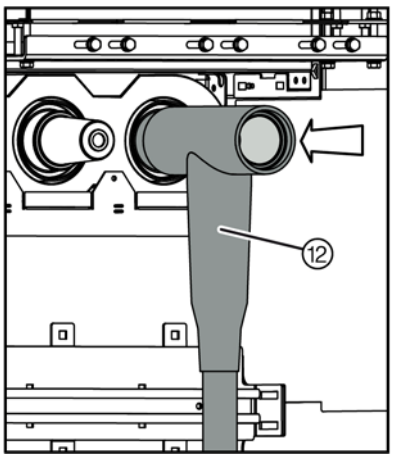
✔ Now the transformer fixing is adjusted for transformer installation. The cables can be connected to the feeder.

Connecting the voltage transformers

If a power-frequency voltage test is planned on site after switchgear installation (see page 137, "Preparing the power-frequency voltage test"), do not mount the voltage transformers yet.

⇨ Mount feeder cables and cable plugs ⑫ on the bushings, see page 107, "Connecting high-voltage cables".

⇨ Remove the sealing stoppers of the cable plugs.

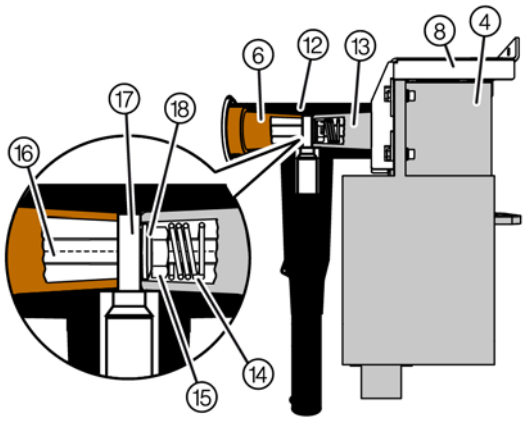


⑫ Cable plug

Fig. 134: Connecting the cable

⇨ Re-insert the voltage transformers with transformer slide and push the voltage transformer cone into the cable plug.

⇨ The transformer cone must be completely inserted in the cable plug.

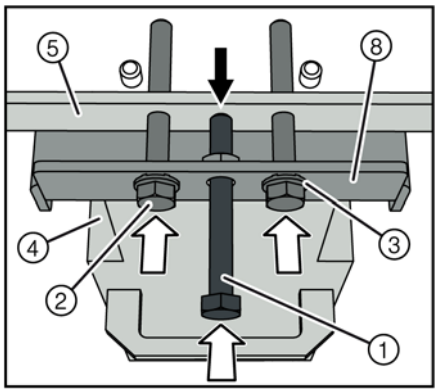


④ Voltage transformer
⑥ Bushing
⑧ Transformer slide
⑫ Cable plug
⑬ Transformer cone
⑭ Contact spring
⑮ Hexagon nut
⑯ Bolt M16
⑰ Feeder cable
⑱ Contact washer

Fig. 135: Installing the voltage transformer at the cable plug

Aligning and fastening the voltage transformer

⇨ Bolt the transformer slide ⑧ together with the transformer mounting plate ⑤ :
- First bolt both exterior hexagon head bolts ② tight, until the voltage transformer begins to incline. Then, turn the bolts back slightly.
- Counter the bolted joint with the central hexagon head bolt ① .



① Hexagon head bolt M8x70
② Hexagon head bolt M8x70
③ Contact washer
④ Voltage transformer
⑤ Transformer mounting plate
⑧ Transformer slide

Fig. 136: Fastening the transformer slide

⇨ Check the vertical alignment of the voltage transformer with a water level and, if required, readjust with the hexagon head bolts:
- Undo the exterior hexagon head bolts ② .
- Readjust the central hexagon head bolt ① .
- Tighten the exterior hexagon head bolts ② again.

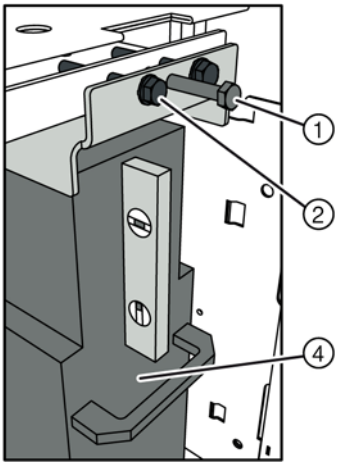


Fig. 137: Fastening and aligning the voltage transformer

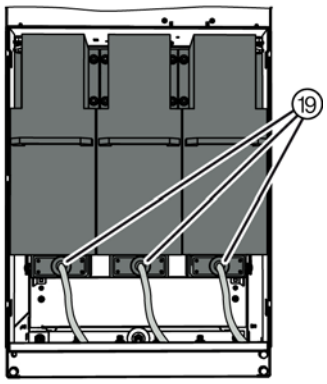
Installing further voltage transformers

⇨ Install the left-hand voltage transformer in the same way.

⇨ Install the central voltage transformer in the same way.

Inserting the low-voltage connector

⇨ Insert the low-voltage connector into the voltage transformers according to the phase designation.



⑲ Low-voltage connector

⇨ Hook the cable compartment cover in (see page 132, "Removing and mounting the cable compartment cover").

✔ The voltage transformers are connected to the cable feeder.

14.8 Installing/removing busbar voltage transformers

	**ATTENTION**
	While mounting metal-coated voltage transformers, the coating may be scratched or damaged. Then, the voltage transformers are not safe-to-touch anymore. ⇨ Work carefully while mounting metal-coated voltage transformers. ⇨ Take care not to scratch or damage the metal coating.

If a power-frequency voltage test is performed before commissioning (see page 137, "Preparing the power-frequency voltage test"), the voltage transformers must be removed.

To replace the busbar voltage transformers, the panels concerned must be accessible from the rear or from above.

	**DANGER**
	High voltage. Risk of reverse voltages. ⇨ Separate the secondary leads of the voltage transformers from any voltage sources before executing the installation work.

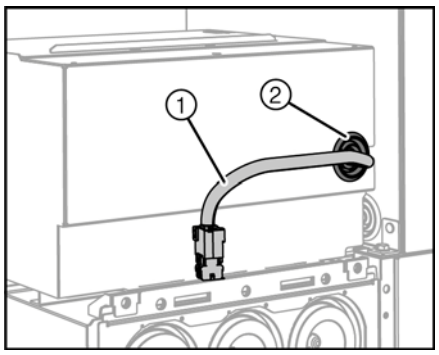
Preparing removal or installation

⇨ If there are no voltage transformers mounted yet: Take the surge-proof caps off the busbar bushings.

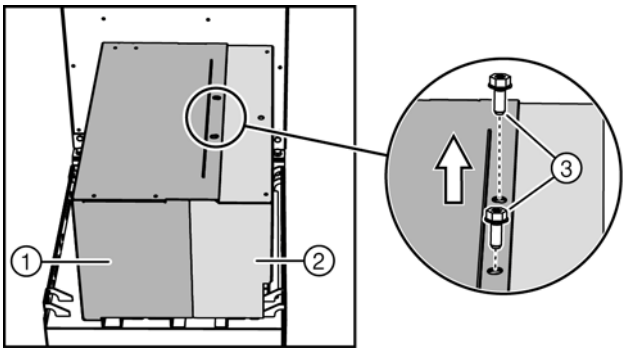
Removing the cover (option)

⇨ Detach the low-voltage plug connections ① from the voltage transformers.

⇨ Remove the cap ② .



➪ Remove 2 bolts M8 from the voltage transformer cover (option).



① Cover (right side)
② Cover (left side)
③ Bolt M8 (2x)

➪ Open the cover (right side), push backwards and remove to the side.

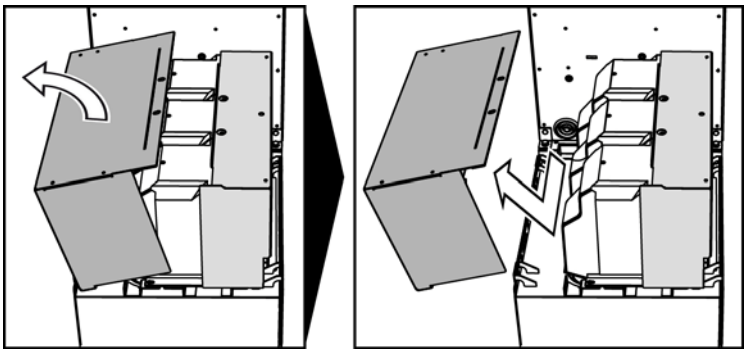


Fig. 138: Removing the cover (right side, view from the rear)

➪ Push the cover (left side) backwards and remove it to the top.

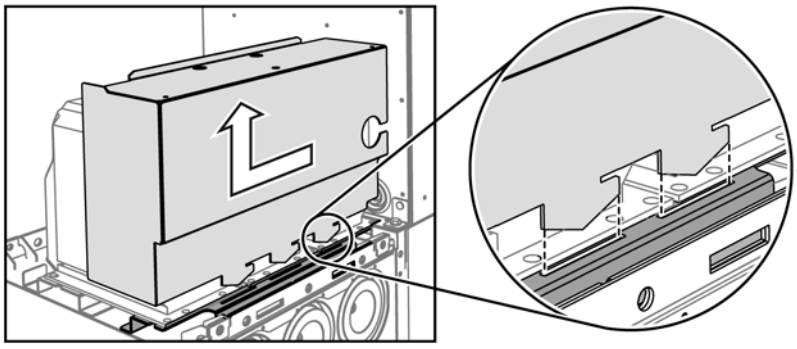


Fig. 139: Removing the cover (left side, view from the rear)

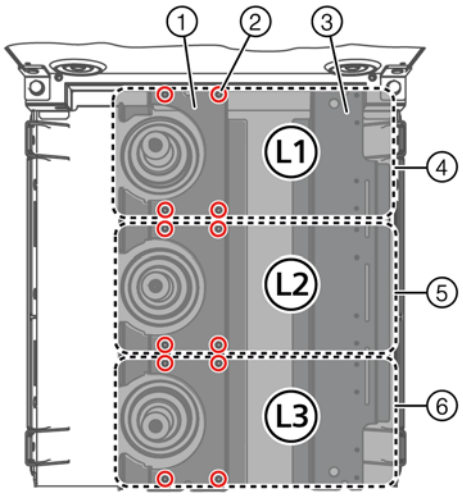
Removing the voltage transformers

⇨ Mount the supplied handles on the voltage transformers.

⇨ Undo the transformer fixing bolts.

Necessary tools:

- Socket spanner extension
- Insert size 10 with magnet



① Transformer mounting plate
② Fixing point
(4 fixing points per transformer)
③ Transformer support
④ Position of transformer in phase L1
⑤ Position of transformer in phase L2
⑥ Position of transformer in phase L3

Fig. 140: Fixing the voltage transformers (top view)

	ATTENTION
	Risk of injury due to high weight of the voltage transformer. ⇨ Use an appropriate lifting tool for lifting the voltage transformers. ⇨ If required, lift the voltage transformer together with several persons. ⇨ Secure the voltage transformer against falling down.

⇨ Lift the voltage transformer upwards by the handles ① .

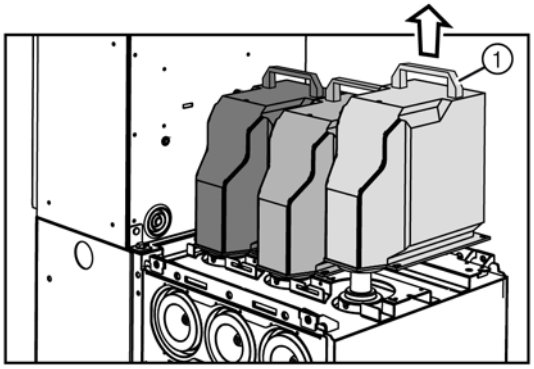


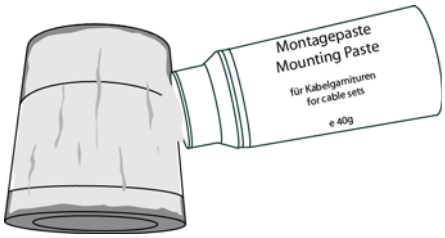
Fig. 141: Lifting the voltage transformer

If the voltage transformers are not going to be mounted again:

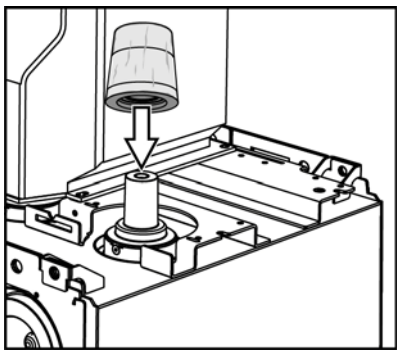
⇨ Mount surge-proof caps on the bushings.

Preparing installation of the voltage transformer

⇨ Clean the bushing in the panel carefully with a lint-free wiping cloth.
⇨ Apply mounting paste evenly to the bushing.
⇨ Coat the transformer inside cone with the supplied mounting paste.



⇨ Push the transformer inside cone onto the bushing.



Positioning and connecting the voltage transformer

⇨ Mount the handle on the voltage transformer and remove the transformer type plate.
⇨ To let excess air out, apply a cable strap ① or nylon thread to the bushing.

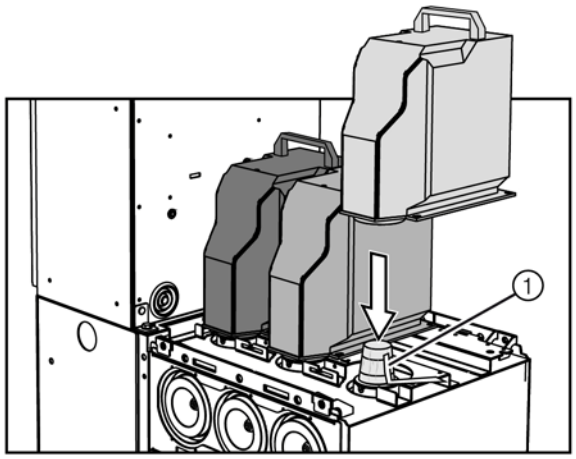
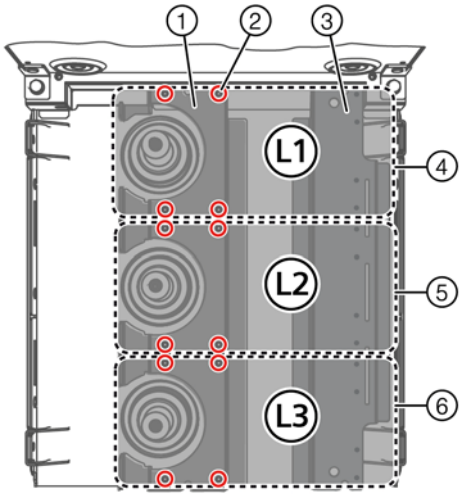


Fig. 142: Setting the voltage transformer down on the bushing

	ATTENTION
	Risk of injury due to high weight of the voltage transformer. ⇨ Use an appropriate lifting tool for lifting the voltage transformers. ⇨ If required, lift the voltage transformer together with several persons. ⇨ Secure the voltage transformer against falling down.

⇨ Take the voltage transformer by the handle and set it onto the bushing from above. Take care that the cable strap does not get out of place.
⇨ While setting down the voltage transformer, pull out the cable strap carefully.
⇨ Verify intact condition of the cable strap. If the cable strap was damaged when it was pulled out, remove the voltage transformer again and eliminate the residues of the cable strap.

⇨ Fasten the voltage transformer with 4 bolts (tightening torque: 12 Nm).
Necessary tools:
- Socket spanner extension
- Insert size 10 with magnet



① Transformer mounting plate
② Fixing point
(4 fixing points per transformer)
③ Transformer support
④ Position of transformer in phase L1
⑤ Position of transformer in phase L2
⑥ Position of transformer in phase L3

Fig. 143: Fixing the voltage transformers (top view)

⇨ Remove the handle from the voltage transformer.
⇨ Install further voltage transformers in the same way.

Mounting the cover (option)

⇨ Hook the cover (left side) in, and push to the front.

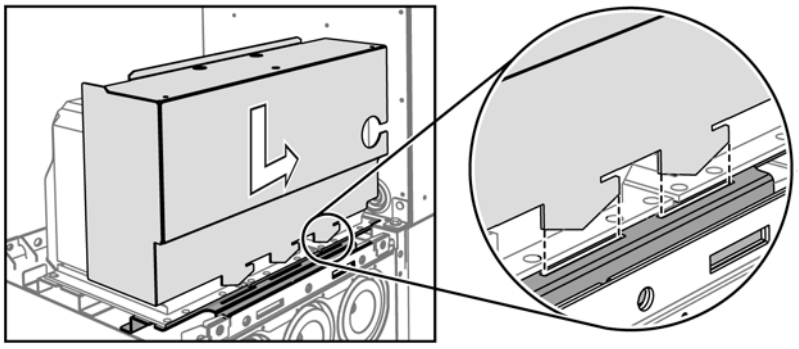


Fig. 144: Mounting the cover (left side, view from the rear)

⇨ Lead the low-voltage plug connections through the low-voltage compartment and out of the cover for further laying.

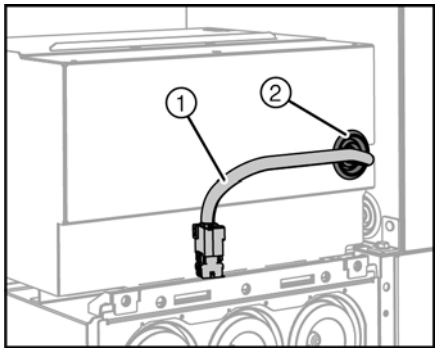


Fig. 145: Pushing the low-voltage plug connection ① through the cover ②

⇨ Hook the cover (right side) in, push to the front, and close.

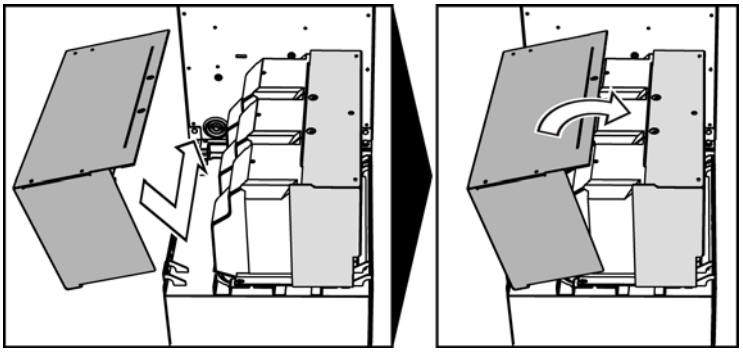


Fig. 146: Mounting the cover (right side, view from the rear)

⇨ Fasten the cover using 2 bolts M8.

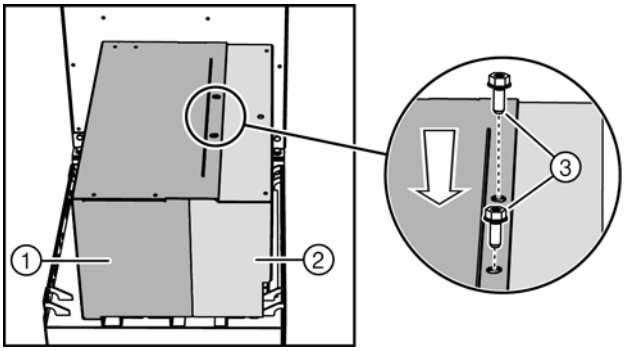


Fig. 147: Fastening the cover

Final work

⇨ Lead the low-voltage plug connection from the instrument transformers into the low-voltage compartment, and connect it to the mating socket according to the phase designation.

⇨ Fix loosened DIN rail again, if required.

⇨ Close the low-voltage compartment.

✔ The voltage transformers are now connected to the busbar.

14.9 Connecting the secondary equipment

	**DANGER** Risk of injury by release of charged operating springs when the front cover of the operating mechanism is removed! Bruises or cuts at the hands can be the consequence. ⇨ To avoid impermissible switching operations, switch off auxiliary voltage, e.g.: - Switch the auxiliary voltage supply of the motor. - Trip the MCB. - Disconnect the control cables from the low-voltage compartment. ⇨ To discharge the spring energy store in the operating mechanism, perform the following operations before removing the front cover: - Actuate the OFF pushbutton. - Actuate the ON pushbutton. - Actuate the OFF pushbutton. ⇨ The spring energy store indicator must show "spring not charged".

	**ATTENTION** Cables laid too close to the ready-for-service indicator can impair the function of the ready-for-service indicator. ⇨ When cables are laid, the transmission linkage of the ready-for-service indicator must move freely.

Wire routing

Wires for secondary equipment can be laid to the side, to the rear or downwards.

For panel blocks, wire routing across panels is possible through the wiring duct on the operating mechanism box (option) or through the front operating mechanism box. For extendable switchgear, wire routing through the wiring ducts is recommended.

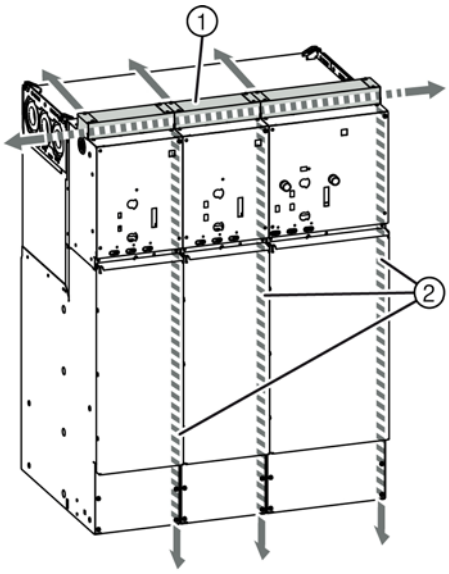


Fig. 148: Wire routing with wiring duct on the front operating mechanism box

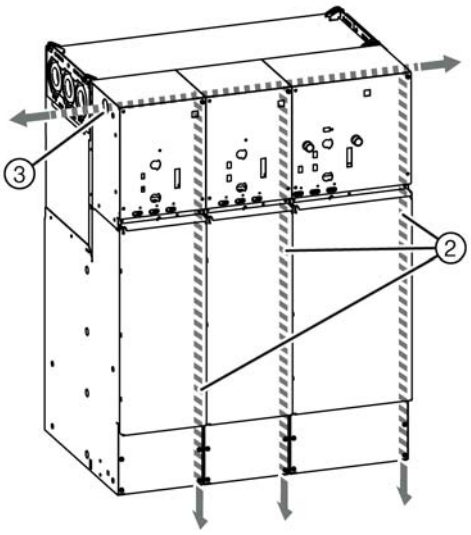


Fig. 149: Wire routing through the operating mechanism box

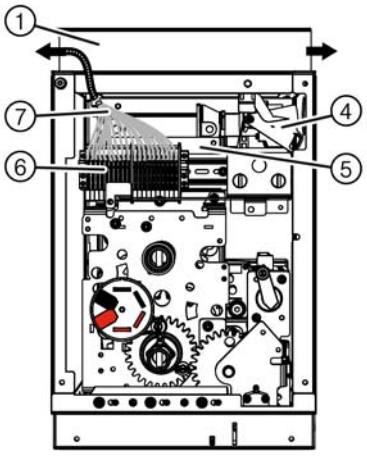


Fig. 150: Wire routing in the operating mechanism box

① Wiring duct on the operating mechanism box (option)
② Lateral wiring ducts (recommended wire routing downwards)
③ Wire routing through the operating mechanism box
④ Ready-for-service indicator
⑤ Fixing duct
⑥ Terminal strip
⑦ Customer-side wiring

Availability of lateral wiring ducts in the cable compartment

Panel type	R, K, K(E)		T		L	
Lateral wiring duct	**left**	**right**	**left**	**right**	**left**	**right**
Panel without current transformers	On request	On request	partially occupied	yes	yes	yes
Panel with current transformers	On request	partially occupied		partially occupied		partially occupied

The terminal strips of the secondary equipment supplied are assigned to the associated operating mechanisms or feeders. For information about the external connection, see the supplied circuit diagrams.

⇨ Switch off auxiliary voltage.

⇨ Remove the front plate.

⇨ Connect the customer wiring ⑦ to the terminal strip ⑥ or directly to the equipment terminals (e.g. CAPDIS S2+, short-circuit indicators) according to the circuit diagrams, and lay it cleanly.

⇨ If available, use the wiring duct ① on the operating mechanism box and the lateral wiring ducts ② .

- Lead the secondary wires of the current transformers and voltage transformers through steel mesh tubes or steel tubes in a shielded way into a lateral wiring duct.
- Earth the steel mesh tubes or steel tubes with metal cable straps.

⇨ Avoid extra-long secondary wires or lay them in the wiring ducts ① and ② or the fixing duct ⑤ in a meandering pattern.

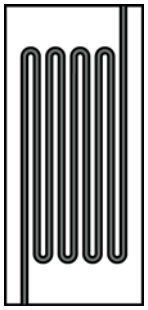


Fig. 151: Secondary wires laid in a meandering pattern

⇨ Wire routing to the side is possible through the cut out cap ③ .

⇨ For wire routing from below, use screened cable plugs.

⇨ Do not switch on auxiliary voltage yet.

14.10 Correcting circuit diagrams

⇨ Document any modification due to installation.

⇨ Document the modifications in the circuit diagram.

⇨ Send documented modifications to the regional Siemens representative.

15 Recurring activities

15.1 Removing and mounting the cable compartment cover

	**DANGER** High voltage! Danger! ⇨ Isolate. ⇨ Secure against reclosing. ⇨ Verify safe isolation from supply. ⇨ Earth and short-circuit. ⇨ Cover or barrier adjacent live parts.

Precondition To remove the cable compartment cover, the associated feeder must be earthed.

	**NOTE** **On the following panel types, the cable compartment cover is screwed on additionally:** • Metering panels • Cable panels • Panels with pressure absorber system (IAC up to 21 kA)

Removing the cable compartment cover

⇨ Earth the feeder.

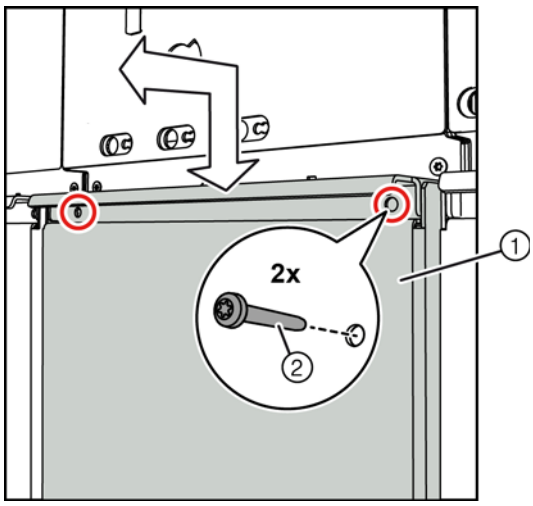
⇨ **On cable panels or panels with a pressure absorber system (IAC up to 21 kA)**: Undo 2 self-tapping bolts ② at the top of the cable compartment cover.

⇨ **On metering panels**: Undo 4 self-tapping bolts ② and 12 bolts ③ at each cable compartment cover.

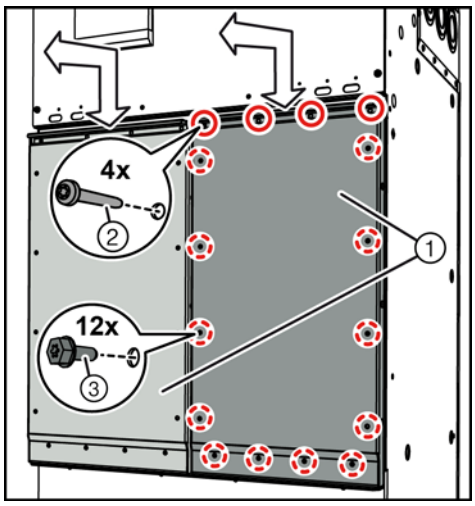
⇨ Lift the cable compartment cover ① and remove it to the front.

All panel types (without metering panel)

The bolted joint ② is only available on cable panels or panels with pressure absorber system (IAC up to 21 kA).



Metering panel



① Cable compartment cover
② Self-tapping bolt M6x50
③ Hexagon head bolt with hexalobular socket and small flange M6x16

Mounting the cable compartment cover

⇨ Hook the cable compartment cover in from above.

⇨ **On cable panels or panels with a pressure absorber system (IAC up to 21 kA)**: Bolt the cable compartment cover to the panel using the 2 self-tapping bolts ② removed before.

⇨ **On metering panels**: Bolt each cable compartment cover to the panel using the 4 self-tapping bolts ② and the 12 bolts ③ removed before.

15.2 Removing and mounting the cross member

	**ATTENTION** If the cross member was removed, the bracing required for the stability of the panel during movement is missing. ⇨ If the cross member is removed, do not move the panel.

Precondition

To disassemble the cross member, the cable compartment cover must be removed from the panel.

⇨ Remove the cable compartment cover (see page 132, "Removing and mounting the cable compartment cover").

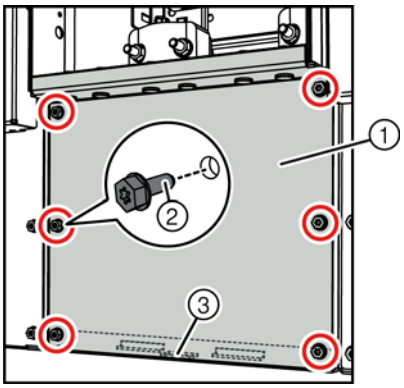
Removing and mounting the cross member (all panel types except metering panel):

Removing the cross member

⇨ The number of fixing bolts depends on the height of the panel:
- Panel height 1200 mm: Remove 4 bolts ② from the cross member ① .
- Panel height 1400 mm: Remove 6 bolts ② from the cross member ① .

⇨ The floor fixing bolt ③ must be removed if the panel was already fastened to the foundation.

⇨ Remove the cross member ① .



① Cross member
② Hexagon head bolt with hexalobular socket and small flange M6x16
③ Floor fixing bolts

Fig. 152: Cross member (panel height 1400 mm)

Mounting the cross member

⇨ Insert the cross member ① in the panel.

⇨ Depending on the panel height, bolt the cross member to the panel again using 4 or 6 bolts ② .

⇨ Fasten the cross member to the foundation again using the floor fixing bolt ③ .

✔ The installation of the cross member is completed.

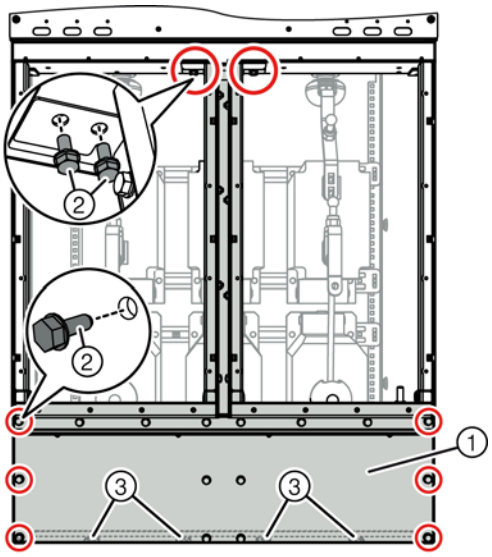
Removing and mounting the cross member in the metering panel

Removing the cross member

⇨ If the panel was already fastened to the foundation, the floor fixing bolts ③ must be removed.

⇨ Remove 10 bolt-and-washer assemblies ② .

⇨ Remove the cross member ① .



① Cross member
② Bolt-and-washer assembly M8x16
③ Floor fixing bolts

Fig. 153: Cross member (metering panel)

Mounting the cross member

⇨ Insert the cross member ① in the panel.

⇨ Fasten the cross member ① to the panel using 10 bolt-and-washer assemblies ② .

⇨ Fasten the cross member to the foundation again using the floor fixing bolts ③ .

✔ The installation of the cross member is completed.

16 Commissioning

	**DANGER** During operation of electrical equipment and switchgear, parts of this equipment are under dangerous electrical voltage. Mechanical components may move quickly, even remotely controlled. ⇨ Do not remove covers. ⇨ Do not reach into openings.

16.1 Final tests after installation

Rating plate

⇨ Check the data on the rating plate and the auxiliary voltage of the control and end devices as against the requirements.

Service readiness

⇨ Check the ready-for-service indicator (see page 58, "Checking service readiness").

Switchgear fixing / switchgear earth

⇨ Check switchgear fixing.
⇨ Check connection to substation earth.
⇨ Check connection of all earthing connections.

High-voltage connections

⇨ Check earthing of cable terminations on all connected high-voltage cables.
⇨ If provided by the customer, perform cable test (see page 176, "Cable testing")

Feeder without cables

⇨ Switch the switching device to EARTHED position and lock it, or cover the bushings with surge-proof caps.

Bolted joints

⇨ Check the tightening torques of the bolted joints of the low-voltage equipment at random.
⇨ Check all switchgear parts that have been disassembled and assembled again at site during installation or that have been installed subsequently, in order to verify correct assembly and completeness.

Auxiliary cable connections

⇨ Check correct wiring according to the circuit diagrams.
⇨ Check clamping and plug connections at random (perfect contact, labels, etc.).

Final work

⇨ Remove any attached instruction labels or documents that are not required anymore for operation.
⇨ Remove any tools, materials etc. that are not required anymore from the area of switchgear.
⇨ Remove dirt from the area of the switchgear.
⇨ Fit all covers.
⇨ Put the covers on the capacitive test sockets.
⇨ Touch up scratches and impacts in the surface painting. To do this, a paint pen can be ordered optionally.

Checking protection devices

⇨ Check the version of the firmware installed on the protection devices, and update if required, see page 9, "IT security".

Accessories

⇨ Keep the following accessories ready to hand:
- Operating instructions
- Operating levers for switching the panel
- Circuit diagrams
- Warning signs
- Indicators for the capacitive voltage detecting system with HR plug-in sockets or LRM plug-in sockets (optional)
- Keys for low-voltage compartment (optional)

16.2 Mechanical and electrical function test

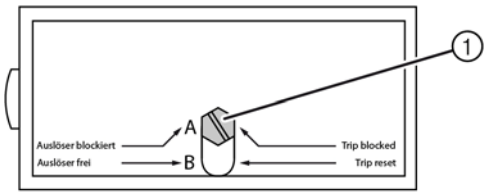
	**DANGER** Putting defective switchgear into operation can endanger the life of people and damage the switchgear. ⇨ Never put switchgear into operation if during test operation a part of it does not work as described here. Please contact the regional Siemens representative. ⇨ Perform test operations without high voltage!

	**ATTENTION** The circuit-breaker can be damaged by no-load switching. After charging the spring energy store, do not open the circuit-breaker directly. ⇨ After charging the spring energy store, close the circuit-breaker first, and then open it.

Undervoltage release (optional)

The operating mechanisms for the circuit-breakers type 2 and type 1.1 can be optionally equipped with an undervoltage release. The undervoltage release is located in the operating mechanism compartment behind the front plate.

A retaining bolt is screwed into the undervoltage release. By changing the position of the retaining bolt, the function of the undervoltage release can be blocked.



①	Retaining bolt of the striker
Position A:	Trip blocked
Position B:	Trip free

Fig. 154: Undervoltage release

- On circuit-breakers type 2, the undervoltage release is delivered by the factory in position A "Trip blocked".
- On circuit-breakers type 1.1, the undervoltage release is delivered by the factory in position B "Trip reset".

Changing the setting of the undervoltage release:

	**DANGER** Risk of injury by release of charged operating springs when the front cover of the operating mechanism is removed! Bruises or cuts at the hands can be the consequence. ⇨ To avoid impermissible switching operations, switch off auxiliary voltage, e.g.: - Switch the auxiliary voltage supply of the motor. - Trip the MCB. - Disconnect the control cables from the low-voltage compartment. ⇨ To discharge the spring energy store in the operating mechanism, perform the following operations before removing the front cover: - Actuate the OFF pushbutton. - Actuate the ON pushbutton. - Actuate the OFF pushbutton. ⇨ The spring energy store indicator must show "spring not charged".

⇨ Remove the front plate.

⇨ Insert the retaining bolt of the striker at the undervoltage release in the desired position.

✔ Mount the front plate.

ATTENTION

Circuit-breaker type L2: To operate the circuit-breaker type 2 for test without auxiliary voltage, the undervoltage release (option) must be blocked. On circuit-breakers type 2, the undervoltage release is delivered by the factory in "Trip blocked" setting (position A), and will not function.

⇨ Perform test operation with the circuit-breaker type 2.

⇨ After test operation, activate the undervoltage release; screw the retaining bolt in at position B.

ATTENTION

Circuit-breaker type L1.1: If the operating mechanism is equipped with an undervoltage release (option), test operation of the circuit-breaker type 1.1 must be performed with auxiliary voltage, as the undervoltage release is delivered in "Trip reset" setting (position B).

⇨ Perform test operation of the circuit-breaker type 1.1 only with auxiliary voltage.

Test operation and mechanical function test

Always perform test operation and mechanical function test without high voltage.

⇨ On circuit-breakers and switch-fuse combinations, do not perform any no-load switching operations, i.e. opening commands without closing before.

⇨ Switch all switching devices several times manually to all switching positions (see page 140, "Operation") and check the position indicators.

⇨ Check mechanical interlocks (see page 14, "Interlocks") with normal force. Verify smooth operation of control gates.

⇨ Check the fuse tripping functionality with a test fuse.

⇨ Fit HV HRC fuse-links, see page 173, "Replacing HV HRC fuse-links".

⇨ Check service readiness, see page 143, "Ready-for-service indicator". The pointer of the ready-for-service indicator must be in the green area.

Electrical function test

⇨ **Only circuit-breaker type L2:** Insert the retaining bolt at the undervoltage release (option) in position B.

⇨ Switch all three-position disconnectors or three-position switch-disconnectors to OPEN position.

⇨ Switch on auxiliary voltage and check polarity.

⇨ Switch switching devices with electrical operation to all switching positions (electrically and manually). Check position indicators and electrical interlocking conditions.

⇨ **Only circuit-breaker type L2:** While charging the spring energy store and in ready-to-close state, auxiliary voltage must be applied without interruption at the undervoltage release (option).

⇨ Check electrical indications and trippings.

16.3 Preparing the power-frequency voltage test

A power-frequency voltage test can be performed at the readily installed switchgear.

Preparations

⇨ Remove voltage transformers.

⇨ Remove surge arresters and surge limiters.

⇨ Protect bushings of voltage transformers, surge arresters and surge limiters in a surge-proof way using suitable sealing caps.

⇨ Short-circuit the current transformers at the secondary terminals.

⇨ Earth the capacitive test sockets.

✔ The power-frequency voltage test can now be performed.

16.4 Instructing the operating personnel

⇨ Instruct operating personnel in theory and practice of switchgear operation.

16.5 Applying operating voltage

DANGER

Hazardous voltage and internal arcing. Can cause death, serious injury or property damage. Do not apply operating voltage before the following instructions have been executed:

- ⇨ Observe the specifications for prevention of accidents.
- ⇨ Observe the operating instructions and work instructions of the switchgear operator.
- ⇨ Install the switchgear according to the installation instructions and drawings supplied.
- ⇨ Perform electrical and mechanical function test successfully.
- ⇨ Instruct the operating personnel in theory and practice of switchgear operation.
- ⇨ Fit all covers and bolt them tight.
- ⇨ Switch all circuit-breakers to OPEN position.
- ⇨ Switch the three-position disconnectors or three-position switch-disconnectors in all panels to OPEN position.
- ⇨ Earth feeders without connected cables. Close all bushings in a surge-proof way.
- ⇨ Switch off the consumers connected to all outgoing feeders.
- ⇨ Short-circuit unused current transformers on the secondary side.
- ⇨ Operate unused voltage transformers open on the secondary side.
- ⇨ Check the phase sequence in all incoming and outgoing feeders to assure a consistent phase sequence in the entire switchgear assembly before connecting them to the busbar.

Energizing incoming feeders

⇨ Energize all incoming feeders in the respective opposite substation.

Verifying correct terminal-phase connections

Verify correct terminal-phase connections of all incoming feeders:

Preconditions

- Use phase comparison test unit according to IEC 61243-5 or VDE 0682-415.
- The panel of the incoming feeder to be tested must be in OPEN position.
- The opposite substation must be de-earthed and live.

Performing the test

⇨ Remove the covers of the capacitive test sockets from phase L1 on the incoming feeder to be tested and on an already energized incoming feeder.

✔ The plug-in sockets of the capacitive voltage detecting system on phase L1 are accessible.

⇨ Plug the measuring cables of the phase comparison test unit into the plug-in sockets of the capacitive voltage detecting system according to the operating instructions.

⇨ Perform phase comparison according to the operating instructions of the phase comparison test unit and read the indication.

⇨ Remove the measuring cables from the plug-in sockets.

⇨ Refit the covers of the capacitive test sockets on both incoming feeders.

Checking further phases

⇨ Perform phase comparison for the phases L2 and L3 in the same way.

✔ If the phase comparison test unit has shown coincidence on all 3 phases, the phase sequence of the tested incoming feeder is correct.

✔ The incoming feeder can be energized.

Applying voltage to the busbar

If the phase sequence of all incoming feeders is correct, the incoming feeders can be connected to the busbar:

⇨ Switch the three-position switch-disconnector, three-position disconnector and circuit-breaker to CLOSED position (see page 140, "Operation" and following chapters).

✔ The busbar of the switchgear is live.

Energizing consumer feeders

When all incoming feeders are connected to the busbar:

⇨ One after the other, energize all consumer feeders with connected consumers.

✔ When all consumer feeders are energized, the switchgear is completely in operation.

Documenting the commissioning

⇨ Document the modifications occurred during installation or commissioning.

⇨ Document the modifications in the circuit diagram.

⇨ Send the modifications to the regional Siemens representative.

After commissioning

⇨ Observe the Five Safety Rules for working in the switchgear:

- Isolate.
- Secure against reclosing.
- Verify safe isolation from supply.
- Earth and short-circuit.
- Cover or barrier adjacent live parts.

⇨ Observe the locally applicable specifications for prevention of accidents.

⇨ If after commissioning further work is required in the area of the switchgear, install warning signs on the switchgear.

Access for working in the area of the switchgear must only be granted to the following persons:

- Electricians and persons who have been properly instructed in electrical engineering
- Persons under the supervision of electricians and persons who have been properly instructed in electrical engineering

Operation

	**DANGER** The internal arc classification of the switchgear according to IEC 62271-200 has only been proved by tests for the switchgear sides with internal arc classification and with closed high-voltage compartments. ⇨ Determine the IAC classification of the switchgear by means of the data on the rating plate (see page 46, "Rating plates"). ⇨ Regulations for access to switchgear areas without internal arc classification according to IEC 62271-200 must be defined by the entrepreneur or the switchgear operator.

	**DANGER** High voltage! Danger! ⇨ Isolate. ⇨ Secure against reclosing. ⇨ Verify safe isolation from supply. ⇨ Earth and short-circuit. ⇨ Cover or barrier adjacent live parts.

	**DANGER** During operation of electrical equipment and switchgear, parts of this equipment are under dangerous electrical voltage. Mechanical components may move quickly, even remotely controlled. ⇨ Do not remove covers. ⇨ Do not reach into openings.

	**DANGER** Switching without service readiness can cause serious injury and property damage. ⇨ Check service readiness of the switchgear before performing any switching operation. ⇨ If the switchgear is not ready for service (pointer in the red area), do not operate the switchgear, but contact the Siemens Service Hotline.

	**ATTENTION** Earthing a live incoming cable will result in a short circuit and trip an upstream circuit-breaker. ⇨ Verify safe isolation from supply of the feeder before earthing.

17 Indicators and control elements

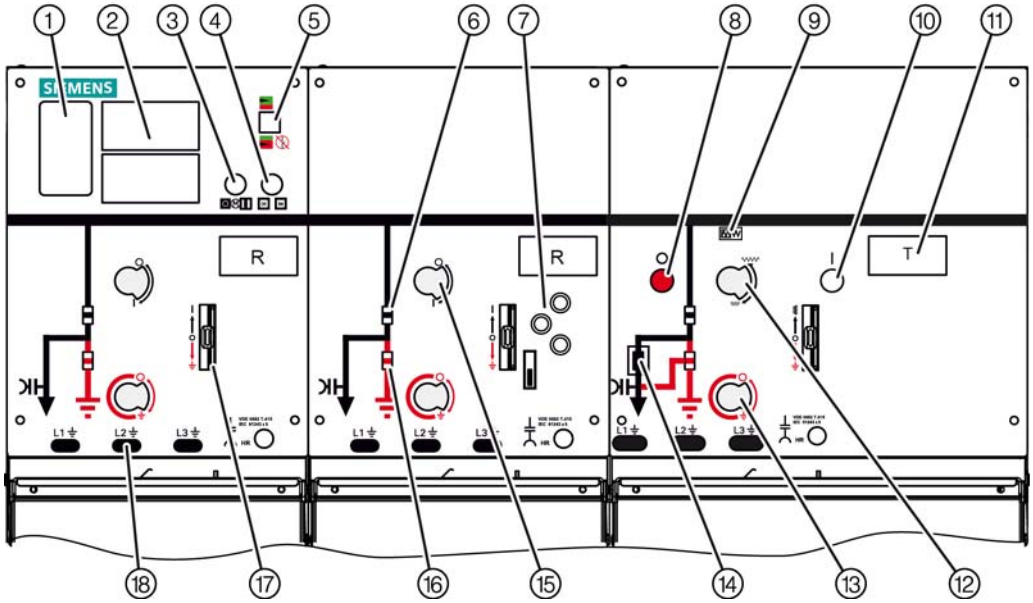


Fig. 155: RRT block 8DJH

① Rating plate
② Short-circuit indicator, earth-fault indicator, integrated capacitive voltage detecting system (option)
③ ON/OFF momentary-contact rotary control switch for motor operating mechanism (option)
④ Local-remote switch for motor operating mechanism (option)
⑤ Ready-for-service indicator
⑥ Position indicator for disconnector
⑦ Key-operated interlock (option)
⑧ OFF pushbutton for transformer feeder
⑨ "Spring charged" indicator
⑩ ON pushbutton for transformer feeder
⑪ Feeder designation label
⑫ Actuating opening for "spring charging"
⑬ Actuating opening for CLOSING/OPENING the earthing switch
⑭ Fuse trip indicator
⑮ Actuating opening for CLOSING/OPENING the disconnector
⑯ Position indicator for earthing switch
⑰ Control gate/locking device (option for three-position switch-disconnector)
⑱ Sockets for capacitive voltage detecting system

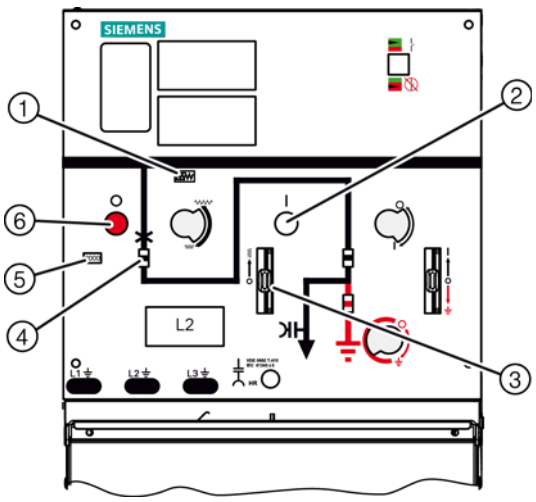


Fig. 156: 8DJH circuit-breaker panel type L2

① "Spring charged" indicator
② ON pushbutton for circuit-breaker
③ Control gate/locking device for circuit-breaker
④ Position indicator for circuit-breaker
⑤ Operations counter
⑥ OFF pushbutton for circuit-breaker

17.1 Position indicators

Switch position	CLOSED	OPEN	EARTHED
Disconnector Switch-disconnector			—
Earthing switch	—		
Circuit-breaker			—

"Fuse tripped" indicator	not tripped	tripped
Transformer panel		

17.2 Operations counter

Operations counter[1]	Number of operating cycles[2]
Circuit-breaker	

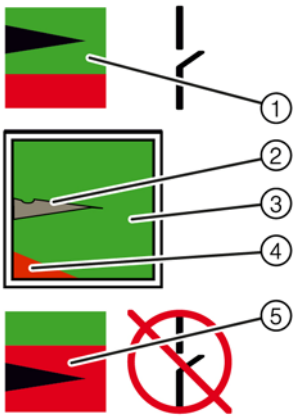
[1] Circuit-breaker type 1.1: standard, circuit-breaker type 2: option
[2] One operating cycle corresponds to one closing operation and one opening operation of the switching device

17.3 "Spring charged" indicator

"Spring charged" indicator	not charged	charged
Transformer panel Circuit-breaker panel type 2		
Circuit-breaker panel type 1.1		

17.4 Ready-for-service indicator

	**DANGER** Switching without service readiness can cause serious injury and property damage. ⇨ Check service readiness of the switchgear before performing any switching operation. ⇨ If the switchgear is not ready for service (pointer in the red area), do not operate the switchgear, but contact the Siemens Service Hotline.



① Indication "ready for service"
② Pointer
③ Green
④ Red
⑤ Indication "not ready for service"/ "do not operate"

Fig. 157: Ready-for-service indicator

17.5 Operating tools

Operating levers are available in different designs.

	**DANGER** Possible malfunctioning caused by switchgear damage. Using incorrect operating levers can damage or deactivate the safety equipment of the switchgear. ⇨ Use only the operating levers corresponding to the switchgear type.

Universal levers (standard)

Operating levers with black ball handles:
- Operation of switch-disconnectors, disconnectors and earthing switches
- Charging of operating mechanisms of circuit-breakers type 2 and switch-fuse combinations

Separate levers (option)

Operating levers with black ball handles:
- Operation of switch-disconnectors and disconnectors
- Charging of operating mechanisms of circuit-breakers type 2 and switch-fuse combinations

Operating levers with red ball handles:
- Operation of earthing switches

Long levers (option)

All operating levers are optionally available with **long** design. The long operating lever is equipped with an additional spacing tube.

Use of long operating levers:
- Switchgear in compact substations
- Switchgear with deep cable compartment cover

Anti-reflex levers

With anti-reflex levers, a direct inversion of the operating direction during a switching operation is prevented.
Every operating lever can be retrofitted to an anti-reflex lever: Remove the setscrew ① from the standard operating lever.

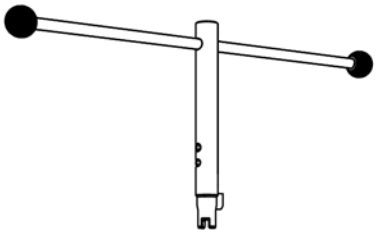
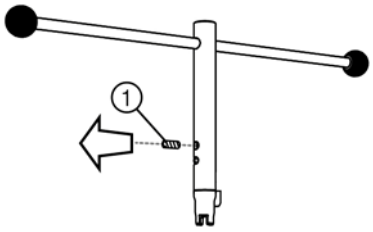


Fig. 158: Standard operating lever, short



① Setscrew

Fig. 159: Retrofitting to an anti-reflex lever

Hand crank

The hand crank is used for charging the spring energy store in panels with circuit-breaker type 1.1.

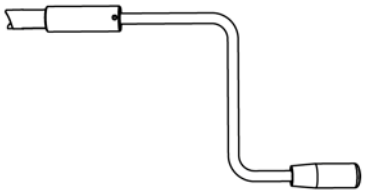


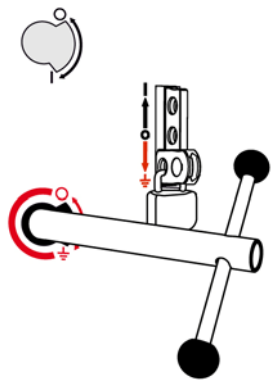
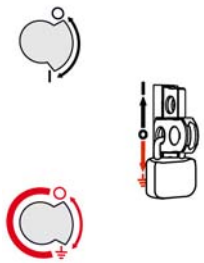
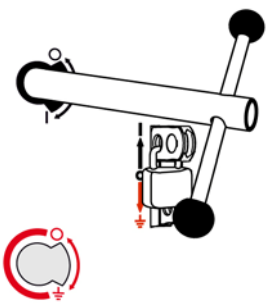
Fig. 160: Hand crank

17.6 Mechanical interlocking with padlock

The locking device (option) of the switching gate can be padlocked in all three switch positions.

The locking device can be padlocked so that no closing, no opening or no earthing is possible.

The padlock can also be fitted in such a way that none of the three switching operations can be performed.

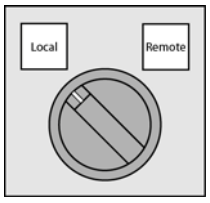
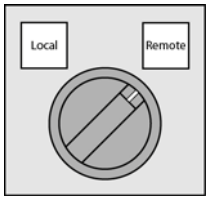
Padlock position	Down	Center	Up	
				
Actuating opening	Earthing switch	None	Disconnector	Circuit-breaker
			Switch-disconnector	Transformer switch
Possible switching operations	Only EARTHING and DE-EARTHING possible	No switching operations possible **Precondition:** Spring energy store not charged	• Only CLOSING and OPENING possible • Only possible if the circuit-breaker is open	• Charging the spring

Padlock

Padlock position	**Shackle diameter**	
	Minimum [mm]	**Maximum [mm]**
Locking device	6	12
Pushbutton (option)	3	6

17.7 Local-remote switch (option)

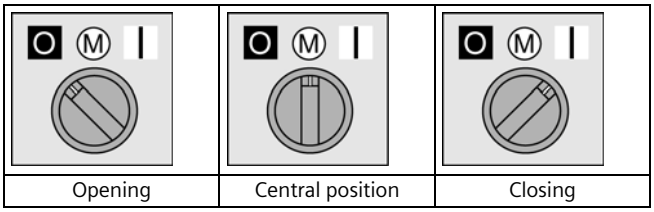
The local-remote switch determines the location from which the three-position disconnectors or three-position switch-disconnectors can be motor-operated. The local-remote switch latches tight in the selected setting.

Local setting: Local operation by motor	
Remote setting: Remote operation by motor from the control room or monitoring station	

17.8 Momentary-contact rotary control switch for motor operating mechanism (option)

On site, the disconnector or the earthing switch can be closed or opened via the motor operating mechanism (option). This function is only active if the local-remote switch (option) is in **Local** position.

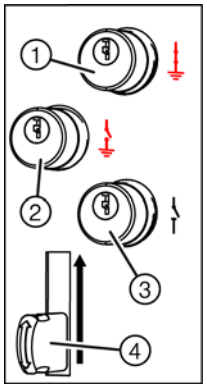
After operation, the momentary-contact rotary control switch returns to the central position automatically.



Opening	Central position	Closing

17.9 Key-operated interlock (option)

Interlocking possibilities of the key-operated interlock (optional):



① **Interlocking condition for earthing switches**
Interlocking the switching operation from EARTHED to OPEN position (KF 3):
- Key free in EARTHED position
- Key trapped in OPEN position

② **Interlocking condition for earthing switches**
Interlocking the switching operation from OPEN to EARTHED position (KF 2):
- Key free in OPEN position
- Key trapped in EARTHED position

③ **Interlocking condition for switch-disconnectors or disconnectors**
Interlocking the switching operation from OPEN to CLOSED position (KF 1):
- Key free in OPEN position
- Key trapped in CLOSED position

④ Control gate of the key-operated interlock

Interlocking the switch position

⇨ Switch the panel to the switch position to be interlocked.
⇨ Push the control gate upwards.
⇨ Turn the key in the cylinder lock according to the interlocking condition, and remove it.
✔ Push the control gate downwards.

18 Operating the panel with switch-disconnector

This chapter describes the manual operation of the following panel types:

- Panels with three-position switch-disconnector (panel types R, S)
- Panels of the panel type M(500).

The operations are exemplarily shown for a ring-main feeder (panel type R).

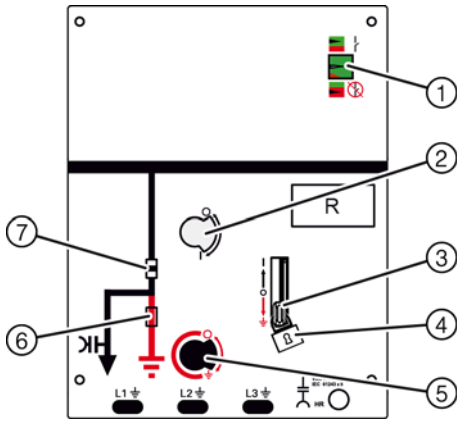
Motor operating mechanism (option)

The panels can be equipped with a motor operating mechanism for all switching operations. The use of the motor operating mechanism is described in the circuit documentation.

Manual switching operations are also possible with motor operating mechanism. If the control gate is operated in order to perform a switching operation, electrical switching commands are suppressed.

	NOTE
	If the operating spring is charged with the motor operating mechanism and the auxiliary voltage fails, the operating mechanism returns to the initial situation autonomously. ⇨ Switch the auxiliary voltage on again; then, the switching process can be repeated.

Control board for switch-disconnector (example: ring-main feeder)



① Ready-for-service indicator
② Actuating opening for switch-disconnector
③ Control gate/locking device (option for spring-operated mechanism)
④ Padlock (option)
⑤ Actuating opening for earthing switch
⑥ Position indicator for earthing switch
⑦ Position indicator for switch-disconnector

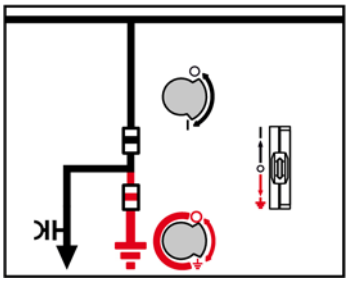
18.1 Switching the three-position switch-disconnector from OPEN to CLOSED position

Precondition

- Three-position switch-disconnector in OPEN position

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

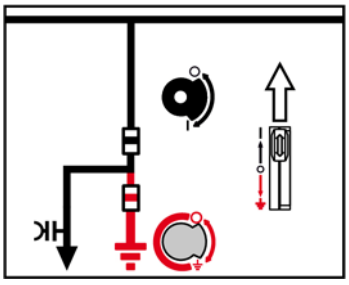
⇨ Remove the padlock (optional) from the locking device.



Releasing the actuating opening

⇨ Push the control gate (optional) upwards, and hold it.

✔ The actuating opening of the switch-disconnector is open.

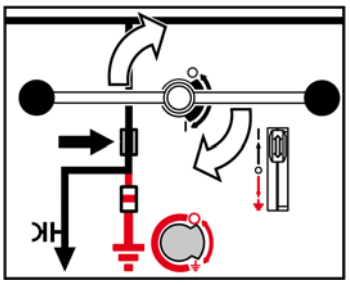


Switching to CLOSED position

⇨ Insert the operating lever and turn straight clockwise as far as it will go.

✔ The position indicator of the switch-disconnector shows the CLOSED position.

✔ The feeder is connected with the busbar.

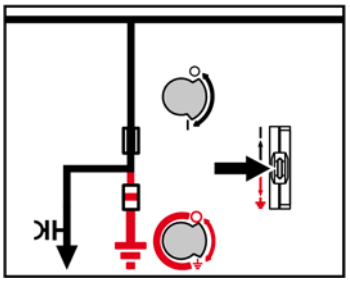


Final activities

⇨ Remove the operating lever.

The control gate returns to its initial position.

⇨ Fit the padlock (optional) on the locking device in the desired position (see page 144, "Mechanical interlocking with padlock").



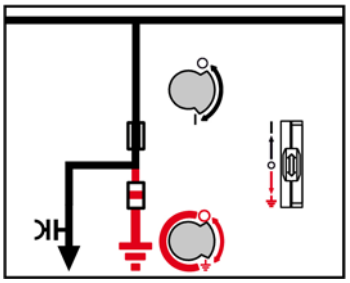
18.2 Switching the three-position switch-disconnector from CLOSED to OPEN position

Precondition

• Three-position switch-disconnector in CLOSED position

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

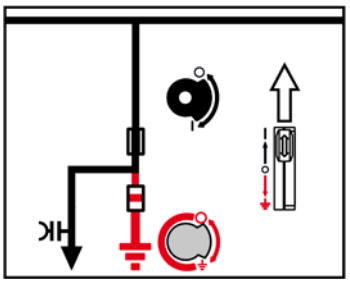
⇨ Remove the padlock from the locking device (optional).



Releasing the actuating opening

⇨ Push the control gate (optional) upwards, and hold it.

✔ The actuating opening of the switch-disconnector is open.

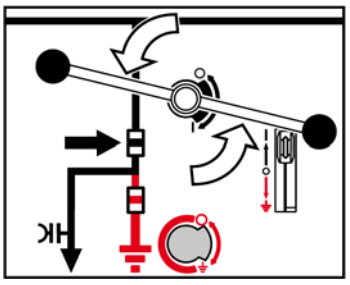


Switching to OPEN position

⇨ Insert the operating lever and turn straight counter-clockwise as far as it will go.

✔ The position indicator of the switch-disconnector shows the OPEN position.

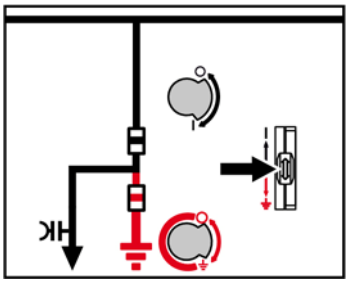
✔ The feeder is disconnected from the busbar.



Final activities

⇨ Remove the operating lever. The control gate returns to its initial position.

⇨ Fit the padlock (optional) on the locking device in the desired position (see page 144, "Mechanical interlocking with padlock").



18.3 Switching the three-position switch-disconnector from OPEN to EARTHED position

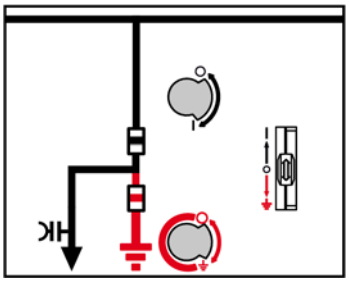
Precondition

- Three-position switch-disconnector in OPEN position

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

⇨ Verify safe isolation from supply of the feeder (see page 168, "Verification of safe isolation from supply").

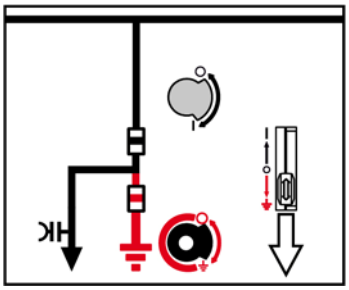
⇨ Remove the padlock (optional) from the locking device.



Releasing the actuating opening

⇨ Push the control gate (optional) downwards, and hold it.

✔ The actuating opening of the earthing switch is open.

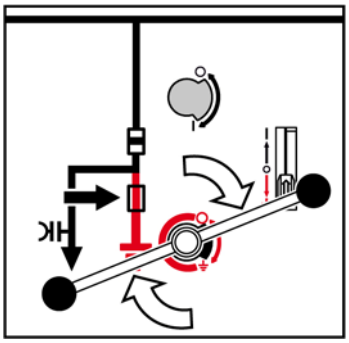


Switching to EARTHED position

⇨ Insert the operating lever and turn straight clockwise as far as it will go.

✔ The position indicator of the earthing switch shows the EARTHED position.

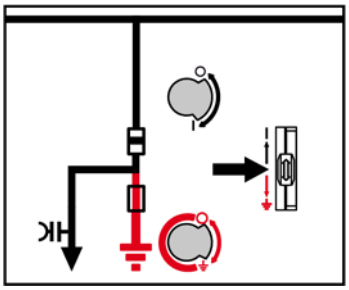
✔ The feeder is earthed.



Final activities

⇨ Remove the operating lever. The control gate returns to its initial position.

⇨ Fit the padlock (optional) on the locking device in the desired position (see page 144, "Mechanical interlocking with padlock").



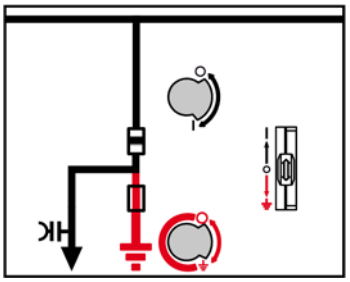
18.4 Switching the three-position switch-disconnector from EARTHED to OPEN position

Precondition

- Three-position switch-disconnector in EARTHED position

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

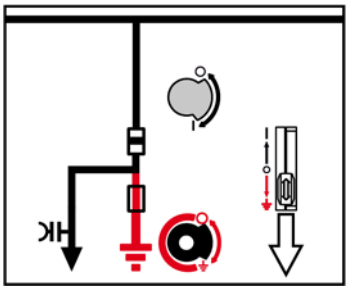
⇨ Remove the padlock (optional) from the locking device.



Releasing the actuating opening

⇨ Push the control gate (optional) downwards, and hold it.

✔ The actuating opening of the earthing switch is open.

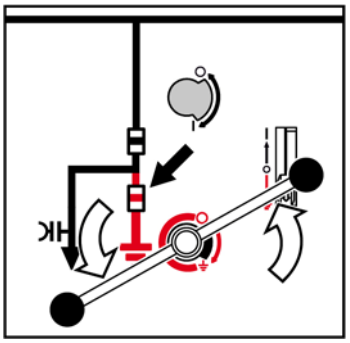


Switching to OPEN position

⇨ Insert the operating lever and turn straight counter-clockwise as far as it will go.

✔ The position indicator of the earthing switch shows the OPEN position.

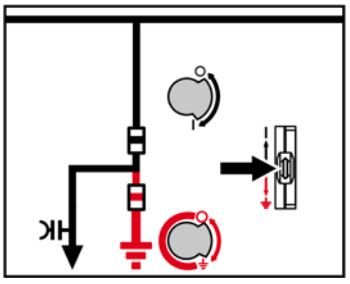
✔ The feeder is de-earthed.



Final activities

⇨ Remove the operating lever. The control gate returns to its initial position.

⇨ Fit the padlock (optional) on the locking device in the desired position (see page 144, "Mechanical interlocking with padlock").



19 Operating the panel with switch-fuse combination

	**DANGER** Risk of injury due to autonomously rotating operating lever. If the test fuse trips the transformer switch and the operating lever is still inserted in the actuating opening, the operating lever is turned quickly. ⇨ Remove the operating lever after every switching operation.

This chapter describes the manual operation of the following panel types:

- Panels with switch-fuse combination (panel type T, H)
- Disconnector with HV HRC fuses (panel type M(430))

The operations are exemplarily shown for a transformer feeder (panel type T).

Motor operating mechanism (option)

To perform the CLOSING and OPENING operations, the panels can be equipped with a motor operating mechanism. The use of the motor operating mechanism is described in the circuit documentation.

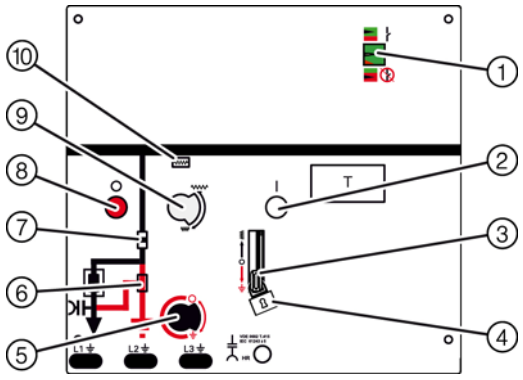
Manual switching operations are also possible with motor operating mechanism. If the control gate is operated in order to perform a switching operation, electrical switching commands are suppressed.

Charging the spring energy store with motor operating mechanism

If the spring-operated/stored-energy mechanism is equipped with a motor operating mechanism (option), the operating spring is charged automatically after applying auxiliary voltage.

	**NOTE** If the operating spring is charged with the motor operating mechanism and the auxiliary voltage fails, the operating mechanism returns to the initial situation autonomously. ⇨ Switch the auxiliary voltage on again; then, the switching process can be repeated.

Control board for switch-fuse combination (example: transformer feeder)



① Ready-for-service indicator
② ON pushbutton
③ Control gate / locking device
④ Padlock (option)
⑤ Actuating opening for earthing switch
⑥ Position indicator for earthing switch
⑦ Position indicator for switch-disconnector
⑧ OFF pushbutton
⑨ Actuating opening for "spring charging"
⑩ "Spring charged" indicator

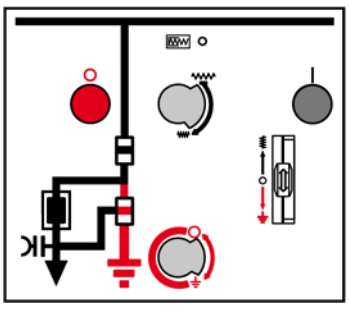
19.1 Switching the three-position switch-disconnector from OPEN to CLOSED position

Precondition

- Three-position switch-disconnector in OPEN position

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

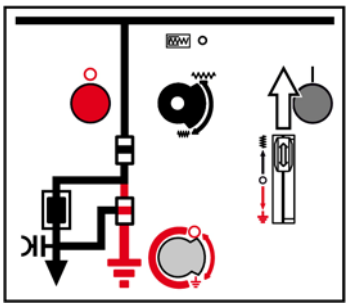
⇨ Remove the padlock (optional) from the locking device.



Releasing the actuating opening

⇨ Push the control gate upwards, and hold it.

✔ The actuating opening for "spring charging" is open.

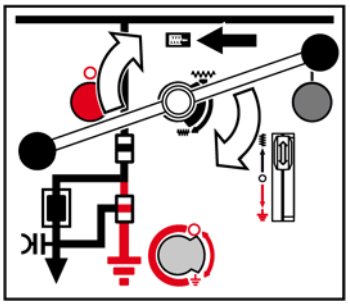


	NOTE
	The operating mechanism is equipped with an operating lever ejection system. The operating lever ejection system prevents the operating lever from being left inserted accidentally. ⇨ To insert the operating lever, a spring resistance must be overcome in the actuating opening.

Charging the spring energy store

⇨ Insert the operating lever and turn straight clockwise as far as it will go.

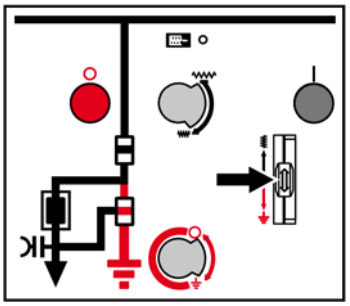
✔ The "spring charged" indicator shows "spring charged".



⇨ Remove the operating lever.

The control gate returns to its initial position.

✔ The feeder is ready to close.



	ATTENTION
	The switch-disconnector can be damaged by no-load switching. After charging the spring energy store, do not open the switch-disconnector directly. ⇨ After charging the spring energy store, close the switch-disconnector first, and then open it.

Switching to CLOSED position

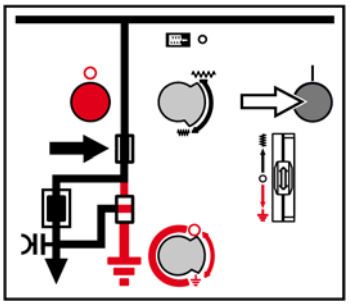
⇨ Actuate the ON pushbutton.

✔ The position indicator of the switch-disconnector shows the CLOSED position.

✔ The feeder is connected with the busbar.

⇨ Fit the padlock (optional) on the locking device in the desired position (see page 144, "Mechanical interlocking with padlock").

✔ The "spring charged" indicator still shows "spring charged".

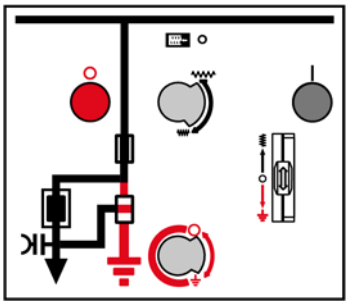


19.2 Switching the three-position switch-disconnector from CLOSED to OPEN position

Preconditions

- Three-position switch-disconnector in CLOSED position
- "Spring charged" indicator shows "spring charged"

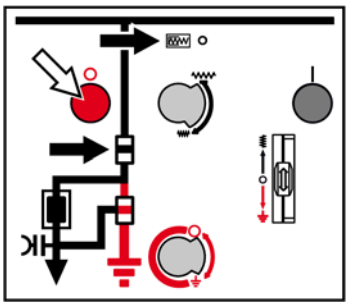
⇨ Check service readiness (see page 143, "Ready-for-service indicator").



Switching to OPEN position

⇨ Actuate the OFF pushbutton.

✔ "Spring charged" indicator shows "spring not charged".



19.3 Switching the three-position switch-disconnector from OPEN to EARTHED position

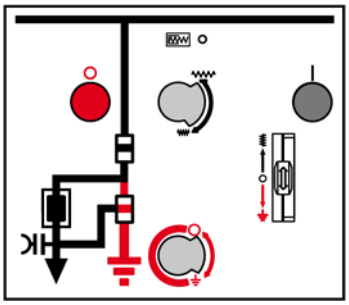
Precondition

- Three-position switch-disconnector in OPEN position

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

⇨ Verify safe isolation from supply of the feeder (see page 168, "Verification of safe isolation from supply").

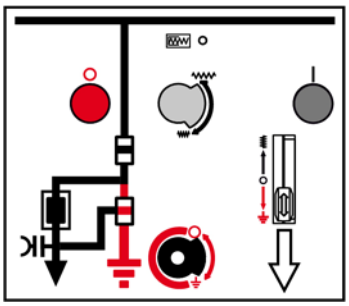
⇨ Remove the padlock (optional) from the locking device.



Releasing the actuating opening

⇨ Push the control gate downwards, and hold it.

✔ The actuating opening of the earthing switch is open.

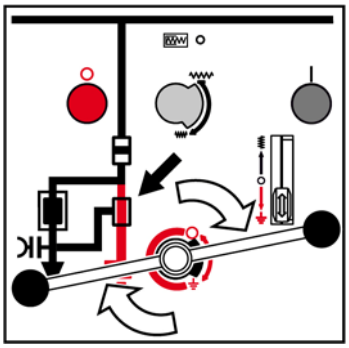


Switching to EARTHED position

⇨ Insert the operating lever and turn straight clockwise as far as it will go.

✔ The position indicator of the earthing switch shows the EARTHED position.

✔ The feeder is earthed.

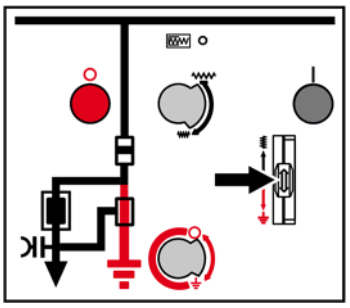


Final activities

⇨ Remove the operating lever.

The control gate returns to its initial position.

⇨ Fit the padlock (optional) on the locking device in the desired position (see page 144, "Mechanical interlocking with padlock").



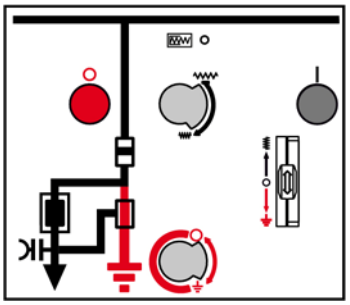
19.4 Switching the three-position switch-disconnector from EARTHED to OPEN position

Precondition

- Three-position switch-disconnector in EARTHED position

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

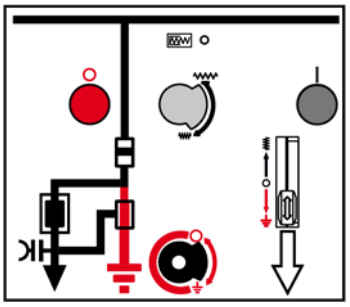
⇨ Remove the padlock from the locking device (optional).



Releasing the actuating opening

⇨ Push the control gate downwards, and hold it.

✔ The actuating opening of the earthing switch is open.

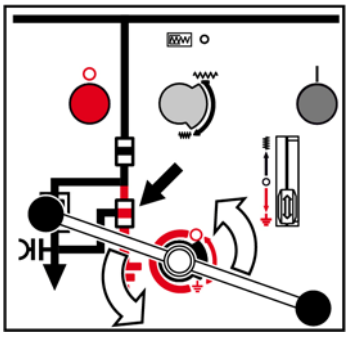


Switching to OPEN position

⇨ Insert the operating lever and turn straight counter-clockwise as far as it will go.

✔ The position indicator of the earthing switch shows the OPEN position.

✔ The feeder is de-earthed.

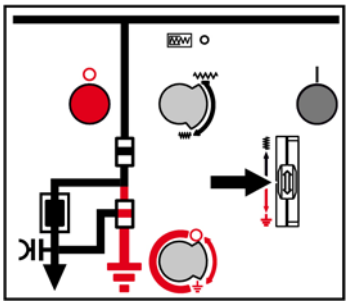


Final activities

⇨ Remove the operating lever.

The control gate returns to its initial position.

⇨ Fit the padlock (optional) on the locking device in the desired position (see page 144, "Mechanical interlocking with padlock").



19.5 Protection tripping of the switch-fuse combination

	NOTE
	If the switch-fuse combination was tripped by a fuse-link: ⇨ The "fuse tripped" indicator shows a red transverse bar. ⇨ Electrical switching commands to the motor operating mechanism (option) are suppressed.

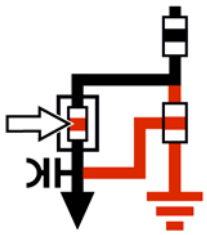


Fig. 161: Indication: Fuse tripped

Re-establishing service readiness

⇨ Switch the switching device to EARTHED position.

⇨ Replace **all** HV HRC fuse-links (see page 173, "Replacing HV HRC fuse-links"). The fuse-links may also be damaged if their striker was not tripped.

20 Operating the panel with circuit-breaker type 2

This chapter describes the manual operation of panels with circuit-breaker type 2 and three-position disconnector (panel types L, V).

The operations are exemplarily shown for a circuit-breaker feeder (panel type L).

Motor operating mechanism (option)

To perform switching operations with the circuit-breaker and the three-position disconnector, the panels can be equipped with a motor operating mechanism. The use of the motor operating mechanism is described in the circuit documentation.

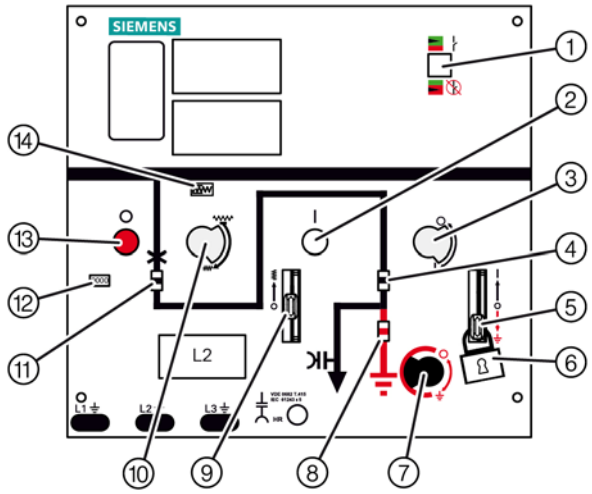
Manual switching operations are also possible with motor operating mechanism. If the control gate is operated in order to perform a switching operation, electrical switching commands to the corresponding switching device are suppressed.

Charging the spring energy store with motor operating mechanism

If the circuit-breaker is equipped with a motor operating mechanism (option), the spring energy store is charged automatically after applying auxiliary voltage.

	NOTE
	If the spring energy store is charged and the auxiliary voltage fails, the operating mechanism and the interlocks are blocked mechanically. ⇨ To deactivate the blocking of the operating mechanism and the interlocks, switch the auxiliary voltage on again.

Control board for circuit-breaker type 2 (example)



① Ready-for-service indicator
② ON pushbutton for circuit-breaker
③ Actuating opening for disconnector
④ Position indicator for disconnector
⑤ Control gate/locking device for three-position disconnector
⑥ Padlock (option)
⑦ Actuating opening for earthing switch
⑧ Position indicator for earthing switch
⑨ Control gate/locking device for circuit-breaker
⑩ Actuating opening for "spring charging"
⑪ Position indicator for circuit-breaker
⑫ Operations counter
⑬ OFF pushbutton for circuit-breaker
⑭ "Spring charged" indicator

20.1 Charging the spring energy store in circuit-breaker type 2 manually

For a circuit-breaker without motor operating mechanism (option), or in case of failure of the auxiliary voltage supply, the operating mechanism of the circuit-breaker must be charged manually before switching operations can be executed.

ATTENTION

The circuit-breaker can be damaged by no-load switching. After charging the spring energy store, do not open the circuit-breaker directly.

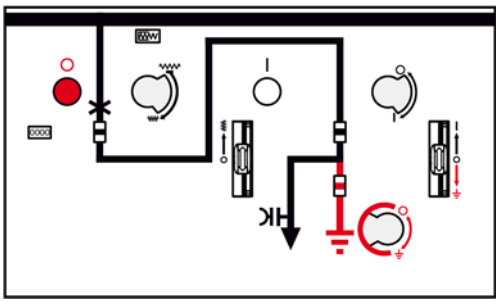
⇨ After charging the spring energy store, close the circuit-breaker first, and then open it.

Preconditions

- Circuit-breaker in OPEN position
- "Spring charged" indicator shows "spring not charged"

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

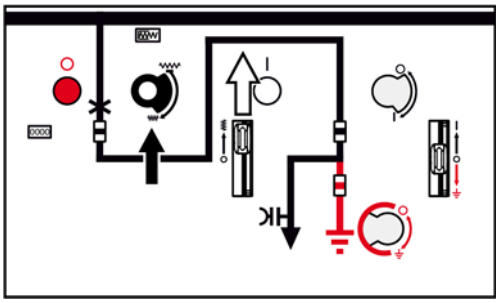
⇨ Remove the padlock (optional) from the locking device of the circuit-breaker.



Releasing the actuating opening

⇨ Push the control gate of the circuit-breaker upwards, and hold it.

⇨ The actuating opening for "spring charging" is open.



NOTE

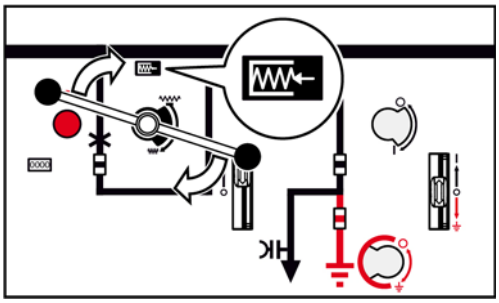
The operating mechanism is equipped with an operating lever ejection system. The operating lever ejection system prevents the operating lever from being left inserted accidentally.

⇨ To insert the operating lever, a spring resistance must be overcome in the actuating opening.

Charging the spring energy store

⇨ Insert operating lever and turn clockwise as far as it will go until the "spring charged" indicator shows "spring charged".

✔ The "spring charged" indicator shows "spring charged".

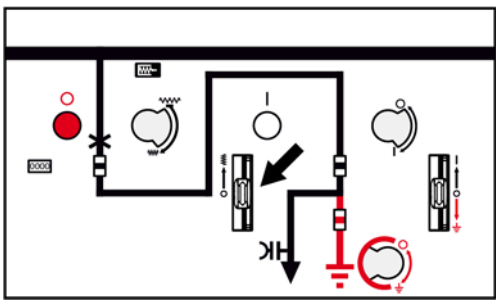


Final activities

⇨ Remove the operating lever.

✔ The control gate of the circuit-breaker returns to its initial position.

✔ The spring energy store is charged. The circuit-breaker can now be closed and opened again.

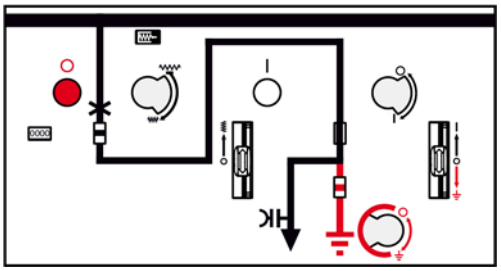


20.2 Closing circuit-breaker type 2

Preconditions

- Circuit-breaker in OPEN position
- Three-position disconnector in CLOSED position
- "Spring charged" indicator shows "spring charged"
- Auxiliary voltage applied at the undervoltage release (option)

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

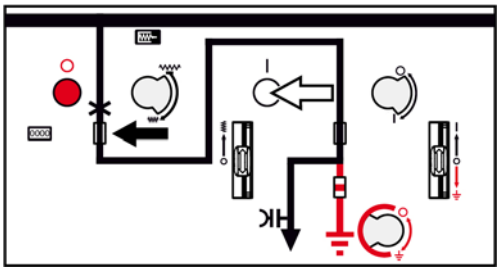


Closing the circuit-breaker

⇨ Actuate the ON pushbutton.

✔ The position indicator of the circuit-breaker is in CLOSED position.

✔ The "spring charged" indicator still shows "spring charged".



20.3 Opening circuit-breaker type 2

ATTENTION

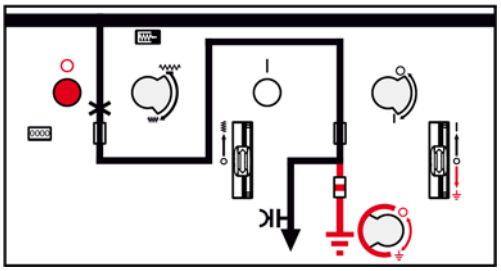
The circuit-breaker can be damaged by no-load switching. After charging the spring energy store, do not open the circuit-breaker directly.

⇨ After charging the spring energy store, close the circuit-breaker first, and then open it.

Preconditions

- Circuit-breaker in CLOSED position
- Three-position disconnector in CLOSED position
- "Spring charged" indicator shows "spring charged"
- Auxiliary voltage applied at the undervoltage release (option)

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

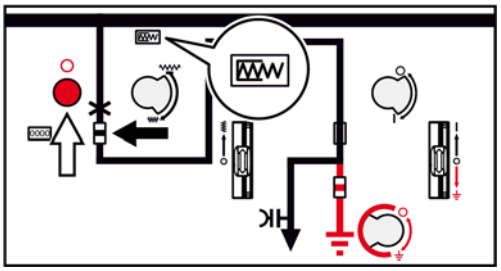


Opening the circuit-breaker

⇨ Actuate the OFF pushbutton.

✔ The position indicator of the circuit-breaker shows the OPEN position.

✔ "Spring charged" indicator shows "spring not charged".



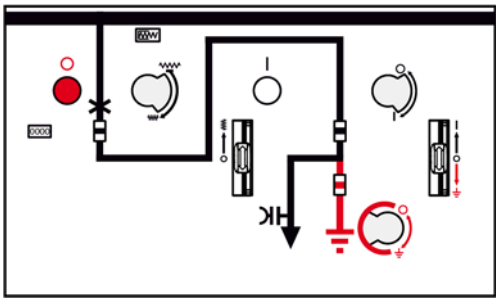
20.4 Switching the three-position disconnector from OPEN to CLOSED position

Preconditions

- Circuit-breaker in OPEN position
- Three-position disconnector in OPEN position

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

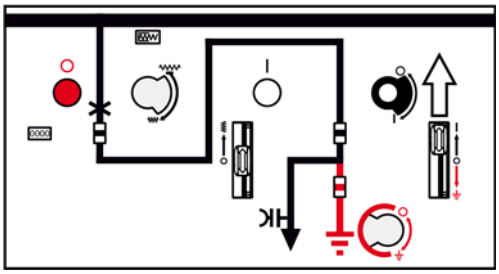
⇨ Remove the padlock (optional) from the locking device of the three-position disconnector.



Releasing the actuating opening

⇨ Push the control gate of the three-position disconnector upwards, and hold it.

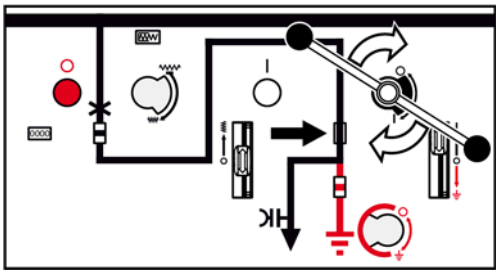
✔ The actuating opening of the disconnector is open.



Switching to CLOSED position

⇨ Insert the operating lever and turn clockwise as far as it will go.

✔ The position indicator of the disconnector shows the CLOSED position.

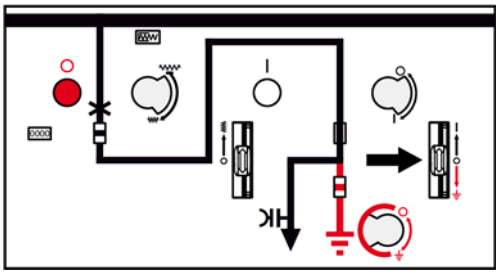


Final activities

⇨ Remove the operating lever.

✔ The control gate returns to its initial position.

⇨ Fit the padlock (optional) on the locking device in the desired position (see page 144, "Mechanical interlocking with padlock").



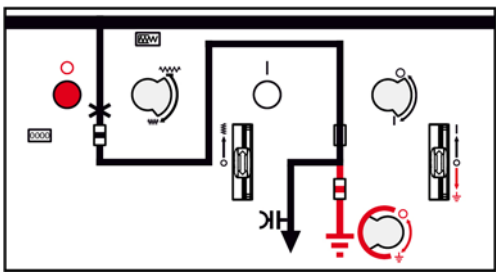
20.5 Switching the three-position disconnector from CLOSED to OPEN position

Preconditions

- Circuit-breaker in OPEN position
- Three-position disconnector in CLOSED position

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

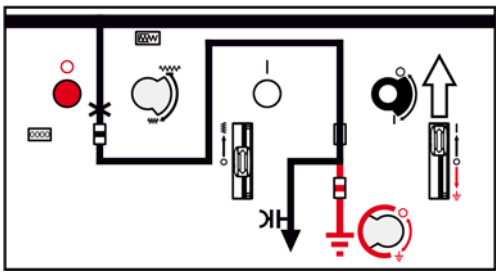
⇨ Remove the padlock (optional) from the locking device of the three-position disconnector.



Releasing the actuating opening

⇨ Push the control gate of the three-position disconnector upwards, and hold it.

✔ The actuating opening of the disconnector is open.

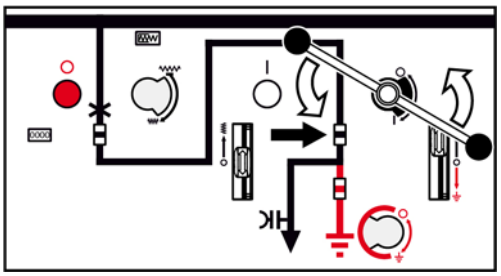


Switching to OPEN position

⇨ Insert the operating lever and turn counter-clockwise as far as it will go.

✔ The position indicator of the disconnector shows the OPEN position.

✔ The three-position disconnector is open.

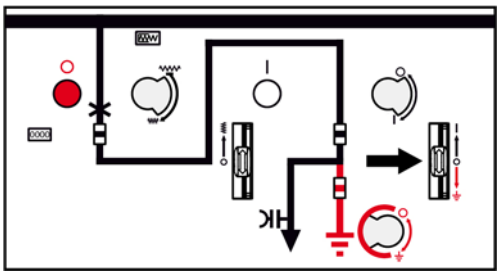


Final activities

⇨ Remove the operating lever.

✔ The control gate returns to its initial position.

⇨ Fit the padlock (optional) on the locking device in the desired position (see page 144, "Mechanical interlocking with padlock").



20.6 Switching the three-position disconnector from OPEN to EARTHED position

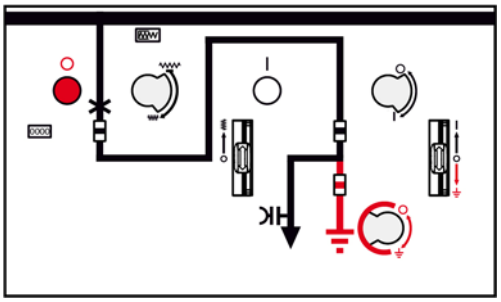
Preconditions

- Circuit-breaker in OPEN position
- Three-position disconnector in OPEN position

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

⇨ Verify safe isolation from supply of the feeder (see page 168, "Verification of safe isolation from supply").

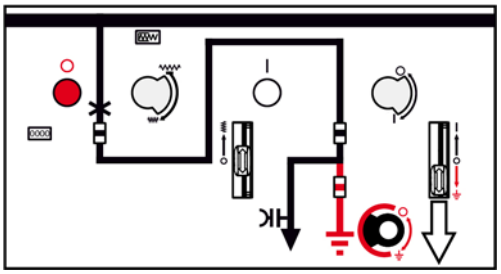
⇨ Remove the padlock (optional) from the locking device of the three-position disconnector.



Releasing the actuating opening

⇨ Push the control gate of the three-position disconnector downwards, and hold it.

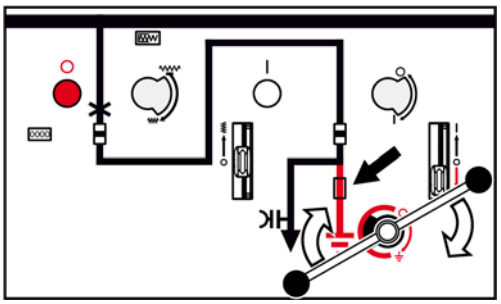
✔ The actuating opening of the earthing switch is open.



Switching to EARTHED position

⇨ Insert the operating lever and turn clockwise as far as it will go.

✔ The position indicator of the earthing switch shows the EARTHED position.

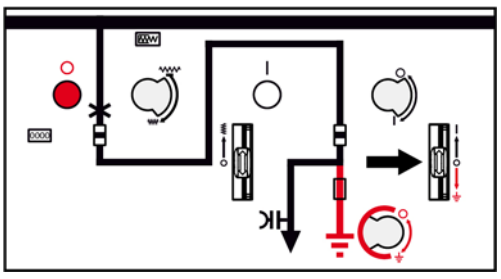


Final activities

⇨ Remove the operating lever.

✔ The control gate returns to its initial position.

⇨ Fit the padlock (optional) on the locking device in the desired position (see page 144, "Mechanical interlocking with padlock").



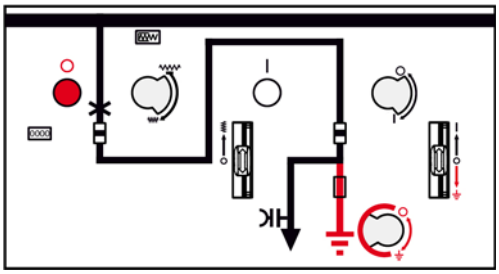
20.7 Switching the three-position disconnector from EARTHED to OPEN position

Preconditions

- Circuit-breaker in OPEN position
- Three-position disconnector in EARTHED position

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

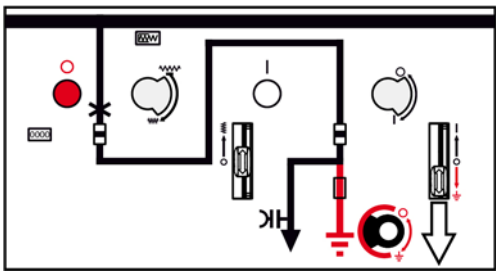
⇨ Remove the padlock (optional) from the locking device of the three-position disconnector.



Releasing the actuating opening

⇨ Push the control gate of the three-position disconnector downwards, and hold it.

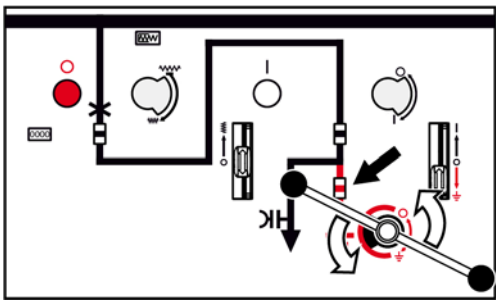
✔ The actuating opening of the earthing switch is open.



Switching to OPEN position

⇨ Insert the operating lever and turn counter-clockwise as far as it will go.

✔ The position indicator of the earthing switch shows the OPEN position.

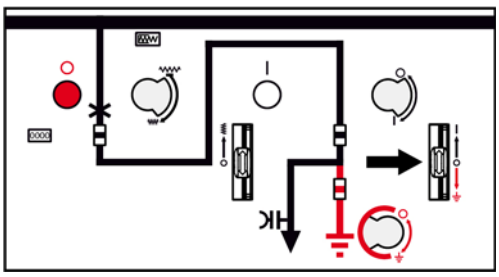


Final activities

⇨ Remove the operating lever.

✔ The control gate returns to its initial position.

⇨ Fit the padlock (optional) on the locking device in the desired position (see page 144, "Mechanical interlocking with padlock").



21 Operating the panel with circuit-breaker type 1.1

This chapter describes the manual operation of panels with circuit-breaker type 1.1 and three-position disconnector (panel types L, V).

The operations are exemplarily shown for a circuit-breaker feeder (panel type L).

Motor operating mechanism (option)

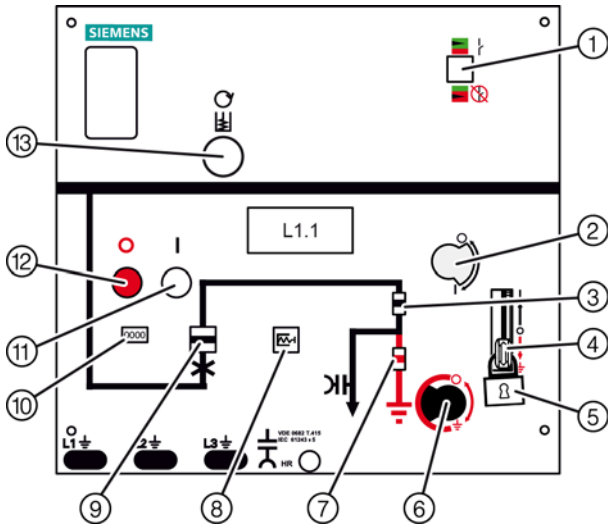
To perform switching operations with the circuit-breaker and the three-position disconnector, the panels can be equipped with a motor operating mechanism. The use of the motor operating mechanism is described in the circuit documentation.

Manual switching operations are also possible with motor operating mechanism. If the control gate is operated in order to perform a switching operation, electrical switching commands to the corresponding switching device are suppressed.

Charging the spring energy store with motor operating mechanism

If the circuit-breaker is equipped with a motor operating mechanism (option), the spring energy store is charged automatically after applying auxiliary voltage.

Control board for circuit-breaker type 1.1 (example)



① Ready-for-service indicator
② Actuating opening for disconnector
③ Position indicator for disconnector
④ Control gate / locking device for three-position disconnector
⑤ Padlock (option)
⑥ Actuating opening for earthing switch
⑦ Position indicator for earthing switch
⑧ "Spring charged" indicator
⑨ Position indicator for circuit-breaker
⑩ Operations counter
⑪ ON pushbutton for circuit-breaker
⑫ OFF pushbutton for circuit-breaker
⑬ Actuating opening for "spring charging"

21.1 Charging the spring energy store in circuit-breaker type 1.1 manually

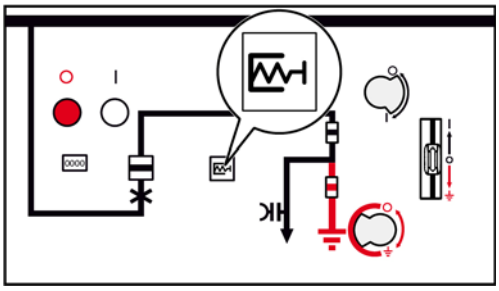
For a circuit-breaker without motor operating mechanism (option), or in case of failure of the auxiliary voltage supply, the operating mechanism of the circuit-breaker must be charged manually before switching operations can be executed.

For charging the operating mechanism, the hand crank supplied with the accessories is used.

Preconditions

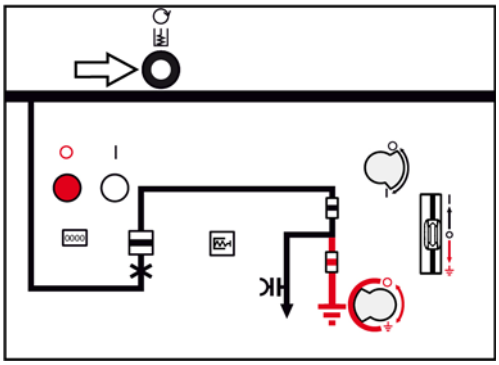
- Circuit-breaker in OPEN position
- "Spring charged" indicator shows "spring not charged"

⇨ Check service readiness (see page 143, "Ready-for-service indicator").



Removing the protective cap

⇨ Remove the protective cap of the actuating opening for the hand crank.



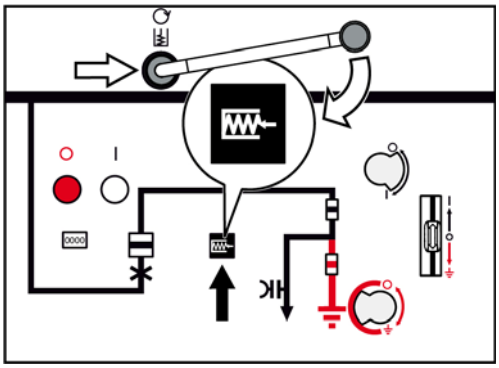
Charging the spring energy store

⇨ Insert the hand crank and turn clockwise until the "spring charged" indicator shows "spring charged".

✔ The "spring charged" indicator shows "spring charged".

⇨ Remove the hand crank.

⇨ Insert the protective cap again into the actuating opening.



Circuit-breaker with automatic reclosing (AR):

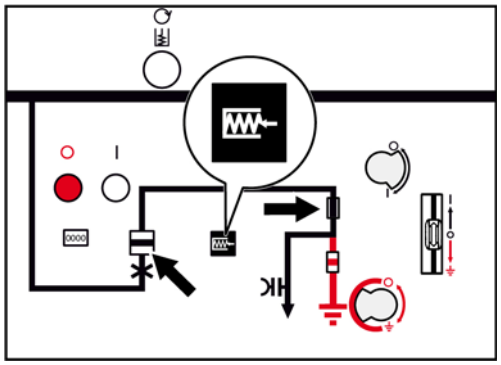
In order to ensure the operating sequence O - 0.3 s - CO for automatic reclosing of a circuit-breaker with automatic reclosing feature (AR), recharge the closing spring manually again after closing.

21.2 Closing circuit-breaker type 1.1

Preconditions

- Circuit-breaker in OPEN position
- Three-position disconnector in CLOSED position
- "Spring charged" indicator shows "spring charged"
- Auxiliary voltage applied at the undervoltage release (option)

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

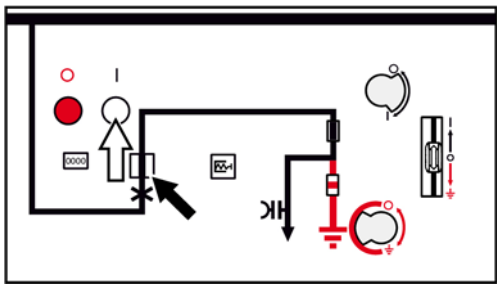


Closing the circuit-breaker

⇨ Actuate the ON pushbutton.

✔ The position indicator of the circuit-breaker is in CLOSED position.

✔ "Spring charged" indicator shows "spring not charged".
If the panel is equipped with a motor operating mechanism, the spring energy store is automatically charged again after a few seconds.
Then, the "spring charged" indicator shows "spring charged" again.

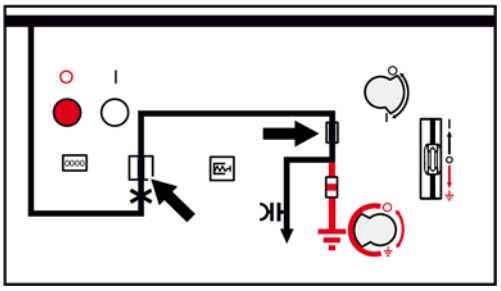


21.3 Opening circuit-breaker type 1.1

Precondition

- Circuit-breaker in CLOSED position
- Three-position disconnector in CLOSED position
- Auxiliary voltage applied at the undervoltage release (option)

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

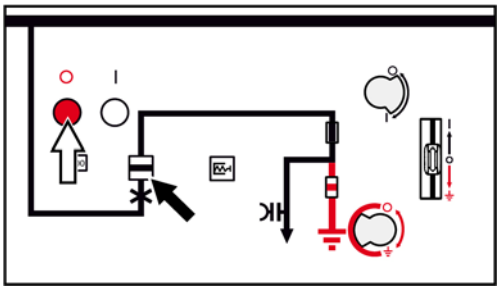


Opening the circuit-breaker

⇨ Actuate the OFF pushbutton.

✔ The position indicator of the circuit-breaker is in OPEN position.

✔ "Spring charged" indicator shows "spring not charged".
If the panel is equipped with a motor operating mechanism, the spring energy store is automatically charged again after a few seconds.
Then, the "spring charged" indicator shows "spring charged" again.



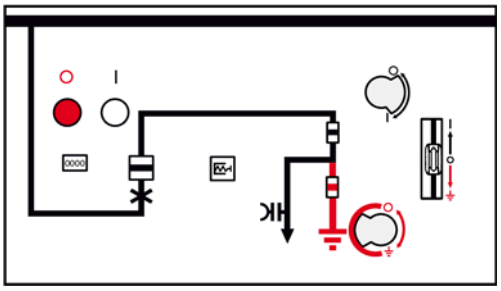
21.4 Switching the three-position disconnector from OPEN to CLOSED position

Preconditions

- Circuit-breaker in OPEN position
- Three-position disconnector in OPEN position

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

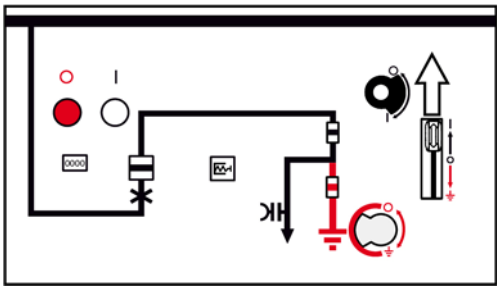
⇨ Remove the padlock (optional) from the locking device.



Releasing the actuating opening

⇨ Push the control gate upwards, and hold it.

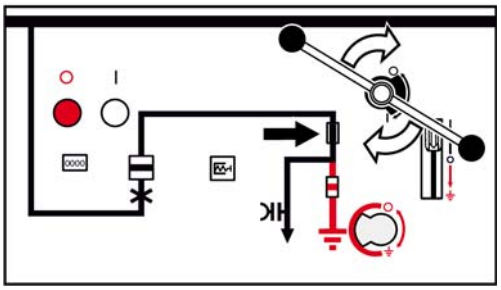
✔ The actuating opening of the disconnector is open.



Switching to CLOSED position

⇨ Insert the operating lever and turn clockwise as far as it will go.

✔ The position indicator of the disconnector shows the CLOSED position.

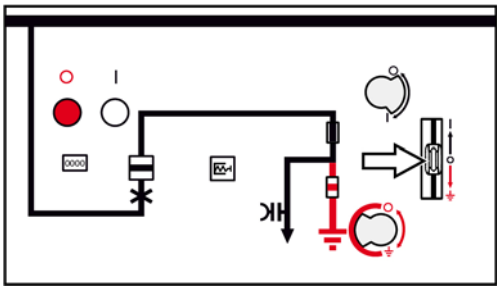


Final activities

⇨ Remove the operating lever.

✔ The control gate returns to its initial position.

⇨ Fit the padlock (optional) on the locking device in the desired position (see page 144, "Mechanical interlocking with padlock").



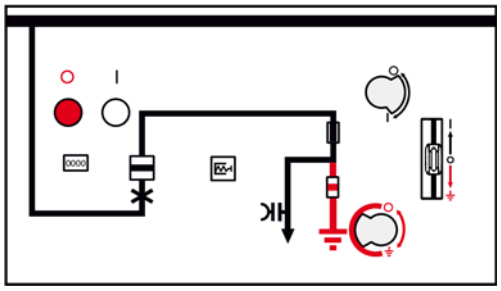
21.5 Switching the three-position disconnector from CLOSED to OPEN position

Preconditions

- Circuit-breaker in OPEN position
- Three-position disconnector in CLOSED position

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

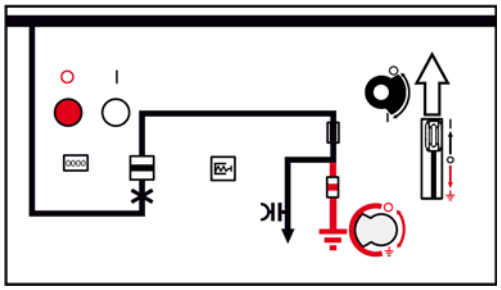
⇨ Remove the padlock (optional) from the locking device.



Releasing the actuating opening

⇨ Push the control gate upwards, and hold it.

✔ The actuating opening of the disconnector is open.

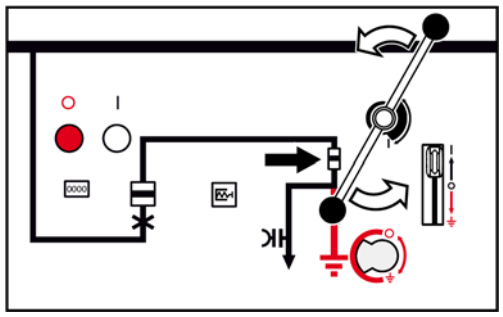


Switching to OPEN position

⇨ Insert the operating lever and turn counter-clockwise as far as it will go.

✔ The position indicator of the disconnector shows the OPEN position.

✔ The three-position disconnector is open.

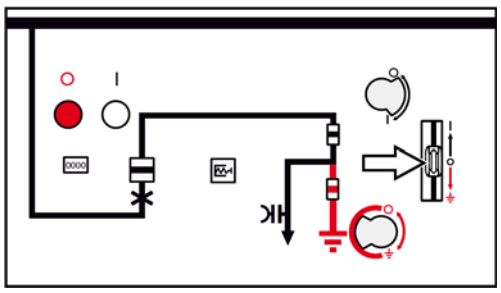


Final activities

⇨ Remove the operating lever.

✔ The control gate returns to its initial position.

⇨ Fit the padlock (optional) on the locking device in the desired position (see page 144, "Mechanical interlocking with padlock").



21.6 Switching the three-position disconnector from OPEN to EARTHED position

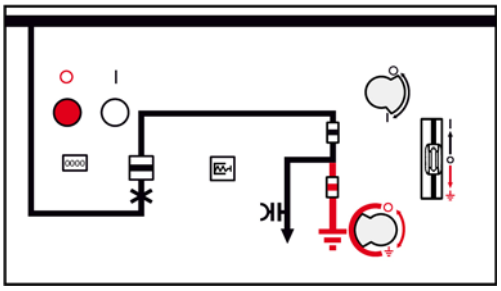
Preconditions

- Circuit-breaker in OPEN position
- Three-position disconnector in OPEN position

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

⇨ Verify safe isolation from supply of the feeder (see page 168, "Verification of safe isolation from supply").

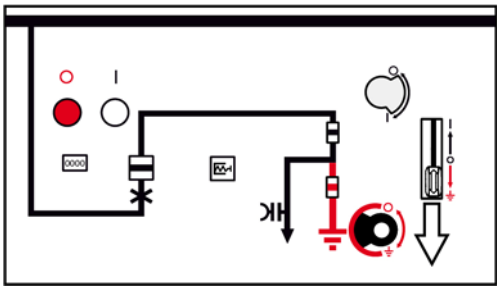
⇨ Remove the padlock (optional) from the locking device.



Releasing the actuating opening

⇨ Push the control gate downwards, and hold it.

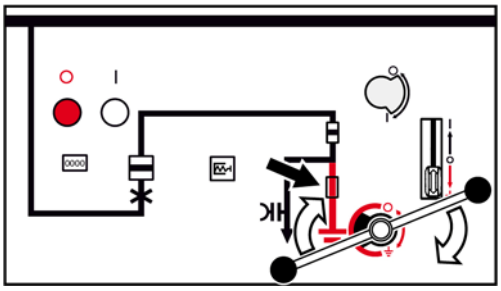
✔ The actuating opening of the earthing switch is open.



Switching to EARTHED position

⇨ Insert the operating lever and turn clockwise as far as it will go.

✔ The position indicator of the earthing switch shows the EARTHED position.

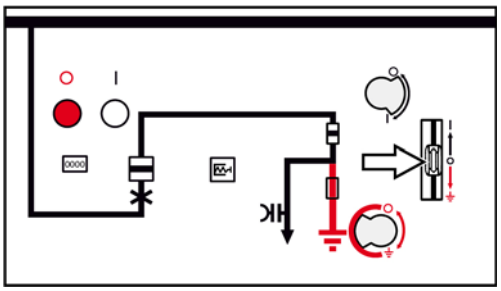


Final activities

⇨ Remove the operating lever.

✔ The control gate returns to its initial position.

⇨ Fit the padlock (optional) on the locking device in the desired position (see page 144, "Mechanical interlocking with padlock").



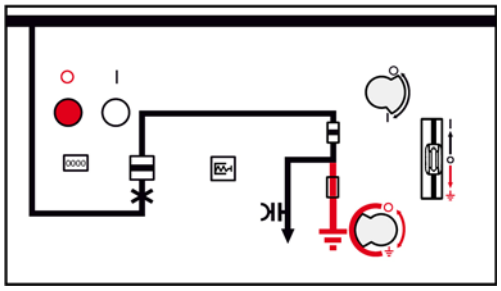
21.7 Switching the three-position disconnector from EARTHED to OPEN position

Preconditions

- Circuit-breaker in OPEN position
- Three-position disconnector in EARTHED position

⇨ Check service readiness (see page 143, "Ready-for-service indicator").

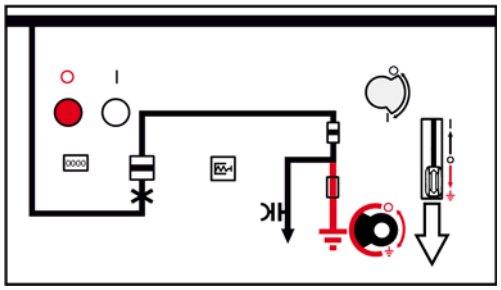
⇨ Remove the padlock (optional) from the locking device.



Releasing the actuating opening

⇨ Push the control gate downwards, and hold it.

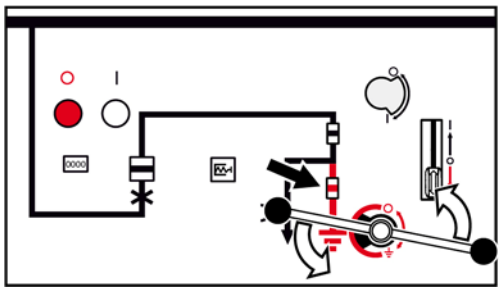
✔ The actuating opening of the earthing switch is open.



Switching to OPEN position

⇨ Insert the operating lever and turn counter-clockwise as far as it will go.

✔ The position indicator of the earthing switch shows the OPEN position.

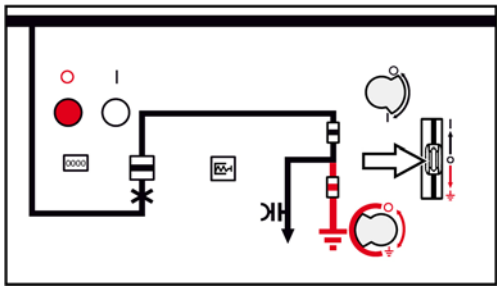


Final activities

⇨ Remove the operating lever.

✔ The control gate returns to its initial position.

⇨ Fit the padlock (optional) on the locking device in the desired position (see page 144, "Mechanical interlocking with padlock").



22 Verification of safe isolation from supply

DANGER

High voltage! Danger! Verify safe isolation from supply without any doubt!

⇨ Possible sources of failure:
- Defective voltage indicator (or device for function testing of the coupling section)
- Maloperation of the voltage indicator (or device for function testing of the coupling section)

⇨ Test the perfect function of the voltage indicator and the coupling section in accordance with national standards:
- On a live panel
- With a test unit according to IEC 61243-5/EN 61243-5
- On all phases

⇨ Use only voltage indicators or devices according to EN 61243-5 / IEC 61243-5 / VDE 0682-415 to test the function of the coupling section. (The interface conditions have not changed as against the old standard VDE 0681 Part 7; the corresponding indicators can still be used.)

⇨ Perform repeat test of interface conditions at the capacitive interfaces, as well as on the indicators according to the customer's specifications or national standards.

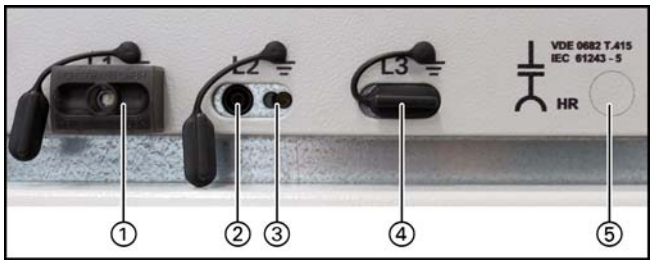
⇨ Do not use short-circuiting jumpers as separate plugs. The function of the surge arrester installed is not guaranteed anymore if short-circuiting jumpers are used (see page 24, "Voltage detecting systems").

NOTE

The following descriptions do not substitute reading the manufacturer documentation.

⇨ Before using the voltage detecting systems, read the supplied manufacturer documentation.

22.1 HR or LRM plug-in sockets



① Voltage indicator type HR
② Capacitive test socket, phase L2
③ Earth socket
④ Cover for test sockets
⑤ Documentation to repeat test of interface condition

⇨ Remove the covers from the plug-in sockets (interfaces of phases L1, L2 and L3).

⇨ Insert the HR or LRM voltage indicator consecutively into the plug-in sockets of the phases L1, L2 and L3.

✔ If the HR or LRM voltage indicator does **not** flash or light up in any of the 3 phases, the phases are not live.

⇨ Refit the covers on the plug-in sockets.

Indication of HR or LRM voltage indicator		Description of the indication
	Indication flashes	Phase not isolated from supply
	Indication lights up	Phase not isolated from supply
	No lighting up or flashing of the indication	Phase isolated from supply

The marking for documentation of the repeat test of the interface condition is located next to the HR or LRM plug-in sockets:

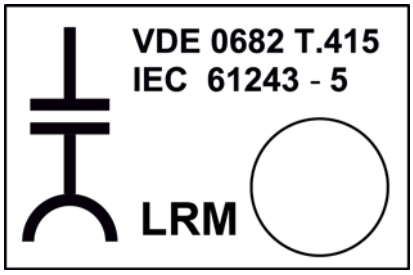


Fig. 162: Documentation to repeat test of interface condition

22.2 VOIS and CAPDIS indications

DANGER

High voltage! Danger! Do only modify the factory setting of the C2 module in the voltage detecting system CAPDIS-S1+/S2+ after consultation with the regional Siemens representative!

⇨ If the setting of the C2 module was modified by mistake, re-establish the factory setting as follows:

- Pull out the C2 module ③ at the rear side of CAPDIS-S1+/S2+. **Attention:** Open printed circuit board may be energized.
- Plug the C2 module ③ into CAPDIS-S1+/S2+ so that the marked arrow ① on the housing points to the marking ② on the C2 module

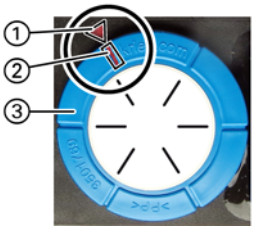


Fig. 163: Marking of the factory setting on the C2 module

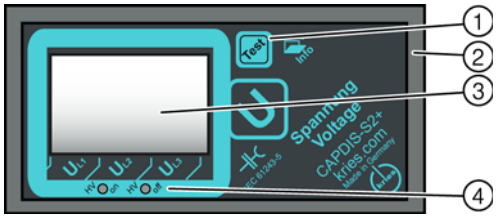


Fig. 164: CAPDIS-S2+: Cover closed

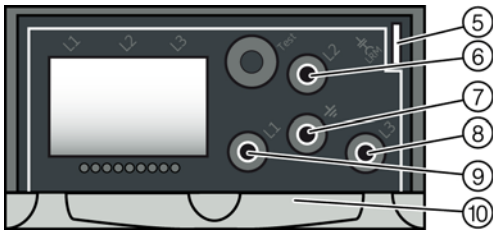


Fig. 165: CAPDIS-S2+: Cover opened

① "Test" button
② Cover
③ LC display
④ LEDs red and green (state of the relay contacts)
⑤ Duct for signaling cables CAPDIS-M
⑥ Test socket L2
⑦ Earth socket
⑧ Test socket L3
⑨ Test socket L1
⑩ Short instructions

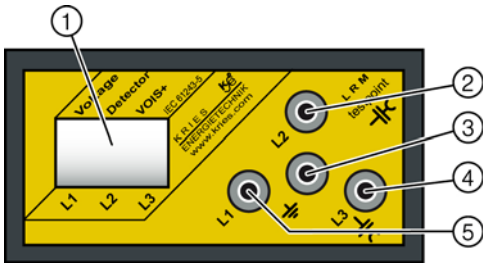


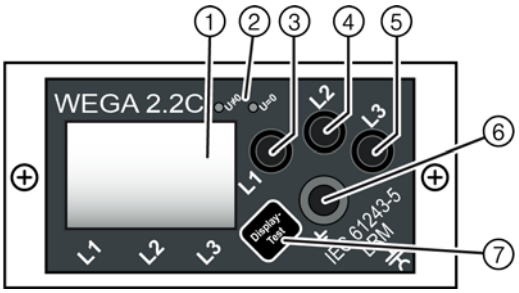
Fig. 166: VOIS+: Cover opened

① LC display
② Test socket L2
③ Earth socket
④ Test socket L3
⑤ Test socket L1

Indication	VOIS+, VOIS R+			CAPDIS-S1+			CAPDIS-S2+					Description of the indication
	L1	L2	L3	L1	L2	L3	L1	L2	L3	State of the relay contacts[1]		
										Red	Green	
A0							000			U ≠ 0 ○	U = 0 ●	Operating voltage not present.
A1	ϟ ϟ ϟ			ϟ ϟ ϟ			ϟ ϟ ϟ			U ≠ 0 ●	U = 0 ○	Operating voltage present.
A2										U ≠ 0 ○	U = 0 ○	• Operating voltage not present. • Auxiliary voltage not available (only CAPDIS-S2+).
A3	ϟ ϟ			ϟ ϟ			ϟ ϟ			U ≠ 0 ●	U = 0 ●	Failure in phase L1, operating voltage at L2 and L3 (for CAPDIS-Sx+ also earth-fault indication).
A4	-			ϟ ϟ ϟ			ϟ ϟ ϟ			U ≠ 0 ●	U = 0 ○	Voltage (**not** operating voltage) present.
A5	-			ϟ ϟ ϟ			ϟ ϟ ϟ			U ≠ 0 ○	U = 0 ○	Indication: "Test" passed (lights up shortly).
A6	-			ϟ ϟ ϟ ERROR			ϟ ϟ ϟ ERROR			U ≠ 0 ○	U = 0 ○	Indication: "Test" not passed (lights up shortly).
A7	-			ϟ ϟ ϟ			ϟ ϟ ϟ			U ≠ 0 ●	U = 0 ●	Overvoltage present (lights up permanently).
A8	-			-			ϟ ϟ ϟ ERROR			U ≠ 0 ○	U = 0 ○	Indication: "ERROR" e.g. in case of missing auxiliary voltage.

[1] ○ ○ LED does not light up, ● ● LED lights up

22.3 WEGA indications



① Display (illuminated for WEGA 2.2C if auxiliary voltage is available)
② LEDs green and red (state of the relay contacts)
③ Test socket L1
④ Test socket L2
⑤ Test socket L3
⑥ Earth socket
⑦ "Display Test" button

Fig. 167: Operating elements WEGA

Indication	WEGA 1.2C			WEGA 2.2C					Description of the indication
	L1	L2	L3	L1	L2	L3	State of the relay contacts[1]		
							Red	Green	
A0							U ≠ 0 ○	U = 0 ●	• Operating voltage not present.
A1	ϟ ϟ ϟ			ϟ ϟ ϟ			U ≠ 0 ●	U = 0 ○	• Operating voltage present. • Integrated repeat test passed.
A2							U ≠ 0 ○	U = 0 ○	• Operating voltage not present.
A3	ϟ ϟ			ϟ ϟ			U ≠ 0 ●	U = 0 ●	• Failure of the operating voltage at phase L1 • Operating voltage present at phases L2 and L3. • Integrated repeat test passed (L2 and L3).
A4	ϟ ϟ ϟ			ϟ ϟ ϟ			U ≠ 0 ●	U = 0 ○	• Voltage present, current monitoring of coupling section below limit value.
A5	ϟ ϟ ϟ			ϟ ϟ ϟ			U ≠ 0 ●	U = 0 ○	If "Display Test" button is pressed: • Display test passed.
A6	ϟ ϟ ϟ			ϟ ϟ ϟ			U ≠ 0 ○	U = 0 ●	In operation: • Voltage present and integrated repeat test passed. • Voltage signal too high.
A7				ϟ ϟ ϟ			U ≠ 0 ○	U = 0 ○	• Auxiliary voltage missing.

[1] ○ ○ LED does not light up, ● ● LED lights up

23 Replacing HV HRC fuse-links

For data to usable HV HRC fuse-links, see page 15, "HV HRC fuse assembly" and see page 39, "Selection of HV HRC fuse-links".

The replacement of fuse-links in the transformer panel is described hereafter. For the panel types H and M(430), the procedure is identical.

	**DANGER**
	High voltage! Danger! ⇨ Isolate. ⇨ Secure against reclosing. ⇨ Verify safe isolation from supply. ⇨ Earth and short-circuit. ⇨ Cover or barrier adjacent live parts.

	**ATTENTION**
	When a HV HRC fuse-link has tripped, the HV HRC fuse-links in the two other phases may also have been stressed. ⇨ When a HV HRC fuse-link has tripped, replace the HV HRC fuse-links in **all three phases**.

Removing the cable compartment cover

The cable compartment cover can only be removed if the earthing switch is in EARTHED position.

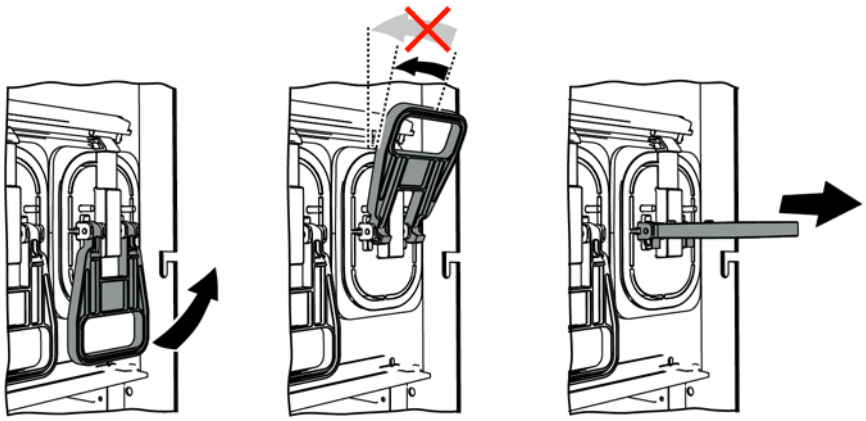
When the cable compartment cover is removed, the earthing switch is interlocked in EARTHED position.

⇨ Isolate and earth the transformer feeder.

⇨ Remove the cable compartment cover, see page 132, "Removing and mounting the cable compartment cover".

Detaching the gasket of the fuse slide

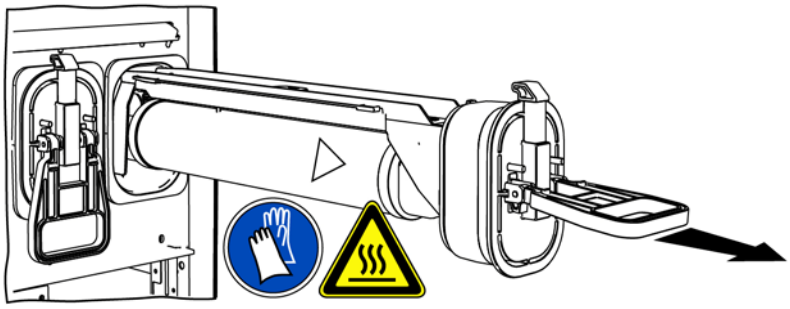
⇨ Push the handle of the fuse slide **slightly** upwards towards the stop in order to detach the gasket in this way and be able to pull fuse slide out more easily.



	**ATTENTION**
	HV HRC fuse-links may be hot! ⇨ Let HV HRC fuse-links cool down or wear gloves to withdraw the fuse slide.

Removing the fuse slide

⇨ Withdraw the fuse slide with the HV HRC fuse-link.

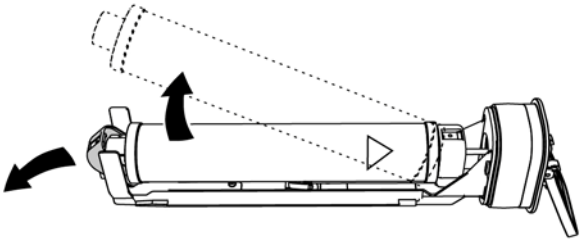


Replacing the HV HRC fuse-links

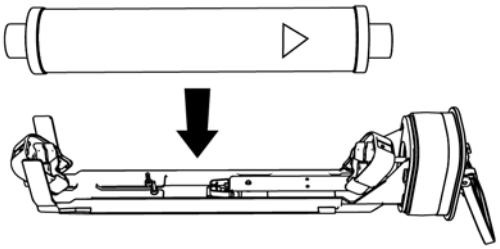
When a HV HRC fuse-link has tripped, replace the HV HRC fuse-links in all three phases.

⇨ Lay the HV HRC fuse-link on a flat, clean and firm underground.

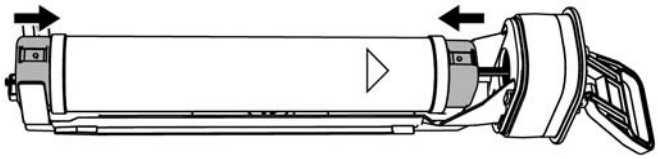
⇨ Push the cover of the HV HRC fuse-link (on the opposite side of the housing cover) aside, and pull the HV HRC fuse-link out of the fuse slide.



⇨ Fit new HV HRC fuse-link into the contact springs and observe the striker position. The arrow on the HV HRC fuse-link must point towards the box cover.



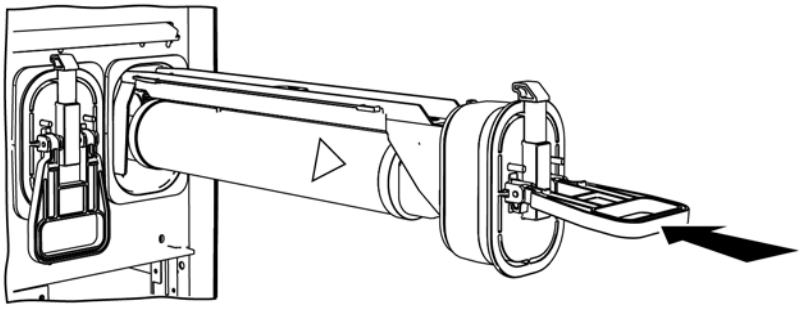
⇨ Verify correct seating of the covers and the HV HRC fuse-link.



	**ATTENTION**
	Incorrectly selected or mounted fuse-links and extension tubes can damage the fuse box or the switchgear. ⇨ 7.2 kV fuse-links with dimension 192 mm and 24 kV fuse-links with dimension 292 mm are **not** permissible.

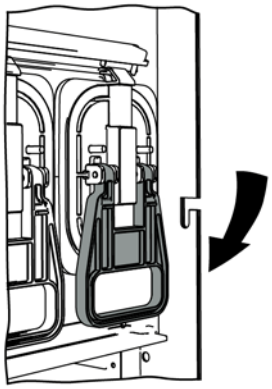
Inserting the fuse slide

⇨ Push the fuse slide into the guide slot of the fuse box.



⇨ Push the fuse slide into the fuse box as far as it will go. The collar of the fuse slide cover must rest on the cast-resin frame of the fuse box.

⇨ Push the handle of the fuse slide down until it latches tight.



Mounting the cable compartment cover

⇨ The cable compartment cover can only be hooked in correctly if the fuse slides are properly latched in.

⇨ Hook the cable compartment cover in, see page 132, "Removing and mounting the cable compartment cover".

24 Cable testing

24.1 Cable testing via cable plugs

	**DANGER** High voltage! Danger! ⇨ Isolate. ⇨ Secure against reclosing. ⇨ Verify safe isolation from supply. ⇨ Earth and short-circuit. ⇨ Cover or barrier adjacent live parts.

	**DANGER** Cable testing with connected cables represents a special stress for the isolating distance. If the busbar of the switchgear under test or the opposite substation are live with operating voltage, adequate measures must be taken in order to prevent overvoltages. Normally, the switch-disconnector is not interlocked during the cable test. ⇨ Fit switching prohibition signs. ⇨ Secure the locking device (option) with a lock.

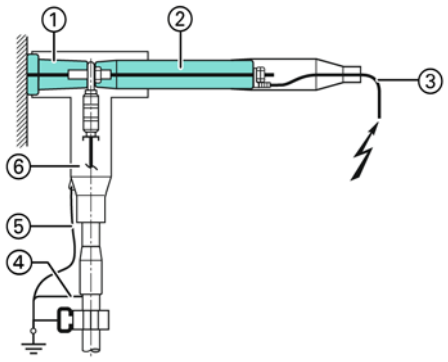
	**ATTENTION** The cables, cable plugs and voltage detecting systems may be damaged by too high test voltages. ⇨ Observe the specifications of the manufacturers of the cables, cable plugs and voltage detecting systems (maximum test values).

Isolating and earthing the feeder under test

⇨ Disconnect the feeder under test.
⇨ Make sure that the feeder in the opposite substation has also been isolated and secured against reclosing.
⇨ Verify safe isolation from supply.
⇨ Earth the feeder.

Preparations

⇨ Remove the cable compartment cover, see page 132, "Removing and mounting the cable compartment cover".
⇨ Remove the voltage transformers on the testing section and close the bushings in a surge-proof way.
⇨ Undo the screw-type cone at the T-plug or at the adapter.
⇨ Fit cable test elements (e.g. measuring bolts) according to the operating instructions of the plug manufacturers.



① Bushing
② Measuring bolt
③ Test lead
④ Earthing connection of cable shield
⑤ Earthing connection of plug
⑥ T-plug

Test voltages

Rated voltage of the switchgear [kV]	DC test voltage				AC test voltage VLF[1] 0.1 Hz				
	AC		DC		Rectangle [kV]		Sinus [kV]		Test duration [min]
	U_{ct} [kV]	Test duration [min]	U_{ct} [kV]	Test duration [min]	Mean value	Maximum value	Mean value	Maximum value	
7.2	11	1	22	15	22	22	15.6	22	60
12	19	1	38	15	38	38	26.8	38	60
15	28	1	52	15	52	52	36.8	52	60
17.5	28	1	52	15	52	52	36.8	52	60
24	38	1	72	15	72	72	51	72	60

[1] Very low frequency

Testing

- ⇨ Barrier the area around the testing place.
- ⇨ De-earth.
- ⇨ Perform the test according to the recommendations of the cable manufacturers or the customers' specifications.

After completion of test

- ⇨ Earth the feeder under test.
- ⇨ Remove cable test elements.
- ⇨ Clean the screw-type cone and apply the supplied mounting paste.
- ⇨ Mount the screw-type cone on the T-plug according to the manufacturer's instructions.
- ⇨ Fit and lock the cable compartment cover.
- ⇨ De-earth the panel and the opposite substation, and re-energize the feeder.

24.2 Cable sheath test

DANGER

High voltage! Danger!

- ⇨ Isolate.
- ⇨ Secure against reclosing.
- ⇨ Verify safe isolation from supply.
- ⇨ Earth and short-circuit.
- ⇨ Cover or barrier adjacent live parts.

DANGER

During the cable sheath test, the feeder is not interlocked . Do not switch to OPEN or CLOSED position.

- ⇨ Fit switching prohibition signs.
- ⇨ Padlock the locking device (option).
- ⇨ Closing lockout (option).

Work operations

- ⇨ Isolate and earth the feeder under test.
- ⇨ Remove the cable compartment cover.
- ⇨ De-earth the cable shield at the cross member of the subframe as well as in the opposite substation.
- ⇨ Perform cable sheath test following the recommendations of the cable manufacturers or the customer's stipulation.
- ⇨ Earth the cable shield again at the cross member of the subframe as well as in the opposite substation.
- ⇨ Refit and lock the cable compartment cover.
- ⇨ De-earth the panel and the opposite substation, and re-energize the feeder.

Annex

25 MCU (Motor Control Unit)

25.1 Extract from the Technical Description

The 8DJH can be equipped with different versions of the electrical motor control unit (MCU). The following sections are an extract from the Technical Description of the electrical motor control unit.

The complete Technical Description of the different versions is available under the following order numbers:

MCU version	Order number
MCU-RI	953-0091.9
MCU-MH	953-0071.9
MCU-MH-MOD	953-0081.9

25.2 Application

The MCU controls the following motor operating mechanisms for three-position switches in medium-voltage load-break switchgear:

- Spring-operated mechanism
- Spring-operated/stored-energy mechanism

Application

The MCU is equipped with a universal wide voltage range. It can optionally be connected to different auxiliary and motor voltages. The auxiliary and motor voltages can be combined and do not necessarily have to be identical.

25.3 Design, function

Fig. 168: MCU-RI

Fig. 169: MCU-MH

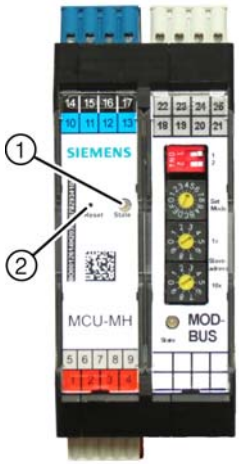


Fig. 170: MCU-MH-MOD

① LED status indicator
② Reset pushbutton

25.4 Fault signals

NOTICE

Functional failure due to insufficient voltage quality

The functioning of MCU may be impaired.

⇨ The voltage quality of the voltages used for auxiliary and load circuits must correspond to applicable standards.

⇨ If an AC control or AC load voltage is used, which is generated directly from single-phase inverters, earth $U_{N2\sim}$.

NOTICE

Functional failure due to incorrect circuit of the command inputs

The functioning of MCU may be impaired.

⇨ For activation of the command inputs for disconnector CLOSED, disconnector OPEN, earthing switch OPEN and earthing switch CLOSED, do not use any external switching contacts that are equipped with capacitors > 4.7 nF connected in parallel with the contact.

NOTICE

Damage to MCU due to test voltages

If the specified limits (1 kV, 1 s) are exceeded during dielectric tests according to the standard IEC 62271-200, the MCU may be damaged by too high test voltages.

⇨ Before performing the dielectric test, remove the connecting plugs at the MCU.

Output of fault signals

Fault signals at the unit are displayed via a red flashing LED status indicator.

Possible causes for a fault signal:

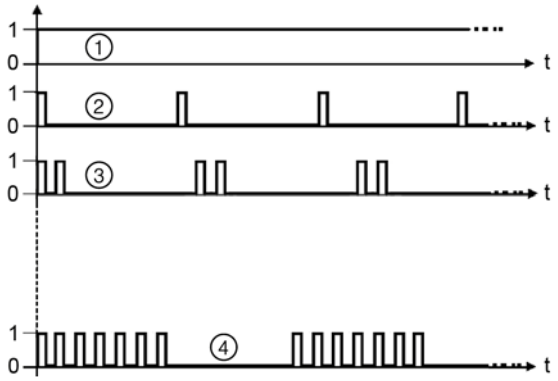
- An incorrect sense of rotation of the motor was detected while moving the operating mechanism from disconnector OPEN / earthing switch OPEN position to disconnector CLOSED / earthing switch CLOSED position.
- There is an internal MCU fault (watchdog).
- The feedback monitoring time (runtime monitoring of the operating mechanism) for protecting the drive motor and the mechanical system was exceeded.
- A command for moving the operating mechanism is applied to the active command inputs (disconnector CLOSED / disconnector OPEN / earthing switch CLOSED / earthing switch OPEN) for more than 5 minutes, although existing interlocking conditions prevent the execution of this command.
- A command is applied to one of the active command inputs (disconnector CLOSED / disconnector OPEN / earthing switch CLOSED / earthing switch OPEN) for more than 5 minutes, although the associated switching operation was completed successfully.

Fault mode, clearing

Options for clearing the fault mode after the cause for the fault mode was eliminated:

- Through the reset button at the device (operation of the reset button: insert a thin, pointed object through the opening at the front side.)
- By removing and re-applying the control voltage

Examples for flashing code of LED status indicator



① LED lights up permanently
② LED flashes 1x
③ LED flashes 2x
④ LED flashes 7x

The following table shows the fault coding of the flashing codes for all versions of the MCU.

Fault coding at the MCU

Type of failure	Indication via LED status indicator	Interlocking to the circuit-breaker[1)]	Cause	Measure
Incorrect sense of rotation of motor	Permanently red	Off	Motor polarity interchanged	Check motor connecting leads at the motor. Then, perform reset of MCU
Relay on MCU clocks on command input (approx. 1x per sec.)	none	Off	No load voltage available	Check load voltage supply
Relay on MCU clocks very quickly on command input (approx. 5x per sec.)	none	Off	No control voltage available	Check control voltage supply
H-bridge is not isolated from supply	2x red	On	N[(2)] not earthed (IT system)	Earth N. Then, perform reset of MCU
			Load voltage relay of MCU defective	Replace MCU
No feedback of disconnector contact after disconnector CLOSED command	3x red	On	Disconnector could not be CLOSED within the maximum permissible runtime. Mechanical defect or defect at the gear motor	Check operating mechanism and gear motor. Then, switch the operating mechanism manually to an end position and perform reset
No feedback of opening contact after disconnector OPEN command	4x red	On	Disconnector could not be OPENED within the maximum permissible runtime. Mechanical defect or defect at the gear motor	Check operating mechanism and gear motor. Then, switch the operating mechanism manually to an end position and perform reset
No feedback of earthing switch contact after earthing switch CLOSED command	5x red	On	Earthing switch could not be CLOSED within the maximum permissible runtime. Mechanical defect or defect at the gear motor	Check operating mechanism and gear motor. Then, switch the operating mechanism manually to an end position and perform reset
No feedback of opening contact after earthing switch OPEN command	6x red	On	Earthing switch could not be OPENED within the maximum permissible runtime. Mechanical defect or defect at the gear motor	Check operating mechanism and gear motor. Then, switch the operating mechanism manually to an end position and perform reset
No standby mode after end of command	8x red	On	Circuit for automatic shutdown of MCU defective	Replace MCU
Impermissibly long switching command	8x red	On	Switching command is applied for more than 5 min	Shorten command output. Then, perform reset of MCU

1) Off = circuit-breaker can be switched, On = circuit-breaker cannot be switched
2) Neutral conductor

25.5 Behavior in case of voltage failure

The failure of the load voltage or the control voltage leads to a defined behavior of the motor control unit. The sequence applies to the voltage failure both in inoperative position and while moving:

- The operating mechanism can no longer be operated electrically, or stops.
- No fault signal is issued.
- Manual movement by manual operation is possible.

Once the voltage returns, normal operation is reestablished.

Siemens Service Hotline

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  - support.energy@siemens.com
  - 24 hours
- **Customer Support Brazil** (for the Brazilian market only)
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  - suporte.br@siemens.com
  - Local working hours
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