User Information

Medium Voltage Switchgear up to 24 kV, SF_6-insulated, Ring Main Unit

non-extensible

Type: GA and GA…-C

MOELLER

Think future. Switch to green.

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6

Contents

General/Description

Advantages of SF_6-insulated switchgear in block construction

With switchgear of Type GA and GA...-C, the Moeller Systems Division meets the following requirements of its customers.

- ✓ Climatic resistance
- ✓ Maintenance-free concept
- ✓ Minimum space requirement
- ✓ Comprehensive personnel protection
- ✓ Great reliability of supply
- ✓ Conventional mode of operation
- ✓ Cable connection for cable plug system
- ✓ Great electrical and mechanical reserves
- ✓ Easy to integrate into existing networks
- ✓ Straightforward mounting
- ✓ No plastic bridging of the isolating gap
- ✓ In the transformer feeder panel always protective earth conductor upstream and downstream of the fuse
- ✓ All switching devices, even the protective earth downstream of the fuse, are SF_6 insulated.

Features

Types GA and GA...-C switchgear panels are type-tested, factory-built, metal-encapsulated switchgear assemblies in block construction, for indoor installation. Switching devices built in are: load-break switches, earthing switches as well as SF_6 circuit-breakers.

Applications

The GA and GA...-C systems in block construction are eminently suitable for installation in:

- Any kind of switchgear room,
- Transformer substations with or without personnel access,
- Sandy or dusty regions.

They are preferred for use in:

- Compact stations,
- Distribution substations in electricity supply company and industrial networks,
- Compact transformer substations, such as with wind-powered generator systems.

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6

General/Description

Construction

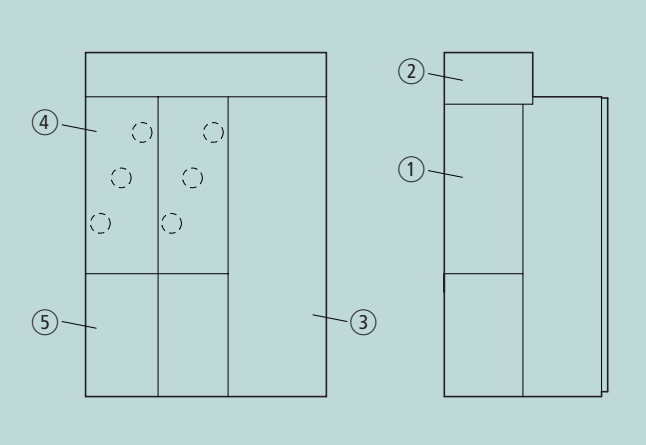
The GA and GA...-C series are block-type systems with integrated individual panels.

Panel versions with

- two feeder circuits,
- three feeder circuits,
- four feeder circuits,

are available.

GA and GA...-C systems have five system elements.



① Electrical switching chamber including busbar compartment, gas-filled
② Drives
③ Fuse arrangement
④ Cable connection compartment, cable termination area
⑤ Panel plinth

The HV compartment

This is a gas-tight welded tank made from stainless steel, which houses all the live parts including the busbars. The incoming and outgoing power feeders, as well as the connections from the fuse compartments are led through cast-resin bushings that are individually tested for adherence to the **maximum admissible partial discharge values (TE ≦ 2 pC) at 26 kV cable to earth voltage** stipulated by Moeller Systems Division. Each HV compartment is equipped with a stainless steel bursting membrane that is specifically designed for the individual tank.

Drives

The sturdy drives, operated by spring or stored energy mechanisms, of the load-break and earthing switches and SF_6 circuit-breakers are located above the HV compartment. The spring operated drives are maintenance free, the tripping mechanism of the stored energy operated drives of transformer and circuit-breaker panels should be operated at least once after 10 years. But, due to the materials selected, there is no need for maintenance even here.

Fuse arrangement

The fuse arrangement is designed as a plug-in system. All the fuse components are coupled to the contacts via cast-resin bushings from outside of the gas tank. (→ page 22).

Cable connection compartments

These are generally provided, and are always in pressure-proof design. Arc-fault resistant compartments can also be supplied if required. They are separated from one panel to the next by sheet steel intermediate walls. Inspections or work can be carried out in this way although the cable connection zone of the neighbouring panel is live. The **front covers** are **interlocked against the the corresponding earthing switch as standard**. The front cover can be opened only with the earthing switch switched On. An anti-reverse interlock system can also be provided for, if required. This prevents the corresponding load-break switch from being switched onto a live busbar when the termination zone is open (front cover removed). The mechanism can be operated only with the front cover in place and the **latch closed**. The **earthing switch at the cable outgoer is not incorporated in this interlock** and is switchable even when the terminal zone is open (necessary for cable testing).

Deeper front covers are available for deeper double-cable connections (→ page 31).

Panel plinth

This is located below the HV compartment. The height of the plinth determines the height of the switchgear.

- GA Standard height 1400 mm
- GA...-C Standard height 1050 mm

Combination of GA and GAE

Due to their uniform design and dimensions, system Types GA and GAE can be combined with one another and simply installed side-by-side (→ page 12 and page 20).

The electrical link between the two types at transfer points, e.g. to adjacent metering panels, must be effected using part-insulated busbar or cable. The cablelink offers a particularly effective solution where electricity supply company and customer sections are installed in separate rooms.

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6

General/Description

Three panel switchgear, Type GA2K1LSF250, with two cable feeder load-break switch panels and one feeder circuit-breaker panel, including relay/control compartment on the top.

Operation

The mechanisms must be operated via the external drive shafts that are included in the mimic diagram. They include operating lever, 1 × load-break switch or circuit-breaker, 1 × earthing switch. Conventional operability is ensured due to the clearly structured mimic diagram and the easy-to-operate rotary handles.

Cable retention brackets

These consist of galvanized pliable metal parts. Thanks to a special screwable design, they can be adjusted in height and depth enabling any of the cable terminations normally used for SF_6 systems to be applied and the cables to be fastened by means of cable clamps without difficulty.

Operational safety

This is assured by the hermetically sealed encapsulation of the primary components which makes them impervious to ambient influences such as dirt, humidity, insects. The actuating parts are maintenance free, and accessible from the outside of the HV compartment.

Arc fault protection

The HV compartments and cable connection compartments were tested to the Standards VDE 0670 Part 6 Appendix AA and IEC 60298 Annex AA, "Internal arc faults", for arc-fault resistance, and fulfilled criteria 1 to 6. This arc fault protection is always present in systems with arc-fault resistant cable compartments. For installation of the system, see the relevant particulars on page 32.

To cool the hot gasses that emanate in the event of an arc fault, a four-layer metal cooling stretch arrangement is fitted into the back plate of the panel plinth in GA... (H = 1400 mm) systems. The pressure arising in the switchgear room due to such a fault, will be reduced by this arrangement. See also the data on page 33 "Maximum pressure in switchgear rooms" in this context.

In the GA...-C (H = 1050 mm) system version, it is not possible to fit a metal cooling stretch arrangement into the plinth. Instead, a metalcooling stretch arrangement can be provided as part of the station building, in the dividing wall towards the transformer room.

SF_6, the insulating and arc quenching medium

Sulphurhexafluoride (SF_6) gas has in recent years increasingly found its way also into medium-voltage load switching systems, having been previously successfully used mainly in circuit-breakers up to highest voltage levels.

This system change is taking place worldwide, since each of the previously used insulating and arc-quenching media, such as air, oil and solid materials, have their own more or less serious disadvantages:

- Air-insulated systems take up a great deal of space and, in extreme climatic or environmental conditions, require maintenance.
- Oil-insulated systems (as still predominantly used in English-speaking countries) although on the whole well protected against external influences, pose a considerable safety risk in the event of an internal fault.
- Solids-insulated systems (e.g. by cast resin), in the final analysis, are air-insulated devices and have the same maintenance problems, but much aggravated due to their compact construction.

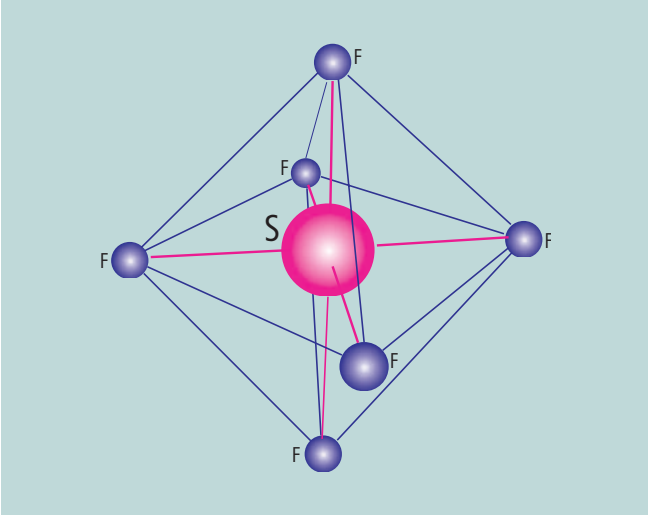
SF_6 as insulating medium has a high degree of dielectric strength thereby enabling the construction of very compact systems that furthermore are maintenance free since all the live electric assembly parts have to be **encapsulated**.

With the actuating mechanics also largely removed from environmental influences, the user therefore gets a product that will do long-term duty **without maintenance**.

SF_6 is a non-poisonous, inert, electronegative gas that is heavier than air. In addition to the high insulating capability already mentioned, it also has extremely effective arc-quenching properties. At the high temperatures arising in the circuit-breaking arc, SF_6 separates into its constituent parts. When it cools, these regenerate to restore the SF_6 gas. This regeneration process is supported by aluminium oxyde (Al_2O_3) within the system. It means that the volume of gas originally introduced remains unchanged and suffices for the entire service life of the system or mechanism. An evaluation of the advantages and potential theoretical risks has shown that at present, there are no technically and ecologically worthwhile alternatives in sight.

The **high operational safety** of the system (external influences such as humidity, conductive dust etc., have no effect) virtually excludes arc faults. Should such a fault nevertheless occur, then the pressure release diaphragm (bursting membrane) comes into play.

There are detailed instructions for use of such a SF_6 system, issued by the German official Labour association. **SF_6 gas contained in the system shall be recycled and not released into the atmosphere. Moeller Systems Division will take care of the disposal for you, should you not wish to dispose of a system yourself. This offer will hold good even after the system has been in operation for 25 to 30 years for the costs then applicable.**



Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6
Technical data

Technical data

Switchgear panels (rated values)

			Rated voltage U_r			
			7.2 kV	12 kV	17.5 kV	24/25 kV[1]
Rated insulation level						
Rated short-duration power-frequency withstand voltage, AC U_d		kV	20	28	38	50
Rated lightning impulse withstand voltage U_p		kV	60	75	95	125
Rated frequency f_r		Hz	50/60	50/60	50/60	50/60
Rated normal current I_r	For feeder circuits	A	630	630	630	630
	For busbars	A	630	630	630	630
Rated short-time current I_k	at t_k = 1 s	Up to kA	20, 25[2]	20, 25[2]	20, 25[2]	20, 25[2]
Rated peak withstand current I_p		Up to kA	50, 63[2]	50, 63[2]	50, 63[2]	50, 63[2]
Rated short-circuit making current I_{ma}		Up to kA	50, 63[2]	50, 63[2]	50, 63[2]	50, 63[2]
Ambient temperature T	Without secondary devices	°C	–25 to +40[2]			
	Without secondary devices	°C	–40 to +40, on request[3]			
	With secondary devices	°C	–25 to +40[3]			
	With reduced current ratings	°C	Above +40			
Relative humidity		%	Maximally 95			
Rated filling pressure of insulating gas at 20 °C and 101.3 kPa		kPa	130 (30 kPa overpressure)/2K1LSF = 150 (50 kPa overpressure)			
Insulating gas			SF_6			
Rated density of insulating gas		kg/m³	7.9			
Encapsulation of the HV compartment		IP	Hermetically welded tank, IP65			
Encapsulation of the fuse compartment		IP	Single-pole arcing-free encapsulation and 3-phase metal encapsulation, IP4X			
Encapsulation of the drive housing		IP	IP4X			
Enclosure of the cable connection compartment		IP	IP4X			
Internal arc test to VDE 0670, Part 6, Appendix AA		kA	16 kA, 1 s for HV compartments[4]			
		kA	16 kA, 1 s for cable connection compartments[4]			
Colour of panel paint finish		RAL	7035 (light grey)			

1) Higher rated voltage, on request.
2) Optional
3) When a pressure switch (optional) is being used, the operating conditions correspond to Class Minus 5, indoor installation.
4) Higher values, on request

Standards

The Type GAE switchgear installation complies with the following Standards and Regulations:

DIN VDE 0670 Part 2	IEC publication 62271-102
DIN VDE 0670 Part 4	IEC publication 60282
DIN VDE 0670 Part 6	IEC-publication 62271-100
DIN VDE 0670 Part 101 to 107	IEC publication 60056
DIN VDE 0670 Part 301	IEC publication 60265-1
DIN VDE 0670 Part 303	IEC publication 60420
DIN VDE 0670 Part 1000	IEC publication 60694
DIN VDE 0670 Part 6 – Appendix AA	IEC publication 60298 – Appendix AA
PEHLA Directive No. 4 and No. 7	

In accordance with the Harmonization Agreement of the European Union, its national Standards and Regulations correspond to IEC publication No. 298.

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6
Technical data

Three-position load-break switches (rated values)

					Rated voltage U_r			
					7.2 kV	**12 kV**	**17.5 kV**	**24/25 kV**
Rated normal current for		Ring cable feeder circuits	I_r	A	630	630	630	630
		Transformer feeder circuits[1]	I_r	A	200	200	200	200
Rated short-time current[2]		For systems with t_k = 1 s	I_k	kA	20, 25[3]	20, 25[3]	20, 25[3]	20, 25[3]
		For systems with t_k = 3 s	I_k	kA	20	20	20	20
Rated peak withstand current[2]			I_p	kA	50, 63[3]	50, 63[3]	50, 63[3]	50, 63[3]
Rated short-circuit making current for		Transformer feeder circuits[4]	I_{ma}	kA	50	50	50	50
		Ring cable feeder circuits	I_{ma}	kA	50, 63[3]	50, 63[3]	50, 63[3]	50, 63[3]
Switching capacity for multi-purpose load-break switches to IEC 60265-1 and VDE 0670 Part 301								
Test sequence 1	Rated mainly active load-breaking current	At 20 operations	I_1	A	630	630	630	630
		At 100 operations	I_1	A	630	630	630	630
		At 5 %	I_1	A	31.5	31.5	31.5	31.5
Test sequence 2a	Rated distribution line closed-loop breaking current, 10 ×		I_2	A	630	630	630	630
Test sequence 4a	Rated cable-charging breaking current		I_{4a}	A	50	50	50	50
Test sequence 5	Rated short-circuit making current		I_{ma}	kA	50, 63[3]	50, 63[3]	50, 63[3]	50, 63[3]
–	Rated no-load transformer breaking current		I_3	A	21[5]	21[5]	21[5]	21[5]
Switching capacity in the event of an earth fault								
Rated earth-fault disconnect current			I_{6a}	A	160	160	160	160
Rated cable-charging breaking current in the event of an earth fault			I_{6b}	A	100	100	100	100
Switching capacity to IEC 60420, DIN EN 60420 and VDE 0670 Part 303								
Rated transfer current		Device Type TS	I_4	A	1100	1100	1100	1100[6]
Rated transfer current	On request	Device Type LTS	I_4	A	2800	2800	–	–
Operations, ring cable panel,1K								
Rated mainly active load-breaking current			n		100 ×	100 ×	100 ×	100 ×
Rated short-circuit making current		50/63 kA	n		5 ×/2 ×	5 ×/ 2×	5 ×/2 ×	5 ×/2 ×
Mechanically admissible			n		3000 ×	3000 ×	3000 ×	3000 ×
Class					E3/E1	E3/E1	E3/E1	E3/E1

1) Dependent on HV fuse link size.

2) In the transformer feeder circuit, these values are limited by HV fuses.

3) Optional

4) Dependent on the HV fuse cut-off current.

5) Defined as the current of an unloaded 1250 kVA transformer in accordance with the above Standard.

6) Only 24 kV.

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6
Technical data

Three-position SF_6 circuit-breaker with stored energy Off (rated values)

To DIN VDE 0670 Part 101 to 107 and IEC 60056				Rated voltage U_r			
				7.2 kV	12 kV	17.5 kV	24 kV
Rated normal current of the feeder circuits		I_r	A	250/630[1)]	250/630[1)]	250/630[1)]	250/630[1)]
Rated short-time current	For systems with t_k = 1 s	I_k	kA	20	20	16	16
	For systems with t_k = 3 s	I_k	kA	20	20	16	16
Rated peak withstand current		I_p	kA	50	50	40	40
Rated short-circuit making current		I_{ma}	kA	50	50	40	40
Rated short-circuit breaking current		I_{sc}	kA	20	20	16	16
Rated cable-charging breaking current		I_c	A	50	50	50	50
Rated switching sequence		–		0 – 3 min – CO – 3 min – CO			
Operations at							
Rated short-circuit making current		n		2 ×	2 ×	2 ×	2 ×
Rated short-circuit breaking current		n		6 ×[2)]	6 ×[2)]	22 ×[2)]	22 ×[2)]
Rated normal current and mechanically admissible		n		2000 ×	2000 ×	2000 ×	2000 ×

1) Optional

2) Higher values, on request

Three-position earthing switch (rated values)

Nach DIN VDE 0670 Teil 2 und IEC 60129				Rated voltage U_r			
				7.2 kV	12 kV	17.5 kV	24/25 kV
Earthing function of the three-position switch							
Rated short-circuit making current		I_{ma}	kA	50, 63	50, 63	50, 63	50, 63
Rated short-time current		I_k = 1 s	kA	20, 25	20, 25	20, 25	20, 25
		I_k = 3 s	kA	20	20	20	20
Earthing function downstream of HV fuse							
Rated short-circuit making current		I_{ma}	kA	6.3	6.3	6.3	6.3
Rated short-time current		I_{th}	kA	2.5	2.5	2.5	2.5
Operations							
Rated short-circuit making current	50/63 kA	n		5 ×/2 ×	5 ×/2 ×	5 ×/2 ×	5 ×/2 ×
Mechanically admissible		n		3000 ×	3000 ×	3000 ×	3000 ×
Class				E3/E1	E3/E1	E3/E1	E3/E1

Range of two-panel systems

Systems with one transformer feeder panel and one cable connection panel with one set of connection bushings

Type GA1KS1A1 or GA1TS1A1,
Type GA1KS1A1-C or GA1TS1A1-C

Standard equipment for
- System,
- KS panel,
- TS panel,
- A1 panel.

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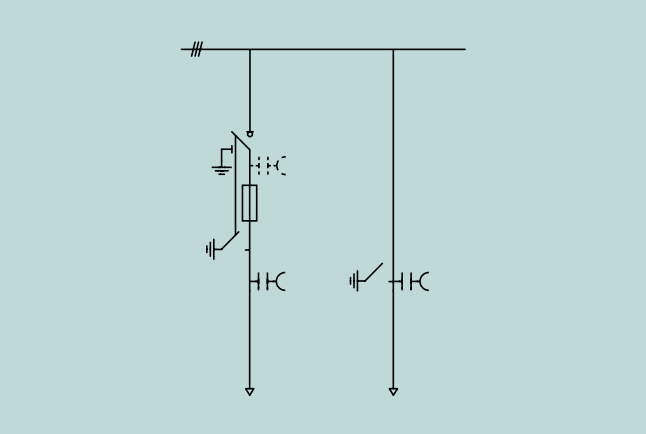
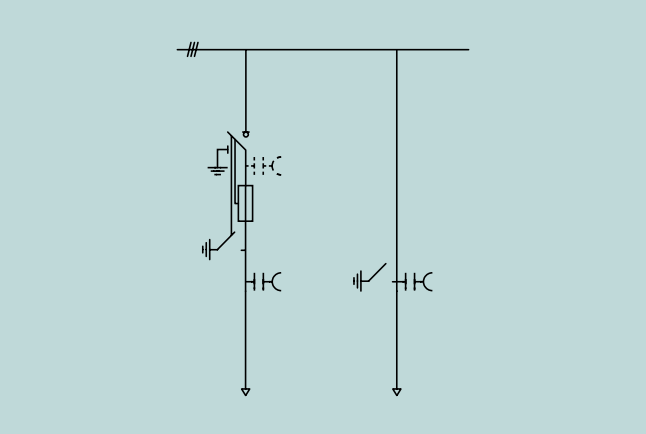


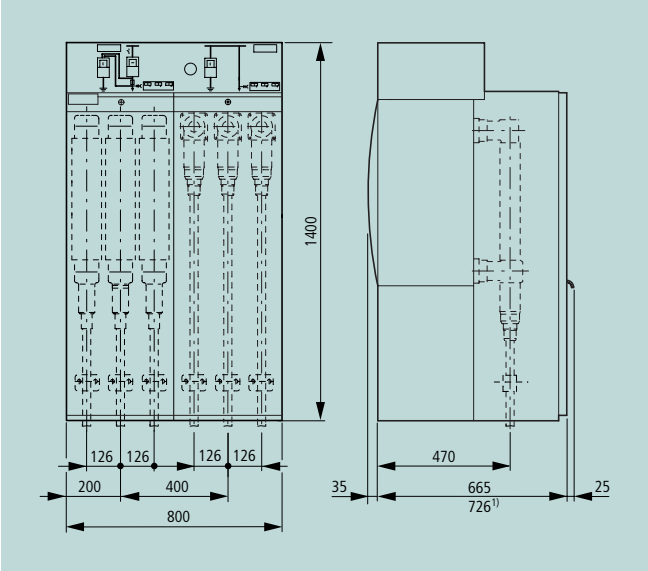
Overview diagram: GA1KS1A1(-C)



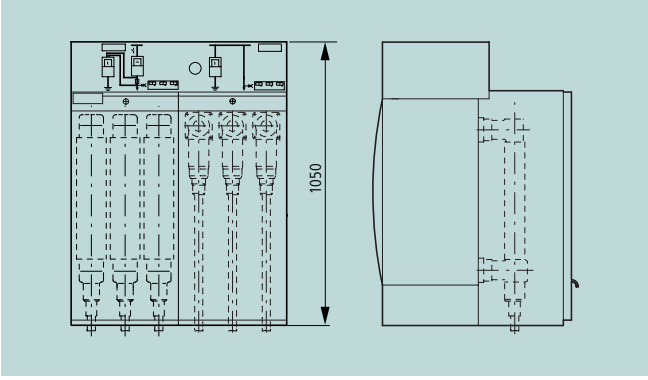
Overview diagram: GA1TS1A1(-C)

Accessories, optional
- Auxiliary contact modules for load-break switches, max. 3 NO, 3 NC, Earthing switches, max. 2 NO, 2 NC,
- Capacitive voltage indication ledges upstream of the HV fuses,
- Shunt trip release, DC or AC,
- Auxiliary contact trip indication[1)],
- Motor operator,
- Anti-reverse interlock,
- Cable clamps,
- Fuse adapter for fuse with dimension "e" = 292 mm,
- Arc-fault resistant cable compartments,
- Switching system for rated transfer current I_4 = 2800 A, based on the fuse selected (usable only up to 12 kV, → page 22, Fuse selection), panel then Type LTS.

1) Suitable only for systems with TS or LTS panel.



1) Deep front cover in A1 panel.
GA1KS1A1/GA1TS1A1 (weight: 236 kg)



GA1KS1A1-C/GA1TS1A1-C (weight: 202 kg)

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6

Range of two-panel systems

Systems with one transformer feeder panel and one cable connection panel with two sets of connection bushings

Type GA1KS1A2 or GA1TS1A2
Type GA1K1A2-C or GA1TS1A2-C

Standard equipment for

- System,
- KS panel,
- TS panel,
- A2 panel.

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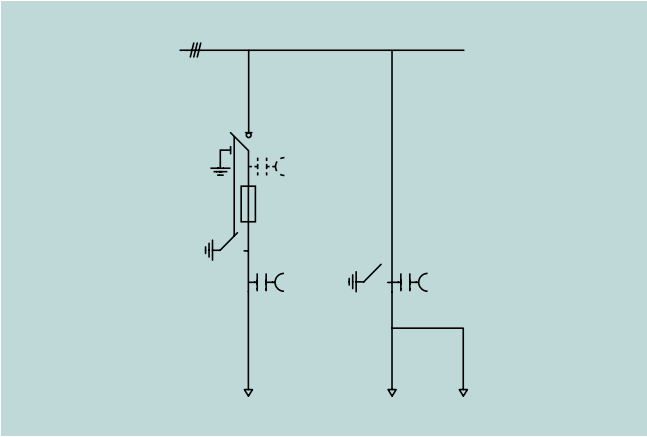
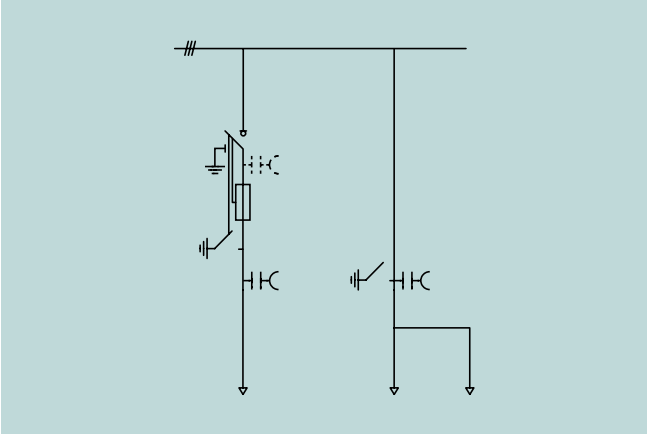


Overview diagram: GA1KS1A2(-C)

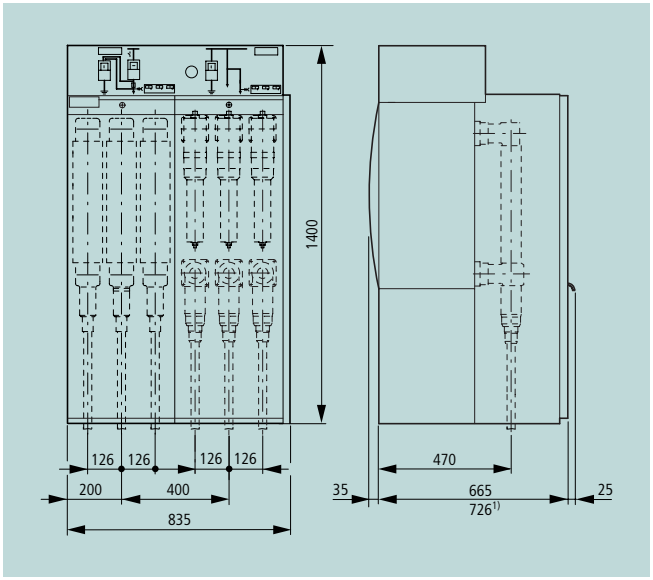


Overview diagram: GA1TS1A2(-C)

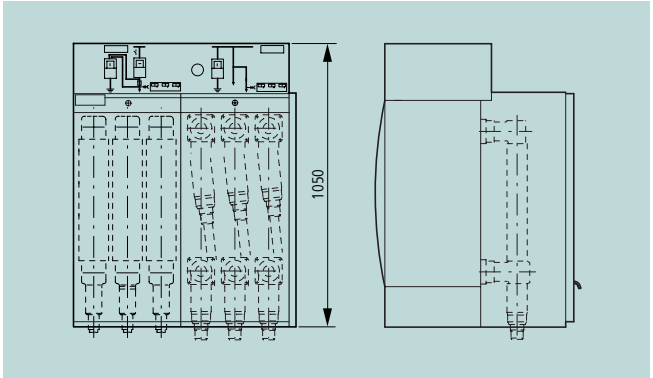
Accessories, optional

- Short-circuit indicator,
- Auxiliary contact modules for load-break switches, max. 3 NO, 3 NC, Earthing switches, max. 2 NO, 2 NC,
- Capacitive voltage indication ledges upstream of the HV fuses,
- Shunt trip release, DC or AC,
- Auxiliary contact trip indication[1)],
- Motor operator,
- Anti-reverse interlock,
- Cable clamps,
- Fuse adapter for fuse with dimension "e" = 292 mm,
- Arc-fault resistant cable compartments,
- Switching system for rated transfer current I_4 = 2800 A, based on the fuse selected (usable only up to 12 kV, → page 22, Fuse selection), panel then Type LTS.

1) Suitable only for systems with TS or LTS panel.



1) Deep front cover in A2 panel.
GA1KS1A2/GA1TS1A2 (weight: 246 kg)
Cable connection panel equipped with overvoltage arrester at the top, with plug connectors at the bottom.



GA1KS1A2-C/GA1TS1A2-C (weight: 212 kg)
Cable connection panel equipped with plug connectors, top and bottom.

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6

Range of three-panel systems

Range of three-panel systems

Systems with three cable feeder panels

Type GA3K,
Type GA3K-C

Standard equipment for

- System,
- K panels.

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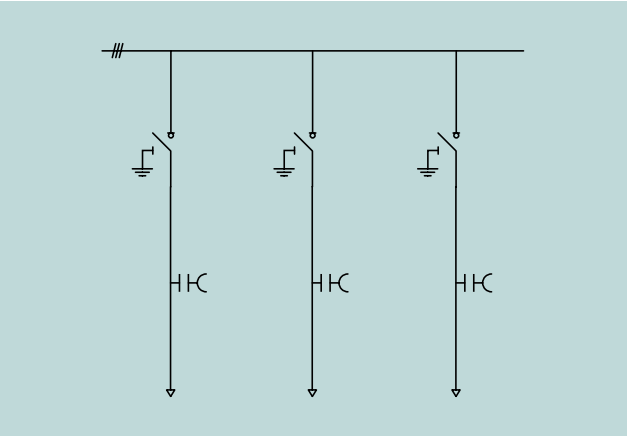
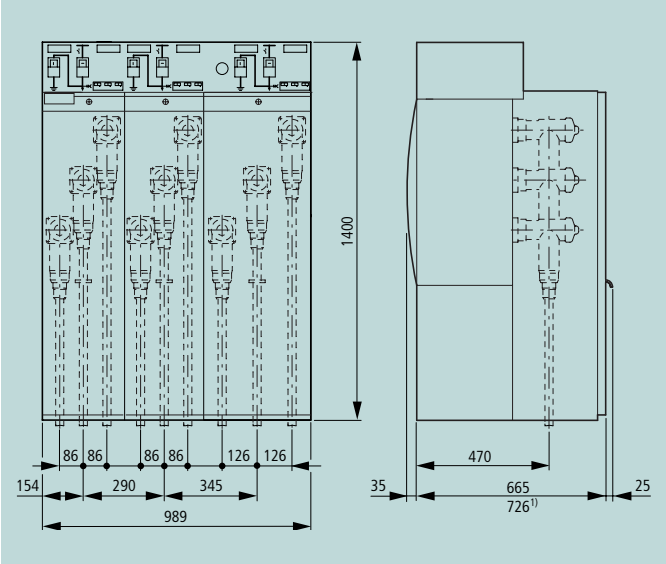
Accessories, optional

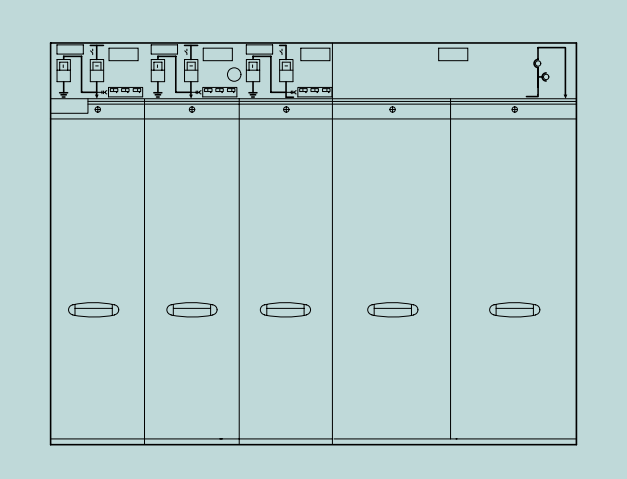
- Short-circuit indicator,
- Auxiliary contact modules for load-break switches, max. 3 NO, 3 NC, Earthing switches, max. 2 NO, 2 NC,
- Motor operator,
- Anti-reverse interlock,
- Cable clamps,
- Arc-fault resistant cable compartments.



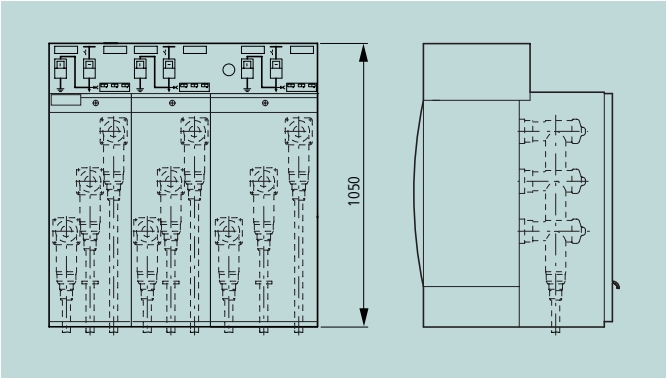
Overview diagram: GA3K(-C)



1) Deep front cover in K panel.
GA3K (weight: 265 kg)



Combination of GA3K system and GAE-1M5 overload metering panel, electrical link via busbar



GA3K-C (weight: 210 kg)

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6

Range of three-panel systems

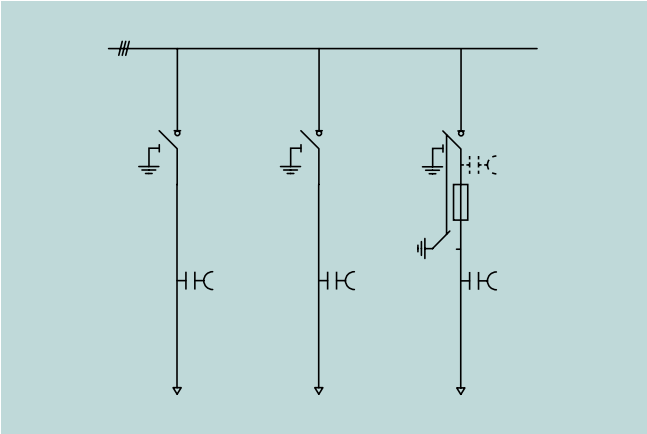
Systems with two cable feeder panels and one transformer feeder panel

Type GA2K1KS or GA2K1TS
Type GA2K1KS-C or GA2K1TS-C

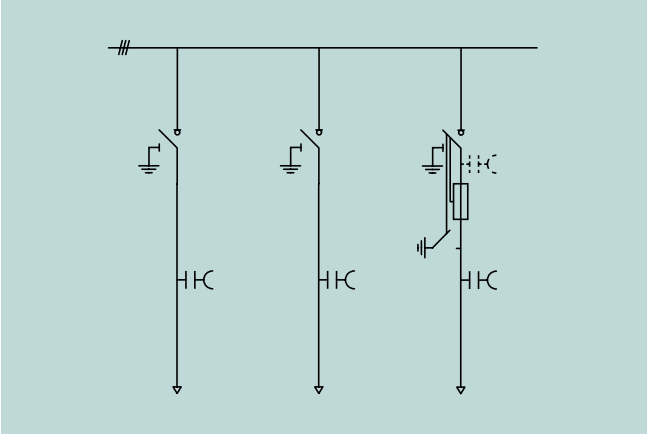
Standard equipment for

- System,
- K panels
- KS panel,
- TS panel.

→ page 21



Overview diagram: GA2K1KS(-C)

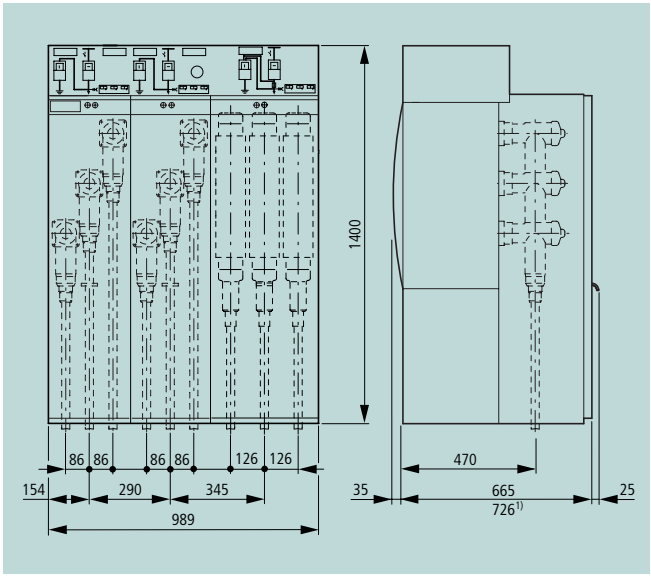


Overview diagram: GA2K1TS(-C)

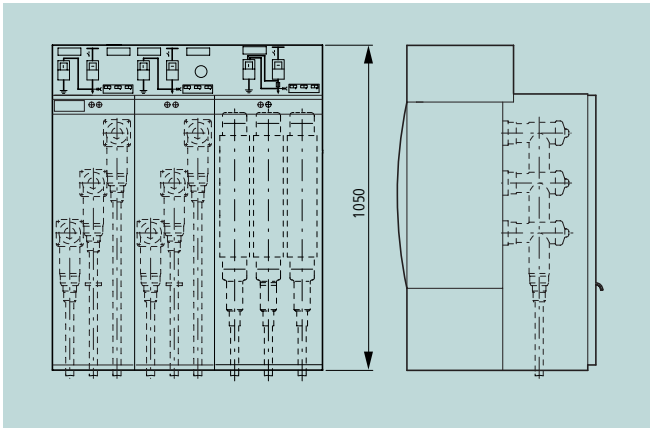
Accessories, optional

- Short-circuit indicator,
- Auxiliary contact modules for load-break switches, max. 3 NO, 3 NC, Earthing switches, max. 2 NO, 2 NC,
- Capacitive voltage indication ledges upstream of the HV fuses,
- Shunt trip release, DC or AC,
- Auxiliary contact trip indication[1],
- Motor operator,
- Anti-reverse interlock,
- Cable clamps,
- Fuse adapter for fuse with dimension "e" = 292 mm,
- Arc-fault resistant cable compartments,
- Switching system for rated transfer current I_4 = 2800 A, based on the fuse selected (usable only up to 12 kV, → page 22, Fuse selection), panel then Type LTS.

1) Suitable only for systems with TS or LTS panel.



1) Deep front cover in K panel.
GA2K1KS/GA2K1TS (weight: 298 kg)



GA2K1KS-C/GA2K1TS-C (weight: 235 kg)

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6

Range of three-panel systems

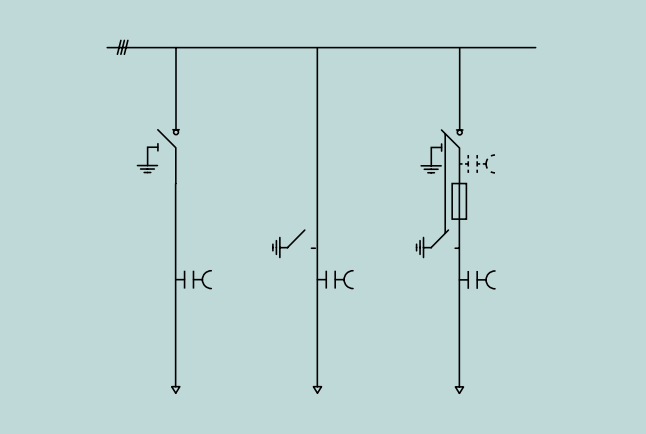
Systems with one cable feeder panel, one cable connection panel transformer feeder panel one transformer feeder panel

Type GA1K1A11KS or GA1K1A11TS
Type GA1K1A11KS-C or GA1K1A11TS-C

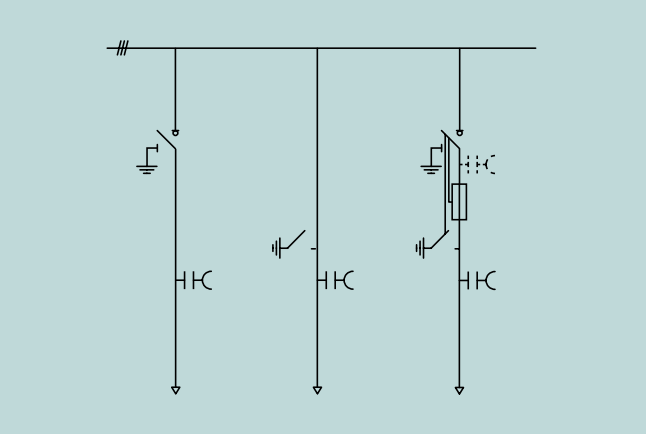
Standard equipment for

- System,
- K panel,
- A1 panel
- KS panel,
- TS panel.

→ page 21



Overview diagram: GA1K1A11KS(-C)

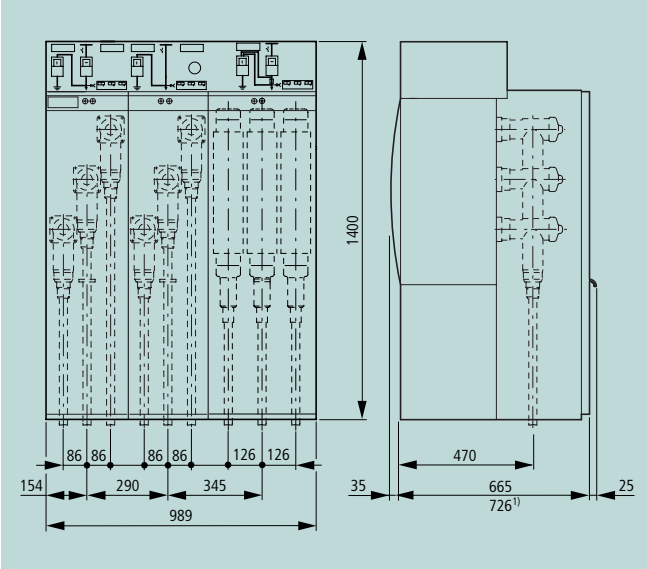


Overview diagram: GA1K1A11TS(-C)

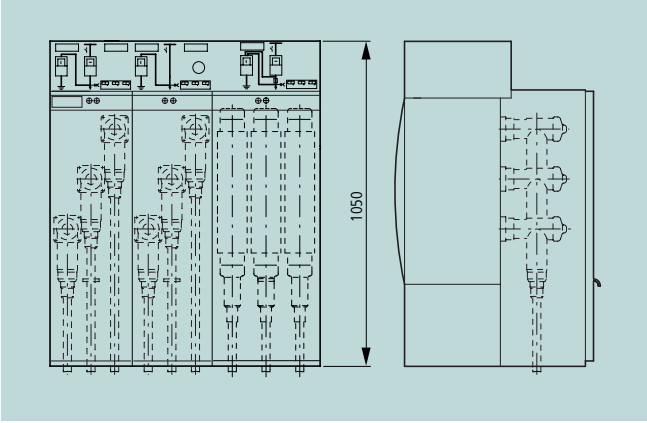
Accessories, optional

- Short-circuit indicator,
- Auxiliary contact modules for load-break switches, max. 3 NO, 3 NC, Earthing switches, max. 2 NO, 2 NC,
- Capacitive voltage indication ledges upstream of the HV fuses,
- Shunt trip release, DC or AC,
- Auxiliary contact trip indication[1],
- Motor operator,
- Anti-reverse interlock,
- Cable clamps,
- Fuse adapter for fuse with dimension "e" = 292 mm,
- Arc-fault resistant cable compartments,
- Switching system for rated transfer current I_4 = 2800 A, based on the fuse selected (usable only up to 12 kV, → page 22, Fuse selection), panel then Type LTS.

1) Suitable only for systems with TS or LTS panel.



1) Deep front cover in K or A1 panel.
GA1K1A11KS/GA1K1A11TS (weight: 293 kg)



GA1K1A11KS-C/GA1K1A11TS-C (weight: 230 kg)

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6

Range of three-panel systems

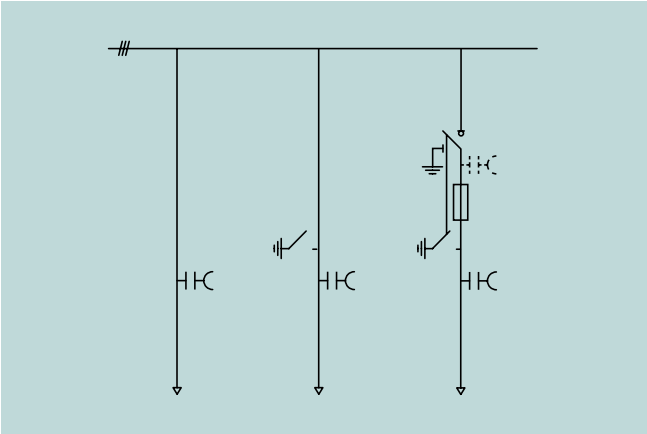
Systems with two cable connection panels and one transformer feeder panel

Type GA2A11KS or GA2A11TS
Type GA2A11KS-C or GA2A11TS-C

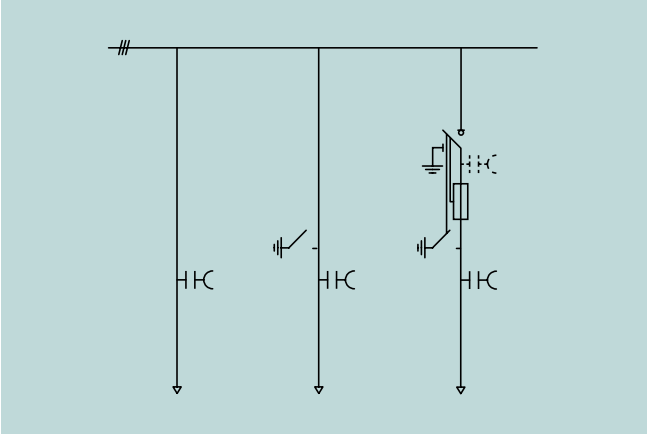
Standard equipment for

- System,
- A1 panels,
- KS panel,
- TS panel.

→ page 21



Overview diagram: GA2A11KS(-C)

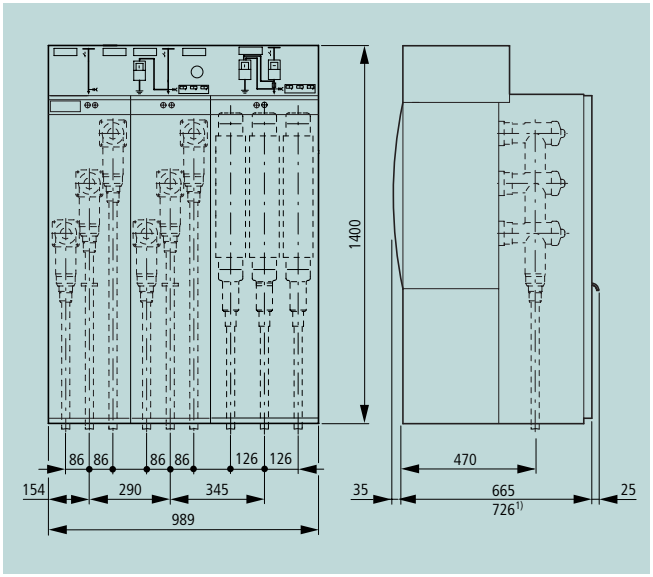


Overview diagram: GA2A11TS(-C)

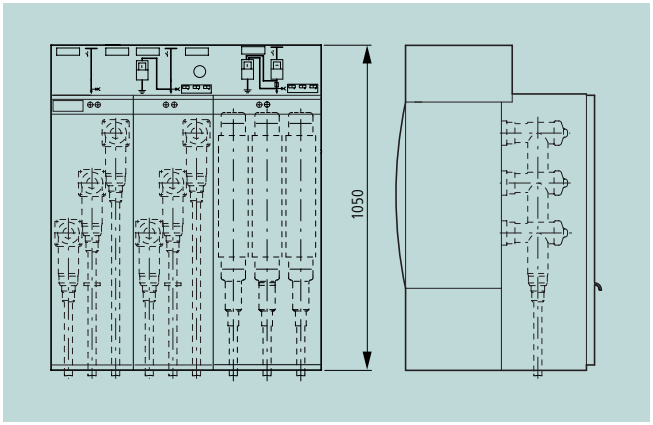
Accessories, optional

- Short-circuit indicator,
- Auxiliary contact modules for load-break switches, max. 3 NO, 3 NC, Earthing switches, max. 2 NO, 2 NC,
- Capacitive voltage indication ledges upstream of the HV fuses,
- Shunt trip release, DC or AC,
- Auxiliary contact trip indication[1)],
- Motor operator,
- Anti-reverse interlock,
- Cable clamps,
- Fuse adapter for fuse with dimension "e" = 292 mm,
- Arc-fault resistant cable compartments,
- Switching system for rated transfer current I_4 = 2800 A, based on the fuse selected (usable only up to 12 kV, → page 22, Fuse selection), panel then Type LTS.

1) Suitable only for systems with TS or LTS panel.



1) Deep front cover in A1 panel.
GA2A11KS/GA2A11TS (weight: 288 kg)



GA2A11KS-C/GA2A11TS-C (weight: 225 kg)

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6

Range of three-panel systems

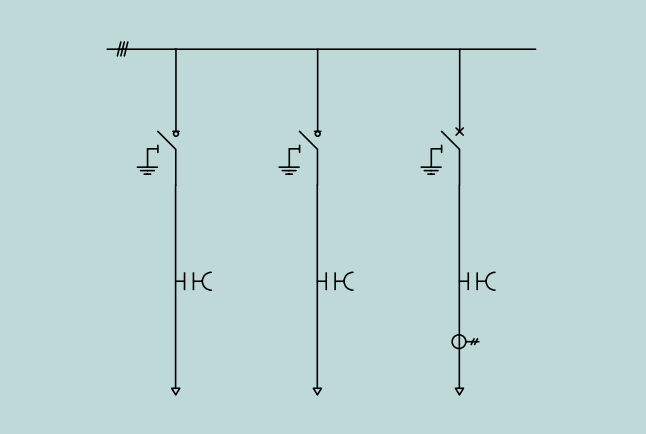
Systems with two cable feeder panels and one bus-sectionalizer feeder panel with SF_6 circuit-breaker

Type GA2K1LSF250 or GA2K1LSF630
Type GA2K1LSF250-C or GA2K1LSF630-C

Standard equipment for

- System,
- K panels,
- LSF panel.

→ page 21



Overview diagram: GA2K1LSF(-C)

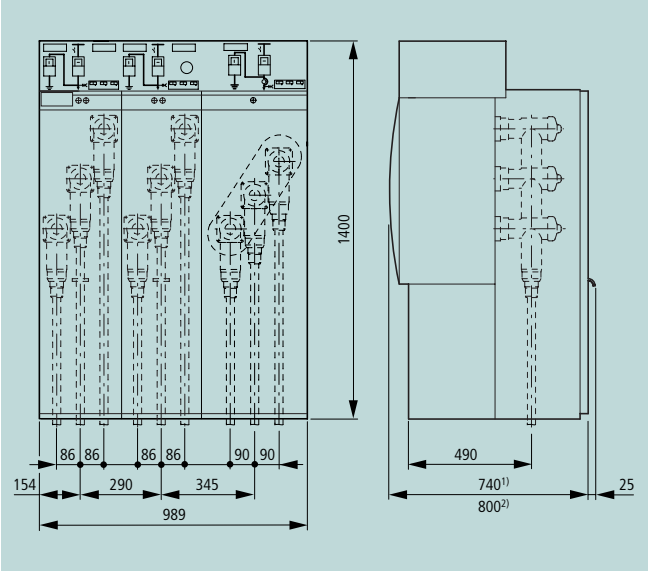
System Type 2K1LSF250 (with relay and control compartment, height 300 mm)

Accessories, optional

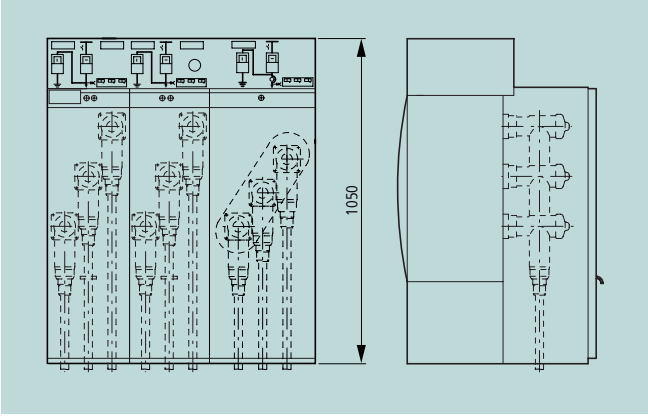
- Short-circuit indicator,
- Auxiliary contact modules for load-break switches, max. 3 NO, 3 NC, Earthing switches, max. 2 NO, 2 NC,
- Auxiliary contact module for SF_6 circuit-breaker, max. 3 NO, 3 NC,
- Motor operator,
- Anti-reverse interlock,
- Cable clamps,
- Arc-fault resistant cable compartments,
- Deep front covers (deep increased by 61 mm).

Optional equipment for SF_6 circuit-breaker

- Shunt trip release, DC or AC,
- Current transformer trip release for pulsed release or via auxiliary current transformer,
- Auxiliary current transformer,
- Relay and control compartment, height 300 or 600 mm,
- Short bushings in connection with split-core current transformers around the cables,
- Long bushings in connection with 3-core current transformer around the bushings.



1) Cable connection compartment standard.
2) Cable connection compartment deep.
GA2K1LSF250/GA2K1LSF630 (weight: 345 kg)



GA2K1LSF250-C/GA2K1LSF630-C (weight: 285 kg)

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6

Range of four-panel systems

Range of four-panel systems

Systems with four cable feeder panels

Type GA4K
Type GA4K-C

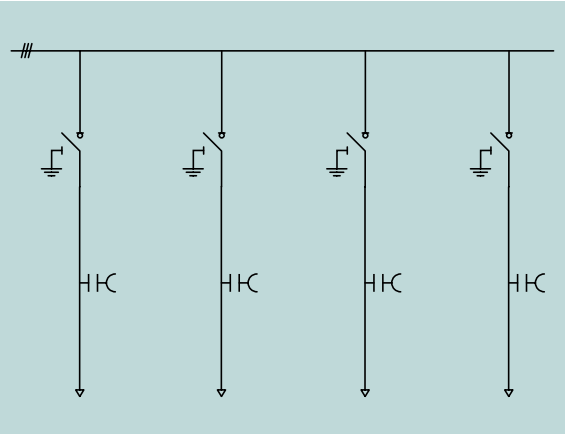
Standard equipment for

- System,
- K panels.

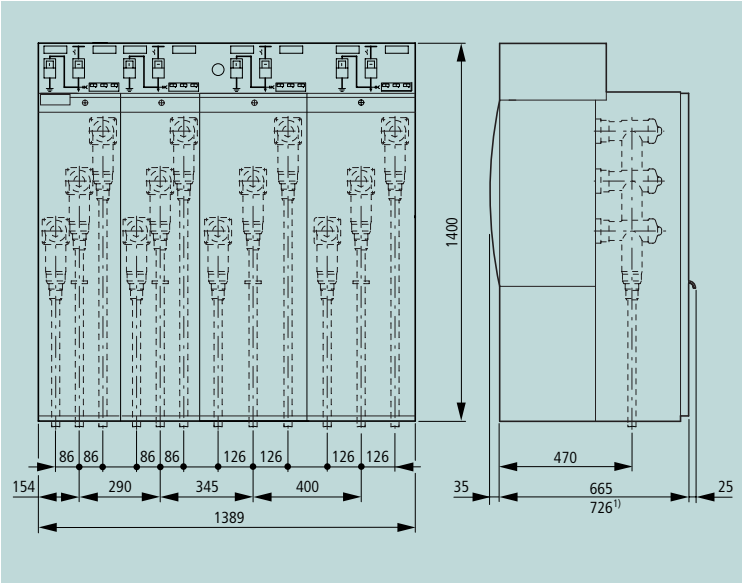
→ page 21

Accessories, optional

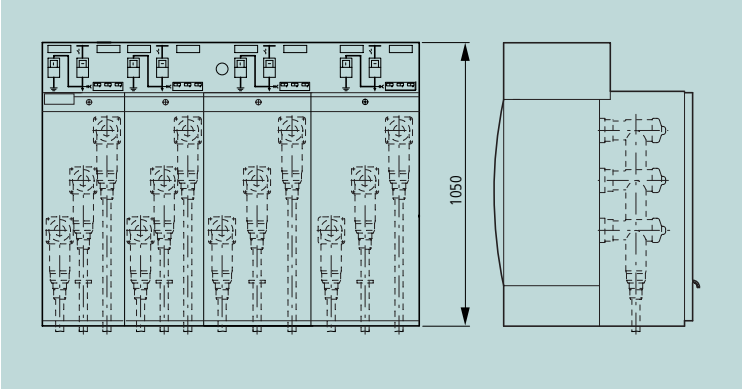
- Short-circuit indicator,
- Auxiliary contact modules for load-break switches, max. 3 NO, 3 NC, Earthing switches, max. 2 NO, 2 NC,
- Motor operator,
- Anti-reverse interlock,
- Cable clamps,
- Arc-fault resistant cable compartments.



Overview diagram: GA4K(-C)



1) Deep front cover in K panel.
GA4K (weight: 325 kg)



GA4K-C (weight: 291 kg)

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6

Range of four-panel systems

Systems with three cable feeder panels and one transformer feeder panel

Type GA3K1KS or GA3K1TS
Type GA3K1KS-C or GA3K1TS-C

Standard equipment for

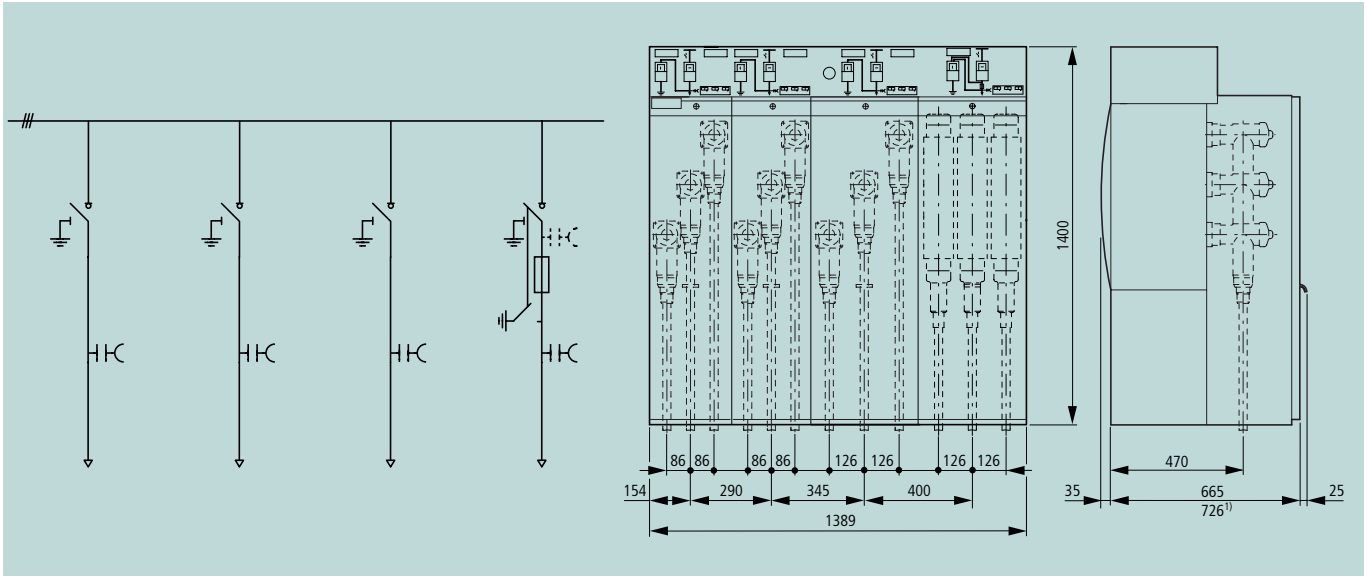
- System,
- K panels,
- KS panel,
- TS panel.

→ page 21

Accessories, optional

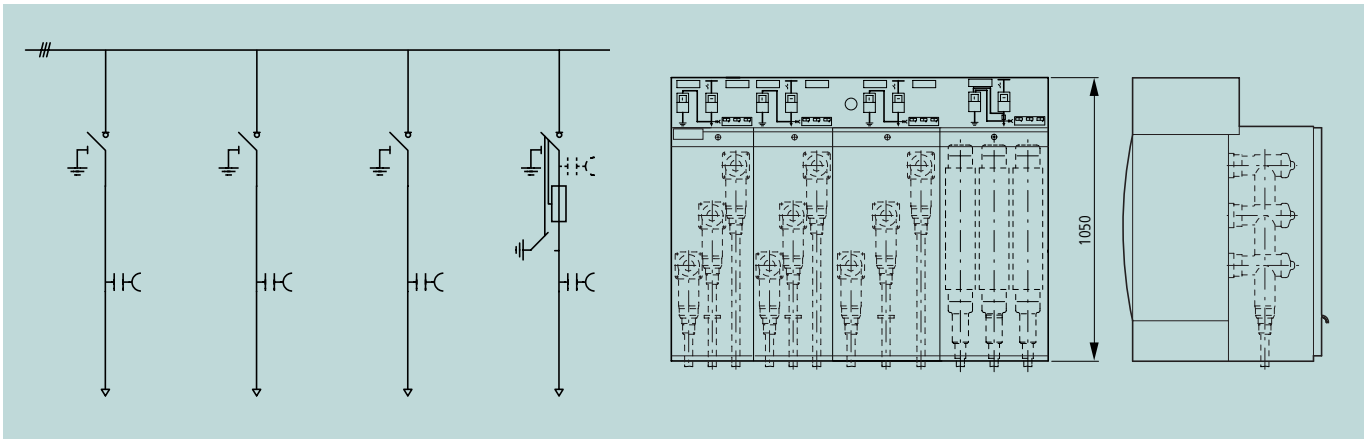
- Short-circuit indicator,
- Auxiliary contact modules for load-break switches, max. 3 NO, 3 NC, Earthing switches, max. 2 NO, 2 NC,
- Capacitive voltage indication ledges upstream of the HV fuses,
- Shunt trip release, DC or AC,
- Auxiliary contact trip indication[1],
- Motor operator,
- Anti-reverse interlock,
- Cable clamps,
- Fuse adapter for fuse with dimension "e" = 292 mm,
- Arc-fault resistant cable compartments,
- Switching system for rated transfer current I_4 = 2800 A, based on the fuse selected (usable only up to 12 kV, → page 22, Fuse selection), panel then Type LTS.

1) Suitable only for systems with TS or LTS panel.



Overview diagram: GA3K1KS(-C)

1) Deep front cover in K panel.
GA3K1KS/GA3K1TS (weight: 366 kg)



Overview diagram: GA3K1TS(-C)

GA3K1KS-C/GA3K1TS-C (weight: 316 kg)

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6

Range of four-panel systems

Systems with two cable feeder panels and two transformer feeder panels

Type GA2K2KS or GA2K2TS
Type GA2K2KS-C or GA2K2TS-C

Standard equipment for

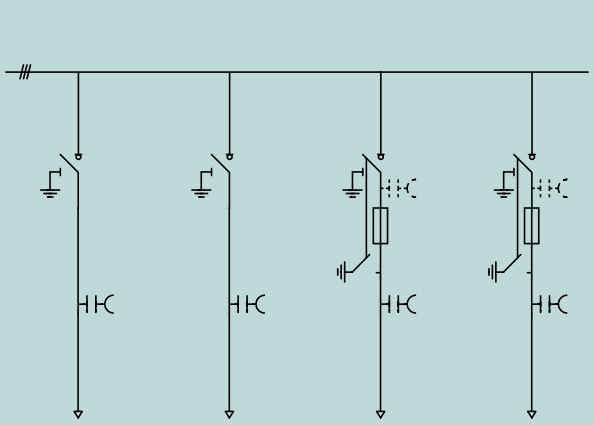
- System,
- K panels,
- KS panels,
- TS panels.

→ page 21

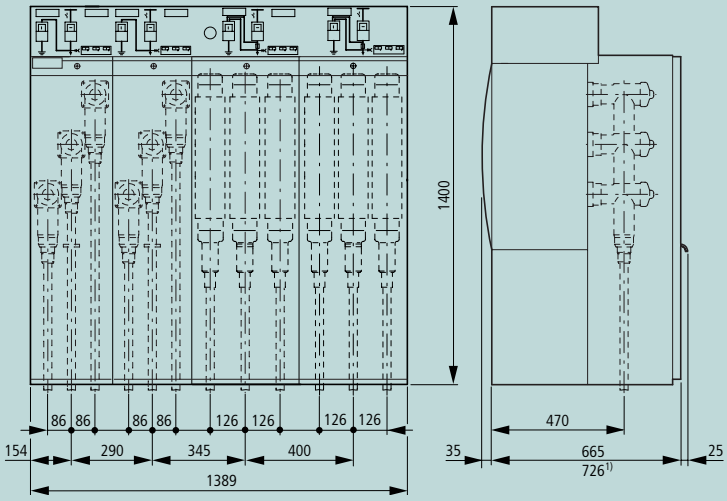
Accessories, optional

- Short-circuit indicator,
- Auxiliary contact modules for load-break switches, max. 3 NO, 3 NC, Earthing switches, max. 2 NO, 2 NC,
- Capacitive voltage indication ledges upstream of the HV fuses,
- Shunt trip release, DC or AC,
- Auxiliary contact trip indication[1],
- Motor operator,
- Anti-reverse interlock,
- Cable clamps,
- Fuse adapter for fuse with dimension "e" = 292 mm,
- Arc-fault resistant cable compartments,
- Switching system for rated transfer current I_4 = 2800 A, based on the fuse selected (usable only up to 12 kV, → page 22, Fuse selection), panel then Type LTS.

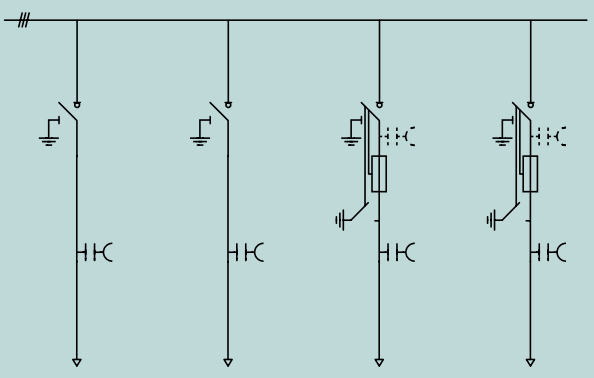
1) Suitable only for systems with TS or LTS panel



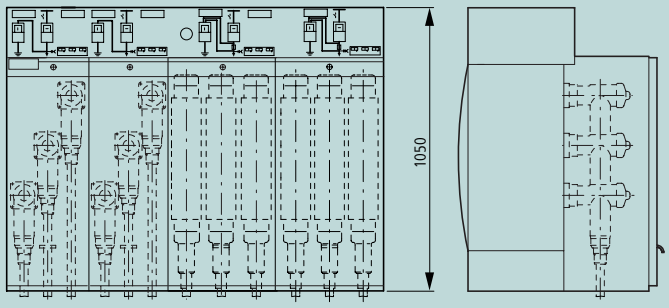
Overview diagram: GA2K2KS(-C)



1) Deep front cover in K panel.
GA2K2KS/GA2K2TS (weight: 399 kg)



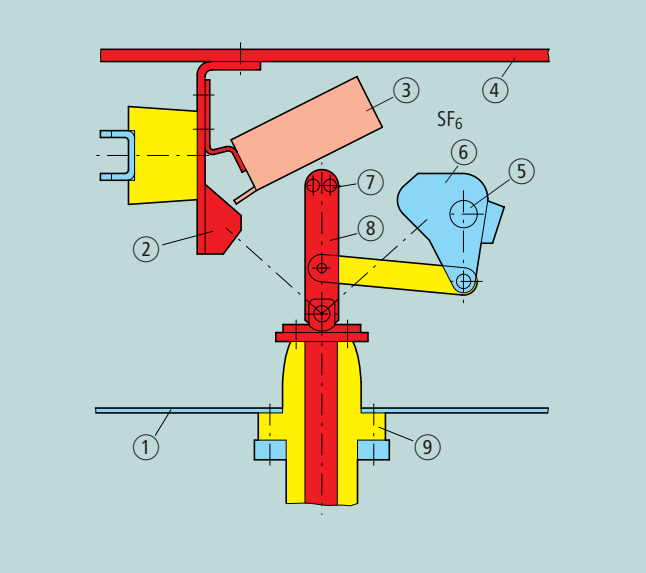
Overview diagram: GA2K2TS(-C)



GA2K2KS-C/GA2K2TS-C (weight: 341 kg)

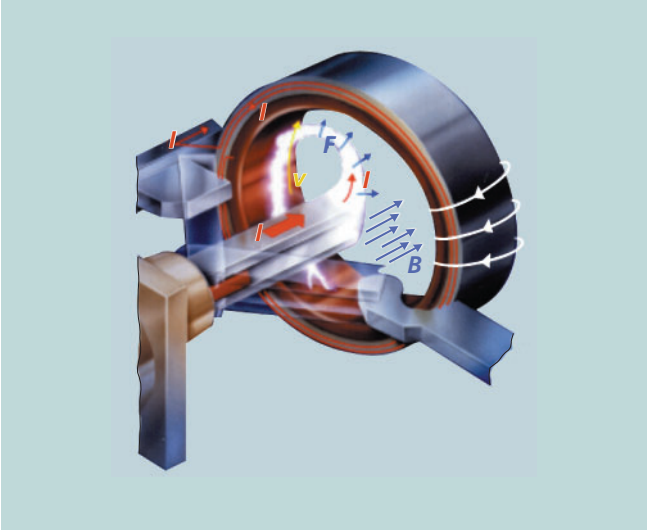
Switching system

Three-position load-break switch, three-position SF_6 circuit-breaker

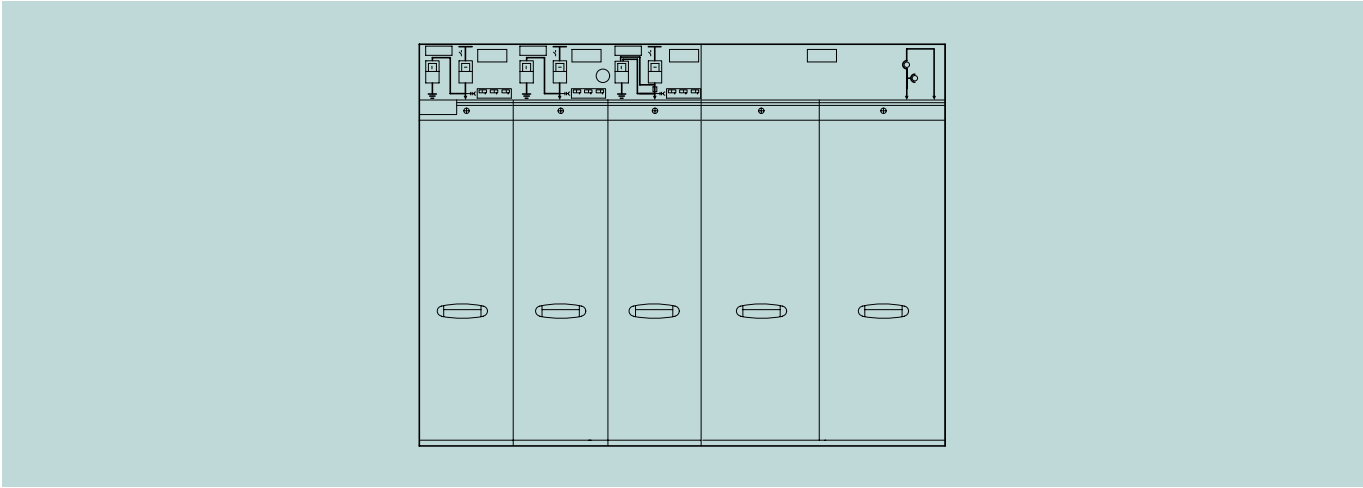


① Front gas tank
② Fixed contact, On
③ Arc quenching coil
④ Busbar
⑤ Drive shaft
⑥ Earthing contact
⑦ Special contact rivets
⑧ Blade contact
⑨ Bushing

Function principle of the arc quenching coil



I = Current
B = Magnetic field generated by current *I* in the arc quenching coil
F = Force exerted on the current-carrying switching arc
v = Speed vector of the switching arc



Combination of GA2K1TS system and GAE1M4 metering panel, electrical link using cable

Range of standard equipment

Standard equipment of GA/GA...-C systems

Depending on its type, every system essentially includes the system elements shown in the diagram on page 4:

- Electrical switching chamber (HV compartment) including the busbar compartment, gas-filled,
- Drive compartment, above the HV compartment, in air,
- Fuse arrangement in systems with KS or TS panels, in air,
- Cable compartment, cable termination area,
- Panel plinth.

Standard equipment of K panel

Cable feeder panel

- SF_6 three-position load-break and earthing switches, including interlock,
- Spring operated drives for load-break and earthing switches – On and Off –,
- Capacitive voltage indication ledges,
- Padlocking facility: Load-break switch and earthing switch drives,
- Interlock between earthing switch and front cover → page 4, section "Cable connection compartments".

Standard equipment for KS panel

Transformer feeder panel

- SF_6 three-position load-break switches and earthing switches, including interlock,
- Spring operated drives for load-break switches and earthing switches – On and Off –,
- 3-phase plug-on fuse arrangement,
- Earthing switch additionally downstream of the HV fuses,
- Capacitive voltage indication ledges downstream of the HV fuses,
- Set of integrated slip-on type cable terminations,
- Padlocking facility: Load-break switch and earthing switch drives,
- Interlock between earthing switch and front cover → page 4, section "Cable connection compartments".

Standard equipment of TS panel

Transformer feeder panel

- SF_6 three-position load-break switches and earthing switches, including interlock,
- Spring operated drive – On – ,
- Spring operated drive – Off – for earthing switch,
- Spring operated drive – Off – for load-break switch,
- 3-phase plug-on fuse arrangement,
- Indication of fuse tripping in all three poles,
- Earthing switch additionally downstream of the HV fuses,
- Capacitive voltage indication ledges downstream of the HV fuses,
- Set of integrated slip-on type cable terminations,
- Padlocking facility: Load-break switch and earthing switch drives,
- Interlock between earthing switch and front cover → page 4, section "Cable connection compartments".

Standard equipment of LSF panel

Bus-sectionalizer feeder panel with SF_6 circuit-breaker

- SF_6 three-position load-break switches and earthing switches, including interlock,
- Spring operated drive – On – ,
- Spring operated drive – Off – for earthing switch,
- Spring operated drive – Off – for load-break switch,
- 3-phase line protection, version and transformer ratio by agreement,
- Tripping indication of line-protective relay,
- Capacitive voltage indication ledges,
- Auxiliary contact for pressure monitoring and interlocking for tripping by density-meter,
- Padlocking facility: Load-break switch and earthing switch drives,
- Interlock between earthing switch and front cover → page 4, section "Cable connection compartments".

Standard equipment of A1 panel

Cable connection panel with one set of connection bushings

- SF_6 earthing switch[1)],
- Spring operated drives – On and Off –,
- Padlocking facility: Drive,
- Capacitive voltage indication ledges,
- Interlock between earthing switch and front cover → page 4, section "Cable connection compartments",
- Bushings for cable termination – one set –.

1) Only one earthing switch in a system with two A1 panels.

Standard equipment of A2 panel

Cable connection panel with two sets of connection bushings

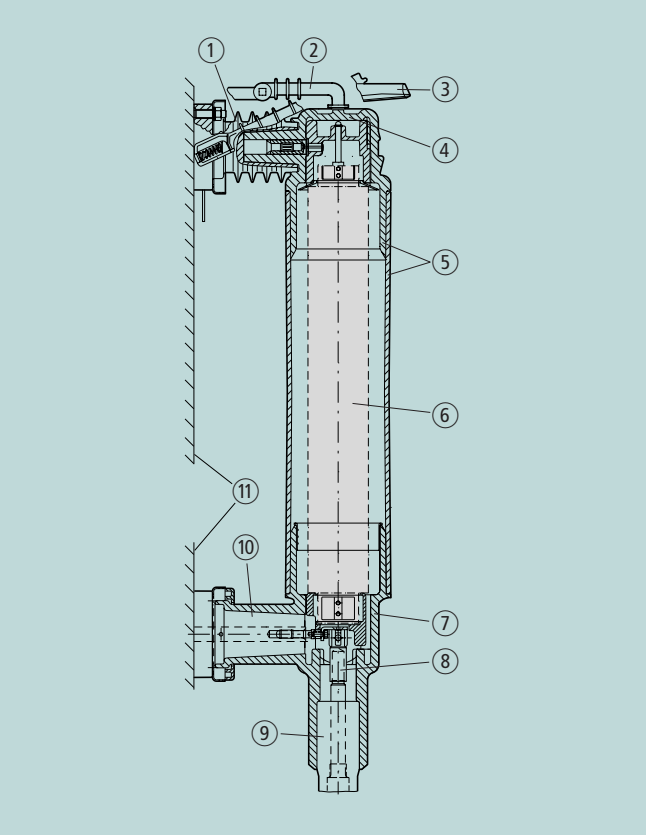
- SF_6 earthing switch,
- Spring operated drives – On and Off –,
- Padlocking facility: Drive,
- Capacitive voltage indication ledges,
- Interlock between earthing switch and front cover → page 4, section "Cable connection compartments",
- Bushings for cable termination – two sets –.

Fuse arrangement, Fuse selection

In the GA system, the fuse arrangement is plug-fitted. All the fuse components are coupled to the contacts via cast-resin bushings from outside of the gas tank. The plug-in system consists of the upper and the lower fuse holder. The plug-in parts, made from silicone rubber, are designed to be track- as well as arc-proof. The lower fuse holder additionally functions as push-on type cable termination. Range of application: for Cu or Al cables from 25 up to 240 mm^2. The earthing switches in the SF_6 chamber enable the HV fuse cartridges to be earthed at both ends. The fuse arrangement is accessible only with earthing switches switched On. **The individual components of the plug-in system can be separated even after years of use since the plug-in surfaces are made of a special combination of materials which prevents sticking.** There is no need to lubricate these surfaces (interfaces).
Fuse length: 442 mm; fuses of 292 mm length can be used with an extension adapter.

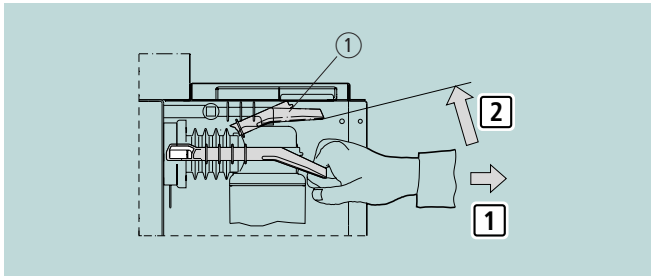
Fuse selection

Only HV back-up fuse links should be used acc. to actual fuse selection table No. 12254569 acc DIN 43625 up to 88 mm ∅ for protection of distribution transformers 6, 12 and 24 kV.
Other types of fuse links only to be used after reconfirmation!

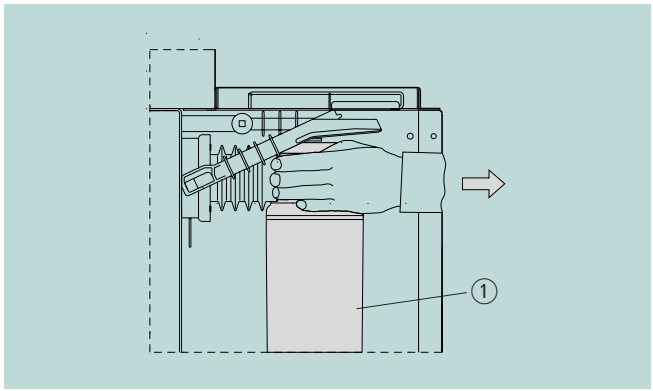


① Upper bushing
② Tripping linkage
③ Tensioning lever
④ Flexible diaphragm
⑤ Upper fuse holder
⑥ HV fuse cartridge
⑦ Lower fuse holder
⑧ Cable lug
⑨ Stress cone
⑩ Lower bushing (2nd earthing switch)
⑪ Front gas tank

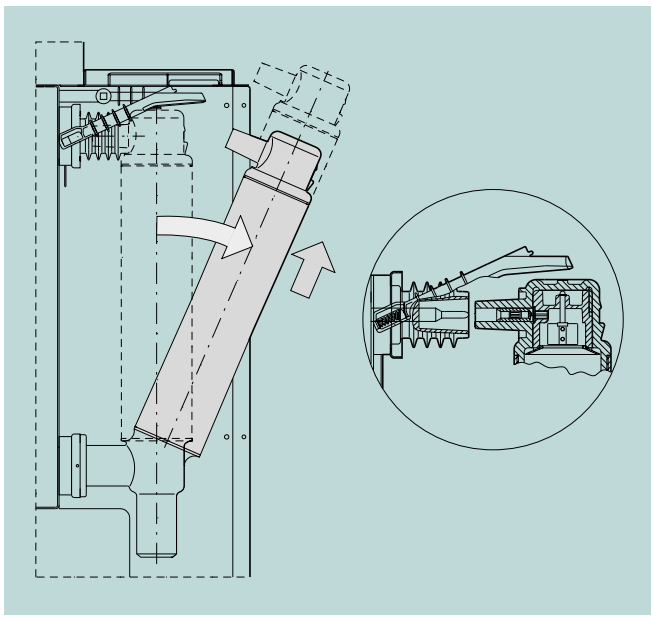
Exchanging an HV fuse



① Tensioning lever
Pull tensioning lever forward against the spring pressure, then swing it upwards, into the fuse compartment.



① Upper fuse holder
Grasp upper fuse holder and pull it straight out of the upper bushing.



Swing upper fuse holder forward, out of the fuse compartment, then pull it out towards the top, and replace the HV fuse link.

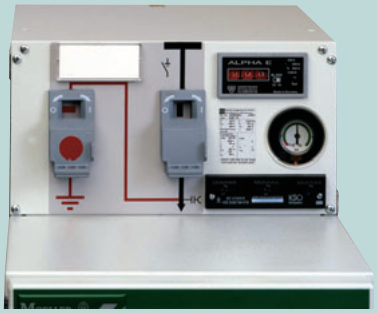
It is not necessary to grease the interface.

To insert a fuse, follow the sequence in reverse.

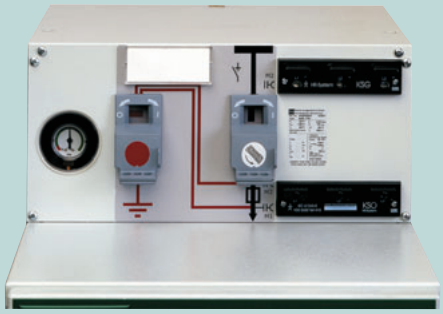
Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6
Front panel

Front panel

Front panel with
- Mimic diagram
- Switch position indication
- Operator surface for the actuators
- Capacitive voltage indicators
- Gas leakage indication
- Short-circuit indicators
- Padlocking facility
- Drive sealed against dust, sand and insects
- Housing IP4x

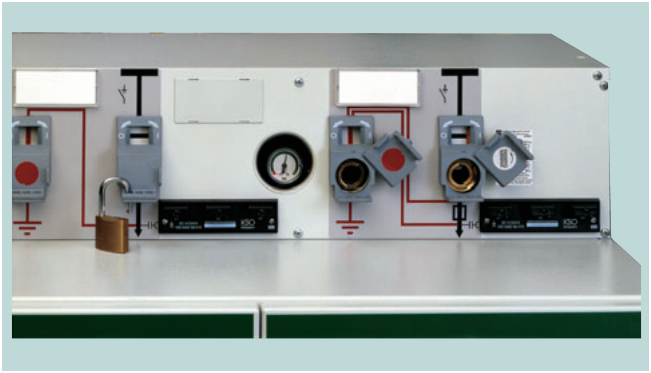


Ring cable panel



Transformer feeder panel

Padlocking facility for drives



Gas leakage indication

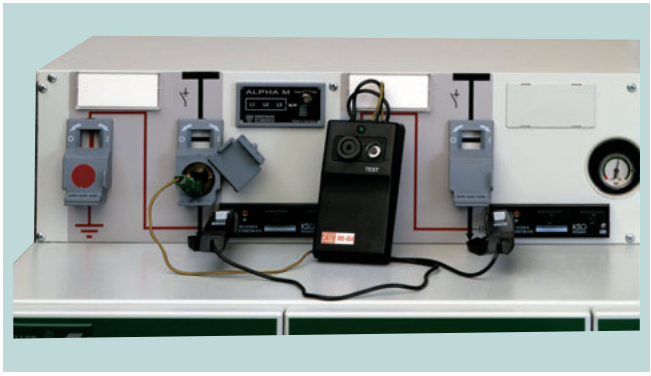
Each gas tank has a pressure display for verification of the SF_6 overpressure within, and allowing its functional safety to be inspected.

Meaning of the indication:
Green = Sufficient service pressure
Red = Insufficient service pressure.

Pressure switch/density switch

Each gas tank can be fitted with a pressure switch resp. density switch (auxiliary contact) for remote monitoring. The lower switching point corresponds to the crossover point to the red measuring range on the gas leakage indication. The density switch can be optionally provided with auxiliary contacts for alarm and tripping function.

Phase sequence indication

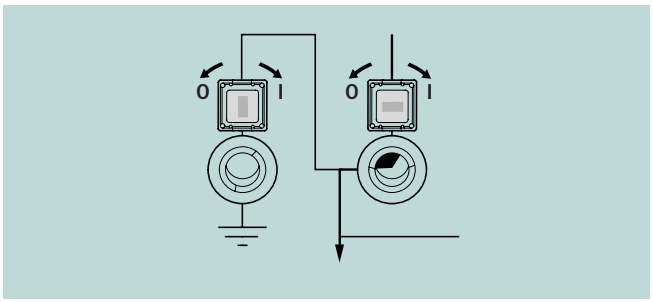


Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6

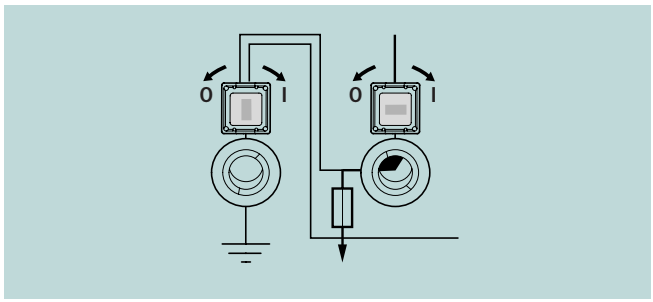
Interlocking function

Interlocking function

Operating lever cannot be inserted

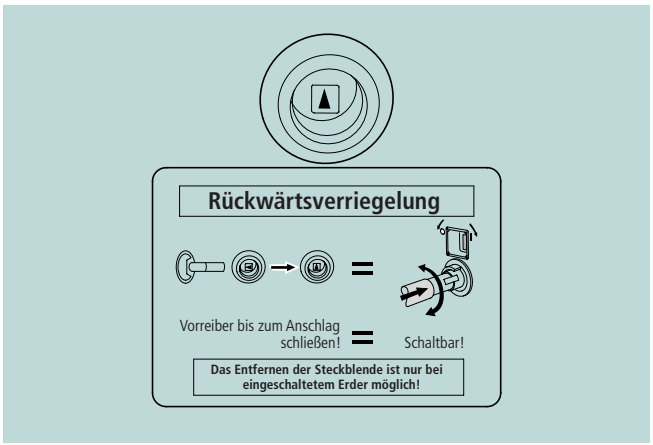


Ring cable panel:Load-break switch blocked by switch interlocking.

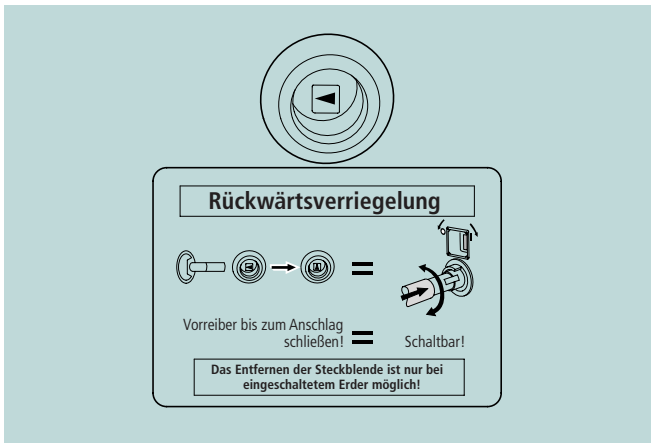


Transformer feeder panel:
Load-break switch blocked by switch interlocking.

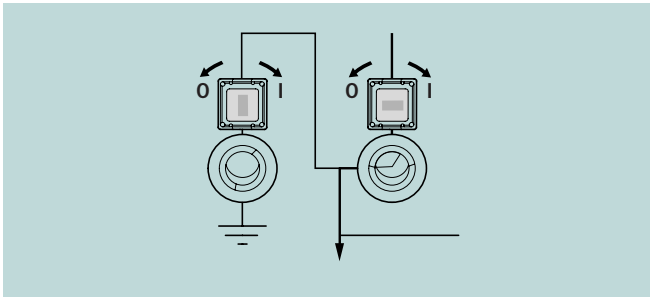
Anti-reversing interlock – Option –



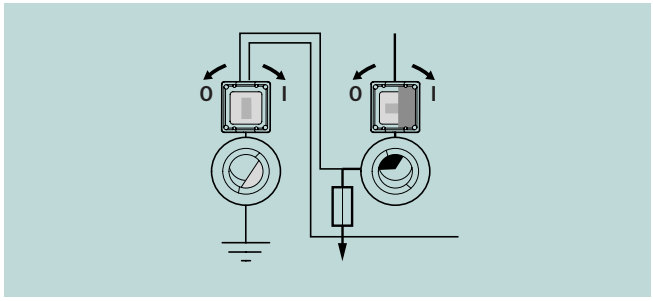
Fastener of the front cover is closed.
Switching processes not restricted.



Fastener of the front cover open.
Switching processes can take place only at the earthing switch in the ring cable panel.



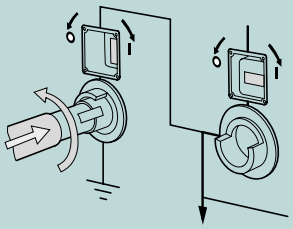
Ring cable panel:
Fastener of the front cover is open. Load-break switch blocked by anti-reverse interlock. The switch interlock plate lies behind that of the anti-reverse interlock. Earthing switch can be operated without restriction even with the front cover removed.



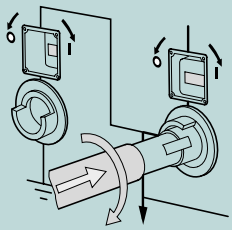
Transformer feeder panel:
Fastener of the front cover is open.
Earthing switch blocked by anti-reverse interlock.

Switching processes in ring cable panels

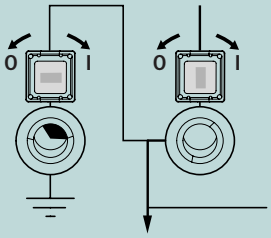
Earthing switch Off – load-break switch On



Switch Off the earthing switch.
Press the operating lever fully (up to the stop) against the spring pressure, hold and turn it to the left.

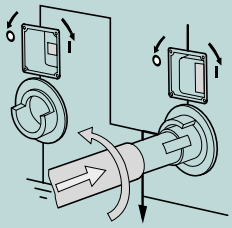


Switch On the load-break switch.
Press the operating lever fully (up to the stop) against the spring pressure, hold and turn it to the right.

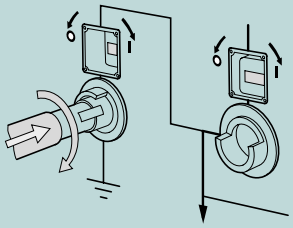


Switch position with load-break switch Off and earthing switch On.

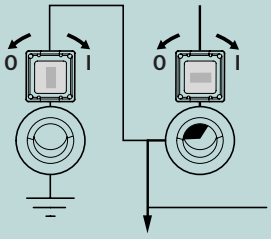
Load-break switch Off – earthing switch On



Switch Off the load-break switch.
Press the operating lever fully (up to the stop) against the spring pressure, hold and turn it to the left.



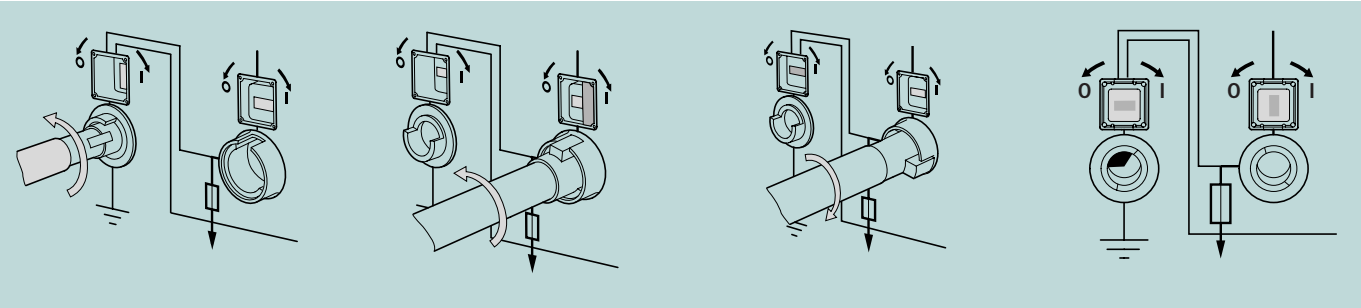
Switch On the earthing switch.
Press the operating lever fully (up to the stop) against the spring pressure, hold and turn it to the right.



Switch position with load-break switch Off and earthing switch On.

Switching processes in transformer feeder panels

Earthing switch Off – Transformer switch On



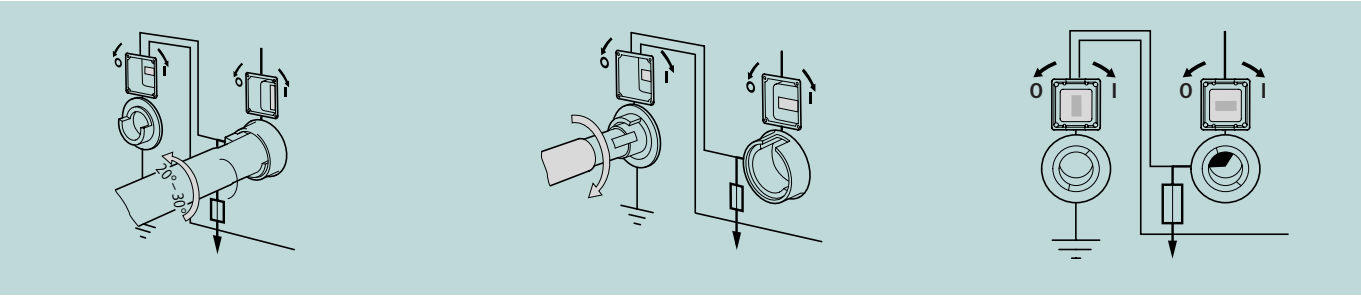
Switch Off the earthing switch. Turn the operating lever fully (up to the stop) to the left.

Charge the transformer switch by turning the operating lever to the left.

Switch On the transformer switch. Turn the operating lever to the right.

Switch position with transformer switch On and earthing switch Off.

Transformer switch Off – earthing switch On

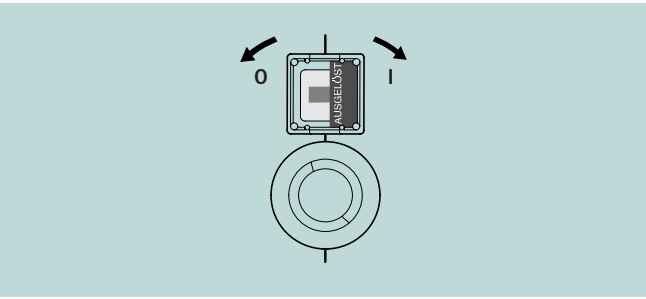


Switch Off the transformer switch. Turn the operating lever about 20 to 30 degrees to the left.

Switch On the earthing switch. Turn the operating lever fully (up to the stop) to the right.

Switch position with transformer switch Off and earthing switch On.

Transformer switch TRIPPED



The TRIPPED flag in the switch position indication shows only when the transformer switch has been de-energized via the HV fuse link having responded or via the shunt trip release (optional). The drive must be charged by turning it to the left, before the transformer switch can be switched On again.

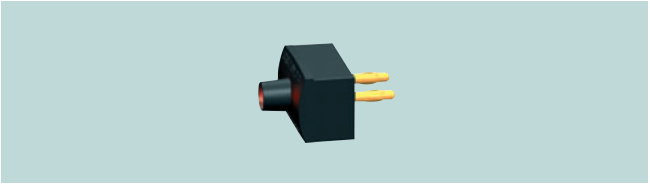
Voltage indication and testing

Each system is equipped with the necessary three-phase capacitive voltage indication ledges Type KSO for voltage testing to VDE 0682 Part 415 and IEC 61243-5 with HR system (other systems on request). This enables the absence of voltage in individual phases to be verified by inserting the voltage indication plugs into the corresponding pairs of sockets. Optionally, fixed-mounted capacitive indication lamps can be provided within indication ledges Type KSG. These are activated by removing the short-circuit bridges. The voltage indication ledge circuitry is designed for **rated operational voltages of 10, 15 and 20 kV**. The minimum and maximum values of the Standard for these voltage ranges are adhered to in the standard system. It is not necessary therefore, to adjust them again when changing the rated operational voltage within this range. Rated operational voltage 6 kV can be implemented in a special version. The live contact sockets are protected against accidental contact.

Voltage indication ledge in sealed version

Voltage indication plug

(Picture shows Horstmann device)

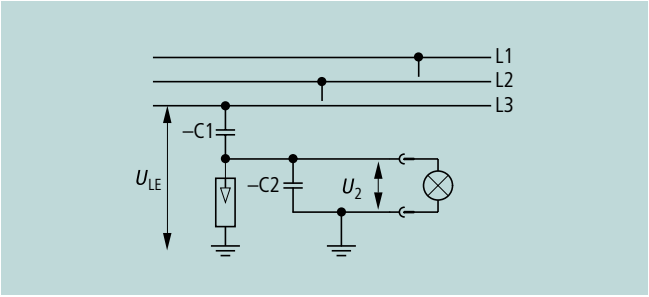


The following devices may be used:

	KSO	KSG
Pfisterer	Type DSA-2	–
Horstmann	Type HO-ST-1	–
ELSIC	Type HO-SA	–
Jordan	Type DSP-HR	–
EMG	–	Type 38.10.01

Indication devices are also suitable for continuous duty.

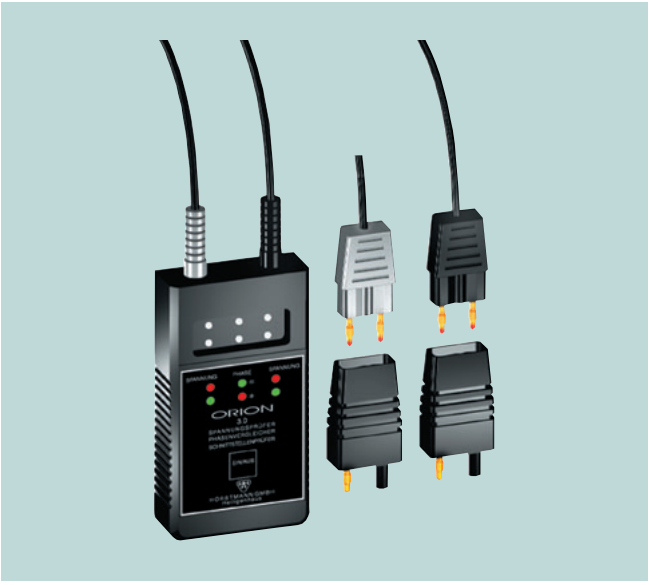
Single-line diagram of a voltage indicator



Voltage indication via capacitive voltage divider, HR system.
Voltage indication plugged in.
C_1 Capacitor integrated in the bushings.
C_2 Capacitance of the connecting cables and the voltage indication device to earth.
$U_{LE} = U_N/\sqrt{3}$ During rated operation in a three-phase system.
$U_2 = U_A$ = Voltage at the capacitive interface of the system or at the voltage indication device.

Phase sequence indication Interface tester

(Picture shows Horstmann device, Type ORIOn 3.0)



The following devices may be used:

Make	Phase sequence indication	Interface tester
Horstmann		H-OM measuring module with Fluke ammeter Type 87 or matrix Type Mx55
Horstmann	Type: Orion	Type: Orion
ELSIC	Type: HO-PV	Type: HO-MPK
Pfisterer	Type: EPV	Type: Euro test-HO
Jordan	–	Type: KSP-HR

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6

Short-circuit/earth-fault indicator

Short-circuit/earth-fault indicator

All ring cable panels can be equipped either with a 3-phase short-circuit or earth-fault indicator.

Selection of short-circuit and earth fault indicators

Messrs. Horstmann[1)]

Indicator Type[1)2)]	Reset	Short-circuit current[3)]	Earth fault current[3)]	Remote indication contact
		A	A	Standard: fleeting contact pulse >100 ms Optional: continuous contact
Short-circuit indicator				
ALPHA M	Manual	400, 600, 800, 1000	–	X
ALPHA E	• Manual, • Automatic after 2 or 4 h	400, 600, 800, 1000	–	X
GAMMA 4.0	• Manual, • Following return of the mains voltage, • Automatic after 2 or 4 h	400, 600, 800, 1000	–	X
ALPHA automatic (on request)	• Manual (by push-button), • Remote resetting (by control voltage), • Automatic after 3 h	Current changes by ΔI = 150 A at 20 ms	–	X
Earth fault/short-circuit indicator				
EKA-3[4)]	Following return of the mains voltage	450	40, 80, 160	–
DELTA M	Manual	400, 600, 800, 1000	200	–
DELTA E	• Manual, • Automatic after 2 or 4 h	400, 600, 800, 1000	200	–
Earth-fault indicator				
EKA-3/1[4)]	Following return of the mains voltage		40, 80, 160	–

1) Other Types and other makes, on request.

2) Option: Electrical remote indication. Fleeting contact on terminal.

3) Standard values: other values on request.

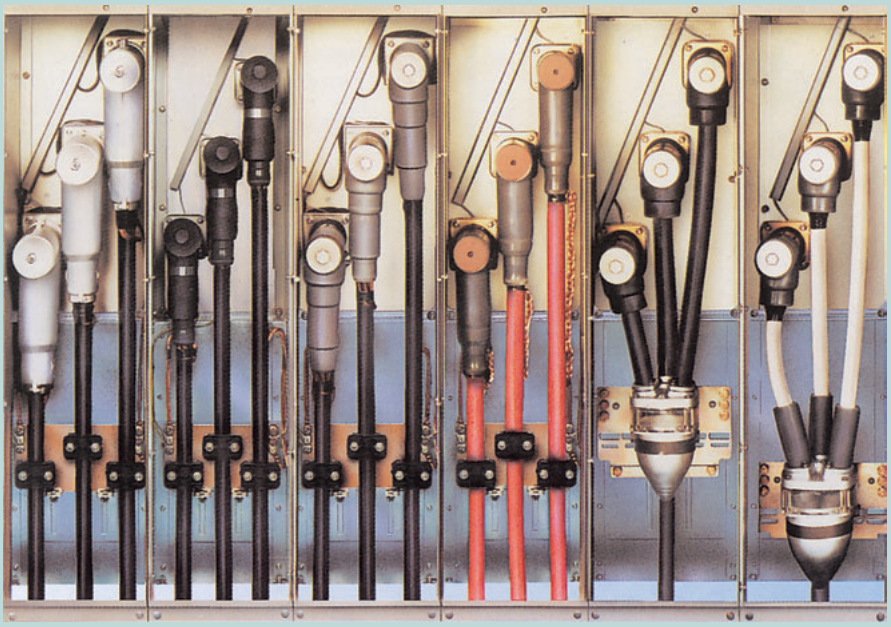
4) External AC 240 V auxiliary voltage required.

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6

Cable connection systems

Cable connection systems

Example: Ring cable panels



T cable connector systems

Range: 25 to 240 mm²

① T connector Type CB (shock-proof) with metal housing

② T connector Type CB (shock-proof) without metal housing, exterior coated with electrically conductive material

③ Adapter connector Type AB12 (not shock-proof)

④ Adapter connector Type AB24 (not shock-proof)

⑤ SkV-sleeved cable termination, 12 kV with AWM adapter for MI cables (on request)

⑥ SkV-sleeved cable termination, 24 kV with AWLS adapter for MI cables

Picture shows cable connector systems from Messrs.: NKT

T cable connector systems

At the customer's discretion, T cable connector systems can be used which are connected to the outer-cone bushings to DIN EN 50181 Type 630 A with screw contacts (M16).

With unscreened systems, the assembly instructions of the manufacturer must be strictly observed.

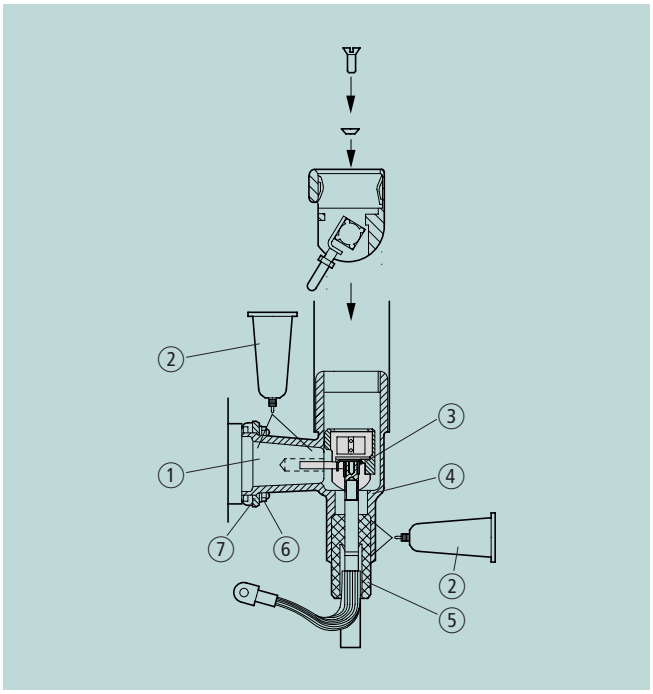
Assembly options of cable connection systems.

	NKT/F&G Type		ABB Type		Tyco Electronics		Euromold/Nexas Type		Pirelli Type	
	10 kV	20 kV	10 kV	20 kV	10 kV	20 kV	10 kV	20 kV	10 kV	20 kV
XLPE cable	CB12	CB24	SET12	SET24	RSTI	RSTI	K400TB	K400TB	FMCTs400	FMCTs400
	CC12	CC24	SEHDT13	SEHDT23	RICS...	RICS...	K400TB	K400TB	FMCTj400	FMCTj400
	CB36	CB36	SEHDT13.1	SEHDT23.1	–		AGT10/630	AGT20/630	–	–
	AB12	–	–	–	–		AGTL10/630	AGTL20/630	–	–
	AC12	–	–	–	–		–	–	–	–
Mass-impregnated (MI) cable	ÜEV10+ AWLS10	–	–	–	RICS...	RICS...	–	–	–	–

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6

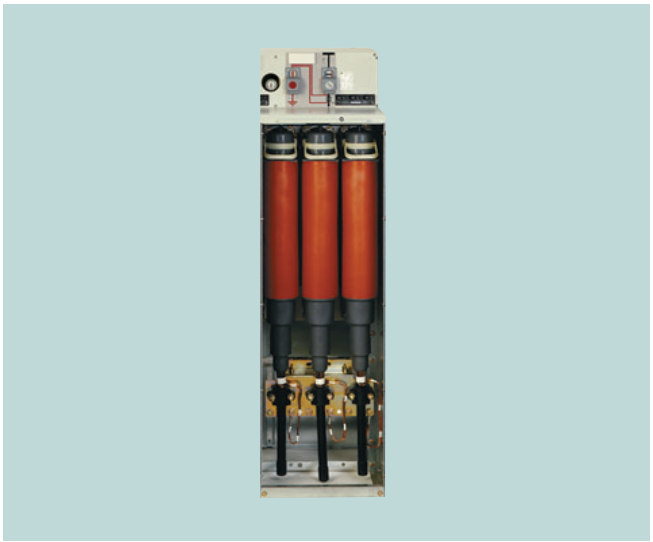
Cable connection systems

Cable connection for transformer panels



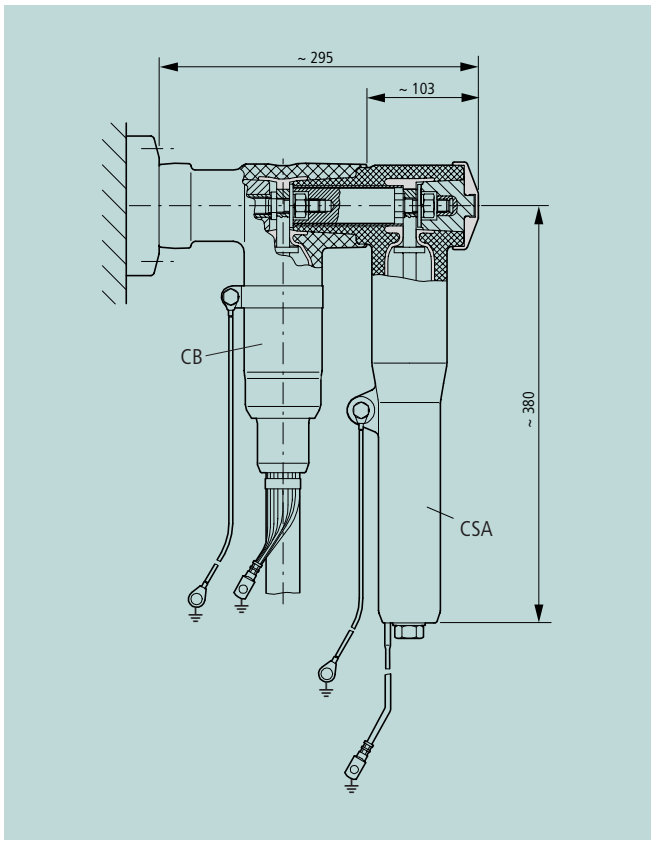
① Bushing cone (lower bushing)
② Assembling paste for fitting of termination
③ Cable lug
④ Lower fuse holder
⑤ Stress cone
⑥ ISO nuts
⑦ Fixing flange

The lower fuse holder additionally functions as **push-on transformer cable termination**. Range of application: for Cu or Al cables from 25 to 240 mm².



Transformer feeder panel, front cover open.
With fuse holders and transformer cable termination.

Lightning arrester at the T cable connector



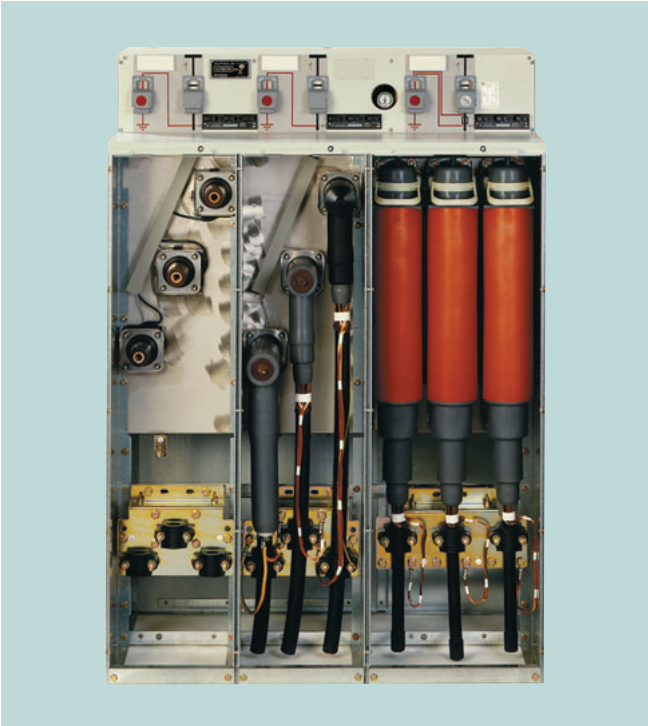
The following combinations of T cable connectors with lightning-arresters may be used:

- Messrs. NKT (picture shows combination from Messrs. NKT):
  Type CB T plug with lightning arrester: CSA
- Messrs. ABB:
  Type SEHDT T plug with lightning arrester: MUT
- Messrs. Raychem:
  Cable terminations: IXSU, SMOE, UHGK, IDST with RICS adapter with RDA lightning arrester

Ring cable panel, front cover open.
With lightning arrester in phase L1.

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6

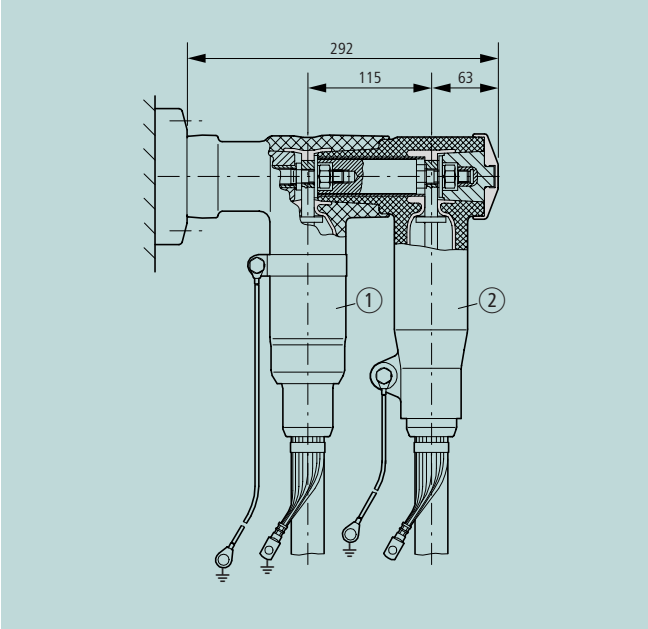
Cable connection systems



GA2K1TS with front covers removed

GA2K1LFS with front covers removed

Double cable connection



① Push-on cable termination, Type: CB12 or 24-630
② Push-on cable termination, Type: CC12 or 24-630

Double cables equipped with the above mentioned cable termination types can be connected to the standard system version without modification.

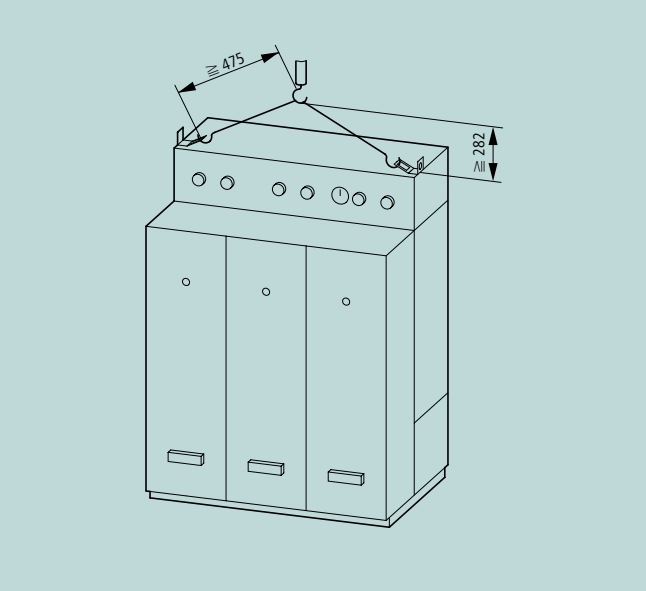
Deeper double-cable connections require a deep front cover (→ page 4).

Other combinations on request.

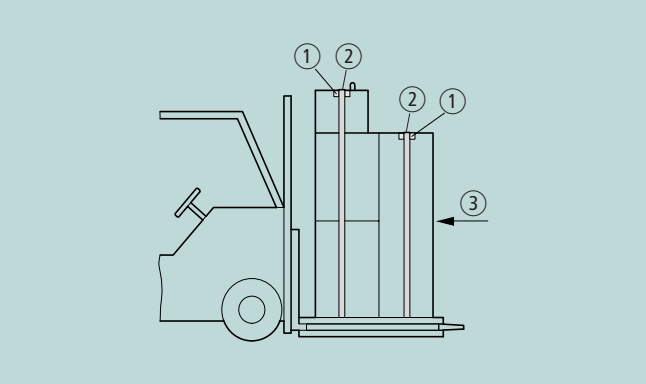
Transport/arc fault protection, panel installation

Modes of transport

For size and weight of transport groups, → page 10 to 19.



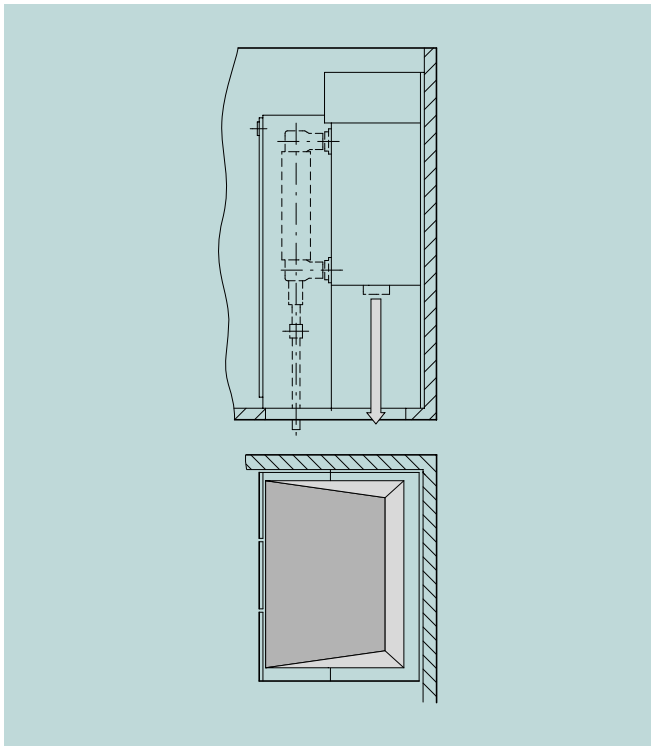
Crane transport using two suspension cables.



For transport by fork-lift or lifting truck, the panel must rest on a pallet.

① Protective corner elements (cardboard)
② Tightening strap
③ Panel front

Arc-fault protection – Installation of standard panel versions 10, 16 and 20 kA without cooling grids



Pressure relief must go into the cable cellar.

For details see relevant operating instructions No. 21025734 for GA- and GA...-C systems.

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6

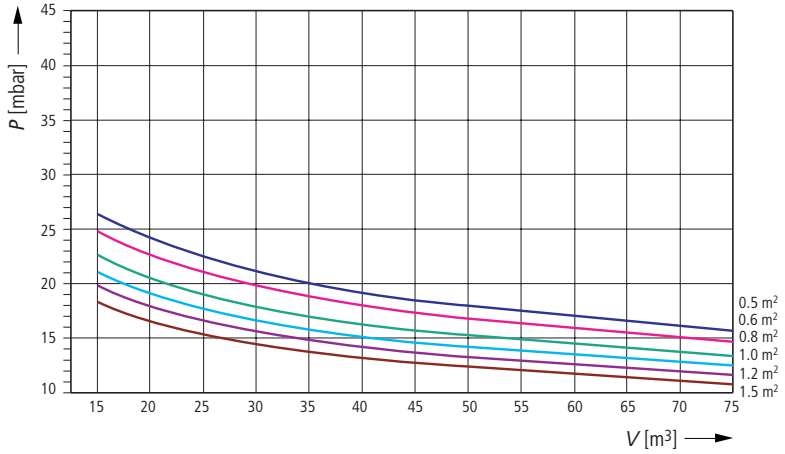
Maximum pressure in switchgear rooms

Maximum pressure in switchgear rooms

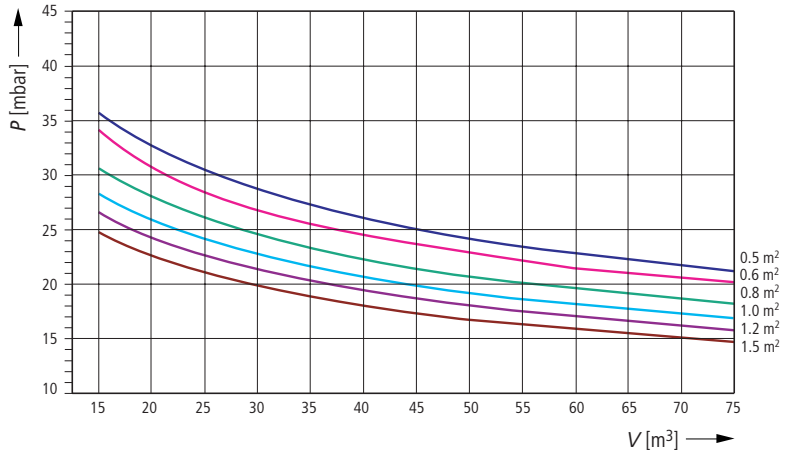
Diagrams apply at rated short-time current 10, 16 and 20 kA for panel version with cooling grids.

Maximum pressure in switchgear rooms relative to room volume and size of pressure relief opening.

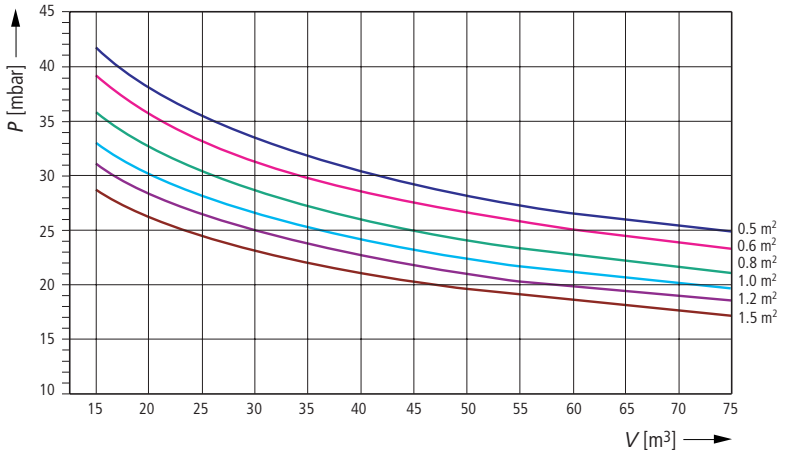
10 kA



16 kA

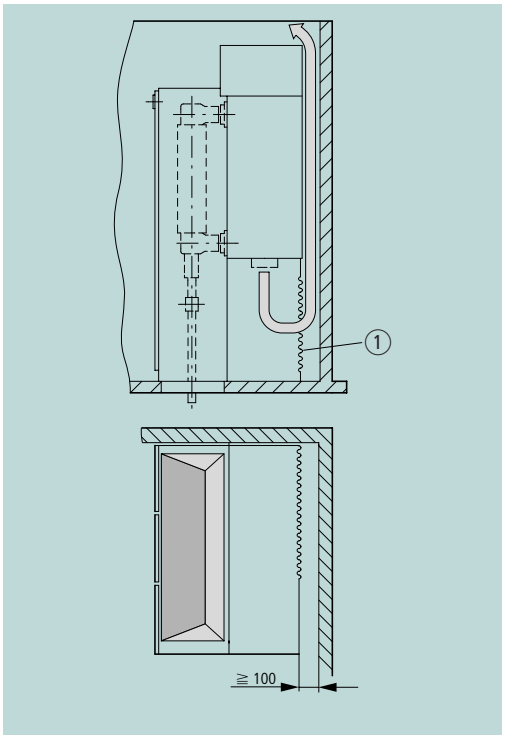


20 kA



P = Overpressure, V = Room volume
The data 0.5 to 1.5 m² refer to the size of the pressure relief apertures.

Arc-fault resistant panel installation for panel version with cooling grids



① Four-layer stretch metal

Pressure relief via four-layer stretch metal.

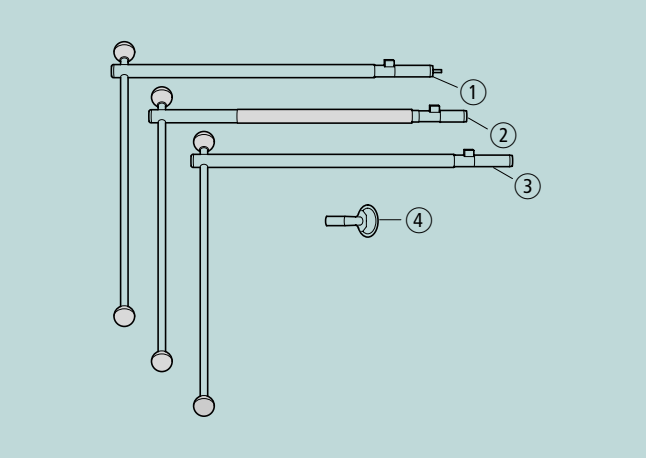
Approximate values for admissible max. overpressure loading in switchgear rooms

- Brick wall without lateral connection
  max. 10 mbar
  (e.g. between concrete pillars)
- Brick wall with reinforcing steel inserted into the mortar joint or embedding during the building of the wall. Wall thickness ≧ 24 cm
  max. 25 mbar
  (resistance and consequently the admissible loading depend significantly on the connection between the panels)
- Pre-fabricated concrete parts and stations
  max. 70 mbar

For detailed pressure calculations, the sales department of Moeller Anlagentechnik GmbH, Krefeld,/Germany, is always at your disposal.

Panel accessories, quality assurance

Operating levers

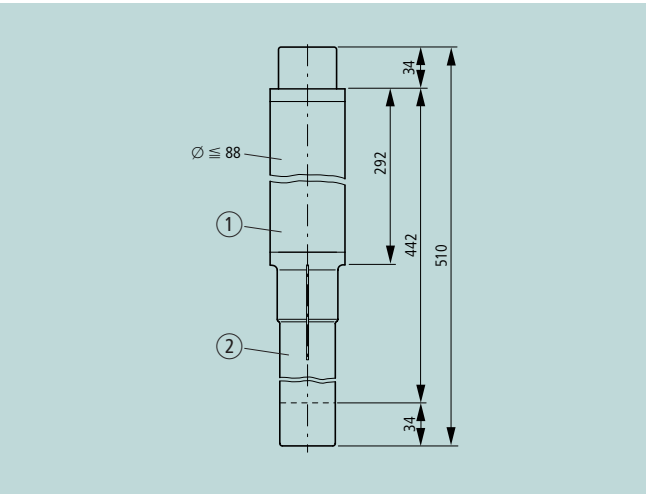


Operating levers, keys for fasteners

① Operating lever (optional) for the load-break switch actuating shaft with motor operator (for manual switching e.g. in case of loss of supply voltage).
② Operating lever for the earthing switch (optional red shaft).
③ Operating lever for the load-break switch (optional plain shaft).
④ Key for the fastener on the front cover (controls the anti-reverse interlock).

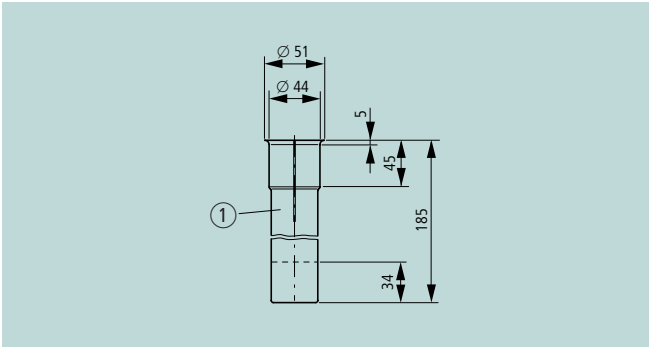
Fuse adapter

The transformer feeder panels are designed for fuses with dimension "e" = 442 mm. An adapter is available to allow fuses with dimension "e" = 292 to be used also.



Fuse link with adapter

① Fuse link
② Adapter



Fuse adapter

① Adapter

Cable clamps

- Size I:
  clamping range 24 to 45 mm for cables, e.g.
  12 kV – 35 mm² ≦ 240 mm²*
  24 kV – 25 mm² ≦ 185 mm²*
- Size II:
  clamping range 36 to 52 mm for cables, e.g.
  12 kV – ≧ 300 mm²
  24 kV – ≧ 240 mm²

* Compare actual cable diameters with the clamping range.

Quality assurance

In order to be able to guarantee and verify quality, Moeller Systems Division (FG) has installed a comprehensive Quality Assurance System.

The system conforms to ISO 9001.

Routine testing of panels and systems as a matter of course includes the various tests to VDE 0670 as well as the testing of customer-specific device configurations.

For example:

- Function tests of devices,
- Rated AC withstand voltage test 1 min,
- Testing of all auxiliary devices such as auxiliary contacts, shunt trip releases, remote operators, protective mechanisms (relays), measuring instruments,
- Function testing of the capacitive measuring device,
- Function testing of short-circuit indicators (where present).

Type GA and GA...-C Medium-Voltage Switchgear up to 24 kV, Metal-Encapsulated to VDE 0670 Part 6

Combined protection and control system

Combined protection and control system

The combined protection and control system, CSP2/CMP1, is a joint development by SEG and Moeller Systems Division (F&G). It is excellently suited to fitting into the relay niche or the relay niche cover of circuit-breaker panels.

It combines:

- Proven protective technology,
- Control of the contact elements,
- Measurement and evaluation of current and voltage,
- Communication within a single device system,
- Display for switch position indication.

CSP2 base unit

Includes the following specific attributes:

- Compact insulated housing with degree of protection IP50,
- Integrated protection and control functions,
- Communication interfaces,
- Expanded fail-safe fault recording function on PC card as an option,
- Maintenance free.

CSP2 base unit

Protective functions

The protective functions can be activated via keypad or PC depending on application and customer specification. Four parameter sets can be configured for each protective function .

- Overcurrent-time protection (directional/non-directional),
- Overload protection with thermal imaging,
- Short-circuit protection (directional/non-directional),
- Earth-fault protection (directional/non-directional),
- Overvoltage/undervoltage,
- Overfrequency/underfrequency,
- Automatic reset facility,
- Power direction,
- Load imbalance,
- Tripping circuit monitoring.

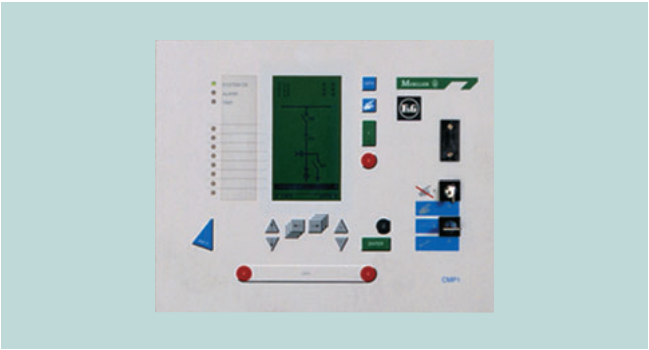
System advantages

- Improved capability to adapt to changing mains conditions.
- Response values, protective functions, messages, status indications etc. are freely configurable (locally or from the remote control station).
- All the functions can be tied into the higher-level system control scheme.
- The event memory ensures fault recording.
- The event memories and fault recorders are fail-safe in the event of power failure.
- Optimum remote monitoring of all switching, indication, measuring and protective functions.
- Cost reduction due to less expenditure on cabling between the switchgear assembly and the control components.

CMP1 display and operator panel

Includes the following specific attributes:

- Flat and compact construction,
- Communication interfaces,
- LCD graphics display for indication of switch positions, measured values and operator instructions,
- Membrane keypad with degree of protection IP54 at the front,
- On site allocation of parameters.



CMP1 display and operator panel

Measuring

Different measuring functions are available depending on the device Type:

- Phase current/voltage,
- Resistive/reactive power,
- Resistive/reactive energy monitoring,
- Min./Max. current-voltage-frequency values,
- Fault values.

Communication

Various communication interfaces are available: CAN-Bus, RS 485, RS 232, optic-fibre connection with the following protocols: IEC 60870-5-103, PROFIBUS-DP, MODBUS RTU. For further details please consult the specific data leaflet.

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Xtra Combinations

The right combination decides
The holistic approach to power distribution and automation in industrial and building applications is becoming increasingly more important. Moeller Systems is specialised in power distribution and automation systems with optimum availability. Experience and expertise, combined with a seamless product and system range for medium and low-voltage power distribution systems and flexible busbar trunking systems, form the basis of this. The professional handling of electrical engineering projects, from consulting, through the value chain to commissioning and service, completes this offer.

MOELLER

Think future. Switch to green.