

↓  
**Medium Voltage Switchgear  
and Switches**



→ **Medium Voltage Switchgear up to 24 kV, 630 A  
SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit**

**Type: GA, GA...-C**

# Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

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## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### General/Description

### General/Description

#### Advantages of SF<sub>6</sub>-insulated switchgear in block construction

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

- ✓ Climatic resistance
- ✓ Maintenance-free concept with SF<sub>6</sub>-pressurised containers as a hermetically sealed pressure system
- ✓ 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
- ✓ Easy combination with GAE panels
- ✓ 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<sub>6</sub> 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<sub>6</sub> 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.



## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C General/Description

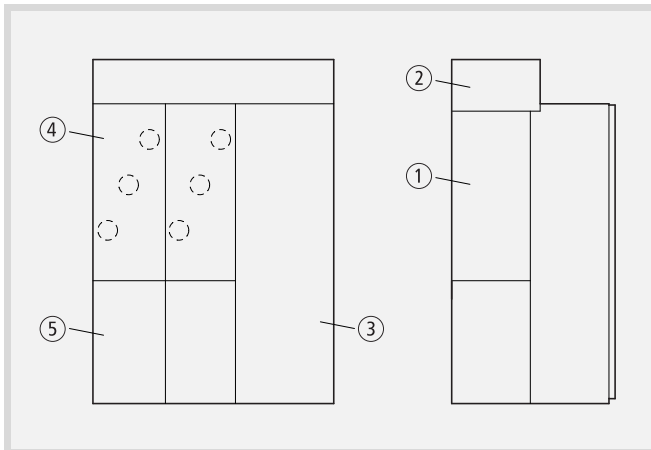
### Construction

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 Ormazabal 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<sub>6</sub> 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 20).

### 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 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 29).

### Panel plinth

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

- GA Standard height 1 400 mm
- GA...-C Standard height 1 050 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 18).

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.

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### 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<sub>6</sub> 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 VDE standard 0670 Part 6 / IEC 60298 resp. VDE 0671 Part 200 / IEC 62271-200 Annex A "internal arc faults" and fulfilled

criteria 1 to 5. This arc fault qualification IAC (AFL) is always present in the arc-fault resistant cable compartment systems. For installation of the system, see the relevant particulars on page 30.

To cool the hot gasses that emanate in the event of an arc fault, an optional 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.

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 lower dividing wall towards the transformer room.

A rear absorber channel is optionally available on request, which enables the installation of the switchgear in connection with metal absorbers on a closed floor.

The pressure relief will be to the rear upwards (see page 31). Also this variant fulfils the arc fault qualification IAC AFL 20 kA 1 s.

By help of this rear absorber channel the pressure data within switchgear rooms will be reduced by appr. 60%.

During a test of a GA 2K1TS within a pressure-proof test cubicle of 77 qm pressure data <15 mbar at 21 kA 1 s have been reached.

Switchgear related pressure calculations can be enquired as part of services at the sales department of Ormazabal.

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### SF<sub>6</sub> the insulating and arc quenching medium

#### SF<sub>6</sub> the insulating and arc quenching medium

Sulphur hexafluoride (SF<sub>6</sub>) 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.

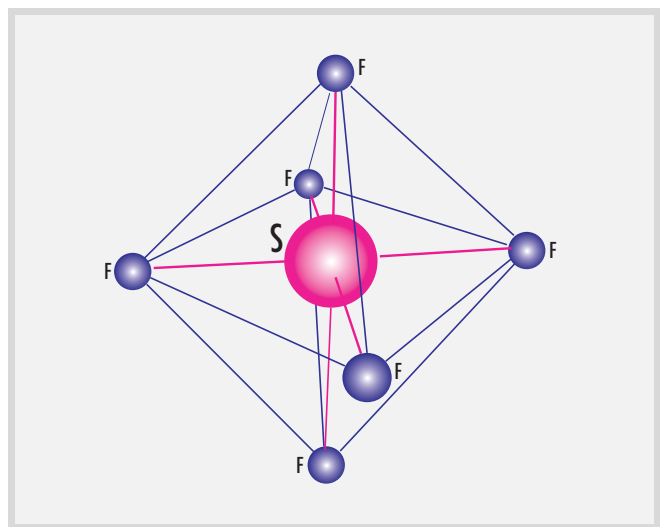
SF<sub>6</sub> as insulating medium has a high degree of dielectric strength thereby enabling the construction of very compact systems that furthermore are maintenance free since all the live electric assembly parts have to be **encapsulated**.

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<sub>6</sub> 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<sub>6</sub> separates into its constituent parts. When it cools, these regenerate to restore the SF<sub>6</sub> gas. This regeneration process is supported by aluminium oxide (Al<sub>2</sub>O<sub>3</sub>) 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<sub>6</sub> system, issued by the German official Labour association. **SF<sub>6</sub> gas contained in the system shall be recycled and not released into the atmosphere. Ormazabal 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.**



# Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

## Technical data

### Technical data

#### Switchgear panels (rated values)

		Rated voltage $U_r$			
		7.2 kV	12 kV	17.5 kV	24 kV <sup>1)</sup>
Rated insulation level					
Rated 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
	For busbars	A	630	630	630
Rated short-time current $I_k$	at $t_k = 1$ s	Up to kA	20, 25 <sup>2)</sup>	20, 25 <sup>2)</sup>	20, 25 <sup>2)</sup>
	at $t_k = 3$ s	Up to kA	20	20	20
Rated peak withstand current $I_p$	Up to kA	50, 63 <sup>2)</sup>	50, 63 <sup>2)</sup>	50, 63 <sup>2)</sup>	50, 63 <sup>2)</sup>
Ambient temperature $T$	Without secondary devices	°C	-25 to +40 (-40 to +40 on request)		
	With secondary devices	°C	-5 to +40 (-25 to +40 on request) <sup>3), 4)</sup>		
	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 <sub>6</sub>			
Rated density of insulating gas	kg/m <sup>3</sup>	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, IP44			
Encapsulation of the drive housing	IP	IP44			
Enclosure of the cable connection compartment	IP	IP44			
Internal arc qualification to VDE 0671, Part 200 resp. IEC 62271-200 (IEC 60298)	kA	IAC AFL 20 kA, 1 s for HV compartments			
	kA	IAC AFL 20 kA, 1 s for cable connection compartments			
Colour of panel paint finish	RAL	7035 (light grey)			
Loss of service continuity category		LSC 2A			
Partition class		PM			

1) Higher rated voltage (25 kV), on request.

2) Optional

3) When a pressure switch (optional) is being used, the operating conditions correspond to Class Minus 5, indoor installation.

4) Depending to the secondary technic.

#### Standards

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

IEC 60265-1 (62271-103*)	/ VDE 0670 Part 301 (VDE 0671 Part 103*)
IEC 60282-1	/ VDE 0670 Part 4
IEC 62271-1 (IEC 60694**)	/ VDE 0670 Part 1000 (VDE 0671 Part 1*)
IEC 62271-100	/ VDE 0671 Part 100
IEC 62271-102	/ VDE 0671 Part 102

IEC 62271-105	/ VDE 0671 Part 105
IEC 62271-200 (60298**)	/ VDE 0671 Part 200 (VDE 0670 Part 6**)

\* = future

\*\* = up to now

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### Technical data

#### Three-position load-break switches (rated values)

Cable feeder panel K, Transformer feeder panel, TS				Rated voltage $U_r$				
				7.2 kV	12 kV	17.5 kV	24 kV <sup>7)</sup>	
Rated normal current for	Ring cable feeder circuits	$I_r$	A	630	630	630	630	
	Transformer feeder circuits <sup>1)</sup>	$I_r$	A	200	200	200	200	
Rated short-time current <sup>2)</sup>	For systems with $t_k = 1$ s	$I_k$	kA	20, 25 <sup>3)</sup>	20, 25 <sup>3)</sup>	20, 25 <sup>3)</sup>	20, 25 <sup>3)</sup>	
	For systems with $t_k = 3$ s	$I_k$	kA	20	20	20	20	
Rated peak withstand current <sup>2)</sup>		$I_p$	kA	50, 63 <sup>3)</sup>	50, 63 <sup>3)</sup>	50, 63 <sup>3)</sup>	50, 63 <sup>3)</sup>	
Rated short-circuit making current for	Transformer feeder circuits <sup>4)</sup>	$I_{ma}$	kA	50	50	50	50	
	Ring cable feeder circuits	$I_{ma}$	kA	50, 63 <sup>3)</sup>	50, 63 <sup>3)</sup>	50, 63 <sup>3)</sup>	50, 63 <sup>3)</sup>	
<b>Switching capacity for multi-purpose load-break switches to IEC 60265-1 and VDE 0670 Part 301</b>								
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, $10 \times$	$I_2$	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 <sup>3)</sup>	50, 63 <sup>3)</sup>	50, 63 <sup>3)</sup>	50, 63 <sup>3)</sup>	
–	Rated no-load transformer breaking current	$I_3$	A	5)	5)	5)	5)	
<b>Switching capacity in the event of an earth fault</b>								
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	
<b>Switching capacity to IEC 62271-105</b>								
Rated transfer current	Device Type TS	$I_{transfer}$	A	1900	1900	1500	1500	
<b>Operations, ring cable panel, 1K</b>								
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		$n$		1000 × <sup>6)</sup>	1000 × <sup>6)</sup>	1000 × <sup>6)</sup>	1000 × <sup>6)</sup>	
Class				E3/E1 M1	E3/E1 M1	E3/E1 M1	E3/E1 M1	

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) Tested exemplary in accordance with the above Standard for 400 kVA and 1000 kVA transformers at 12 kV and 24 kV.

6) Higher values on request.

7) Higher rated voltage (25 kV) on request.

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### Technical data

#### Three-position SF<sub>6</sub> circuit-breaker with stored energy Off (rated values)

SF <sub>6</sub> Circuit-breaker panel LSF, Switching capability acc. to IEC 62271-100, test duty I <sub>100a</sub> is not required			Rated voltage U <sub>r</sub>				
			7.2 kV	12 kV	17.5 kV	24 kV <sup>1)</sup>	
Rated normal current of the feeder circuits	I <sub>r</sub>	A	250/630	250/630	250/630	250/630	
Rated short-time current	For systems with t <sub>k</sub> = 1 s	I <sub>k</sub>	kA	20	20	16	16
	For systems with t <sub>k</sub> = 3 s	I <sub>k</sub>	kA	20	20	16	16
Rated peak withstand current	I <sub>p</sub>	kA	50	50	40	40	
Rated short-circuit making current	I <sub>ma</sub>	kA	50	50	40	40	
Rated short-circuit breaking current	I <sub>sc</sub>	kA	20	20	16	16	
Rated cable-charging breaking current	I <sub>c</sub>	A	50	50	50	50	
Rated switching sequence	–		0 – 3 min – C0 – 3 min – C0				
<b>Operations at</b>							
Rated short-circuit making current	n		5 ×	5 ×	5 ×	5 ×	
Rated short-circuit breaking current	n		20 ×	20 ×	22 ×	22 ×	
Rated normal current and mechanically admissible	n		2000 ×	2000 ×	2000 ×	2000 ×	
Class			M1, E2	M1, E2	M1, E2	M1, E2	

1) Higher rated voltage (25 kV) on request

#### Three-position earthing switch (rated values)

To DIN VDE 0670 Part 2 and IEC 60129 Panels K, TS, LSF			Rated voltage U <sub>r</sub>			
			7.2 kV	12 kV	17.5 kV	24 kV <sup>2)</sup>
<b>Earthing function of the three-position switch</b>						
Rated short-circuit making current	I <sub>ma</sub>	kA	50, 63	50, 63	50, 63	50, 63
Rated short-time current	I <sub>k</sub> = 1 s	kA	20, 25	20, 25	20, 25	20, 25
	I <sub>k</sub> = 3 s	kA	20	20	20	20
<b>Earthing function downstream of HV fuse</b>						
Rated short-circuit making current	I <sub>ma</sub>	kA	6.3	6.3	6.3	6.3
Rated short-time current	I <sub>th</sub>	kA	2.5	2.5	2.5	2.5
<b>Operations</b>						
Rated short-circuit making current	50/63 kA	n	5 ×/2 ×	5 ×/2 ×	5 ×/2 ×	5 ×/2 ×
Mechanically admissible		n	1 000 × <sup>1)</sup>	1 000 × <sup>1)</sup>	1 000 × <sup>1)</sup>	1 000 × <sup>1)</sup>
Class			E2/E1	E2/E1	E2/E1	E2/E1

1) Higher values, on request

2) Higher rated voltage (25 kV) on request

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### Range of two-panel systems

#### Range of two-panel systems

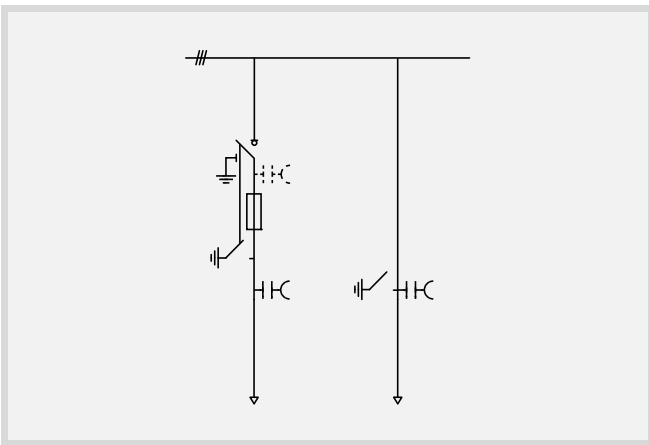
**Systems with one transformer feeder panel and one cable connection panel with one set of connection bushings**

#### Standard equipment for

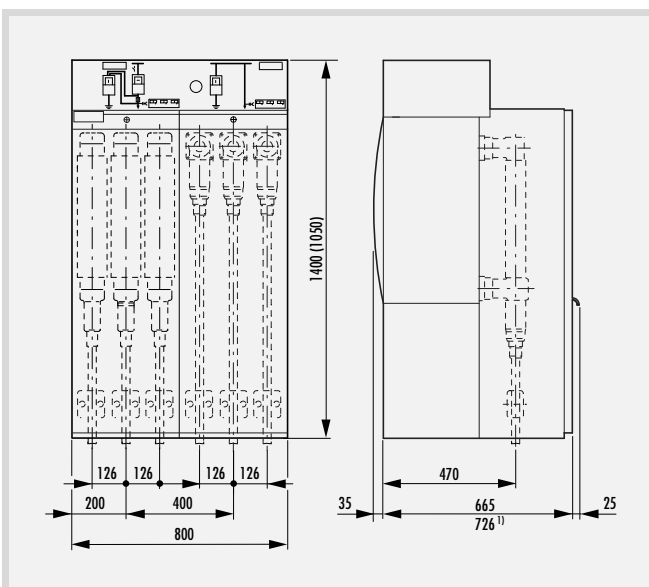
- System,
- KS panel,
- TS panel,
- A1 panel.

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



Overview diagram GA1KS1A1(-C)



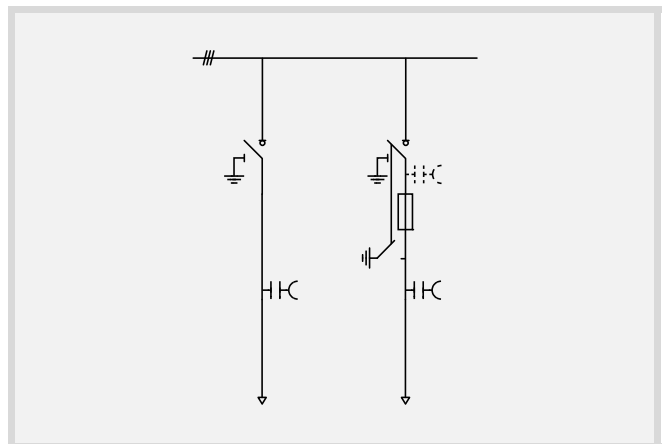
1) Deep front cover in A1 panel.

GA1KS1A2/GA1TS1A1 (weight: 236 kg) (-C weight: 214 kg)

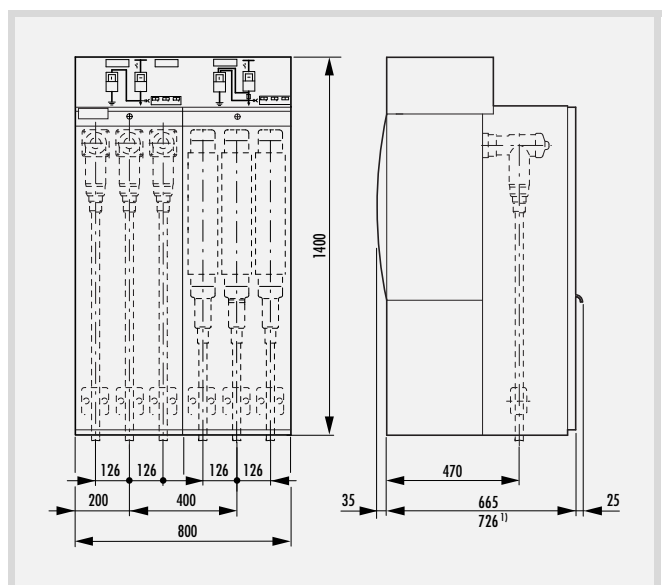
#### Accessories, optional

- 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<sup>1)</sup>,
- Motor operator,
- Anti-reverse interlock,
- Cable clamps,
- Fuse adapter for fuse with dimension "e" = 292 mm,
- Arc-fault resistant cable compartments,
- Rear absorber channel with metal absorbers for installation on closed floor (standard switchgear depth 915 mm).

**Type GA1K1TS-B**



Overview diagram GA1K1TS-B



1) Deep front cover in K1 panel.

GA1K1TS-B (weight: 236 kg)

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### Range of two-panel systems

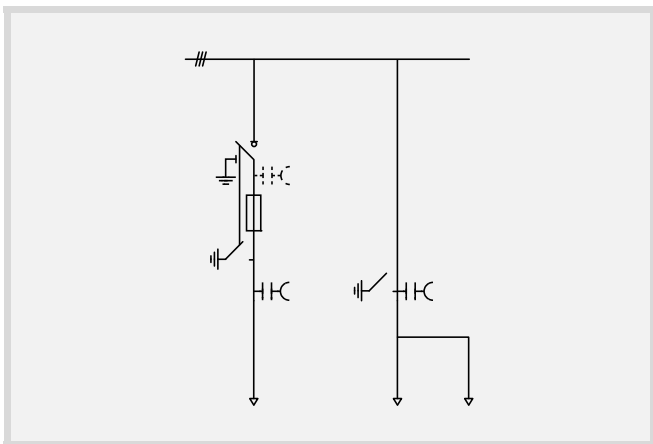
#### Systems with one transformer feeder panel and one cable connection panel with two sets of connection bushings

Type GA1KS1A2 or GA1TS1A2

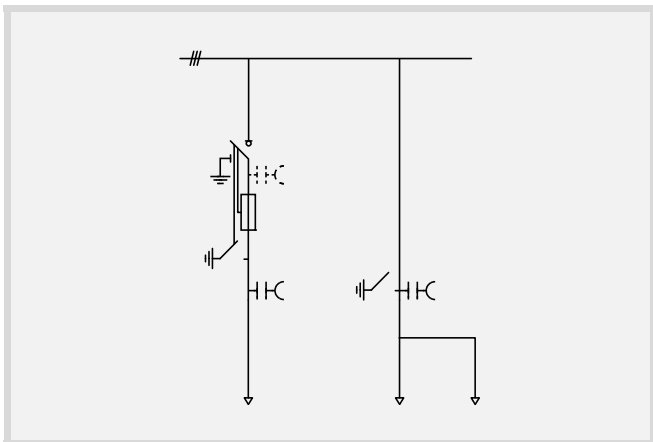
Type GA1K1A2-C or GA1TS1A2-C

#### Standard equipment for

- System,
  - KS panel,
  - TS panel,
  - A2 panel.
- page 19



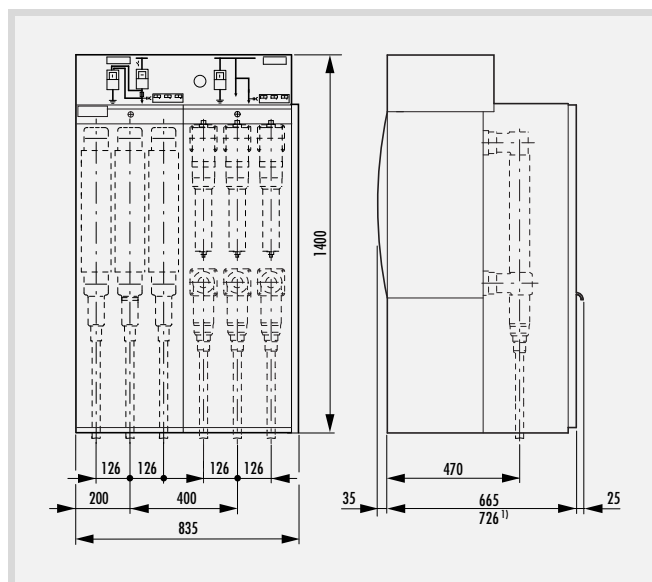
Overview diagram: GA1KS1A2(-C)



Overview diagram: GA1TS1A2(-C)

#### Accessories, optional

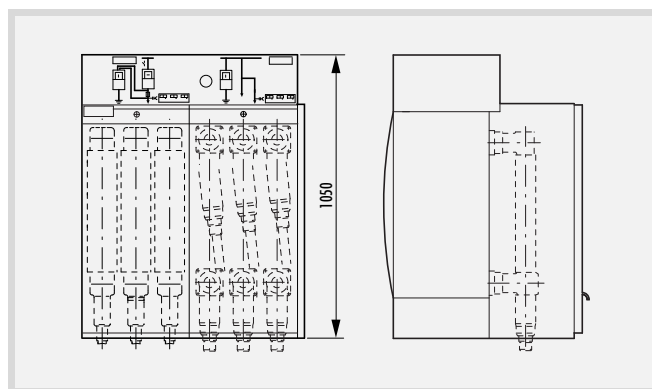
- Short-circuit indicator,
- Auxiliary contact modules for load-break switches, max. 3 NO, 3 NC, Earthing switches, max. 2 NO, 2 NC,
- Capacitive voltage indication ledges upstream of the HV fuses,
- Shunt trip release, DC or AC,
- Auxiliary contact trip indication<sup>1)</sup>,
- Motor operator,
- Anti-reverse interlock,
- Cable clamps,
- Fuse adapter for fuse with dimension "e" = 292 mm,
- Arc-fault resistant cable compartments,
- Rear absorber channel with metal absorbers for installation on closed floor (standard switchgear depth 915 mm).



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: 233 kg)

Cable connection panel equipped with plug connectors, top and bottom.

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### Range of three-panel systems

#### Range of three-panel systems

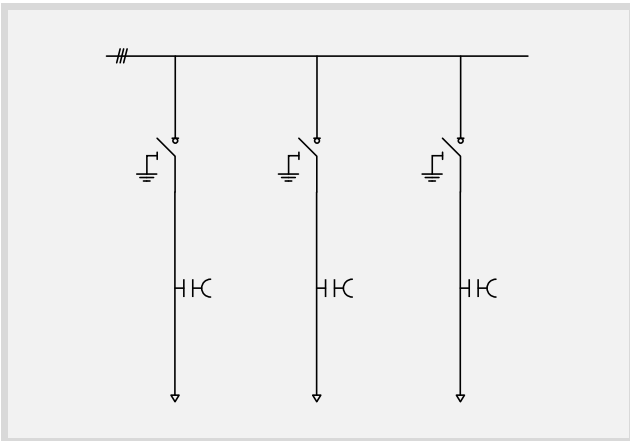
##### Systems with three cable feeder panels

Type GA3K,  
Type GA3K-C

##### Standard equipment for

- System,
- K panels.

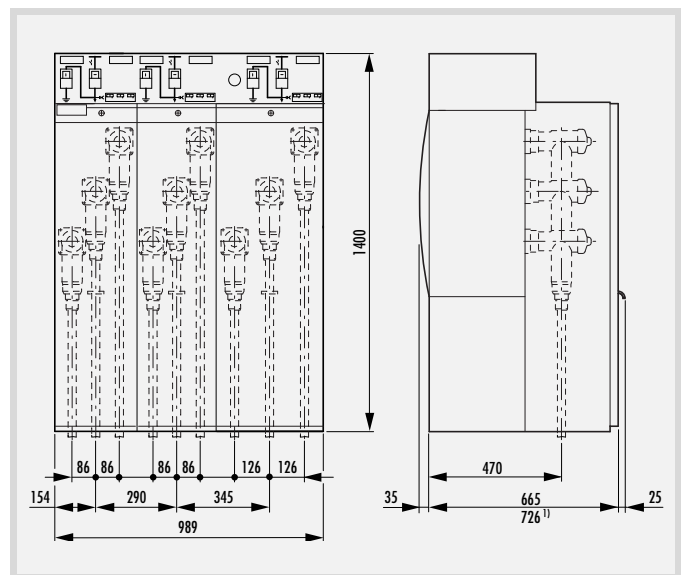
→ page 19



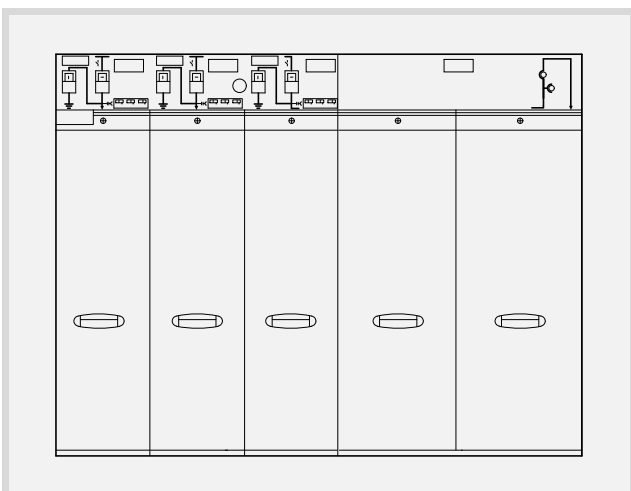
Overview diagram: GA3K(-C)

##### Accessories, optional

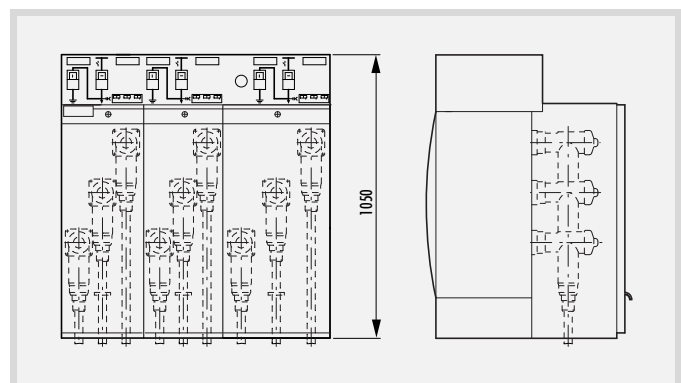
- Short-circuit indicator,
- Auxiliary contact modules for load-break switches, max. 3 NO, 3 NC, Earthing switches, max. 2 NO, 2 NC,
- Motor operator,
- Anti-reverse interlock,
- Cable clamps,
- Arc-fault resistant cable compartments,
- Deep front cover (depth + 61 mm),
- Extra deep front cover in K-feeder panel (depth + 150 mm),
- Rear absorber channel with metal absorbers for installation on closed floor (standard switchgear depth 915 mm).



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



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



GA3K-C (weight: 234 kg)

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C Range of three-panel systems

### Systems with two cable feeder panels and one transformer feeder panel

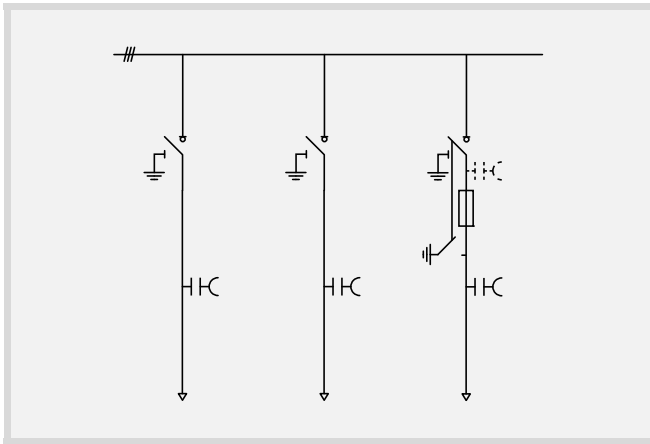
Type GA2K1KS or GA2K1TS

Type GA2K1KS-C or GA2K1TS-C

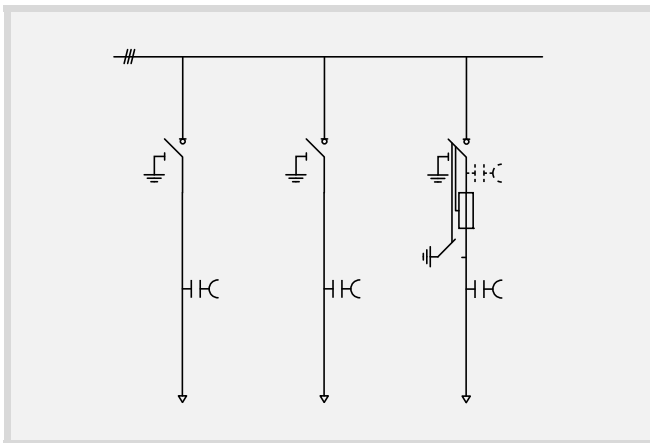
#### Standard equipment for

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

→ page 19



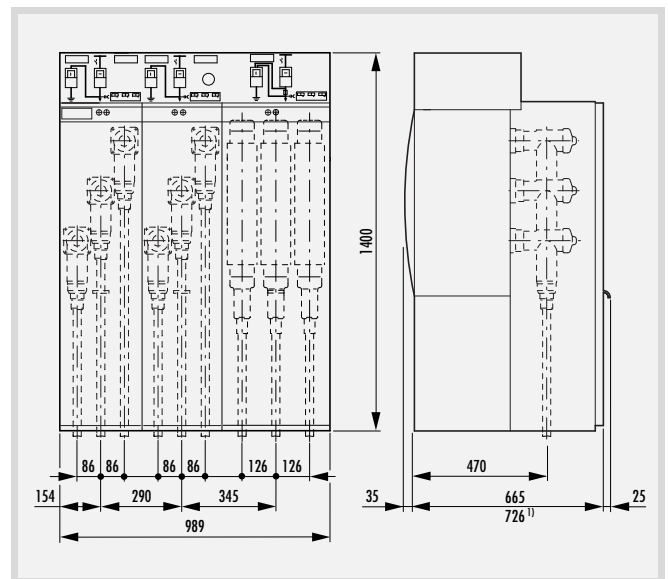
Overview diagram: GA2K1KS(-C)



Overview diagram: GA2K1TS(-C)

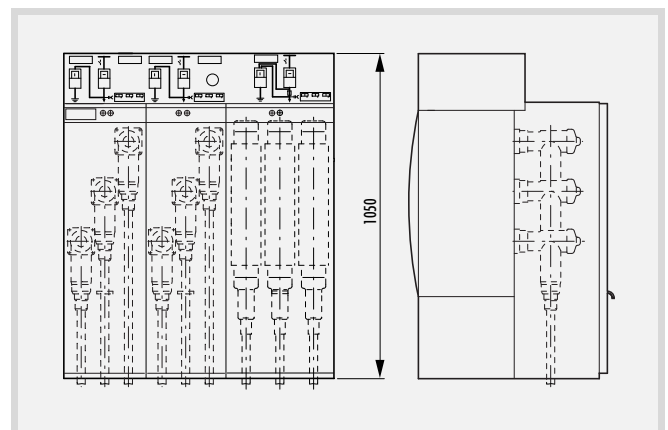
#### Accessories, optional

- 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<sup>1)</sup>,
- Motor operator,
- Anti-reverse interlock,
- Cable clamps,
- Fuse adapter for fuse with dimension "e" = 292 mm,
- Arc-fault resistant cable compartments,
- Rear absorber channel with metal absorbers for installation on closed floor (standard switchgear depth 915 mm),
- Deep front cover (depth + 61 mm),
- Extra deep front cover in K-feeder panel (depth + 150 mm).



1) Deep front cover in K panel.

GA2K1KS/GA2K1TS (weight: 298 kg)

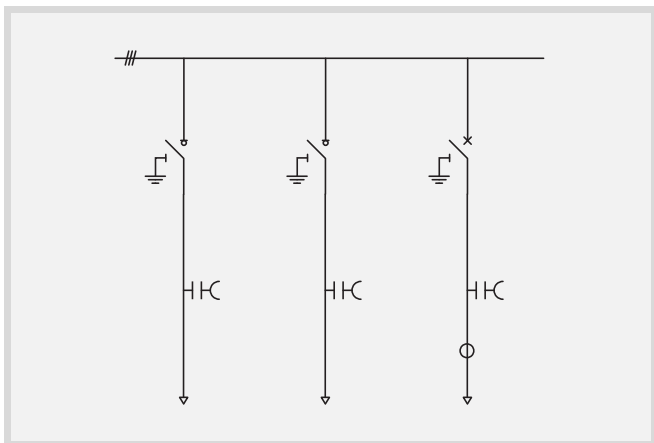


GA2K1KS-C/GA2K1TS-C (weight: 240 kg)

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C Range of three-panel systems

### Standard equipment for

- System,
  - K panels,
  - LSF panel.
- page 19



Overview diagram: GA2K1LSF(-C)



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

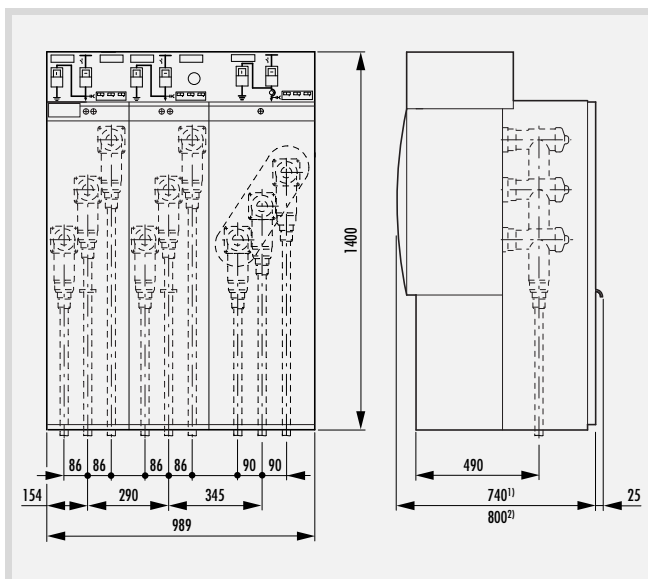
### Accessories, optional

- 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<sub>6</sub> circuit-breaker, max. 3 NO, 3 NC,
- Motor operator,

- Anti-reverse interlock,
- Cable clamps,
- Arc-fault resistant cable compartments,
- Deep cable compartment (+ 80 mm),
- Rear absorber channel with metal absorbers for installation on closed floor (standard switchgear depth 915 mm),
- Deep front cover (depth + 61 mm),
- Extra deep front cover in K-feeder panel (depth + 150 mm).

### Optional equipment for SF<sub>6</sub> circuit-breaker

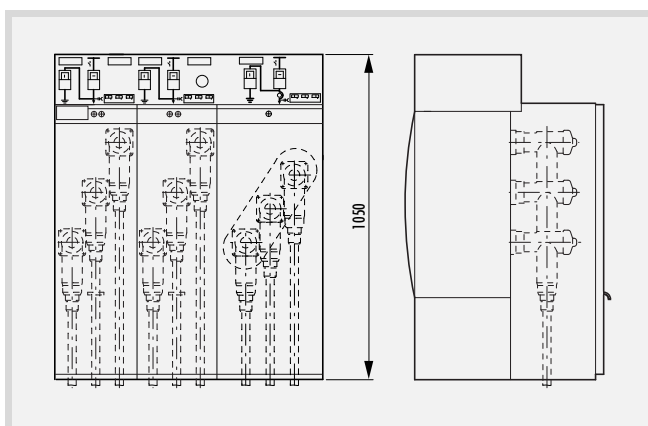
- Shunt trip release, DC or AC,
- Current transformer trip release for pulsed release or via auxiliary current transformer,
- Auxiliary current transformer,
- Relay and control compartment, height 300 or 600 mm,
- Short bushings in connection with split-core current transformers around the cables,
-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

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### Range of four-panel systems

#### Range of four-panel systems

##### Systems with four cable feeder panels

##### Type GA4K

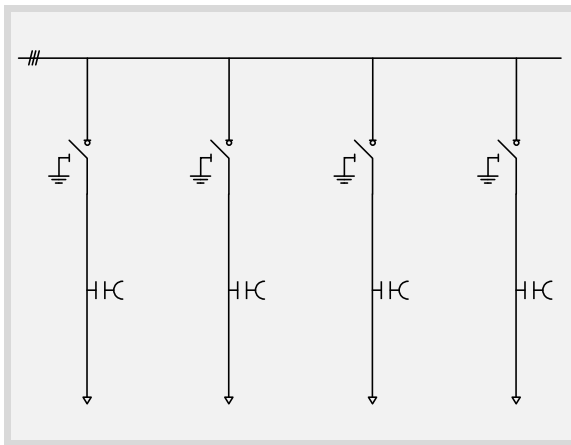
##### Type GA4K-C

##### Standard equipment for

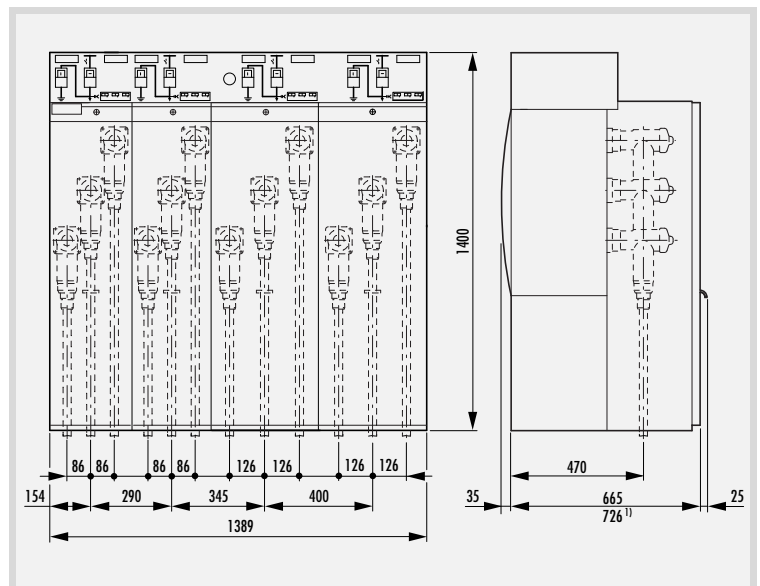
- System,
  - K panels.
- page 19

##### Accessories, optional

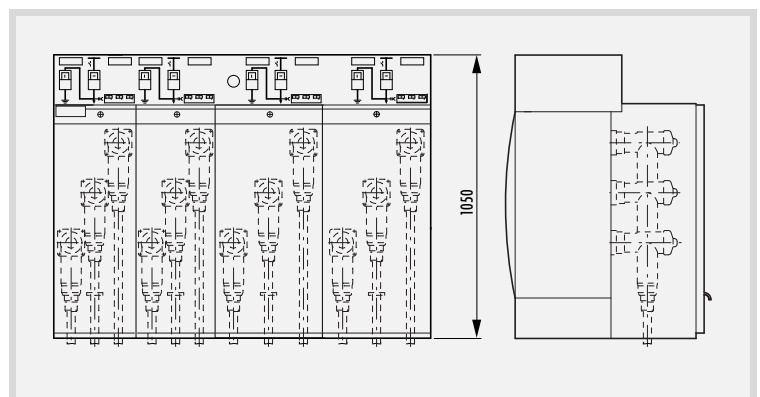
- Short-circuit indicator,
- Auxiliary contact modules for load-break switches, max. 3 NO, 3 NC, Earthing switches, max. 2 NO, 2 NC,
- Motor operator,
- Anti-reverse interlock,
- Cable clamps,
- Arc-fault resistant cable compartments,
- Rear absorber channel with metal absorbers for installation on closed floor (standard switchgear depth 915 mm),
- Deep front cover (depth + 61 mm),
- Extra deep front cover in K-feeder panel (depth + 150 mm).



Overview diagram: GA4K(-C)



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



GA4K-C (weight: 291 kg)

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### Range of four-panel systems

#### Systems with three cable feeder panels and one transformer feeder panel

Type GA3K1KS or GA3K1TS

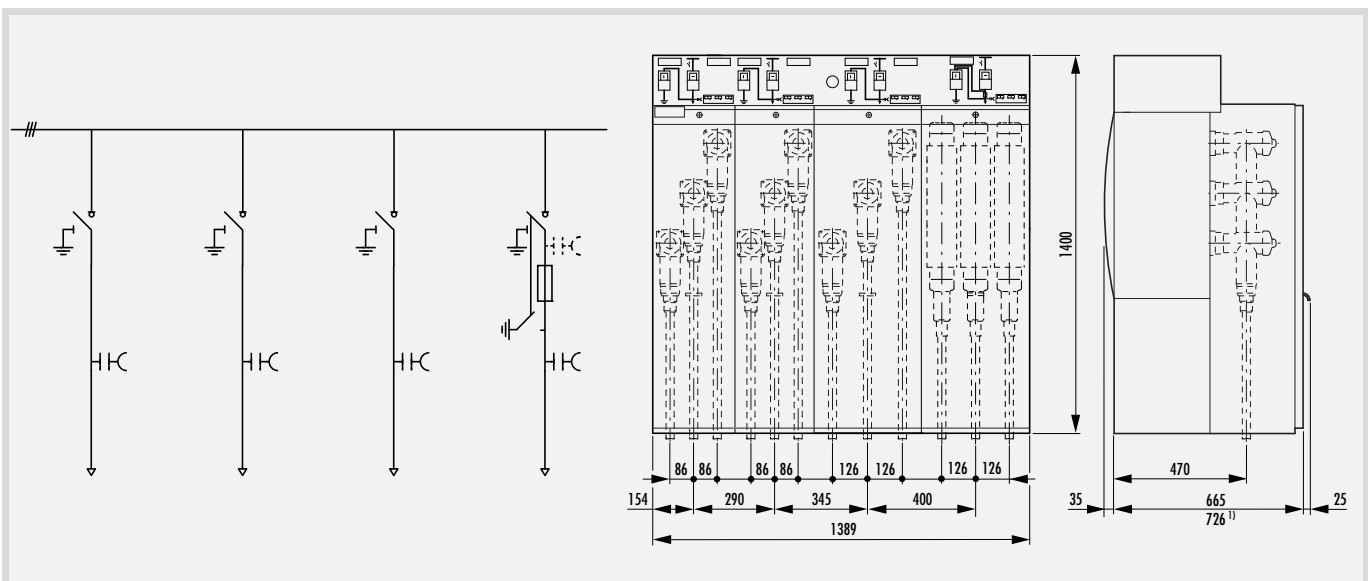
Type GA3K1KS-C or GA3K1TS-C

#### Standard equipment for

- System,
  - K panels,
  - KS panel,
  - TS panel.
- page 19

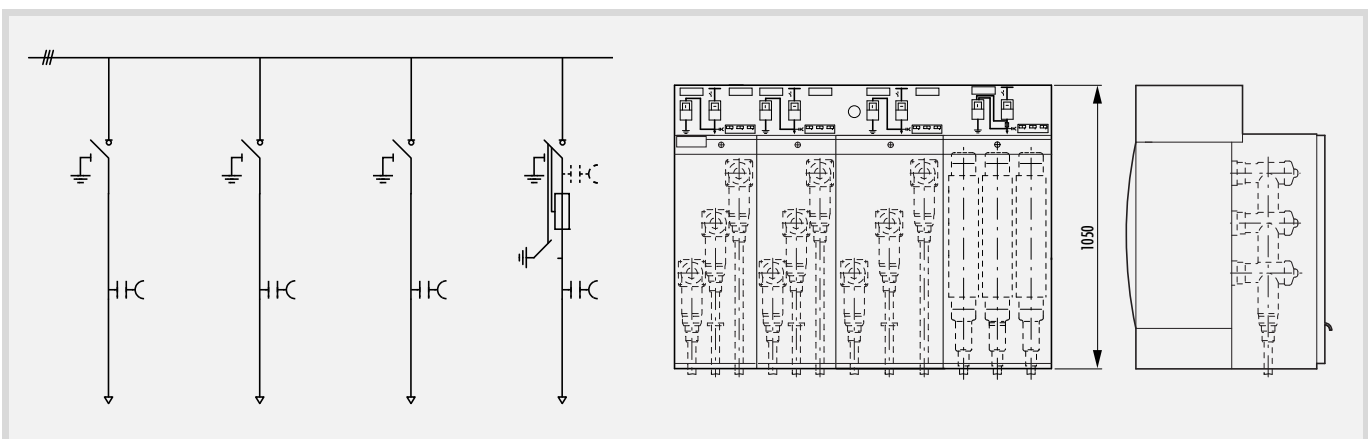
#### Accessories, optional

- 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,
- Motor operator,
- Anti-reverse interlock,
- Cable clamps,
- Fuse adapter for fuse with dimension "e" = 292 mm,
- Arc-fault resistant cable compartments,
- Rear absorber channel with metal absorbers for installation on closed floor (standard switchgear depth 915 mm),
- Deep front cover (depth + 61 mm),
- Extra deep front cover in K-feeder panel (depth + 150 mm).



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: 325 kg)

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### Range of four-panel systems

#### Systems with two cable feeder panels and two transformer feeder panels

Type GA2K2KS or GA2K2TS

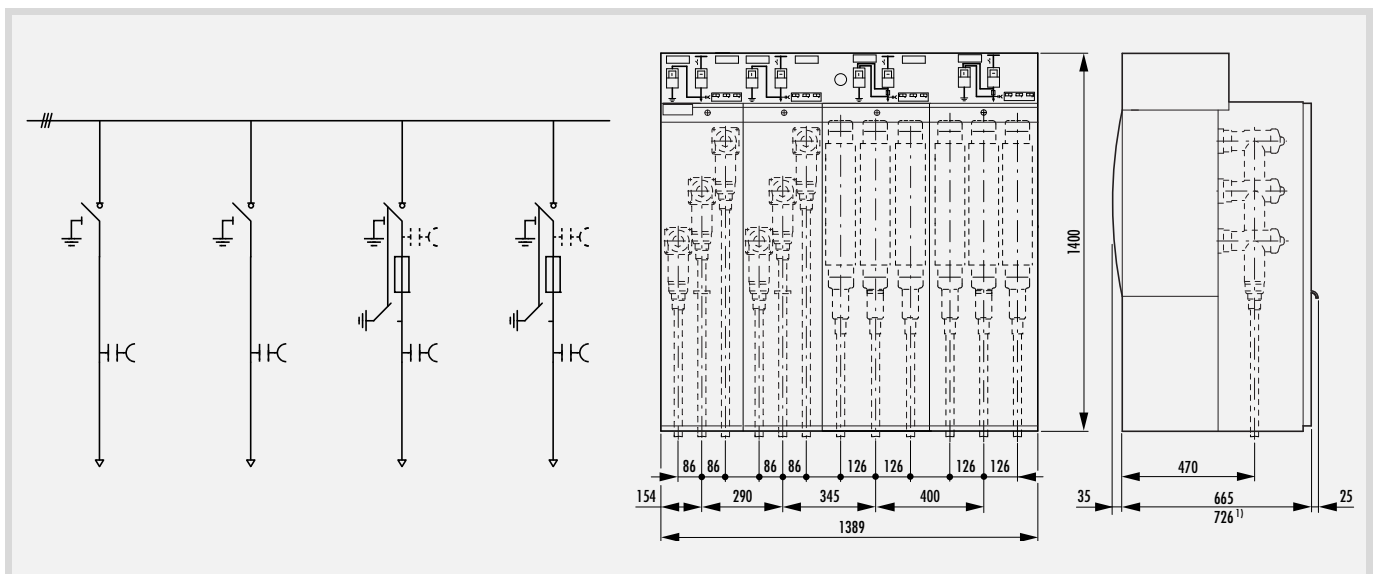
Type GA2K2KS-C or GA2K2TS-C

#### Standard equipment for

- System,
  - K panels,
  - KS panels,
  - TS panels.
- page 19

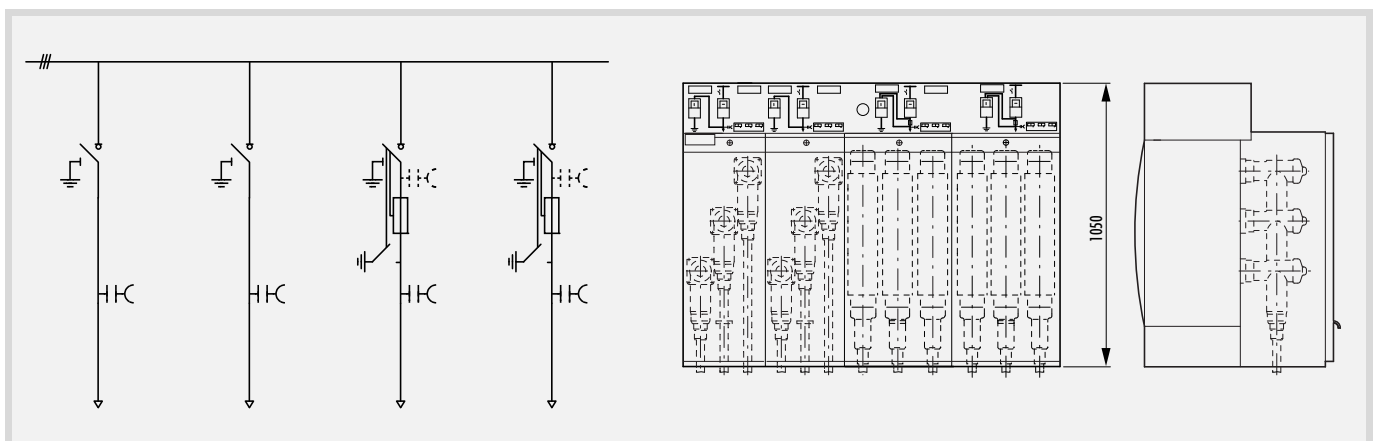
#### Accessories, optional

- 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,
- Motor operator,
- Anti-reverse interlock,
- Cable clamps,
- Fuse adapter for fuse with dimension "e" = 292 mm,
- Arc-fault resistant cable compartments,
- Rear absorber channel with metal absorbers for installation on closed floor (standard switchgear depth 915 mm),
- Deep front cover (depth + 61 mm),
- Extra deep front cover in K-feeder panel (depth + 150 mm).



Overview diagram: GA2K2KS(-C)

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



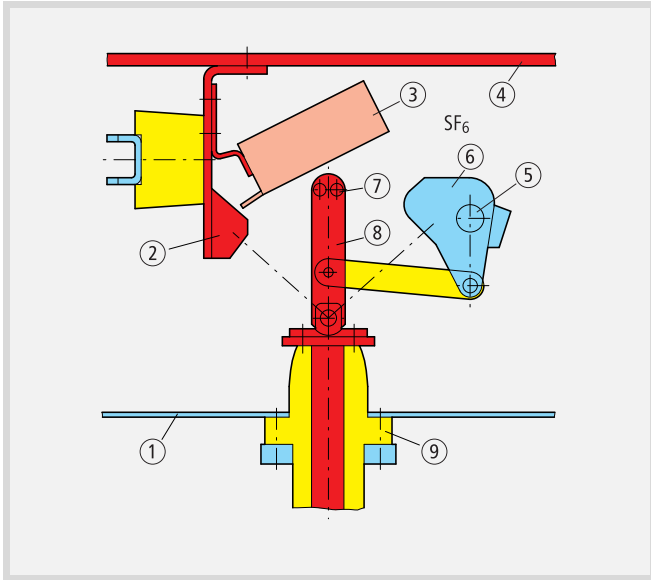
Overview diagram: GA2K2TS(-C)

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

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C Switching system

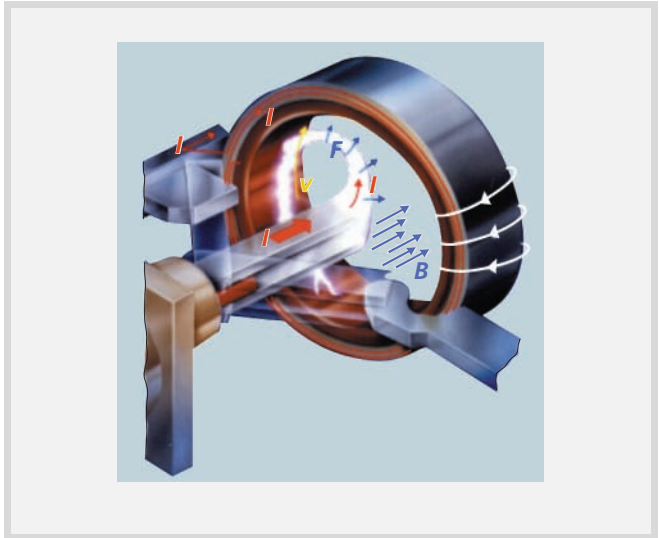
### Switching system

#### Three-position load-break switch, three-position SF<sub>6</sub> 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 GAE1M1 metering panel, electrical link via insulated busbar

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### Range of standard equipment

#### 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<sub>6</sub> 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<sub>6</sub> 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<sub>6</sub> 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

###### Outgoing feeder panel with SF<sub>6</sub> circuit-breaker

- SF<sub>6</sub> three-position circuit-breaker and earthing switch 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,
- 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<sub>6</sub> 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 – one set –.

##### Standard equipment of A2 panel

###### Cable connection panel with two sets of connection bushings

- SF<sub>6</sub> 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 –.

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### Fuse arrangement, Fuse selection

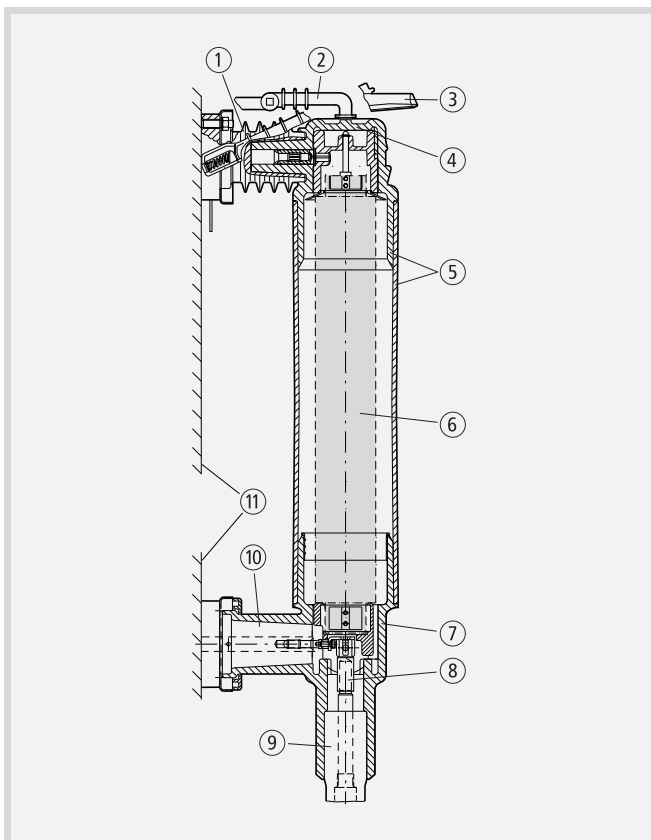
#### Fuse arrangement, Fuse selection

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<sup>2</sup>. The earthing switches in the SF<sub>6</sub> 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.

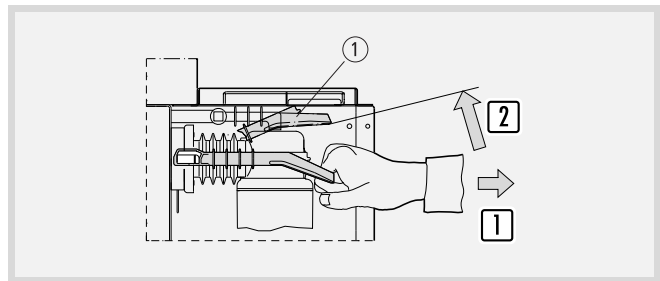
#### Fuse selection

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



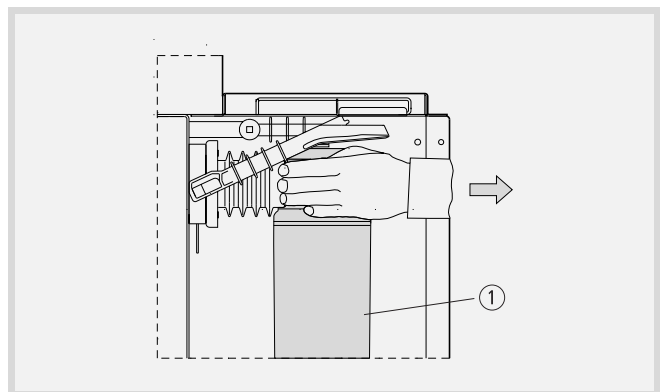
- |                      |  |
|----------------------|--|
| ① Upper bushing      | ⑦ Lower fuse holder                      |
| ② Tripping linkage   | ⑧ Cable lug                              |
| ③ Tensioning lever   | ⑨ Stress cone                            |
| ④ Flexible diaphragm | ⑩ Lower bushing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

#### Exchanging of HV fuse



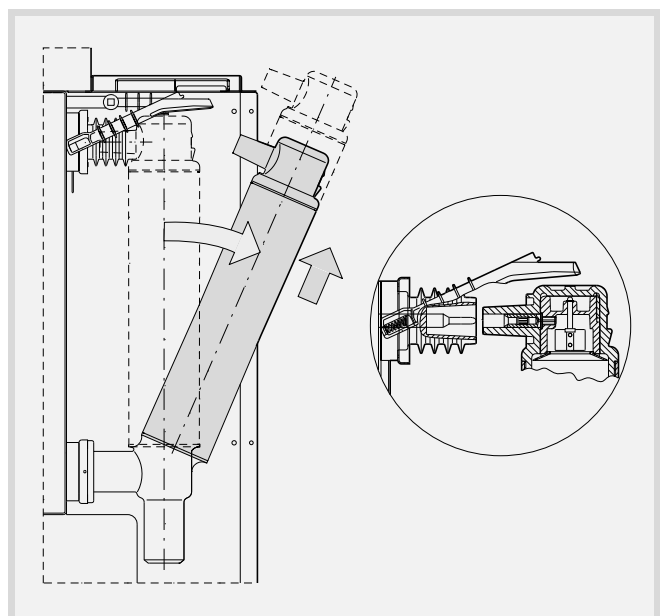
- ① Tensioning lever

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.

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### Front panel

#### Front panel

Front panel with

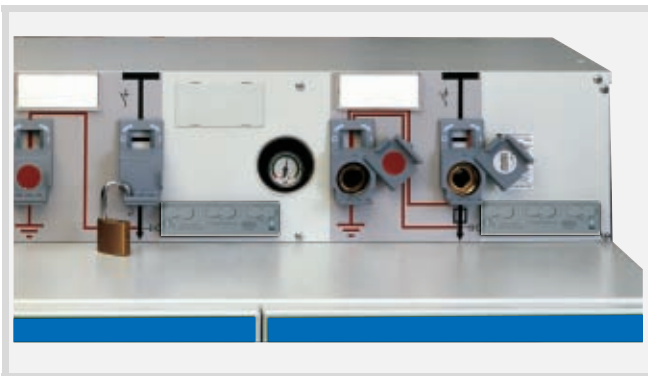
- Mimic diagram
- Switch position indication
- Operator surface for the actuators
- Capacitive voltage indicators
- Gas leakage indication
- Short-circuit indicators
- Padlocking facility
- Drive sealed against dust, sand and insects
- Housing IP44



Ring cable panel

Transformer feeder panel

#### Padlocking facility for drives



#### Pressure switch/density switch

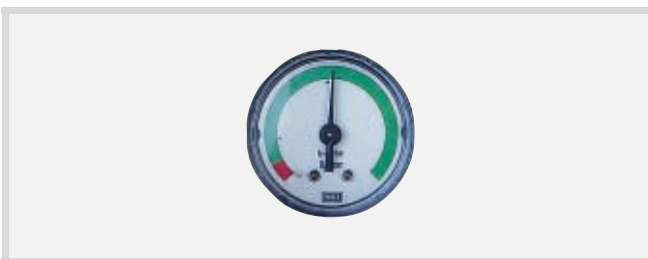
Each gas tank can be fitted with a pressure switch resp. density switch (auxiliary contact) for remote monitoring. The lower switching point corresponds to the crossover point to the red measuring range on the gas leakage indication. The density switch can be optionally provided with auxiliary contacts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

#### Phase sequence indication



#### Gas leakage indication

Each gas tank has a pressure display for verification of the SF<sub>6</sub> overpressure within, and allowing its functional safety to be inspected.



Meaning of the indication:

Green = Sufficient service pressure

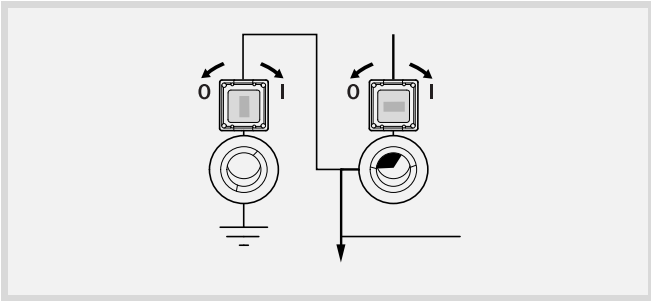
Red = Insufficient service pressure.

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

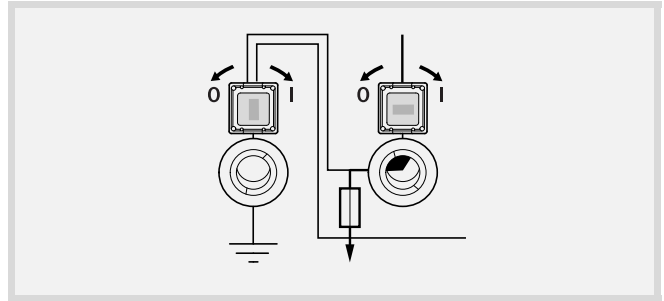
### Interlocking function

#### Interlocking function

Operating lever cannot be inserted

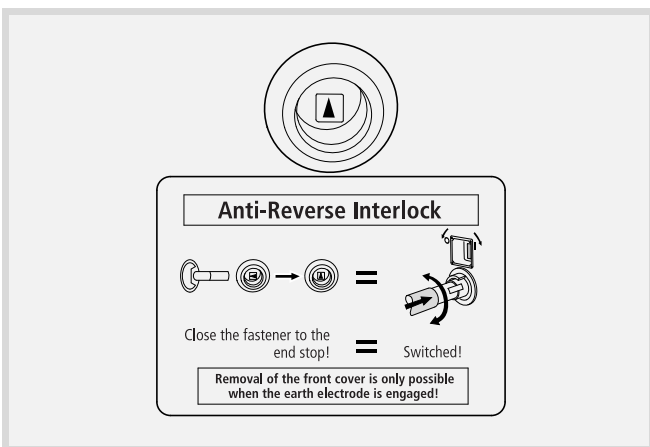


Ring cable panel: Load-break switch blocked by switch interlocking.

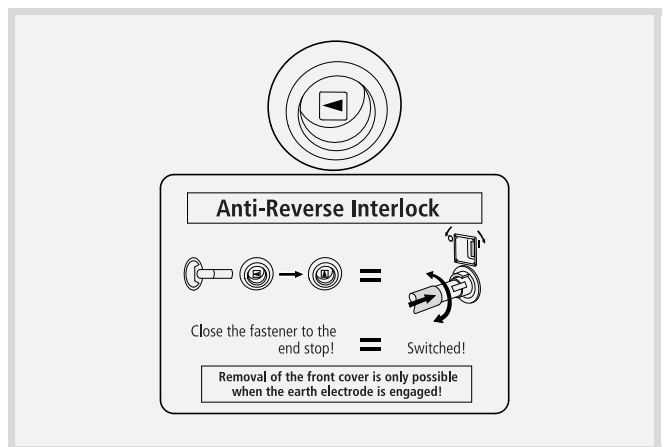


Transformer feeder panel:  
Load-break switch blocked by switch interlocking.

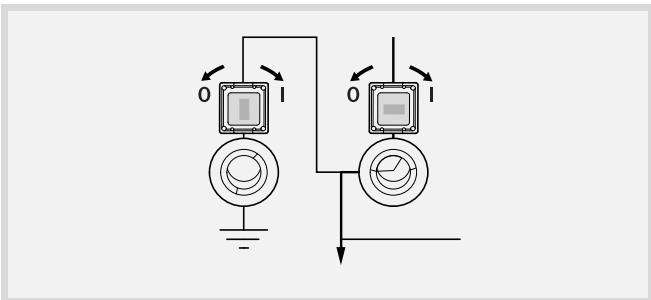
#### Anti-reversing interlock – Option –



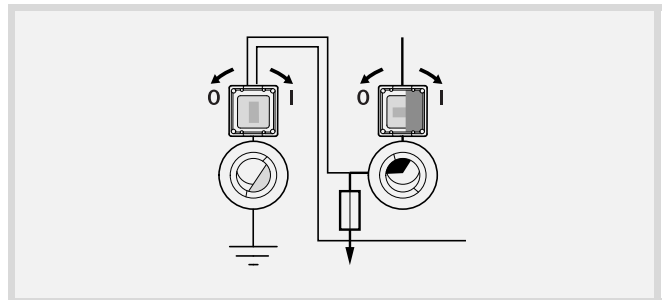
Fastener of the front cover is closed.  
Switching processes not restricted.



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.



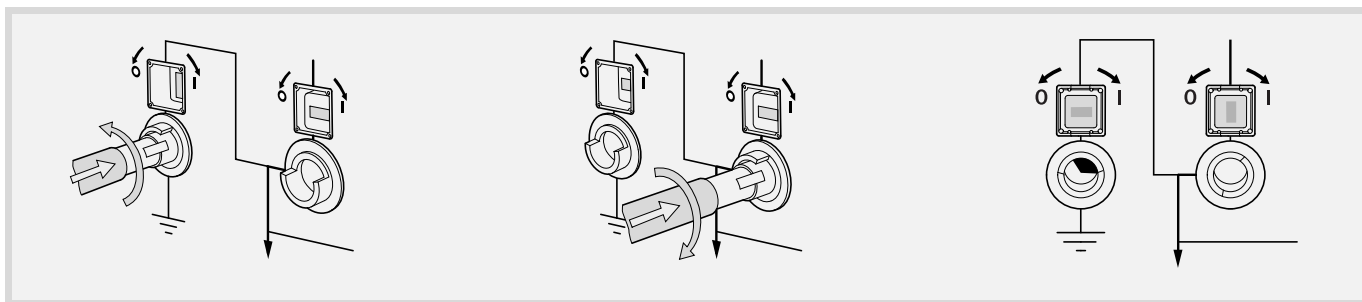
Transformer feeder panel:  
Fastener of the front cover is open.  
Earthing switch blocked by anti-reverse interlock.

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### Switching processes in ring cable panels

#### Switching processes in ring cable panels

##### Earthing switch Off – load-break switch On

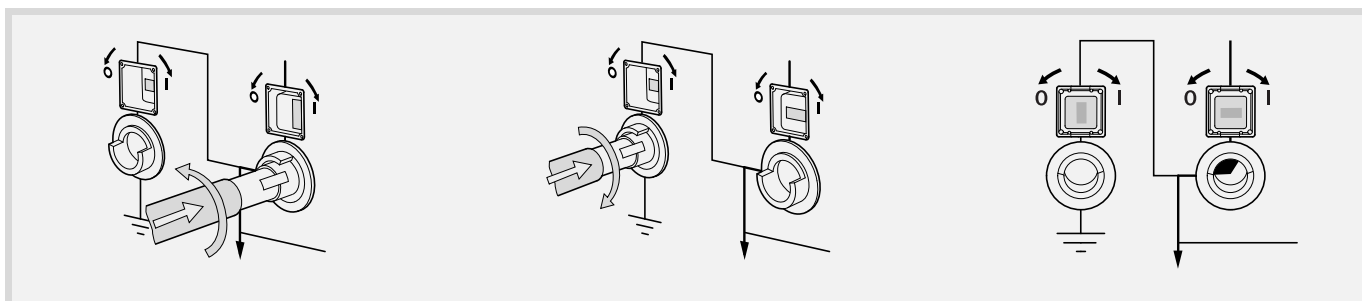


Switch Off the earthing switch.  
Press the operating lever fully (up to the stop) against the spring pressure, hold and turn it to the left.

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.

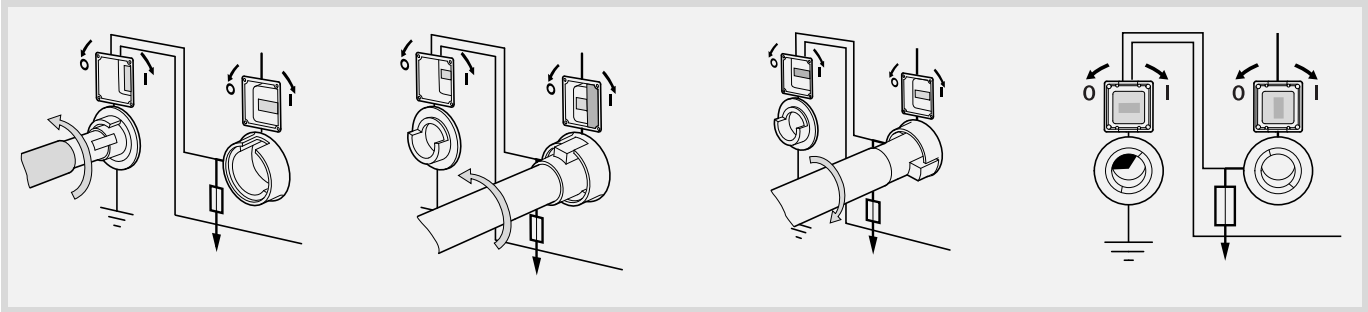
Switch position with load-break switch Off and earthing switch On.

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### Switching processes in transformer feeder panels

#### Switching processes in transformer feeder panels

##### Earthing switch Off – Transformer switch On



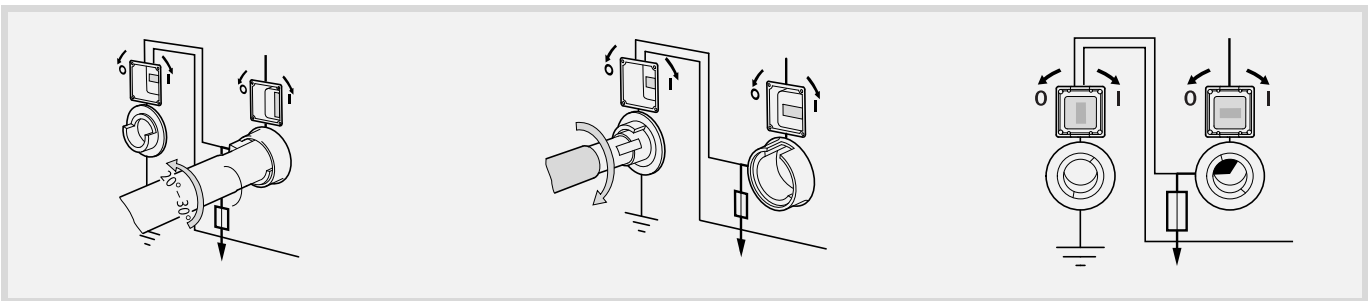
Switch Off the earthing switch.  
Turn the operating lever fully  
(up to the stop) to the left.

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

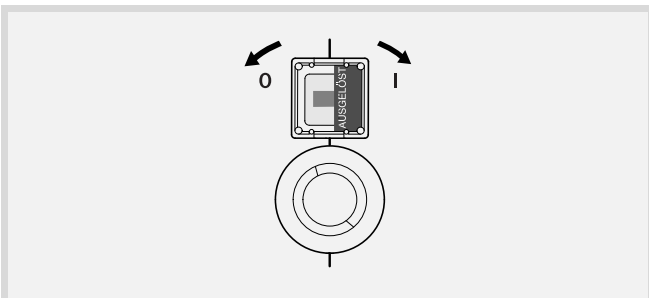


Switch Off the transformer switch.  
Turn the operating lever about 20 to  
30 degrees to the left.

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.

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### Voltage indication and testing

#### Voltage indication and testing

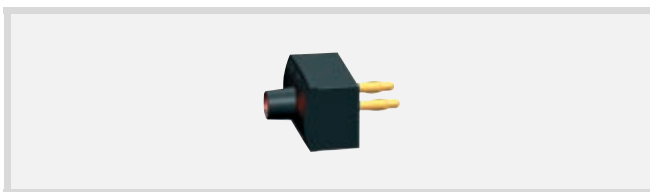
Each system is equipped with the necessary three-phase capacitive voltage indication ledges Type KSO for voltage testing to VDE 0682 Part 415 and IEC 61243-5 with HR system (other systems on request). This enables the absence of voltage in individual phases to be verified by inserting the voltage indication 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)

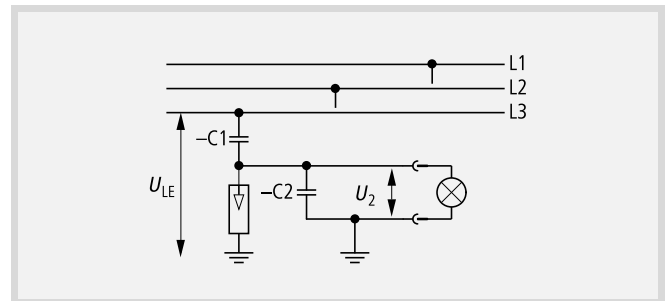


#### The following devices may be used:

Pfisterer	Type DSA-2
Horstmann	Type HO-ST-1
ELSIC	Type HO-SA
Jordan	Type DSP-HR
Dehn	Type DEHNcap/P-HR

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 (II unit IV)
Horstmann	Type: Orion	Type: Orion
ELSIC	Type: HO-PV	–
Pfisterer	Type: EPV	Type: Euro test-HO
Jordan	–	Type: KSP-HR
Kries	Type: CAP-Phase	Type: CAP-Phase

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### 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.

Manufacturer	Type
Horstmann	ALPHA M
	ALPHA E
	APLHA automatic
	DELTA M
	DELTA E
	EKA-3
	EKA 3/1
	GAMMA 4.0
	Opto
Kries	IKI-10V2SP
	IKI-20B1

Other types and products on demand.



#### Cable connection systems

##### 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 connection type C (630 A) with screw contacts (M16).

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

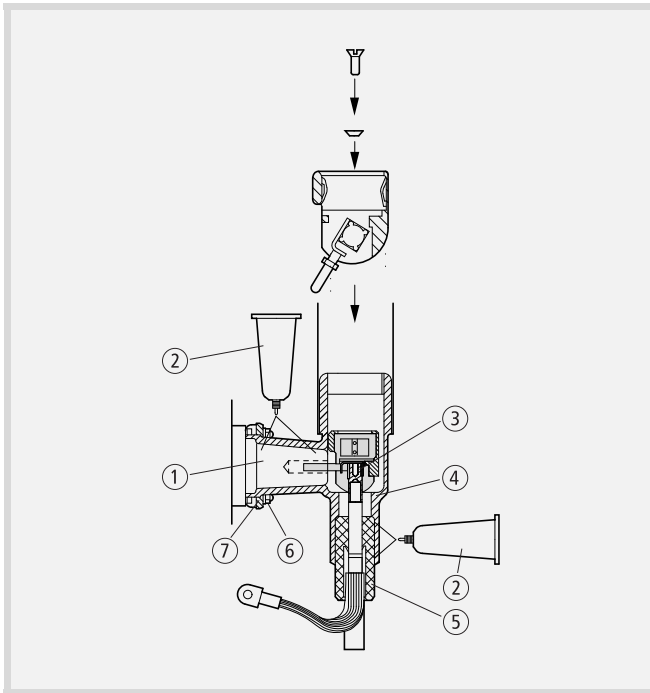
Assembly options of cable connection systems.

	NKT Type		Süd kabel Type		Tyco Electronics		Euromold/Nexas Type		Prysman 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	–	–	–	–	–	–	–	–	–

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

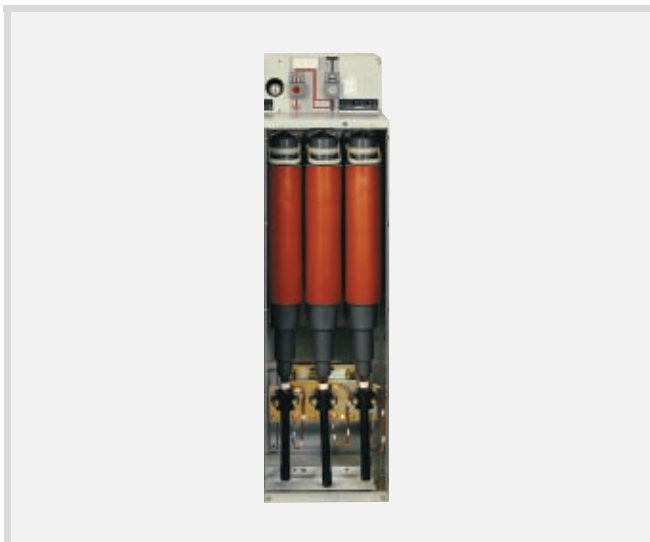
### Short-circuit/earth-fault indicator

#### Cable connection for transformer panels



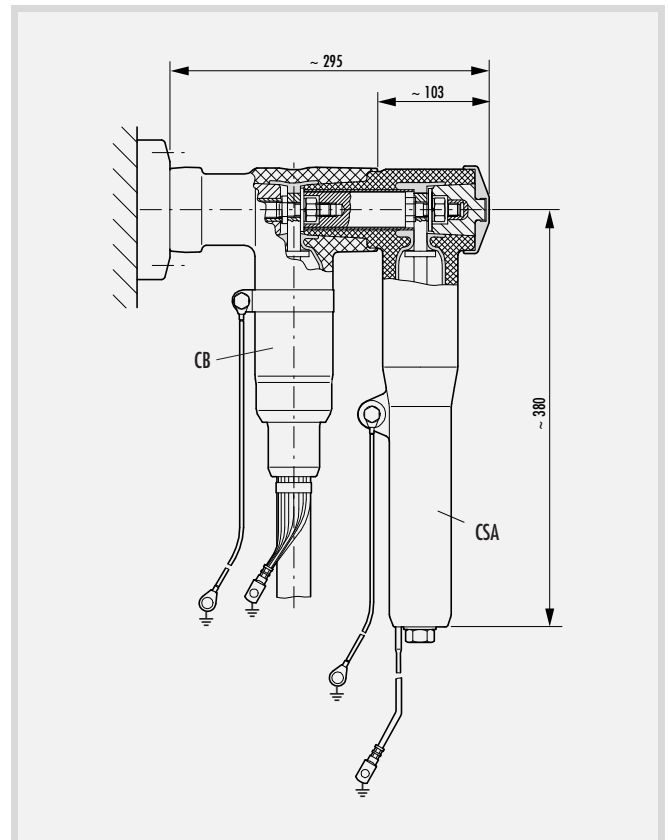
- ① Bushing cone (lower bushing)
- ② Assembling paste for fitting of termination
- ③ Cable lug
- ④ Lower fuse holder
- ⑤ Stress cone
- ⑥ ISO nuts
- ⑦ Fixing flange

The lower fuse holder additionally functions as **push-on transformer cable termination**. Range of application: for Cu or Al cables from 25 to 240 mm<sup>2</sup>.



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

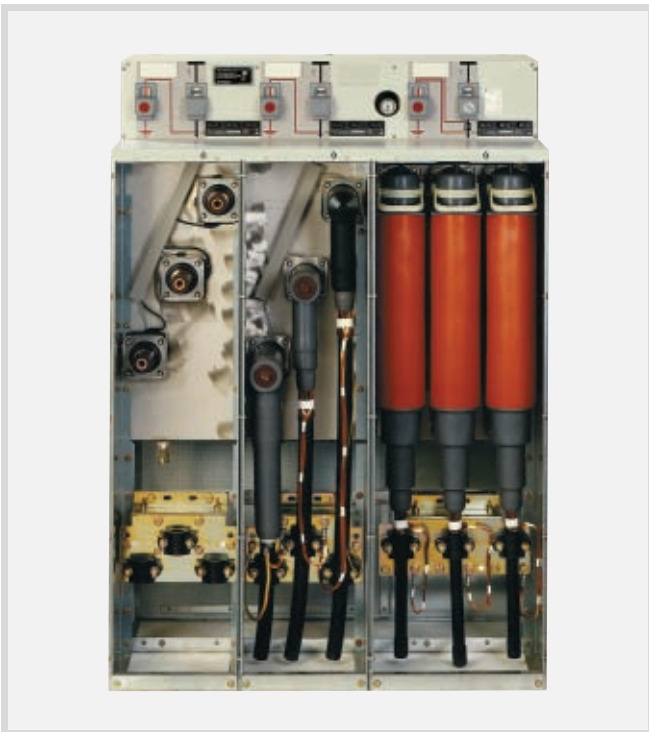
## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C Short-circuit/earth-fault indicator



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



GA2K1LFS with front covers removed

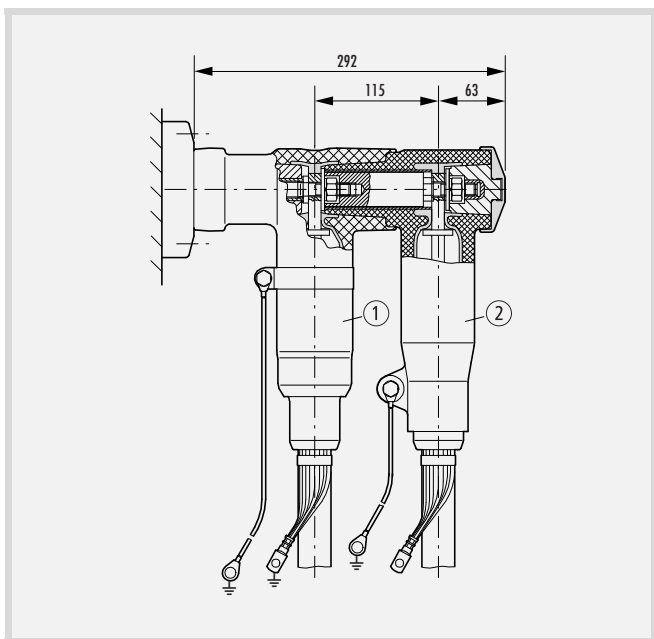


GA2K1TS with front covers removed

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### Short-circuit/earth-fault indicator

#### 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 (maximal depth of installation 318 mm).

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

Other combinations on request.

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

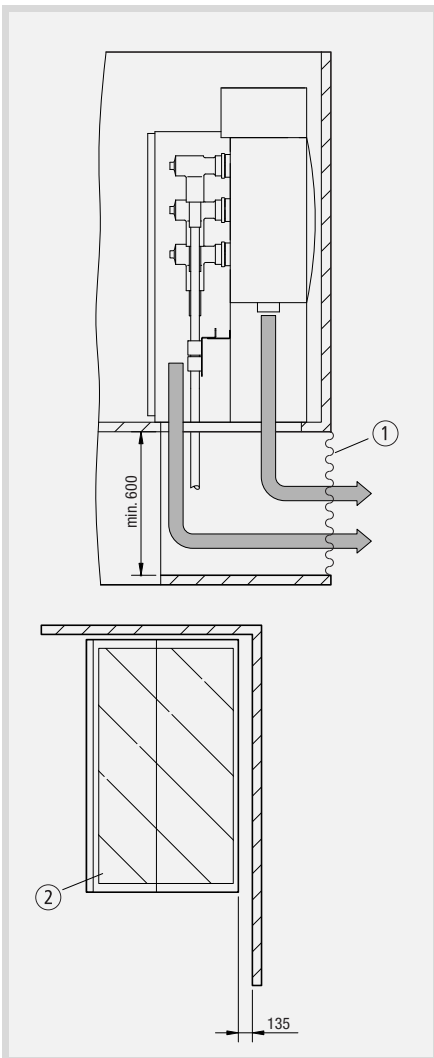
### Installation possibilities in switchgear rooms

#### Installation possibilities in switchgear rooms

#### Installation possibilities for Ring Main Units type GA and GA-C In accessible and non-accessible switchgear rooms

##### Installation GA and GA-C

- Without metal cooling stretch arrangement within pedestal
- Bottom open

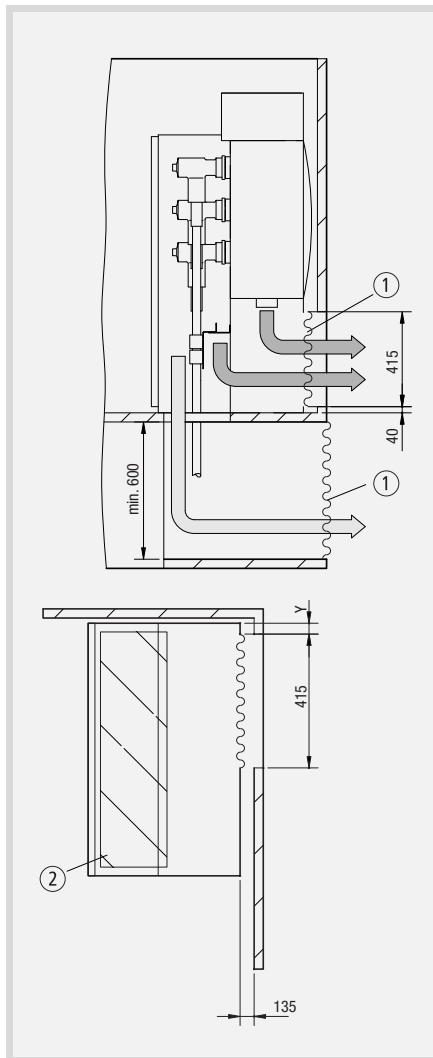


Pressure relief only into cable cellar/cable trench.

- ① Metal cooling stretch arrangement to cool down hot gases generated in case of an internal arc fault.
- ② Cable trench/cable cellar

##### Installation GA

- With metal cooling stretch arrangement within pedestal
- Bottom open



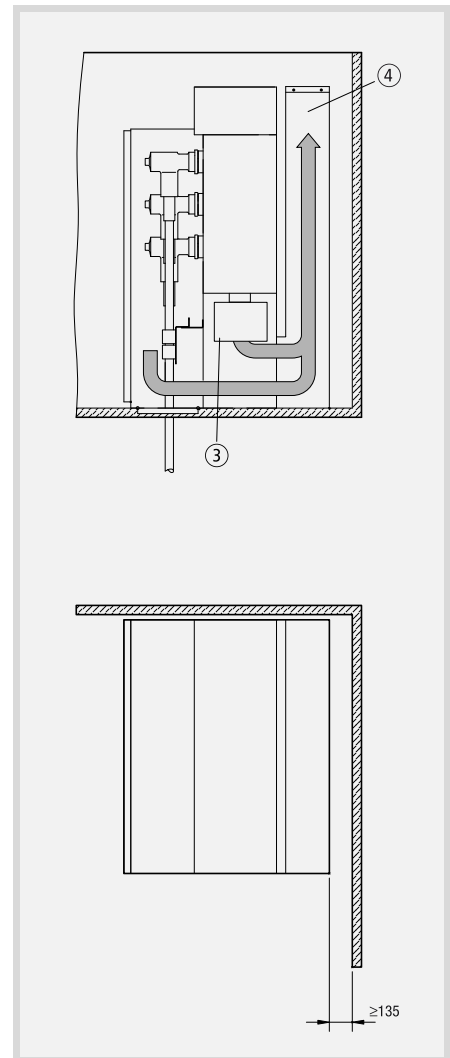
Pressure relieve via metal cooling stretch arrangement into the room behind.

(Optionally also in the cable trench)  
Dimension Y = 30 mm for 3-panel-units  
Dimension Y = 395 mm für 4-panel units

- ① Metal cooling stretch arrangement to cool down hot gases generated in case of an internal arc fault.
- ② Cable trench/cable cellar

##### Installation GA

- With rear absorber channel and metal absorber
- Bottom closed



Pressure relieve via rear absorber channel.

- ③ Metal absorber
- ④ Rear absorber channel

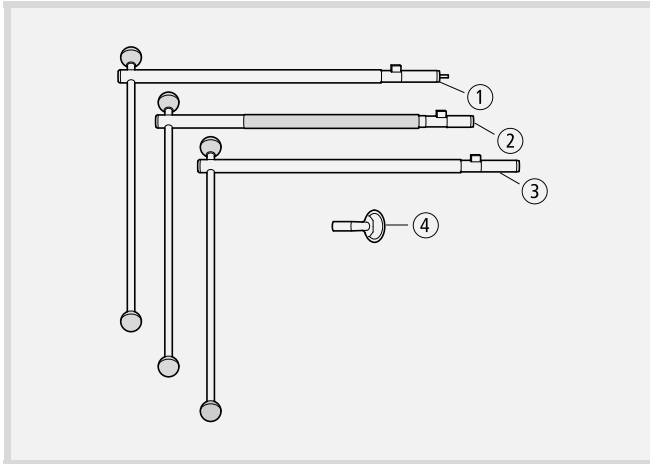
For details see relevant operating instructions for GA- and GA...-C systems.

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### Panel accessories, quality

### Panel accessories, quality

#### Operating levers

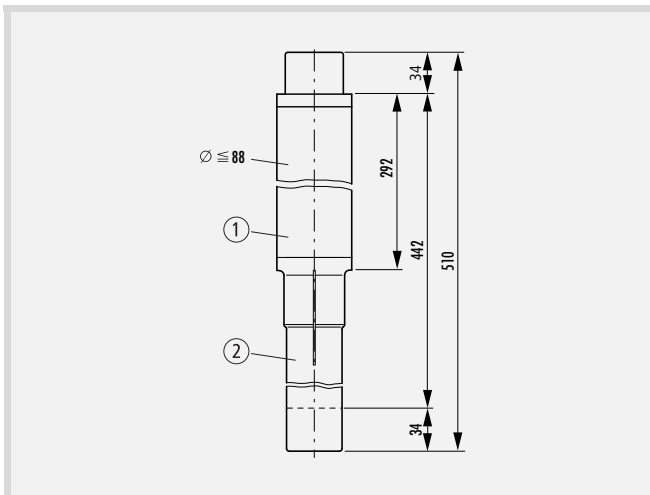


#### Operating levers, keys for fasteners

- 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).

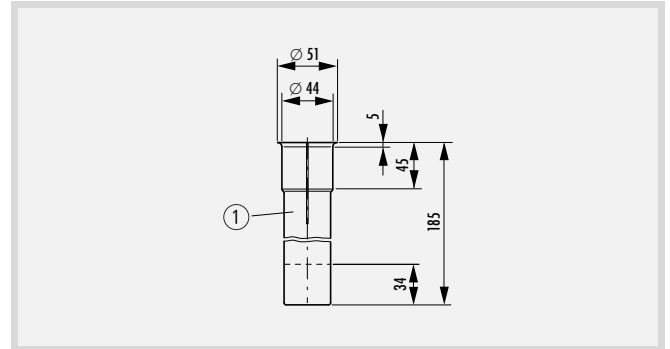
#### Fuse adapter

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 26 to 38 mm for cables, e.g.  
12 kV – 35 mm<sup>2</sup> ≤ 240 mm<sup>2</sup>\*  
24 kV – 25 mm<sup>2</sup> ≤ 185 mm<sup>2</sup>\*
- Size II:  
clamping range 36 to 52 mm for cables, e.g.  
12 kV – ≥ 300 mm<sup>2</sup>  
24 kV – ≥ 240 mm<sup>2</sup>

\* Compare actual cable diameters with the clamping range.

#### Quality

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

The system conforms to ISO 9001:2000 and ISO 14001:1996.

Routine testing of panels and systems as a matter of course includes the various tests to VDE 0670/IEC 62271 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).

## Medium-Voltage Switchgear up to 24 kV, SF<sub>6</sub>-insulated, Non-extensible Ring Main Unit, Type GA and GA...-C

### Protection technology

#### Protection technology

All commercially available protection relays can be installed in the type GA switchgear for the LSF circuit breaker panels.

The variants range from transformer-operated protection relays to combined protection and control systems.

Low energy trips 0.5 VA and 0.1 VA are available for the transformer-operated relays.

In this context special relay-transformer combinations are tested.

Common protocols and interfaces, e.g. Profibus DP, Modbus, IEC 60870-5-103, IEC 60870-5-101 and IEC 61850 can be provided with related relays.

Installation is in low-voltage compartment / relay niche.

Optionally, the protection relay can also be installed in the related cover.

It is also possible to configure the parameters for the protection relay in accordance with customer requirements.

A few commercially available protection relays as examples:

#### Transformer supplied:



SEG type WIC

- SEG type WIC
- SEG WIP
- Siemens type 7SJ45
- Areva type P114S



Siemens type 7SJ45

#### Supplied with external power:



SEG type MRI3

- SEG type MRI...
- Siemens type FSJ60...
- Areva type P141



Siemens type FSJ600

Notes

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## Notes

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Notes

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■ SF<sub>6</sub>-insulated switchgear



- type GA
- type GAE
- type CPG.0
- type CPG.1

■ Air-insulated switchgear

- type EA
- type AMC

■ Air-insulated switches

- type NVL
- type KL(F), T, DES

