

# SIEMENS



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## Switchgear Type SIMOSEC, up to 24 kV, Air-Insulated, Extendable Medium-Voltage Switchgear

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# Application

## Typical uses

R-HA40-111.tif



R-HA41-115.tif

Example  
Transfer switchgear with  
integrated low-voltage niche

R-HA40-112.tif



R-HA41-135.tif

Utilities transfer substation  
for industrial plants

# Switchgear Type SIMOSEC, up to 24 kV, Air-Insulated, Extendable

Medium-Voltage Switchgear

Catalog HA 41.43 · 2018

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[siemens.com/medium-voltage-switchgear](https://www.siemens.com/medium-voltage-switchgear)  
[siemens.com/SIMOSEC](https://www.siemens.com/SIMOSEC)

The products and systems described in this catalog are manufactured and sold according to a certified management system (acc. to ISO 9001, ISO 14001 and BS OHSAS 18001).

|                                                                            |              |
|----------------------------------------------------------------------------|--------------|
| <b>Application, Requirements</b>                                           | <b>Pages</b> |
| Typical uses                                                               | 2            |
| Features, classification                                                   | 4 – 6        |
| <b>Technical Data</b>                                                      |              |
| Electrical data of the switchgear                                          | 7 – 10       |
| Technical data, switching capacity and classification of switching devices | 11 – 13      |
| <b>Product Range</b>                                                       |              |
| Product range overview, options for panels                                 | 14 – 15      |
| Product range overview, equipment features                                 | 16 – 17      |
| Panels                                                                     | 18 – 22      |
| <b>Design</b>                                                              |              |
| Panel design                                                               | 23 – 24      |
| Operation (examples)                                                       | 25           |
| <b>Components</b>                                                          |              |
| Three-position switch-disconnector                                         | 26           |
| Operating mechanisms, equipment                                            | 27 – 28      |
| Vacuum circuit-breaker, busbars                                            | 29 – 32      |
| Cable connection                                                           | 33 – 34      |
| Cable cross-sections, HV HRC fuse assembly                                 | 35 – 40      |
| Instrument transformers                                                    | 41 – 43      |
| Indicating and measuring equipment                                         | 44 – 53      |
| Protection systems                                                         | 54           |
| Low-voltage compartment                                                    | 55           |
| Low-voltage niche                                                          | 56           |
| <b>Dimensions</b>                                                          |              |
| Switchgear installation                                                    | 57 – 59      |
| Panels                                                                     | 60 – 65      |
| Floor openings and fixing points                                           | 66 – 68      |
| <b>Installation</b>                                                        |              |
| Shipping data, transport                                                   | 69 – 71      |
| <b>Standards</b>                                                           |              |
| Standards, specifications, guidelines                                      | 72 – 75      |

# Application, Requirements

## Features

SIMOSEC switchgear is a factory-assembled, type-tested, three-phase, metal-enclosed, indoor switchgear according to IEC 62271-200 \*) and GB 3906 \*) for single busbars.

### Typical uses

SIMOSEC switchgear is used for power distribution in distribution systems with busbar currents up to 1250 A.

The modular, space saving design enables application in

- Substations, customer transfer substations, distribution substations and switching substations of power supply and public utilities
- Public buildings, such as high-rise buildings, railway stations, hospitals
- Industrial plants.

### Typical applications

- Wind power stations
- High-rise buildings
- Airports
- Underground railway stations
- Sewage treatment plants
- Port facilities
- Traction power supply systems
- Automobile industry
- Petroleum industry
- Chemical industry
- Unit-type heating power stations
- Textile, paper and food industries
- Emergency power supply installations
- Shopping centers and data centers.

### Modular design

- Individual panels, for free combination and extension
- Option: Low-voltage compartments can be supplied in two overall heights
- Circuit-breaker panels for various applications.

### Reliability

- Type and routine-tested \*)
- No cross insulation between phases
- Standardized and manufactured using numerically controlled machines
- Quality management system according to DIN EN ISO 9001
- More than 100,000 switchgear components in operation worldwide for many years.

### Personal safety

- All switching operations can be performed with closed panel front
- Metal-enclosed LSC 2 panels
- HV HRC fuses and cable sealing ends are only accessible when the outgoing feeders are earthed
- Logical mechanical interlocking
- Capacitive voltage detecting system for verification of safe isolation from supply
- Earthing of outgoing feeders by means of make-proof earthing switches
- Partition class: **PM** (metallic partition).

### Compact design

Thanks to the use of gas-insulated switching-device vessel compact dimensions are possible.

Thus:

- Existing switchgear rooms can be used effectively
- New constructions cost little
- Costly city-area space is saved.

### Security of operation

- Components, e.g. operating mechanisms, three-position switches, vacuum circuit-breakers proven for years
- LSC 2 panels:
  - Panels with metallic partition (metal-clad) between busbar and switching device and between switching device and cable compartment (R, T, L)
  - Panels with metallic partition between switching device and busbar compartment
- Metal-enclosed switching-device vessel with three-position switch, gas-insulated
  - Welded sealed-for-life switching-device vessel
  - No cross insulation between phases
  - With welded-in rotary bushings for operation
  - Three-position switch-disconnector with gas-insulated switching functions
  - Three-position disconnector, gas-insulated
  - Switching functions CLOSE-OPEN-EARTH
- Operating mechanisms of switching devices accessible outside the switching-device vessel
- Maintenance-free operating mechanism parts (IEC 62271-1/VDE 0671-1 \*) and GB 11022 \*)
- Mechanical position indication integrated in mimic diagram
- Switchgear interlocking system with logical mechanical interlocks
- Partition class: **PM** (metallic partition).

### Reavailability

- Three-position switch-disconnector with gas-insulated, maintenance-free quenching principle
- Metallic partition between busbar compartment, switching devices and cable compartment
- Separate pressure relief for each compartment
- Cable testing without the need to isolate the busbar
- Mounting location of three-phase current transformer for selective disconnection of circuit-breaker feeders.

\*) For standards, see page 72

**Cost-efficiency**

Low "lifecycle costs" and high availability throughout the entire product service lifecycle as a result of:

- Minimum space requirement
- Easy switchgear extension, without gas work
- Maintenance-free gas-insulated switching functions of the three-position switch (gas-insulated quenching principle)
- Vacuum circuit-breaker
- Modular product range and design, e.g. circuit-breaker panels
- Low maintenance
- Option: Numerical multifunction protection relay (SIPROTEC protection device family, optionally external makes).

**Quality and environment**

- Quality and environmental management system according to DIN EN ISO 9001 and DIN EN ISO 14001
- Easy switchgear extension, without gas work on site
- Minimum space requirements.

**Service life**

Under normal operating conditions, the expected service life of air-insulated switchgear SIMOSEC is at least 35 years, probably 40 to 50 years, taking the tightness of the hermetically welded switching-device vessel into account. The service life is limited by the maximum number of operating cycles of the switchgear devices installed:

- For circuit-breakers, according to the endurance class defined in IEC 62271-100
- For three-position disconnectors and earthing switches, according to the endurance class defined in IEC 62271-102
- For three-position switch-disconnectors, according to the endurance class defined in IEC 62271-103.

**Technology**

- Air-insulated indoor switchgear
- Gas-insulated, maintenance-free switching functions for the three-position switch as switch-disconnector
- Partition class: **PM** (metallic partition)
- Three-pole primary enclosure
- Phases arranged one behind the other
- No cross insulation between phases
- Busbar system at the top
- Air-insulated busbar and cable connection system
- Three-position switch, metal-enclosed, with air-insulated primary terminals and gas-insulated switching functions
- Vacuum circuit-breaker, metal-enclosed, up to 1250 A, fixed-mounted in gas-insulated switching-device vessel
- Option: Vacuum circuit-breaker (type 3A\_), air-insulated, up to 1250 A, removable design: Easy to remove after loosening the fixing bolts
- Hermetically-sealed by welded, stainless-steel switching-device vessel
  - For switching devices
  - With insulating gas SF<sub>6</sub> (fluorinated greenhouse gas).

**Insulating system**

- Switching-device vessel filled with SF<sub>6</sub> gas
- Features of SF<sub>6</sub> gas:
  - Non-toxic
  - Odorless and colorless
  - Non-inflammable
  - Chemically neutral
  - Heavier than air
  - Electronegative (high-quality insulator)
  - Global Warming Potential GWP = 22,800
- Pressure of SF<sub>6</sub> gas in the switching-device vessel (absolute values at 20 °C):
  - Rated filling level: 140 kPa
  - Design pressure: 180 kPa
  - Design temperature of the SF<sub>6</sub> gas: 80 °C
  - Operating pressure of bursting disc: ≥ 270 kPa
  - Bursting pressure: ≥ 550 kPa
  - Gas leakage rate: < 0.1 % per year.

**Panel design**

- Factory-assembled, type-tested
- Metal-enclosed, with metallic partitions
- LSC 2 panels, LSC 1 panels (without isolating distance)
- Pressure relief
  - To the rear and upwards
  - Separately for each compartment
- Air-insulated cable connection system for conventional cable sealing ends
- Option: Three-phase current transformer, factory-assembled on the feeder bushings
- Integrated low-voltage niche (standard) for installation of, e.g.
  - Terminals, MCBs, pushbuttons
  - Protection devices
- Option: Top-mounted low-voltage compartment
- Option: Panel heating for severe ambient conditions, e.g. condensation.

**Standards** (see page 72)

# Application, Requirements

## Features, classification

### Electrical features

- Rated voltages up to 24 kV
- Rated short-time withstand current up to 25 kA
- Rated normal current of feeders
  - Up to 800 A, e.g. for ring-main, metering panels
  - Up to 1250 A, for circuit-breaker panels
  - Up to 1250 A, for bus sectionalizer panels
- Rated normal current of busbar up to 1250 A.

SIMOSEC switchgear is a factory-assembled, type-tested, metal-enclosed switchgear for indoor installation. SIMOSEC switchgear is classified according to IEC 62271-200 / VDE 0671-200.

### Design and construction

| Partition class                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | PM (metallic partition)                                                                                                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Loss of service continuity category<br>Panels <ul style="list-style-type: none"><li>– With HV HRC fuses [T, M(VT-F), ...]</li><li>– Without HV HRC fuses (R, L, D, ...)</li><li>– Metering panels type M or H1 or bus riser panel type H</li></ul>                                                                                                                                                                                                                                                                  | LSC 2<br>LSC 2<br>LSC 1                                                                                                                                                                                                                           |
| Accessibility to compartments (enclosure) <ul style="list-style-type: none"><li>– Busbar compartment</li><li>– Switching-device compartment</li><li>– Switching-device compartment with removable circuit-breaker</li><li>– Low-voltage compartment (Option)</li><li>– Cable compartment for panels:<ul style="list-style-type: none"><li>– Without HV HRC fuses (R, L, ...)</li><li>– With HV HRC fuses (T, ...)</li><li>– Cable feeder (K)</li><li>– Metering panel (air-insulated) (M, ...H)</li></ul></li></ul> | <ul style="list-style-type: none"><li>– Tool-based</li><li>– Non-accessible</li><li>– Interlock-controlled</li><li>– Tool-based</li><li>– Interlock-controlled</li><li>– Interlock-controlled</li><li>– Tool-based</li><li>– Tool-based</li></ul> |

### Internal arc classification (option)

|                                                                                                                               |                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The following internal arc classifications are fulfilled:<br>IAC A FL(R), $I_{SC}$ , $t$                                      |                                                                                                                                                                                      |
| IAC                                                                                                                           | = Internal arc classification                                                                                                                                                        |
| IAC class for <ul style="list-style-type: none"><li>– Wall-standing arrangement</li><li>– Free-standing arrangement</li></ul> | Rated voltage 7.2 kV to 24 kV:<br>IAC A FL, $I_{SC}$ , $t$<br>IAC A FLR, $I_{SC}$ , $t$                                                                                              |
| Type of accessibility: A <ul style="list-style-type: none"><li>– F</li><li>– L</li><li>– R</li></ul>                          | Switchgear in closed electrical service location, access "for authorized personnel only" (according to IEC 62271-200)<br>Front<br>Lateral<br>Rear<br>(for free-standing arrangement) |
| Arc test current $I_{SC}$                                                                                                     | Up to 21 kA                                                                                                                                                                          |
| Test duration $t$                                                                                                             | 1 s                                                                                                                                                                                  |

## Common electrical data

|                                           |                                          |                                                               |          |           |    |           |    |      |    |     |    |    |
|-------------------------------------------|------------------------------------------|---------------------------------------------------------------|----------|-----------|----|-----------|----|------|----|-----|----|----|
| Rated insulation level                    |                                          | Rated voltage $U_r$                                           | kV       | 7.2       |    | 12        |    | 17.5 |    | 24  |    |    |
|                                           |                                          | Rated short-dur. power-frequency withstand voltage $U_d$      |          |           |    |           |    |      |    |     |    |    |
|                                           |                                          | – phase-to-phase, phase-to-earth, open contact gap            | kV       | 20        |    | 28, 42 *) |    | 38   |    | 50  |    |    |
|                                           |                                          | – across the isolating distance                               | kV       | 23        |    | 32, 48 *) |    | 45   |    | 60  |    |    |
|                                           |                                          | Rated lightning impulse withstand voltage $U_p$               |          |           |    |           |    |      |    |     |    |    |
|                                           |                                          | – phase-to-phase, phase-to-earth, open contact gap            | kV       | 60        |    | 75        |    | 95   |    | 125 |    |    |
|                                           |                                          | – across the isolating distance                               | kV       | 70        |    | 85        |    | 110  |    | 145 |    |    |
| Rated frequency $f_r$                     |                                          |                                                               | Hz       | 50/60     |    |           |    |      |    |     |    |    |
| Rated normal current $I_r$ **) for busbar |                                          | Standard                                                      | A        | 630       |    |           |    |      |    |     |    |    |
|                                           |                                          | <u>Option</u>                                                 | A        | 800, 1250 |    |           |    |      |    |     |    |    |
| 50 Hz                                     | Rated short-time withstand current $I_k$ | for rated duration of short-circuit $t_k = 1$ s, 2 s *)       | up to kA | 21        | 25 | 21        | 25 | 21   | 25 | 16  | 20 | 25 |
|                                           |                                          | for rated duration of short-circuit $t_k = 3$ s (20 kA/4 s *) | up to kA | 21        | –  | 21        | –  | 21   | –  | 16  | 20 | –  |
|                                           | Rated peak withstand current $I_p$       |                                                               | up to kA | 52.5      | 63 | 52.5      | 63 | 52.5 | 63 | 40  | 50 | 63 |
| 60 Hz                                     | Rated short-time withstand current $I_k$ | for rated duration of short-circuit $t_k = 1$ s, 2 s *)       | up to kA | 21        | 25 | 21        | 25 | 21   | 25 | 16  | 20 | 25 |
|                                           |                                          | for rated duration of short-circuit $t_k = 3$ s               | up to kA | 21        | –  | 21        | –  | 21   | –  | 16  | 20 | –  |
|                                           | Rated peak withstand current $I_p$       |                                                               | up to kA | 55        | 65 | 55        | 65 | 55   | 65 | 42  | 52 | 65 |

## Pressure values, temperature

|                                                                                                                                  |                                                             |           |              |              |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|-----------|--------------|--------------|--|--|--|
| Pressure in gas-insulated switching-device vessel for SF <sub>6</sub> gas-insulated switching devices (pressure values at 20 °C) | Rated filling level for insulation $p_{re}$ (absolute)      | kPa       | 140          |              |  |  |  |
|                                                                                                                                  | Minimum functional level for insulation $p_{me}$ (absolute) | kPa       | 120          |              |  |  |  |
|                                                                                                                                  | Signal of filling level for insulation $p_{ae}$ (absolute)  | kPa       | 120          |              |  |  |  |
|                                                                                                                                  | Minimum functional level for switching $p_{sw}$ (absolute)  | kPa       | 120          |              |  |  |  |
| Ambient air temperature T (minimum/maximum air temperature depends on the secondary equipment used)                              | Operation:                                                  | Standard  | °C           | –5 to +55 1) |  |  |  |
|                                                                                                                                  |                                                             | Option    | °C           | –25 1) △)    |  |  |  |
|                                                                                                                                  | Storage/transport                                           | Standard  | °C           | –5 to +55 1) |  |  |  |
|                                                                                                                                  |                                                             | Option    | °C           | –25, +70 1)  |  |  |  |
|                                                                                                                                  |                                                             | Option *) | °C           | –40          |  |  |  |
|                                                                                                                                  |                                                             |           |              |              |  |  |  |
| Degree of protection                                                                                                             | for gas-filled switching-device vessel                      |           | IP65         |              |  |  |  |
|                                                                                                                                  | for switchgear enclosure                                    |           | IP2X/IP3X *) |              |  |  |  |
|                                                                                                                                  | for low-voltage compartment                                 |           | IP3X/IP4X *) |              |  |  |  |

\*) As design option, according to some national requirements (e.g.: GOST, GB, ...)

\*\*) The rated normal currents apply to ambient air temperatures of max. 40 °C.

The 24-hour mean value is max. 35 °C (according to IEC 62271-1/VDE 0671-1)

1) Depending on the secondary equipment used

△) If panel heating available

# Technical Data

## Electrical data of the switchgear

### Common electrical data of the switchgear panels

| Rated insulation level | Rated voltage $U_r$ | kV | 7.2 | 12 | 17.5 | 24 |
|------------------------|---------------------|----|-----|----|------|----|
|------------------------|---------------------|----|-----|----|------|----|

### Ring-main panel types R, R1, R(T), R1(T), cable panel types K and K1 <sup>3)</sup>

| Rated normal current $I_r^{**1)}$ |                                             | Standard                                                                   | A        | 630                   |    |      |    |      |    |    |    |    |
|-----------------------------------|---------------------------------------------|----------------------------------------------------------------------------|----------|-----------------------|----|------|----|------|----|----|----|----|
|                                   |                                             | Option                                                                     | A        | 800, 1250 for type K1 |    |      |    |      |    |    |    |    |
| 50 Hz                             | Rated short-time withstand current $I_k$    | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^{*)}$  | up to kA | 21                    | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
|                                   |                                             | for rated duration of short-circuit $t_k = 3 \text{ s} (4 \text{ s}^{*)})$ | up to kA | 21                    | –  | 21   | –  | 21   | –  | 16 | 20 | –  |
|                                   | Rated peak withstand current $I_p$          |                                                                            | up to kA | 52.5                  | 63 | 52.5 | 63 | 52.5 | 63 | 40 | 50 | 63 |
|                                   | Rated short-circuit making current $I_{ma}$ | for ring-main feeders                                                      | up to kA | 52.5                  | 63 | 52.5 | 63 | 52.5 | 63 | 40 | 50 | 63 |
| 60 Hz                             | Rated short-time withstand current $I_k$    | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^{*)}$  | up to kA | 21                    | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
|                                   |                                             | for rated duration of short-circuit $t_k = 3 \text{ s}$                    | up to kA | 21                    | –  | 21   | –  | 21   | –  | 16 | 20 | –  |
|                                   | Rated peak withstand current $I_p$          |                                                                            | up to kA | 55                    | 65 | 55   | 65 | 55   | 65 | 42 | 52 | 65 |
|                                   | Rated short-circuit making current $I_{ma}$ | for ring-main feeders                                                      | up to kA | 55                    | 65 | 55   | 65 | 55   | 65 | 42 | 52 | 65 |

### Transformer panel types T, T1, T(T) as switch-fuse combination according to IEC 62271-105

| Rated normal current $I_r^{**1)}$ |                                                  | Standard                                                                   | A        | 200  |    |      |    |      |    |    |    |    |
|-----------------------------------|--------------------------------------------------|----------------------------------------------------------------------------|----------|------|----|------|----|------|----|----|----|----|
| 50 Hz                             | Rated short-time withstand current $I_k^{1) 4)}$ | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^{*)}$  | up to kA | 21   | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
|                                   |                                                  | for rated duration of short-circuit $t_k = 3 \text{ s} (4 \text{ s}^{*)})$ | up to kA | 21   | –  | 21   | –  | 21   | –  | 16 | 20 | –  |
|                                   | Rated peak withstand current $I_p^{1)}$          | for transformer feeders <sup>1)</sup>                                      | up to kA | 52.5 | 63 | 52.5 | 63 | 52.5 | 63 | 40 | 50 | 63 |
|                                   | Rated short-circuit making current $I_{ma}^{1)}$ | for transformer feeders <sup>1)</sup>                                      | up to kA | 52.5 | 63 | 52.5 | 63 | 52.5 | 63 | 40 | 50 | 63 |
| 60 Hz                             | Rated short-time withstand current $I_k^{1) 4)}$ | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^{*)}$  | up to kA | 21   | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
|                                   |                                                  | for rated duration of short-circuit $t_k = 3 \text{ s}$                    | up to kA | 21   | –  | 21   | –  | 21   | –  | 16 | 20 | –  |
|                                   | Rated peak withstand current $I_p^{1)}$          | for transformer feeders <sup>1)</sup>                                      | up to kA | 55   | 65 | 55   | 65 | 55   | 65 | 42 | 52 | 65 |
|                                   | Rated short-circuit making current $I_{ma}^{1)}$ | for transformer feeders <sup>1)</sup>                                      | up to kA | 55   | 65 | 55   | 65 | 55   | 65 | 42 | 52 | 65 |
| Dimension e of HV HRC fuse-link   |                                                  | e = 292 mm                                                                 |          | •    |    | •    |    | •    |    | –  |    |    |
|                                   |                                                  | e = 442 mm                                                                 |          | •    |    | •    |    | •    |    | •  |    |    |

### Disconnecter panel types D1, D1(T)

| Rated normal current $I_r^{**})$ |                                          | Standard                                                                   | A        | 1250 |    |      |    |      |    |    |    |    |
|----------------------------------|------------------------------------------|----------------------------------------------------------------------------|----------|------|----|------|----|------|----|----|----|----|
|                                  |                                          | On request                                                                 | A        | 630  |    |      |    |      |    |    |    |    |
| 50 Hz                            | Rated short-time withstand current $I_k$ | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^{*)}$  | up to kA | 21   | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
|                                  |                                          | for rated duration of short-circuit $t_k = 3 \text{ s} (4 \text{ s}^{*)})$ | up to kA | 21   | –  | 21   | –  | 21   | –  | 16 | 20 | –  |
|                                  | Rated peak withstand current $I_p$       |                                                                            | up to kA | 52.5 | 63 | 52.5 | 63 | 52.5 | 63 | 40 | 50 | 63 |
| 60 Hz                            | Rated short-time withstand current $I_k$ | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^{*)}$  | up to kA | 21   | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
|                                  |                                          | for rated duration of short-circuit $t_k = 3 \text{ s}$                    | up to kA | 21   | –  | 21   | –  | 21   | –  | 16 | 20 | –  |
|                                  | Rated peak withstand current $I_p$       |                                                                            | up to kA | 55   | 65 | 55   | 65 | 55   | 65 | 42 | 52 | 65 |

- possible
- not possible

\*) As design option, on request according to some national requirements (e.g.: GOST, GB, ...)

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

1) Depending on HV HRC fuse-link (depending on the let-through current of the HV HRC fuse-link), earthing switch at the feeder: see page 11  
3) On request: Panel types K and K1, each with make-proof earthing switch  
4) Busbar

### Common electrical data of the switchgear panels

| Rated insulation level | Rated voltage $U_r$ | kV | 7.2 | 12 | 17.5 | 24 |
|------------------------|---------------------|----|-----|----|------|----|
|------------------------|---------------------|----|-----|----|------|----|

### Circuit-breaker panel <sup>2)</sup> types L, L1, L(T), L1(T)

| Rated normal current $I_r^{**})$ |                                               | Standard: L, L(T), L1, L1(T)                                               | A        | 630              |    |      |    |      |    |    |    |    |
|----------------------------------|-----------------------------------------------|----------------------------------------------------------------------------|----------|------------------|----|------|----|------|----|----|----|----|
|                                  |                                               | Option: L1, L1(T)                                                          | A        | 1250 A $\Delta)$ |    |      |    |      |    |    |    |    |
| 50 Hz                            | Rated short-time withstand current $I_k$      | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^{*)}$  | up to kA | 21               | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
|                                  |                                               | for rated duration of short-circuit $t_k = 3 \text{ s} (4 \text{ s}^{*)})$ | up to kA | 21               | –  | 21   | –  | 21   | –  | 16 | 20 | –  |
|                                  | Rated peak withstand current $I_p$            |                                                                            | up to kA | 52.5             | 63 | 52.5 | 63 | 52.5 | 63 | 40 | 50 | 63 |
|                                  | Rated short-circuit making current $I_{ma}$   |                                                                            | up to kA | 52.5             | 63 | 52.5 | 63 | 52.5 | 63 | 40 | 50 | 63 |
|                                  | Rated short-circuit breaking current $I_{sc}$ |                                                                            | up to kA | 21               | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
| 60 Hz                            | Rated short-time withstand current $I_k$      | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^{*)}$  | up to kA | 21               | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
|                                  |                                               | for rated duration of short-circuit $t_k = 3 \text{ s}$                    | up to kA | 21               | –  | 21   | –  | 21   | –  | 16 | 20 | –  |
|                                  | Rated peak withstand current $I_p$            |                                                                            | up to kA | 55               | 65 | 55   | 65 | 55   | 65 | 42 | 52 | 65 |
|                                  | Rated short-circuit making current $I_{ma}$   |                                                                            | up to kA | 55               | 65 | 55   | 65 | 55   | 65 | 42 | 52 | 65 |
|                                  | Rated short-circuit breaking current $I_{sc}$ |                                                                            | up to kA | 21               | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |

### Metering panel types M, bus riser panel types H, H1

| Rated normal current $I_r^{**})$ for: |                                          |                                                                            | A        | 630       |    |      |    |      |    |    |    |    |
|---------------------------------------|------------------------------------------|----------------------------------------------------------------------------|----------|-----------|----|------|----|------|----|----|----|----|
| M, M(-K), M(-B), M(-BK), H, M(KK), H1 |                                          | Standard                                                                   | A        | 630       |    |      |    |      |    |    |    |    |
| M, M(-K), M(-B), M(-BK), H, H1        |                                          | Option                                                                     | A        | 800, 1250 |    |      |    |      |    |    |    |    |
| 50 Hz                                 | Rated short-time withstand current $I_k$ | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^{*)}$  | up to kA | 21        | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
|                                       |                                          | for rated duration of short-circuit $t_k = 3 \text{ s} (4 \text{ s}^{*)})$ | up to kA | 21        | –  | 21   | –  | 21   | –  | 16 | 20 | –  |
|                                       | Rated peak withstand current $I_p$       |                                                                            | up to kA | 52.5      | 63 | 52.5 | 63 | 52.5 | 63 | 40 | 50 | 63 |
| 60 Hz                                 | Rated short-time withstand current $I_k$ | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^{*)}$  | up to kA | 21        | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
|                                       |                                          | for rated duration of short-circuit $t_k = 3 \text{ s}$                    | up to kA | 21        | –  | 21   | –  | 21   | –  | 16 | 20 | –  |
|                                       | Rated peak withstand current $I_p$       |                                                                            | up to kA | 55        | 65 | 55   | 65 | 55   | 65 | 42 | 52 | 65 |

### Circuit-breaker panel types L1(r), L2(r), L1(r, T), L2(r, T)

| Rated normal current $I_r^{**})$ |                                               | Standard: L1(r), L1(r, T)                                                 | A        | 630  |    |      |    |      |    |    |    |    |
|----------------------------------|-----------------------------------------------|---------------------------------------------------------------------------|----------|------|----|------|----|------|----|----|----|----|
|                                  |                                               | Option: L2(r), L2(r, T)                                                   | A        | 1250 |    |      |    |      |    |    |    |    |
| 50 Hz                            | Rated short-time withstand current $I_k$      | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^{*)}$ | up to kA | 21   | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
|                                  |                                               | for rated duration of short-circuit $t_k = 3 \text{ s}$                   | up to kA | 21   | –  | 21   | –  | 21   | –  | 16 | 20 | –  |
|                                  | Rated peak withstand current $I_p$            |                                                                           | up to kA | 52.5 | 63 | 52.5 | 63 | 52.5 | 63 | 40 | 50 | 63 |
|                                  | Rated short-circuit making current $I_{ma}$   |                                                                           | up to kA | 52.5 | 63 | 52.5 | 63 | 52.5 | 63 | 40 | 50 | 63 |
|                                  | Rated short-circuit breaking current $I_{sc}$ |                                                                           | up to kA | 21   | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
| 60 Hz                            | Rated short-time withstand current $I_k$      | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^{*)}$ | up to kA | 21   | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
|                                  |                                               | for rated duration of short-circuit $t_k = 3 \text{ s}$                   | up to kA | 21   | –  | 21   | –  | 21   | –  | –  | 20 | –  |
|                                  | Rated peak withstand current $I_p$            |                                                                           | up to kA | 55   | 65 | 55   | 65 | 55   | 65 | 42 | 52 | 65 |
|                                  | Rated short-circuit making current $I_{ma}$   |                                                                           | up to kA | 55   | 65 | 55   | 65 | 55   | 65 | 42 | 52 | 65 |
|                                  | Rated short-circuit breaking current $I_{sc}$ |                                                                           | up to kA | 21   | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |

- possible
- not possible

\*) As design option, on request according to some national requirements (e.g.: GOST, GB, ...)

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

2) With vacuum circuit-breaker in gas-filled switching-device vessel (maintenance-free under normal ambient conditions according to IEC 62271-1)

$\Delta$ ) 1250 A in preparation

# Technical Data

Electrical data of the switchgear

## Common electrical data of the switchgear panels

| Rated insulation level | Rated voltage $U_r$ | kV | 7.2 | 12 | 17.5 | 24 |
|------------------------|---------------------|----|-----|----|------|----|
|------------------------|---------------------|----|-----|----|------|----|

### Busbar voltage metering panel types M(VT-F), M1(VT-F)

| Rated normal current $I_r^{**1)}$ | Standard                                      | A                                                                                                                                      | 200                                                       |    |      |    |      |    |    |    |    |
|-----------------------------------|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|----|------|----|------|----|----|----|----|
| 50 Hz                             | Rated short-time withstand current $I_k^{2)}$ | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^{*)}$ up to kA                                                     | 21                                                        | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
|                                   |                                               | for rated duration of short-circuit $t_k = 3 \text{ s} (4 \text{ s}^{*)})$ up to kA                                                    | 21                                                        | –  | 21   | –  | 21   | –  | 16 | 20 | –  |
|                                   | Rated peak withstand current $I_p^{1)2)}$     | up to kA                                                                                                                               | 52.5                                                      | 63 | 52.5 | 63 | 52.5 | 63 | 40 | 50 | 63 |
| 60 Hz                             | Rated short-time withstand current $I_k^{2)}$ | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^{*)}$ up to kA                                                     | 21                                                        | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
|                                   |                                               | for rated duration of short-circuit $t_k = 3 \text{ s}$ up to kA                                                                       | 21                                                        | –  | 21   | –  | 21   | –  | 16 | 20 | –  |
|                                   | Rated peak withstand current $I_p^{1)2)}$     | up to kA                                                                                                                               | 55                                                        | 65 | 55   | 65 | 55   | 65 | 42 | 52 | 65 |
|                                   | Dimension of HV HRC fuse-link                 | Standard: For HV HRC fuse-link<br>On request: Option:<br>For HV HRC fuse-link according to IEC / EN 60282-1 / VDE 0670-4 and DIN 43625 | application of fuses for voltage transformer protection → |    |      |    |      |    |    |    |    |
|                                   |                                               | $e = 292 \text{ mm}$                                                                                                                   | •                                                         |    | •    |    | •    |    | •  |    |    |
|                                   |                                               | $e = 442 \text{ mm}$                                                                                                                   | –                                                         |    | –    |    | –    |    | –  |    |    |

### Busbar voltage metering panel types M(VT), M1(VT)

| Rated normal current $I_r^{**1)}$ | Standard                                      | A                                                                                   | 200  |    |      |    |      |    |    |    |    |
|-----------------------------------|-----------------------------------------------|-------------------------------------------------------------------------------------|------|----|------|----|------|----|----|----|----|
| 50 Hz                             | Rated short-time withstand current $I_k^{2)}$ | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^{*)}$ up to kA  | 21   | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
|                                   |                                               | for rated duration of short-circuit $t_k = 3 \text{ s} (4 \text{ s}^{*)})$ up to kA | 21   | –  | 21   | –  | 21   | –  | 16 | 20 | –  |
|                                   | Rated peak withstand current $I_p^{2)}$       | up to kA                                                                            | 52.5 | 63 | 52.5 | 63 | 52.5 | 63 | 40 | 50 | 63 |
| 60 Hz                             | Rated short-time withstand current $I_k^{2)}$ | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^{*)}$ up to kA  | 21   | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
|                                   |                                               | for rated duration of short-circuit $t_k = 3 \text{ s}$ up to kA                    | 21   | –  | 21   | –  | 21   | –  | 16 | 20 | –  |
|                                   | Rated peak withstand current $I_p^{2)}$       | up to kA                                                                            | 55   | 65 | 55   | 65 | 55   | 65 | 42 | 52 | 65 |

### Busbar earthing panel type E

|       |                                             |                                                                                     |      |    |      |    |      |    |    |    |    |
|-------|---------------------------------------------|-------------------------------------------------------------------------------------|------|----|------|----|------|----|----|----|----|
| 50 Hz | Rated short-time withstand current $I_k$    | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^{*)}$ up to kA  | 21   | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
|       |                                             | for rated duration of short-circuit $t_k = 3 \text{ s} (4 \text{ s}^{*)})$ up to kA | 21   | –  | 21   | –  | 21   | –  | 16 | 20 | –  |
|       | Rated peak withstand current $I_p$          | up to kA                                                                            | 52.5 | 63 | 52.5 | 63 | 52.5 | 63 | 40 | 50 | 63 |
|       | Rated short-circuit making current $I_{ma}$ | up to kA                                                                            | 52.5 | 63 | 52.5 | 63 | 52.5 | 63 | 40 | 50 | 63 |
| 60 Hz | Rated short-time withstand current $I_k$    | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^{*)}$ up to kA  | 21   | 25 | 21   | 25 | 21   | 25 | 16 | 20 | 25 |
|       |                                             | for rated duration of short-circuit $t_k = 3 \text{ s}$ up to kA                    | 21   | –  | 21   | –  | 21   | –  | 16 | 20 | –  |
|       | Rated peak withstand current $I_p$          | up to kA                                                                            | 55   | 65 | 55   | 65 | 55   | 65 | 42 | 52 | 65 |
|       | Rated short-circuit making current $I_{ma}$ | up to kA                                                                            | 55   | 65 | 55   | 65 | 55   | 65 | 42 | 52 | 65 |

- possible
- not possible

### Footnotes: for page 10

- \*) As design option, on request according to some national requirements (e.g.: GOST, GB, ...)
- \*\*) The rated normal currents apply to ambient air temperatures of max. 40 °C.
- 1) Depending on HV HRC fuse-link (depending on the let-through current of the HV HRC fuse-link)
- 2) Busbar

### Footnotes: for page 11

- \*) As design option, on request according to some national requirements (e.g.: GOST, GB,  $I_{load} = 800 \text{ A}$ , ...)
- \*\*) The rated normal currents apply to ambient air temperatures of max. 40 °C.
- The 24-hour mean value is max. 35 °C (according to IEC 62271-1/VDE 0671-1)
- 1) Depending on HV HRC fuse-link (depending on the let-through current of the HV HRC fuse-link)
- 2) The following values apply to 60 Hz: 2 resp. E1

### Three-position switch-disconnector

|                                  |                                             |                                                              |          |       |           |      |    |      |    |    |     |    |  |
|----------------------------------|---------------------------------------------|--------------------------------------------------------------|----------|-------|-----------|------|----|------|----|----|-----|----|--|
| Rated insulation level           |                                             | Rated voltage $U_r$                                          | kV       | 7.2   | 12        |      |    | 17.5 |    |    | 24  |    |  |
|                                  |                                             | Rated short-duration power-frequency withstand voltage $U_d$ |          |       |           |      |    |      |    |    |     |    |  |
|                                  |                                             | – phase-to-phase, phase-to-earth, open contact gap           | kV       | 20    | 28, 42 *) |      |    | 38   |    |    | 50  |    |  |
|                                  |                                             | – across the isolating distance                              | kV       | 23    | 32, 48 *) |      |    | 45   |    |    | 60  |    |  |
|                                  |                                             | Rated lightning impulse withstand voltage $U_p$              |          |       |           |      |    |      |    |    |     |    |  |
|                                  |                                             | – phase-to-phase, phase-to-earth, open contact gap           | kV       | 60    | 75        |      |    | 95   |    |    | 125 |    |  |
|                                  |                                             | – across the isolating distance                              | kV       | 70    | 85        |      |    | 110  |    |    | 145 |    |  |
|                                  |                                             |                                                              |          |       |           |      |    |      |    |    |     |    |  |
| Rated frequency $f_r$            |                                             |                                                              | Hz       | 50/60 |           |      |    |      |    |    |     |    |  |
| Rated normal current $I_r^{**})$ |                                             | Standard:                                                    | A        | 630   |           |      |    |      |    |    |     |    |  |
|                                  |                                             | Option:                                                      | A        | 800   |           |      |    |      |    |    |     |    |  |
| 50 Hz                            | Rated short-time withstand current $I_k$    | for rated duration of short-circuit $t_k = 1$ s, 2 *)        | up to kA | 21    | 25        | 21   | 25 | 21   | 25 | 16 | 20  | 25 |  |
|                                  |                                             | for rated duration of short-circuit $t_k = 3$ s (4 s *)      | up to kA | 21    | –         | 21   | –  | 21   | –  | 16 | 20  | –  |  |
|                                  | Rated peak withstand current $I_p$          |                                                              | up to kA | 52.5  | 63        | 52.5 | 63 | 52.5 | 63 | 40 | 50  | 63 |  |
|                                  | Rated short-circuit making current $I_{ma}$ |                                                              | up to kA | 52.5  | 63        | 52.5 | 63 | 52.5 | 63 | 40 | 50  | 63 |  |
| 60 Hz                            | Rated short-time withstand current $I_k$    | for rated duration of short-circuit $t_k = 1$ s, 2 *)        | up to kA | 21    | 25        | 21   | 25 | 21   | 25 | 16 | 20  | 25 |  |
|                                  |                                             | for rated duration of short-circuit $t_k = 3$ s              | up to kA | 21    | –         | 21   | –  | 21   | –  | 16 | 20  | –  |  |
|                                  | Rated peak withstand current $I_p$          |                                                              | up to kA | 55    | 65        | 55   | 65 | 55   | 65 | 42 | 52  | 65 |  |
|                                  | Rated short-circuit making current $I_{ma}$ |                                                              | up to kA | 55    | 65        | 55   | 65 | 55   | 65 | 42 | 52  | 65 |  |

### Switching capacity for general-purpose switches according to IEC/EN 62271-103

|                                                                        |                                                                                                                 |                                         |          |                         |    |      |    |      |    |    |    |    |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------|----------|-------------------------|----|------|----|------|----|----|----|----|
| Test duty TD <sub>load</sub>                                           | Rated mainly active load-breaking current $I_{load}$                                                            | 100 operations $I_{load}$ [ $I_1$ *)    | A        | 630                     |    |      |    |      |    |    |    |    |
|                                                                        |                                                                                                                 | 20 operations 0.05 $I_{load}$ [ $I_1$ ] | A        | 31.5                    |    |      |    |      |    |    |    |    |
| Test duty TD <sub>loop</sub>                                           | Rated closed-loop breaking current $I_{loop}$ [ $I_{2a}$ ]                                                      |                                         | A        | 630                     |    |      |    |      |    |    |    |    |
| Test duty TD <sub>cc</sub>                                             | Rated cable-charging breaking current $I_{cc}$ [ $I_{4a}$ ]                                                     |                                         | A        | 68                      |    |      |    |      |    |    |    |    |
| Test duty TD <sub>lc</sub>                                             | Rated line-charging breaking current $I_{lc}$ [ $I_{4b}$ ]                                                      |                                         | A        | 68                      |    |      |    |      |    |    |    |    |
| Test duty TD <sub>ma</sub>                                             | Rated short-circuit making current $I_{ma}$                                                                     | 50 Hz                                   | up to kA | 52.5                    | 63 | 52.5 | 63 | 52.5 | 63 | 40 | 50 | 63 |
|                                                                        |                                                                                                                 | 60 Hz                                   | up to kA | 55                      | 65 | 55   | 65 | 55   | 65 | 42 | 52 | 65 |
| Test duty TD <sub>ef1</sub>                                            | Rated earth-fault breaking current $I_{ef1}$ [ $I_{6a}$ ]                                                       |                                         | A        | 200                     |    |      |    |      |    |    |    |    |
| Test duty TD <sub>ef2</sub>                                            | Rated cable-charging breaking current and line-charging breaking current under earth-fault conditions $I_{ef2}$ |                                         | A        | 115                     |    |      |    |      |    |    |    |    |
| Number of mechanical operating cycles / M-classification               |                                                                                                                 |                                         | n        | 1000 / M1; 2000 *) / M1 |    |      |    |      |    |    |    |    |
| Number of electrical operating cycles with $I_{load}$ / Classification |                                                                                                                 |                                         | n        | 100 / E3                |    |      |    |      |    |    |    |    |
| Number of short-circuit making operations with $I_{ma}$                |                                                                                                                 |                                         | n        | 5                       | 5  | 5    | 5  | 5    | 5  | 5  | 5  | 5  |
| Classification                                                         |                                                                                                                 |                                         |          | E3                      | E3 | E3   | E3 | E3   | E3 | E3 | E3 | E3 |
| C-classification                                                       | for general-purpose switch (no restrikes, TD: $I_{cc}$ , $I_{lc}$ )                                             |                                         |          | C2                      | C2 | C2   | C2 | C2   | C2 | C2 | C2 | C2 |

### Classification for disconnectors according to IEC/EN 62271-102/VDE 0671-102

|                                       |   |               |  |  |  |  |  |  |  |  |  |  |
|---------------------------------------|---|---------------|--|--|--|--|--|--|--|--|--|--|
| Number of mechanical operating cycles | n | 1000 (2000 *) |  |  |  |  |  |  |  |  |  |  |
| M-classification                      |   | M0 (M1 *)     |  |  |  |  |  |  |  |  |  |  |

### Technical data and switching capacity for earthing switch according to IEC/EN 62271-102/VDE 0671-102

|                                                          |       |          |      |           |      |    |      |    |    |    |                     |
|----------------------------------------------------------|-------|----------|------|-----------|------|----|------|----|----|----|---------------------|
| Rated short-time withstand current $I_k$                 | 50 Hz | up to kA | 21   | 25        | 21   | 25 | 21   | 25 | 16 | 20 | 25                  |
| Rated short-circuit making current $I_{ma}$              | 50 Hz | up to kA | 52.5 | 63        | 52.5 | 63 | 52.5 | 63 | 40 | 50 | 63                  |
| Rated short-time withstand current $I_k$                 | 60 Hz | up to kA | 21   | 25        | 21   | 25 | 21   | 25 | 16 | 20 | 25                  |
| Rated short-circuit making current $I_{ma}$              | 60 Hz | up to kA | 55   | 65        | 55   | 65 | 55   | 65 | 42 | 52 | 65                  |
| Number of mechanical operating cycles / M-classification |       |          | n    | 1000 / M0 |      |    |      |    |    |    |                     |
| Number of short-circuit making operations with $I_{ma}$  |       |          | n    | 5         | 5    | 5  | 5    | 5  | 5  | 5  | 5 / 2 <sup>2)</sup> |
| Classification                                           |       |          |      | E2        | E2   | E2 | E2   | E2 | E2 | E2 | E2/E1 <sup>2)</sup> |

### Switch-disconnector/fuse combination according to IEC/EN 62271-105/VDE 0671-105

|                                       |     |                   |      |      |      |
|---------------------------------------|-----|-------------------|------|------|------|
| Rated voltage $U_r$                   | kV  | 7.2               | 12   | 17.5 | 24   |
| Rated normal current $I_r$ **)        | A   | 200 <sup>1)</sup> |      |      |      |
| Rated transfer current $I_{transfer}$ | A   | 1750              | 1750 | 1500 | 1400 |
| Maximum transformer rating            | kVA | 800               | 1600 | 1600 | 2500 |

### Switching capacity for make-proof earthing switch, arranged on feeder side, downstream from HV HRC fuse, for typical: T, T1, M(VT-F)

|                                                                            |       |    |     |           |      |      |      |      |      |      |      |
|----------------------------------------------------------------------------|-------|----|-----|-----------|------|------|------|------|------|------|------|
| Rated short-time withstand current $t_k = 1$ s                             | kA    | 2  |     |           |      |      |      |      |      |      |      |
| Rated short-circuit making current $I_{ma}$                                | 50 Hz | kA | 5   |           |      |      |      |      |      |      |      |
|                                                                            | 60 Hz | kA | 5.2 |           |      |      |      |      |      |      |      |
| Number of short-circuit making operations with $I_{ma}$ / E-classification |       |    | n   | 5/E2      | 5/E2 | 5/E2 | 5/E2 | 5/E2 | 5/E2 | 5/E2 | 5/E2 |
| Number of mechanical operating cycles / M-classification                   |       |    | n   | 1000 / M0 |      |      |      |      |      |      |      |

For footnotes, see page 10

# Technical Data

Technical data, switching capacity and classification of switching devices

## Three-position disconnecter, with the functions: Disconnecting CLOSE/OPEN-EARTH,

[e.g. for disconnecter panel types D1, D1(T), for circuit-breaker panel types L1(r), L2(r), L1(r,T), L2(r,T)]

### Technical data and classification for disconnectors according to IEC/EN 62271-102/VDE 0671-102

| Rated voltage $U_r$                   |                                    |                                                                         |          | kV                              |    | 7.2                   |    | 12                    |    | 17.5 |    | 24 |  |
|---------------------------------------|------------------------------------|-------------------------------------------------------------------------|----------|---------------------------------|----|-----------------------|----|-----------------------|----|------|----|----|--|
| Rated frequency $f_r$                 |                                    |                                                                         |          | Hz                              |    | 50/60                 |    |                       |    |      |    |    |  |
| Rated normal current $I_r^{**}$       |                                    |                                                                         |          | A                               |    | 630 (on request: 800) |    |                       |    |      |    |    |  |
| for panel types:                      |                                    |                                                                         |          | Types L1(r), L1(r,T)            |    | A                     |    | 630 (on request: 800) |    |      |    |    |  |
|                                       |                                    |                                                                         |          | Types L2(r), L2(r,T), D1, D1(T) |    | A                     |    | 1250                  |    |      |    |    |  |
| 50 Hz                                 | Rated short-time                   | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^*)$ | up to kA | 21                              | 25 | 21                    | 25 | 21                    | 25 | 16   | 20 | 25 |  |
|                                       | withstand current $I_k$            | for rated duration of short-circuit $t_k = 3 \text{ s} (4 \text{ s}^*)$ | up to kA | 21                              | —  | 21                    | —  | 21                    | —  | 16   | 20 | —  |  |
|                                       | Rated peak withstand current $I_p$ |                                                                         | up to kA | 52.5                            | 63 | 52.5                  | 63 | 52.5                  | 63 | 40   | 50 | 63 |  |
| 60 Hz                                 | Rated short-time                   | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^*)$ | up to kA | 21                              | 25 | 21                    | 25 | 21                    | 25 | 16   | 20 | 25 |  |
|                                       | withstand current $I_k$            | for rated duration of short-circuit $t_k = 3 \text{ s}$                 | up to kA | 21                              | —  | 21                    | —  | 21                    | —  | 16   | 20 | —  |  |
|                                       | Rated peak withstand current $I_p$ |                                                                         | up to kA | 55                              | 65 | 55                    | 65 | 55                    | 65 | 42   | 52 | 65 |  |
| Number of mechanical operating cycles |                                    |                                                                         |          | n                               |    | 1000 (2000 $^{**})$   |    |                       |    |      |    |    |  |
| M-classification                      |                                    |                                                                         |          |                                 |    | M0 (M1 $^{**})$       |    |                       |    |      |    |    |  |

### Classification for earthing switch according to IEC/EN 62271-102/VDE 0671-102 [for panel types D1, D1(T)]

|                                                          |  |  |  |   |  |           |  |    |  |    |  |    |  |
|----------------------------------------------------------|--|--|--|---|--|-----------|--|----|--|----|--|----|--|
| Number of mechanical operating cycles / M-classification |  |  |  | n |  | 1000 / M0 |  |    |  |    |  |    |  |
| Number of short-circuit making operations with $I_{ma}$  |  |  |  | n |  | 5         |  | 5  |  | 5  |  | 5  |  |
| Classification                                           |  |  |  |   |  | E2        |  | E2 |  | E2 |  | E2 |  |

## Make-proof earthing switch

### Technical data and switching capacity for earthing switch according to IEC/EN 62271-102/VDE 0671-102 (for panel types: R, D, E)

| Rated voltage $U_r$                                      |                                             |                                                                         |          | kV   |    | 7.2       |    | 12   |    | 17.5 |    | 24 |  |
|----------------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------|----------|------|----|-----------|----|------|----|------|----|----|--|
| 50 Hz                                                    | Rated short-time                            | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^*)$ | up to kA | 21   | 25 | 21        | 25 | 21   | 25 | 16   | 20 | 25 |  |
|                                                          | withstand current $I_k$                     | for rated duration of short-circuit $t_k = 3 \text{ s} (4 \text{ s}^*)$ | up to kA | 21   | —  | 21        | —  | 21   | —  | 16   | 20 | —  |  |
|                                                          | Rated short-circuit making current $I_{ma}$ |                                                                         | up to kA | 52.5 | 63 | 52.5      | 63 | 52.5 | 63 | 40   | 50 | 63 |  |
| 60 Hz                                                    | Rated short-time                            | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^*)$ | up to kA | 21   | 25 | 21        | 25 | 21   | 25 | 16   | 20 | 25 |  |
|                                                          | withstand current $I_k$                     | for rated duration of short-circuit $t_k = 3 \text{ s}$                 | up to kA | 21   | —  | 21        | —  | 21   | —  | —    | 20 | —  |  |
|                                                          | Rated short-circuit making current $I_{ma}$ |                                                                         | up to kA | 55   | 65 | 55        | 65 | 55   | 65 | 42   | 52 | 65 |  |
| Number of mechanical operating cycles / M-classification |                                             |                                                                         |          | n    |    | 1000 / M0 |    |      |    |      |    |    |  |
| Number of short-circuit making operations with $I_{ma}$  |                                             |                                                                         |          | n    |    | 5         |    | 5    |    | 5    |    | 5  |  |
| Classification                                           |                                             |                                                                         |          |      |    | E2        |    | E2   |    | E2   |    | E2 |  |

## Make-proof earthing switch (air-insulated, arranged at cable feeder)

[e.g. for circuit-breaker panel types L1(r), L2(r)]

### Technical data and switching capacity for earthing switch according to IEC/EN 62271-102/VDE 0671-102

| Rated voltage $U_r$                                      |                                             |                                                         |          | kV |    | 7.2       |    | 12 |    | 17.5 |    | 24 |  |
|----------------------------------------------------------|---------------------------------------------|---------------------------------------------------------|----------|----|----|-----------|----|----|----|------|----|----|--|
| 50 Hz                                                    | Rated short-time                            | for rated duration of short-circuit $t_k = 1 \text{ s}$ | up to kA | 20 | 25 | 20        | 25 | 20 | 25 | 16   | 20 |    |  |
|                                                          | withstand current $I_k$                     | for rated duration of short-circuit $t_k = 3 \text{ s}$ | up to kA | 20 | —  | 20        | —  | 20 | —  | 16   | 20 |    |  |
|                                                          | Rated short-circuit making current $I_{ma}$ |                                                         | up to kA | 50 | 63 | 50        | 63 | 50 | 63 | 40   | 50 |    |  |
|                                                          | Rated peak withstand current $I_p$          |                                                         | up to kA | 50 | 63 | 50        | 63 | 50 | 63 | 40   | 50 |    |  |
| 60 Hz                                                    | Rated short-time                            | for rated duration of short-circuit $t_k = 1 \text{ s}$ | up to kA | 20 | 25 | 20        | 25 | 20 | 25 | 16   | 20 |    |  |
|                                                          | withstand current $I_k$                     | for rated duration of short-circuit $t_k = 3 \text{ s}$ | up to kA | 20 | —  | 20        | —  | 20 | —  | —    | 20 |    |  |
|                                                          | Rated short-circuit making current $I_{ma}$ |                                                         | up to kA | 52 | 65 | 52        | 65 | 52 | 65 | 42   | 52 |    |  |
|                                                          | Rated peak withstand current $I_p$          |                                                         | up to kA | 52 | 65 | 52        | 65 | 52 | 65 | 42   | 52 |    |  |
| Number of mechanical operating cycles / M-classification |                                             |                                                         |          | n  |    | 1000 / M0 |    |    |    |      |    |    |  |
| Number of short-circuit making operations with $I_{ma}$  |                                             |                                                         |          | n  |    | 2         |    | 2  |    | 2    |    | 2  |  |
| Classification                                           |                                             |                                                         |          |    |    | E1        |    | E1 |    | E1   |    | E1 |  |

\*) As design option, on request according to some national requirements (e.g.: GOST, GB, ...)

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

### Vacuum circuit-breaker

Switching capacity according to IEC/EN 62271-100/VDE 0671-100

Type CB-f <sup>1) 4)</sup>, combined with three-position disconnecter, in gas-insulated switching-device vessel <sup>4)</sup>

Type CB-r / SION L (3AE6) <sup>1)</sup>

| Rated voltage $U_r$                                     |                                               |                                                                             | kV       | 7.2             | 12 |      | 17.5 |      | 24 |    |    |    |
|---------------------------------------------------------|-----------------------------------------------|-----------------------------------------------------------------------------|----------|-----------------|----|------|------|------|----|----|----|----|
| Rated normal current $I_r$ **) for circuit-breaker type | CB-f, CB-r (SION L)                           |                                                                             | A        | 630             |    |      |      |      |    |    |    |    |
|                                                         |                                               |                                                                             | A        | on request: 800 |    |      |      |      |    |    |    |    |
|                                                         | CB-r (SION L)                                 |                                                                             | A        | 1250            |    |      |      |      |    |    |    |    |
| Rated frequency $f_r$                                   |                                               |                                                                             | Hz       | 50/60           |    |      |      |      |    |    |    |    |
| 50 Hz                                                   | Rated short-time withstand current $I_k$      | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^*)$     | up to kA | 21              | 25 | 21   | 25   | 21   | 25 | 16 | 20 | 25 |
|                                                         |                                               | for rated duration of short-circuit $t_k = 3 \text{ s} (4 \text{ s}^*)$ □)) | up to kA | 21              | –  | 21   | –    | 21   | –  | 16 | 20 | –  |
|                                                         | Rated peak withstand current $I_p$            |                                                                             | up to kA | 52.5            | 63 | 52.5 | 63   | 52.5 | 63 | 40 | 50 | 63 |
|                                                         | Rated short-circuit breaking current $I_{sc}$ |                                                                             | up to kA | 21              | 25 | 21   | 25   | 21   | 25 | 16 | 20 | 25 |
|                                                         | Rated short-circuit making current $I_{ma}$   |                                                                             | up to kA | 52.5            | 63 | 52.5 | 63   | 52.5 | 63 | 40 | 50 | 63 |
| 60 Hz                                                   | Rated short-time withstand current $I_k$      | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}^*)$     | up to kA | 21              | 25 | 21   | 25   | 21   | 25 | 16 | 20 | 25 |
|                                                         |                                               | for rated duration of short-circuit $t_k = 3 \text{ s}$                     | up to kA | 21              | –  | 21   | –    | 21   | –  | 16 | 20 | –  |
|                                                         | Rated peak withstand current $I_p$            |                                                                             | up to kA | 55              | 65 | 55   | 65   | 55   | 65 | 42 | 52 | 65 |
|                                                         | Rated short-circuit breaking current $I_{sc}$ |                                                                             | up to kA | 21              | 25 | 21   | 25   | 21   | 25 | 16 | 20 | 25 |
|                                                         | Rated short-circuit making current $I_{ma}$   |                                                                             | up to kA | 55              | 65 | 55   | 65   | 55   | 65 | 42 | 52 | 65 |

Classification and number of operating cycles for circuit-breaker according to IEC/EN 62271-100/VDE 0671-100

Circuit-breaker: CB-f NAR <sup>3)</sup>

|                          |                                                           |          |                             |   |   |   |
|--------------------------|-----------------------------------------------------------|----------|-----------------------------|---|---|---|
| Mechanical               | Number of operating cycles                                | 2000     | —                           | — | — | — |
|                          | Class                                                     | M1       | —                           | — | — | — |
| Electrical               | Number of operating cycles with $I_r$ : 2000              | Class E2 | —                           | — | — | — |
|                          | Breaking of capacitive currents                           | Class C1 | —                           | — | — | — |
|                          | Number of short-circuit breaking operations with $I_{sc}$ | n        | 20                          | — | — | — |
| Rated operating sequence |                                                           | CB-f NAR | O – 3 min – CO – 3 min – CO | — | — | — |

Circuit-breaker: CB-f AR <sup>1)</sup>; CB-r AR <sup>1) 3)</sup>

|                          |                                                                       |          |                             |   |   |   |
|--------------------------|-----------------------------------------------------------------------|----------|-----------------------------|---|---|---|
| Mechanical               | Number of operating cycles                                            | n        | 10 000                      | — | — | — |
|                          | Class                                                                 | M2       | —                           | — | — | — |
| Electrical               | Number of operating cycles with $I_r$ : 10,000                        | Class E2 | —                           | — | — | — |
|                          | Breaking of capacitive currents                                       | Class C2 | —                           | — | — | — |
|                          | Number of short-circuit breaking operations with $I_{sc}$ for CB-f AR | n        | 30 or 50                    | — | — | — |
|                          | Number of short-circuit breaking operations with $I_{sc}$ for CB-r AR | n        | 30                          | — | — | — |
|                          |                                                                       | Class S2 | —                           | — | — | — |
| Rated operating sequence | CB-f                                                                  |          | O – 0.3 s – CO – 3 min – CO | — | — | — |
|                          | CB-f                                                                  |          | O – 0.3 s – CO – 30 s – CO  | — | — | — |
|                          | CB-r (SION L)                                                         |          | O – 0.3 s – CO – 15 s – CO  | — | — | — |

Classification for disconnecter according to IEC/EN 62271-102/VDE 0671-102 (for panel types L, L1, ...)

|                                       |   |                            |   |   |   |
|---------------------------------------|---|----------------------------|---|---|---|
| Number of mechanical operating cycles | n | 1000 (2000 <sup>*)</sup> ) | — | — | — |
| M-classification                      |   | M0 (M1 <sup>*)</sup> )     | — | — | — |

Classification for earthing switch according to IEC/EN 62271-102/VDE 0671-102 (for panel types L, L1, ...)

|                                                         |   |           |    |    |    |    |    |    |    |    |
|---------------------------------------------------------|---|-----------|----|----|----|----|----|----|----|----|
| Number of mechanical operating cycles /M-classification | n | 1000 / M0 |    |    |    |    |    |    |    | →  |
| Number of short-circuit making operations with $I_{ma}$ | n | 5         | 5  | 5  | 5  | 5  | 5  | 5  | 5  | 5  |
| Classification                                          |   | E2        | E2 | E2 | E2 | E2 | E2 | E2 | E2 | E2 |

<sup>\*)</sup> As design option, on request according to some national requirements (e.g.: GOST, GB, ...)

<sup>\*\*)</sup> The rated normal currents apply to ambient air temperatures of max. 40 °C.

The 24-hour mean value is max. 35 °C (acc. to IEC 62271-1/VDE 0671-1)

□) Only for CB-f

| 1) Definition of the different types of vacuum circuit-breakers (= VCB): |               |                                                                                                   | VCB version:             |                       |
|--------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------|--------------------------|-----------------------|
| Panel type                                                               | VCB type      | Vacuum circuit-breaker – Design:                                                                  | without AR <sup>3)</sup> | with AR <sup>3)</sup> |
| L, L1                                                                    | CB-f          | fixed-mounted in gas-insulated switching-device vessel, combined with three-position disconnecter | CB-f NAR                 | CB-f AR               |
| L1(r), L2(r)                                                             | CB-r (SION L) | air-insulated, removable, separate three-position disconnecter                                    |                          | CB-r AR               |

3) AR = Automatic reclosing; NAR = Non-automatic reclosing

4) VCB in switching-device vessel (maintenance-free under normal ambient conditions according to IEC 62271-1)

# Product Range

## Product range overview

### Standard panels (examples)



R-HA41-116a.tif

Ring-main panel, type R



R-HA41-117a.tif

Transformer panel, type T

### Circuit-breaker panel



R-HA41-137a.tif

Circuit-breaker panel, type L with CB type "CB-f NAR" 2) (500 mm)

| Application as: | Panel designation | Panel type | Panel width mm | Rated current |  |
|-----------------|-------------------|------------|----------------|---------------|--|
|                 |                   |            |                |               |  |

### Column No.

|                                          |                                                                                     |          |     |                      |  |
|------------------------------------------|-------------------------------------------------------------------------------------|----------|-----|----------------------|--|
| Cable feeder panels                      | Ring-main panel 1)                                                                  | R        | 375 | 630 A, 800 A         |  |
|                                          |                                                                                     | R1       | 500 | 630 A, 800 A         |  |
|                                          | Transformer panel 1)                                                                | T        | 375 | 200 A                |  |
|                                          |                                                                                     | T1       | 500 | 200 A                |  |
|                                          | Cable panel                                                                         | K        | 375 | 630 A                |  |
|                                          |                                                                                     | K1       | 500 | 630 A, 1250 A        |  |
|                                          | Circuit-breaker panel (fixed-mounted CB, gas-insul.) 1)<br>(with CB type "CB-f" 2)) | L        | 500 | 630 A                |  |
| Transfer panels                          |                                                                                     | L1       | 750 | 630 A, 1250 A Δ)     |  |
|                                          | Circuit-breaker panel (removable CB) type "CB-r"                                    | L1(r)    | 750 | 630 A                |  |
|                                          |                                                                                     | L2(r)    | 875 | 1250 A               |  |
|                                          | Disconnecter panel 1)                                                               | D1 Δ)    | 500 | 1250 A Δ)            |  |
|                                          | Ring-main transfer panel 1)                                                         | R(T)     | 375 | 630 A, 800 A         |  |
|                                          | Ring-main transfer panel 1)                                                         | R1(T)    | 500 | 630 A                |  |
|                                          | Circuit-breaker transfer panel 1)                                                   | L(T)     | 500 | 630 A                |  |
| Metering panels and other panel versions | Circuit-breaker transfer panel 1)                                                   | L1(T)    | 750 | 630 A, 1250 A        |  |
|                                          | Circuit-breaker transfer panel (removable CB)                                       | L1(r, T) | 750 | 630 A                |  |
|                                          |                                                                                     | L2(r, T) | 875 | 1250 A               |  |
|                                          | Disconnecter transfer panel 1)                                                      | D1(T)    | 500 | 1250 A               |  |
|                                          | Metering panel as billing metering panel                                            | M        | 750 | 630 A, 800 A, 1250 A |  |
|                                          | Metering panel with cable connection                                                | M(-K)    | 750 | 630 A, 800 A, 1250 A |  |
|                                          | Metering panel with busbar connection                                               | M(-B)    | 750 | 630 A, 800 A, 1250 A |  |
|                                          | Metering panel with busbar and cable connection                                     | M(-BK)   | 750 | 630 A, 800 A, 1250 A |  |
|                                          | Metering panel with cable connection: Individual panel                              | M(KK)    | 750 | 630 A, 800 A         |  |
|                                          | Busbar voltage metering panel                                                       | M(VT)    | 375 | 200 A                |  |
|                                          | Busbar voltage metering panel                                                       | M1(VT)   | 500 | 200 A                |  |
|                                          | Busbar voltage metering panel with fuse                                             | M(VT-F)  | 375 | 200 A                |  |
|                                          | Busbar voltage metering panel with fuse                                             | M1(VT-F) | 500 | 200 A                |  |
| Busbar earthing panel                    | Bus riser panel                                                                     | H        | 375 | 630 A, 800 A, 1250 A |  |
|                                          | Metering panel / bus riser panel                                                    | H1       | 500 | 630 A, 1250 A        |  |
|                                          | Busbar earthing panel                                                               | E        | 375 | –                    |  |

- Available
- Optionally available
- Not applicable

|  | <div>Three-phase CT</div> <div>CT as cast-resin CT (e.g. type 4MA)</div> <div>CT as cable-type CT</div> <div>VT (1-pole) as cast-resin VT</div> <div>VT (2-pole) as cast-resin VT</div> <div>2<sup>nd</sup> cable</div> <div>3<sup>rd</sup> cable</div> <div>Surge arrester instead of 2<sup>nd</sup> cable (3<sup>rd</sup> cable)</div> <div>LSC category (Loss of service continuity category)</div> <div>Rated voltage</div> |   |   |   |   |                   |   |                   |       |         | Panel type |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|-------------------|---|-------------------|-------|---------|------------|
|  | 1                                                                                                                                                                                                                                                                                                                                                                                                                               | 2 | 3 | 4 | 5 | 6                 | 7 | 8                 | 9     | 10      |            |
|  | ●                                                                                                                                                                                                                                                                                                                                                                                                                               | – | ● | – | – | ○ (up to 17.5 kV) | – | ○ (up to 17.5 kV) | LSC 2 | 24 kV   | R          |
|  | ●                                                                                                                                                                                                                                                                                                                                                                                                                               | ● | ● | ○ | – | ○                 | – | ○                 |       | 24 kV   | R1         |
|  | –                                                                                                                                                                                                                                                                                                                                                                                                                               | – | ● | – | – | –                 | – | –                 | LSC 2 | 24 kV   | T          |
|  | –                                                                                                                                                                                                                                                                                                                                                                                                                               | – | ● | – | – | –                 | – | –                 |       | 24 kV   | T1         |
|  | –                                                                                                                                                                                                                                                                                                                                                                                                                               | – | ● | ○ |   | ○ (up to 17.5 kV) | – | ○ (up to 17.5 kV) | LSC 1 | 24 kV   | K          |
|  | –                                                                                                                                                                                                                                                                                                                                                                                                                               | ● | ● | ○ |   | ○                 | – | ○                 |       | 24 kV   | K1         |
|  | ●                                                                                                                                                                                                                                                                                                                                                                                                                               | ● | ● | ○ |   | ○                 |   | ○                 | LSC 2 | 24 kV   | L          |
|  | ●                                                                                                                                                                                                                                                                                                                                                                                                                               | ● | ● | ○ |   | ○                 | ○ | ○                 |       | 24 kV   | L1         |
|  | ●                                                                                                                                                                                                                                                                                                                                                                                                                               | ● | ● | ○ |   | ○                 | – | ○                 | LSC 2 | 24 kV   | L1(r)      |
|  | ●                                                                                                                                                                                                                                                                                                                                                                                                                               | ● | ● | ○ |   | ○                 | ○ | ○                 |       | 24 kV   | L2(r)      |
|  | ●                                                                                                                                                                                                                                                                                                                                                                                                                               | ● | ● | ○ |   | ○                 | – | ○                 | LSC 2 | 24 kV   | D1 △)      |
|  | –                                                                                                                                                                                                                                                                                                                                                                                                                               |   | – |   |   | –                 | – | –                 | LSC 2 | 24 kV   | R(T)       |
|  | –                                                                                                                                                                                                                                                                                                                                                                                                                               |   | – |   |   | –                 | – | –                 | LSC 2 | 24 kV   | R1(T)      |
|  | ●                                                                                                                                                                                                                                                                                                                                                                                                                               | ● | – | ○ | – | –                 | – | –                 | LSC 2 | 24 kV   | L(T)       |
|  | ●                                                                                                                                                                                                                                                                                                                                                                                                                               | ● | – | ○ | – | –                 | – | –                 | LSC 2 | 24 kV   | L1(T)      |
|  | ●                                                                                                                                                                                                                                                                                                                                                                                                                               | ● | – | ○ | – | –                 | – | –                 | LSC 2 | 24 kV   | L1(r, T)   |
|  | ●                                                                                                                                                                                                                                                                                                                                                                                                                               | ● | – | ○ | – | –                 | – | –                 |       | 24 kV   | L2(r, T)   |
|  | –                                                                                                                                                                                                                                                                                                                                                                                                                               |   | – |   |   | –                 | – | –                 | LSC 2 | 24 kV   | D1(T)      |
|  | –                                                                                                                                                                                                                                                                                                                                                                                                                               | ● | – | ○ | ○ | –                 | – | –                 | LSC 1 | 24 kV   | M          |
|  | –                                                                                                                                                                                                                                                                                                                                                                                                                               | ● |   | ○ | ○ | ○                 | – | ○                 |       | 24 kV   | M(-K)      |
|  | –                                                                                                                                                                                                                                                                                                                                                                                                                               | ● | – | ○ | ○ | –                 | – | –                 |       | 24 kV   | M(-B)      |
|  | –                                                                                                                                                                                                                                                                                                                                                                                                                               | ● |   | ○ | ○ | ○                 | – | ○                 |       | 24 kV   | M(-BK)     |
|  | –                                                                                                                                                                                                                                                                                                                                                                                                                               | ● |   | ○ | ○ | ○                 | – | ○                 |       | 24 kV   | M(KK)      |
|  | –                                                                                                                                                                                                                                                                                                                                                                                                                               | – | – | ○ |   | –                 | – | –                 | LSC 2 | 17.5 kV | M(VT)      |
|  | –                                                                                                                                                                                                                                                                                                                                                                                                                               | – | – | ○ |   | –                 | – | –                 |       | 24 kV   | M1(VT)     |
|  | –                                                                                                                                                                                                                                                                                                                                                                                                                               | – | – | ○ |   | –                 | – | –                 |       | 17.5 kV | M(VT-F)    |
|  | –                                                                                                                                                                                                                                                                                                                                                                                                                               | – | – | ○ |   | –                 | – | –                 |       | 24 kV   | M1(VT-F)   |
|  | –                                                                                                                                                                                                                                                                                                                                                                                                                               | ○ | – | ○ | – | –                 | – | –                 | LSC 1 | 24 kV   | H          |
|  | –                                                                                                                                                                                                                                                                                                                                                                                                                               | ○ | – | ○ | ○ | –                 | – | –                 | LSC 1 | 24 kV   | H1         |
|  | –                                                                                                                                                                                                                                                                                                                                                                                                                               | – | – | – | – | –                 | – | –                 | LSC 2 | 24 kV   | E          |

△) In preparation

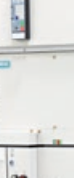
- 1) Panel type:  
Metal-clad
- 2) Type designation  
of vacuum  
circuit-breaker

## Product range overview

R-HA41-119a.tif



R-HA41-141.tif



R-HA41-139a.tif

| Panel designation | Panel type | Panel width mm |  |
|-------------------|------------|----------------|--|
|-------------------|------------|----------------|--|

|                                                                          |                     |                      |            |  |
|--------------------------------------------------------------------------|---------------------|----------------------|------------|--|
| Ring-main panel <sup>1)</sup>                                            | as feeder           | R<br>R1              | 375<br>500 |  |
|                                                                          | as transfer         | R(T)<br>R1(T)        | 375<br>500 |  |
| Transformer panel <sup>1)</sup>                                          | as feeder           | T<br>T1              | 375<br>500 |  |
| Cable panel                                                              | as feeder           | K<br>K1              | 375<br>500 |  |
| Circuit-breaker panel <sup>1)</sup><br>with CB type "CB-f" <sup>2)</sup> | as feeder           | L<br>L1              | 500<br>750 |  |
|                                                                          | as transfer         | L(T)<br>L1(T)        | 500<br>750 |  |
| Circuit-breaker panel <sup>1)</sup><br>with CB type 3AE <sup>2)</sup>    | as feeder           | L1(r)<br>L2(r)       | 750<br>875 |  |
|                                                                          | as transfer         | L1(r, T)<br>L2(r, T) | 750<br>875 |  |
| Metering panels<br>(as billing metering panel)                           | standard            | M<br>M(-B)           | 750<br>750 |  |
|                                                                          | as end panel        | M(-K)<br>M(-BK)      | 750<br>750 |  |
| Metering panel                                                           | as individual panel | M(KK)                | 750        |  |
| Busbar voltage<br>metering panel <sup>1)</sup>                           |                     | M(VT)                | 375        |  |
|                                                                          |                     | M1(VT)               | 500        |  |
|                                                                          |                     | M(VT-F)              | 375        |  |
|                                                                          |                     | M1(VT-F)             | 500        |  |
| Bus riser panel                                                          |                     | H                    | 375        |  |
| Metering panel / bus riser panel                                         |                     | H1                   | 500        |  |
| Disconnecter panel <sup>1)</sup>                                         | as feeder           | D1 <sup>Δ)</sup>     | 500        |  |
|                                                                          | as transfer         | D1(T)                | 500        |  |
| Busbar earthing panel                                                    |                     | E                    | 375        |  |

2) Type designation of vacuum circuit-breaker

- Basic equipment
- Additional equipment (option), further additional equipment on request
- Not available

|  | 1               | 2 | 3 | 4               | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16              | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | Panel type |
|--|-----------------|---|---|-----------------|---|---|---|---|---|----|----|----|----|----|----|-----------------|----|----|----|----|----|----|----|----|----|----|------------|
|  | ● <sup>1)</sup> | ● | – | ●               | ● | – | ● | ○ | ○ | ○  | ○  | –  | –  | ○  | –  | ○               | ○  | –  | –  | ○  | ○  | ○  | ○  | ○  | ○  | –  | R          |
|  | ●               | ● | – | –               | ● | – | ● | ○ | ○ | ○  | ○  | –  | –  | ○  | –  | –               | ○  | –  | –  | ○  | –  | ○  | ○  | ○  | ○  | –  | R(T)       |
|  | ●               | ● | – | ● <sup>8)</sup> | ● | ○ | ● | ○ | ○ | ○  | ○  | –  | ●  | ○  | ○  | ●               | ○  | –  | –  | ○  | –  | ○  | ○  | ○  | ○  | ○  | T          |
|  | –               | – | ● | ●               | ● | – | – | – | – | –  | –  | –  | –  | –  | –  | ○               | ○  | –  | –  | –  | ○  | ○  | ○  | ○  | ○  | ○  | K          |
|  | ● <sup>2)</sup> | ● | – | ●               | ● | ○ | ● | ○ | ○ | ○  | ○  | ●  | –  | ○  | –  | ○               | ○  | ○  | ○  | ○  | ○  | ○  | ○  | ○  | ○  | ○  | K1         |
|  | ● <sup>2)</sup> | ● | – | –               | ● | ○ | ● | ○ | ○ | ○  | ○  | ●  | –  | ○  | –  | –               | ○  | ○  | ○  | ○  | ○  | ○  | ○  | ○  | ○  | ○  | L          |
|  | ● <sup>2)</sup> | ● | – | –               | ● | ○ | ● | ○ | ○ | ○  | ○  | ●  | –  | ○  | –  | –               | ○  | ○  | ○  | ○  | ○  | ○  | ○  | ○  | ○  | ○  | L(T)       |
|  | ● <sup>2)</sup> | ● | – | –               | ● | ○ | ● | ○ | ○ | ○  | ○  | ●  | –  | ○  | –  | ○ <sup>6)</sup> | ○  | ○  | ○  | ○  | ○  | ○  | ○  | ○  | ○  | ○  | L1(T)      |
|  | ● <sup>2)</sup> | ● | – | –               | ● | ○ | ● | ○ | ○ | ○  | ○  | ●  | –  | ○  | –  | –               | ○  | ○  | ○  | ○  | ○  | ○  | ○  | ○  | ○  | ○  | L1(r)      |
|  | –               | – | ● | –               | ● | – | – | – | – | –  | –  | –  | –  | –  | –  | ○               | ○  | –  | –  | –  | –  | ○  | ○  | ○  | ○  | ○  | L2(r)      |
|  | –               | – | ● | ●               | ● | – | – | – | – | –  | –  | –  | –  | –  | –  | ○               | ○  | –  | –  | –  | –  | ○  | ○  | ○  | ○  | ○  | L1(r, T)   |
|  | –               | – | ● | ●               | ● | – | – | – | – | –  | –  | –  | –  | –  | –  | ○               | ○  | –  | –  | –  | –  | ○  | ○  | ○  | ○  | ○  | L2(r, T)   |
|  | –               | – | ● | ●               | ● | – | – | – | – | –  | –  | –  | –  | –  | –  | ○               | ○  | –  | –  | –  | –  | ○  | ○  | ○  | ○  | ○  | M          |
|  | –               | – | ● | ●               | ● | – | – | – | – | –  | –  | –  | –  | –  | –  | ○               | ○  | –  | –  | –  | –  | ○  | ○  | ○  | ○  | ○  | M(-B)      |
|  | –               | – | ● | ●               | ● | – | – | – | – | –  | –  | –  | –  | –  | –  | ○               | ○  | –  | –  | –  | –  | ○  | ○  | ○  | ○  | ○  | M(-K)      |
|  | –               | – | ● | ●               | ● | – | – | – | – | –  | –  | –  | –  | –  | –  | ○               | ○  | –  | –  | –  | –  | ○  | ○  | ○  | ○  | ○  | M(-BK)     |
|  | –               | – | ● | ●               | ● | – | – | – | – | –  | –  | –  | –  | –  | –  | ○               | ○  | –  | –  | –  | –  | ○  | ○  | ○  | ○  | ○  | M(KK)      |
|  | ● <sup>1)</sup> | ● | – | –               | ● | – | ● | ○ | ○ | ○  | ○  | –  | –  | –  | ○  | –               | ○  | –  | –  | ○  | –  | ○  | ○  | ○  | ○  | ○  | M(VT)      |
|  | ● <sup>1)</sup> | ● | – | –               | ● | – | ● | ○ | ○ | ○  | ○  | –  | –  | –  | ○  | –               | ○  | –  | –  | ○  | –  | ○  | ○  | ○  | ○  | ○  | M1(VT)     |
|  | ● <sup>1)</sup> | ● | – | –               | ● | – | ● | ○ | ○ | ○  | ○  | –  | –  | –  | ○  | ○               | ○  | –  | –  | ○  | –  | ○  | ○  | ○  | ○  | ○  | M(VT-F)    |
|  | ● <sup>1)</sup> | ● | – | –               | ● | – | ● | ○ | ○ | ○  | ○  | –  | –  | –  | ○  | ○               | ○  | –  | –  | ○  | –  | ○  | ○  | ○  | ○  | ○  | M1(VT-F)   |
|  | –               | – | ● | –               | ● | – | – | – | – | –  | –  | –  | –  | –  | –  | ○               | ○  | –  | –  | –  | –  | ○  | ○  | ○  | ○  | ○  | H          |
|  | –               | – | ● | –               | ● | – | – | – | – | –  | –  | –  | –  | –  | –  | ○               | ○  | –  | –  | –  | –  | ○  | ○  | ○  | ○  | ○  | H1         |
|  | ●               | ● | – | ●               | ● | – | ● | ○ | ○ | ○  | ○  | –  | –  | ○  | –  | ○               | ○  | –  | –  | ○  | ○  | ○  | ○  | ○  | ○  | ○  | D1 △)      |
|  | ●               | ● | – | –               | ● | – | ● | ○ | ○ | ○  | ○  | –  | –  | ○  | –  | –               | ○  | –  | –  | ○  | –  | ○  | ○  | ○  | ○  | ○  | D1(T) △)   |
|  | ●               | – | ● | –               | ● | – | ● | ○ | ○ | –  | –  | –  | –  | –  | –  | ○               | ○  | –  | –  | ○  | –  | ○  | ○  | ○  | ○  | ○  | E          |

△) In preparation

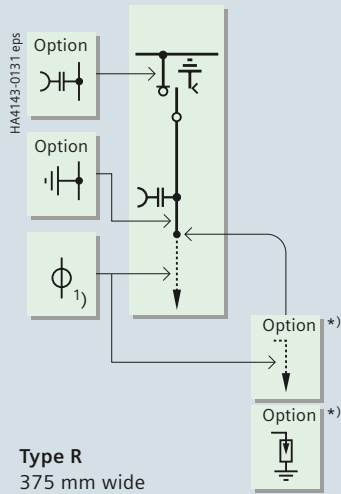
- 1) Three-position switch as three-position switch-disconnector
- 2) Three-position switch as three-position disconnector
- 4) In special cases, deeper floor cover for panels with cable feeder required. Design of floor cover: Depending of direction of pressure relief

- 5) Not to be applied for versions with separate feeder earthing switch in panel types L1(r), L2(r)
- 6) Inspection window is a standard equipment in panel types L1(r), L2(r) for versions with separate earthing switch at the cable feeder
- 7) Or for earthing switch in panel type E
- 8) For panel type T with a rated voltage of 24 kV: Deeper cable fixing located underneath the panel

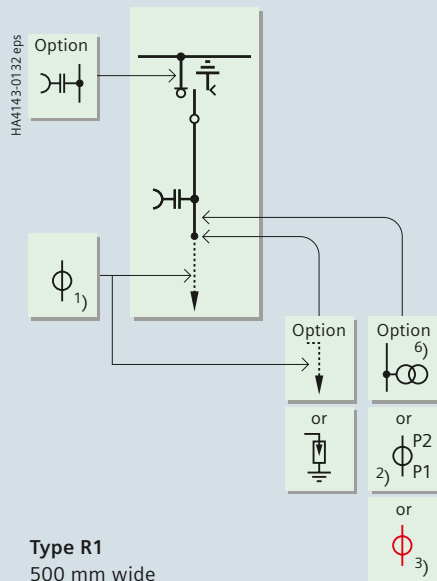
# Product Range

Ring-main panels, cable panels, busbar earthing panels

## Ring-main panels as feeder panels

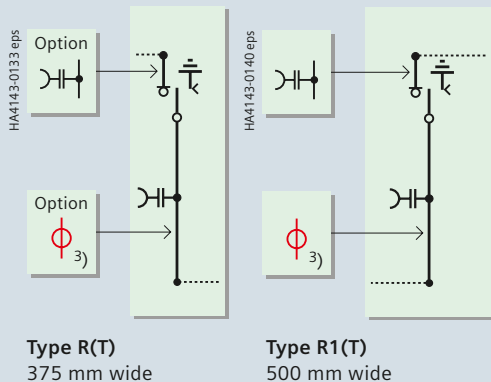


**Type R**  
375 mm wide



**Type R1**  
500 mm wide

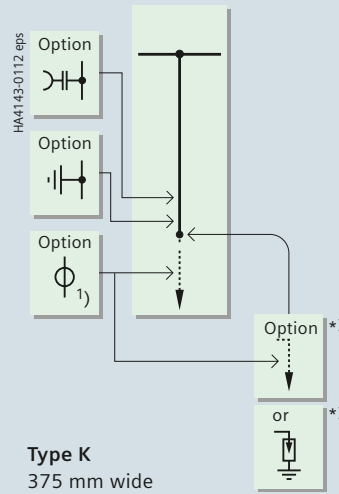
## Ring-main panel as transfer panel for attachment to panel types M, M(-K), H      types L1(r, T)



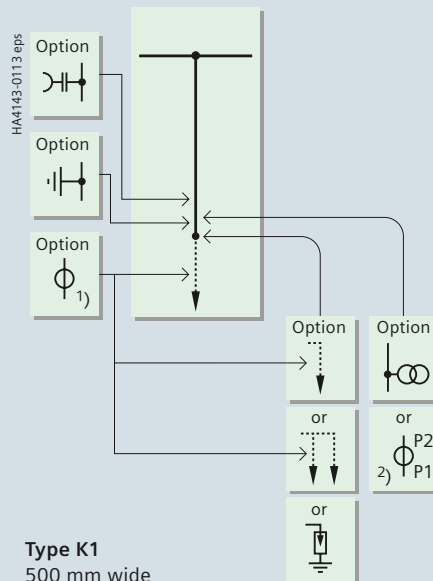
**Type R(T)**  
375 mm wide

**Type R1(T)**  
500 mm wide

## Cable panels as feeder panels, 630 A

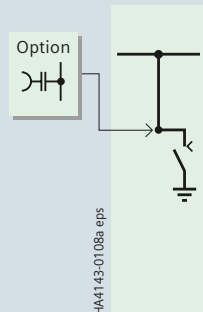


**Type K**  
375 mm wide



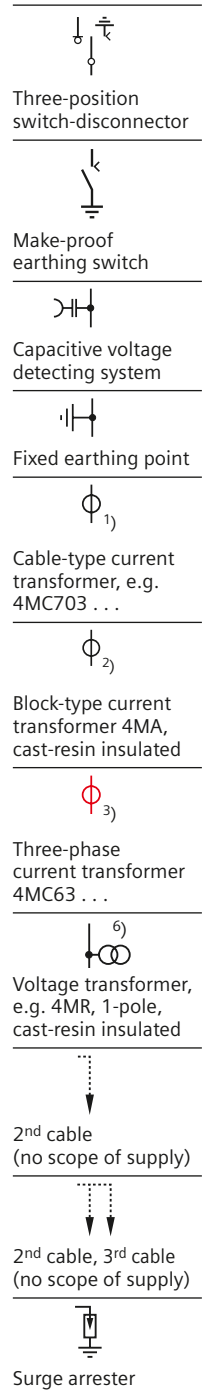
**Type K1**  
500 mm wide

## Busbar earthing panel



**Type E**  
375 mm wide

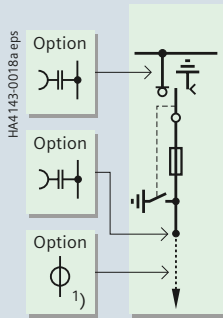
Panel equipment with devices and current and voltage transformers depends on the rated voltage and the panel type (e.g. L1, R) as well as on the panel combination [e.g. R(T)]



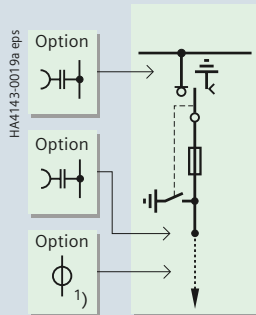
\*) Option: Up to  $U_r=17.5$  kV

2) P1 and P2 are terminal designations of the current transformer

## Transformer panels as feeder panels

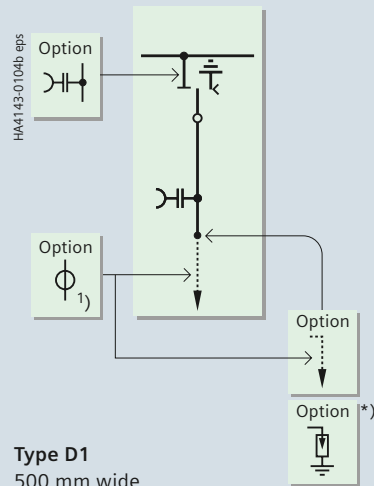


**Type T**  
375 mm wide

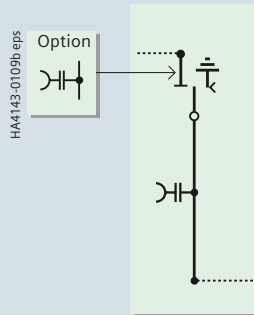


**Type T1**  
500 mm wide

## Disconnector panels as feeder panels $\Delta$ )

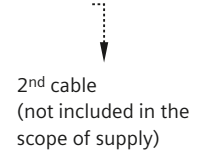
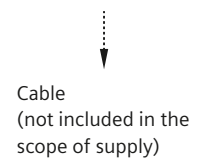
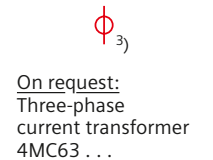
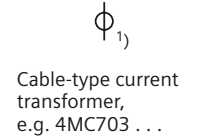
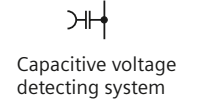
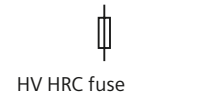
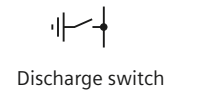
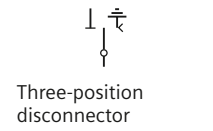
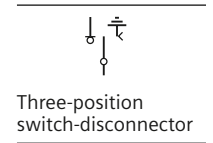


**Type D1**  
500 mm wide



**Type D1(T)**  
500 mm wide

Panel equipment with devices and current and voltage transformers depends on the rated voltage and the panel type (e.g. L1, R) as well as on the panel combination [e.g. R(T)]



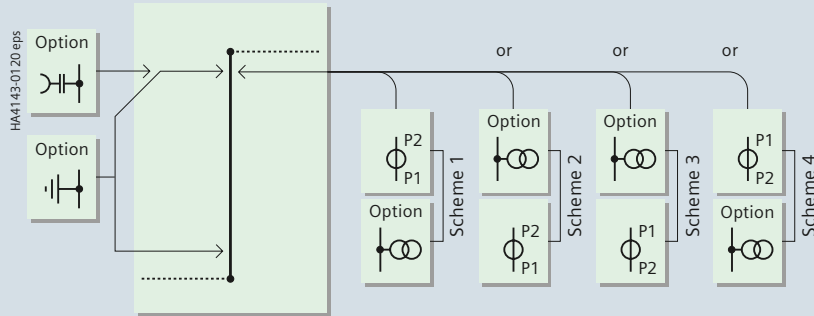
\*) On request

$\Delta$ ) In preparation

# Product Range

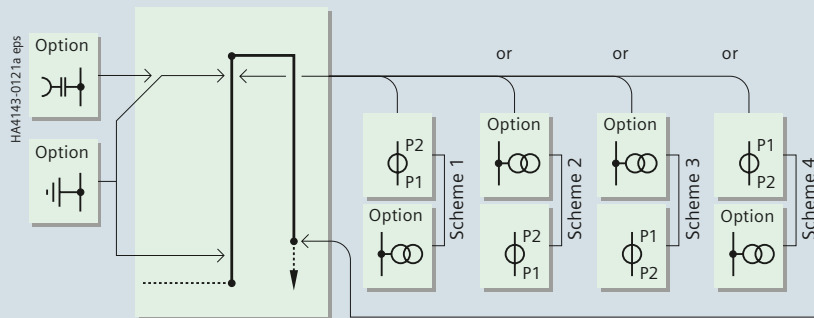
Metering panels as billing metering panel

## Billing metering panels 630 A, 800 A, 1250 A Standard



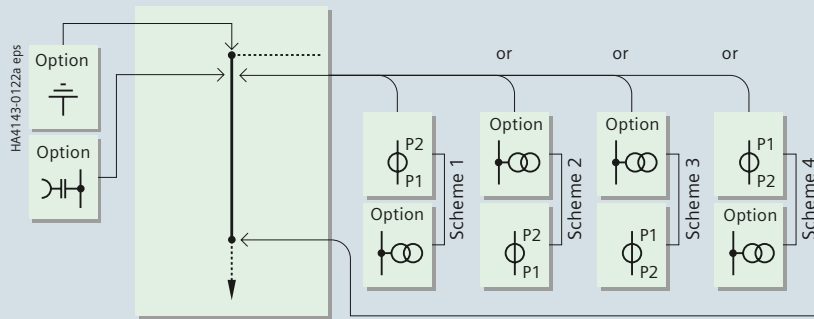
Type M 750 mm wide

## Billing metering panels 630 A, 800 A, 1250 A for cable connection



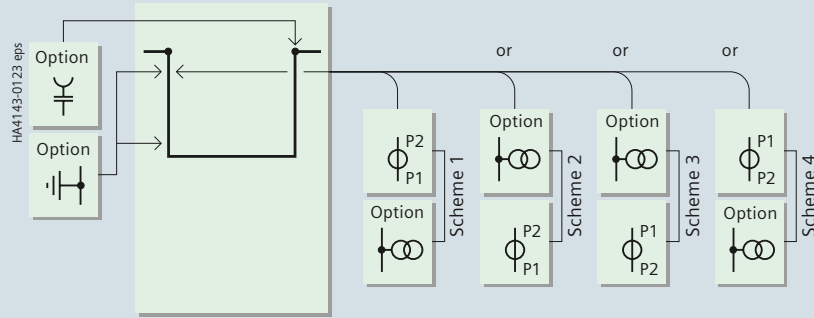
Type M(-K) 750 mm wide

## Billing metering panels 630 A, 800 A, 1250 A for busbar connection



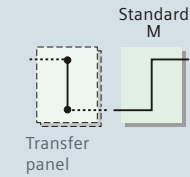
Type M(-BK) 750 mm wide

## Billing metering panels 630 A, 800 A, 1250 A for busbar connection



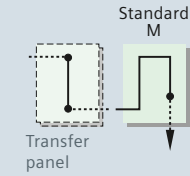
Type M(-B) 750 mm wide

### Panel design of M



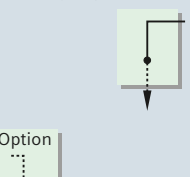
Standard:  
For transfer  
to the right

### Panel design of M(K)

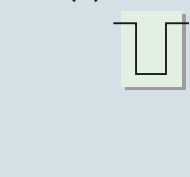


Standard:  
For transfer  
to the right

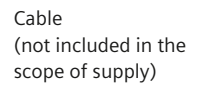
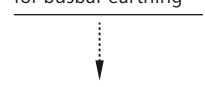
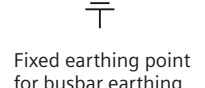
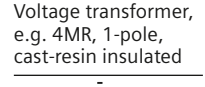
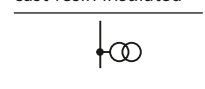
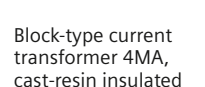
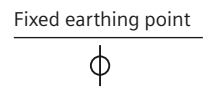
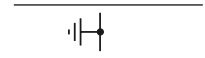
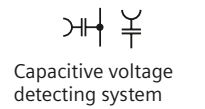
### Panel design of M(-BK)



### Panel design of M(-B)



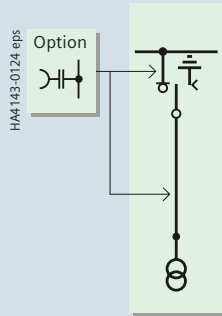
Panel equipment with devices and current and voltage transformers depends on the rated voltage and the panel type (e.g. L1, R) as well as on the panel combination [e.g. R(T)]



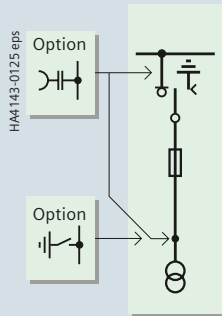
2) P1 and P2 are terminal designations of the current transformer

## Busbar voltage metering panels

up to 17.5 kV

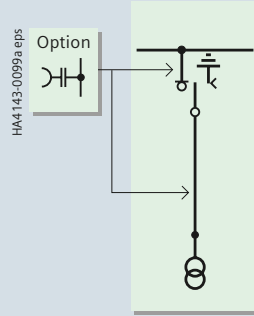


**Type M(VT)**  
375 mm wide

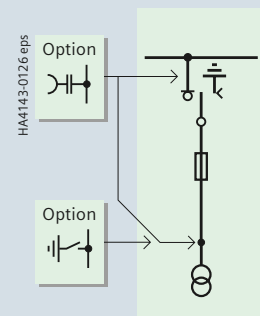


**Type M(VT-F)**  
375 mm wide

up to 24 kV

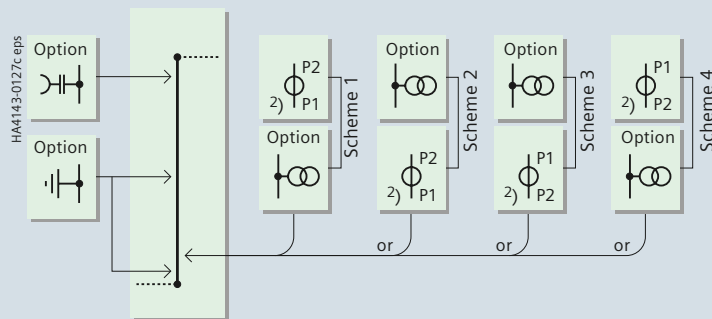


**Type M1(VT)**  
500 mm wide

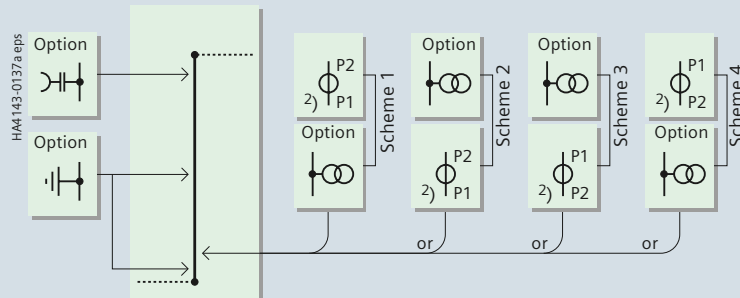


**Type M1(VT-F)**  
500 mm wide

## Metering panel and/or bus riser panels



**Type H, 630 A, 800 A, 1250 A**  
375 mm wide



**Type H1, 630 A, 1250 A**  
500 mm wide

Schemes 1 to 4 depend on:  
– Rated voltage  $U_r$   
– Panel combinations (TC-xx)  
with the adjacent panel types

Panel equipment with devices and current and voltage transformers depends on the rated voltage and the panel type (e.g. L1, R) as well as on the panel combination [e.g. R(T)]



Three-position  
switch-disconnector



Capacitive voltage  
detecting system



Fixed earthing point



HV HRC fuse



Voltage transformer,  
e.g. 4MR, 1-pole,  
cast-resin insulated



Discharge switch



Block-type current  
transformer 4MA,  
cast-resin insulated



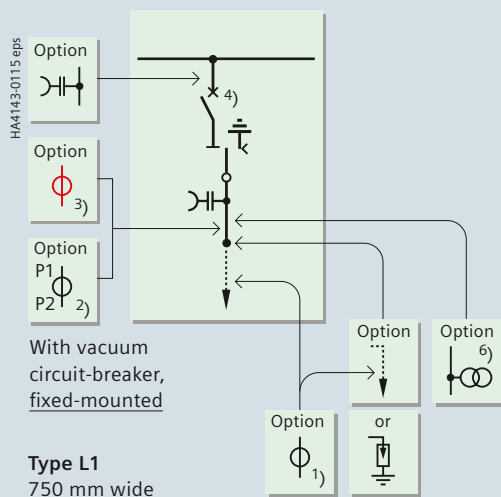
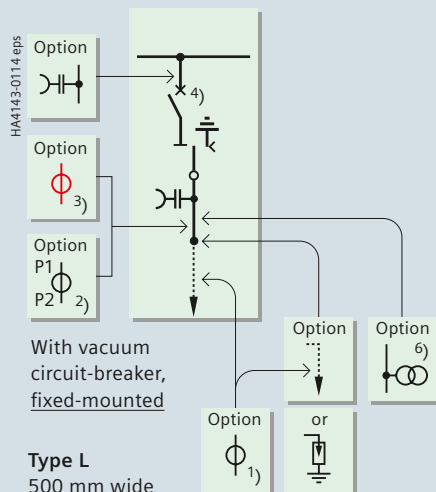
Voltage transformer,  
e.g. 4MR, 1-pole,  
cast-resin insulated

<sup>2)</sup> P1 and P2 are terminal designations of the current transformer

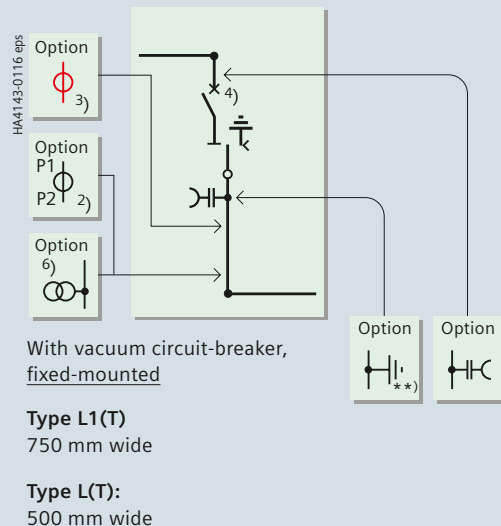
# Product Range

Circuit-breaker panels

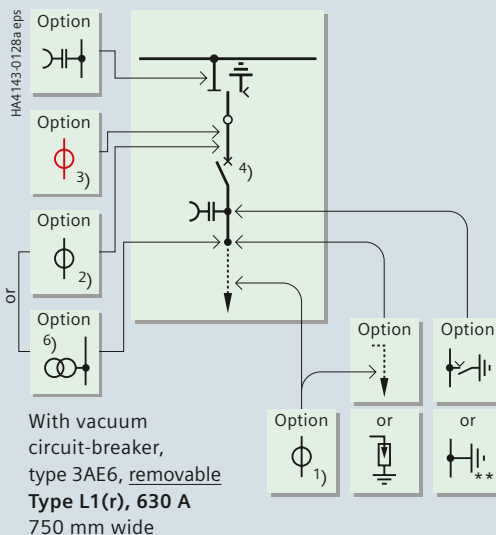
## Circuit-breaker panels 630 A as feeder panels



## as transfer panel for attachment to panel types M or H or R(T), D1(T)

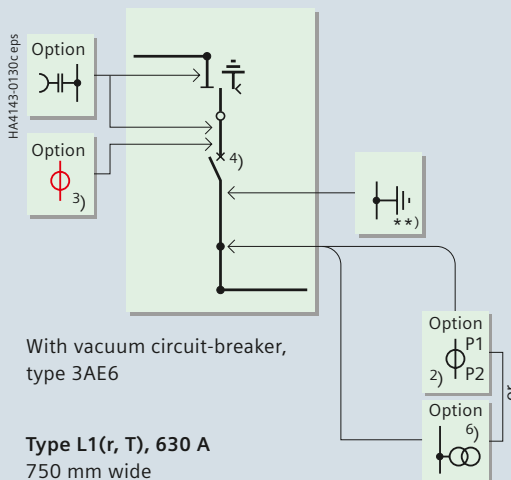


## Circuit-breaker panels 630 A, 1250 A as feeder panels



## **Type L2(r), 1250 A** 875 mm wide

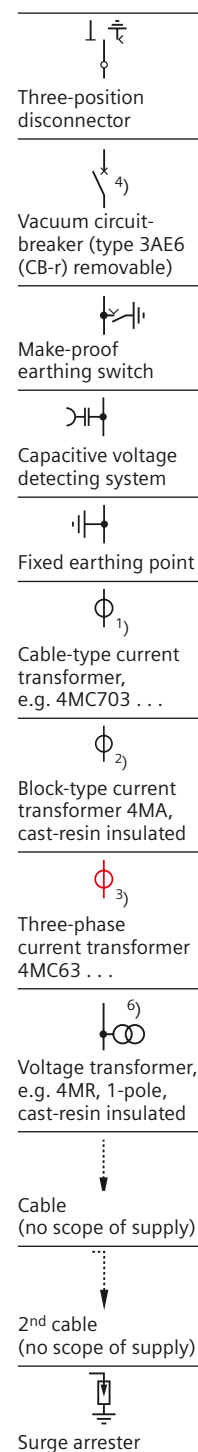
## as transfer panel for attachment to panel types, see table below



\*\*) Standard: Feeder earthing via the vacuum circuit-breaker type 3AE6 (with interlocks, without earthing switch)

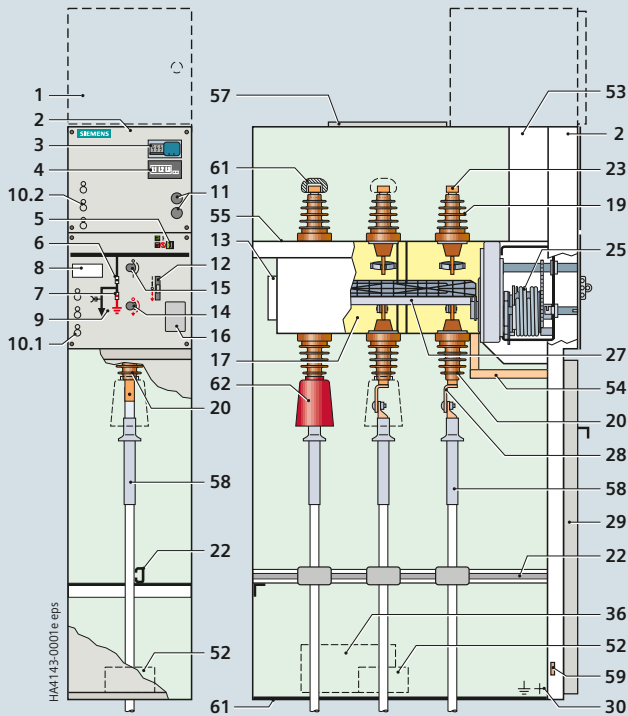
| Panel combinations | Design   | Rated current |
|--------------------|----------|---------------|
| L1(r, T) + H1      | Standard | 630 A         |
| L1(r, T) + R1(T)   | Standard | 630 A         |
| L2(r, T) + D1(T)   | Standard | 1250 A        |
| L2(r, T) + H1      | Standard | 1250 A        |

Panel equipment with devices and current and voltage transformers depends on the rated voltage and the panel type (e.g. L1, R) as well as on the panel combination [e.g. R(T)]



2) P1 and P2 are terminal designations of the current transformer

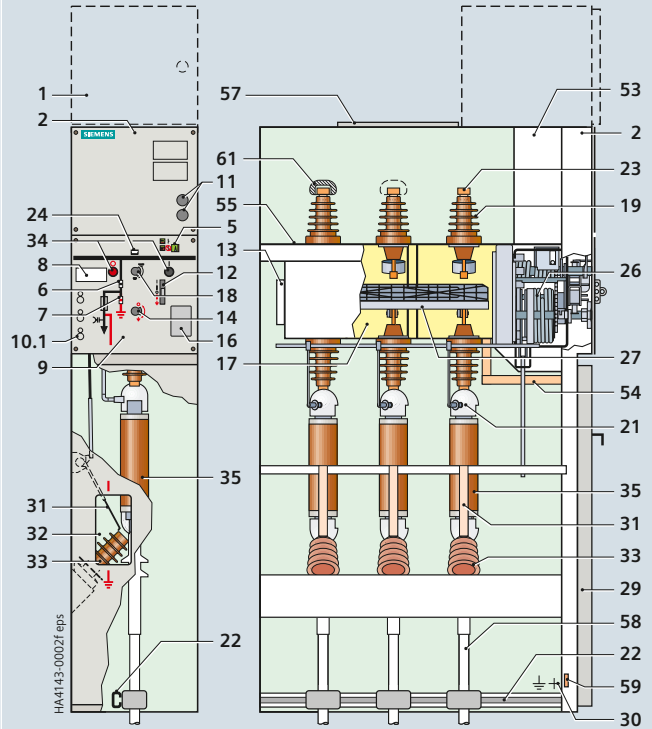
Ring-main panel as feeder



Type R

Section

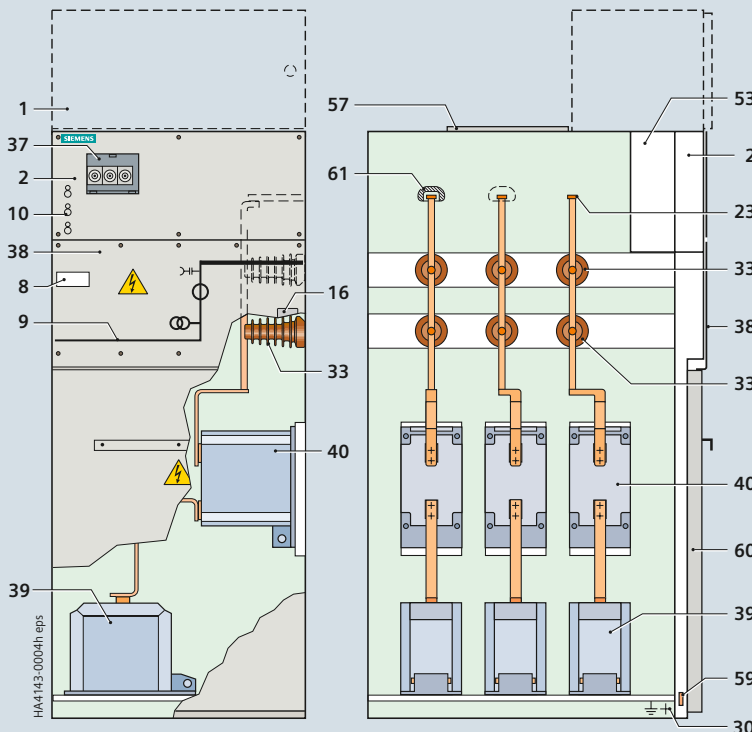
Transformer panel as feeder



Type T

Section

Billing metering panel



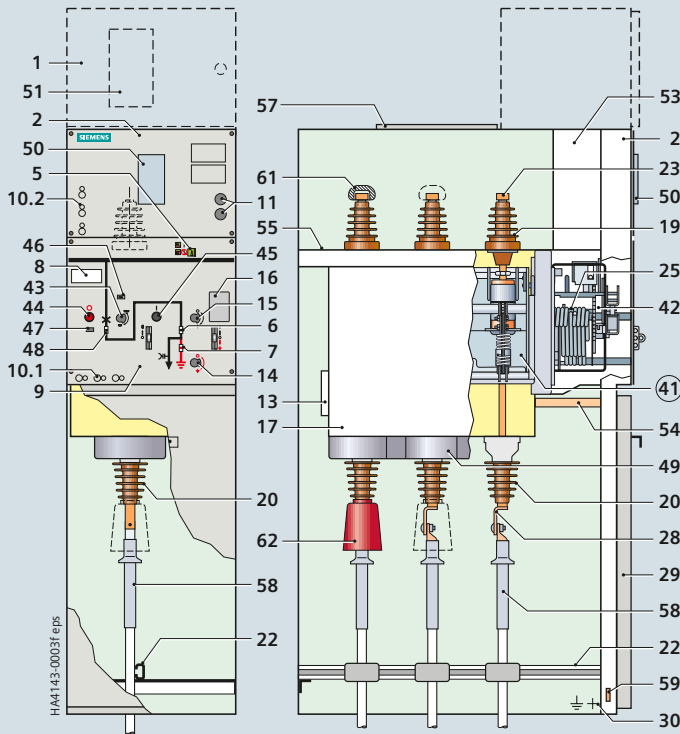
Type M

Section

Legend for pages 23 and 24 (contin. on page 24)

- 1 Option: Low-voltage compartment
- 2 Niche for optional low-voltage equipment, cover can be unscrewed
- 3 Option: CAPDIS-Sx voltage detecting system
- 4 Option: Short-circuit/earth-fault indicator
- 5 Option: Ready-for-service indicator for switching device
- 6 Position indication for load-break function "CLOSED – OPEN"
- 7 Position indication for earthing function "OPEN – EARTHED"
- 8 Feeder designation label
- 9 Mimic diagram
- 10 Option: Sockets for capacitive voltage detecting system (depending on arrangement)
- 10.1 for feeder
- 10.2 for busbar
- 11 Option: Momentary-contact rotary control switch "CLOSED – OPEN" for motor operating mechanism with local-remote switch for three-position switch-disconnector
- 12 Option: Locking device for three-position switch-disconnector
- 13 Pressure relief device for switching device
- 14 Manual operation for the mechanism of the earthing function
- 15 Manual operation for the mechanism of the load-break or disconnecting function in L panels
- 16 Rating and type plate
- 17 Gas-insulated vessel for switching device (contains fluorinated greenhouse gas SF<sub>6</sub>)
- 18 Manual operation for mechanism "spring charging"
- 19 Bushing-type insulator for busbar

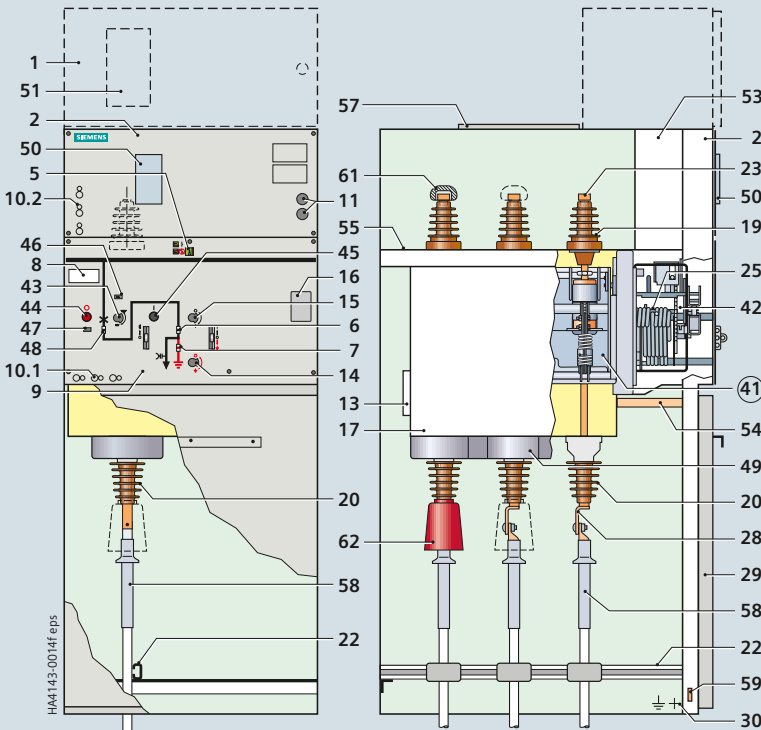
### Circuit-breaker panel (with vacuum circuit-breaker type CB-f NAR)



Type L (500 mm)

Section

### Circuit-breaker panel (with vacuum circuit-breaker type CB-f NAR)



Type L1 (750 mm)

Section

#### Legend for pages 23 and 24

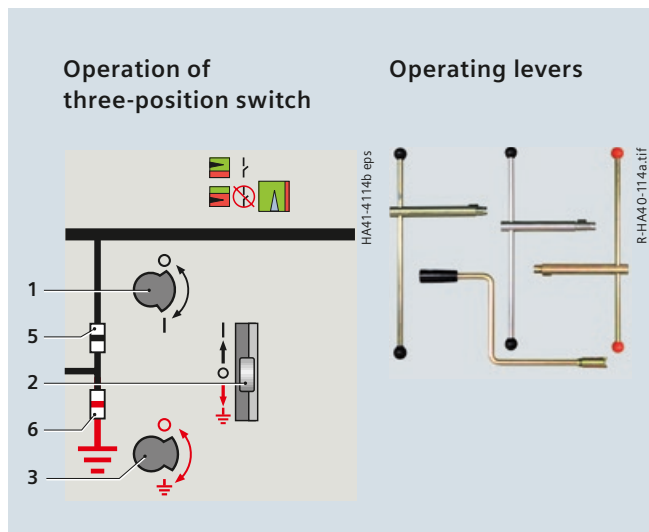
- 20 Bushing-type insulator for feeder
- 21 Terminal for HV HRC fuse assembly (with tripping)
- 22 Cable bracket with cable clamps (option) for fastening cables
- 23 Busbar
- 24 "Spring charged" indicator for stored-energy "OPEN"
- 25 Spring-operated mechanism for three-position switch-disconnector
- 26 Spring-operated / stored-energy mechanism for three-position switch-disconnector
- 27 Three-position switch-disconnector
- 28 Cable connection
- 29 Cable compartment cover
- 30 Earthing connection (for location, see dimension drawings)
- 31 Earthing switch for cable connection
- 32 Inspection window
- 33 Post insulator
- 34 Operation for stored-energy mechanism
  - stored-energy "OPEN" (red)
  - stored-energy "CLOSED" (black)
- 35 Option: HV HRC fuse-link (e = 292 mm or 442 mm)
- 36 Option: Heating in the panel
- 37 Option: Secondary protection for voltage transformer
- 38 Cover, screwed on
- 39 4MR voltage transformer
- 40 4MA7 block-type current transformer

#### Vacuum circuit-breaker:

- 41 Vacuum circuit-breaker, (VCB) fixed-mounted
- 42 Operating mechanism box
- 43 Manual operation for "spring charging"
  - for closing with manual operating mechanism
  - for emergency operation with motor operating mechanism
- 44 Mechanical "OFF" pushbutton
- 45 Mechanical "ON" pushbutton (not supplied with spring-operated mechanism)
- 46 "Spring charged" indicator
- 47 Operations counter (option for VCB type: CB-f NAR)
- 48 Position indicator
- 49 Option: Three-phase current transformer 4MC63
- 50 Option: Overcurrent-time protection relay (type 7SR45 or similar)
- 51 Option: Multifunction protection relay SIPROTEC 5 7SJ82
- 52 Cable-type current transformer
- 53 Niche applicable for control cables and / or bus wires
- 54 Option: Additional earthing busbar for switching-device vessel
- 55 Metallic partition of busbar compartment
- 57 Busbar compartment cover for panel extension
- 58 Cable sealing end (not included in scope of supply)
- 59 Earthing busbar
- 60 Cover for transformer connection compartment
- 61 Insulating cap on the busbar (for  $U_r > 17.5$  kV)
- 62 Insulating cap for cable connection (for  $U_r > 17.5$  kV)

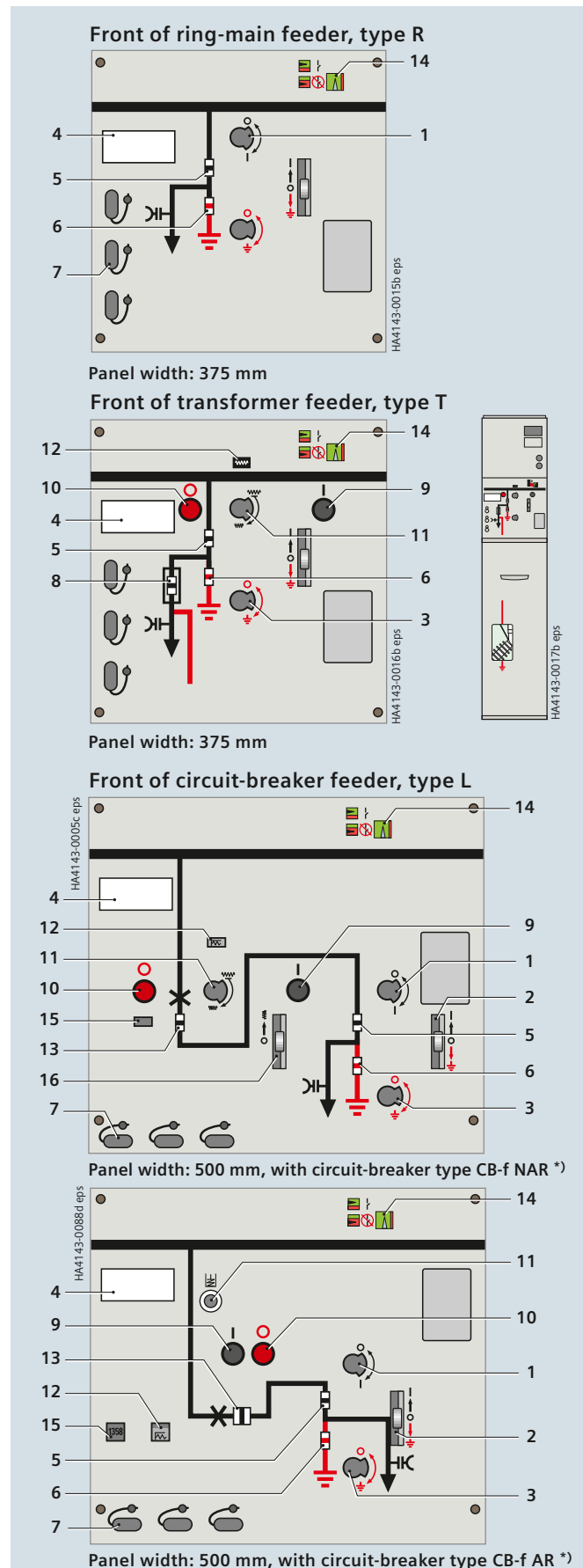
## Control board

The control boards are function-related. They integrate operation, mimic diagram and position indication. Furthermore, the respective indicating, measuring and monitoring equipment as well as locking devices and control elements (e.g. local-remote switch) are arranged there according to the panel type and version. The ready-for-service indicator and rating plates are also located at the operating front. Operation is identical for transformer and circuit-breaker feeders. First, the operating mechanism must be charged; then, closing / opening is done through separate pushbuttons. The condition of the energy store is indicated. All actuating openings are functionally interlocked against each other, and are optionally lockable. The operating lever carries two plug inserts, separately for the disconnecting and earthing function.



- 1 Manual operation of load-break function (R, T) or disconnecting function (L)
- 2 Locking function (option for ring-main feeders)
- 3 Manual operation of earthing function
- 4 Panel designation label
- 5 Position indicator for switch-disconnector
- 6 Position indicator for earthing switch
- 7 Sockets of capacitive voltage detecting system
- 8 "Fuse tripped" indicator
- 9 ON pushbutton for transformer or circuit-breaker function
- 10 OFF pushbutton for transformer or circuit-breaker function
- 11 Manual operation for "spring charging"
- 12 "Spring charged" indicator
- 13 Position indicator for circuit-breaker
- 14 Ready-for-service indicator
- 15 Operations counter
- 16 Preselection for manual charging of circuit-breaker panels

\*) AR = Automatic reclosing  
NAR = Non automatic reclosing



# Components

## Three-position switch-disconnector

### Features

- Switch positions:  
CLOSED – OPEN – EARTHED
- Switching functions as general-purpose switch-disconnector (class E3) according to  
– IEC/EN 62271-103/VDE 0671-103 \*)  
– IEC/EN 62271-102/VDE 0671-102 \*)
- Designed as a three-position switch with the functions  
– Switch-disconnector and  
– Make-proof earthing switch
- Operation via rotary bushing welded gas-tight into the front of the switching-device vessel
- Climate-independent contact in the gas-filled switching-device vessel
- Maintenance-free according to IEC/EN 62271-1/VDE 0671-1
- Individual secondary equipment
- No cross insulation between phases.

### Mode of operation

The operating shaft forms one unit together with the three contact blades. Due to the arrangement of the fixed contacts (earth – busbar), it is not necessary to interlock the CLOSE and EARTHING functions.

### Closing operation

During the closing operation, the operating shaft with the moving contact blades changes from the "OPEN" to the "CLOSED" position.

The force of the spring-operated mechanism ensures a high closing speed and a reliable connection of the main circuit.

### Opening operation

During the opening operation, the arc is caused to rotate by the arc-suppression system. This rotation movement prevents the development of a fixed root.

The isolating distance in gas established after breaking fulfills the conditions applicable to isolating distances in accordance with

– IEC/EN 62271-102/VDE 0671-102 \*)

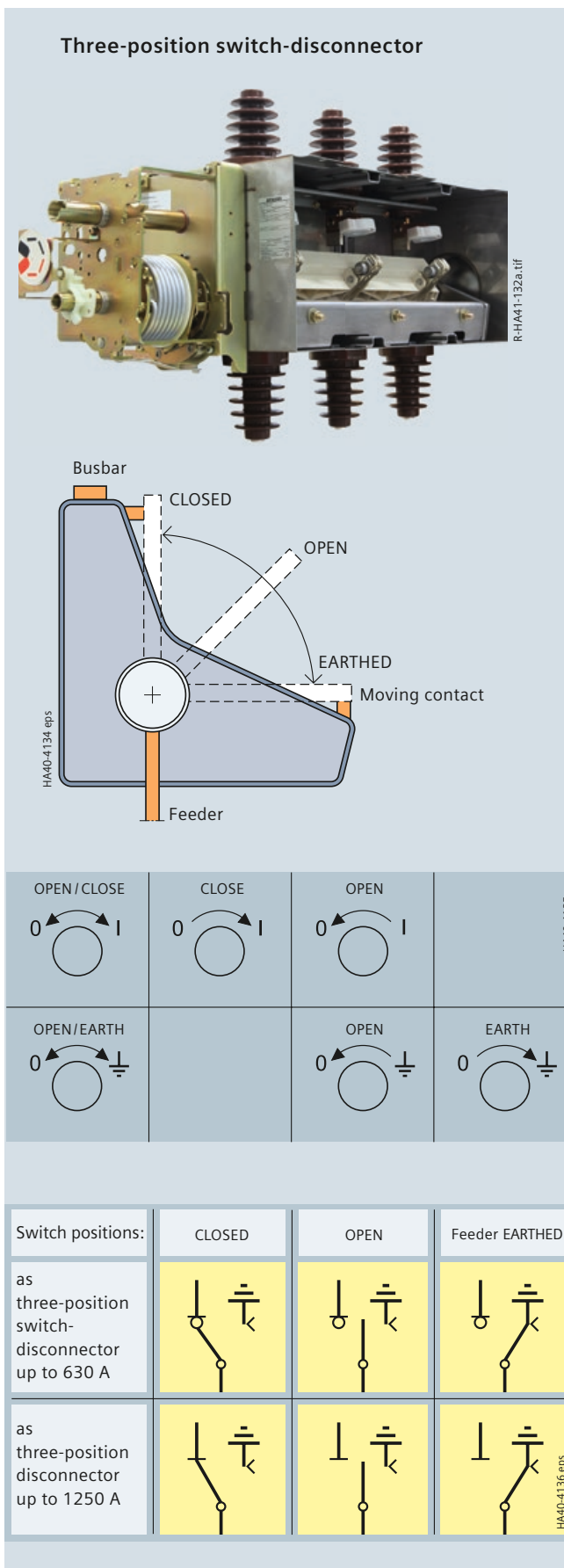
and

– IEC/EN 62271-1/VDE 0671-1 \*).

Due to the arc rotation caused by the arc-suppression system, both load currents and minor no-load currents are safely interrupted.

### Earthing operation

The EARTHING operation is implemented by changing from the "OPEN" to the "EARTHED" position.



\*) For standards, see page 72

### Features

- Mechanical endurance of more than 1000 operating cycles
- Parts subjected to mechanical stress are highly corrosion-proof
- Manual operation with the help of a slip-on operating lever
- Option: Motor operation
- Control board with accordingly cut-out switching gate prevents the three-position switch-disconnector from being switched directly from the "CLOSED" via the "OPEN" to the "EARTHED" position
- Two separate actuating openings are provided for unambiguous selection of the DISCONNECTING and EARTHING functions
- Operation via rotary movement, operating direction according to IEC/EN 60447/VDE 0196 (recommendation of FNN \*).

### Spring-operated mechanism

The switching movements are performed independently of the operating speed.

### Spring-operated/stored-energy mechanism

The switching movements are performed independently of the operating speed.

During the charging process, the closing and opening springs are charged. This ensures that the switch-disconnector/fuse combination can switch off all types of faults reliably even during closing.

Closing and opening is done via pushbuttons, and is therefore identical with the operation of circuit-breaker operating mechanisms.

An energy store is available for tripping by means of an operating HV HRC fuse or via a shunt release (f-release). After tripping, a red bar appears on the position indicator.

### • Motor operating mechanism (option)

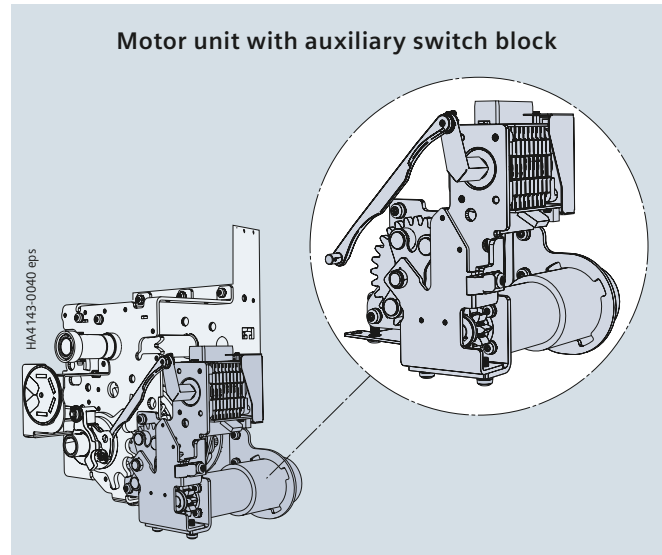
The manual operating mechanisms of SIMOSEC switchgear can be equipped with motor operating mechanisms for the three-position switch-disconnector. Retrofitting is possible.

Operating voltages for motor operating mechanisms:

- 24, 48, 60, 110, 220 V DC
- 110 and 230 V AC, 50/60 Hz.

Operation:

- Local operation by momentary-contact rotary control switch (option)
- Remote operation (standard) applied to terminal.



### Shunt release (option) (f-release)

Spring-operated/stored-energy mechanisms can be equipped with a shunt release. Remote electrical tripping of the three-position switch-disconnector is possible via the magnet coil of the shunt release, e.g. transformer overtemperature tripping. To avoid thermal overloading of the shunt release in the event of a continuous signal that may be applied, the shunt release is switched off via an auxiliary switch which is mechanically coupled with the three-position switch-disconnector.

### Assignment of operating mechanism type of three-position switch to panel types

| Panel type                  | R, L, D1, L(r)                                                            | E               | T, M(VT-F), M(VT)                                          |                 |
|-----------------------------|---------------------------------------------------------------------------|-----------------|------------------------------------------------------------|-----------------|
| Function                    | Switch-disconnector (R)<br>Disconnect (L, D)<br>Disconnect [L1(r), L2(r)] | Earthing switch | Switch-disconnector (T, T1)<br>Disconnect [M(VT), M(VT-F)] | Earthing switch |
| Type of operating mechanism | Spring-operated                                                           | Spring-operated | Stored-energy                                              | Spring-operated |
| Operation                   | Manual<br>Motor (option)                                                  | Manual          | Manual<br>Motor (option)                                   | Manual          |

### Legend

D = Disconnecter feeder

E = Earthing panel

L = Circuit-breaker feeder

R = Ring-main feeder

T = Transformer feeder

M(VT), M(VT-F) = Busbar voltage metering panel

\*) FNN: Forum network technology/network operation of the VDE (FNN)

# Components

Equipment (optional)

## Auxiliary switch (option)

Each operating mechanism of the three-position switch-disconnector (or three-position disconnector) can be optionally equipped with an auxiliary switch for the position indication:

- Switch-disconnector function: \*\*)
  - CLOSED and OPEN: 1 NO + 1 NC + 2 changeover (manually operated)
- Earthing switch function:
  - CLOSED and OPEN: 1 NO + 1 NC + 2 changeover
- Switch-disconnector function in T typical: \*\*)
  - CLOSED and OPEN: 2 changeover (manually operated, motor-operated)
- Earthing switch function:
  - CLOSED and OPEN: 1 NO + 1 NC + 2 changeover.

## Technical data of the auxiliary switch

### Breaking capacity

| AC operation<br>at 40 Hz up to 60 Hz |                | DC operation      |                                                     |    |
|--------------------------------------|----------------|-------------------|-----------------------------------------------------|----|
| Operating voltage                    | Normal current | Operating voltage | Normal current<br>Resistive Inductive,<br>T = 20 ms |    |
| V                                    | A              | V                 | A                                                   | A  |
| up to 230                            | 10             | 24                | 10                                                  | 10 |
|                                      |                | 48                | 10                                                  | 9  |
|                                      |                | 60                | 9                                                   | 7  |
|                                      |                | 110               | 5                                                   | 4  |
|                                      |                | 240               | 2.5                                                 | 2  |

### Rated switching capacity

|                        |                         |
|------------------------|-------------------------|
| Rated insulation level | 250 V AC/DC             |
| Insulation group       | C according to VDE 0110 |
| Continuous current     | 10 A                    |
| Making capacity        | 50 A                    |

### Abbreviations:

NO = Normally open contact

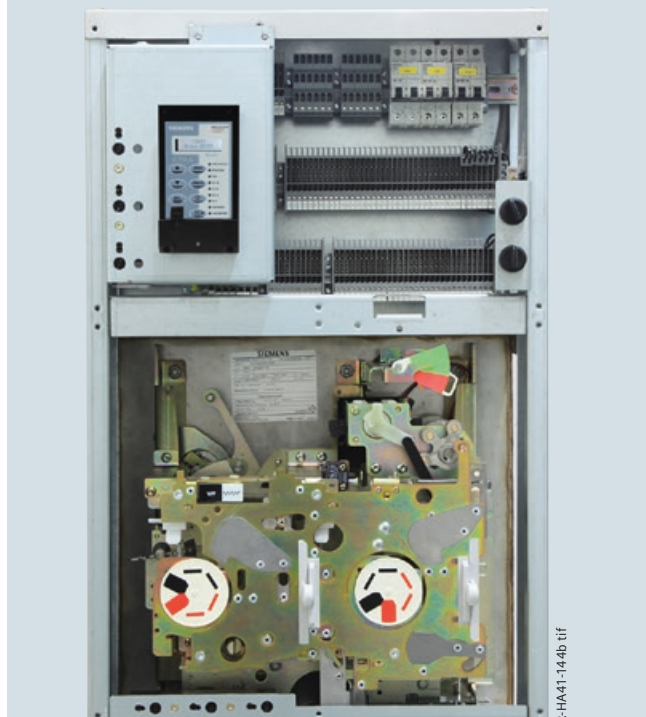
NC = Normally closed contact

\*\*) Depending on the secondary equipment of the three-position switch



**Panel type R:**

Operating mechanism for three-position switch, and low-voltage niche with terminals and MCB's (options)



**Panel type L:**

Motor operating mechanism for three-position switch, and circuit-breaker type "CB-f NAR"

## Features

- According to IEC/EN 62271-100/VDE 0671-100/GB 1984 \*)
- Application in hermetically welded switching-device vessel in conformity with the system
- Climate-independent vacuum interrupter poles in the gas-filled switching-device vessel
- Operating mechanism located outside the switching-device vessel in the front operating mechanism box
- Maintenance-free for indoor installation according to IEC/EN 62271-1/VDE 0671-1 \*)
- Individual secondary equipment.

## Operating mechanism functions

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

In operating mechanisms provided for automatic reclosing (AR), the closing spring can be recharged manually or automatically in case of motor operating mechanism. Thus, the "closing option" is available again.

## Operating mechanism

The operating mechanism assigned to a circuit-breaker feeder consists of the following components:

- Operating mechanism for circuit-breaker
- Operating mechanism for three-position disconnect
- Motor operating mechanism (optional)
- Position indicators
- Pushbuttons for CLOSING and OPENING the circuit-breaker
- Operations counter (optional)
- Interlocking between circuit-breaker and disconnect.

## Assignment of operating mechanism type

| Panel type                  | L, L1, L(T), L1(r), L2(r) |                           |                 |
|-----------------------------|---------------------------|---------------------------|-----------------|
| Function                    | Circuit-breaker           | Three-position disconnect |                 |
|                             |                           | Disconnect                | Earthing switch |
| Type of operating mechanism | Stored-energy             | Spring-operated           | Spring-operated |
| Operation                   | Manual/motor              | Manual/motor              | Manual          |

## Trip-free mechanism

The vacuum circuit-breaker is fitted with a trip-free mechanism according to IEC/EN 62271-100/VDE 0671-100 \*). In the event of an opening command being given after a closing operation has been initiated, the moving contacts return to the open position and remain there even if the closing command is sustained. This means that the contacts are momentarily in the closed position, which is permissible according to the mentioned standard.

\*) For standards, see page 72

## Technical data of the vacuum circuit-breaker

| Vacuum circuit-breaker                               | Type       | CB-f AR *)       | CB-f NAR *) | CB-r 3AE6 Δ) |
|------------------------------------------------------|------------|------------------|-------------|--------------|
| Short-circuit breaking current                       |            | up to 25 kA      | up to 25 kA | up to 25 kA  |
| Rated operating sequence:                            |            |                  |             |              |
| – O – 0.3 s – CO – 3 min – CO                        | •          | –                | –           | –            |
| – O – 0.3 s – CO – 15 s – CO                         | on request | –                | •           | –            |
| – O – 0.3 s – CO – 30 s – CO                         | •          | –                | –           | –            |
| – O – 3 min – CO – 3 min – CO                        | –          | •                | –           | –            |
| Number of breaking operations $I_t$                  |            | 10 000           | 2 000       | 10 000       |
| Number of short-circuit breaking operations $I_{SC}$ |            | 30<br>Option: 50 | 20          | 30           |
| Individual panel type L ...:                         | 500 mm     | L                | L           | –            |
| Individual panel type L1...:                         | 750 mm     | L1               | L1          | L1(r)        |
|                                                      | 875 mm     | –                | –           | L2(r)        |

### Explanations:

- Design option
- Not available

\*) AR = Automatic reclosing; NAR = Non automatic reclosing

Δ) In preparation; circuit-breaker design: • CB-r: removably

## Vacuum circuit-breaker type CB-f

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

## Circuit-breaker secondary equipment

| Circuit-breaker                 | Type CB-f AR                   | Type CB-f NAR                  | Type CB-r AR                   |
|---------------------------------|--------------------------------|--------------------------------|--------------------------------|
| Motor operating mechanism       | ○                              | ○                              | ○                              |
| Closing solenoid                | ●                              | ○                              | ●                              |
| Shunt release                   | ○                              | ○                              | ○                              |
| C.t.-operated release           | ○                              | ○                              | ○                              |
| Low-energy magnetic release     | –                              | ○                              | –                              |
| Undervoltage release            | ○                              | ○                              | ○                              |
| Anti-pumping                    | ●                              | o.r.                           | ●                              |
| Circuit-breaker tripping signal | ●                              | ○                              | ●                              |
| Varistor module                 | for<br>≥ 60 V DC               | for<br>≥ 60 V DC               | for<br>≥ 60 V DC               |
| Auxiliary switch                |                                |                                |                                |
| 6 NO + 6 NC                     | ●                              | ●                              | ●                              |
| free contacts thereof 1)        | 1 NO + 2 NC<br>+ 2 change-over | 1 NO + 1 NC<br>+ 2 change-over | 2 NO + 2 NC<br>+ 2 change-over |
| 11 NO + 11 NC                   | ○                              | –                              | ○                              |
| free contacts thereof 1)        | 6 NO + 7 NC<br>+ 2 change-over | –                              | 7 NO + 7 NC<br>+ 2 change-over |
| Position switch                 | ●                              | ●                              | ●                              |
| Mechanical interlocking         | ●                              | ●                              | ●                              |
| Operations counter              | ●                              | ○                              | ●                              |

- = Standard
- = Option
- o.r. = on request

### Abbreviations:

NO = Normally open contact  
NC = Normally closed contact

1) Depending on the selected secondary components

# Components

## Secondary equipment of the vacuum circuit-breaker

### Motor operating mechanism (option)

Operating voltages for motor operating mechanisms:

- 24, 48, 60, 110, 220 V DC
- 110 and 230 V AC, 50/60 Hz.

Further values on request.

Motor rating for circuit-breaker operating mechanism at:

CB-f AR: \*)

- Maximum 500 W
- Maximum 650 VA

CB-f NAR: \*)

- Maximum 80 W
- Maximum 80 VA.

### Secondary components

The scope of the secondary equipment of the vacuum circuit-breaker depends on the type of application and offers a wide range of possible variations, allowing almost every requirement to be satisfied.

### Closing solenoid

- For electrical closing.

### Shunt release

- Standard: Magnet coil
- Option: Magnet coil with energy store
- Tripping by protection relay or electrical actuation.

### C.t.-operated release

- For tripping pulse 0.1 Ws in conjunction with suitable protection systems, e.g. protection system 7SJ45, make Woodward/SEG type WIC; other designs on request
- Used if external auxiliary voltage is missing, tripping via protection relay.

### Low-energy magnetic release (for CB-f NAR)

- For tripping pulse 0.02 Ws, tripping via transformer monitor (IKI-30).

### Undervoltage release

- Comprising:
  - Energy store and unlatching mechanism
  - Electromagnetic system, which is permanently connected to voltage while the vacuum circuit-breaker is closed; tripping is initiated when this voltage drops
- Connection to voltage transformers possible.

### Anti-pumping (standard for CB-f AR) \*) (mechanical and electrical)

Function: If constant CLOSE and OPEN commands are present at the vacuum circuit-breaker at the same time, the vacuum circuit-breaker will return to the open position after closing. It remains in this position until a new CLOSE command is given. In this manner, continuous closing and opening (= pumping) is avoided.

### Circuit-breaker tripping signal

- For electrical signaling (as pulse > 10 ms), e.g. to remote control systems, in the case of automatic tripping (e.g. protection)
- Via limit switch and cutout switch.

### Varistor module

- To limit overvoltages to approx. 500 V for protection devices (when inductive components are mounted in the vacuum circuit-breaker)
- For auxiliary voltages  $\geq 60$  V DC.

### Auxiliary switch

- For electrical position indication.

### Position switch

- For signaling "closing spring charged".

### Mechanical interlocking

- Dependent on the type of operating mechanism
- Logical mechanical interlock between the three-position disconnecter and the circuit-breaker (option: Closing lock-out for the three-position disconnecter in circuit-breaker panels)
- Option: Operating mechanism with mechanical interlocking as
  - Spring-operated mechanism: Opening for operating crank is blocked
  - Stored-energy mechanism with closing solenoid and pushbutton: The pushbutton operated by the mechanical interlock prevents a continuous command to the closing solenoid
- During operation of the three-position disconnecter from CLOSED to OPEN, the vacuum circuit-breaker cannot be in CLOSED position.

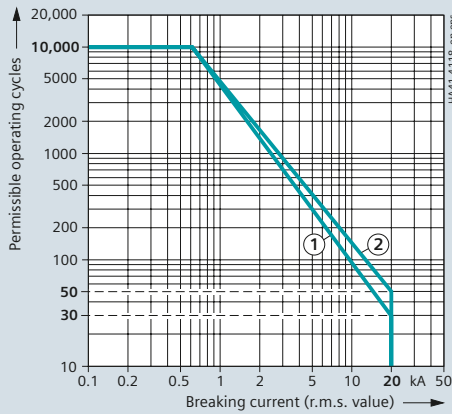
### Operations counter

- As numeric indicator, 5 digits, mechanical.

\*) AR = Automatic reclosing  
NAR = Non automatic reclosing

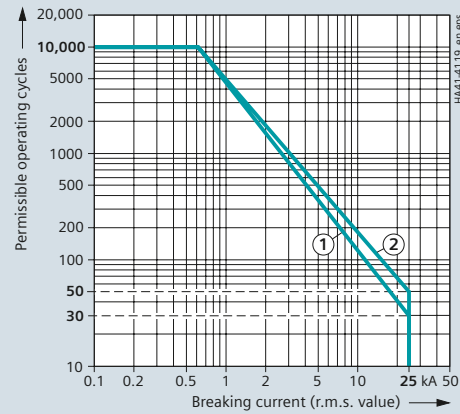
## Electrical service life

### Vacuum circuit-breaker type CB-f AR \*)



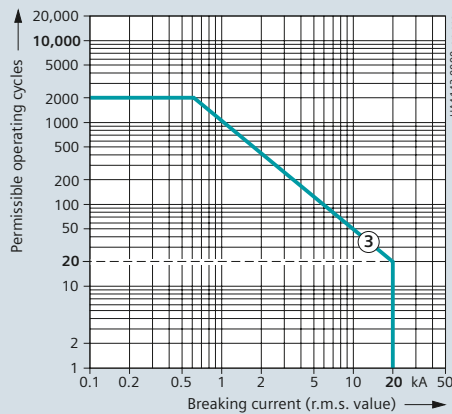
Rated short-circuit breaking current 20 kA

Max. number of short-circuit breaking operations: ①  $n = 30$ , ②  $n = 50$



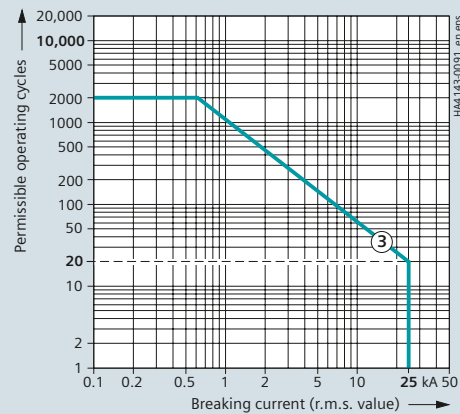
Rated short-circuit breaking current 25 kA

### Vacuum circuit-breaker type CB-f NAR \*)



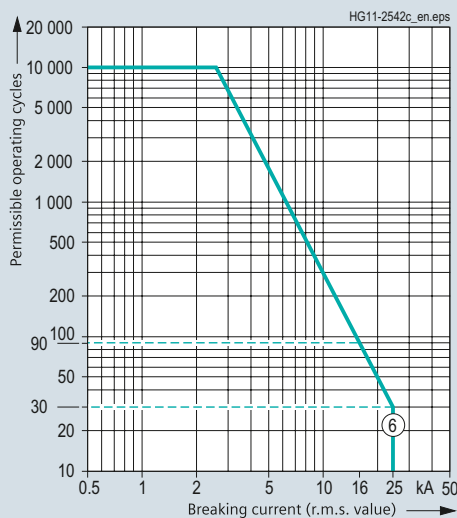
Rated short-circuit breaking current 20 kA

Max. number of short-circuit breaking operations: ③  $n = 20$



Rated short-circuit breaking current 25 kA

### Vacuum circuit-breaker type 3AE6, for switchgear type SIMOSEC as CB-r AR \*)



Rated short-circuit breaking current 25 kA

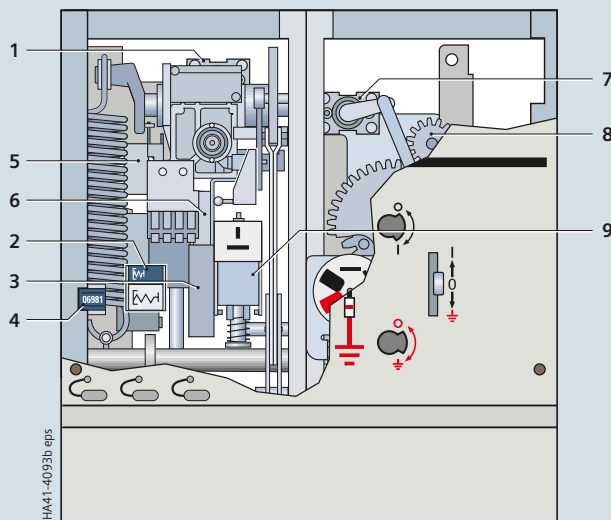
Max. number of short-circuit breaking operations: ⑥  $n = 30$

\*) AR = Automatic reclosing  
NAR = Non automatic reclosing

# Components

Secondary equipment of the vacuum circuit-breaker, busbars

**Vacuum circuit-breaker type CB-f AR \*)**



## Maximum secondary equipment

- 1 Auxiliary switch at the circuit-breaker
- 2 Position switch "spring charged"
- 3 2<sup>nd</sup> release
- 4 Operations counter
- 5 1<sup>st</sup> release
- 6 Motor operating mechanism, circuit-breaker
- 7 Auxiliary switch at the three-position disconnecter
- 8 Motor operating mechanism, three-position disconnecter
- 9 Closing solenoid, circuit-breaker

## Busbars

- Safe-to-touch due to metallic enclosure
- Metal-clad busbar compartment
- Three-pole design, bolted from panel to panel
- Easy switchgear extension
- Made of copper: Round E-Cu.

## Busbars



**Busbar compartment extending over 3 panels (example ≤ 17.5 kV)**  
Side view



**Busbar compartment extending over 3 panels (example 24 kV)**  
Side view

\*) AR: Automatic reclosing

## General features

- Connecting lugs for sealing ends arranged one behind the other
- Uniform cable connection height for the respective panel types
- With cable bracket, e.g. type C40 according to DIN EN 50024
- Access to the cable compartment only if feeder has been isolated and earthed.

## Special features

- In cable panels (type K)
- In ring-main panels (type R)
- In circuit-breaker panels (type L)
- For thermoplastic-insulated cables
- For paper-insulated mass-impregnated cables with adapter systems
- For connection cross-sections up to 300 mm<sup>2</sup>
- Cable routing downwards.
- In transformer panels (type T)
- For thermoplastic-insulated cables
- For connection cross-sections up to 120 mm<sup>2</sup>: Cable lug max. 32 mm wide
- For rated normal currents of 200 A.

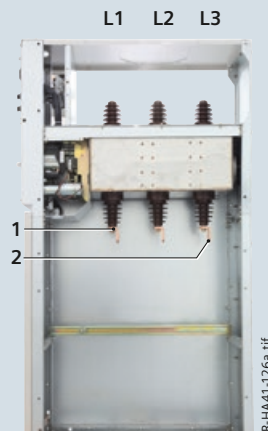
### Note:

- Cable sealing ends and cable clamps are not included in the scope of supply

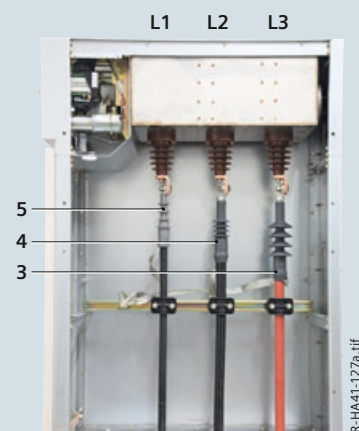
### For options, see figures:

- 1) Only with ring-main panel
- 2) Cable clamps in transformer panels type T... partly mounted underneath the panel in the cable basement (for 24 kV = standard)
- 3) Make Siemens, type 3EK, other makes on request

## Cable connection (examples)



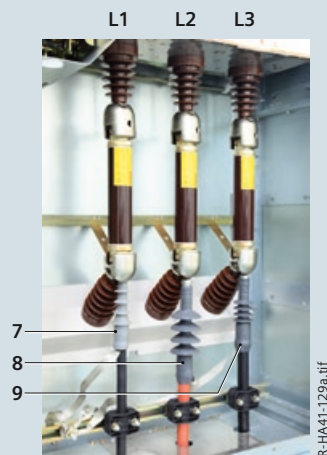
**Ring-main panel type R**  
Cable compartment as delivered



Cable compartment with cable sealing ends (options: A, B, C <sup>1)</sup> and D <sup>1)</sup>, see below)



**Transformer panel type T**  
Cable compartment as delivered



Cable compartment with cable sealing ends (option: A <sup>2)</sup>, see below)

### Options

- |                                              |                                                                   |
|----------------------------------------------|-------------------------------------------------------------------|
| <b>A</b> Mounted cable clamps <sup>2)</sup>  | <b>C</b> Double cable connection                                  |
| <b>B</b> Short-circuit/earth-fault indicator | <b>D</b> Suitable for connection of surge arresters <sup>3)</sup> |

## Cable sealing ends (examples)

- |                                                                                                                                                                     |                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>1</b> As-delivered condition                                                                                                                                     | <b>6</b> As-delivered condition, prepared for cable sealing end                                                                |
| <b>2</b> Connection for cable                                                                                                                                       |                                                                                                                                |
| <b>3</b> <u>Phase L1:</u><br>Make Lovink-Enertech, type IAEM 20, 240 mm <sup>2</sup> (20 kV)                                                                        | <b>7</b> <u>Phase L1:</u><br>Make Lovink-Enertech, type IAEM 20, 95 mm <sup>2</sup> (20 kV)                                    |
| <b>4</b> <u>Phase L2:</u><br>Make Prysmian Kabel und Systeme (Pirelli Elektrik) type ELTI mb-1C-2h-C-T3, 240 mm <sup>2</sup> (24 kV)                                | <b>8</b> <u>Phase L2:</u><br>Make Tyco Electronics Raychem, type TFTI/5131, 95 mm <sup>2</sup> (24 kV), as push-on sealing end |
| <b>5</b> <u>Phase L3:</u><br>Make Tyco Electronics Raychem, type EPKT 24 C/1X, 185 mm <sup>2</sup> (24 kV), as shrink-on sealing end, for severe ambient conditions | <b>9</b> <u>Phase L3:</u><br>Make Euromold, type ITK, 95 mm <sup>2</sup> (24 kV)                                               |

# Components

Selection data for various cable sealing ends <sup>1)</sup>

Cable sealing end, e.g. for panel types R..., K..., D..., M(-K), M(-BK), L... and T...<sup>2)</sup>  
(for connection heights of cables, see opposite dimension drawings)

| Make                                                                                                        | Type                  | Cross-section in mm <sup>2</sup> |
|-------------------------------------------------------------------------------------------------------------|-----------------------|----------------------------------|
| <b>Single-core thermoplastic-insulated cables for ≤ 12 kV (6/10 kV); acc. to IEC standard <sup>2)</sup></b> |                       |                                  |
| Euromold                                                                                                    | AIN 10, AFN 10        | 25–300 (500 *)                   |
|                                                                                                             | AIS, AIP              | 150–300; 50–300                  |
|                                                                                                             | 12 MONOi              | 25–300 (500 *)                   |
|                                                                                                             | ITK-212 <sup>*)</sup> | 50–300 (400 *)                   |
| Prysmian Kabel und Systeme                                                                                  | ELTI mb-1C-12         | 35–240                           |
|                                                                                                             | ELTI-1C-12            | 25–300                           |
| TE Connectivity                                                                                             | IXSU-F                | 16–300 (500 *)                   |
|                                                                                                             | MVTI-31xx-            | 25–240 (300 *)                   |
|                                                                                                             | EPKT                  | 16–300                           |
| Lovink-Enertech                                                                                             | IAEM 10               | 25–300                           |
|                                                                                                             | IAES 10               | 25–300 (500 *)                   |
| 3M                                                                                                          | 92-EB 6x-1            | 35–300 (400 *)                   |
| Südkabel                                                                                                    | SEHDI 10.2            | 35–300 (500 *)                   |
| nkt cables                                                                                                  | TI 12                 | 25–240                           |
|                                                                                                             | TO 12                 | 25–300 (500 *)                   |

**Three-core thermoplastic-insulated cables for ≤ 12 kV (6/10 kV); acc. to IEC standard <sup>2)</sup>**

|                            |                              |                |
|----------------------------|------------------------------|----------------|
| Euromold                   | AIN 10, AFN 10 <sup>*)</sup> | 25–300 (500 *) |
|                            | 12 MONOi                     | 35–300 (500 *) |
| Prysmian Kabel und Systeme | ELTI-3C-12                   | 25–300         |
| TE Connectivity            | IXSU-F33xx                   | 16–300 (500 *) |
| Lovink-Enertech            | IAES 10                      | 25–300         |
|                            | GHKI                         | 16–300 (400 *) |

**Single-core thermoplastic-insulated cables for > 12 kV to ≤ 24 kV (12/20 kV) <sup>\*) 2)</sup>**

|                            |                                |                |
|----------------------------|--------------------------------|----------------|
| Euromold                   | AIN 20, AFN 20                 | 25–300 (630 *) |
|                            | AIS, AIP                       | 70–300; 25–300 |
|                            | 24 MONOi                       | 25–300 (500 *) |
|                            | 36 MSC <sup>3)</sup>           | 95–300 (500 *) |
|                            | 36 MSC (Option <sup>4)</sup> ) | 95–300 (500 *) |
|                            | ITK-224                        | 25–240         |
| Prysmian Kabel und Systeme | ELTI mb-1C-24                  | 35–240         |
|                            | ELTI-1C-24                     | 25–300         |
| TE Connectivity            | IXSU-F                         | 25–300 (500 *) |
|                            | MVTI-51xx-                     | 25–300         |
|                            | EPKT                           | 16–300 (500 *) |
| Lovink-Enertech            | IAEM 20                        | 25–300         |
|                            | IAES 20                        | 25–300 (500 *) |
| 3M                         | 93-EB 6x-1                     | 50–300 (400 *) |
| Südkabel                   | SEHDI 20.2                     | 35–300 (500 *) |
|                            | SEI 24                         | 25–240         |
| nkt cables                 | TI 24                          | 25–240         |
|                            | TO 24                          | 25–300 (500 *) |

**Three-core thermoplastic-insulated cables for > 12 kV to ≤ 24 kV (12/20 kV) <sup>\*) 2)</sup>**

|                 |                       |                |
|-----------------|-----------------------|----------------|
| Euromold        | 24 MONOi              | 35–300 (500 *) |
|                 | AFN 20, AIN 20        | 35–300         |
| Lovink-Enertech | GHKI                  | 25–300 (500 *) |
| TE Connectivity | on request IXSU-F53xx | on request     |

\*) On request: Max. connection cross-section of cable sealing end types

\*\*) Due to the installation of 4MA cast-resin insulated block-type current transformers, the connection height of the cables is reduced in the corresponding panel types [e.g.: L, L1, M (-K), ...]

1) **Note:**

For cable connections, the manufacturer information about the sealing end and the design of the cable must be taken into account (e.g., operating voltage, rated power-frequency withstand voltage, cable type, core material)

2) Transformer panels type T...:

- Lower edge of sealing end partly underneath the panel (depending on type of sealing end)
- Cable lugs of sealing ends up to 32 mm width
- Owing to the various lengths of the sealing ends, mounted cable clamps are partly underneath the panel

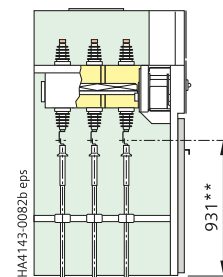
3) Circuit-breaker panel types L...:

Lower edge of sealing end below panel

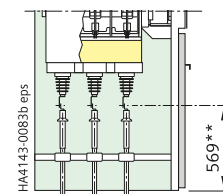
4) Cable sealing end type with insulation shields

\*) Remark concerning applications with requirements according to the GB standard (China): Type suitable for rated short-duration power-frequency withstand voltage  $U_d = 42$  kV according to IEC 62271-1 and  $U_m = 42$  kV according to EN/HD 629

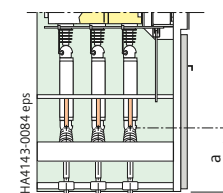
Connection height <sup>\*\*) of cables above floor or above lower edge of panel:</sup>



Panel type R ...



Panel type L ...



Panel type T ...

**Dimension a**

~ 384 mm:

For fuses with  $e = 442$  mm (standard for 24 kV)

~ 534 mm:

For fuses with  $e = 292$  mm

**Note:**

Depending on make and type, the termination of the cable sealing end (= shield earth) for the 3-core thermoplastic-insulated cable and the fitted cable clamp (option) may be located underneath the panel in the cable basement. This must be taken into account in panels with floor cover (option).

## Cable cross-sections

| Panel type       | Panel width | Version    | Connected cables<br>x connection cross-section<br>number x mm <sup>2</sup><br>for rated voltage |         |         | Transformer combination in the connection<br>compartment |   |   |
|------------------|-------------|------------|-------------------------------------------------------------------------------------------------|---------|---------|----------------------------------------------------------|---|---|
|                  |             |            | 12 kV                                                                                           | 17.5 kV | 24 kV   | Current transformer                                      |   |   |
| K                | 375         | Standard   | 1 x 300                                                                                         | 1 x 300 | 1 x 300 | ○                                                        |   |   |
|                  |             | On request | 2 x 300                                                                                         | 2 x 300 | 2 x 300 |                                                          |   |   |
| K1               | 500         | Standard   | 1 x 300                                                                                         | 1 x 300 | 1 x 300 | ○                                                        |   |   |
|                  |             | Option     | 2 x 400                                                                                         | 2 x 300 | 2 x 300 |                                                          |   |   |
| R                | 375         | Standard   | 1 x 300                                                                                         | 1 x 300 | 1 x 300 | ○                                                        |   |   |
|                  |             | On request | 2 x 300                                                                                         | 2 x 300 | 2 x 300 |                                                          |   |   |
| R1, D1           | 500         | Standard   | 1 x 300                                                                                         | 1 x 300 | 1 x 300 | ○                                                        |   |   |
|                  |             | Option     | 2 x 300                                                                                         | 2 x 300 | 2 x 300 |                                                          |   |   |
| L                | 500         | Standard   | 1 x 300                                                                                         | 1 x 300 | 1 x 300 | ○                                                        |   |   |
|                  |             | Option     | 2 x 240                                                                                         | 2 x 240 | 2 x 240 |                                                          | – | – |
| L1               | 750         | Standard   | 1 x 300                                                                                         | 1 x 300 | 1 x 300 | ○                                                        |   |   |
|                  |             | Option     | 2 x 300                                                                                         | 2 x 300 | 2 x 300 |                                                          | ○ | ○ |
| M(-K),<br>M(-BK) | 750         | Standard   | 1 x 400                                                                                         | 1 x 300 | 1 x 300 |                                                          | ○ | ○ |
|                  |             | Option     | 3 x 400                                                                                         | 3 x 300 | 3 x 300 |                                                          | ○ | ○ |
| M(KK)            | 750         | Standard   | 1 x 400                                                                                         | 1 x 300 | 1 x 300 |                                                          | ○ | ○ |
|                  |             | Option     | 2 x 300                                                                                         | 2 x 300 | 2 x 300 |                                                          | ○ | ○ |
| L1(r)            | 750         | Standard   | 1 x 300                                                                                         | 1 x 300 | 1 x 300 | ○                                                        | ○ | – |
|                  |             | Option     | 2 x 300                                                                                         | 2 x 300 | 2 x 300 | ○                                                        |   | – |
| L2(r)            | 875         | Standard   | 2 x 300                                                                                         | 2 x 300 | 2 x 300 | ○                                                        | ○ |   |
|                  |             | Option     | 3 x 300                                                                                         | 3 x 300 | 3 x 300 |                                                          | ○ |   |

○ possible – not possible

**Cable fixing:** Depending on the cable type (1-core cable, 3-core cable) or the associated panel type  $\Delta$  and its components, the cable may also be fixed in the cable basement (for local installation):

**1-core cable**

Optionally, a deep floor cover is also possible:

**3-core cable**

| Max. dimensions                           | Cable version |        |
|-------------------------------------------|---------------|--------|
| H <sub>cc</sub> in mm                     | 1-core        | 3-core |
| Standard                                  | 435           | 425    |
| Option:<br>With additional<br>floor cover | 469           | 459    |
| 5) Height of<br>cable clamp<br>(= Option) | 60            | 77     |

H<sub>cc</sub> = Available height for cable connection: From the mounted cable clamp 5)

1) CT as an option (cable-type current transformer)  
 2) CT as an option (zero-sequence current transformer for earth-fault detection)  
 3) Deep floor cover  
 4) Cable fixing bar, additionally movable downwards  
 5) Option: Cable clamp

H<sub>0</sub> = Height of cable connection in the panel  
 \*) Extendable up to 600 mm  
 Δ) For panel types T and T1 with a rated voltage of 24 kV: Deeper cable fixing located underneath the panel

# Components

## HV HRC fuse assembly

### HV HRC fuse assembly

#### Features

- Application for
  - Transformer panel types T (375 mm) and T1 (500 mm)
  - Busbar voltage metering panel type M(VT-F), M1(VT-F)
- HV HRC fuse-links acc. to DIN 43625 (main dimensions) with striker version "medium" acc. to IEC 60282 / VDE 0670-4 \*)
- As short-circuit protection before transformers
- With selectivity (depending on correct selection) to upstream and downstream connected equipment
- Requirements according IEC 62271-105 fulfilled as HV alternating current switch-fuse combination
- Selection of HV HRC fuses for transformers
- Fuse replacement possible only when feeder is earthed
- Option: Shunt release on operating mechanism of three-position switch-disconnector
- Option: "Tripped indication" of three-position switch-disconnector in transformer feeder (transformer switch) for remote electrical indication with one normally-open contact (1 NO).

#### Mode of operation

##### "HV HRC fuse tripped"

Following the tripping of an HV HRC fuse-link, the mechanism for charging the spring must be set to the "OPEN" position.

Subsequently, earthing can be implemented by means of the three-position switch-disconnector and e.g. the fuse can be replaced.

##### Replacement of HV HRC fuse-links (without any tools)

- Isolating and earthing of the transformer feeder
- Opening the connection compartment cover
- Subsequent manual replacement of the HV HRC fuse-link.

#### Note to HV HRC fuse-links

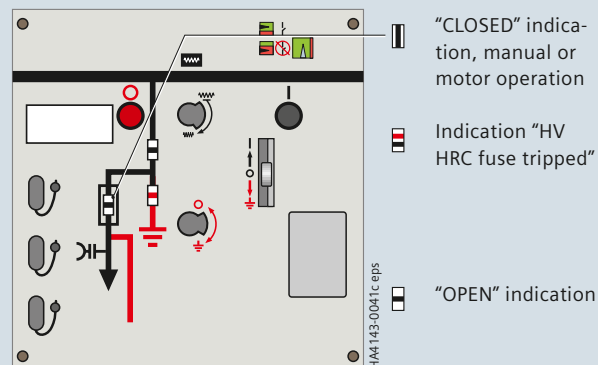
According to IEC 60282-1 (2009) Clause 6.6, the breaking capacity of HV HRC fuses is tested within the scope of the type test at 87 % of their rated voltage.

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

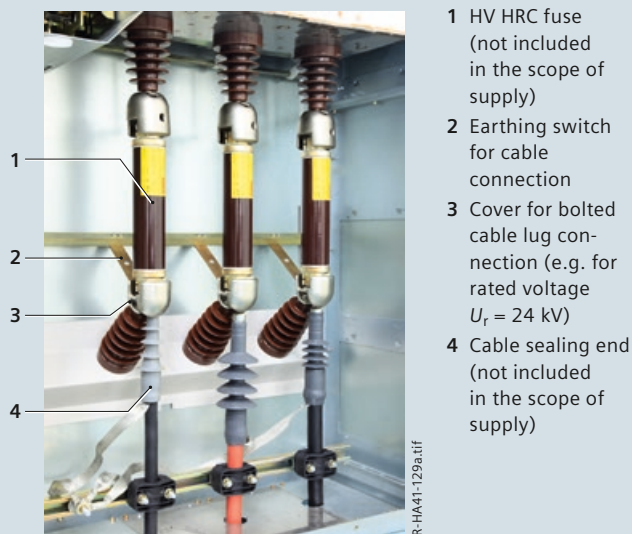
It must therefore already be ensured during configuration of the switching devices and selection of the HV HRC fuse that only such fuse-links are used, which either satisfy the above operating conditions, or whose breaking capacity was tested at least with the maximum system voltage. In case of doubt, a suitable HV HRC fuse must be selected together with the fuse manufacturer.

\*) For standards, see page 72

### HV HRC fuse assembly



### Control board of a transformer feeder



HV HRC fuses in transformer panel type T  
Side view

## Fuse protection table

The following table shows the recommended HV HRC fuse-links make SIBA (electrical data valid for ambient air temperatures of up to 40 °C) for fuse protection of transformers. The three-position switch-disconnector in the transformer feeder in panel type "T" was combined and tested according to IEC 62271-103.

## Standards

HV HRC fuse-links "medium" version with striker and for tripping energy  $1 \pm 0.5$  Joule according to

- IEC/EN 60282-1/VDE 0670-4
- IEC/EN 60787/VDE 0670-402
- DIN 43625 main dimensions.

| MV system               | Transformer       |                                  |                     | HV HRC fuse-link    |                                      |             |                      |                                |
|-------------------------|-------------------|----------------------------------|---------------------|---------------------|--------------------------------------|-------------|----------------------|--------------------------------|
| Operating voltage $U_n$ | Rated power $S_r$ | Relative impedance voltage $u_k$ | Rated current $I_r$ | Rated current $I_r$ | Min. operating / rated voltage $U_r$ | Dimension e | Outside diameter $d$ | Order No. Make SIBA            |
| kV                      | kVA               | %                                | A                   | A                   | kV                                   | mm          |                      |                                |
| 3.3 to 3.6              | 20                | 4                                | 3.5                 | 6.3<br>10           | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>53             | 30 098 13.6,3<br>30 098 13.10  |
|                         | 50                | 4                                | 8.75                | 16<br>20            | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>53             | 30 098 13.16<br>30 098 13.20   |
|                         | 75                | 4                                | 13.1                | 20<br>25            | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>53             | 30 098 13.20<br>30 098 13.25   |
|                         | 100               | 4                                | 17.5                | 31.5<br>40          | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>53             | 30 098 13.31,5<br>30 098 13.40 |
|                         | 125               | 4                                | 21.87               | 31.5<br>40          | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>53             | 30 098 13.31,5<br>30 098 13.40 |
|                         | 160               | 4                                | 28                  | 40<br>50            | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>53             | 30 098 13.40<br>30 098 13.50   |
|                         | 200               | 4                                | 35                  | 50<br>63            | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>67             | 30 098 13.50<br>30 099 13.63   |
|                         | 250               | 4                                | 43.74               | 63<br>80            | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 67<br>67             | 30 099 13.63<br>30 099 13.80   |
|                         | 315               | 4                                | 55.1                | 80<br>100           | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 67<br>67             | 30 099 13.80<br>30 099 13.100  |
|                         | 400               | 4                                | 70                  | 100                 | 3 to 7.2                             | 292         | 67                   | 30 099 13.100                  |
| 4.16 to 4.8             | 20                | 4                                | 2.78                | 6.3                 | 3 to 7.2                             | 292         | 53                   | 30 098 13.6,3                  |
|                         | 30                | 4                                | 4.2                 | 10                  | 3 to 7.2                             | 292         | 53                   | 30 098 13.10                   |
|                         | 50                | 4                                | 6.93                | 16                  | 3 to 7.2                             | 292         | 53                   | 30 098 13.16                   |
|                         | 75                | 4                                | 10.4                | 16<br>20            | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>53             | 30 098 13.16<br>30 098 13.20   |
|                         | 100               | 4                                | 13.87               | 20<br>25            | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>53             | 30 098 13.20<br>30 098 13.25   |
|                         | 125               | 4                                | 17.35               | 25<br>31.5          | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>53             | 30 098 13.25<br>30 098 13.31,5 |
|                         | 160               | 4                                | 22.2                | 31.5<br>40          | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>53             | 30 098 13.31,5<br>30 098 13.40 |
|                         | 200               | 4                                | 27.75               | 40<br>50            | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>53             | 30 098 13.40<br>30 098 13.50   |
|                         | 250               | 4                                | 34.7                | 50<br>63            | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>67             | 30 098 13.50<br>30 099 13.63   |
|                         | 315               | 4                                | 43.7                | 63                  | 3 to 7.2                             | 292         | 67                   | 30 099 13.63                   |
|                         | 400               | 4                                | 55.5                | 80                  | 3 to 7.2                             | 292         | 67                   | 30 099 13.80                   |
|                         | 500               | 4                                | 69.4                | 100                 | 3 to 7.2                             | 292         | 67                   | 30 099 13.100                  |
| 5 to 5.5                | 20                | 4                                | 2.3                 | 6.3                 | 3 to 7.2                             | 292         | 53                   | 30 098 13.6,3                  |
|                         | 30                | 4                                | 3.2                 | 6.3<br>10           | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>53             | 30 098 13.6,3<br>30 098 13.10  |
|                         | 50                | 4                                | 5.7                 | 10<br>16            | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>53             | 30 098 13.10<br>30 098 13.16   |
|                         | 75                | 4                                | 8.6                 | 16<br>20            | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>53             | 30 098 13.16<br>30 098 13.20   |
|                         | 100               | 4                                | 11.5                | 16<br>20            | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>53             | 30 098 13.16<br>30 098 13.20   |
|                         | 125               | 4                                | 14.4                | 20<br>25            | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>53             | 30 098 13.20<br>30 098 13.25   |
|                         | 160               | 4                                | 18.4                | 31.5<br>40          | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>53             | 30 098 13.31,5<br>30 098 13.40 |
|                         | 200               | 4                                | 23                  | 40<br>50            | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>53             | 30 098 13.40<br>30 098 13.50   |
|                         | 250               | 4                                | 28.8                | 40<br>50            | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>53             | 30 098 13.40<br>30 098 13.50   |
|                         | 315               | 4                                | 36.3                | 50<br>63            | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 53<br>67             | 30 098 13.50<br>30 099 13.63   |
|                         | 400               | 4                                | 46.1                | 63<br>80            | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 67<br>67             | 30 099 13.63<br>30 099 13.80   |
|                         | 500               | 4                                | 52.5                | 80<br>100           | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 67<br>67             | 30 099 13.80<br>30 099 13.100  |
|                         | 630               | 4                                | 72.7                | 100<br>125          | 3 to 7.2<br>3 to 7.2                 | 292<br>292  | 67<br>67             | 30 099 13.100<br>30 099 13.125 |

# Components

Allocation of HV HRC fuses and transformers

Recommended HV HRC fuses for switchgear type SIMOSEC

| MV system               | Transformer       |                                  |                     | HV HRC fuse-link    |                                      |             |                      |                     |
|-------------------------|-------------------|----------------------------------|---------------------|---------------------|--------------------------------------|-------------|----------------------|---------------------|
| Operating voltage $U_n$ | Rated power $S_r$ | Relative impedance voltage $u_k$ | Rated current $I_r$ | Rated current $I_r$ | Min. operating / rated voltage $U_r$ | Dimension e | Outside diameter $d$ | Order No. Make SIBA |
| kV                      | kVA               | %                                | A                   | A                   | kV                                   | mm          |                      |                     |
| 6 to 7.2                | 20                | 4                                | 1.9                 | 6.3                 | 6 to 12                              | 292         | 53                   | 30 004 13.6,3       |
|                         |                   |                                  |                     | 6.3                 | 6 to 12                              | 442         | 53                   | 30 101 13.6,3       |
|                         | 30                | 4                                | 2.9                 | 6.3                 | 6 to 12                              | 292         | 53                   | 30 004 13.6,3       |
|                         |                   |                                  |                     | 6.3                 | 6 to 12                              | 292         | 53                   | 30 101 13.6,3       |
|                         | 50                | 4                                | 4.8                 | 10                  | 6 to 12                              | 292         | 53                   | 30 004 13.10        |
|                         |                   |                                  |                     | 10                  | 6 to 12                              | 442         | 53                   | 30 101 13.10        |
|                         | 75                | 4                                | 7.2                 | 16                  | 6 to 12                              | 292         | 53                   | 30 004 13.16        |
|                         |                   |                                  |                     | 16                  | 6 to 12                              | 442         | 53                   | 30 101 13.16        |
|                         | 100               | 4                                | 9.6                 | 16                  | 6 to 12                              | 292         | 53                   | 30 004 13.16        |
|                         |                   |                                  |                     | 16                  | 6 to 12                              | 442         | 53                   | 30 101 13.16        |
|                         |                   |                                  |                     | 20                  | 6 to 12                              | 292         | 53                   | 30 004 13.20        |
|                         |                   |                                  |                     | 20                  | 6 to 12                              | 442         | 53                   | 30 101 13.20        |
|                         | 125               | 4                                | 12                  | 20                  | 6 to 12                              | 292         | 53                   | 30 004 13.20        |
|                         |                   |                                  |                     | 20                  | 6 to 12                              | 442         | 53                   | 30 101 13.20        |
|                         |                   |                                  |                     | 25                  | 6 to 12                              | 292         | 53                   | 30 004 13.25        |
|                         |                   |                                  |                     | 25                  | 6 to 12                              | 442         | 53                   | 30 101 13.25        |
|                         | 160               | 4                                | 15.4                | 31.5                | 6 to 12                              | 292         | 53                   | 30 004 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 6 to 12                              | 442         | 53                   | 30 101 13.31,5      |
|                         | 200               | 4                                | 19.2                | 31.5                | 6 to 12                              | 292         | 53                   | 30 004 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 6 to 12                              | 442         | 53                   | 30 101 13.31,5      |
|                         |                   |                                  |                     | 40                  | 6 to 12                              | 292         | 53                   | 30 004 13.40        |
|                         |                   |                                  |                     | 40                  | 6 to 12                              | 442         | 53                   | 30 101 13.40        |
|                         | 250               | 4                                | 24                  | 40                  | 6 to 12                              | 292         | 53                   | 30 004 13.40        |
|                         |                   |                                  |                     | 40                  | 6 to 12                              | 442         | 53                   | 30 101 13.40        |
|                         |                   |                                  |                     | 50                  | 6 to 12                              | 442         | 53                   | 30 101 13.50        |
|                         | 315               | 4                                | 30.3                | 50                  | 6 to 12                              | 292         | 53                   | 30 004 13.50        |
|                         |                   |                                  |                     | 50                  | 6 to 12                              | 442         | 53                   | 30 101 13.50        |
|                         |                   |                                  |                     | 63                  | 6 to 12                              | 292         | 67                   | 30 012 43.63        |
|                         | 400               | 4                                | 38.4                | 63                  | 6 to 12                              | 292         | 67                   | 30 012 43.63        |
|                         |                   |                                  |                     | 80                  | 6 to 12                              | 292         | 67                   | 30 012 43.80        |
|                         |                   |                                  |                     | 80                  | 6 to 12                              | 442         | 67                   | 30 102 43.80        |
|                         |                   |                                  |                     | 63                  | 6 to 12                              | 292         | 67                   | 30 012 13.63        |
|                         |                   |                                  |                     | 63                  | 6 to 12                              | 442         | 67                   | 30 102 13.63        |
|                         | 500               | 4                                | 48                  | 80                  | 6 to 12                              | 292         | 67                   | 30 012 43.80        |
|                         |                   |                                  |                     | 80                  | 6 to 12                              | 442         | 67                   | 30 102 43.80        |
|                         |                   |                                  |                     | 80                  | 6 to 12                              | 442         | 67                   | 30 102 13.80        |
|                         |                   |                                  |                     | 100                 | 6 to 12                              | 292         | 67                   | 30 012 43.100       |
|                         |                   |                                  |                     | 100                 | 6 to 12                              | 442         | 67                   | 30 102 43.100       |
|                         | 630               | 4                                | 61                  | 100                 | 6 to 12                              | 442         | 67                   | 30 102 43.100       |
|                         |                   |                                  |                     | 125                 | 6 to 12                              | 442         | 85                   | 30 103 43.125       |
|                         |                   |                                  |                     | 125                 | 6 to 12                              | 292         | 85                   | 30 020 43.125       |
|                         | 800               | 5 (5.5)                          | 77                  | 125                 | 6 to 12                              | 292         | 85                   | 30 020 43.125       |
|                         |                   |                                  |                     | 125                 | 6 to 12                              | 442         | 85                   | 30 103 43.125       |
| 10 to 12                | 20                | 4                                | 1.15                | 4                   | 6 to 12                              | 292         |                      | on request          |
|                         |                   |                                  |                     | 10                  | 6 to 12                              | 292         | 53                   | 30 004 13.10        |
|                         | 50                | 4                                | 2.9                 | 10                  | 6 to 12                              | 442         | 53                   | 30 101 13.10        |
|                         |                   |                                  |                     | 10                  | 10 to 17.5                           | 292         | 53                   | 30 255 13.10        |
|                         |                   |                                  |                     | 10                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.10        |
|                         |                   |                                  |                     | 10                  | 10 to 24                             | 442         | 53                   | 30 006 13.10        |
|                         |                   |                                  |                     | 10                  | 10 to 24                             | 442         | 53                   | 30 006 13.10        |
|                         | 75                | 4                                | 4.3                 | 10                  | 6 to 12                              | 292         | 53                   | 30 004 13.10        |
|                         |                   |                                  |                     | 10                  | 6 to 12                              | 442         | 53                   | 30 101 13.10        |
|                         |                   |                                  |                     | 10                  | 10 to 17.5                           | 292         | 53                   | 30 255 13.10        |
|                         |                   |                                  |                     | 10                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.10        |
|                         |                   |                                  |                     | 10                  | 10 to 24                             | 442         | 53                   | 30 006 13.10        |
|                         | 100               | 4                                | 5.8                 | 16                  | 6 to 12                              | 292         | 53                   | 30 004 13.16        |
|                         |                   |                                  |                     | 16                  | 6 to 12                              | 442         | 53                   | 30 101 13.16        |
|                         |                   |                                  |                     | 16                  | 10 to 17.5                           | 292         | 53                   | 30 255 13.16        |
|                         |                   |                                  |                     | 16                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.16        |
|                         |                   |                                  |                     | 16                  | 10 to 24                             | 442         | 53                   | 30 006 13.16        |
|                         | 125               | 4                                | 7.2                 | 16                  | 6 to 12                              | 292         | 53                   | 30 004 13.16        |
|                         |                   |                                  |                     | 16                  | 6 to 12                              | 442         | 53                   | 30 101 13.16        |
|                         |                   |                                  |                     | 16                  | 10 to 17.5                           | 292         | 53                   | 30 255 13.16        |
|                         |                   |                                  |                     | 16                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.16        |
|                         |                   |                                  |                     | 16                  | 10 to 24                             | 442         | 53                   | 30 006 13.16        |
|                         | 160               | 4                                | 9.3                 | 20                  | 6 to 12                              | 292         | 53                   | 30 004 13.20        |
|                         |                   |                                  |                     | 20                  | 6 to 12                              | 442         | 53                   | 30 101 13.20        |
|                         |                   |                                  |                     | 20                  | 10 to 17.5                           | 292         | 67                   | 30 221 13.20        |
|                         |                   |                                  |                     | 20                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.20        |
|                         |                   |                                  |                     | 20                  | 10 to 24                             | 442         | 53                   | 30 006 13.20        |

| MV system               | Transformer       |                                  |                     | HV HRC fuse-link    |                                      |             |                      |                     |
|-------------------------|-------------------|----------------------------------|---------------------|---------------------|--------------------------------------|-------------|----------------------|---------------------|
| Operating voltage $U_n$ | Rated power $S_r$ | Relative impedance voltage $u_k$ | Rated current $I_r$ | Rated current $I_r$ | Min. operating / rated voltage $U_r$ | Dimension e | Outside diameter $d$ | Order No. Make SIBA |
| kV                      | kVA               | %                                | A                   | A                   | kV                                   | mm          |                      |                     |
| 10 to 12                | 200               | 4                                | 11.5                | 25                  | 6 to 12                              | 292         | 53                   | 30 004 13.25        |
|                         |                   |                                  |                     | 25                  | 6 to 12                              | 442         | 53                   | 30 101 13.25        |
|                         |                   |                                  |                     | 25                  | 10 to 17.5                           | 292         | 67                   | 30 221 13.25        |
|                         |                   |                                  |                     | 25                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.25        |
|                         |                   |                                  |                     | 25                  | 10 to 24                             | 442         | 53                   | 30 006 13.25        |
|                         | 250               | 4                                | 14.5                | 25                  | 6 to 12                              | 292         | 53                   | 30 004 13.25        |
|                         |                   |                                  |                     | 25                  | 6 to 12                              | 442         | 53                   | 30 101 13.25        |
|                         |                   |                                  |                     | 25                  | 10 to 17.5                           | 292         | 67                   | 30 221 13.25        |
|                         |                   |                                  |                     | 25                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.25        |
|                         |                   |                                  |                     | 25                  | 10 to 24                             | 442         | 53                   | 30 006 13.25        |
|                         |                   |                                  |                     | 31.5                | 6 to 12                              | 292         | 53                   | 30 004 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 6 to 12                              | 442         | 53                   | 30 101 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 10 to 17.5                           | 292         | 67                   | 30 221 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 10 to 24                             | 442         | 53                   | 30 006 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 10 to 24                             | 442         | 53                   | 30 004 13.31,5      |
|                         | 315               | 4                                | 18.3                | 31.5                | 6 to 12                              | 292         | 53                   | 30 101 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 6 to 12                              | 442         | 53                   | 30 221 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 10 to 17.5                           | 292         | 67                   | 30 231 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 10 to 17.5                           | 442         | 53                   | 30 006 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 10 to 24                             | 442         | 53                   | 30 101 13.40        |
|                         | 400               | 4                                | 23.1                | 40                  | 6 to 12                              | 292         | 53                   | 30 004 13.40        |
|                         |                   |                                  |                     | 40                  | 6 to 12                              | 442         | 53                   | 30 101 13.40        |
|                         |                   |                                  |                     | 40                  | 10 to 17.5                           | 292         | 67                   | 30 221 13.40        |
|                         |                   |                                  |                     | 40                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.40        |
|                         |                   |                                  |                     | 40                  | 10 to 24                             | 442         | 53                   | 30 006 13.40        |
|                         | 500               | 4                                | 29                  | 50                  | 6 to 12                              | 292         | 53                   | 30 004 13.50        |
|                         |                   |                                  |                     | 50                  | 6 to 12                              | 442         | 53                   | 30 101 13.50        |
|                         |                   |                                  |                     | 50                  | 10 to 17.5                           | 292         | 67                   | 30 221 13.50        |
|                         |                   |                                  |                     | 50                  | 10 to 17.5                           | 442         | 67                   | 30 232 13.50        |
|                         |                   |                                  |                     | 50                  | 10 to 24                             | 442         | 67                   | 30 014 13.50        |
|                         |                   |                                  |                     | 63                  | 6 to 12                              | 292         | 67                   | 30 012 43.63        |
|                         |                   |                                  |                     | 63                  | 10 to 24                             | 442         | 67                   | 30 014 43.63        |
|                         | 630               | 4                                | 36.4                | 63                  | 6 to 12                              | 292         | 67                   | 30 012 43.63        |
|                         |                   |                                  |                     | 63                  | 6 to 12                              | 292         | 67                   | 30 012 13.63        |
|                         |                   |                                  |                     | 63                  | 6 to 12                              | 442         | 67                   | 30 102 13.63        |
|                         |                   |                                  |                     | 63                  | 10 to 17.5                           | 442         | 67                   | 30 232 13.63        |
|                         |                   |                                  |                     | 63                  | 10 to 17.5                           | 292         | 85                   | 30 221 13.63        |
|                         |                   |                                  |                     | 63                  | 10 to 24                             | 442         | 67                   | 30 014 13.63        |
|                         |                   |                                  |                     | 63                  | 10 to 24                             | 442         | 67                   | 30 014 43.63        |
|                         |                   |                                  |                     | 80                  | 10 to 24                             | 442         | 67                   | 30 014 43.80        |
|                         |                   |                                  |                     | 80                  | 6 to 12                              | 292         | 85                   | 30 012 43.80        |
|                         |                   |                                  |                     | 80                  | 6 to 12                              | 442         | 67                   | 30 102 43.80        |
|                         | 800               | 5 (5.5)                          | 46.2                | 63                  | 6 to 12                              | 292         | 67                   | 30 012 13.63        |
|                         |                   |                                  |                     | 80                  | 6 to 12                              | 292         | 67                   | 30 012 43.80        |
|                         |                   |                                  |                     | 80                  | 6 to 12                              | 442         | 67                   | 30 102 43.80        |
|                         | 1000              | 5 (5.5)                          | 58                  | 100                 | 6 to 12                              | 442         | 67                   | 30 012 43.100       |
|                         |                   |                                  |                     | 100                 | 10 to 24                             | 442         | 85                   | 30 022 43.100       |
|                         | 1250              | 5 (5.5)                          | 72.2                | 125                 | 10 to 24                             | 442         | 85                   | 30 022 43.125       |
|                         | 1600              | 5 (to 5.7)                       | 92.3                | 160                 | 6 to 12                              | 442         | 85                   | 30 103 43.160       |
| 13.8                    | 20                | 4                                | 0.8                 | 3.15                | 10 to 24                             | 442         | 53                   | 30 006 13.3,15      |
|                         | 50                | 4                                | 2.1                 | 6.3                 | 10 to 17.5                           | 442         | 53                   | 30 231 13.6,3       |
|                         |                   |                                  |                     | 6.3                 | 10 to 17.5                           | 292         | 53                   | 30 255 13.6,3       |
|                         |                   |                                  |                     | 6.3                 | 10 to 24                             | 442         | 53                   | 30 006 13.6,3       |
|                         | 75                | 4                                | 3.2                 | 6.3                 | 10 to 17.5                           | 442         | 53                   | 30 231 13.6,3       |
|                         |                   |                                  |                     | 10                  | 10 to 17.5                           | 292         | 53                   | 30 255 13.10        |
|                         |                   |                                  |                     | 10                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.10        |
|                         |                   |                                  |                     | 10                  | 10 to 24                             | 442         | 53                   | 30 006 13.10        |
|                         | 100               | 4                                | 4.2                 | 10                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.10        |
|                         | 125               | 4                                | 5.3                 | 10                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.10        |
|                         |                   |                                  |                     | 16                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.16        |
|                         |                   |                                  |                     | 16                  | 10 to 17.5                           | 292         | 53                   | 30 255 13.16        |
|                         |                   |                                  |                     | 16                  | 10 to 24                             | 442         | 53                   | 30 006 13.16        |
|                         | 160               | 4                                | 6.7                 | 16                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.16        |
|                         | 200               | 4                                | 8.4                 | 16                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.16        |
|                         |                   |                                  |                     | 20                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.20        |
|                         |                   |                                  |                     | 20                  | 10 to 17.5                           | 292         | 53                   | 30 221 13.20        |
|                         |                   |                                  |                     | 20                  | 10 to 24                             | 442         | 53                   | 30 006 13.20        |
|                         | 250               | 4                                | 10.5                | 20                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.20        |
|                         |                   |                                  |                     | 25                  | 10 to 17.5                           | 292         | 67                   | 30 221 13.25        |
|                         |                   |                                  |                     | 25                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.25        |
|                         |                   |                                  |                     | 25                  | 10 to 24                             | 442         | 53                   | 30 006 13.25        |

# Components

Allocation of HV HRC fuses and transformers

Recommended HV HRC fuses for switchgear type SIMOSEC

| MV system               | Transformer       |                                  |                     | HV HRC fuse-link    |                                      |             |                      |                     |
|-------------------------|-------------------|----------------------------------|---------------------|---------------------|--------------------------------------|-------------|----------------------|---------------------|
| Operating voltage $U_n$ | Rated power $S_r$ | Relative impedance voltage $u_k$ | Rated current $I_r$ | Rated current $I_r$ | Min. operating / rated voltage $U_r$ | Dimension e | Outside diameter $d$ | Order No. Make SIBA |
| kV                      | kVA               | %                                | A                   | A                   | kV                                   | mm          |                      |                     |
| 13.8                    | 315               | 4                                | 13.2                | 25                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.25        |
|                         |                   |                                  |                     | 31.5                | 10 to 17.5                           | 292         | 67                   | 30 221 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 10 to 17.5                           | 442         | 53                   | 30 231 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 10 to 24                             | 442         | 53                   | 30 006 13.31,5      |
|                         | 400               | 4                                | 16.8                | 31.5                | 10 to 17.5                           | 442         | 53                   | 30 231 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 10 to 17.5                           | 292         | 67                   | 30 221 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 10 to 24                             | 442         | 53                   | 30 006 13.31,5      |
|                         | 500               | 4                                | 21                  | 40                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.40        |
|                         |                   |                                  |                     | 40                  | 10 to 17.5                           | 292         | 67                   | 30 221 13.40        |
|                         |                   |                                  |                     | 40                  | 10 to 24                             | 442         | 53                   | 30 006 13.40        |
|                         | 630               | 4                                | 26.4                | 50                  | 10 to 17.5                           | 442         | 67                   | 30 232 13.50        |
|                         |                   |                                  |                     | 50                  | 10 to 17.5                           | 292         | 67                   | 30 221 13.50        |
|                         |                   |                                  |                     | 50                  | 10 to 24                             | 442         | 67                   | 30 014 13.50        |
| 15 to 17.5              | 800               | 5 to 6                           | 33.5                | 63                  | 10 to 24                             | 442         | 67                   | 30 014 43.63        |
|                         | 1000              | 5 to 6                           | 41.9                | 80                  | 10 to 24                             | 442         | 67                   | 30 014 43.80        |
|                         | 1250              | 5 to 6                           | 52.3                | 100                 | 10 to 24                             | 442         | 85                   | 30 022 43.100       |
|                         | 1600              | 5 to 6                           | 66.9                | 125                 | 10 to 24                             | 442         | 85                   | 30 022 43.125       |
|                         | 20                | 4                                | 0.77                | 3.15                | 10 to 24                             | 442         | 53                   | 30 006 13.3,15      |
|                         |                   |                                  |                     | 6.3                 | 10 to 17.5                           | 442         | 53                   | 30 231 13.6,3       |
|                         |                   |                                  |                     | 6.3                 | 10 to 17.5                           | 292         | 53                   | 30 255 13.6,3       |
|                         | 50                | 4                                | 1.9                 | 6.3                 | 10 to 24                             | 442         | 53                   | 30 006 13.6,3       |
|                         |                   |                                  |                     | 6.3                 | 10 to 17.5                           | 442         | 53                   | 30 231 13.6,3       |
|                         |                   |                                  |                     | 6.3                 | 10 to 17.5                           | 292         | 53                   | 30 231 13.10        |
|                         | 75                | 4                                | 2.9                 | 6.3                 | 10 to 17.5                           | 442         | 53                   | 30 231 13.16        |
|                         | 100               | 4                                | 3.9                 | 10                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.16        |
|                         | 125               | 3 (3.5)                          | 4.8                 | 16                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.20        |
|                         |                   |                                  |                     | 16                  | 10 to 24                             | 442         | 53                   | 30 006 13.20        |
|                         | 160               | 4                                | 6.2                 | 16                  | 10 to 17.5                           | 442         | 53                   | 30 231 13.20        |
|                         | 200               | 3 (3.5)                          | 7.7                 | 20                  | 10 to 17.5                           | 442         | 53                   | 30 221 13.25        |
|                         |                   |                                  |                     | 20                  | 10 to 17.5                           | 292         | 67                   | 30 221 13.31,5      |
|                         |                   |                                  |                     | 20                  | 10 to 24                             | 442         | 53                   | 30 006 13.31,5      |
|                         | 250               | 3 (3.5)                          | 9.7                 | 25                  | 10 to 17.5                           | 292         | 67                   | 30 231 13.31,5      |
|                         | 315               | 3 (3.5)                          | 12.2                | 31.5                | 10 to 17.5                           | 292         | 67                   | 30 221 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 10 to 24                             | 442         | 53                   | 30 006 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 10 to 17.5                           | 442         | 53                   | 30 231 13.31,5      |
|                         | 400               | 4                                | 15.5                | 31.5                | 10 to 17.5                           | 292         | 67                   | 30 221 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 10 to 17.5                           | 442         | 53                   | 30 006 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 10 to 24                             | 442         | 53                   | 30 231 13.31,5      |
|                         | 500               | 4                                | 19.3                | 31.5                | 10 to 17.5                           | 442         | 53                   | 30 006 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 10 to 24                             | 442         | 53                   | 30 221 13.31,5      |
|                         |                   |                                  |                     | 31.5                | 10 to 17.5                           | 292         | 67                   | 30 231 13.40        |
|                         |                   |                                  |                     | 40                  | 10 to 17.5                           | 442         | 53                   | 30 006 13.40        |
|                         |                   |                                  |                     | 40                  | 10 to 24                             | 442         | 53                   | 30 231 13.40        |
|                         |                   |                                  |                     | 40                  | 10 to 17.5                           | 292         | 67                   | 30 221 13.40        |
|                         |                   |                                  |                     | 40                  | 10 to 24                             | 442         | 67                   | 30 232 13.50        |
|                         | 630               | 4                                | 24.3                | 50                  | 10 to 17.5                           | 442         | 67                   | 30 014 13.50        |
|                         |                   |                                  |                     | 50                  | 10 to 24                             | 442         | 67                   | 30 014 43.63        |
|                         |                   |                                  |                     | 63                  | 10 to 24                             | 442         | 67                   | 30 014 43.63        |
|                         |                   |                                  |                     | 63                  | 10 to 24                             | 442         | 67                   | on request          |
|                         |                   |                                  |                     | 100                 | 10 to 24                             | 442         | 85                   | on request          |
|                         |                   |                                  |                     | 125                 | 10 to 24                             | 442         | 85                   | on request          |
|                         |                   |                                  |                     | 125                 | 10 to 24                             | 442         | 85                   | on request          |
| 20 to 24                | 20                | 4                                | 0.57                | 3.15                | 10 to 24                             | 442         | 53                   | 30 006 13.3,15      |
|                         | 50                | 4                                | 1.5                 | 6.3                 | 10 to 24                             | 442         | 53                   | 30 006 13.6,3       |
|                         | 75                | 4                                | 2.2                 | 6.3                 | 10 to 24                             | 442         | 53                   | 30 006 13.6,3       |
|                         | 100               | 4                                | 2.9                 | 6.3                 | 10 to 24                             | 442         | 53                   | 30 006 13.6,3       |
|                         | 125               | 4                                | 3.6                 | 10                  | 10 to 24                             | 442         | 53                   | 30 006 13.10        |
|                         | 160               | 4                                | 4.7                 | 10                  | 10 to 24                             | 442         | 53                   | 30 006 13.10        |
|                         | 200               | 4                                | 5.8                 | 16                  | 10 to 24                             | 442         | 53                   | 30 006 13.16        |
|                         | 250               | 4                                | 7.3                 | 16                  | 10 to 24                             | 442         | 53                   | 30 006 13.16        |
|                         | 315               | 4                                | 9.2                 | 16                  | 10 to 24                             | 442         | 53                   | 30 006 13.16        |
|                         |                   |                                  |                     | 20                  | 10 to 24                             | 442         | 53                   | 30 006 13.20        |
|                         | 400               | 4                                | 11.6                | 20                  | 10 to 24                             | 442         | 53                   | 30 006 13.20        |
|                         | 500               | 4                                | 14.5                | 25                  | 10 to 24                             | 442         | 53                   | 30 006 13.25        |
|                         |                   |                                  |                     | 31.5                | 10 to 24                             | 442         | 53                   | 30 006 13.31,5      |
|                         | 630               | 4                                | 18.2                | 31.5                | 10 to 24                             | 442         | 53                   | 30 006 13.31,5      |
|                         | 800               | 5 to 6                           | 23.1                | 31.5                | 10 to 24                             | 442         | 53                   | 30 006 13.31,5      |
|                         |                   |                                  |                     | 40                  | 10 to 24                             | 442         | 53                   | 30 006 13.40        |
|                         | 1000              | 5 to 6                           | 29                  | 40                  | 10 to 24                             | 442         | 53                   | 30 006 13.40        |
|                         | 1250              | 5 (to 5.9)                       | 36                  | 50                  | 10 to 24                             | 442         | 67                   | 30 014 13.50        |
|                         | 1600              | 5 (to 5.5)                       | 46.5                | 80                  | 10 to 24                             | 442         | 67                   | 30 014 43.80        |
|                         | 2000              | 5 to 6                           | 57.8                | 100                 | 10 to 24                             | 442         | 85                   | 30 022 43.100       |
|                         | 2500              | 5 (to 5.7)                       | 72.2                | 140                 | 10 to 24                             | 442         | 85                   | 30 022 43.140       |

### Features

- According to IEC 61869-2 / DIN EN 61869-2 \*)
- Designed as a three-pole ring-core current transformer
- Free of dielectrically stressed cast-resin parts (due to design)
- Insulation class E
- Inductive type
- Climate-independent
- Secondary connection by means of a terminal strip in the panel.

### Installation

- Arranged outside the switching-device vessel on the bushings
- Factory-assembled
- Mounting location:
  - For circuit-breaker panels type L...
  - For bus sectionalizer panels type L(T)
  - Option: On request for ring-main-panels type R...

### Other designs (option)

For protection equipment based on the current-transformer operation principle: Three-phase current transformer type 4MC63 60 for

- Protection relay 7SR45 (7SJ46) as definite-time overcurrent protection
- Definite-time overcurrent protection relay, make Woodward/SEG, type WIP-1.

Three-phase current transformer 4MC63 64 for

- Definite-time overcurrent protection relay, make Woodward/SEG, type WIC.

### Three-phase current transformer 4MC63 ...



### installed on bushing-type insulators



| Technical data | Three-phase current transformer <b>4MC63 60</b> (standard type) <sup>1)</sup> |                                           |                                             |
|----------------|-------------------------------------------------------------------------------|-------------------------------------------|---------------------------------------------|
|                | for $I_N \leq 150$ A<br>for $I_D = 630$ A                                     | for $I_N \leq 400$ A<br>for $I_D = 630$ A | for $I_N \leq 1000$ A<br>for $I_D = 1250$ A |

### Primary data

|                                                                       |                                                  |     |     |    |    |                                                  |     |     |                                                  |     |     |     |
|-----------------------------------------------------------------------|--------------------------------------------------|-----|-----|----|----|--------------------------------------------------|-----|-----|--------------------------------------------------|-----|-----|-----|
| Highest voltage for equipment $U_m$                                   | 0.72 kV                                          |     |     |    |    | 0.72 kV                                          |     |     | 0.72 kV                                          |     |     |     |
| Rated current $I_N$                                                   | A                                                | 150 | 100 | 75 | 50 | 400                                              | 300 | 200 | 1000                                             | 750 | 600 | 500 |
| Rated short-duration power-frequency withstand voltage (winding test) | 3 kV                                             |     |     |    |    | 3 kV                                             |     |     | 3 kV                                             |     |     |     |
| Rated short-time thermal current $I_{th}$                             | 25 kA / 1 s, 2 s <sup>1)</sup><br>or 20 kA / 3 s |     |     |    |    | 25 kA / 1 s, 2 s <sup>1)</sup><br>or 20 kA / 3 s |     |     | 25 kA / 1 s, 2 s <sup>1)</sup><br>or 20 kA / 3 s |     |     |     |
| Rated continuous thermal current $I_D$                                | 630 A                                            |     |     |    |    | 630 A                                            |     |     | 1250 A                                           |     |     |     |
| Transient overload current                                            | 1.5 x $I_D$ / 1 h                                |     |     |    |    | 2 x $I_D$ / 0.5 h                                |     |     | 1.5 x $I_D$ / 1 h                                |     |     |     |
| Rated dynamic current $I_{dyn}$                                       | 2.5 x $I_{th}$                                   |     |     |    |    | 2.5 x $I_{th}$                                   |     |     | unlimited                                        |     |     |     |

### Secondary data

|                        |                    |       |   |      |     |      |         |      |     |        |      |     |     |
|------------------------|--------------------|-------|---|------|-----|------|---------|------|-----|--------|------|-----|-----|
| Rated current          |                    | A     | 1 | 0.67 | 0.5 | 0.33 | 1       | 0.75 | 0.5 | 1      | 0.75 | 0.6 | 0.5 |
| Rating                 |                    | VA    | 5 | 3.33 | 2.5 | 1.67 | 5       | 3.75 | 2.5 | 5      | 3.75 | 3   | 2.5 |
| Rated current (option) |                    | 5 A   |   |      |     |      | 5 A     |      |     | 5 A    |      |     |     |
| Current at $I_D$       |                    | 4.2 A |   |      |     |      | 1.575 A |      |     | 1.25 A |      |     |     |
| Protection core        | Class              | 10 P  |   |      |     |      | 10 P    |      |     | 10 P   |      |     |     |
|                        | Overcurrent factor | 10    |   |      |     |      | 10      |      |     | 10     |      |     |     |

1) Other values on request, e.g. as additional type 4MC63 63 (complementary types)

\*) For standards, see page 72

# Components

Cable-type current transformers 4MC70 33 and 4MC70 31

## Features

- According to IEC 61869-2 / DIN EN 61869-2 \*)
- Designed as a single-pole ring-core current transformer
- Climate-independent
- Free of dielectrically stressed cast-resin parts (due to design)
- Insulation class E
- Inductive type
- Secondary connection by means of a terminal strip inside the panel.

## Application

- For circuit-breaker panels type L...
- For ring-main panels type R...
- For transformer panels type T...

## Installation

- Cable-type current transformer 4MC70 33 for panel types: R..., K..., L...
- Cable-type current transformer 4MC70 31: E.g. for panel types R..., K... and T...
- Arranged on the cable at the panel connection
- For shielded cables
- Transformers mounted on a supporting plate at our factory; final assembly on the cables on site.

\*) For standards, see page 72

1) Depending on the core data

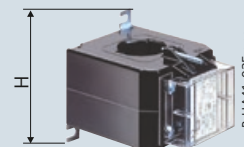
2) Available installation space for cable-type current transformers inside the panels depends on make, type and cross-section of sealing end.

Example: Panel type R or K:  
Installation space approx. 285 mm

## Cable-type current transformer 4MC70 33, 4 overall heights



## Cable-type current transformer 4MC70 31



On request:

Cable-type current transformer



| Technical data | Cable-type current transformer 4MC70 33 | Cable-type current transformer 4MC70 31 |
|----------------|-----------------------------------------|-----------------------------------------|
|----------------|-----------------------------------------|-----------------------------------------|

## Primary data

|                                                                       |                                                 |                                                 |
|-----------------------------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Highest voltage for equipment $U_m$                                   | 0.72 kV                                         | 0.72 kV                                         |
| Rated current $I_N$                                                   | 20 A to 600 A                                   | 50 A to 600 A                                   |
| Rated short-duration power-frequency withstand voltage (winding test) | 3 kV                                            | 3 kV                                            |
| Rated short-time thermal current $I_{th}$                             | up to 25 kA/1 s or 25 kA/3 s or 20 kA/3 s       | 25 kA/1 s, or 14.5 kA/3 s                       |
| Rated continuous thermal current $I_D$                                | $1.0 \times I_N$<br>option: $1.2 \times I_N$    | $1.0 \times I_N$<br>option: $1.2 \times I_N$    |
| Transient overload current                                            | $1.5 \times I_D/1$ h<br>or $2 \times I_D/0.5$ h | $1.5 \times I_D/1$ h<br>or $2 \times I_D/0.5$ h |
| Rated dynamic current $I_{dyn}$                                       | $2.5 \times I_{th}$                             | $2.5 \times I_{th}$                             |

## Secondary data

|                       |                    |                            |     |            |
|-----------------------|--------------------|----------------------------|-----|------------|
| Rated current         | 1 A or 5 A         |                            |     | 1 A or 5 A |
| Measuring core        | Class              | 0.2                        | 0.5 | 1          |
|                       | Overcurrent factor | without                    | FS5 | FS10       |
|                       | Rating             | 2.5 VA to 30 VA            |     |            |
| Protection core       | Class              | 10 P                       | 5 P | –          |
|                       | Overcurrent factor | 10                         | 10  | –          |
|                       | Rating             | 2.5 VA to 10 VA            |     |            |
| Option: Secondary tap |                    | 1 : 2 (e.g. 150 A – 300 A) |     |            |
|                       |                    | 1 : 2                      |     |            |

## Dimensions

|                          |        |        |        |        |                |
|--------------------------|--------|--------|--------|--------|----------------|
| Overall height $H$ 2) mm | 65 1)  | 110 1) | 170 1) | 285 1) | 89             |
| Outside diameter         | 150 mm |        |        |        | 85 mm x 114 mm |
| Inside diameter          | 55 mm  |        |        |        | 40 mm          |
| For cable diameter       | 50 mm  |        |        |        | 36 mm          |

Other values on request

## Features

### Current transformer 4MA7

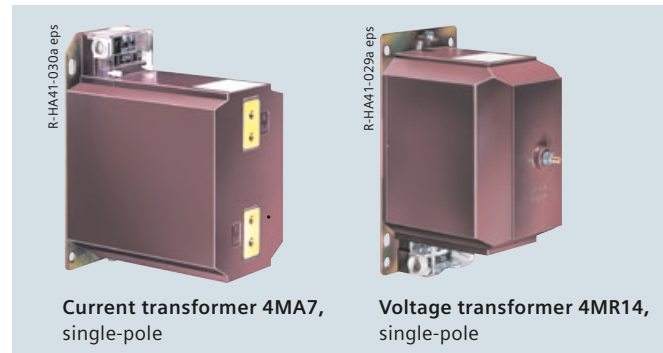
- According to IEC 61869-2 / DIN EN 61869-2 \*)
- Dimensions according to DIN 42600-8
- Designed as a single-pole indoor block-type current transformer
- Cast-resin insulated
- Insulation class E
- Secondary connection by means of screw-type terminals.

### Voltage transformer 4MR

- According to IEC 61869-3 / DIN EN 61869-3 \*)
- Dimensions according to DIN 42600-9 (small model)
- Designed as an indoor voltage transformer:
  - Type 4MR, single-pole
  - Option: Type 4MR, two-pole
- Cast-resin insulated
- Insulation class E
- Secondary connection by means of screw-type terminals.

## Application

- For panel types:
  - Metering panel type M...as billing metering panel (750 mm wide)
  - Metering panel/bus riser panel type H and H1
  - Busbar voltage transformer panel types M(VT), M(VT-F), L ...
- For mounting at the feeder.



## Technical data

### Current transformer 4MA7, single-pole (other values on request)

#### Primary data

|                                                              |    |                                                    |     |    |    |      |     |
|--------------------------------------------------------------|----|----------------------------------------------------|-----|----|----|------|-----|
| Highest voltage for equipment $U_m$                          | kV | 3.6                                                | 7.2 | 12 | 12 | 17.5 | 24  |
| Rated short-duration power-frequency withstand voltage $U_d$ | kV | 10                                                 | 20  | 28 | 42 | 38   | 50  |
| Rated lightning impulse withstand voltage $U_p$              | kV | 20                                                 | 60  | 75 | 75 | 95   | 125 |
| Rated current $I_N$                                          | A  | 20 to 1200                                         |     |    |    |      |     |
| Rated short-time thermal current $I_{th}$                    | kA | up to 20 kA/3 s, or up to 25 kA/1 s                |     |    |    |      |     |
| Rated continuous thermal current $I_D$                       |    | up to $1.0 \times I_N$ (option: $1.2 \times I_N$ ) |     |    |    |      |     |
| Rated dynamic current $I_{dyn}$                              |    | max. $2.5 \times I_{th}$                           |     |    |    |      |     |

#### Secondary data

|                 |                    |    |             |     |      |
|-----------------|--------------------|----|-------------|-----|------|
| Rated current   |                    | A  | 1 or 5      |     |      |
| Measuring core  | Class              |    | 0.2         | 0.5 | 1    |
|                 | Overcurrent factor |    | without     | FS5 | FS10 |
|                 | Rating             | VA | 2.5 to 30   |     |      |
| Protection core | Class              |    | 5 P or 10 P |     |      |
|                 | Overcurrent factor |    | 10          |     |      |
|                 | Rating             | VA | 2.5 to 30   |     |      |

### Voltage transformer 4MR, single-pole (other values on request)

#### Primary data

|                                                              |    |                  |                                                                    |                                         |                    |                                                     |                                          |
|--------------------------------------------------------------|----|------------------|--------------------------------------------------------------------|-----------------------------------------|--------------------|-----------------------------------------------------|------------------------------------------|
| Highest voltage for equipment $U_m (= 1.2 \times U_N)$       | kV | 3.6              | 7.2                                                                | 12                                      | 12                 | 17.5                                                | 24                                       |
| Rated short-duration power-frequency withstand voltage $U_d$ | kV | 10               | 20                                                                 | 28                                      | 42                 | 38                                                  | 50                                       |
| Rated lightning impulse withstand voltage $U_p$              | kV | 20               | 60                                                                 | 75                                      | 75                 | 95                                                  | 125                                      |
| Rated voltage $U_N$                                          | kV | 3.3/√3           | 3.6/√3<br>4.2/√3<br>4.8/√3<br>5.0/√3<br>6.0/√3<br>6.3/√3<br>6.6/√3 | 7.2/√3<br>10.0/√3<br>11.0/√3<br>11.6/√3 | 10.0/√3<br>11.0/√3 | 12.8/√3<br>13.2/√3<br>13.8/√3<br>15.0/√3<br>16.0/√3 | 17.5/√3<br>20.0/√3<br>22.0/√3<br>23.0/√3 |
| Rated voltage factor (8 h)                                   |    | $1.9 \times U_N$ |                                                                    |                                         |                    |                                                     |                                          |

#### Secondary data

|                                              |    |                 |     |     |  |  |  |
|----------------------------------------------|----|-----------------|-----|-----|--|--|--|
| Rated voltage                                | V  | 100/√3          |     |     |  |  |  |
|                                              |    | 110/√3 (option) |     |     |  |  |  |
|                                              |    | 120/√3 (option) |     |     |  |  |  |
| Rated voltage for auxiliary winding (option) | V  | 100/3           |     |     |  |  |  |
|                                              |    | 110/3 (option)  |     |     |  |  |  |
|                                              |    | 120/3 (option)  |     |     |  |  |  |
| Rating                                       | VA | 20              | 50  | 100 |  |  |  |
| Class                                        |    | 0.2             | 0.5 | 1.0 |  |  |  |

\*) For standards, see page 72

# Components

## Indicating and measuring equipment

### Ready-for-service indicator

#### Features

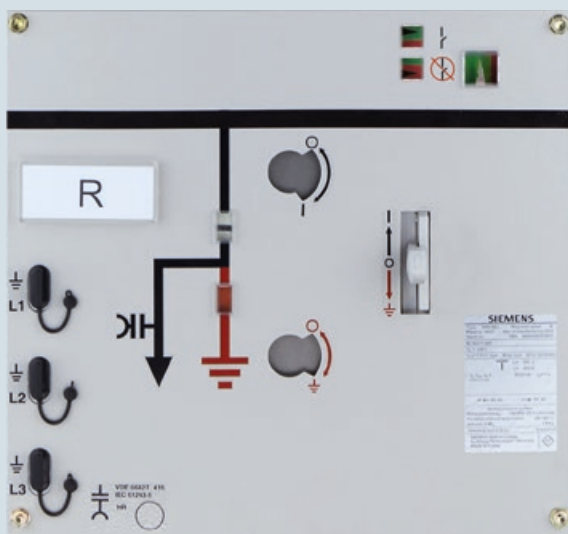
- Self-monitoring; easy to read
- Independent of temperature and pressure variations
- Independent of the site altitude
- Only responds to changes in gas density
- Option: Alarm switch "1 NO" for remote electrical indication.

#### Mode of operation

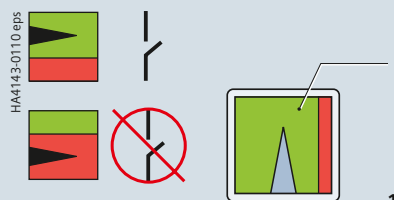
For the ready-for-service indicator, a gas-tight measurement box is installed inside the switching-device vessel. A coupling magnet, which is fitted to the bottom end of the measurement box, transmits its position to an outside armature through the non-magnetizable stainless-steel switching-device vessel. This armature moves the ready-for-service indicator of the switchgear.

While changes in the gas density during the loss of gas, which are decisive for the dielectric strength, are displayed, temperature-dependent changes in the gas pressure are not. The gas in the measurement box has the same temperature as that in the switching-device vessel. The temperature effect is compensated via the same pressure change in both gas volumes.

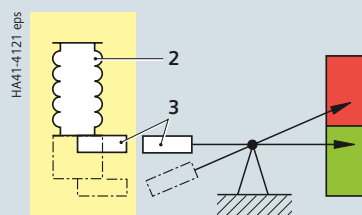
### Ready-for-service indicator



### Gas monitoring



1 Green indication:  
Ready for service  
(red indication:  
Not ready for service)



Stainless-steel vessel  
filled with SF<sub>6</sub> gas

Ready-for-service  
indicator

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

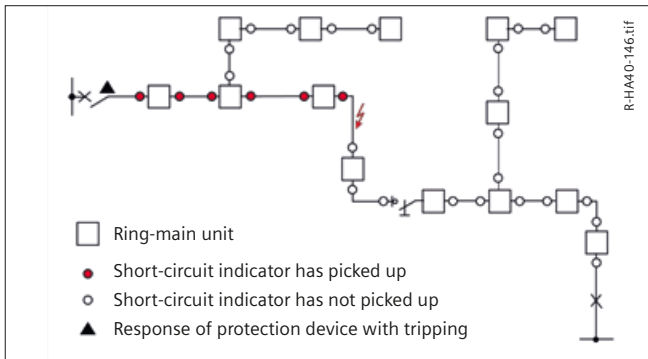
2 Measurement box  
3 Magnetic coupling

### Short-circuit/earth-fault indicators make Horstmann

Short-circuit/earth-fault indicator (option)

Ring-main, cable and circuit-breaker feeders can optionally be equipped with short-circuit or earth-fault indicators in different designs. The equipment features are shown in the table on page 46.

Short-circuit and earth-fault indicators reduce the downtimes of a power system by delimiting the fault locations in medium-voltage systems.



Short-circuit/earth-fault indicators can be used in all kinds of power systems. In impedance-earthed and solidly earthed systems, as well as in isolated and compensated (resonant-earthed) systems, earth-fault detection is also possible.

### SIGMA 2.0 with basic functions

- Adjustable pickup values
- Phase-selective fault indication
- Reset of the fault indication: manually, automatically, from remote
- Earth-fault detection in impedance-earthed or solidly earthed systems
- Remote indication with relay contacts.

### SIGMA D++ with directional function

- Directional short-circuit indication
- Directional earth-fault indication for all types of neutral treatment
- Unambiguous indication of the fault direction
- Monitoring with "SIGMA Explorer" software.

### ComPass B 2.0 with monitoring

- Voltage detection via WEGA voltage detecting system and resistive sensor system for up to 4 devices
- High-precision current and voltage measurement up to 0.5 %
- Monitoring of the values: U, I, f, P, Q, S, E, cos  $\varphi$ , load flow direction, power meter with direction
- Temperature measurement with PT100
- Limit value recording for U, I, P, Q, T
- Transfer of measured values, fault indications and events via RS485/MODBUS.

### ComPass Bs 2.0 with control function

- Remote control of a switch-disconnector or circuit-breaker
- Freely programmable logic to define the switching conditions
- 6 binary inputs for recording relevant state information from the switchgear/substation.



EARTH ZERO



ALPHA E



SIGMA 2.0



SIGMA D++



ComPass B 2.0

All indicators (except ALPHA) use the same phase current sensors.

# Components

Indicating and measuring equipment

| Short-circuit/<br>earth-fault indicators<br>from Horstmann | ALPHA M<br>ALPHA E | SIGMA 2.0<br>SIGMA 2.0 AC / DC | SIGMA F+E 2.0<br>SIGMA F+E 2.0 AC / DC | SIGMA F+E 3 2.0<br>SIGMA F+E 3 2.0 AC / DC | SIGMA D | SIGMA D+ | SIGMA D++ | ComPass A 2.0 | ComPass B 2.0 | ComPass Bs 2.0 | Earth Zero-<br>EarthZeroFlag |
|------------------------------------------------------------|--------------------|--------------------------------|----------------------------------------|--------------------------------------------|---------|----------|-----------|---------------|---------------|----------------|------------------------------|
|------------------------------------------------------------|--------------------|--------------------------------|----------------------------------------|--------------------------------------------|---------|----------|-----------|---------------|---------------|----------------|------------------------------|

## Function

|                                                                      |       |       |       |       |       |       |       |       |       |       |       |
|----------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Short circuit / earth fault                                          | ■ / ■ | ■ / ■ | ■ / ■ | ■ / ■ | ■ / ■ | ■ / ■ | ■ / ■ | ■ / ■ | ■ / ■ | ■ / ■ | - / ■ |
| Direction indication                                                 | -     | -     | -     | -     | ■     | ■     | ■     | -     | ■     | ■     | -     |
| Monitoring: U, I, f, P, Q, S, E, cos $\varphi$ , load flow direction | -     | -     | -     | -     | -     | -     | -     | ■     | ■     | ■     | -     |
| Control of a CB or SD                                                | -     | -     | -     | -     | -     | -     | -     | -     | -     | ■     | -     |
| Logic                                                                | -     | -     | -     | -     | -     | -     | -     | -     | -     | ■     | -     |

## Applicable for the following neutral treatments

|                   |   |   |   |   |   |   |   |   |   |   |   |
|-------------------|---|---|---|---|---|---|---|---|---|---|---|
| Impedance earthed | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Solidly earthed   | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Isolated          | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | - |
| Compensated       | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | - |

## Short-circuit pickup values

|                           |                       |                                                        |                     |                                                                                     |  |              |  |   |  |
|---------------------------|-----------------------|--------------------------------------------------------|---------------------|-------------------------------------------------------------------------------------|--|--------------|--|---|--|
| I>> Short-circuit current | 400, 600, 800, 1000 A | 200, 300, 400, 600, 800, 1000, 2000 A, self-adjustment |                     | DIP: 200, 300, 400, 600, 800, 2000 A, self-adjustment<br>Software (SW): 50 – 2000 A |  | 20 – 2000 A  |  | - |  |
| tl>> Pickup delay         | 100 ms                | 40, 80 ms                                              | 40, 80, 200, 300 ms | DIP: 40, 80 ms,<br>Software (SW): 40 ms – 60 s                                      |  | 40 ms – 60 s |  | - |  |

## Earth-fault pickup values

|                                       |   |   |                                   |                     |                                                                       |            |            |              |            |                   |
|---------------------------------------|---|---|-----------------------------------|---------------------|-----------------------------------------------------------------------|------------|------------|--------------|------------|-------------------|
| IES> Short-circuit-to-earth current   | – | – | 20, 40, 60, 80, 100, 120 or 160 A |                     | DIP: off, 20, 40, 60, 80, 100, 120, 160 A, Software (SW): 20 – 1000 A |            |            | 20 – 1000 A  |            | 25, 50, 75, 100 A |
| IET> Transient earth fault            | – | – | –                                 | –                   | –                                                                     | 10 – 100 A | 10 – 500 A | –            | 10 – 500 A | –                 |
| IEP> Active residual current cos φ    | – | – | –                                 | –                   | –                                                                     | 5 – 200 A  | 5 – 200 A  | –            | 1 – 200 A  | –                 |
| IEQ> Reactive current sin φ           | – | – | –                                 | –                   | –                                                                     | 5 – 200 A  | 5 – 200 A  | –            | 1 – 200 A  | –                 |
| UNE> Permanent earth fault            | – | – | –                                 | –                   | –                                                                     | –          | –          | –            | 1 – 100%   | –                 |
| ΔIE> Pulse location (pulse amplitude) | – | – | –                                 | ■                   | –                                                                     | 1 – 100 A  | 1 – 100 A  | 1 – 200 A    |            | –                 |
| Pickup delay                          | – | – | 80, 200 ms                        | 60, 80, 200, 300 ms | DIP: 80, 160 ms, Software (SW): 40 ms – 60 s                          |            |            | 40 ms – 60 s |            | 80, 160 ms        |

## Reset

|                          |                        |       |       |       |       |       |       |       |       |       |       |
|--------------------------|------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Manually / from remote   | ■ / - (M)<br>■ / ■ (E) | ■ / ■ | ■ / ■ | ■ / ■ | ■ / ■ | ■ / ■ | ■ / ■ | ■ / ■ | ■ / ■ | ■ / ■ | ■ / - |
| Auto. time reset         | ■ (E)                  | ■     | ■     | ■     | ■     | ■     | ■     | ■     | ■     | ■     | ■     |
| Current/voltage recovery | -                      | -     | -     | ■ / - | ■ / ■ | ■ / ■ | ■ / ■ | ■ / - | ■ / ■ | ■ / ■ | - / ■ |

## Test

|                        |       |       |       |       |       |       |       |       |   |   |       |
|------------------------|-------|-------|-------|-------|-------|-------|-------|-------|---|---|-------|
| Manually / from remote | ■ / - | ■ / ■ | ■ / ■ | ■ / ■ | ■ / ■ | ■ / ■ | ■ / ■ | ■ / ■ | ■ | ■ | ■ / - |
|------------------------|-------|-------|-------|-------|-------|-------|-------|-------|---|---|-------|

## Communication

|                              |            |            |   |            |   |            |   |            |   |            |   |
|------------------------------|------------|------------|---|------------|---|------------|---|------------|---|------------|---|
| Relay contact                | 1          | 1          | 2 | 3          | 4 | 4          | 4 | 4          | 4 | 4          | 1 |
| Maintained / passing contact | adjustable | adjustable |   | adjustable |   | adjustable |   | adjustable |   | adjustable |   |
| RS485 / MODBUS-RTU           | -          | -          | - | -          | - | -          | - | ■          | ■ | ■          | - |
| USB connection               | -          | -          | - | -          | ■ | ■          | ■ | ■          | ■ | ■          | - |

## Parameterizing

|                        |       |       |       |       |       |       |       |       |       |       |       |
|------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Manually / from remote | ■ / - | ■ / - | ■ / - | ■ / - | ■ / - | ■ / - | ■ / - | ■ / ■ | ■ / ■ | ■ / ■ | ■ / - |
|------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|

## Supply

|                              |       |                                               |   |                                                  |   |                                        |                                  |                    |   |   |   |
|------------------------------|-------|-----------------------------------------------|---|--------------------------------------------------|---|----------------------------------------|----------------------------------|--------------------|---|---|---|
| Lithium cell, ≥ 20 years     | ■ (E) | ■ / Capacitor (AC/DC)                         |   | ■                                                | ■ | ■                                      | ■                                | ■                  | ■ | ■ | ■ |
| Current-transformer operated | ■     | ■                                             | ■ | ■                                                | ■ | ■                                      | ■ (not IET>)                     | -                  | - | - | ■ |
| External auxiliary voltage   | -     | 24 – 230 V AC / DC<br>(only AC / DC versions) |   | 24 – 230 V AC / DC<br>(SIGMA F+E 3 2.0 optional) | - | 24 V AC,<br>24 – 60 V DC<br>(possible) | 24 – 230 V AC / DC<br>(for IET>) | 24 – 230 V AC / DC |   | - |   |

## Binary inputs

|        |   |   |   |   |   |   |   |   |   |   |   |
|--------|---|---|---|---|---|---|---|---|---|---|---|
| Number | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 6 | - |
|--------|---|---|---|---|---|---|---|---|---|---|---|

## Number of phase current/summation current sensors

|                             |     |     |     |     |     |                     |            |     |                       |     |  |
|-----------------------------|-----|-----|-----|-----|-----|---------------------|------------|-----|-----------------------|-----|--|
| Short circuit / earth fault | 3/0 | 3/0 | 3/0 | 3/0 | 3/0 | 3/0 or 3/1 for IET> | 3/0 or 3/1 | 3/0 | 3/0 (opt. 3/1 or 2/1) | 0/1 |  |
|-----------------------------|-----|-----|-----|-----|-----|---------------------|------------|-----|-----------------------|-----|--|

## Voltage coupling

|            |   |   |   |   |   |   |   |   |   |   |   |
|------------|---|---|---|---|---|---|---|---|---|---|---|
| Capacitive | - | - | - | - | ■ | ■ | ■ | - | ■ | ■ | - |
| Resistive  | - | - | - | - | - | - | - | - | ■ | ■ | - |

### Short-circuit / short-circuit-to-earth and earth-fault indicators, make Kries

Ring-main, cable and circuit-breaker feeders can optionally be equipped with short-circuit or earth-fault indicators in different designs. The equipment features are shown in the table on page 48.

The three most common types of faults in medium-voltage systems are earth faults in cables and switchgear, faults and overloads of distribution transformers, as well as short circuits in cables and switchgear. For fast fault location and minimization of downtimes, electronic fault indicators are used:

- Selective fault detection, and thus minimization of downtimes
- Reliable fault detection through electronic measured-value acquisition
- Remote indication of fault events and measured values.

#### 1. Short-circuit and short-circuit-to-earth indicator IKI-20

- Universally adjustable
- Current-transformer supported battery version or auxiliary voltage versions available
- Extended commissioning and testing functions.

#### 2. Short-circuit and earth-fault indicator IKI-20PULS

- Short-circuit detection same as IKI-20
- Earth-fault detection via pulse location in compensated systems.

#### 3. Short-circuit and earth-fault indicator IKI-20C(PULS)

- Current-transformer operated (No battery, no auxiliary voltage)
- Optionally with pulse location for earth-fault detection in compensated systems.

#### 4. Directional short-circuit and earth-fault indicator IKI-22

- Directional fault detection for all system types
- Directional detection combined with the voltage detecting system CAPDIS-Sx+.

#### 5. Grid-Inspector IKI-50

- Directional measured-value acquisition
- Monitoring of values U, I, f, P, Q, S, E, cos  $\varphi$ , power factor, load flow direction (momentary value, mean value and min/max value, directional)
- Directional fault detection for all system types
- Switchgear control or automation through an integrated, programmable logic component
- Directional detection combined with the voltage detecting system CAPDIS-Sx+.

#### Options:

- One device controls two cable panels and the load flow total
- Directional detection combined with resistor dividers (accuracy 1.0 %)
- Early fault detection and detection of intermittent earth faults
- Telecontrol interface according to IEC 60870-5-104.

#### 6. Short-circuit-to-earth indicator IKI-10light

- Earth-fault detection in systems with impedance-earthed neutral or temporarily impedance-earthed neutral
- Adjustable.



# Components

## Indicating and measuring equipment

| Short-circuit/<br>earth-fault indicators<br>from Kries | IKI-20B | IKI-20T | IKI-20U | IKI-20PULS | IKI-20C | IKI-20CPULS | IKI-22 | IKI-50_1F | IKI-<br>50_1F_EW_<br>PULS | IKI-50_2F | IKI-<br>50_2F_EW_<br>PULS | IKI-10-light-P |
|--------------------------------------------------------|---------|---------|---------|------------|---------|-------------|--------|-----------|---------------------------|-----------|---------------------------|----------------|
|--------------------------------------------------------|---------|---------|---------|------------|---------|-------------|--------|-----------|---------------------------|-----------|---------------------------|----------------|

### Function

|                                                    |   |   |   |   |   |   |   |   |   |   |   |   |
|----------------------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Short-circuit indication                           | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |   |
| Earth-fault indication                             |   |   |   | ■ |   | ■ | ■ | ■ | ■ | ■ | ■ |   |
| Short-circuit-to-earth<br>indication <sup>5)</sup> | ■ | ■ | ■ |   | ■ |   | ■ | ■ | ■ | ■ | ■ | ■ |
| Direction indication                               |   |   |   |   |   |   | ■ | ■ | ■ | ■ | ■ |   |

### Applicable for the following neutral earthing options

|             |   |   |   |   |   |   |   |   |   |   |   |   |
|-------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Impedance   | ■ | ■ | ■ |   | ■ |   | ■ | ■ | ■ | ■ | ■ | ■ |
| Solid       | ■ | ■ | ■ |   | ■ |   | ■ | ■ | ■ | ■ | ■ | ■ |
| Isolated    | ■ | ■ | ■ |   | ■ | ■ | ■ | ■ | ■ | ■ | ■ |   |
| Compensated | ■ | ■ | ■ | ■ | ■ |   | ■ | ■ | ■ | ■ | ■ |   |

### Pickup current

|                                                 |                                       |  |  |   |                       |   |                                            |  |                                 |  |                  |  |
|-------------------------------------------------|---------------------------------------|--|--|---|-----------------------|---|--------------------------------------------|--|---------------------------------|--|------------------|--|
| Short-circuit current                           | 100, 200, 400, 600, 800, 1000, 2000 A |  |  |   | 400, 600, 800, 1000 A |   | 100, 200, 300, 400, 600, 800, 1000, 2000 A |  | 100 ... 1000 A (steps of 100 A) |  |                  |  |
| Earth-fault current                             |                                       |  |  |   |                       |   | Transient fault detection                  |  | 4 ... 30 A (steps of 1 A)       |  |                  |  |
| Short-circuit-to-earth<br>current <sup>5)</sup> | 40, 80, 100, 150 A                    |  |  |   |                       |   | 40, 80, 100, 200 A                         |  | 40 ... 200 A (steps of 10 A)    |  | 20, 40, 60, 80 A |  |
| Pulse location                                  |                                       |  |  | ■ |                       | ■ |                                            |  | ■                               |  | ■                |  |

### Pickup time

|                                              |                     |  |  |                |  |                     |                           |               |  |
|----------------------------------------------|---------------------|--|--|----------------|--|---------------------|---------------------------|---------------|--|
| Short-circuit current                        | 60, 80, 150, 200 ms |  |  | 100 ms         |  | 60, 80, 150, 200 ms |                           | 60 – 1600 ms  |  |
| Short-circuit-to-earth current <sup>5)</sup> | 60, 80, 150, 200 ms |  |  | 100 ms         |  | 60, 80, 150, 200 ms |                           | 60 – 1600 ms  |  |
| Earth-fault current                          |                     |  |  | Pulse location |  | Pulse location      | Transient fault detection | 400 – 3000 ms |  |
|                                              |                     |  |  |                |  |                     |                           | 70, 250 ms    |  |

### Reset

|             |   |   |   |   |   |   |   |   |   |   |   |   |
|-------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Manual      | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Automatic   | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| From remote | ■ | ■ | ■ | ■ |   |   | ■ | ■ | ■ | ■ | ■ | ■ |

### Remote indication

|                    |            |  |  |  |   |   |   |            |  |  |  |  |
|--------------------|------------|--|--|--|---|---|---|------------|--|--|--|--|
| Passing contact    | adjustable |  |  |  | ■ | ■ | ■ | adjustable |  |  |  |  |
| Maintained contact | adjustable |  |  |  |   |   |   | adjustable |  |  |  |  |

### Interface

|                          |  |  |  |  |  |  |  |   |   |   |   |  |
|--------------------------|--|--|--|--|--|--|--|---|---|---|---|--|
| RS485/MODBUS             |  |  |  |  |  |  |  | ■ | ■ | ■ | ■ |  |
| IEC 60870-5-104 (option) |  |  |  |  |  |  |  | ■ | ■ | ■ | ■ |  |

### Power supply

|                            |   |   |   |   |  |  |                                       |                                           |  |  |  |   |
|----------------------------|---|---|---|---|--|--|---------------------------------------|-------------------------------------------|--|--|--|---|
| Lithium battery            | ■ |   |   |   |  |  | ■                                     |                                           |  |  |  | ■ |
| External auxiliary voltage |   | ■ | ■ | ■ |  |  | Only for transient fault<br>detection | Buffered for 6 h by<br>internal capacitor |  |  |  | ■ |

### Current inputs

|                   |   |   |   |   |   |   |   |                 |                 |                 |                 |   |
|-------------------|---|---|---|---|---|---|---|-----------------|-----------------|-----------------|-----------------|---|
| Phase current     | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3               | 3               | 6               | 6               | – |
| Summation current | 1 | 1 | 1 | 1 |   | 1 |   | 1 <sup>1)</sup> | 0 <sup>2)</sup> | 0 <sup>2)</sup> | 0 <sup>2)</sup> | 1 |

### Voltage inputs

|                                  |  |  |  |  |  |  |   |   |   |   |   |   |
|----------------------------------|--|--|--|--|--|--|---|---|---|---|---|---|
| Via CAPDIS                       |  |  |  |  |  |  | 3 | 3 | 3 | 6 | 6 | – |
| Via resistor divider<br>(option) |  |  |  |  |  |  |   | 3 | 3 | 6 | 6 | – |

### Release outputs

|                                            |       |       |       |       |   |   |   |                 |                 |                 |                 |   |
|--------------------------------------------|-------|-------|-------|-------|---|---|---|-----------------|-----------------|-----------------|-----------------|---|
| Potential-free                             | 1 – 3 | 1 – 3 | 1 – 3 | 1 – 3 | 2 | 2 | 4 | 4               | 4               | 4               | 4               | 1 |
| Supplied by internal<br>capacitor (option) |       |       |       |       |   |   |   | 2 <sup>3)</sup> | 2 <sup>3)</sup> | 2 <sup>3)</sup> | 2 <sup>3)</sup> |   |

### Binary inputs

|        |                  |  |  |  |  |  |                  |   |   |   |   |   |
|--------|------------------|--|--|--|--|--|------------------|---|---|---|---|---|
| Number | 2 (test + reset) |  |  |  |  |  | 2 (test + reset) | 4 | 4 | 4 | 4 | – |
|--------|------------------|--|--|--|--|--|------------------|---|---|---|---|---|

1) Optional for wattmetric detection of earth-fault direction

2) Creation of sum signal via 3 transformers mounted around the conductor

3) 0.1 Ws, 24 V DC

4) Momentary value, mean value and min/max value, directional

5) Short-circuit to earth = Earth fault in impedance-earthed system

| Short-circuit/earth-fault indicator from Siemens             | SICAM FCM                    | SICAM FPI                                                   |
|--------------------------------------------------------------|------------------------------|-------------------------------------------------------------|
| <b>Function</b>                                              |                              |                                                             |
| Short-circuit indication                                     | ■                            | ■                                                           |
| Earth-fault indication                                       | ■                            | ■                                                           |
| Earth-fault function (impedance-earthed system)              | ■                            | ■                                                           |
| Indication of direction, short-circuit/earth-fault           | ■                            | –                                                           |
| Undervoltage and overvoltage indication                      | ■                            | –                                                           |
| <b>Applicable for the following neutral earthing options</b> |                              |                                                             |
| Impedance                                                    | ■                            | ■                                                           |
| Solid                                                        | ■                            | ■                                                           |
| Isolated                                                     | ■                            | ■                                                           |
| Compensated                                                  | ■                            | ■                                                           |
| <b>Pickup current</b>                                        |                              |                                                             |
| Short-circuit current                                        | 50 ... 2000 A (steps of 1 A) | Type 1: 200 – 1200 A, type 2: 200 – 800 A (in 7 steps each) |
| Earth-fault current                                          | 1 ... 1000 A (steps of 1 A)  | Type 1: 10 – 100 A, type 2: 40 – 300 A (in 7 steps each)    |
| Pulse location                                               | –                            | –                                                           |
| <b>Pickup time</b>                                           |                              |                                                             |
| Short-circuit current                                        | 40 ms<br>< t < 60 s          | < 500 ms adjustable                                         |
| Earth-fault current                                          | 40 ms<br>< t < 60 s          | < 500 ms adjustable                                         |
| <b>Reset</b>                                                 |                              |                                                             |
| Manual                                                       | ■                            | ■                                                           |
| Automatic                                                    | ■                            | ■                                                           |
| From remote                                                  | ■                            | ■                                                           |
| <b>Remote indication</b>                                     |                              |                                                             |
| Passing contact                                              | adjustable                   | –                                                           |
| Maintained contact                                           | adjustable                   | 2 binary outputs                                            |
| <b>Interface</b>                                             |                              |                                                             |
| RS485/MODBUS                                                 | ■                            | –                                                           |
| <b>Power supply</b>                                          |                              |                                                             |
| Lithium battery                                              | ■                            | ■                                                           |
| External auxiliary voltage                                   | ■                            | –                                                           |
| <b>Current inputs</b>                                        |                              |                                                             |
| Phase current                                                | 3 (2) <sup>1)</sup>          | 3 optical                                                   |
| Summation current                                            | 0 (1) <sup>1)</sup>          | 1 optical                                                   |
| <b>Voltage inputs</b>                                        |                              |                                                             |
| Via resistor divider                                         | 3                            | –                                                           |
| Via integrated capacitive voltage indicator (optional)       | 3                            | –                                                           |
| <b>Relay outputs</b>                                         |                              |                                                             |
| Potential-free                                               | 2 <sup>2)</sup>              | 2                                                           |
| <b>Binary inputs</b>                                         |                              |                                                             |
| Number                                                       | 1                            | –                                                           |

1) Measuring sensor 3+0 (summation current is calculated), measuring sensor 2+1 (phase L2 is calculated)  
2) Optional



## 1. SICAM FCM

The short-circuit and earth-fault indicator SICAM FCM (Feeder Condition Monitor) with direction indication enables fast and precise fault location, thus reducing the downtimes in the power system. The possibility to determine and telecommunicate the values U, I, f, P, Q, S, E, cos φ and load flow direction supports efficient operational management and network planning.

- Usable in earthed, isolated and resonance-earthed systems
- Directional short-circuit and earth-fault detection
- Selective fault information with direction indication as a basis for “self-healing” applications
- Usable with current and voltage sensors according to IEC 60044 for precise measurement without calibration and adjustment to the primary values
- Alternatively usable with an integrated capacitive voltage detecting system
- Flexible earth-current detection as from 0.4 A
- Integrated MODBUS-RTU interface:
- Remote parameterization via SICAM A8000 and MODBUS
- Self-test function of the communication connection.

## 2. SICAM FPI (Fault Passage Indicator)

- Detection of short circuits and earth faults
- Indication of phase and earth faults via 4 separate LEDs
- Enhanced diagnostics, self and sensor cable diagnostics is supported
- Configurable binary outputs, for remote indication to SCADA via RTU for faults and for diagnostics.



# Components

Indicating and measuring equipment, transformer monitor systems

## For circuit-breaker panels (type L, L1 ...)

Protection of distribution transformers with ratings that cannot or should not be protected with HV HRC fuses:

- Tripping of the circuit-breaker in case of overload (delayed)
- Tripping of the circuit-breaker when the short-circuit current arises.

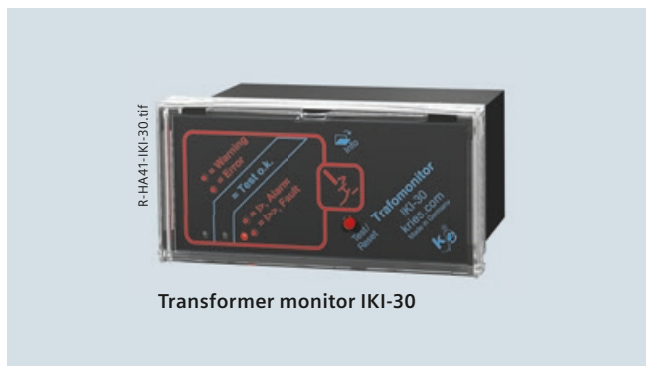
## On request: Application with switch-fuse combination (panel type T...)

Monitoring of the overload range of distribution transformers with

- Tripping of the switch in case of overload (current smaller than the rated current of the switch)
- Blocking of the tripping function in the short-circuit range (here, the fuse takes over the disconnecting function).

## Features

- Current-transformer operated (cable-type transformer), alternatively auxiliary voltage 24 ... 230 V AC/DC
- Instrument transformer
  - Special cable-type current transformer
  - No direction-dependent installation required
  - No earthing of a transformer pole required
  - No short-circuit terminals required for maintenance
- Low-energy magnetic release (0.02 Ws)
- Mounting location
  - In the low-voltage niche of the feeder panel
  - In the low-voltage compartment (option) of the circuit-breaker feeder
- Response performance
  - Definite-time overcurrent characteristic
  - Definite-time overcurrent characteristic for earth-fault protection (additional sensor required)
  - Inverse-time overcurrent characteristic
    - extremely inverse
    - normal inverse
  - Externally undelayed instantaneous tripping
- Self-test function
  - Display test LED (red)
  - Battery test (under load) LED (green)
  - Primary current test with tripping and with primary current injection into the transformers
- Indication
  - LED indication for tripping (single flash: Starting, double flash: Tripping)
  - Reset after 2 h, 4 h or automatically (after return of power) or manually with reset pushbutton



## Example for selection of transformer protection

| Operating voltage (kV) | Transformer rating (kVA)<br>Make and type of the device |                          |                 |
|------------------------|---------------------------------------------------------|--------------------------|-----------------|
|                        | Siemens<br>7SJ45/7SJ46                                  | Woodward/SEG<br>WIC 1-2P | Kries<br>IKI-30 |
| 5                      | ≥ 160                                                   | ≥ 160                    | ≥ 160           |
| 6                      | ≥ 160                                                   | ≥ 160                    | ≥ 160           |
| 6.6                    | ≥ 160                                                   | ≥ 160                    | ≥ 160           |
| 10                     | ≥ 200                                                   | ≥ 250                    | ≥ 160           |
| 11                     | ≥ 200                                                   | ≥ 250                    | ≥ 160           |
| 13.8                   | ≥ 250                                                   | ≥ 400                    | ≥ 160           |
| 15                     | ≥ 315                                                   | ≥ 400                    | ≥ 160           |
| 20                     | ≥ 400                                                   | ≥ 500                    | ≥ 250           |

- Outputs
  - Tripping signal: 1 floating relay output (NC contact) for telecommunication as passing contact
  - Starting signal: 1 floating relay output (NC contact)
    - is activated as long as the starting criterion is reached, e.g. to block an upstream primary protection
  - 1 watchdog (relay)
  - 1 external tripping output for control of an existing release, e.g. via capacitor
  - Tripping output designed as impulse output for direct control of the low-energy release
- Input
  - Remote tripping signal, control via floating external contact
  - Instantaneous tripping.

### Voltage detecting systems according to IEC 61243-5 or VDE 0682-415

- For verification of safe isolation from supply
- HR or LRM detecting systems with plug-in indicator
- LRM detecting systems with integrated indicator type VOIS+, VOIS R+, CAPDIS-S1+, CAPDIS-S2+, WEGA 1.2 C, WEGA 2.2 C or WEGA 3.

#### Plug-in voltage indicator

- Verification of safe isolation from supply phase by phase
- Indicator suitable for continuous operation
- Measuring system and voltage indicator can be tested, repeat test according to local specifications and standards
- Voltage indicator flashes if high voltage is present.

#### VOIS+, VOIS R+

- Without auxiliary power
- Display indication "A1" to "A3" (see legend)
- Repeat test according to local specifications and standards
- With integrated 3-phase LRM test socket for phase comparison
- With integrated signaling relay (only VOIS R+).

#### Common features of CAPDIS-Sx+

- Without auxiliary power
- Integrated repeat test of the interfaces (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the "Test" button
- Adjustable for different operating voltages (adjustable capacitance C2)
- With integrated 3-phase LRM test socket for phase comparison
- With connectable signal-lead test
- With overvoltage monitoring and signaling (1.2 times operating voltage).

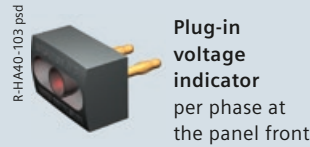
#### CAPDIS-S1+

- Without auxiliary power
- Display indication "A1" to "A7" (see legend)
- Without ready-for-service monitoring
- Without signaling relay (without auxiliary contacts).

#### CAPDIS-S2+

- Display indication "A0" to "A8" (see legend)
- Only by pressing the "Test" pushbutton: "ERROR" indication (A8), e.g. in case of missing auxiliary voltage
- With ready-for-service monitoring (auxiliary power required)
- With integrated signaling relay for signals (auxiliary power required).

### Indicators and detecting systems



### Symbols shown

|    | VOIS+, VOIS R+ | CAPDIS-S1+ | CAPDIS-S2+ |                   |
|----|----------------|------------|------------|-------------------|
|    | L1 L2 L3       | L1 L2 L3   | L1 L2 L3   |                   |
| A0 |                |            | 000        | U=0<br>U=0<br>U=0 |
| A1 | ⚡ ⚡ ⚡          | ⚡ ⚡ ⚡      | ⚡ ⚡ ⚡      | U=0<br>U=0<br>U=0 |
| A2 |                |            |            | U=0<br>U=0<br>U=0 |
| A3 | ⚡ ⚡            | ⚡ ⚡        | ⚡ ⚡        | U=0<br>U=0<br>U=0 |
| A4 |                | ⚡ ⚡ ⚡      | ⚡ ⚡ ⚡      | U=0<br>U=0<br>U=0 |
| A5 |                | 000        | 000        | U=0<br>U=0<br>U=0 |
| A6 |                | ERROR      | ERROR      | U=0<br>U=0<br>U=0 |
| A7 |                | 000        | 000        | U=0<br>U=0<br>U=0 |
| A8 |                |            | ERROR      | U=0<br>U=0<br>U=0 |

CAPDIS S2+: The red and green LEDs show the state of the relay contacts

LED doesn't light up

LED lights up

U = Operating voltage

A0 CAPDIS-S2+: Operating voltage not present

A1 Operating voltage present

A2 – Operating voltage not present  
– For CAPDIS-S2+: Auxiliary power not present

A3 Failure in phase L1, operating voltage at L2 and L3 (for CAPDIS-Sx+ also earth-fault indication)

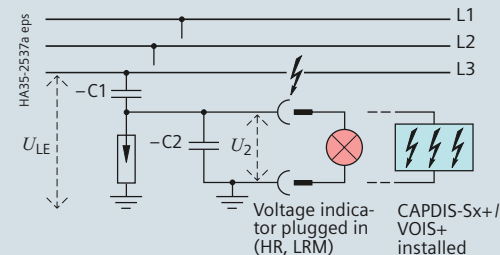
A4 Voltage (not operating voltage) present

A5 Indication "Test" passed (lights up shortly)

A6 Indication "Test" not passed (lights up shortly)

A7 Overvoltage present (lights up permanently)

A8 "ERROR" indication, e.g. in case of missing auxiliary voltage



#### Voltage indication

via capacitive voltage divider (principle)

- C1 Capacitance integrated into bushing
- C2 Capacitance of the connection leads and the voltage indicator to earth

$U_{LE} = U_N / \sqrt{3}$  during rated operation in the three-phase system

$U_2 = U_A =$  Voltage at the capacitive interface of the switchgear or at the voltage indicator

# Components

## Indicating and measuring equipment

### WEGA 3

- Display indication "A1" to "A5"
- Integrated repeat test of the interface (self-monitoring)
- With integrated 3-phase LRM test socket for phase comparison.

### WEGA 1.2 C

- Display indication "A1" to "A6" (see legend)
- Integrated repeat test of the interface (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the "Display Test" button
- With integrated 3-phase LRM test socket for phase comparison.

### WEGA 2.2 C

- Display indication "A0" to "A7" (see legend)
- Integrated repeat test of the interface (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the "Display Test" button
- With integrated 3-phase LRM test socket for phase comparison
- With two integrated signaling relays (auxiliary power required \*).



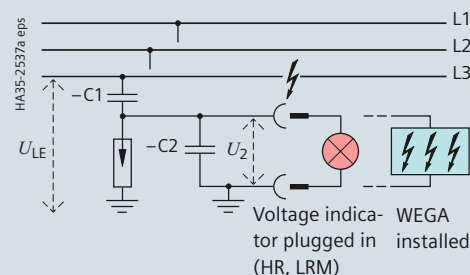
Integrated voltage indicator  
WEGA 3



Integrated voltage indicator  
WEGA 1.2 C



Integrated voltage indicator  
WEGA 2.2 C



#### Voltage indication

via capacitive voltage divider (principle)

- C1 Capacitance integrated into bushing
- C2 Capacitance of the connection leads and the voltage indicator to earth

$$U_{LE} = U_N / \sqrt{3} \text{ during rated operation in the three-phase system}$$

$$U_2 = U_A = \text{Voltage at the capacitive interface of the switchgear or at the voltage indicator}$$

#### Symbols shown

|    | WEGA 3 |    |    | WEGA 1.2 C |    |    | WEGA 2.2 C |    |    |            |
|----|--------|----|----|------------|----|----|------------|----|----|------------|
|    | L1     | L2 | L3 | L1         | L2 | L3 | L1         | L2 | L3 |            |
| A0 |        |    |    |            |    |    |            |    |    | U≠0<br>U=0 |
| A1 | ⚡      | ⚡  | ⚡  | ⚡          | ⚡  | ⚡  | ⚡          | ⚡  | ⚡  | U≠0<br>U=0 |
| A2 |        |    |    |            |    |    |            |    |    | U≠0<br>U=0 |
| A3 | ⚡      | ⚡  |    | ⚡          | ⚡  |    | ⚡          | ⚡  |    | U≠0<br>U=0 |
| A4 | ⚡      | ⚡  | ⚡  | ⚡          | ⚡  | ⚡  | ⚡          | ⚡  | ⚡  | U≠0<br>U=0 |
| A5 | ⚡      | ⚡  | ⚡  | ⚡          | ⚡  | ⚡  | ⚡          | ⚡  | ⚡  | U≠0<br>U=0 |
| A6 |        |    |    | ⚡          | ⚡  | ⚡  | ⚡          | ⚡  | ⚡  | U≠0<br>U=0 |
| A7 |        |    |    |            |    |    | ⚡          | ⚡  | ⚡  | U≠0<br>U=0 |

LC display gray: not illuminated

LC display white: illuminated

WEGA 2.2 C: The red and green LEDs show the state of the relay contacts

○ LED doesn't light up

● LED lights up

U = Operating voltage

A0 For WEGA 2.2 C:

Operating voltage not present, auxiliary power present, LCD illuminated

A1 Operating voltage present

For WEGA 2.2 C: Auxiliary power present, LCD illuminated

A2 Operating voltage not present

For WEGA 2.2 C: Auxiliary power not present, LCD not illuminated

A3 Failure in phase L1, operating voltage at L2 and L3

For WEGA 2.2 C: Auxiliary power present, LCD illuminated

A4 Voltage present, current monitoring of coupling section below limit value

For WEGA 2.2 C: Auxiliary power present, LCD illuminated

A5 Indication "Display-Test" passed

For WEGA 2.2 C: Auxiliary power present, LCD illuminated

A6 Indication "Display Test" passed

For WEGA 2.2 C: Auxiliary power present

A7 For WEGA 2.2 C: LCD for missing auxiliary voltage is not illuminated

\*) Shows the function of the relay via the LED indications (U=0, U≠0)

### Verification of correct terminal-phase connections

- Verification of correct terminal-phase connections possible by means of a phase comparison test unit (can be ordered separately)
- Safe-to-touch handling of the phase comparison test unit by inserting it into the capacitive taps (socket pairs) of the switchgear.

### Phase comparison test units according to IEC 61243-5 or VDE 0682-415



**Phase comparison test unit make Pfisterer, type EPV**  
as combined test unit (HR and LRM) for:

- Voltage detection
- Phase comparison
- Interface test
- Integrated self-test
- Indication via LED.



**Phase comparison test unit make Kries, type CAP-Phase**  
as combined test unit (HR and LRM) for:

- Voltage detection
- Repeat test
- Phase comparison
- Phase sequence test
- Self-test.

The unit does not require a battery.



**Phase comparison test unit make Horstmann, type ORION 3.1**  
as combined test unit (HR and LRM) for:

- Phase comparison
- Interface testing at the switchgear
- Voltage detection
- Integrated self-test
- Indication via LED and acoustic alarm
- Phase sequence indication.



**Phase comparison test unit make Horstmann, type ORION M1**  
as combined test unit (HR and LRM) for:

- Voltage detection
- Phase comparison
- Interface testing at the switchgear
- Integrated self-test
- Indication via display and acoustic alarm
- Phase sequence indication and status LED
- Measurement of interface current up to 25  $\mu$ A
- Measurement of phase angle from  $-180^\circ$  to  $+180^\circ$
- Measurement of harmonics up to 40<sup>th</sup> harmonic
- Securing the measured values via PC software (ORION explorer) and USB.

# Components

## Protection systems

### Simple protection systems

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

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

#### Mounting location

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

### Application of simple protection systems

| Operating voltage (kV) | Transformer rating (kVA) |          |
|------------------------|--------------------------|----------|
|                        | 7SJ45/7SJ46              | WIC 1-2P |
| 6                      | ≥ 160                    | ≥ 160    |
| 10                     | ≥ 200                    | ≥ 250    |
| 13.8                   | ≥ 250                    | ≥ 400    |
| 15                     | ≥ 315                    | ≥ 400    |
| 20                     | ≥ 400                    | ≥ 500    |

### Multifunction protection (selection)

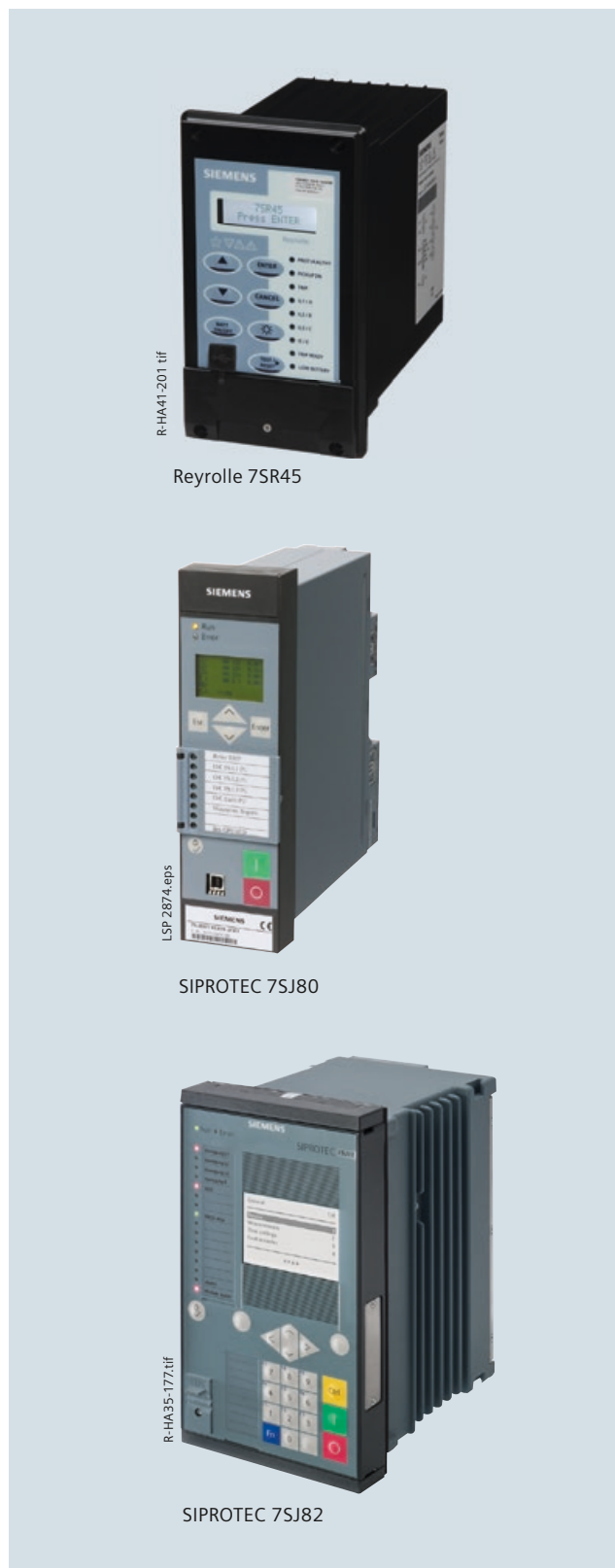
#### SIPROTEC Compact series

##### Overcurrent protection SIPROTEC 7SJ80

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

##### SIPROTEC 5 series, overcurrent protection SIPROTEC 7SJ82

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



Reyrolle 7SR45

SIPROTEC 7SJ80

SIPROTEC 7SJ82

### Other types and makes on request

#### Mounting location

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

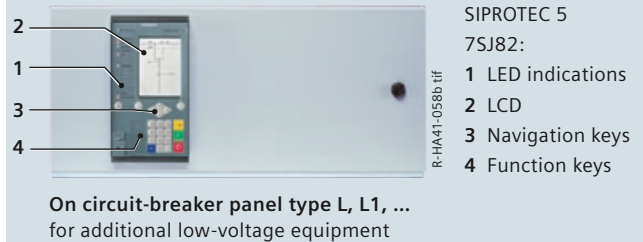
## Features of low-voltage compartment (option)

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

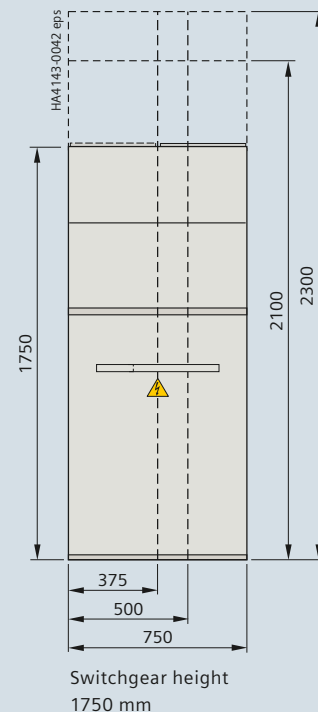
## Low-voltage cables

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

## Low-voltage compartment (option)



## Low-voltage compartment (example 750 x 350 mm)



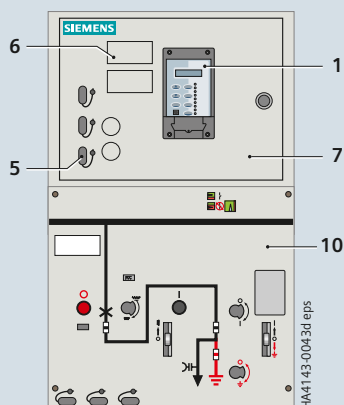
# Components

## Low-voltage niche

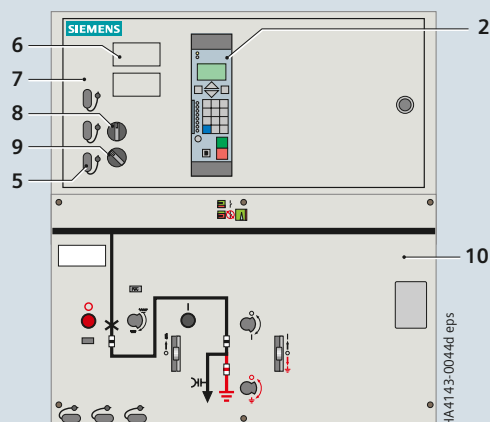
### Low-voltage niche (standard)

- Inside the panel
- Cover for low-voltage niche:
  - Standard: Screwed-on cover
  - With door (option)
- For accommodation of terminals and standard protection devices, e.g. in circuit-breaker panels combined with frame cover for panels
- Protection relays (with max. 75 mm wide mounting frame), e.g.
  - Type 7SR45, 7SR10: For type L and L1
  - Make Woodward/SEG, type WIC1: For type L and L1
- On request:
  - 7SJ80
  - Make Woodward/SEG, WIP-1
- For bus wires and /or control cables; niche open at the side to the adjacent panel
- Safe-to-touch, separated from high-voltage part of the panel
- Degree of protection IP3X (standard).

### Low-voltage niche (examples)



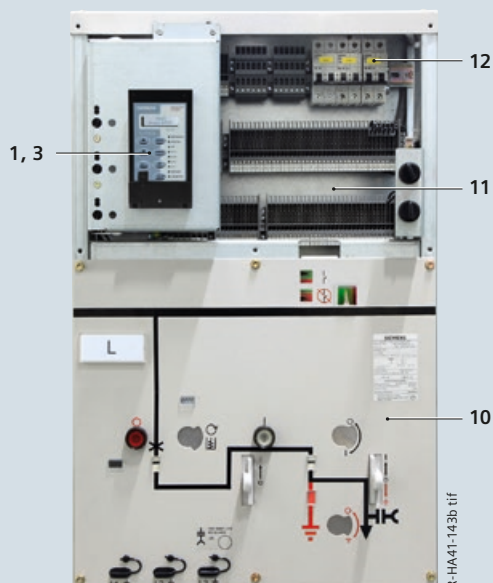
In circuit-breaker panel type L (500 mm) (with CB-f NAR\*)



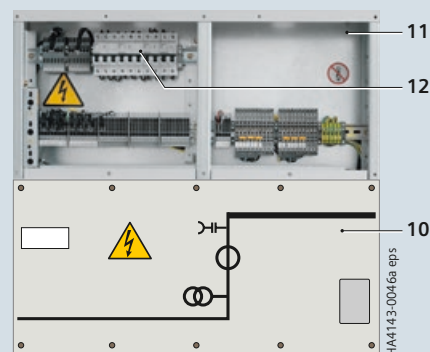
In circuit-breaker panel type L1 (750 mm)

### Protection relay as option:

- 1 Protection relay type 7SR45
- 2 On request: Protection relay type 7SJ80 in LV niche
- 3 Protection relay make Woodward (SEG), type WIC
- 4 On request: Multifunction protection relay SIPROTEC 4 type 7SJ61 on swing-out frame
- 5 Option: Sockets for capacitive voltage detecting system for busbar
- 6 Short-circuit/earth-fault indicator
- 7 Frame cover of low-voltage niche (can be unscrewed)  
Option: as door
- 8 Option: Local-remote switch for three-position switch-disconnector
- 9 Option: Momentary-contact rotary control switch ON-OFF for motor operating mechanism of the three-position switch-disconnector
- 10 Panel front
- 11 Low-voltage niche open
- 12 Option: Installed equipment



In circuit-breaker panel type L (500 mm)



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

\*) AR = Automatic reclosing  
NAR = Non automatic reclosing

## Room planning

### Switchgear installation

Wall-standing arrangement, free-standing arrangement

- 1 row
- 2 rows (for face-to-face arrangement).

### Room dimensions

See opposite dimension drawings.

### Door dimensions

The door dimensions depend on the

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

### Switchgear fastening

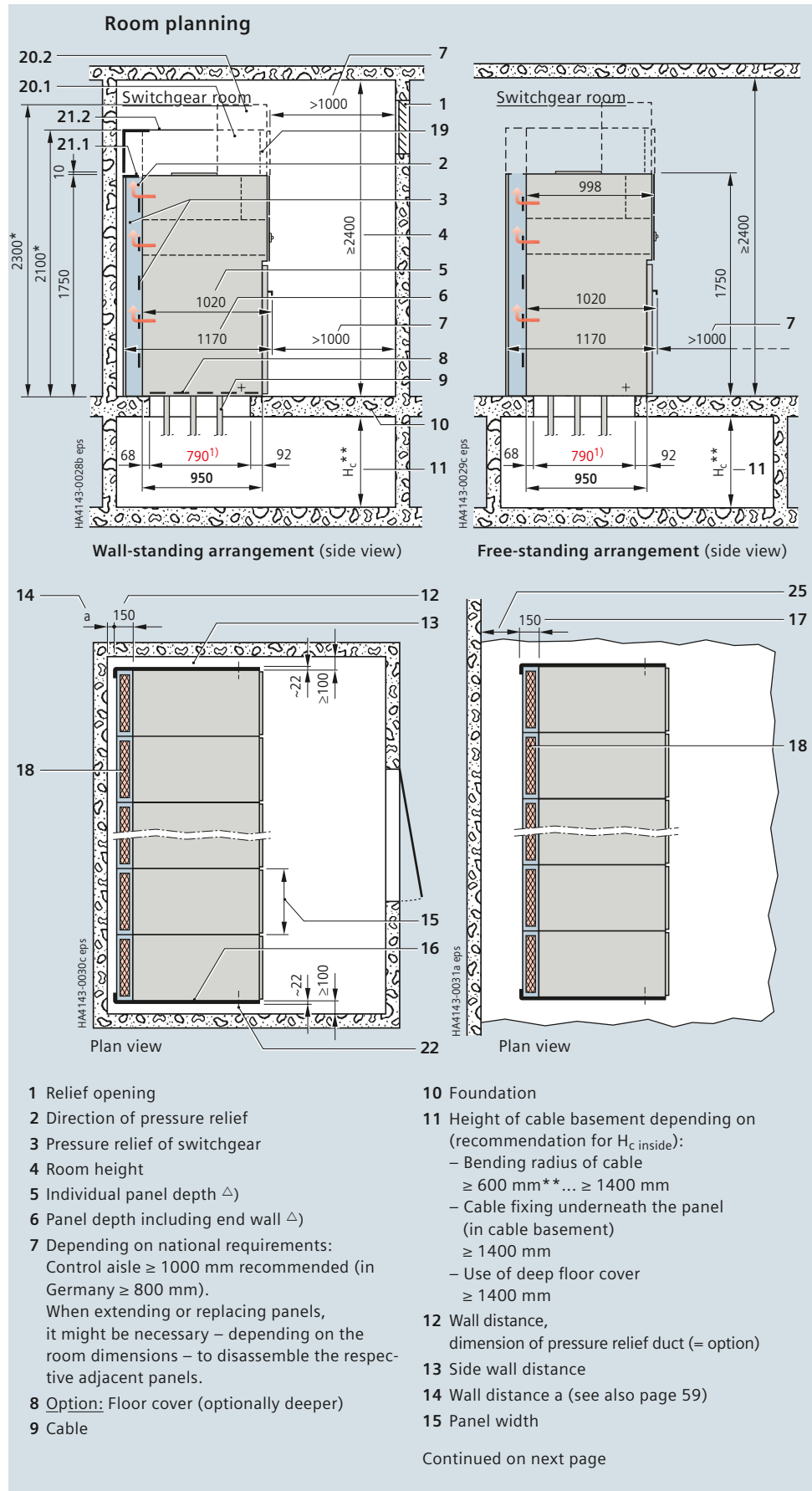
- For floor openings and fixing points of the switchgear, see pages 66 to 68
- Foundations:
  - Steel girder construction
  - Steel-reinforced concrete.

### Panel dimensions

See pages 60 to 65

### Weight

The weight of a panel depends on the extent to which it is equipped (e.g. with motor operating mechanism, voltage transformer). For details, please refer to page 69.



1) Floor opening

$\Delta$ ) Panel type L, L1, L(1), L1(T) with VCB type 3AH569:  
Panel depth: 1080 mm,  
switchgear depth: 1230 mm

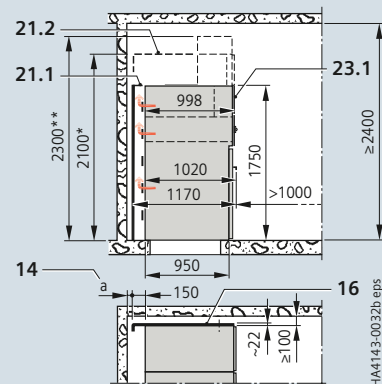
\*) Switchgear height 2100 mm if height of low-voltage compartment 350 mm; switchgear height 2300 mm if height of low-voltage compartment 550 mm

\*\*) Cable fixing in the panel,  
– without deep floor cover  
(for version without current transformer on the cable)

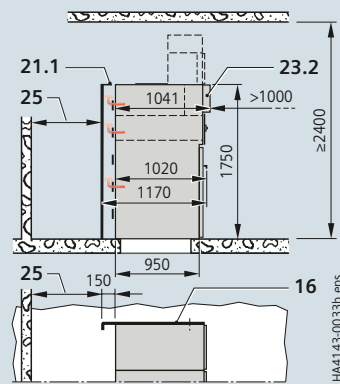
# Dimensions

## Switchgear installation

### Wall-standing arrangement



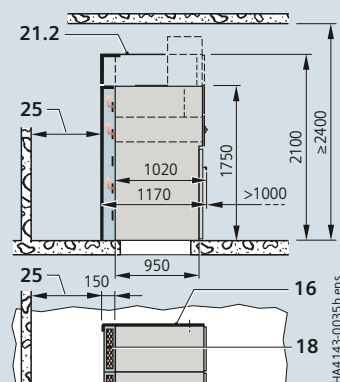
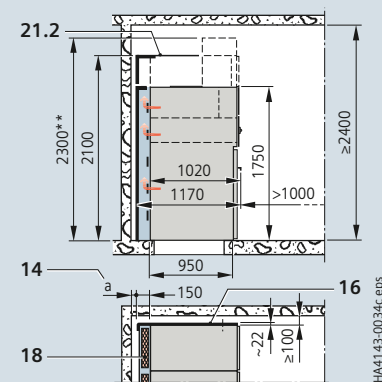
### Free-standing arrangement



### Design of switchgear

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

Floor cover: Available as option



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

Floor cover: Available as option

Continued from page 57

16 End wall

17 Depth of pressure relief duct

18 Option: Pressure relief duct for each panel, for wall-standing or free-standing arrangement

19 Option: Front cover (panel without low-voltage compartment)

20.1 Option: Low-voltage compartment: 350 mm high

20.2 Option: Low-voltage compartment: 550 mm high

21.1 End wall: 1750 mm high

21.2 End wall: 2100 mm high (standard for IAC design, option without IAC = 2100 mm high)

22 Earthing terminal

23 Cover for low-voltage niche

23.1 Standard: Cover screwed-on (panel depth: 998 mm)

23.2 Option: Door (= 45 mm, panel depth: 1041 mm)

25 Distance to rear wall: ≥ 800 mm (for free-standing arrangement)

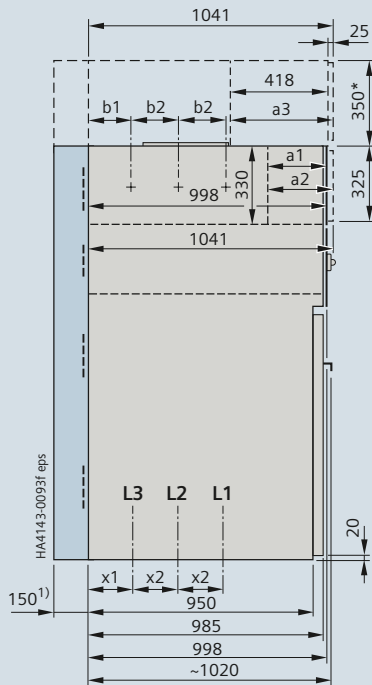
△) Option: Rear pressure relief duct

● As standard

\*) Panel height: 2100 mm, height of low-voltage compartment: 350 mm

\*\*) Option: Panel height: 2300 mm, height of low-voltage compartment : 550 mm

For standard dimensions and IAC design, see also page 59



| Compartment                      | Dimensions for:<br>"Available mounting depth<br>for low-voltage equipment" | in mm<br>approx. |
|----------------------------------|----------------------------------------------------------------------------|------------------|
| LV niche – with front cover      | a <sub>1</sub>                                                             | 201              |
| LV niche – with door<br>(option) | a <sub>2</sub>                                                             | 246              |
| LV compartment (option)          | a <sub>3</sub>                                                             | 443              |

\*) Option: Low-voltage compartment or front cover  
available in two heights: 350 mm or 550 mm

1) Option: Pressure relief duct

| Rated voltage U <sub>r</sub>  | Dimensions in mm |               |
|-------------------------------|------------------|---------------|
| Position of cables $\Delta$ ) | x1 $\Delta$ )    | x2 $\Delta$ ) |
| Up to 17.5 kV                 | 187              | 210           |
| 24 kV                         | 187              | 210           |
| Position of busbar            | b1               | b2            |
| Up to 24 kV                   | 187              | 210           |

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

## Standard dimensions of switchgear

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

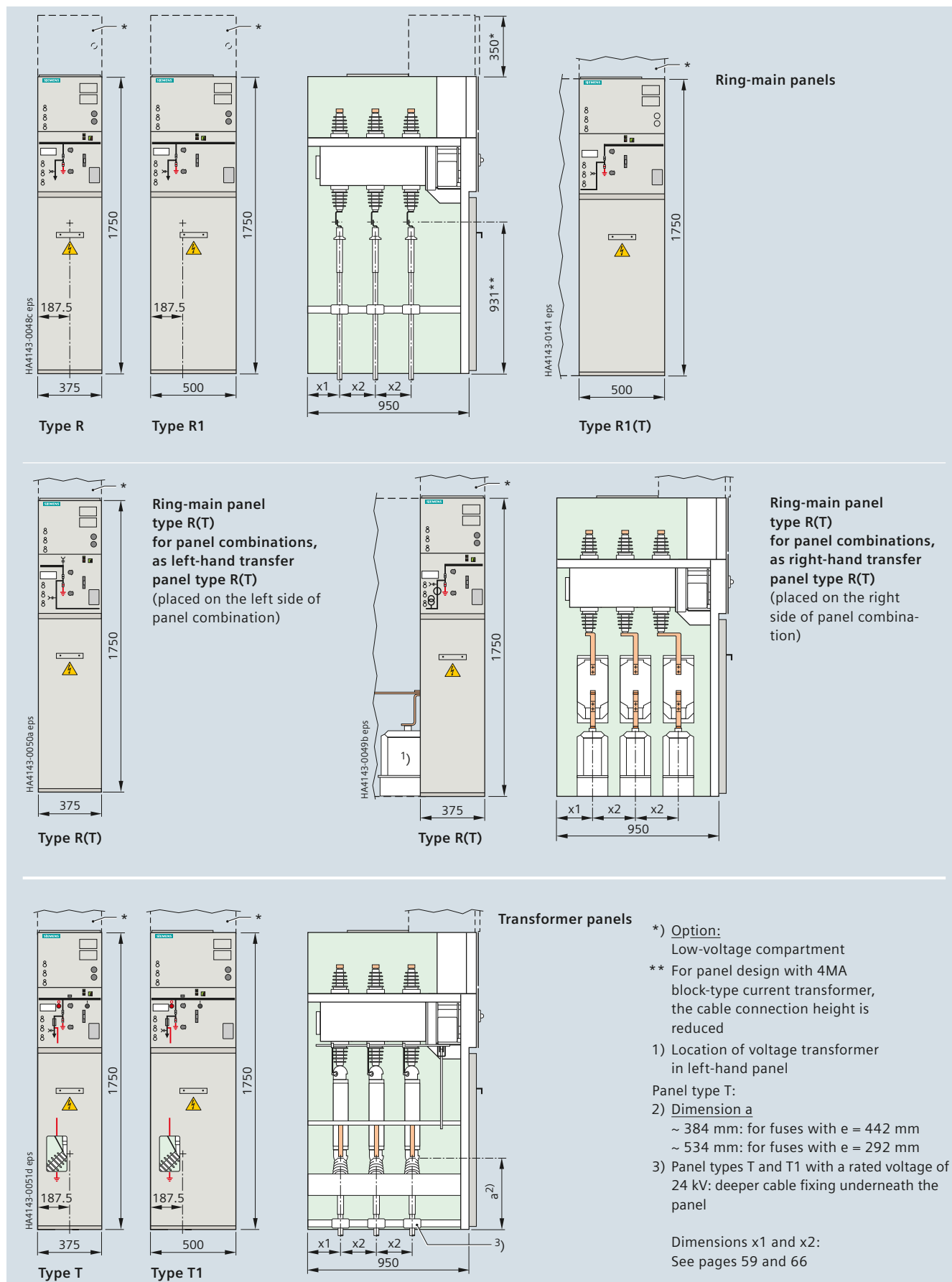
\*) Panel depth depends on panel type and panel design:

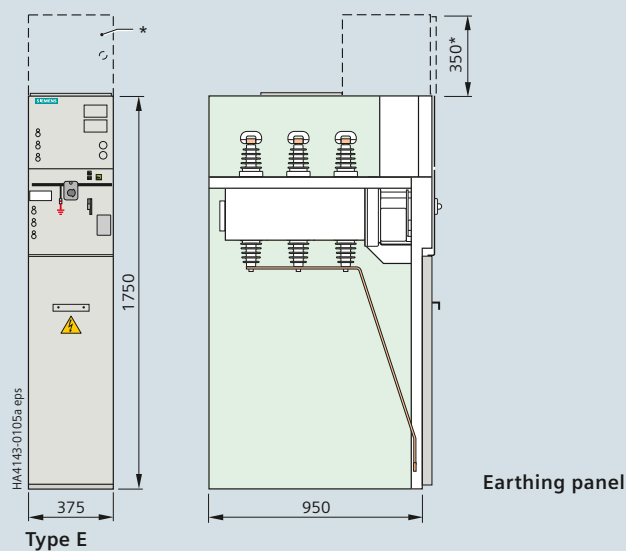
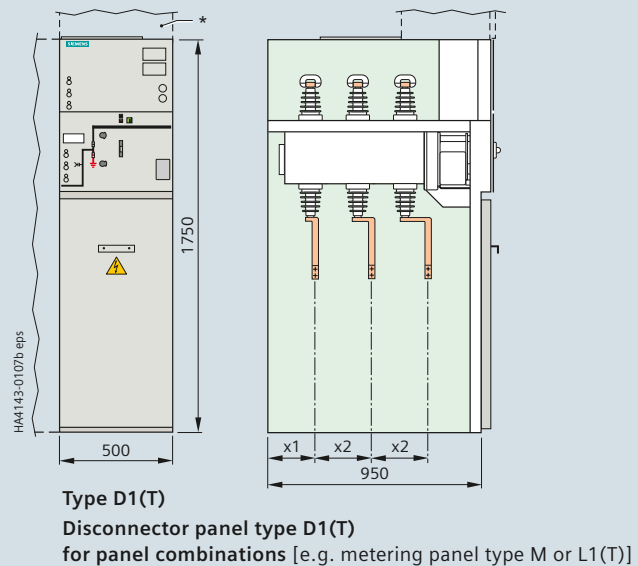
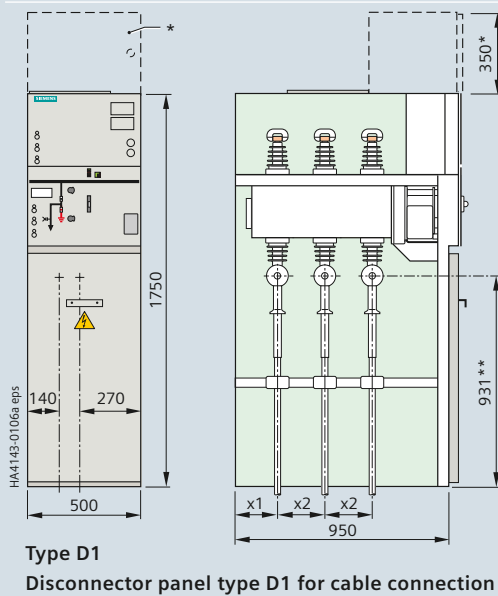
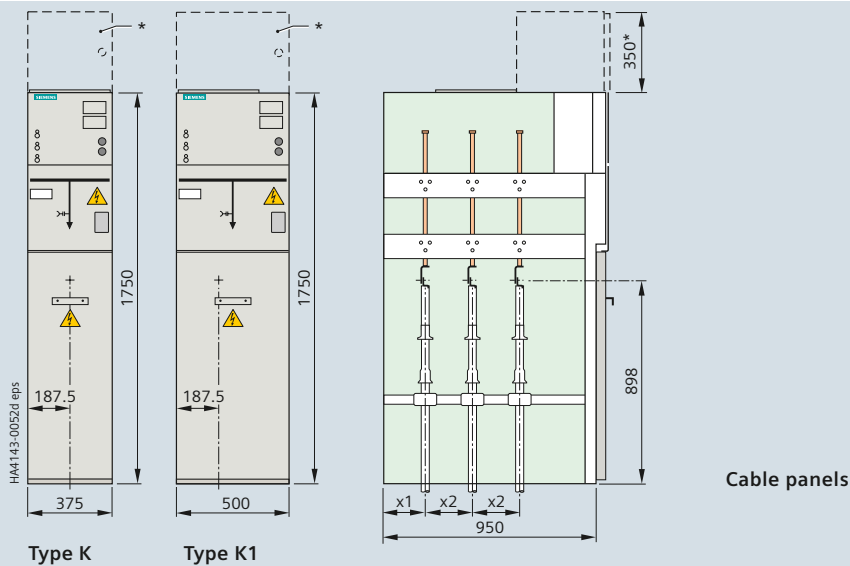
- Low-voltage niche with door (= option) (instead of screwed front cover): 1041 mm
- Low-voltage niche with door: 1041 mm

\*\*) In addition, a low-voltage compartment can be selected optionally. The switchgear height is changed respectively

# Dimensions

Ring-main panels, transformer panels



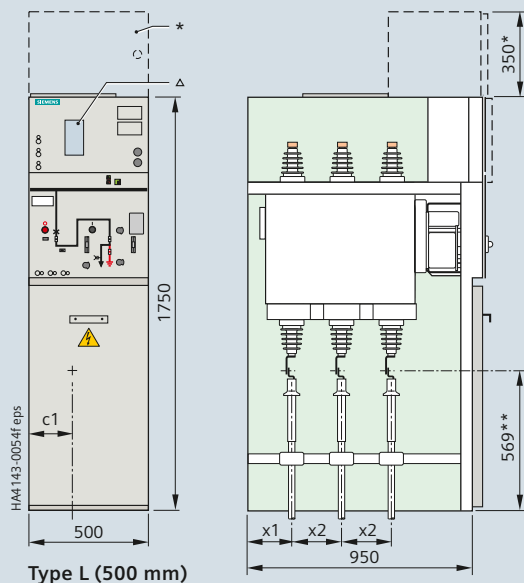


- \*) Option:  
Low-voltage compartment
- \*\*) For panel design with 4MA  
block-type current transformer,  
the cable connection height is  
reduced

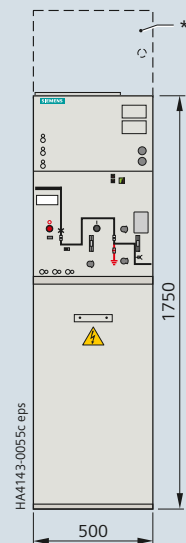
Dimensions x1 and x2:  
See pages 59 and 66

# Dimensions

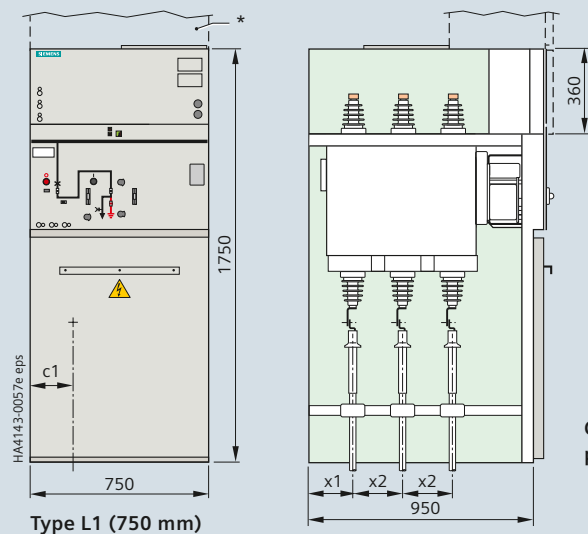
## Circuit-breaker panels



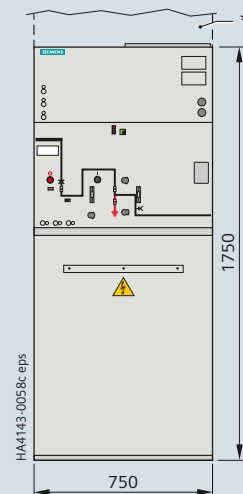
Circuit-breaker panel 630 A



Type L(T)  
as transfer panel to the right



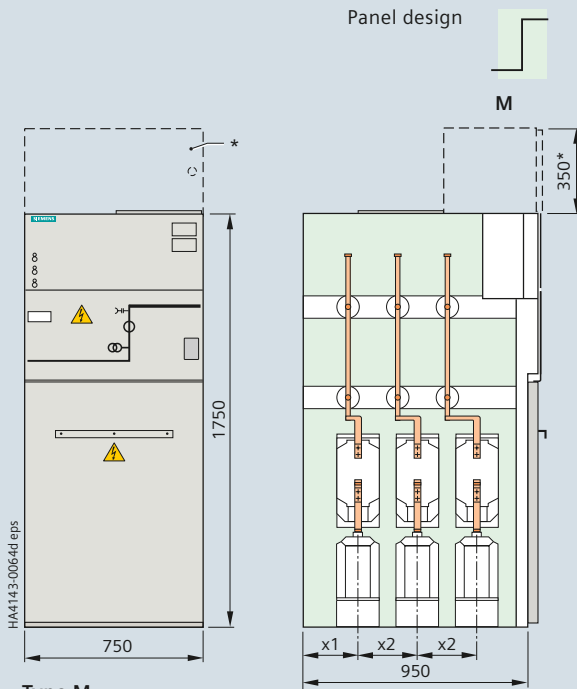
Circuit-breaker panel 630 A, 1250 A



Type L1(T)  
as transfer panel to the right

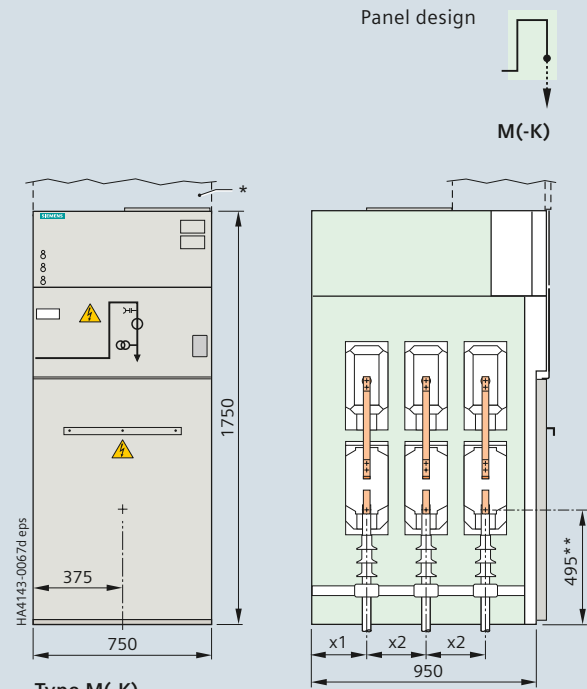
Position of L1, L2 and L3: See page 59  
Dimensions x1 and x2: See pages 59 and 66

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



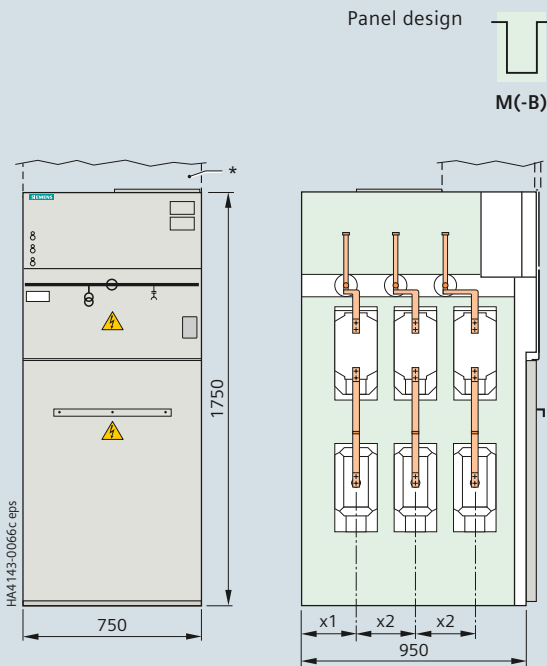
Type M

Metering panel type M (standard)



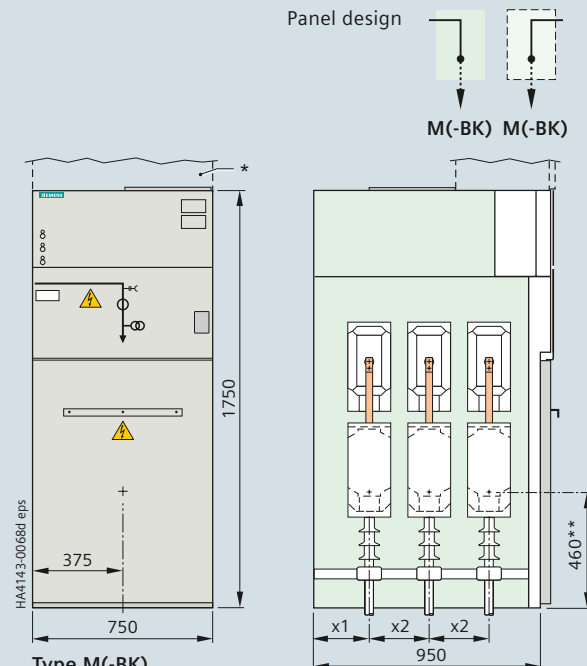
Type M(-K)

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



Type M(-B)

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



Type M(-BK)

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

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

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

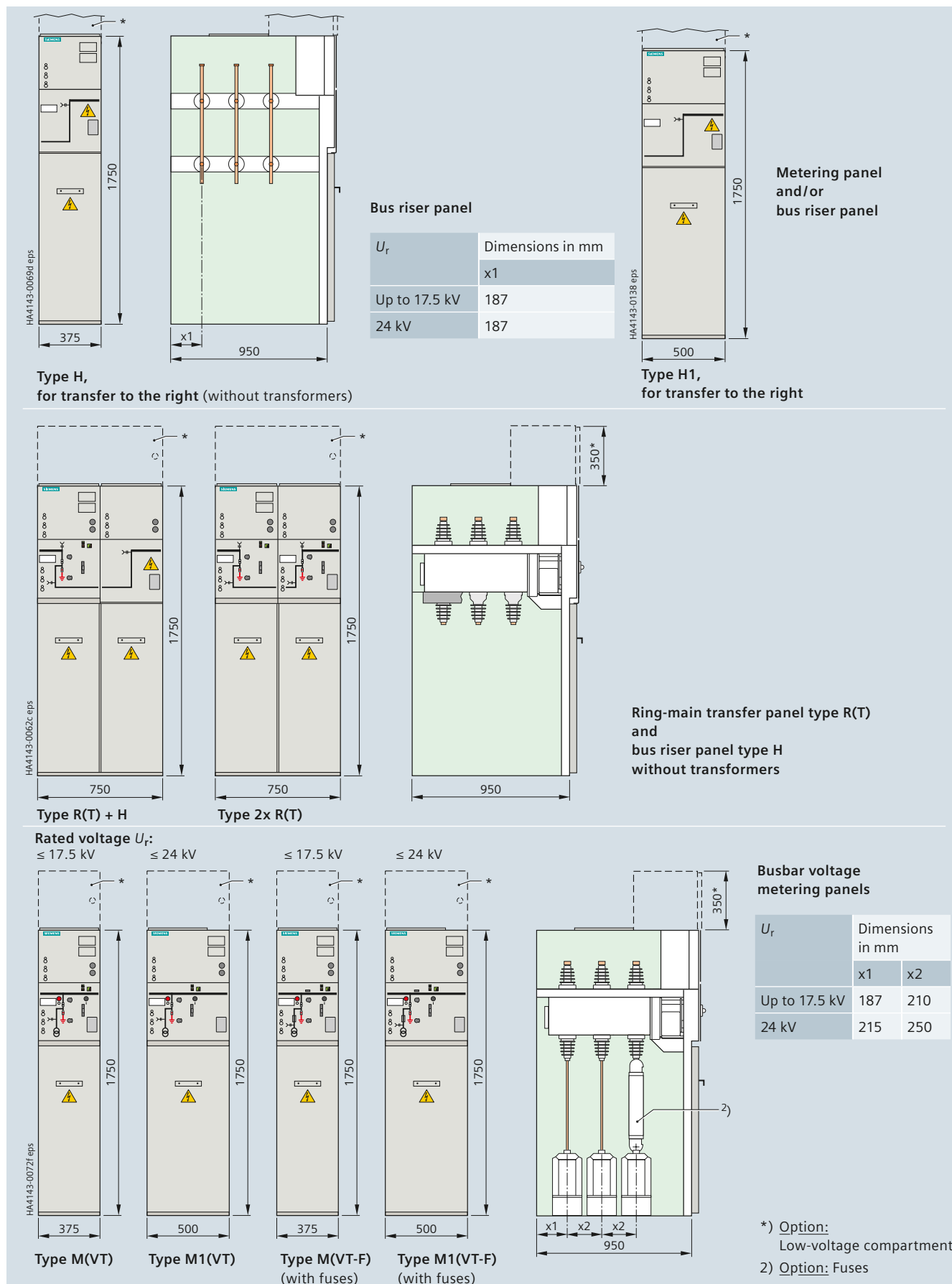
\*) Option:

Low-voltage compartment

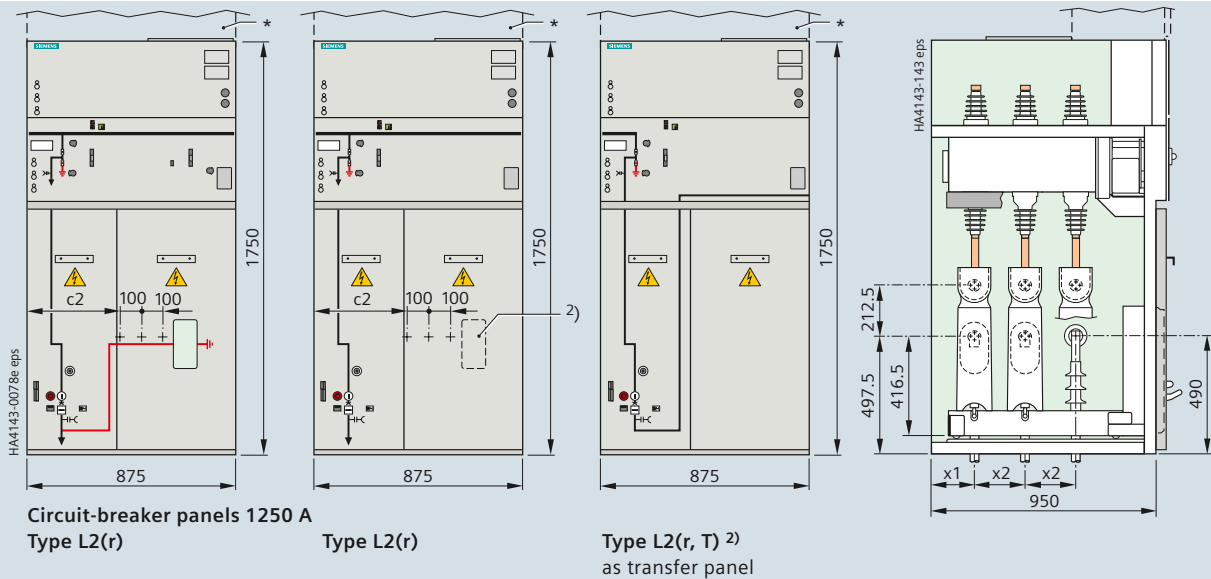
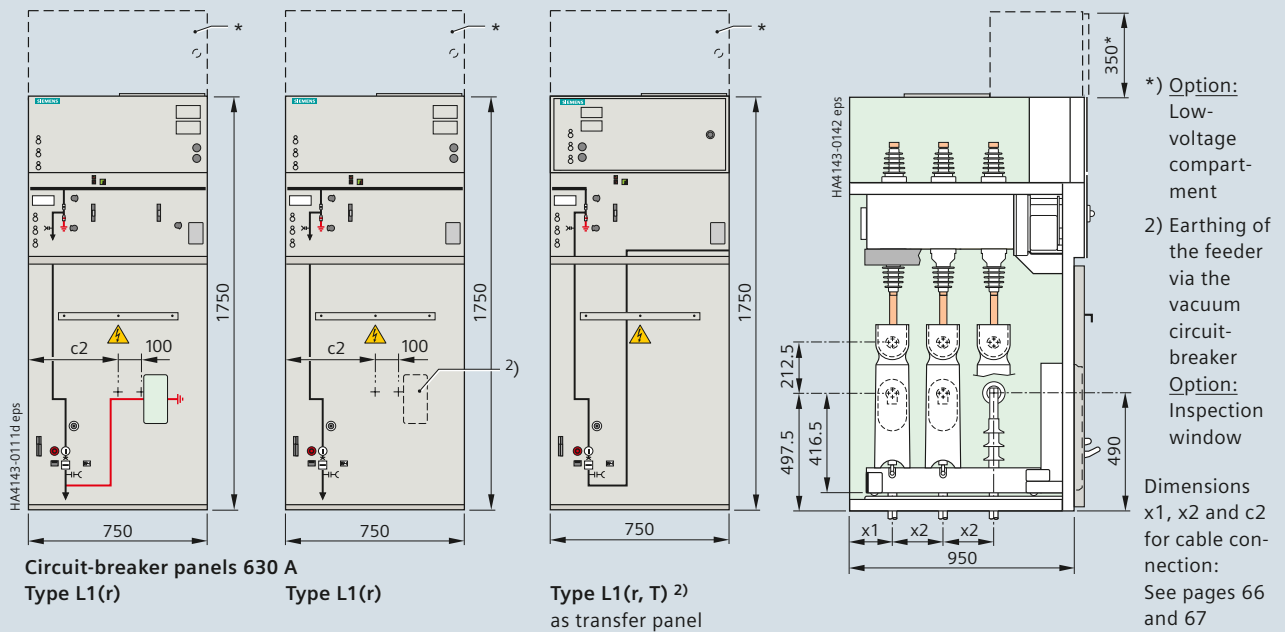
\*\*) The cable connection height depends on the rated voltage, the transformer design and the number of cable connections

# Dimensions

Metering/bus riser panels, busbar voltage metering panels



Circuit-breaker panels (for removable circuit-breaker type CB-r), overview of panel combination "TC"



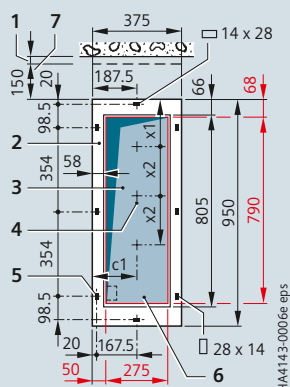
| Panel combination *) | Rated normal current of TC | Total width of TC (in mm) | Serial no. of TC | Panel combination *) | Rated normal current of TC | Total width of TC (in mm) | Serial no. of TC |
|----------------------|----------------------------|---------------------------|------------------|----------------------|----------------------------|---------------------------|------------------|
| R(T) - H             | 630 A, 800 A               | 750                       | TC-1             | L1(T) - M            | 630 A                      | 1500                      | TC-23            |
| H - R(T)             | 630 A                      | 750                       | TC-2             | L1(T) - M(-K)        | 630 A                      | 1500                      | TC-25            |
| R(T) - R(T)          | 630 A, 800 A               | 750                       | TC-3             | L1(T) - R(T)         | 630 A                      | 1125                      | TC-27            |
| R(T) - M             | 630 A, 800 A               | 1125                      | TC-4             | D1(T) - H            | 1250 A                     | 875                       | TC-45            |
| R(T) - M(-K)         | 630 A, 800 A               | 1125                      | TC-6             | L1(r,T) - H1         | 630 A                      | 1250                      | TC-61            |
| L(T) - H             | 630 A                      | 875                       | TC-11            | L1(r,T) - R1(T)      | 630 A                      | 1250                      | TC-62            |
| L(T) - M             | 630 A                      | 1250                      | TC-13            | L2(r,T) - H1         | 1250 A                     | 1375                      | TC-63            |
| L(T) - M(-K)         | 630 A                      | 1250                      | TC-15            | L2(r,T) - D1(T)      | 1250 A                     | 1375                      | TC-64            |
| L(T) - R(T)          | 630 A                      | 875                       | TC-17            | R(TM) - L(TM)        | 630 A                      | 1500                      | TC-57            |
| L1(T) - H            | 630 A                      | 1125                      | TC-21            | R(TM) - L1(TM)       | 630 A                      | 1750                      | TC-58            |

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

# Dimensions

Floor openings (dimensions in red) and fixing points

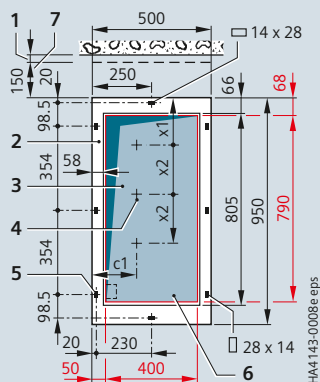
## For panel width 375 mm



With cable connection

| For panel type | Position of cables <sup>1)</sup> |       |         |       |         |       |
|----------------|----------------------------------|-------|---------|-------|---------|-------|
|                | Dimensions in mm                 |       |         |       |         |       |
|                | x1                               | x1    | x2      |       | c1      |       |
|                | 17.5 kV                          | 24 kV | 17.5 kV | 24 kV | 17.5 kV | 24 kV |
| R              | 187                              | 187   | 210     | 210   | 187.5   | 187.5 |
| K              | 187                              | 187   | 210     | 210   | 187.5   | 187.5 |
| T              | 187                              | 187   | 210     | 210   | 187.5   | 187.5 |

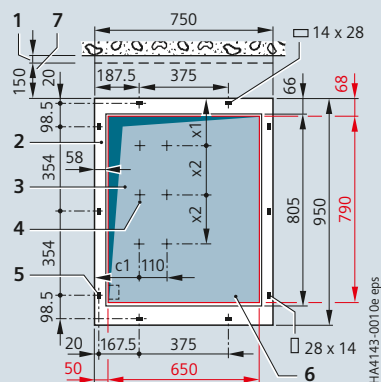
## For panel width 500 mm



With cable connection

| For panel type  | Position of cables <sup>1)</sup> |       |         |       |         |       |
|-----------------|----------------------------------|-------|---------|-------|---------|-------|
|                 | Dimensions in mm                 |       |         |       |         |       |
|                 | x1                               | x1    | x2      |       | c1      |       |
|                 | 17.5 kV                          | 24 kV | 17.5 kV | 24 kV | 17.5 kV | 24 kV |
| R1, D1          | 187                              | 187   | 210     | 210   | 187.5   | 187.5 |
| K1              | 187                              | 187   | 210     | 210   | 187.5   | 187.5 |
| T1              | 187                              | 187   | 210     | 210   | 187.5   | 187.5 |
| L               | 187                              | 187   | 210     | 210   | 187.5   | 187.5 |
| L with CTs, VTs | 187                              | 235   | 210     | 230   | 250     | 300   |

## For panel width 750 mm



With cable connection

| For panel type   | Position of cables <sup>1)</sup> |         |       |         |       |         |       |
|------------------|----------------------------------|---------|-------|---------|-------|---------|-------|
|                  | Dimensions in mm                 |         |       |         |       |         |       |
|                  | Number of cables                 | x1      | x1    | x2      |       | c1      | c1    |
|                  |                                  | 17.5 kV | 24 kV | 17.5 kV | 24 kV | 17.5 kV | 24 kV |
| L1               | 1                                | 187     | 187   | 210     | 210   | 187.5   | 187.5 |
|                  | 2                                | 187     | 187   | 210     | 210   | 172.5   | 172.5 |
| L1 with CTs, VTs | 1                                | 187     | 215   | 210     | 250   | 235     | 335   |
|                  | 2                                | 187     | 215   | 210     | 250   | 235     | 335   |

1 Wall distance (see page 59)

2 Fixing frame (base) of an individual panel or panel block

3 Floor opening for high-voltage cables and, where applicable, control cables

### Note:

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

4 Position of the led-in cables for the feeder <sup>1)</sup>

5 Fixing points

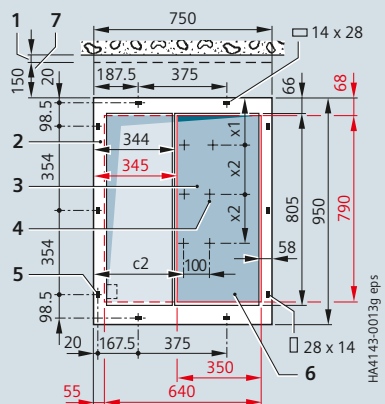
6 Floor opening if required for panels without cable connection

7 Option: Pressure relief duct

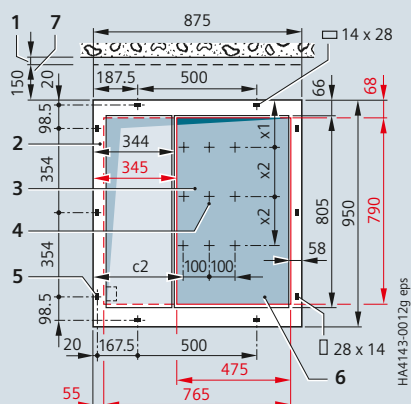
1) The position of the cables in the panel depends on the additional built-in panel components, e.g. current and voltage transformers. Therefore, the dimensions x1, x2, c1, c2 may be different.

Technical drawing of a window frame assembly. The drawing shows a cross-section of the frame with various dimensions and components labeled. The main frame is 750 mm wide and 805 mm high. The inner opening is 650 mm wide and 790 mm high. The frame is made of 14 x 28 mm material. The drawing includes dimensions for the frame, the opening, and the surrounding structure. The frame is labeled with dimensions 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100. The opening is labeled with dimensions 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100. The surrounding structure is labeled with dimensions 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

For panel type L1(r), width 750 mm



For panel type L2(r), width 875 mm



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

| For panel type | Position of cables <sup>1)</sup> |       |         |       |         |       |     |
|----------------|----------------------------------|-------|---------|-------|---------|-------|-----|
|                | Dimensions in mm                 |       |         |       |         |       |     |
|                | Number of cables                 | x1    | x1      | x2    |         | c2    | c2  |
| 17.5 kV        |                                  | 24 kV | 17.5 kV | 24 kV | 17.5 kV | 24 kV |     |
| L1(r)          | 1                                | 187   | 235     | 210   | 230     | 377   | 377 |
|                | 2                                | 187   | 235     | 210   | 230     | 377   | 377 |

| For panel type | Position of cables <sup>1)</sup> |       |         |       |         |       |     |
|----------------|----------------------------------|-------|---------|-------|---------|-------|-----|
|                | Dimensions in mm                 |       |         |       |         |       |     |
|                | Number of cables                 | x1    | x1      | x2    |         | c2    | c2  |
| 17.5 kV        |                                  | 24 kV | 17.5 kV | 24 kV | 17.5 kV | 24 kV |     |
| L2(r)          | 1                                | 187   | 235     | 210   | 230     | 377   | 377 |
|                | 2                                | 187   | 235     | 210   | 230     | 377   | 377 |
|                | 3                                | 187   | 235     | 210   | 230     | 377   | 377 |

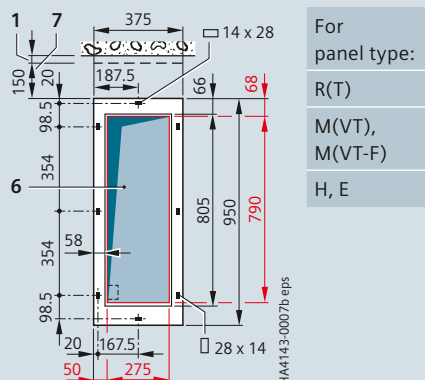
- 4 Position of the led-in cables for the feeder <sup>1)</sup>
- 5 Fixing points
- 6 Floor opening if required for panels without cable connection
- 7 Option: Pressure relief duct

1) The position of the cables in the panel depends on the additional built-in panel components, e.g. current and voltage transformers. Therefore, the dimensions  $x_1$ ,  $x_2$ ,  $c_1$ ,  $c_2$  may be different.

# Dimensions

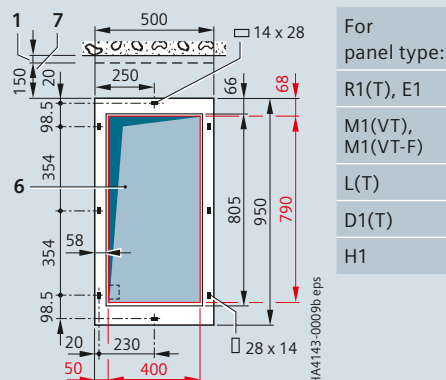
Floor openings (dimensions in red) and fixing points

## For panel width 375 mm



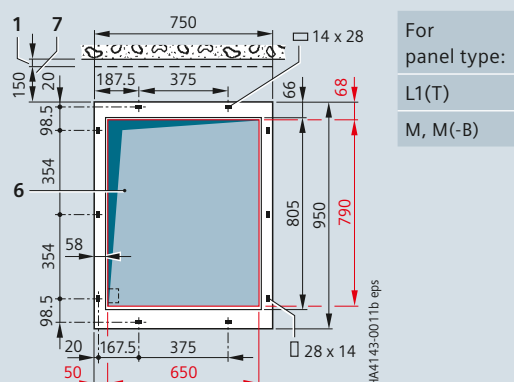
Without cable connection

## For panel width 500 mm



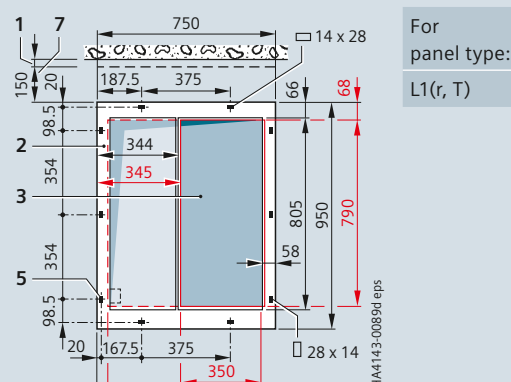
Without cable connection

## For panel width 750 mm



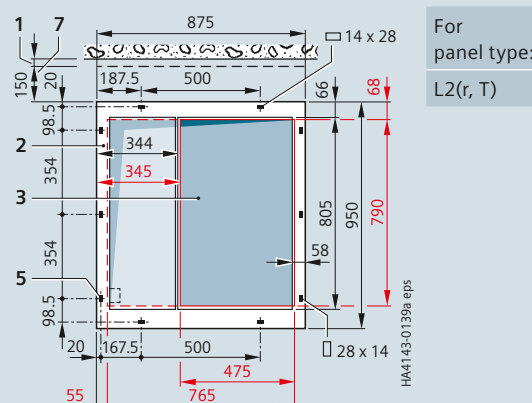
Without cable connection

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



Without cable connection

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



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

### Note:

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

- 4 Position of the led-in cables for the feeder <sup>1)</sup>
  - 5 Fixing points
  - 6 Floor opening if required for panels without cable connection
  - 7 Option: Pressure relief duct
- 1) The position of the cables in the panel depends on the additional built-in panel components, e.g. current and voltage transformers. Therefore, the dimensions x1, x2, c1, c2 may be different.

| Individual panels or combinations thereof for standard switchgear | Panel type | Panel or panel combination |                                        | Transport unit "TU" (including packing) for standard panels (without / with pressure relief duct, <u>option</u> ) |                                        |               |                                 |                                            |
|-------------------------------------------------------------------|------------|----------------------------|----------------------------------------|-------------------------------------------------------------------------------------------------------------------|----------------------------------------|---------------|---------------------------------|--------------------------------------------|
|                                                                   |            | Width B1<br>mm             | Net weight <sup>1)</sup><br>approx. kg | Width B2<br>m                                                                                                     | Height H <sup>Δ)</sup><br>of "TU"<br>m | Depth T2<br>m | Volume<br>m <sup>3</sup>        | Gross weight <sup>1)4)</sup><br>approx. kg |
|                                                                   |            |                            | without/with<br>LV C*) / LV C*)        |                                                                                                                   | without/with<br>LV C*) / LV C*)        |               | without/with<br>LV C*) / LV C*) | without/with<br>LV C*) / LV C*)            |

## Transport of individual panels <sup>○)</sup>

|                                                                   |                 |     |         |      |          |      |           |         |
|-------------------------------------------------------------------|-----------------|-----|---------|------|----------|------|-----------|---------|
| Ring-main panel                                                   | R               | 375 | 160/220 | 1.08 | 1.95/2.3 | 1.40 | 2.95/3.48 | 220/280 |
|                                                                   | R1              | 500 | 180/240 | 1.08 |          |      |           | 240/300 |
| Ring-main transfer panel                                          | R(T)            | 375 | 250/310 | 1.08 |          |      |           | 310/370 |
| Transformer panel                                                 | T               | 375 | 180/240 | 1.08 |          |      |           | 240/300 |
|                                                                   | T1              | 500 | 200/260 | 1.08 |          |      |           | 260/320 |
| Cable panel                                                       | K               | 375 | 140/200 | 1.08 |          |      |           | 200/260 |
|                                                                   | K1              | 500 | 150/210 | 1.08 |          |      |           | 210/270 |
| Cable panel with make-proof earthing switch                       | K               | 375 | 150/210 | 1.08 |          |      |           | 210/270 |
|                                                                   | K1              | 500 | 170/220 | 1.08 |          |      |           | 230/330 |
| Circuit-breaker panel (fixed-mounted circuit-breaker type "CB-f") | L               | 500 | 300/360 | 1.08 |          |      |           | 360/420 |
|                                                                   | L1              | 750 | 340/400 | 1.08 |          |      |           | 400/460 |
|                                                                   | L(T)            | 500 | 300/360 | 1.08 |          |      |           | 360/420 |
|                                                                   | L1(T)           | 750 | 340/400 | 1.08 |          |      |           | 400/460 |
| Circuit-breaker panel (removable circuit-breaker)                 | L1(r)           | 750 | 350/410 | 1.08 |          |      |           | 410/470 |
|                                                                   | L2(r)           | 875 | 380/440 | 1.08 |          |      |           | 440/500 |
| Disconnecter panel                                                | D1              | 500 | 180/240 | 1.08 |          |      |           | 240/300 |
| Disconnecter transfer panel                                       | D1(T)           | 500 | 250/310 | 1.08 |          |      |           | 310/370 |
| Metering panel                                                    | M; M(-K)        | 750 | 270/330 | 1.08 |          |      |           | 340/390 |
|                                                                   | M(-B); M(-BK)   | 750 | 270/330 | 1.08 |          |      |           | 340/390 |
| Metering panel                                                    | M(KK)           | 750 | 270/330 | 1.08 |          |      |           | 340/390 |
| Busbar voltage metering panel                                     | M(VT)           | 375 | 210/270 | 1.08 |          |      |           | 270/330 |
|                                                                   | M(VT-F)         | 375 | 230/290 | 1.08 |          |      |           | 290/350 |
|                                                                   | M1(VT)          | 500 | 240/300 | 1.08 |          |      |           | 310/370 |
|                                                                   | M1(VT-F)        | 500 | 250/310 | 1.08 |          |      |           | 330/390 |
| Bus riser panel                                                   | H               | 375 | 170/230 | 1.08 |          |      |           | 230/290 |
|                                                                   | H <sup>3)</sup> | 375 | 280/340 | 1.08 |          |      |           | 340/400 |
| Busbar earthing panel                                             | E               | 375 | 180/240 | 1.08 |          |      |           | 240/300 |

|                                                                 |                           |     |         |      |          |      |           |         |
|-----------------------------------------------------------------|---------------------------|-----|---------|------|----------|------|-----------|---------|
| Panel combinations                                              |                           |     |         |      | 1.95/2.3 | 1.40 | 2.95/3.48 |         |
| Bus sectionalizer panel (with circuit-breaker)                  | L(T) + H                  | 875 | 470/570 | 1.08 |          |      |           | 530/630 |
| Bus sectionalizer panel (with circuit-breaker)                  | L(T) + R(T)               | 875 | 500/600 | 1.08 |          |      |           | 560/660 |
| Bus sectionalizer panel (1 three-position switch-disconnector)  | R(T) + H                  | 750 | 250/350 | 1.08 |          |      |           | 310/410 |
|                                                                 | R(T) + H <sup>3)</sup>    | 750 | 350/450 | 1.08 |          |      |           | 410/510 |
| Bus sectionalizer panel (2 three-position switch-disconnectors) | R(T) + R(T)               | 750 | 310/410 | 1.08 |          |      |           | 370/470 |
|                                                                 | R(T) + R(T) <sup>3)</sup> | 750 | 420/520 | 1.08 |          |      |           | 480/580 |

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

\* ) Low-voltage compartment, 350 mm high, weight approx. 60 kg depending on the panel type and on the extent to which it is equipped, or optionally 550 mm high

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

○ ) Depending on the delivering factory

1) The **net weight** and the gross weight depend on the extent to which the panel is equipped (e.g. current transformers, motor operating mechanisms) and are therefore given as mean value

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

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

# Installation

## Shipping data, transport

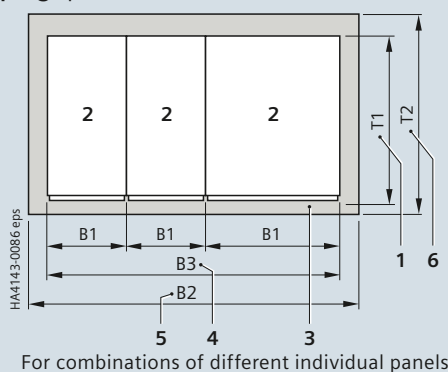
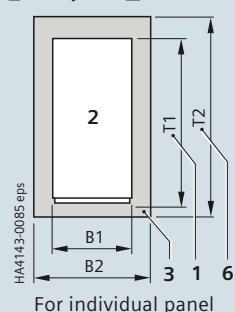
| Individual panels or combinations thereof for standard switchgear | Panel type | Panel or panel combination |                                        | Transport unit "TU" (including packing) for standard panels (without/with pressure relief duct, option) |                                        |               |                                 |                                          |
|-------------------------------------------------------------------|------------|----------------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------|----------------------------------------|---------------|---------------------------------|------------------------------------------|
|                                                                   |            | Width B1<br>mm             | Net weight <sup>1)</sup><br>approx. kg | Width B2<br>m                                                                                           | Height H <sup>Δ)</sup><br>of "TU"<br>m | Depth T2<br>m | Volume<br>m <sup>3</sup>        | Gross weight <sup>1)</sup><br>approx. kg |
|                                                                   |            |                            | without/with<br>LV C*) / LV C*)        |                                                                                                         | without/with<br>LV C*) / LV C*)        |               | without/with<br>LV C*) / LV C*) | without/with<br>LV C*) / LV C*)          |

### Transport dimensions <sup>O)</sup> for combinations of different individual panels

| Transport unit "TU":                                                            | Max. width of switchgear unit "B3" | B2   | T2       |      |                               |
|---------------------------------------------------------------------------------|------------------------------------|------|----------|------|-------------------------------|
| – Standard: As individual panels arranged side by side and not screwed together | On request                         | 0.70 | 1.95/2.3 | 1.40 | 1.91/2.25                     |
| – Option: As multi-panel transport unit, panels screwed together                | ≤ 875 mm                           | 1.08 | 1.95/2.3 | 1.40 | 2.95/3.48 <b>2)</b> + 70 **)  |
| Standard packing for:                                                           | ≤ 1000 mm ***)                     | 1.20 | 1.95/2.3 | 1.40 | 3.28/3.86 <b>2)</b> + 80 **)  |
| – Truck                                                                         | ≤ 1500 mm                          | 1.78 | 1.95/2.3 | 1.40 | 4.64/5.47 <b>2)</b> + 100 **) |
| – Sea transport, airfreight                                                     | ≤ 2125 mm                          | 2.33 | 1.95/2.3 | 1.40 | 6.36/7.50 <b>2)</b> + 120 **) |
| Container packing, standard (other dimensions on request)                       | ≤ 875 mm                           | 1.10 | 1.95/2.3 | 1.40 | 3.00/3.50 <b>2)</b> + 80 **)  |
|                                                                                 | ≤ 2000 mm                          | 2.20 | 1.95/2.3 | 1.40 | 6.00/7.10 <b>2)</b> + 120 **) |

| Transport unit "TU" (CN):                                                       | Max. width of switchgear unit "B3" | B2    | T2       |      |                               |
|---------------------------------------------------------------------------------|------------------------------------|-------|----------|------|-------------------------------|
| – Standard: As individual panels arranged side by side and not screwed together | On request                         | 0.70  | 1.95/2.3 | 1.40 | 1.91/2.25                     |
| – Option: As multi-panel transport unit, panels screwed together                | ≤ 875 mm                           | 1.050 | 1.95/2.3 | 1.40 | 2.95/3.48 <b>2)</b> + 70 **)  |
| Standard packing for:                                                           | ≤ 1125 mm                          | 1.290 | 1.95/2.3 | 1.40 | 3.08/3.70 <b>2)</b> + 80 **)  |
| – Truck                                                                         | ≤ 1500 mm                          | 1.680 | 1.95/2.3 | 1.40 | 4.64/5.47 <b>2)</b> + 100 **) |
| – Sea transport                                                                 | ≤ 2000 mm                          | 2.200 | 1.95/2.3 | 1.40 | 6.00/7.10 <b>2)</b> + 120 **) |
| – Container transport (other packing on request)                                |                                    |       |          |      |                               |

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



- 1 T1 = Depth of individual panel
- 2 Individual panel dimension B1 x T1
- 3 Transport unit, dimension B2 x T2
- 4 B3 = Overall width of combination of different individual panels
- 5 B2 = Width of the transport unit
- 6 T2 = Depth of the transport unit

\*) Low-voltage compartment, 350 mm high, weight approx. 60 kg depending on the panel type and on the extent to which it is equipped, or optionally 550 mm high

\*\* Packing weight

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

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

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

1) The net weight and the gross weight depend on the extent to which the panel is equipped (e.g. current transformers, motor operating mechanisms) and are therefore given as mean value

**2)** Sum of the net weights of individual panels

## Packing types (examples)

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

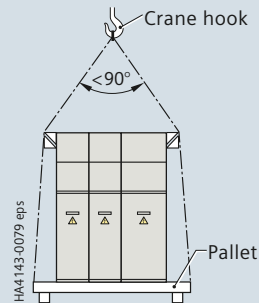
| Place of destination and means of transport | Examples for packing <sup>○)</sup>                                                                           |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------|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

## Transport

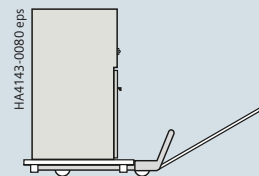
SIMOSEC switchgear is completely delivered in transport units. Please observe the following:

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

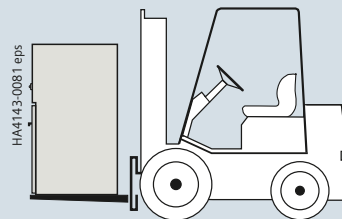
## Types of transport (examples)



Crane transport with pallet



Transport with lifting truck with or without pallet



Transport with fork-lift truck, standing

○) Depending on the delivering factory

# Standards

Standards, specifications, guidelines

## Standards

SIMOSEC switchgear complies with the relevant standards and specifications applicable at the time of type tests.

In accordance with the harmonization agreement reached by the countries of the European Union, their national specifications conform to the IEC standard.

## Overview of standards (2018)

|                                |                                                          | IEC standard  | VDE standard | EN standard  | GB standard                                                         |
|--------------------------------|----------------------------------------------------------|---------------|--------------|--------------|---------------------------------------------------------------------|
| Switchgear                     | SIMOSEC                                                  | IEC 62271-1   | VDE 0671-1   | EN 62271-1   | GB/T 11022                                                          |
|                                |                                                          | IEC 62271-200 | VDE 0671-200 | EN 62271-200 | GB 3906                                                             |
| Devices                        | Circuit-breakers                                         | IEC 62271-100 | VDE 0671-100 | EN 62271-100 | GB 1984                                                             |
|                                | Disconnectors and earthing switches                      | IEC 62271-102 | VDE 0671-102 | EN 62271-102 | GB 1985                                                             |
|                                | Switch-disconnectors                                     | IEC 62271-103 | VDE 0671-103 | EN 62271-103 | GB 3804                                                             |
|                                | Switch-disconnector/fuse combination                     | IEC 62271-105 | VDE 0671-105 | EN 62271-105 | GB 16926                                                            |
|                                | HV HRC fuses                                             | IEC 60282-1   | VDE 0670-4   | EN 60282-1   | GB 15166.2                                                          |
|                                | Voltage detecting systems                                | IEC 61243-5   | VDE 0682-415 | EN 61243-5   | DL/T 538-2006 (acc. to IEC 61958-2008, similar to Chinese standard) |
|                                | Voltage presence indicating systems                      | IEC 62271-206 | VDE 0671-206 | EN 62271-206 |                                                                     |
| Degree of protection           | IP code                                                  | IEC 60529     | VDE 0470-1   | EN 60529     | GB 4208                                                             |
|                                | IK code                                                  | IEC 62262     | VDE 0470-100 | EN 50102     |                                                                     |
| Insulation                     | –                                                        | IEC 60071     | VDE 0111     | EN 60071     | GB/T 311.2                                                          |
| Transformers                   | Instrument transformers:<br>General requirements         | IEC 61869-1   | VDE 0414-9-1 | EN 61869-1   |                                                                     |
|                                | Current transformers                                     | IEC 61869-2   | VDE 0414-9-2 | EN 61869-2   | GB 1208                                                             |
|                                | Voltage transformers                                     | IEC 61869-3   | VDE 0414-9-3 | EN 61869-3   | GB 1207                                                             |
| Power installations            | Common rules                                             | IEC 61936-1   | VDE 0101-1   | EN 61936-1   | –                                                                   |
|                                | Earthing of power installations                          | –             | VDE 0101-2   | EN 50522     | –                                                                   |
| Insulating gas SF <sub>6</sub> | Specification for sulfur hexafluoride (SF <sub>6</sub> ) | IEC 60376     | VDE 0373-1   | EN 60376     | –                                                                   |

## Type of service location

SIMOSEC switchgear can be used as an indoor installation in accordance with IEC 61936 (Power installations exceeding 1 kV AC) and VDE 0101:

- Outside lockable electrical service locations at places which are not accessible to the public. Enclosures of switchgear can only be removed with tools.
- Inside lockable electrical service locations. A lockable electrical service location is a place outdoors or indoors that is reserved exclusively for housing electrical equipment and which is kept under lock and key. Access is restricted to authorized personnel and persons who have been properly instructed in electrical engineering.  
Untrained or unskilled persons may only enter under the supervision of authorized personnel or properly instructed persons.

### Dielectric strength

- The dielectric strength is verified by testing the switchgear with rated values of short duration power-frequency withstand voltage and lightning impulse withstand voltage according to IEC 62271-1 / VDE 0671-1 and GB 11022 (see table "Dielectric strength").
- The rated values are referred to sea level and to normal atmospheric conditions (1013 hPa, 20 °C, 11 g/m<sup>3</sup> humidity in accordance with IEC 60071 and VDE 0111).
- The dielectric strength decreases with increasing altitude. For site altitudes above 1000 m (above sea level) the standards do not provide any guidelines for the insulation rating. Instead, special regulations apply to these altitudes.
- Site altitude
  - As the altitude increases, the dielectric strength of insulation in air decreases due to the decreasing air density. This reduction is permitted up to a site altitude of 1000 m according to IEC and VDE.
  - For site altitudes above 1000 m a higher insulation level must be selected. It results from the multiplication of the rated insulation level for 0 to 1000 m with the altitude correction factor  $K_a$ .

**Table – Dielectric strength**

| Rated voltage (r.m.s. value) kV | 7.2 | 12 | 15 | 17.5 | 24 |
|---------------------------------|-----|----|----|------|----|
|---------------------------------|-----|----|----|------|----|

Rated short-duration power-frequency withstand voltage (r.m.s. value)

|                                  |    |    |    |       |    |    |    |
|----------------------------------|----|----|----|-------|----|----|----|
| – Across the isolating distances | kV | 23 | 32 | 48 *) | 39 | 45 | 60 |
| – Between phases and to earth    | kV | 20 | 28 | 42 *) | 36 | 38 | 50 |

Rated lightning impulse withstand voltage (peak value)

|                                  |    |    |    |  |     |     |     |
|----------------------------------|----|----|----|--|-----|-----|-----|
| – Across the isolating distances | kV | 70 | 85 |  | 105 | 110 | 145 |
| – Between phases and to earth    | kV | 60 | 75 |  | 95  | 95  | 125 |

### Current carrying capacity

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

### Internal arc classification

- Protection of operating personnel by means of tests for verifying the internal arc classification
- Internal arcing tests must be performed in accordance with IEC 62271-200 or VDE 0671-200
- Definition of criteria:
  - **Criterion 1:**  
Correctly secured doors and covers do not open, limited deformations are accepted

\*) Value according to GB standard

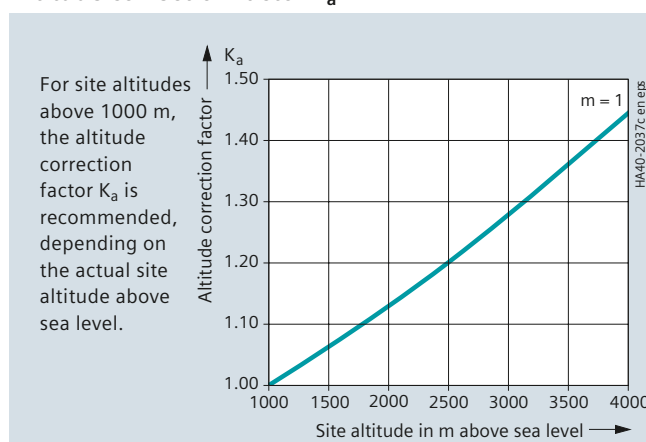
- **Criterion 2:**  
No fragmentation of the enclosure, no projection of small parts above 60 g
- **Criterion 3:**  
No holes in accessible sides up to a height of 2 m
- **Criterion 4:**  
No ignition of indicators due to hot gases
- **Criterion 5:**  
The enclosure remains connected to its earthing point.

### Resistance to internal faults (option)

In SIMOSEC switchgear, the appearance of internal faults (internal arcs) is less compared with earlier designs due to:

- Use of gas-insulated switching-device vessels
- Use of metal-enclosed switching-device vessels
- The fact that maloperation is practically excluded due to logical arrangement of operating elements and use of logical mechanical interlocks
- Short-circuit-proof feeder earthing by means of the three-position switch (make-proof earthing switch) or the circuit-breaker.

### Altitude correction factor $K_a$



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

$\geq$  Rated short-duration power-freq. withstand volt. up to  $\leq 1000 \text{ m} \cdot K_a$

Rated lightning impulse withstand voltage for site altitudes > 1000 m to be selected

$\geq$  Rated lightning impulse withstand voltage up to  $\leq 1000 \text{ m} \cdot K_a$

#### Example 1:

3000 m site altitude above sea level  
 17.5 kV switchgear rated voltage  
 95 kV rated lightning impulse withstand voltage  
 Rated lightning impulse withstand volt. to be selected  $95 \text{ kV} \cdot 1.28 = 122 \text{ kV}$   
**Result:**  
 According to the above table, a switchgear for a rated voltage of 24 kV with a rated lightning impulse withstand voltage of 125 kV is to be selected

#### Example 2:

2750 m site altitude above sea level  
 7.2 kV switchgear rated voltage  
 60 kV rated lightning impulse withstand voltage  
 Rated lightning impulse withstand volt. to be selected  $60 \text{ kV} \cdot 1.25 = 75 \text{ kV}$   
**Result:**  
 According to the above table, a switchgear for a rated voltage of 12 kV with a rated lightning impulse withstand voltage of 75 kV is to be selected.

# Standards

Standards, specifications, guidelines

## Cable testing

- For circuit-breaker and switch-disconnector feeders
- **DC voltage test**  
Before the test:  
Remove or disconnect any voltage transformers at the cable connection in SIMOSEC switchgear
- SIMOSEC switchgear, e.g. for rated voltages up to 17.5 kV can be subjected to cable tests at a max. DC test voltage of 38 kV according to VDE. The voltage at the busbar may be 17.5 kV in this case
- SIMOSEC switchgear for rated voltages up to 24 kV can be subjected to cable tests at a max. DC test voltage of 72 kV or according to VDE at 70 kV, 15 min. The voltage at the busbar may be 24 kV in this case.
- For cable testing
  - the installation and operating instructions of the switchgear
  - the standards IEC 62271-200/VDE 0671-200 Clause 5.105 \*)
  - the information on manufacturer-dependent cable sealing ends
  - the cable version (e.g. paper-insulated mass-impregnated cables, PVC cables or XLPE cables)

must be observed.

Test voltages:

| Rated voltage | $U_0 / U (U_m)$ | Max. test voltage applied to the connected cable |             |                                          |
|---------------|-----------------|--------------------------------------------------|-------------|------------------------------------------|
|               |                 | VLF <sup>1)</sup> , 0.1 Hz                       | acc. to IEC | VDE 0278                                 |
|               |                 | $3 \times U_0$<br>$U_{LF}$                       | $U =$       | $6 \times U_0$ ,<br>15 min<br>max. $U =$ |
| $U_r$ (kV)    | (kV)            | AC (kV)                                          | DC (kV)     | DC (kV)                                  |
| 12            | 6/10 (12)       | 19                                               | 24          | 38 <sup>2)</sup>                         |
| 24            | 12/20 (24)      | 38                                               | 48          | 70                                       |

## Color of the switchgear

Panel front:

RAL 7035 (light grey)

End walls:

Standard: Steel (sendzimir galvanized)

Option: Painted, color according to panel front.

## Terms

“Make-proof earthing switches” are earthing switches with short-circuit making capacity according to

- IEC 62271-102 and
- VDE 0671-102.

## Climate and environmental influences

Indoor installation:

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

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

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

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

Climate classes:

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

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

- Environmental influences
  - Natural foreign materials
  - Chemically active pollutants
  - Small animals

## Recycling

The switchgear can be recycled in ecological manner in compliance with existing legislation. Auxiliary devices such as short-circuit indicators have to be recycled as electronic scrap. Batteries have to be recycled professionally. Insulating gas SF<sub>6</sub> has to be evacuated professionally as a reusable material and recycled (SF<sub>6</sub> must not be released into the environment).

\*) For standards, see page 72

1) VLF = very low frequency

2) Referred to:  $U_0 / U (U_m = 6.35 / 11 (12) \text{ kV})$

3) Secondary devices (e.g. protection devices, meters, measuring transducers, etc.) must be suitable for the given operating conditions.

**PM**

Metallic partition according to IEC 62271-200 (3.109.1).  
Metallic partitions between open, accessible compartments and live parts.

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

### Protection against solid foreign objects, electric shock and water

SIMOSEC switchgear fulfills according to the standards \*)

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

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

| Degree of protection "IP" | Type of protection                                                              |
|---------------------------|---------------------------------------------------------------------------------|
| IP2X (standard)           | for switchgear enclosure                                                        |
| IP3X (option)             | for switchgear enclosure (optional)                                             |
| IP3XD (option on request) | for switchgear enclosure (on request)                                           |
| IP65                      | for parts of the primary circuit of switching-device vessels under high voltage |
| Degree of protection IK   | Type of protection                                                              |
| IK 07                     | for switchgear enclosure                                                        |

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

**IEC/EN 60529:**

| Type of protection                                                                                                                                                                                                             | Degree of protection |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <u>Standard:</u>                                                                                                                                                                                                               | <b>IP 2 X</b>        |
| <b>Protection against solid foreign objects</b><br>Protected against solid foreign objects of 12.5 mm diameter and greater (the object probe, sphere of 12.5 mm diameter, shall not fully penetrate)                           |                      |
| <b>Protection against access to hazardous parts</b><br>Protected against access to hazardous parts with a finger (the jointed test finger of 12 mm diameter, 80 mm length, shall have adequate clearance from hazardous parts) |                      |
| <b>Protection against water</b><br>No definition                                                                                                                                                                               |                      |
| <u>Option:</u>                                                                                                                                                                                                                 | <b>IP 3 X</b>        |
| <b>Protection against solid foreign objects</b><br>Protected against solid foreign objects of 2.5 mm diameter and greater (the object probe, sphere of 2.5 mm diameter, shall not penetrate at all)                            |                      |
| <b>Protection against access to hazardous parts</b><br>Protected against access to hazardous parts with a tool (the access probe of 2.5 mm diameter shall not penetrate)                                                       |                      |
| <b>Protection against water</b><br>No definition                                                                                                                                                                               |                      |
| <u>Option on request:</u>                                                                                                                                                                                                      | <b>IP 3 X D</b>      |
| <b>Protection against solid foreign objects</b><br>Protected against solid foreign objects of 2.5 mm diameter and greater (the object probe, sphere of 2.5 mm diameter, shall not penetrate at all)                            |                      |
| <b>Protection against water</b><br>No definition                                                                                                                                                                               |                      |
| <b>Protection against access to hazardous parts</b><br>Protected against access with a wire (the access probe of 1.0 mm diameter, 100 mm length, shall have adequate clearance from hazardous parts)                           |                      |
|                                                                                                                                                                                                                                | <b>IP 6 5</b>        |
| <b>Protection against solid foreign objects</b><br>Dust-tight (No ingress of dust)                                                                                                                                             |                      |
| <b>Protection against access to hazardous parts</b><br>Protected against access to hazardous parts with a wire (the access probe of 1.0 mm diameter shall not penetrate)                                                       |                      |
| <b>Protection against water</b><br>Protected against water jets (water projected in jets against the enclosure from any direction shall have no harmful effects)                                                               |                      |

\*) For standards, see page 72

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