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

Medium-Voltage Switchgear

Catalog HA 41.21
2003

Supersedes:
Catalog HA 41.21 · 2002

SIEMENS

# Contents






# Application

## Typical uses


Example
4-panel transfer switchgear with integrated low-voltage niche

**Utilities transfer substation for industrial plants**

# Application, Requirements

## Features

SIMOSEC switchgear is a factory-assembled, type-tested, three-phase, metal-enclosed, metal-clad indoor switchgear according to IEC 60 298 / VDE 0670, Part 6 for single busbars.

### Typical uses

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

Modular space-saving design allows use 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 examples

- 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 industry
- Emergency power supply installations

### Modular design

- Individual panels, for free combination and extension
- Option: low-voltage compartments can be supplied in two overall heights

### Technical features

- Air-insulated indoor switchgear
- Gas-insulated, maintenance-free switching functions for the three-position switch
- Three-pole primary enclosure
- Phases arranged one behind the other
- No cross-insulation between phases
- Busbar system at 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 3AH5, metal-enclosed, up to 630 A, fixed-mounted in gas-insulated switchgear vessel
- Vacuum circuit-breaker 3AH6, air-insulated, up to 1250 A, easy to withdraw after loosening the fixing bolts
- Hermetically-sealed by welding, stainless-steel switchgear vessel,
  – For switching devices
  – With welded-in bushings (for electrical connections and mechanical components)
  – With insulating gas $SF_6$
- Cubicle-type or metal-clad panel design
- Pressure relief
  – To the rear and upwards
  – Separately for each compartment
- Air-insulated cable connection system for conventional cable sealing ends
- Three-phase current transformer, factory-assembled on the feeder bushings
- Integrated low-voltage niche (standard) for installation of, e.g.
  – Terminals, MCBs, push-buttons
  – Protection devices
- Option: Top-mounted low-voltage compartment
- Option: Panel heating for severe ambient conditions, e.g. condensation

### Reliability

- Type and routine-tested
- Standardized and manufactured using numerically controlled machines
- Quality management system according to DIN EN ISO 9001
- More than 350,000 switchgear components in operation worldwide for many years
- No cross-insulation between phases

### Personal safety

- All switching operations can be performed with closed panel front
- Metal-enclosed, cubicle-type or metal-clad switchgear
- HV HRC fuses and cable sealing ends are only accessible when the outgoing feeders are earthed
- Logical mechanical interlocking
- Capacitive voltage detection system for verification of safe isolation from supply
- Earthing of outgoing feeders by means of make-proof earthing switches

### Security of operation

- Components, e.g. operating mechanisms, three-position switches, vacuum circuit-breakers proven for years
- Metal-clad panels (metal compartmentalization between busbar and switching device and between switching device and cable connection compartment)
- Cubicle-type panels with metal compartmentalization between switching device and busbar compartment
- Three-position switch metal-enclosed with gas-insulated switching functions
  – Welded sealed-for-life switchgear vessel
  – No cross-insulation between phases
  – With welded-in bushings for cable connection, busbar and operating mechanism
- Switch operating mechanisms outside switchgear vessel
- Maintenance-free operating mechanism parts (IEC 60 694/ VDE 0670 Part 1000 *)
- Mechanical switch position indications integrated in mimic diagram
- Switchgear interlocking system with logical mechanical interlocks

### Reavailability

- Three-position switch disconnector with gas-insulated, maintenance-free quenching principle
- Metal compartmentalization between busbar compartment, switching devices and cable connection 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

### Cost-efficiency

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

- Three-position switch with gas-insulated quenching principle
- 3AH vacuum circuit-breaker
- Minimum space requirement
- Easy switchgear extension
- Standard protection relays, e.g. multifunction protection SIPROTEC 4

### Electrical features

- Rated voltages up to 24 kV
- Rated short-time withstand current up to 25 kA
- Rated normal current of feeders
  – Up to 630 A, e.g. for ring-main, metering and circuit-breaker panels
  – Up to 1250 A, for circuit-breaker and bus sectionalizer panels
- Rated normal current of busbar up to 1250 A

* Standards see page 41

# Technical Data

## Electrical data of panels, pressure values, temperature

### Common details on electrical data, filling pressure and temperature

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rated insulation level | Rated voltage $U_r$ | kV | **7.2** | | | **12** | | | **15** | | | **17.5** | | | **24** | | | | | | |
| | Rated short-dur. power-freq. withstand voltage $U_d$ | kV | 20 | | | 28 | | | 35 | | | 38 | | | 50 | | | | | | |
| | Rated lightning impulse withstand voltage $U_p$ | kV | 60 | | | 75 | | | 95 | | | 95 | | | 125 | | | | | | |
| Rated frequency $f_r$ | | | 50/60 Hz → | | | | | | | | | | | | | | | | | | |
| Rated normal current $I_r$ [1] of busbar | Standard | | 630 A → | | | | | | | | | | | | | | | | | | |
| | Option | | 1250 A → | | | | | | | | | | | | | | | | | | |
| Rated short-time withstand current $I_k$ | for switchgear with $t_k$ = 1 s | up to kA | 20 | | 25 | 20 | | 25 | 16 | 20 | 25 | 16 | 20 | 25 | 16 | | 20 |
| | for switchgear with $t_k$ = 3 s | up to kA | 20 | | – | 20 | | – | – | 20 | – | – | 20 | – | – | | 20 |
| Rated peak withstand current $I_p$ | | up to kA | 50 | 63 | | 50 | 63 | | 40 | 50 | 63 | 40 | 50 | 63 | 40 | | 50 |
| Rated filling pressure $p_{re}$ [2] | for insulation | | 1500 hPa (absolute) at 20 °C → | | | | | | | | | | | | | | | | | | |
| Minimum operating pressure $p_{me}$ [2] | for insulation | | 1300 hPa (absolute) at 20 °C → | | | | | | | | | | | | | | | | | | |
| Ambient temperature $T$ | for panels without secondary equipment | | – 25 °C to +55 °C → | | | | | | | | | | | | | | | | | | |
| | for panels with secondary equipment | | – 5 °C to +55 °C → | | | | | | | | | | | | | | | | | | |

### Ring-main panel type RK and cable connection panel type K

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rated normal current $I_r$ [1] | for feeder and transfer, panel type RK | | 400, 630 A → | | | | | | | | | | | | | | | | | | |
| | for feeder, panel type K | | 400, 630 A → | | | | | | | | | | | | | | | | | | |
| | for feeder, panel type K1 | | 400, 630, 1250 A → | | | | | | | | | | | | | | | | | | |
| Rated short-circuit making current $I_{ma}$ | | up to kA | 50 | 63 | | 50 | 63 | | 40 | 50 | 63 | 40 | 50 | 63 | 40 | | 50 |

### Transformer panel type TR

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rated normal current $I_r$ [1] | for feeder [3] | | 200 A | | | | | | | | | | | | | | | | | | |
| Rated peak withstand current $I_p$ [3] | | up to kA | 50 | 63 | | 50 | 63 | | 40 | 50 | 63 | 40 | 50 | 63 | 40 | | 50 |
| Rated short-circuit making current $I_{ma}$ [3] | | up to kA | 25 | 25 | | 25 | 25 | | 25 | 25 | 25 | 25 | 25 | 25 | 25 | | 25 |
| Reference dimension "e" | for HV HRC fuse links | mm | 292 [4] | | | 292 | | | 442 | | | 442 | | | 442 | | | | | | |

### Circuit-breaker panel type LS

| | for feeder | for transfer | with | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rated normal current $I_r$ [1] | f. panel type LS1 | and LS1-U | 3AH5 * | 630 A → | | | | | | | | | | | | | | | | | |
| | f. panel type LS11 | and LS11-U | 3AH6 * | 630 A → | | | | | | | | | | | | | | | | | |
| | f. panel type LS31, LS32 | and LS31-U | 3AH6 * | 1250 A → | | | | | | | | | | | | | | | | | |
| Rated short-circuit making current $I_{ma}$ | | | up to kA | 50 | 63 | | 50 | 63 | | 40 | 50 | 63 | 40 | 50 | 63 | 40 | | 50 |
| Rated short-circuit breaking current $I_{sc}$ | for 3AH vacuum circuit-breaker | | up to kA | 20 | 25 | | 20 | 25 | | 16 | 20 | 25 | 16 | 20 | 25 | 16 | | 20 |

### Busbar earthing panel type SE

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rated short-circuit making current $I_{ma}$ | | up to kA | 50 | 63 | | 50 | 63 | | 40 | 50 | 63 | 40 | 50 | 63 | 40 | | 50 |

### Busbar voltage metering panels type ME3 and type ME31-F

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rated peak withstand current $I_p$ [3] | | up to kA | 50 | 63 | | 50 | 63 | | 40 | 50 | 63 | 40 | 50 | 63 | 40 | | 50 |
| Rated short-circuit making current $I_{ma}$ [3] | | up to kA | 25 | 25 | | 25 | 25 | | 25 | 25 | 25 | 25 | 25 | 25 | 25 | | 25 |
| Reference dim. "e" in panel type ME31-F | for HV HRC fuse links | | 292 mm → | | | | | | | | | | | | | | | | | | |

### Billing metering panels type ME1

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rated normal current $I_r$ [1] | for transfer, panel types ME1 and ME1-H | | 630 A, 1250 A → | | | | | | | | | | | | | | | | | | |
| | for feeder as cable-connection panel type ME1-K | | 630 A, 1250 A → | | | | | | | | | | | | | | | | | | |
| | for busbar connection, panel type ME1-S | | 630 A, 1250 A → | | | | | | | | | | | | | | | | | | |
| | for bus riser panel type HF | | 630 A, 1250 A → | | | | | | | | | | | | | | | | | | |

### Bus sectionalizer panels type LT

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rated normal current $I_r$ [1] | for panel types LT10 and HF, with 3AH5 * | | 630 A → | | | | | | | | | | | | | | | | | | |
| | for panel type LT1, with 3AH5 *: On request | | 630 A → | | | | | | | | | | | | | | | | | | |
| | for panel types LT11 and HF, with 3AH6 * | | 630 A → | | | | | | | | | | | | | | | | | | |
| | for panel types LT2 and LT22 | | 630 A → | | | | | | | | | | | | | | | | | | |
| | for panel types LT31 and HF, with 3AH6 * | | 1250 A → | | | | | | | | | | | | | | | | | | |
| Rated short-circuit making current $I_{ma}$ | | up to kA | 50 | 63 | | 50 | 63 | | 40 | 50 | 63 | 40 | 50 | 63 | 40 | | 50 |
| Rated short-circuit breaking current $I_{sc}$ | for 3AH vacuum circuit-breaker | up to kA | 20 | 25 | | 20 | 25 | | 16 | 20 | 25 | 16 | 20 | 25 | 16 | | 20 |
| Electrical service life | for 3AH vacuum circuit-breaker: | | | | | | | | | | | | | | | | | | | | |
| | at rated normal current $I_r$ [1] | | 10,000 operating cycles | | | | | | | | | | | | | | | | | | |
| | at rated short-time breaking current $I_{sc}$ | | 50 breaking operations, 35 breaking operations on 3AH6 * with 25 kA | | | | | | | | | | | | | | | | | | |

1) The rated normal currents apply to ambient temperatures of 40 °C. The 24-hour-mean value is max. 35 °C (according to IEC 60 694 / VDE 0670 Part 1000)

2) Pressure values for $SF_6$-insulated vessels

3) For panel types TR and ME31-F depending on the max. cut-off current of the HV HRC fuse link

4) With reference dimension e = 192 mm, an extension tube (100 mm long) is additionally required for fuse mounting 292 mm

* Type designation of the vacuum circuit-breaker

# Electrical data * of the switching devices

## Three-position switch-disconnector

| | | | | | 7.2 | 12 | 15 | 17.5 | 24 |
|---|---|---|---|---|---|---|---|---|---|
| Rated voltage | | | $U_r$ | kV | 7.2 | 12 | 15 | 17.5 | 24 |
| Rated insulation level | Rated short-duration power-frequency withstand volt. | | $U_d$ | kV | 20 | 28 | 36 | 38 | 50 |
| | Rated lightning impulse withstand voltage | | $U_w$ | kV | 60 | 75 | 95 | 95 | 125 |
| Rated frequency | | | $f_r$ | Hz | 50/60 | 50/60 | 50/60 | 50/60 | 50/60 |
| Rated normal current for | ring-main feeders | | $I_r$ | A | 400, 630 | 400, 630 | 400, 630 | 400, 630 | 400, 630 |
| | transformer feeders 1) | | $I_r$ | A | 200 | 200 | 200 | 200 | 200 |
| Rated short-time withstand current | for switchgear with $t_k$ ($t_{tk}$)** = 1 s | | $I_k$ ($I_{th}$)** | up to kA | 25 | 25 | 25 | 25 | 20 |
| | for switchgear with $t_k$ ($t_{tk}$)** = 3 s | | $I_k$ ($I_{th}$)** | kA | 20 | 20 | 20 | 20 | 20 |
| Rated peak withstand current | | | $I_p$ | up to kA | 63 | 63 | 63 | 63 | 50 |
| Rated short-circuit making current for | transformer feeders 2) | | $I_{ma}$ | kA | 25 | 25 | 25 | 25 | 25 |
| | ring-main feeders | | $I_{ma}$ | up to kA | 63 | 63 | 63 | 63 | 50 |
| **Switching capacity of general-purpose switches (class E3) according to IEC 60 265-1 / VDE 0670 Part 301** (Standards see page 41) | | | | | | | | | |
| Test duty 1 | Rated mainly active load breaking current | for 100 switching operations | $I_1$ | A | 630 | 630 | 630 | 630 | 630 |
| | | for 20 switching operations | $I_1$ | A | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 |
| Test duty 2a | Rated closed-loop breaking current | | $I_{2a}$ | A | 630 | 630 | 630 | 630 | 630 |
| Test duty 3 | Rated transformer breaking current | | $I_3$ | A | 40 | 40 | 40 | 40 | 40 |
| Test duty 4a | Rated cable-charging breaking current | | $I_{4a}$ ($I_C$ or $I_6$)** | A | 68 | 68 | 68 | 68 | 68 |
| Test duty 4b | Rated line-charging breaking current | | $I_{4b}$ | A | 68 | 68 | 68 | 68 | 68 |
| Test duty 5 | Rated short-circuit making current | | $I_{ma}$ | up to kA | 63 | 63 | 63 | 63 | 50 |
| Test duty 6a | Rated earth-fault breaking current | | $I_{6a}$ ($I_e$)** | A | 60 | 60 | 60 | 60 | 60 |
| Test duty 6b | Rated cable-charging breaking current and line-charging breaking current under earth-fault conditions | | $I_{6b}$ ($\sqrt{3} \cdot I_{CL}$)** | A | 35 | 35 | 35 | 35 | 35 |
| – | Cable-charging breaking current under earth-fault conditions with superimposed load current | | $I_L + \sqrt{3} \cdot I_{CL}$ | A | 630+50 | 630+50 | 630+50 | 630+50 | 630+50 |
| **Switching capacity of switch-disconnector/fuse combination** (Standards see page 41) | | | | | | | | | |
| Rated transfer current | | | $I_4$ | A | 1150 | 1150 | 830 | 830 | 830 |

## Earthing switch

| | | | | | 7.2 | 12 | 15 | 17.5 | 24 |
|---|---|---|---|---|---|---|---|---|---|
| Rated voltage | | | $U_r$ | kV | 7.2 | 12 | 15 | 17.5 | 24 |
| Make-proof earthing function of the three-position switch-disconnector | Rated short-circuit making current | | $I_{ma}$ | up to kA | 63 | 63 | 63 | 63 | 50 |
| | Rated short-time withstand current | | $I_k$ ($I_{th}$)** | up to kA | 25 | 25 | 25 | 25 | 20 |
| Make-proof earthing function in panels LS11, LS31, LS32 | Rated short-circuit making current | | $I_{ma}$ | up to kA | 63 | 63 | 63 | 63 | 50 |
| | Rated short-time withstand current | | $I_k$ ($I_{th}$)** | up to kA | 25 | 25 | 25 | 25 | 20 |
| Earthing function of the three-position disconnector | Rated short-time withstand current | | $I_k$ ($I_{th}$)** | up to kA | 25 | 25 | 25 | 25 | 20 |

HA41-29a eps

## 3AH5 and 3AH6 vacuum circuit-breakers

| | | | | | 7.2 | 12 | 15 | 17.5 | 24 |
|---|---|---|---|---|---|---|---|---|---|
| Rated voltage | | | $U_r$ | kV | 7.2 | 12 | 15 | 17.5 | 24 |
| Rated insulation level | Rated short-duration power-frequency withstand volt. | | $U_d$ | kV | 20 | 28 | 36 | 38 | 50 |
| | Rated lightning impulse withstand voltage | | $U_p$ | kV | 60 | 75 | 95 | 95 | 125 |
| Rated frequency | | | $f_r$ | Hz | 50/60 | 50/60 | 50/60 | 50/60 | 50/60 |
| Rated normal current of feeders | | for 3AH5 | $I_r$ | A | 400, 630 | 400, 630 | 400, 630 | 400, 630 | 400, 630 |
| | | for 3AH6 | $I_r$ | A | 630, 1250 | 630, 1250 | 630, 1250 | 630, 1250 | 630,1250 |
| Rated short-time withstand current | | | $I_k$ ($I_{th}$)** | up to kA | 25 | 25 | 25 | 25 | 20 |
| Rated short-circuit duration | | | $t_k$ ($t_{th}$)** | s | 3 | 3 | 3 | 3 | 3 |
| Rated peak withstand current | | | $I_p$ | up to kA | 63 | 63 | 63 | 63 | 50 |
| Rated short-circuit breaking current | | | $I_{sc}$ | up to kA | 25 | 25 | 25 | 25 | 20 |
| Rated short-circuit making current | | | $I_{ma}$ | up to kA | 63 | 63 | 63 | 63 | 50 |
| Electrical service life at rated normal current | | | – | – | 10,000 operating cycles | | | | |

* Higher values of electrical data available on request

** Indications in parenthesis acc. to previous standards

1) Depending on the HV HRC fuse links

2) Depending on the cut-off current of the HV HRC fuse

# Technical Data

## Switchgear installation

### Room planning

Switchgear installation

Wall-standing arrangement
– Single row
– Double row (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 page 40
- Foundations:

– Steel structure
– Steel-reinforced concrete

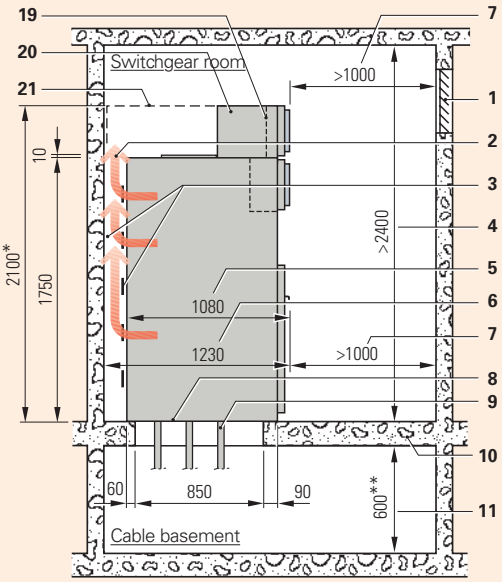
Panel dimensions

See pages 34 to 39

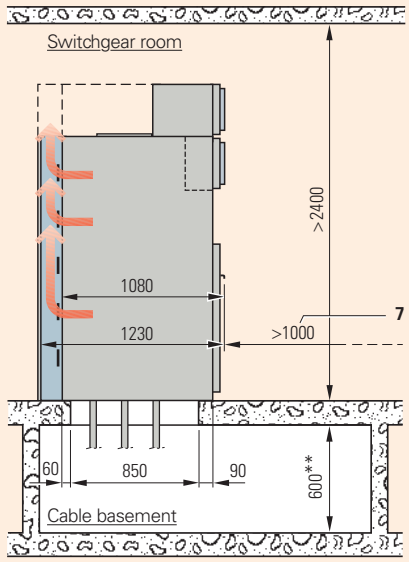
### Weight

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 7.

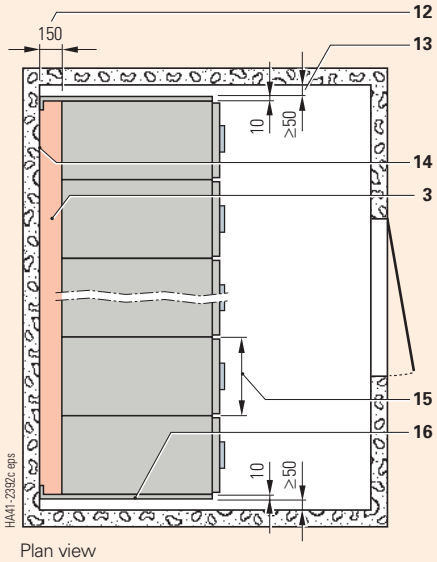
### Room planning



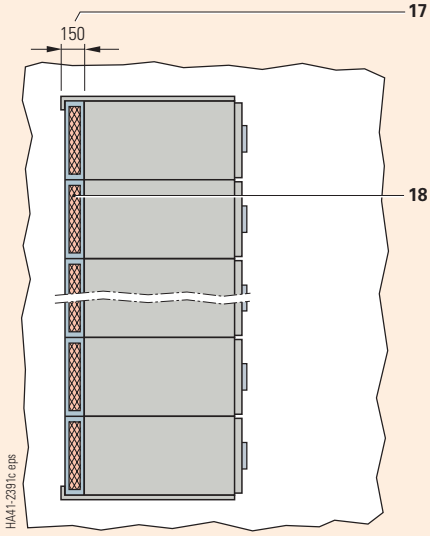

**Wall-standing arrangement** (side view)




**Free-standing arrangement** (side view)




Plan view




Plan view

**1** Relief opening
**2** Direction of pressure relief
**3** Pressure relief of switchgear
**4** Room height
**5** Individual panel depth
**6** Panel depth including end wall
**7** Control aisle
**8** Option: Floor cover
**9** Cable
**10** Foundation
**11** Height of cable basement corresponding to cable bending radius

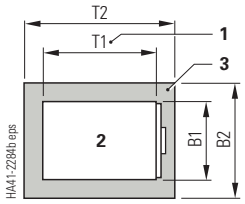
* Switchgear height 2100 mm if height of low-voltage compartment 350 mm; switchgear height 2300 mm if height of low-voltage compartment 550 mm

**12** Wall distance
**13** Side wall distance
**14** Installation flush with rear wall
**15** Panel width
**16** End wall
**17** Depth of pressure relief duct
**18** Option: For free-standing arrangement pressure relief duct for each panel for rated short-time withstand current $I_k \leq 20$ kA
**19** Option: Front cover
**20** Option: Low-voltage compartment
**21** Option: High end wall

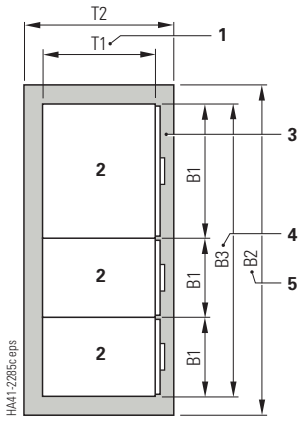
** Depending on bending radius of cable

## Shipping data

### Transport units for shipping (plan view)




With individual panel




With combinations of different individual panels

**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

| Individual panel or combinations thereof for standard switchgear (without pressure relief duct) | Panel type | Panel or panel combination | | Transport unit (including packing) for standard panels (without pressure relief duct) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Width B1 mm | Net weight [1] approx. kg with- / without LVC* / LVC* | Width B2 m | Height m with- / without LVC* / LVC* | Depth T2 m | Volume $m^3$ with- / without LVC* / LVC* | Gross weight approx. kg with- / without LVC* / LVC* |
| **Transport of individual panels** | | | | | | | | |
| Ring-main panel | RK<br>RK1 | 375<br>500 | 190 / 250<br>210 / 270 | 0.7<br>0.7 | 1.9 / 2.3 | 1.40 | 1.86 / 2.25<br>1.86 / 2.25 | 250 / 310<br>270 / 330 |
| Ring-main panel for panel combinations | RK-U | 375 | 260 / 320 | 0.7 | | | 1.86 / 2.25 | 320 / 380 |
| Cable panel | K, K-E<br>K1, K1-E | 375<br>500 | 190 / 250<br>190 / 250 | 0.7<br>0.7 | | | 1.86 / 2.25<br>1.86 / 2.25 | 250 / 310<br>250 / 310 |
| Transformer panel | TR<br>TR1 | 375<br>500 | 210 / 270<br>230 / 290 | 0.7<br>0.7 | | | 1.86 / 2.25<br>1.86 / 2.25 | 270 / 330<br>290 / 350 |
| Circuit-breaker panel 630 A | LS1<br>LS11 | 750<br>750 | 340 / 400<br>340 / 400 | 1.08<br>1.08 | | | 2.87 / 3.48<br>2.87 / 3.48 | 410 / 460<br>410 / 460 |
| Circuit-breaker panel 1250 A<br>– For connection of max. 2 cables<br>– For connection of 3 cables | <br>LS31<br>LS32 | <br>750<br>875 | <br>400 / 460<br>460 / 520 | <br>1.08<br>1.08 | | | <br>2.87 / 3.48<br>2.87 / 3.48 | <br>470 / 520<br>530 / 580 |
| Bus sectionalizer panel 1250 A | LT31 | 750 | 450 / 510 | 1.08 | | | 2.87 / 3.48 | 520 / 570 |
| Bus sectionalizer panel 630 A with vacuum circuit-breaker | LT10<br>LT11 | 750<br>750 | 320 / 380<br>320 / 380 | 1.08<br>1.08 | | | 2.87 / 3.48<br>2.87 / 3.48 | 390 / 440<br>390 / 440 |
| Bus sectionalizer panel with 1 three-position switch-disconnector | LT2<br>LT2-W | 750<br>750 | 250 / 310<br>310 / 370 | 1.08<br>1.08 | | | 2.87 / 3.48<br>2.87 / 3.48 | 320 / 370<br>380 / 430 |
| Bus sectionalizer panel with 2 three-position switch-disconnectors | LT22<br>LT22-W | 750<br>750 | 290 / 350<br>350 / 410 | 1.08<br>1.08 | | | 2.87 / 3.48<br>2.87 / 3.48 | 360 / 410<br>420 / 470 |
| Billing metering panel | ME1....<br>ME1-H | 750<br>750 | 270 / 330<br>330 / 390 | 1.08<br>1.08 | | | 2.87 / 3.48<br>2.87 / 3.48 | 340 / 390<br>400 / 450 |
| Busbar voltage metering panel | ME3<br>ME31-F | 375<br>500 | 210 / 270<br>270 / 330 | 0.7<br>0.7 | | | 1.86 / 2.25<br>1.86 / 2.25 | 270 / 330<br>330 / 390 |
| Bus riser panel – without transformers | HF | 375 | 170 / 230 | 0.7 | | | 1.86 / 2.25 | 230 / 290 |
| Bus riser panel – with transformers | HF | 375 | 260 / 320 | 0.7 | | | 1.86 / 2.25 | 320 / 380 |
| Busbar earthing panel | SE1<br>SE2 | 375<br>500 | 190 / 250<br>270 / 330 | 0.7<br>0.7 | | | 1.86 / 2.25<br>1.86 / 2.25 | 250 / 310<br>330 / 390 |

| For individual panel | Panel width mm | Additional weight approx. kg |
|---|---|---|
| Pressure relief duct for free-standing arrangement of switchgear | 375 | 30 |
| | 500 | 40 |
| | 750 | 60 |
| | 875 | 70 |

**Transport of combinations of different individual panels**

| Transport unit: | Overall width B3 | B2 | | T2 | | |
|---|---|---|---|---|---|---|
| – Standard: As individual panels arranged side by side and not screwed together | ≤ 875 mm | 1.08 | 1.9 / 2.3 | 1.40 | 2.87 / 3.48 | [2] + 70 ** |
| – Option: As multi-panel transport unit, panels screwed together | ≤ 1125 mm | 1.20 | 1.9 / 2.3 | 1.40 | 3.19 / 3.86 | [2] + 80 ** |
| | ≤ 1500 mm | 1.70 | 1.9 / 2.3 | 1.40 | 4.52 / 5.47 | [2] + 100 ** |
| | ≤ 2000 mm | 2.33 | 1.9 / 2.3 | 1.40 | 6.20 / 7.50 | [2] + 120 ** |

### Packing, transport (examples)

| Packing | Version | For supply | Transport |
|---|---|---|---|
| Panels mounted on wooden floor and covered with PE protection sheeting | Open | In Europe | Rail, truck |
| | In container | Overseas | Ship + truck |

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

[2] Sum of the net weights of individual panels

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

** Packing weight

# Product Range

## Product range overview

### Standard panels


**Ring-main panel**
type RK


**Circuit-breaker panel**
type LS1


**Transformer panel**
type TR


**Circuit-breaker panel**
type LS11


**Cable panel**
type K


**Billing metering panel**
type ME1

| Panel designation | | Panel type | Panel width |
|---|---|---|---|
| Column No. | | | |
| **Ring-main panel** [1] | as feeder | RK<br>RK1 | 375 mm<br>500 mm |
| | as transfer | RK-U | 375 mm |
| **Transformer panel** [1] | as feeder | TR<br>TR1 | 375 mm<br>500 mm |
| **Cable panel** | as feeder | K<br>K1 | 375 mm<br>500 mm |
| **Cable panel** [1] [2] | as feeder | K-E<br>K1-E | 375 mm<br>500 mm |
| **Circuit-breaker panel 630 A** [1] with 3AH5 [3] | as feeder | LS1 | 750 mm |
| | as transfer | LS1-U | 750 mm |
| **Circuit-breaker panel 630 A** with 3AH6 [3] | as feeder | LS11 | 750 mm |
| | as transfer | LS11-U | 750 mm |
| **Circuit-breaker panel 1250 A** with 3AH6 [3] | as feeder | LS31<br>LS32 | 750 mm<br>875 mm |
| | as transfer | LS31-U | 750 mm |
| **Bus sectionalizer panel 630 A** [1] with 3AH5 [3], for panel type HF | | LT10 | 750 mm |
| **Bus sectionalizer panel 630 A** with 3AH6 [3], for panel type HF | | LT11 | 750 mm |
| **Bus sectionalizer panel 1250 A** with 3AH6 [3], for panel type HF | | LT31 | 750 mm |
| **Bus sectionalizer panel 630 A** [1] | [4] | LT2<br>LT2-W | 750 mm<br>750 mm |
| | [5] | LT22<br>LT22-W | 750 mm<br>750 mm |
| **Billing metering panel** | Standard | ME1<br>ME1-S | 750 mm<br>750 mm |
| | as end panel | ME1-K<br>ME1-KS | 750 mm<br>750 mm |
| **Billing metering panel** for additional current transformer | | ME1-H | 750 mm |
| **Busbar voltage metering panel** [1] | | ME3<br>ME31-F | 375 mm<br>500 mm |
| **Busbar earthing panel** [1] | | SE1 | 375 mm |
| | [6] | SE2 | 500 mm |
| **Bus riser panel** | | HF | 375 mm |

1) Metal-clad
2) With additional make-proof earthing switch
3) Type designation of vacuum circuit-breaker
4) With 1 three-position switch-disconnector
5) With 2 three-position switch-disconnectors
6) With voltage transformer for busbar metering

## Equipment features

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

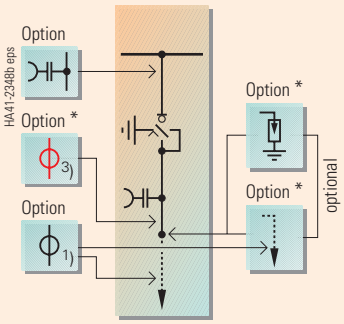
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | Panel type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Manual operating mechanism for three-position switch | Interlock for cable compartment cover | Cable compartment cover locked in place | C-rail as cable bracket | Low-voltage niche as terminal compartment | Release as shunt release | Mechanical ready-for-service indicator for three-position switch | Signalling switch (1NO) for remote electrical ready-for-service indication for three-position switch | Aux. switch (2NO + 1NC for "CLOSED/EARTHED" and 2NO for "OPEN") for three-position switch and make-proof earthing switch | Motor operating mechanism for three-position switch [1) 2)] | Local remote switch for motor operat. mech. of three-position switch [1) 2)] | Interlock in circuit-breaker panel between three-position switch [1) 2)] and 3AH... vacuum circuit-breaker | Locking device for switch position "CLOSED" of 3AH6 vacuum circuit-breaker with earthed three-position switch | De-earthing lock-out for make-proof earthing switch | Inspection window in the connection/cable compartment cover | Low-voltage compartment or shutter | Closing lock-out for three-position switch | Motor operating mechanism for vacuum circuit-breaker | Release as c.t.-operated release in 3AH [3)] | Locking device for three-position switch | Short-circuit or earth-fault indicator | – Secondary equipment | – Floor cover [4)] | – Panel heating | Mounted cable clamps | |
| • | • | – | • | • | – | o | o | o | o | o | – | – | – | o | o | o | – | – | o | o | o o o | o | RK<br>RK1 |
| • | • | – | – | • | – | o | o | o | o | o | – | – | – | – | o | o | – | – | • | – | o o o | – | RK-U |
| • | • | – | • | • | o | o | o | o | o | o | – | – | o | • | o | – | – | – | o | – | o o o | o | TR<br>TR1 |
| • | – | • | • | • | – | – | – | – | – | – | – | – | – | o | o | – | – | – | – | o | o o o | o | K<br>K1 |
| – | • | – | • | • | – | o | o | o | o | o | – | – | – | o | o | – | – | – | • | o | o o o | o | K-E<br>K1-E |
| • | • | – | • | • | – | o | o | o | o | o | o | – | – | o | o | o | o | o | o | o | o o o | o | LS1 |
| • | • | – | – | • | o | o | o | o | o | o | o | – | – | – | o | o | o | o | • | – | o o o | – | LS1-U |
| • | • | – | • | • | o | o | o | o | o | o | o | o [5)] | – | o [6)] | o | o | o | o | o | o | o o o | o | LS11 |
| • | • | – | – | • | o | o | o | o | o | o | o | o | – | – | o | o | o | o | • | – | o o o | – | LS11-U |
| • | • | – | • | • | o | o | o | o | o | o | • | • [5)] | – | o [6)] | o | o | o | o | o | o | o o o | o | LS31<br>LS32 |
| • | • | – | – | • | o | o | o | o | o | o | • | • | – | – | o | o | o | o | o | – | o o o | – | LS31-U |
| • | • | – | – | • | o | o | o | o | o | o | o | o | – | – | o | –[7)] | o | o | • | – | o o o | – | LT10 |
| • | • | – | – | • | o | o | o | o | o | o | o | • | – | – | o | –[7)] | o | o | • | – | o o o | – | LT11 |
| • | • | – | – | • | o | o | o | o | o | o | • | • | – | – | o | –[7)] | o | o | o | – | o o o | – | LT31 |
| • | • | • | – | • | – | o | o | o | o | o | – | – | – | – | o | o | – | – | • | – | o o o | – | LT2<br>LT2-W |
| • | • | – | – | • | – | o | o | o | o | o | – | – | – | – | o | o | – | – | • | – | o o o | – | LT22<br>LT22-W |
| – | – | • | – | • | – | – | – | – | – | – | – | – | – | o | o | – | – | – | – | – | o o o | – | ME1<br>ME1-S |
| – | – | • | • | • | – | – | – | – | – | – | – | – | – | o | o | – | – | – | – | – | o o o | o | ME1-K<br>ME1-KS |
| – | – | • | – | • | – | – | – | – | – | – | – | – | – | o | o | – | – | – | – | – | o o o | – | ME1-H |
| • | • | – | – | • | – | o | o | o | o | o | – | – | o | – o | o | – | – | – | o | – | o o o | – | ME3<br>ME31-F |
| • | • | – | – | • | – | o | o | o | – | – | – | – | – | – | o | – | – | – | • | – | o o o | – | SE1 |
| • | • | – | – | • | – | o | o | o | – | – | – | – | o | – | o | – | – | – | • | – | o o o | – | SE2 |
| – | – | • | – | • | – | – | – | – | – | – | – | – | – | – | o | – | – | – | – | – | o o o | – | HF |

1) Three-position switch as three-position switch-disconnector
2) Three-position switch as three-position disconnector in panel types LS31, LS31-U, LS32 and LT31
3) Type designation of the vacuum circuit-breaker
4) In special cases, deeper floor cover required
5) Not to be applied for versions with separate feeder earthing switch in panel types LS11, LS31 and LS32
6) Inspection window is a standard equipment in panel types LS11, LS31 and LS32 for versions with separate earthing switch
7) Option (on request): Closing lock-out possible for panels LT11 or LT31 in combination with the adjacent panel type HF

# Product Range

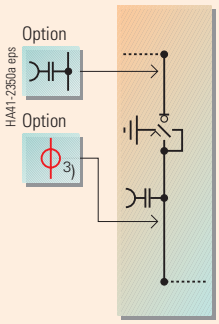
## Ring-main panels

### Ring-main panels
as feeder panels




**Type RK**
375 mm wide

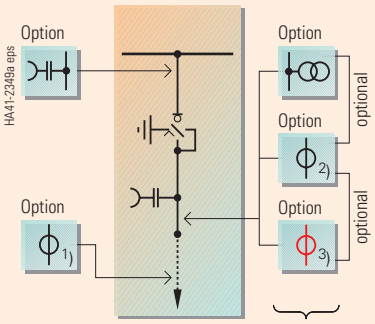
### Ring-main panel
as transfer panel for attachment to panel types ME1... or ME1-H




Standard:
transfer to the right

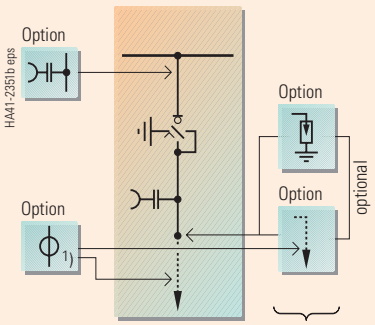
Option:
transfer to the left

**Type RK-U**
375 mm wide




**Type RK1**
500 mm wide

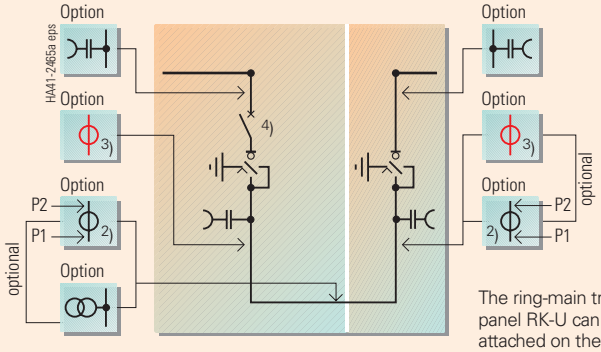
either:
Version with transformers




**Type RK1**
500 mm wide

or:
Version with connection fittings

For other panel combinations



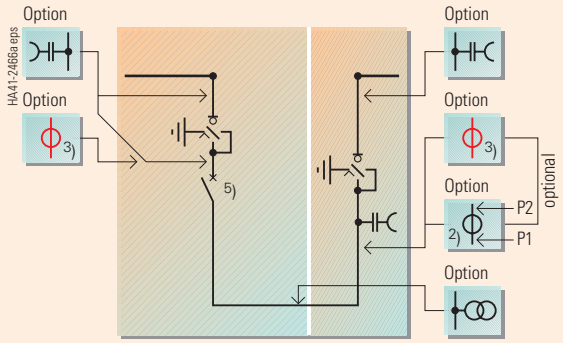

With 3AH5 vacuum circuit-breaker, fixed-mounted

**Type LT10**
750 mm wide

**Type RK-U**
375 mm wide

Bus sectionalizer panel type LT10 with ring-main transfer panel type RK-U

The ring-main transfer panel RK-U can be attached on the left or right of the bus sectionalizer panel LT10




With 3AH6 vacuum circuit-breaker, withdrawable

**Type LT11**
750 mm wide

**Type RK-U**
375 mm wide

Bus sectionalizer panel type LT11 with ring-main transfer panel type RK-U (non-interchangeable arrangement)

3AH5 vacuum circuit-breaker

3AH6 vacuum circuit-breaker

Three-position switch-disconnector

Capacitive voltage detection system

Cable-type current transformer e.g. 4MC703 . . .

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

Three-phase current transformer 4MC63 . . .

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

Cable (not included in the scope of supply)

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

Surge arrester

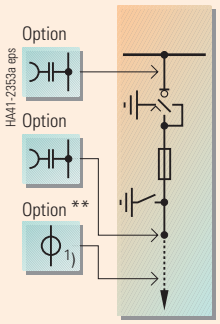
HA41-2390b eps

P1 and P2 are terminal designations of the current transformer

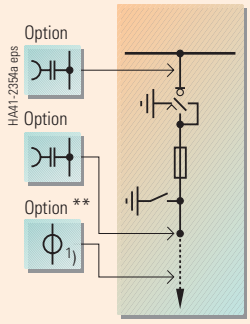
* On request up to 12 kV

## Transformer and cable panels

### Transformer panels
as feeder panels

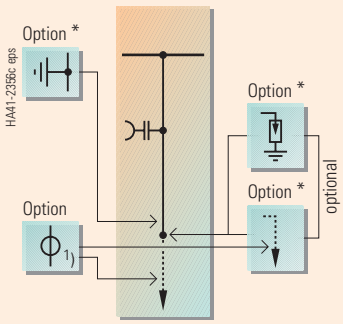



**Type TR**
375 mm wide



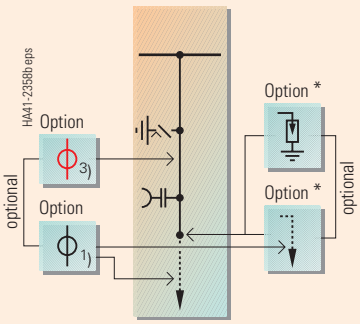

**Type TR1**
500 mm wide

### Cable panels
as feeder panels, 630 A



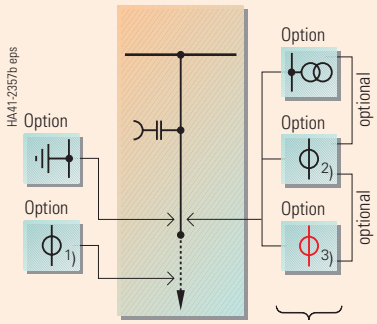

**Type K**
375 mm wide

### Cable panels
as feeder panels with make-proof earthing switch



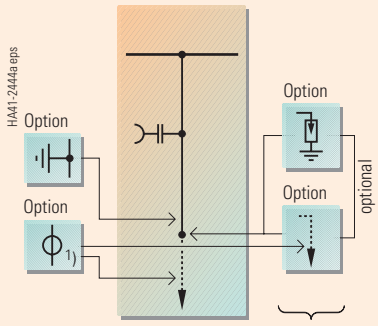

**Type K-E**
375 mm wide

as feeder panels
630 A and 1250 A



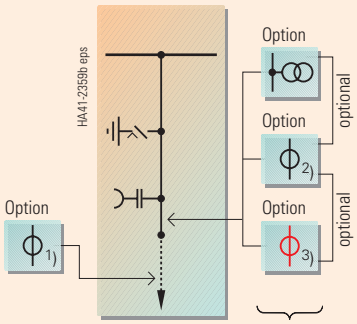

**Type K1**
500 mm wide

either:
Version with transformers



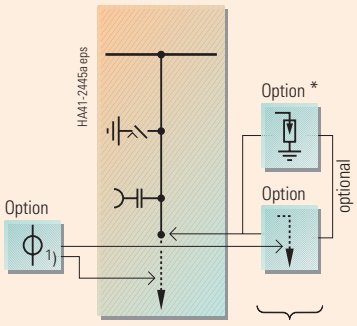

**Type K1**
500 mm wide

or:
Version with connection fittings



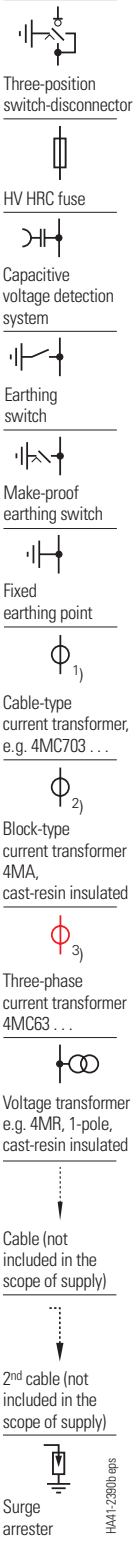

**Type K1-E**
500 mm wide

either:
Version with transformers




**Type K1-E**
500 mm wide

or:
Version with connection fittings



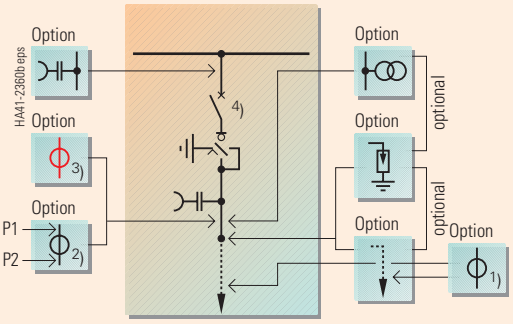

* On request up to 12 kV

** Current transformer located partly underneath the panel

# Product Range

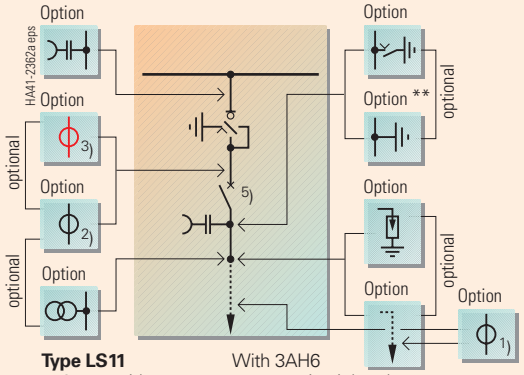
## Circuit-breaker panels

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




**Type LS1**
750 mm wide

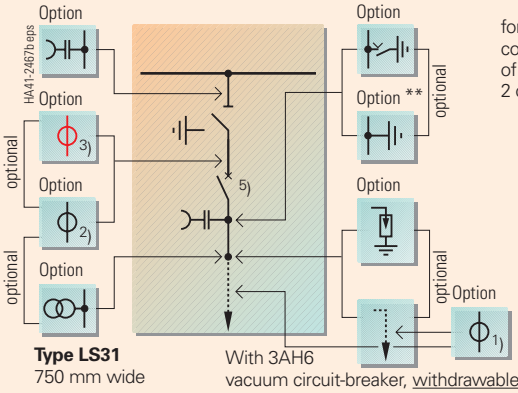
With 3AH5 vacuum circuit-breaker, fixed-mounted




**Type LS11**
750 mm wide

With 3AH6 vacuum circuit-breaker, withdrawable

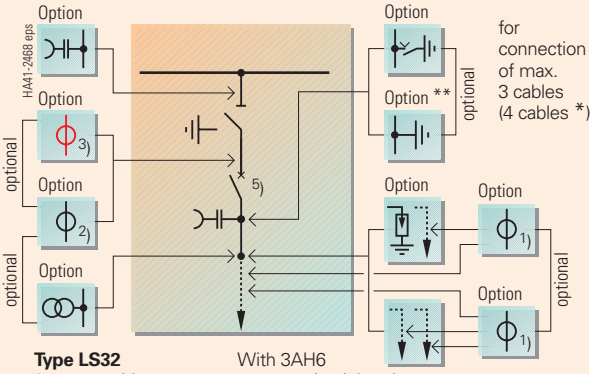
### Circuit-breaker panels 1250 A
as feeder panels




for connection of max. 2 cables

**Type LS31**
750 mm wide

With 3AH6 vacuum circuit-breaker, withdrawable

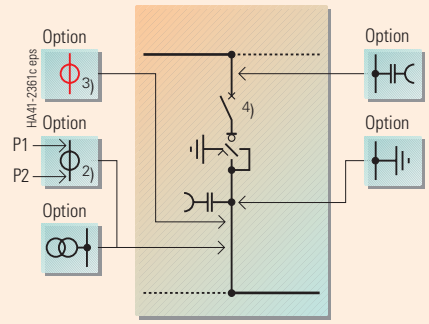



for connection of max. 3 cables (4 cables *)

**Type LS32**
875 mm wide

With 3AH6 vacuum circuit-breaker, withdrawable

as transfer panels for attachment to panel types ME1... or ME1-H

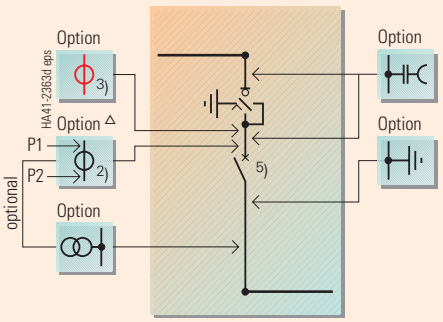



Standard: transfer to the right

Option: transfer to the left

**Type LS1-U**
750 mm wide

With 3AH5 vacuum circuit-breaker, fixed-mounted

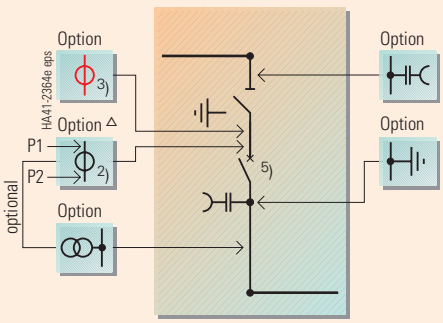



Transfer possible only to the right

**Type LS11-U**
750 mm wide

With 3AH6 vacuum circuit-breaker, withdrawable

as transfer panel for attachment to panel types ME1... or ME1-H




Transfer possible only to the right

**Type LS31-U**
750 mm wide

With 3AH6 vacuum circuit-breaker, withdrawable

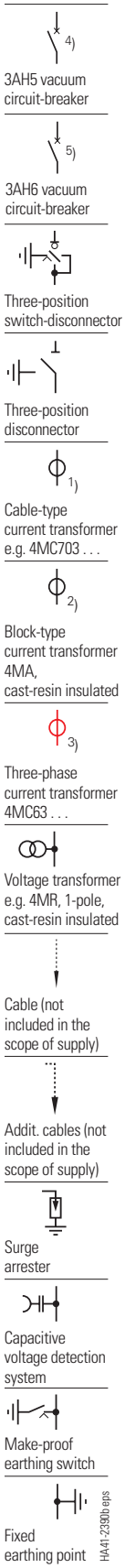
Footnotes for the left and right columns:

* On request

** Standard: Feeder earthing via the 3AH6 vacuum circuit-breaker with interlocks (without earthing switch)

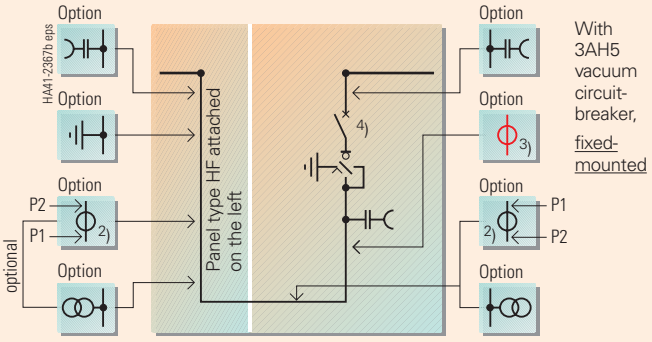
△ Mounting position of the current transformer with terminal P1 at the top only

P1 and P2 are terminal designations of the current transformer

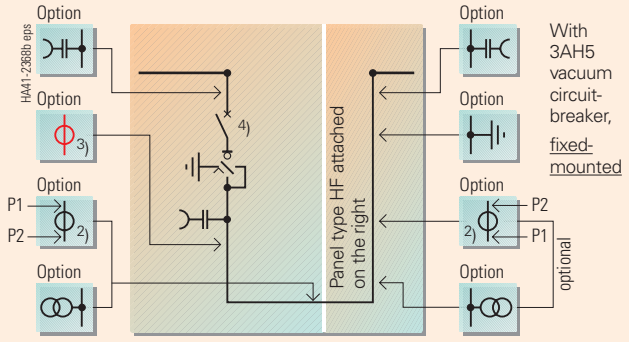


## Bus sectionalizer panels

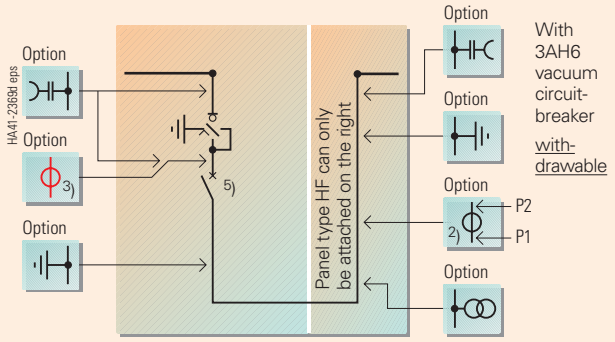
### Bus sectionalizer panels 630 A
in combination with bus riser panel




**Type HF** 375 mm **Type LT10** 750 mm wide

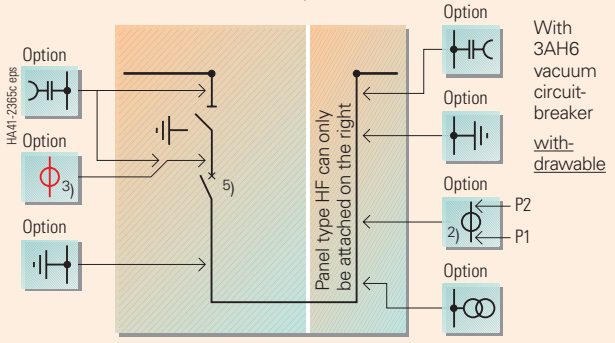



**Type LT10** 750 mm wide **Type HF** 375 mm wide



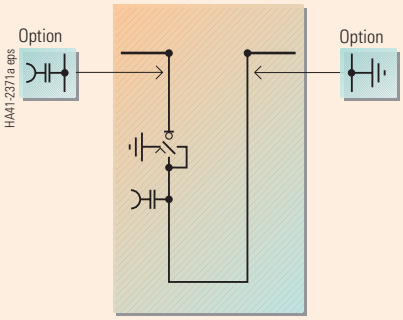

**Type LT11** 750 mm wide **Type HF** 375 mm wide

### Bus sectionalizer panel 1250 A
in combination with bus riser panel

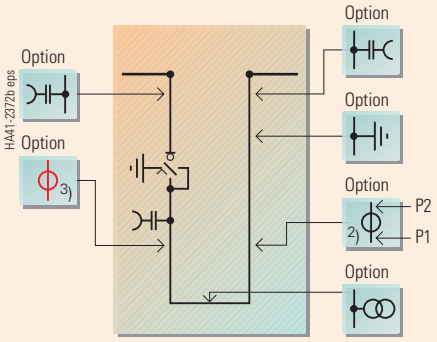



**Type LT31** 750 mm wide **Type HF** 375 mm wide

### Bus sectionalizer panels 630 A
with 1 three-position switch-disconnector

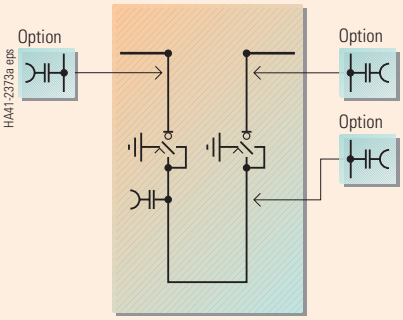



**Type LT2** 750 mm wide corresponds to type RK-U with type HF

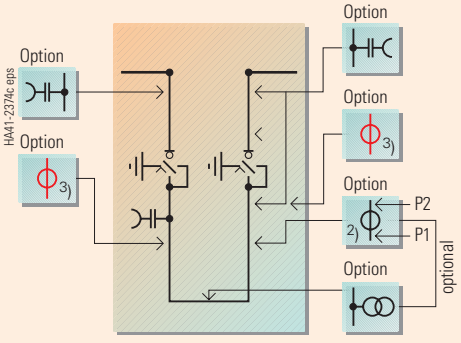



**Type LT2-W** 750 mm wide corresponds to type RK-U with type HF

with 2 three-position switch-disconnectors




**Type LT22** 750 mm wide corresponds to type RK-U with type RK-U




**Type LT22-W** 750 mm wide corresponds to type RK-U with type RK-U


3AH5 vacuum circuit-breaker


3AH6 vacuum circuit-breaker

Three-position switch-disconnector

Three-position disconnector


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




Three-phase current transformer 4MC63 . . .

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

Capacitive voltage detection system



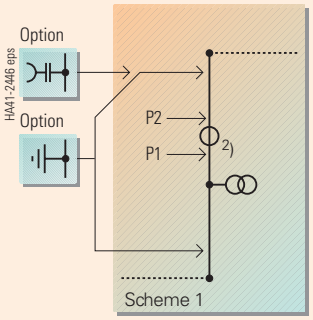
Fixed earthing point HA41-2390b eps

P1 and P2 are terminal designations of the current transformer

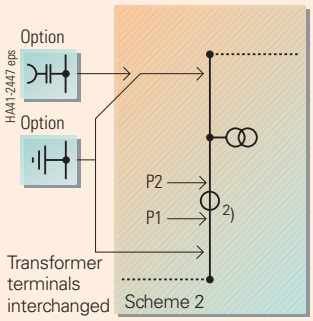
# Product Range

## Billing metering panels

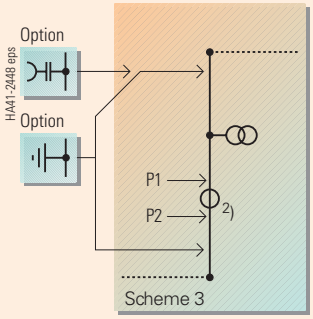
### Billing metering panels 630 A and 1250 A
Standard



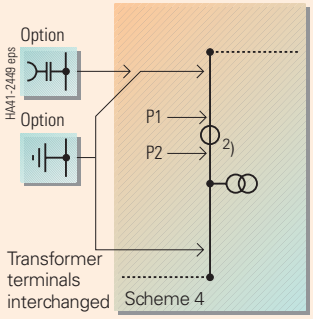

**Type ME1** 750 mm wide — Standard **: Transfer to the right




**Type ME1** 750 mm wide — Standard **: Transfer to the right

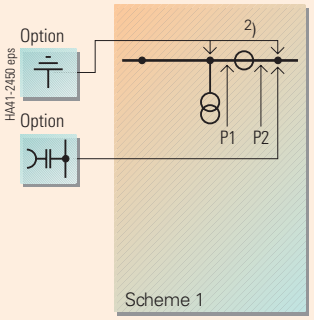



**Type ME1** 750 mm wide — Standard **: Transfer to the right

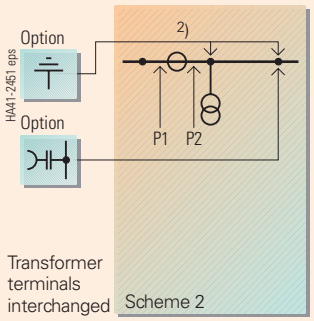



**Type ME1** 750 mm wide — Standard **: Transfer to the right

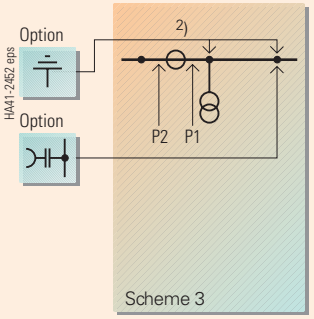
### Billing metering panels 630 A and 1250 A
for busbar connection



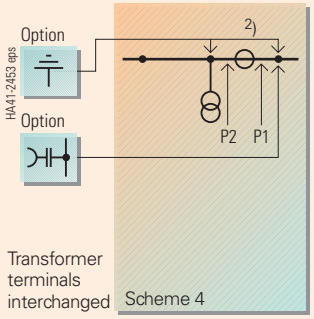

**Type ME1-S** 750 mm wide — Standard **: Transfer to the right




**Type ME1-S** 750 mm wide — Standard **: Transfer to the right

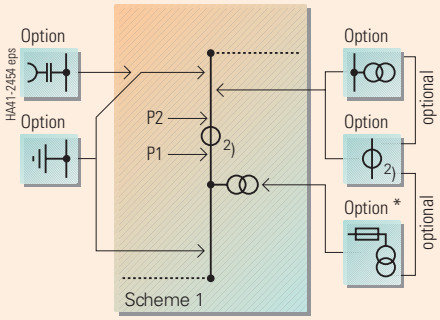



**Type ME1-S** 750 mm wide — Standard **: Transfer to the right

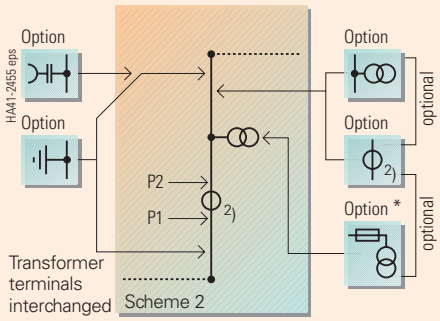



**Type ME1-S** 750 mm wide — Standard **: Transfer to the right

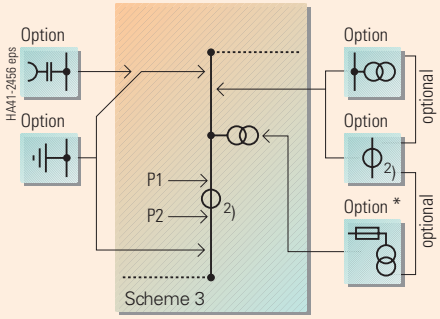
### Billing metering panels 630 A and 1250 A
for additional current transformer



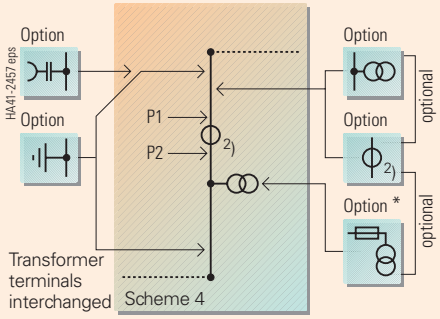

**Type ME1-H** 750 mm wide — Standard **: Transfer to the right




**Type ME1-H** 750 mm wide — Standard **: Transfer to the right




**Type ME1-H** 750 mm wide — Standard **: Transfer to the right




**Type ME1-H** 750 mm wide — Standard **: Transfer to the right

Capacitive voltage detection system

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

On request: Voltage transformer, e.g. 4MR, cast-resin insulated with HV HRC fuse

Voltage transformer, e.g. 4MR, 1- or 2-pole, cast-resin insulated

Fixed earthing point

Fixed earthing point for busbar earthing

HA41-2390b eps

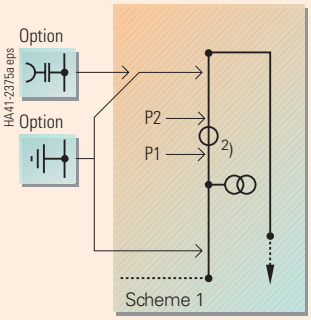
P1 and P2 are terminal designations of the current transformer

* On request

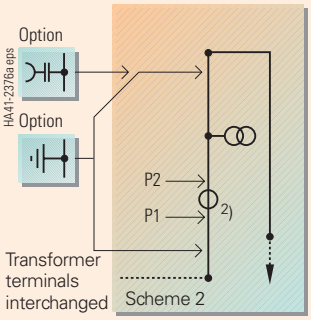
** Option: Transfer to the left

# Billing metering panels, busbar voltage metering panels, busbar earthing panels and bus riser panels

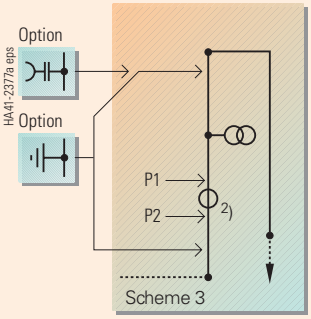
## Billing metering panels 630 A and 1250 A **
for cable connection



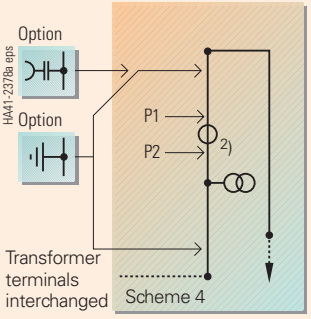

**Type ME1-K** Standard △):
750 mm wide Transfer to the right




**Type ME1-K** Standard △):
750 mm wide Transfer to the right

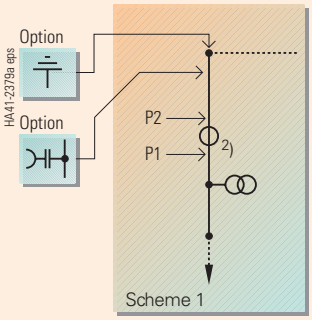



**Type ME1-K** Standard △):
750 mm wide Transfer to the right

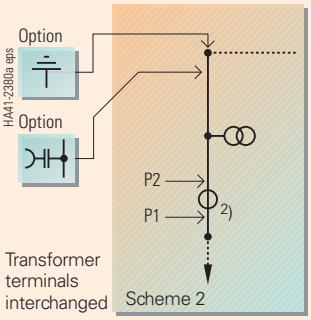



**Type ME1-K** Standard △):
750 mm wide Transfer to the right

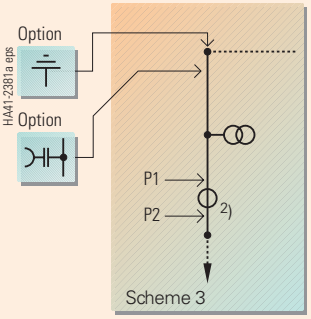
## Billing metering panels 630 A and 1250 A **
for busbar connection



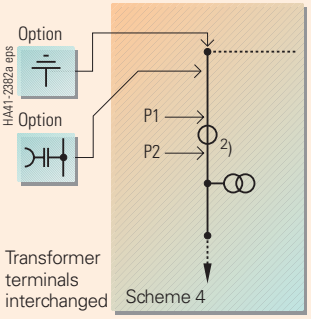

**Type ME1-KS** as right or left
750 mm wide end panel




**Type ME1-KS** as right or left
750 mm wide end panel

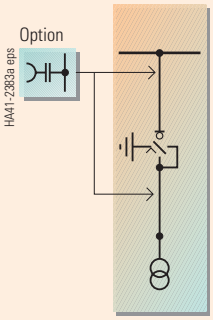



**Type ME1-KS** as right or left
750 mm wide end panel

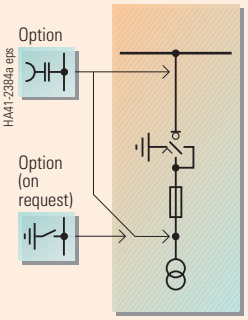



**Type ME1-KS** as right or left
750 mm wide end panel

## Busbar voltage metering panels

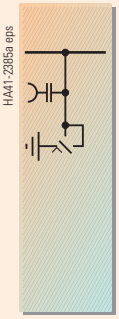



**Type ME3**
375 mm wide

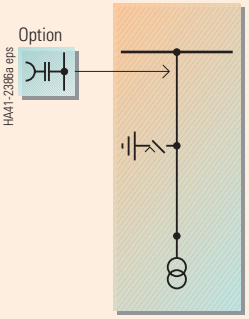



**Type ME31-F**
500 mm wide

## Busbar earthing panels

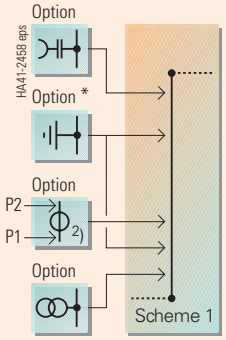



**Type SE1**
375 mm wide

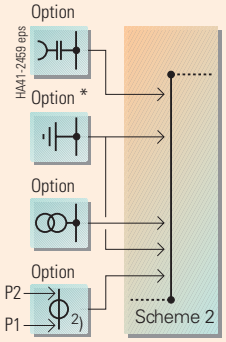



**Type SE2**
500 mm wide

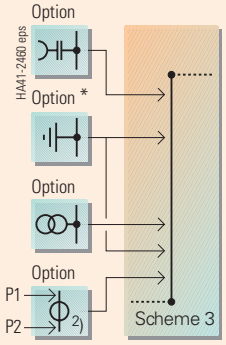
## Bus riser panels 630 A and 1250 A



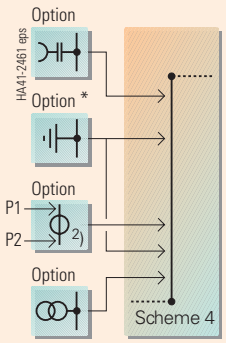

**Type HF** △△)
375 mm wide



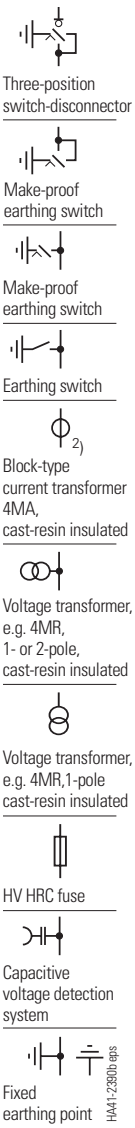

**Type HF** △△)
375 mm wide




**Type HF** △△)
375 mm wide




**Type HF** △△)
375 mm wide




P1 and P2 are terminal designations of the current transformer

* On request up to 12 kV

** Connection for 3 cables possible

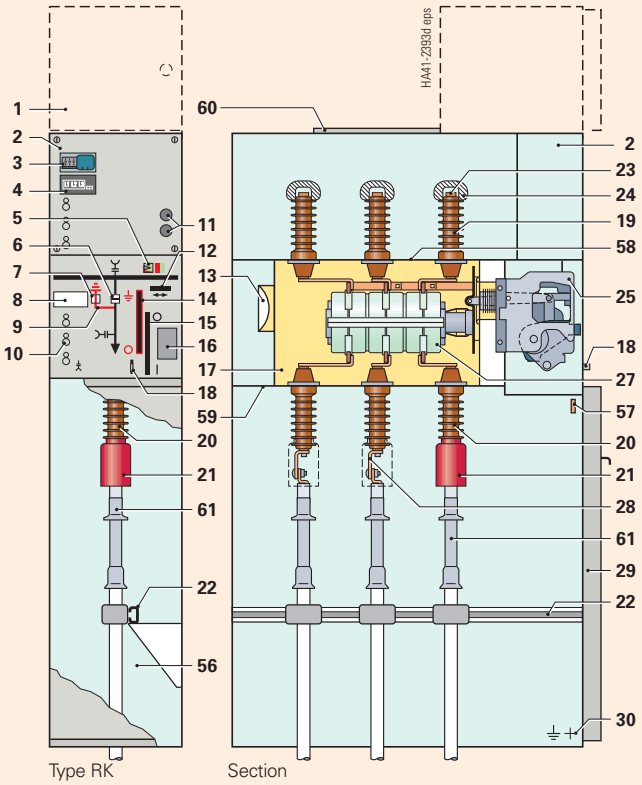
△ Option: Transfer to the left

△△ For attachment to left or right ring-main panels type RK-U

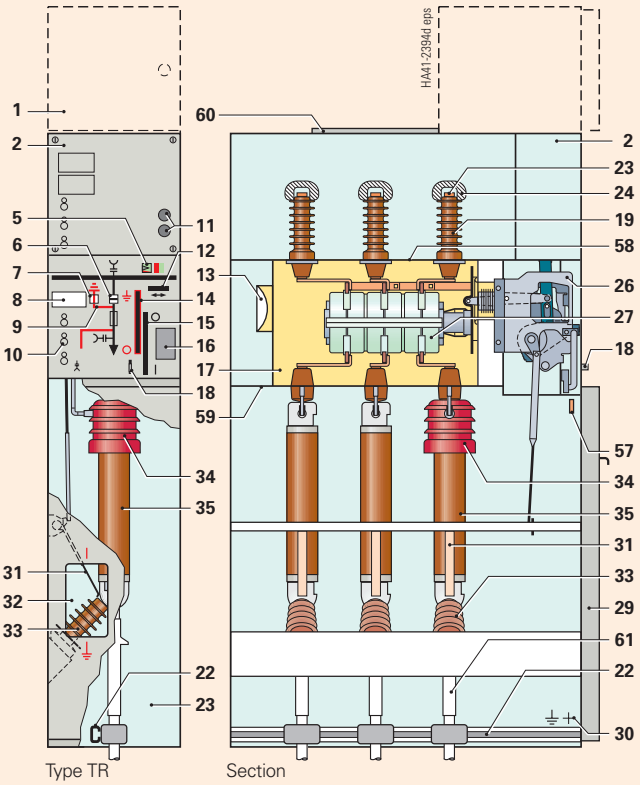
# Design

## **Panel design** (examples)

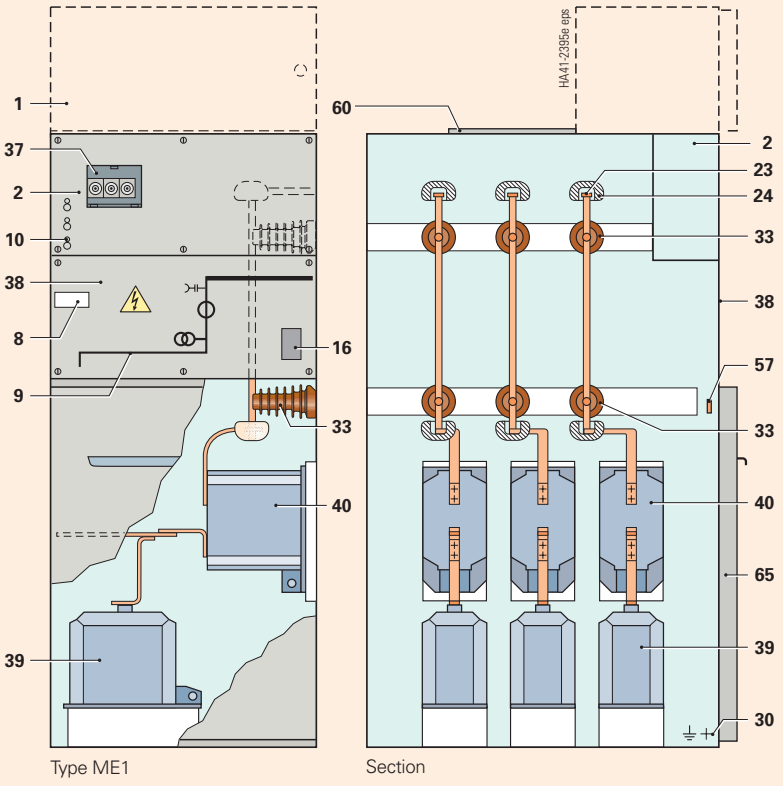
### Ring-main panel as feeder




### Transformer panel as feeder




### Billing metering panel

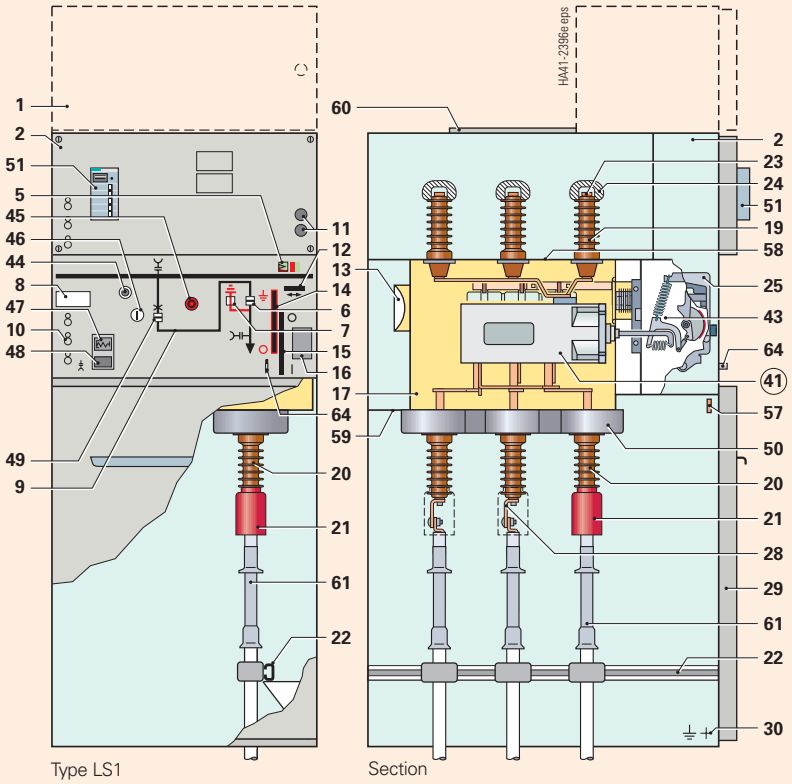



**Legend for pages 14 and 15**

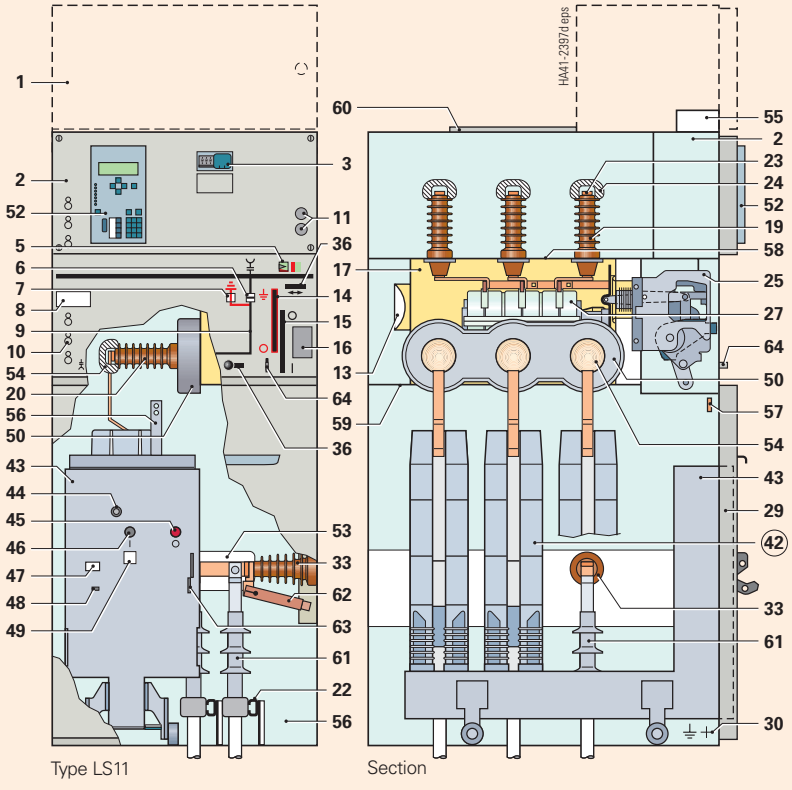
**1** Option: Low-voltage compartment
**2** Niche for optional low-voltage equipment, cover can be unscrewed
**3** Option: CAPDIS voltage detection system
**4** Option: Short-circuit/earth-fault indicator
**5** Option: Ready-for-service indicator for switching device
**6** Switch position indication for load-break function "CLOSED – OPEN"
**7** Switch position indication for earthing function "OPEN – EARTHED"
**8** Feeder designation label
**9** Mimic diagram
**10** Option: Sockets for capacitive voltage detection system (depending on arrangement)
**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 function
**16** Rating and type plate
**17** Gas-insulated vessel for switching device
**18** Interlocking of the cable compartment cover
**19** Bushing-type insulator for busbar
**20** Bushing-type insulator for feeder

## **Panel design** (examples)

### **Circuit-breaker panel** (with 3AH5 vacuum circuit-breaker)




### **Circuit-breaker panel** (with 3AH6 vacuum circuit-breaker)




**21** Insulating sleeve *
**22** Cable bracket with clamps (option) for fastening cables
**23** Busbar
**24** Insulating cap ** on busbar
**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** Insulating sleeve
**35** Option: HV HRC fuse link
**36** Option only for panel types LS11 ... and LT11 ...: Logical mechanical interlocking between circuit-breaker "OPEN" and three-position switch-disconnector and locking device for three-position switch-disconnector
**37** Option: Part of the low-voltage equipment
**38** Cover, screwed on
**39** 4MR voltage transformer
**40** 4MA7 block-type current transformer

Vacuum circuit-breaker:

(41) 3AH5 vacuum circuit-breaker, fixed-mounted
(42) 3AH6 vacuum circuit-breaker, withdrawable

**43** Operating mechanism box
**44** Manual operation
– for closing with manual operating mechanism
– for emergency operation with motor operating mechanism
**45** Mechanical "OFF" pushbutton
**46** Mechanical "ON" pushbutton (not supplied with spring-operated mechanism)
**47** "Spring charged" indicator
**48** Operating cycle counter
**49** Switch position indication

**50** Option: Three-phase current transformer 4MC63 53
**51** Option: Overcurrent-time protection relay SIPROTEC easy 7SJ45
**52** Option: Multifunction protection relay SIPROTEC 4 7SJ62
**53** Insulating cap * for cable connection
**54** Insulating cap * on bushing-type insulator
**55** Option: Wiring duct, removable, for control cables and/or bus wires
**56** Logical mechanical interlocking for three-position switch
**57** Earthing busbar
**58** Metal compartmentalization of busbar compartment
**59** Metal compartmentalization of cable connection compartment
**60** Busbar compartment cover for panel extension
**61** Cable sealing end (not included in scope of supply)
**62** Option: Feeder earthing via make-proof earthing switch
**63** or feeder earthing via vacuum circuit-breaker (= locking device for feeder earthed when circuit-breaker "CLOSED")
**64** Interlocking of cable compartment cover in circuit-breaker panels
**65** Cover for transformer connection compartment

* For example for $U_r$ = 24 kV
** For example for $U_r$ > 12 kV

# Components

## 3AH5 and 3AH6 vacuum circuit-breakers

### Common features

- Circuit-breakers with vacuum interrupters
- Stored-energy spring-operated mechanism for 10,000 operating cycles
- Maintenance-free for indoor installation according to IEC 60 694 / VDE 0670 Part 1000, subsequently IEC 62 271-1*
- Individual secondary equipment

### Switching duties and operating mechanisms

The switching duties of the vacuum circuit-breaker are dependent, among other factors, on its type of operating mechanism. Three operating mechanism versions are available:

- Motor operating stored-energy mechanism
  – For auto-reclosure (K),
  – For synchronization and rapid load transfer (U)
- Manual operating stored-energy mechanism
  – For auto-reclosure (K)
- Manual spring-operated mechanism (= spring CLOSED, stored-energy OPEN)
  – Not for auto-reclosure (K)
  – For normal closing and
  – For storage of one opening

### Trip-free mechanism

- The vacuum circuit-breakers are fitted with a trip-free mechanism according to IEC 60 056 and VDE 0670.

* Standards see page 41

1) Withdrawable after loosening the respective contact connections and fixing bolts

*Abbreviations for switching duties and applications:*

U = Synchronization and rapid load transfer (make time ≤ 90 ms)

K = Auto-reclosure

For further details, please refer also to Catalog HG 11.11 "3AH Vacuum Circuit-Breakers"

### 3AH5 vacuum circuit-breaker

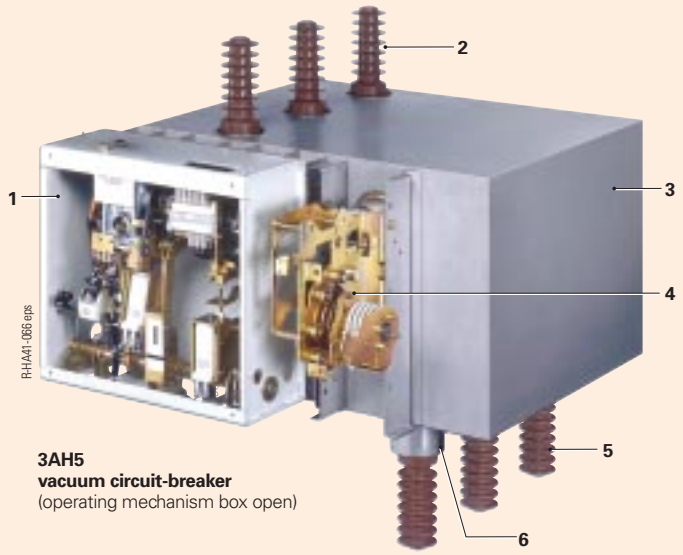
- Metal-enclosed
- Up to 630 A
- Pole parts with vacuum interrupters fixed-mounted in hermetically welded, gas-filled switchgear vessel
- System-conforming use with three-position switch in gas-insulated switchgear vessel
- Operating mechanism arranged outside the switchgear vessel and behind the control board
- Air-insulated primary terminals

Installation in metal-clad panels

- Feeder panels type LS1, panel width 750 mm
- Transfer panels type LS1-U, panel width 750 mm
- Bus sectionalizer panels type LT10 (for adjacent bus riser panel type HF), panel width 750 mm

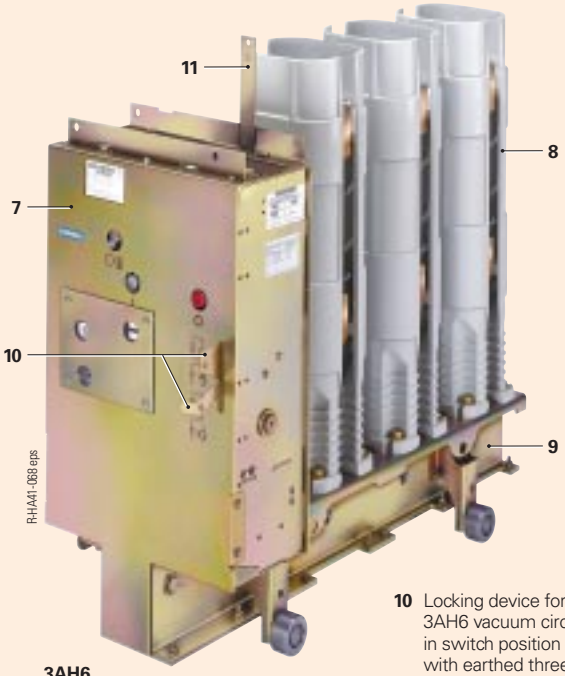
### 3AH6 vacuum circuit-breaker

- Withdrawable [1]) lateral-mechanism circuit-breaker, air-insulated
- Up to 1250 A
- Circuit-breaker poles arranged one behind the other
- Operating mechanism in separate box behind lower panel cover
- Logical mechanical interlocking between 3AH6 vacuum circuit-breaker and three-position switch
- Installation in:
  – Feeder panel type LS11, panel width 750 mm
  – Transfer panel type LS11-U, panel width 750 mm
  – Bus sectionalizer panels type LT11 and LT31 (for adjacent bus riser panel type HF), panel width 750 mm
  – Feeder panel type LS31 (for connection of max. 2 cables), panel width 750 mm
  – Feeder panel type LS32 (for connection of 3 cables; 4 cables on request), panel width 875 mm




**3AH5**
**vacuum circuit-breaker**
(operating mechanism box open)

**1** Operating mechanism box
**2** Bushing-type insulator for busbar
**3** Switchgear vessel, gas-filled, with 3AH5 vacuum circuit-breaker and three-position switch-disconnector
**4** Spring-operated mechanism of three-position switch-disconnector
**5** Bushing-type insulator for feeder
**6** Location for three-phase current transformer (option)




**3AH6**
**vacuum circuit-breaker**

**7** Operating mechanism box with control elements
**8** Circuit-breaker poles with vacuum interrupters
**9** Truck
**10** Locking device for the 3AH6 vacuum circuit-breaker in switch position "CLOSED" with earthed three-position switch in switch position "EARTHED"
**11** Logical mechanical interlocking (standard when earthing the feeder with closed vacuum circuit-breaker) in panel types:
– 630 A: LS11, LS11-U and LT11
– 1250 A: LS31, LS31-U, LS32 and LT31

## 3AH5 and 3AH6 vacuum circuit-breakers

### Operating mechanism functions

Motor operating mechanism [1] (M1 *)

In the case of the motor operating mechanism, the closing spring is charged by means of a motor and latched in the charged position (the "spring charged" indication is visible). Closing is effected either by means of an ON pushbutton or a closing solenoid. The closing spring is recharged automatically (for auto-reclosure).

Manual operating stored-energy mechanism

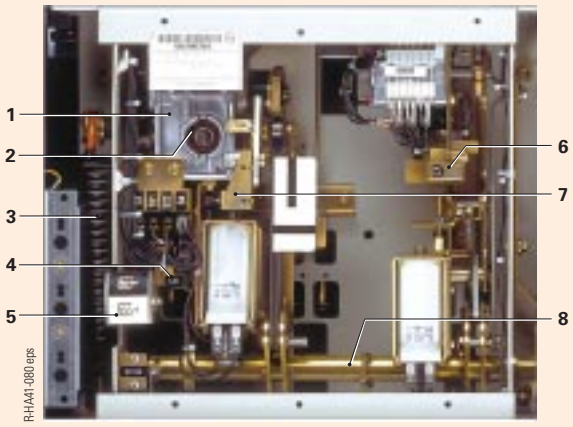
The closing spring is charged by means of the supplied hand crank until latching of the closing latch is indicated (= "spring charged" indication).

Subsequently the vacuum circuit-breaker can be closed either manually or electrically. The closing spring can be recharged manually. The "possibility to close" is thus stored once more (for auto-reclosure).

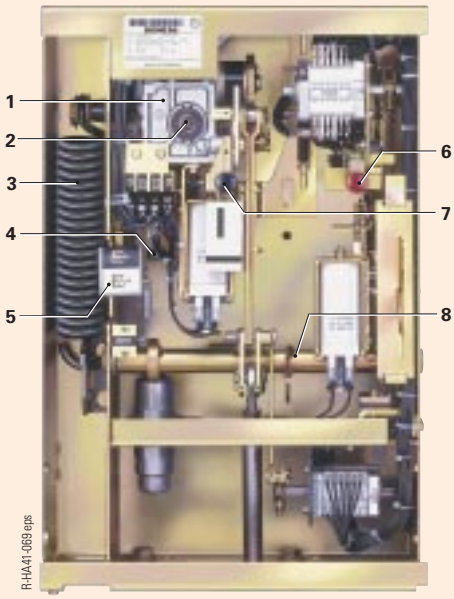
Manual spring-operated mechanism
(= spring CLOSED, stored-energy OPEN)

The closing spring of the vacuum circuit-breaker is charged by means of the supplied hand crank until the vacuum circuit-breaker closes. Subsequently either manual or electrical opening is possible.

Vacuum circuit-breakers with spring-operated mechanism are not suitable for auto-reclosure.




**Operating mechanism elements of the 3AH5 vacuum circuit-breaker**




**Operating mechanism elements of the 3AH6 vacuum circuit-breaker**

**Operating mechanism elements**

**1** Gear
**2** Coupling on gear for operation with hand crank
– For closing with manual spring-operated mechanism
– For charging the closing spring with stored-energy mechanism
**3** Closing spring
**4** Motor (M1 *)
**5** "Closing spring charged" indicator
**6** Circuit-breaker "OPEN"
**7** Circuit-breaker "CLOSED"
**8** Operating rod

**Differences between the vacuum circuit-breakers depending on the operating mechanism version**

| Operating mechanism version | Motor operating stored-energy mechanism | Manual operating stored-energy mechanism | Manual spring-operated mechanism |
|---|---|---|---|
| Typical uses | Utility substations and industrial plants | Classic transfer substations and substations without auxiliary voltage supply | Simple utility substations (circuit-breaker as transformer switch) |
| Mechanism function | Stored-energy CLOSED, stored-energy OPEN | Stored-energy CLOSED, stored-energy OPEN | Spring CLOSED, stored-energy OPEN |
| Mechanism operation | With motor [1], manual (emergency) operation at the panel including anti-pumping | With hand crank | With hand crank |
| Closing the vacuum circuit-breaker | Electrically [2] or mechanically at the panel with pushbutton | Mechanically at the panel with pushbutton, option: electrically [2] | Mechanically at the panel with hand crank (charging process) |
| Closing solenoid, e.g. for remote electrical closing | Always provided, with electrical signal "closing spring charged" | Option | Without |
| Rated switching sequence | O-*t*-CO or O-*t*-CO-*t'*-CO | O-*t*-CO | O or CO |
| Auto-reclosure (K) | Suitable (multiple auto-reclosure possible) | Suitable (only with closing solenoid) | – |

1) Motor rating at
24 V to 220 V DC: 350 W
110 V and 220 V AC: 400 VA

2) With closing solenoid

* Equipment code

*Abbreviations:*

O = OPEN operation

CO = CLOSE operation with subsequent OPEN operation at the shortest internal close-open time of the vacuum circuit-breaker

*t* = Dead time 0.3 s

*t'* = Dead time 3 min

For further details, please refer also to Catalog HG 11.11 "3AH Vacuum Circuit-Breakers"

# Components

## Secondary equipment of the 3AH5 and 3AH6 vacuum circuit-breakers

The scope of the secondary equipment of the 3AH vacuum circuit-breaker depends on the type of application and offers a wide range of variations, thus allowing even the highest requirements to be satisfied.

### Closening solenoid

- Type 3AY15 10 (Y9 *)
- For electrical closing

### Shunt releases

- Types:
– Standard: 3AY15 10 (Y1 *)
– Option: 3AX11 01 (Y2 *), with energy store
- Tripping by protection relay or electrical operation

### Current transformer-operated release

- Type 3AX11 04 (Y6 *) for tripping pulse ≥ 0.1 Ws in conjunction with suitable protection systems, e.g. 7SJ4 protection relay, SEG relay (other designs on request)
- Used where no external auxiliary voltage is available, tripping by protection relay

### Undervoltage release

- Type 3AX11 03 (Y7 *)
- Comprising:
– Energy store and unlatching mechanism
– Electromagnetic system, to which voltage is permanently applied in the CLOSED position of the vacuum circuit-breaker; tripping is initiated when this voltage drops
- Connection to voltage transformer possible

### Position switch

- Type 3SE4 (S4 *)
- For signalling "closing spring charged"
- Only in conjunction with stored-energy mechanisms

### Anti-pumping (standard) (mechanical and electrical)

- Function: If CLOSE and OPEN commands are applied simultaneously and continuously to the vacuum circuit-breaker, this reverts to its OPEN position after closing. The circuit-breaker remains in this position until the OPEN command is eliminated and a new CLOSE command is given. Thus continuous closing and opening (= pumping) is avoided.

### Breaker tripping signal (standard)

- For electrical signalling (as pulse > 10 ms), e.g. to remote control systems, in the case of automatic tripping (e.g. protection)
- Via NO contact (S6 *) and cut-out switch (S7 *)

### Varistor module

- As overvoltage protection for protection devices in conjunction with inductive devices in the vacuum circuit-breaker (limiting to approx. 500 V)
- Recommended for auxiliary voltages ≥ 60 V DC

### Auxiliary switch

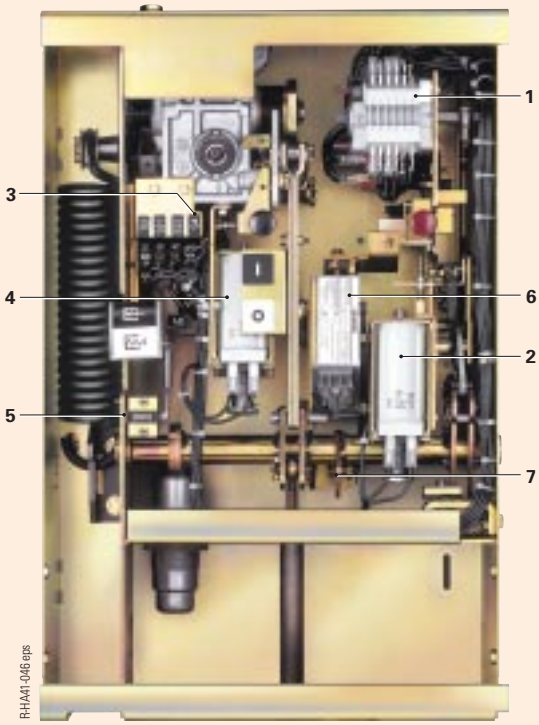
- Type 3SV9 (S1 *)
- Standard: 6NO+6NC, of which 2NO+2NC +2 changeover contacts are free [1])
- Option: 12NO+12NC, of which 7NO+4NC+2 changeover contacts are free [1])

### Mechanical interlocking

- Dependent on the type of operating mechanism:
– Spring-operated mechanism or
– Stored-energy mechanism
- Option: Switchgear interlocking with the three-position switch-disconnector

For further details concerning interlocking functions, refer to page 26.


**Secondary equipment of the 3AH5 vacuum circuit-breaker** (typical example)




**Secondary equipment of the 3AH6 vacuum circuit-breaker** (typical example)

**Basic equipment**

**1** Auxiliary switch 6NO+6NC (S1 *), option: 12NO+12NC
**2** 1st release (Y1 *)

**Additional equipment**

**3** Position switch (S4 *)
**4** Closing solenoid (Y9 *)
**5** Operating cycle counter
**6** 2nd release (e.g. Y2 *, Y6 * and Y7 *)
**7** Mechanical interlocking with interrogation of the three-position switch-disconnector

1) For utilization by the customer

* Equipment code

Abbreviations:
NO = normally-open contact
NC = normally-closed contact

For further details, please refer also to Catalog HG 11.11 "3AH Vacuum Circuit-Breakers"

# Three-position switches as three-position switch-disconnectors or disconnectors

### Common features

- Metal-enclosed
- Located in a gas-insulated switchgear vessel
- Switch positions: CLOSED-OPEN-EARTHED
- No cross insulation between phases
- Three-position switch with air-insulated primary connections for busbar and feeder
- Operation via a gas-tight welded-in bushing in the front of the switchgear vessel

### Mode of operation

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

Compression vanes, which rotate in conjunction with the switch shaft, divide the arcing chamber into two subchambers each of which changes in conjunction with the rotation.

During the switching movement, the compression vanes generate a pressure difference between the subchambers. The $SF_6$ gas flows through a nozzle, causes a directional blow-out of the breaking arc and quenches it rapidly.

Interlocking is not necessary as the "CLOSED" and "EARTHED" functions cannot be implemented simultaneously.

### Three-position switch-disconnector 630 A

- Up to 630 A
- With gas-insulated, maintenance-free quenching principle

Operating mechanism

- Spring-operated mechanism with detachable lever
- Manual operation with the aid of a detachable lever
- Options:
  – Mechanical ready-for-service indication
  – Auxiliary switch
  – Motor operating mechanism for switch-disconnector
  – Locking device
- Spring-operated/stored-energy mechanism for transformer panel types TR, TR1 and ME31-F

Interlocks

- Opening of lower panel cover or cable compartment cover only in "EARTHED" position
- Option: Logical mechanical interlocking of three-position switch-disconnector with vacuum circuit-breaker

### Three-position disconnector 1250 A

- Up to 1250 A, for panel types LS31, LS31-U, LS32 and LT31
- Metal-enclosed

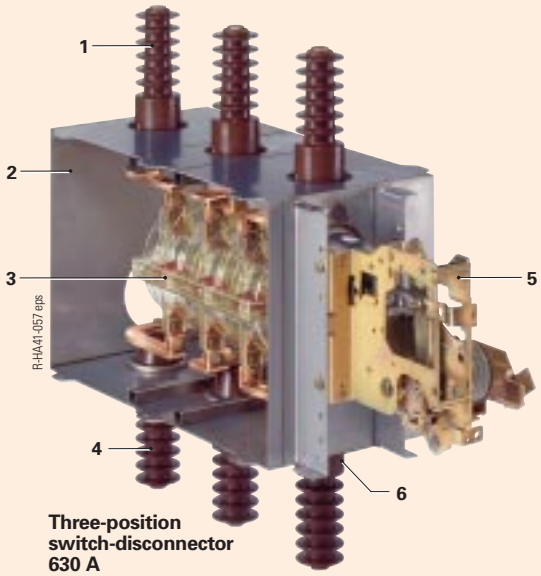
Operating mechanism

- Spring-operated mechanism with detachable lever
- Manual operation with the aid of a detachable lever
- Options:
  – Mechanical ready-for-service indication
  – Auxiliary switch
  – Motor operating mechanism for disconnector
  – Locking device

Interlocks

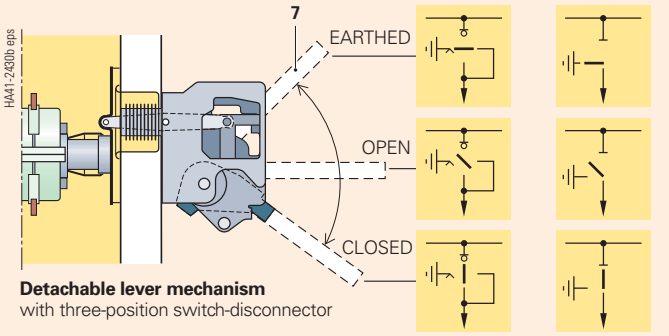
- Opening of lower panel cover or cable compartment cover only in "EARTHED" position
- Logical mechanical interlocking with vacuum circuit-breaker

Note: Standards see page 41




**Three-position switch-disconnector 630 A**

**1** Bushing-type insulator for busbar
**2** Switchgear vessel for gas insulation
**3** Three-position switch-disconnector
**4** Bushing-type insulator for feeder
**5** Spring-operated mechanism with detachable lever
**6** Mounting location for three-phase current transformer (option)




**Detachable lever mechanism**
with three-position switch-disconnector

**7** Operating lever, plugged inserted

**Switching functions of the three-position switch-disconnector 630 A**

- Switching and disconnecting under load
- Switching function as general purpose switch-disconnector (class E3 and M1) according to
  – IEC 60 265-1
  – VDE 0670 Part 301
  – IEC 62 271-102
  – VDE 0670 Part 2 / EN 60 129
- Make-proof earthing function

**Switching functions of the three-position disconnector 1250 A**

- Disconnecting
- Switching functions according to
  – IEC 62 271-102
  – VDE 0670 Part 2 / EN 60 129
- Earthing function
- For panel types LS31, LS31-U, LS32 and LT31

# Components

## Busbars, HV HRC fuse assembly

### 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:
  – Fl E-Cu for ≤ 630 A
  – Rd E-Cu for > 630 A to 1250 A
- For > 12 kV:
  With insulated busbar

### HV HRC fuse assembly

- For transformer panel types TR and TR1
- For busbar voltage metering panel type ME31-F
- HV HRC fuse links acc. to DIN 43 625 (main dimensions) with striker pin; version "medium" acc. to IEC 60 282/ VDE 0670 Part 4 *
  – As short-circuit protection before transformers
  – With selectivity (depending on correct selection) to upstream and downstream connected equipment
  – Single-pole insulation
- Requirements acc. to IEC 60 420 * fulfilled by combination of HV HRC fuse and three-position switch-disconnector
- 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 (1NO)

"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

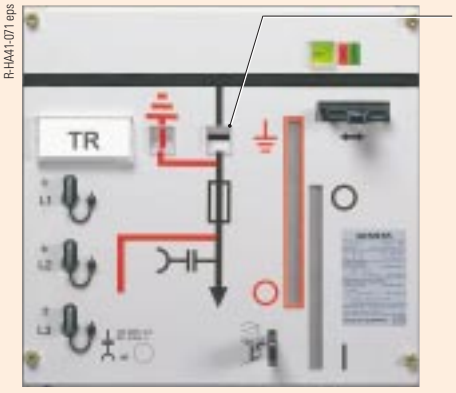
- Isolating and earthing of the transformer feeder
- Subsequent manual replacement of the HV HRC fuse link

### Busbars


**1** Busbar
**2** Insulating cap (e.g. for $U_r$ > 17.5 kV) on busbar
**3** Bushing-type insulator for busbar

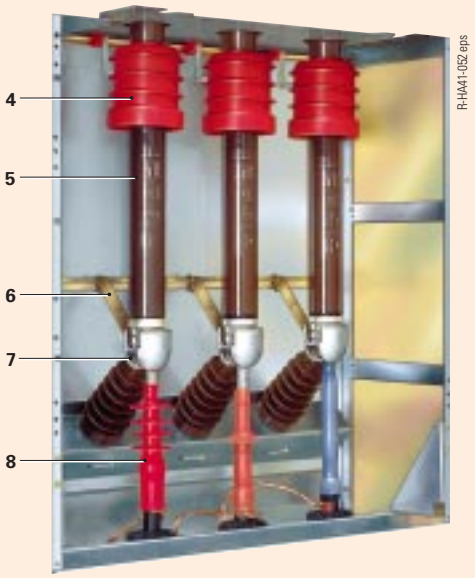
**Busbar compartment extending over 3 panels** (example)
Side view

### HV HRC fuse assembly




"CLOSED" indication, manual or motor operation
Indication "HV HRC fuse tripped" or "shunt release tripped"
"OPEN" indication

**Control board of a transformer feeder**




**4** Insulating sleeve
**5** HV HRC fuse (not included in the scope of supply)
**6** Earthing switch (rated short-circuit making current $I_{ma}$ = 4 kA) for cable connection
**7** Cover for bolted cable lug connection (e.g. for rated voltage $U_r$ = 24 kV)
**8** Cable sealing end (not included in the scope of supply)

**HV HRC fuses in transformer panel type TR**
Side view

* Standards see page 41

## Allocation of HV HRC fuses and transformers

The table opposite shows the recommended 3GD HV HRC fuse links (electrical data valid for ambient temperatures of up to 40 °C) for the fuse protection of transformers

### Recommendation

The three-position switch-disconnector in the transformer feeder (transformer switch) was combined with Siemens HV HRC fuse links of type 3GD and tested in accordance with IEC 60 420 *

### Standards

HV HRC fuse links with striker pin, "medium" version according to

- IEC 60 282 *
- VDE 0670 Parts 4 and 402
- DIN 43 625 main dimensions

| Rated system voltage | Transformer | | | Rated normal current of the HV HRC fuse link at ambient temperature of 40 °C | |
|---|---|---|---|---|---|
| | Rating $S_N$ | Relative impedance voltage $u_k$ | Rated current $I_1$ | Lowest value | Highest value |
| kV | kVA | % | A | A | A |
| 6 to 7.2 | 50 | 4 | 4.8 | 16 | 16 |
| | 75 | 4 | 7.2 | 16 | 16 |
| | 100 | 4 | 9.6 | 20 | 25 |
| | 125 | 4 | 12.0 | 25 | 25 |
| | 160 | 4 | 15.4 | 32 | 32 |
| | 200 | 4 | 19.2 | 40 | 40 |
| | 250 | 4 | 24.0 | 50 | 50 |
| | 315 | 4 | 30.3 | 50 | 63 |
| | 400 | 4 | 38.4 | 63 | 100 |
| | 500 | 4 | 48.0 | 63 | 100 |
| | 630 | 4 | 61.0 | 80 | 100 |
| 10 to 12 | 50 | 4 | 2.9 | 10 | 10 |
| | 75 | 4 | 4.3 | 10 | 10 |
| | 100 | 4 | 5.8 | 16 | 16 |
| | 125 | 4 | 7.2 | 16 | 16 |
| | 160 | 4 | 9.3 | 20 | 20 |
| | 200 | 4 | 11.5 | 25 | 25 |
| | 250 | 4 | 14.5 | 25 | 32 |
| | 315 | 4 | 18.3 | 32 | 40 |
| | 400 | 4 | 23.1 | 40 | 50 |
| | 500 | 4 | 29.0 | 50 | 63 |
| | 630 | 4 | 36.4 | 63 | 80 |
| | 800 | 5 to 6 | 46.2 | 63 | 80 |
| | 1000 | 5 to 6 | 58.0 | 80 | 100 |
| | 1250 | 5 to 6 | 72.3 | 100 | 100 |
| 13.8 | 50 | 4 | 2.1 | 6 | 6 |
| | 75 | 4 | 3.2 | 10 | 10 |
| | 100 | 4 | 4.2 | 10 | 10 |
| | 125 | 4 | 5.3 | 16 | 16 |
| | 160 | 4 | 6.7 | 16 | 16 |
| | 200 | 4 | 8.4 | 16 | 20 |
| | 250 | 4 | 10.5 | 20 | 25 |
| | 315 | 4 | 13.2 | 25 | 32 |
| | 400 | 4 | 16.8 | 32 | 32 |
| | 500 | 4 | 21.0 | 40 | 50 |
| | 630 | 4 | 26.4 | 50 | 50 |
| | 800 | 5 to 6 | 33.5 | 50 | 50 |
| | 1000 | 5 to 6 | 41.9 | 63 | 63 |
| | 1250 | 5 to 6 | 52.4 | 80 | 80 |
| 15 to 17.5 | 50 | 4 | 1.9 | 6 | 6 |
| | 75 | 4 | 2.9 | 10 | 10 |
| | 100 | 4 | 3.9 | 10 | 10 |
| | 125 | 4 | 4.8 | 10 | 10 |
| | 160 | 4 | 6.2 | 16 | 16 |
| | 200 | 4 | 7.7 | 16 | 20 |
| | 250 | 4 | 9.7 | 20 | 25 |
| | 315 | 4 | 12.2 | 25 | 25 |
| | 400 | 4 | 15.5 | 32 | 32 |
| | 500 | 4 | 19.3 | 32 | 40 |
| | 630 | 4 | 24.3 | 40 | 50 |
| | 800 | 5 to 6 | 30.9 | 50 | 50 |
| | 1000 | 5 to 6 | 38.5 | 63 | 63 |
| | 1250 | 5 to 6 | 48.2 | 63 | 80 |
| 20 to 24 | 50 | 4 | 1.5 | 6 | 6 |
| | 75 | 4 | 2.2 | 6 | 6 |
| | 100 | 4 | 2.9 | 10 | 10 |
| | 125 | 4 | 3.6 | 10 | 10 |
| | 160 | 4 | 4.7 | 10 | 10 |
| | 200 | 4 | 5.8 | 16 | 16 |
| | 250 | 4 | 7.3 | 16 | 16 |
| | 315 | 4 | 9.2 | 20 | 20 |
| | 400 | 4 | 11.6 | 20 | 25 |
| | 500 | 4 | 14.5 | 25 | 32 |
| | 630 | 4 | 18.2 | 32 | 40 |
| | 800 | 5 to 6 | 23.1 | 32 | 32 |
| | 1000 | 5 to 6 | 29.0 | 40 | 40 |
| | 1250 | 5 to 6 | 36.0 | 50 | 50 |
| | 1600 | 5 to 6 | 46.5 | 63 | 80 |
| | 2000 | 5 to 6 | 57.8 | 80 | 80 |

* Standards see page 41

# Components

## Operating mechanisms for three-position switches

### Manual operating mechanism

- Standard:
  As detachable lever mechanism
- Option: Design according to VDEW recommendation – Association of German Power Stations – VDEW e. V.
- Spring-operated mechanism
  – For ring-main panel types RK and RK1
  – For all three-position switches (except in panel types TR and TR1)
- Spring-operated-/stored-energy mechanism
  For transformer panel types TR and TR1 as well as for busbar voltage metering panel type ME31-F

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

### Motor operating mechanism (option)

The manual operating mechanisms can be equipped with motor operating mechanisms both for the three-position switch-disconnector and for the three-position disconnector.

Operating voltages for motor operating mechanisms:
– 24, 48, 60, 110, 220 V DC
– 50/60 Hz 110 and 230 V AC

Electrical operation:

- Standard: Remote operation (applied to terminal)
- Option: Local operation by momentary-contact rotary control switch

### Shunt release (option)

Spring-operated/stored-energy mechanisms can be equipped with a shunt release. Remote electrical tripping of the three-position switch-disconnector is possible via the magnetic coil of the shunt release, e.g. transformer overtemperature tripping.

To avoid thermal overloading of the shunt release in the event of a continuous signal that may be applied, the shunt release is switched off via an auxiliary switch which is mechanically coupled with the three-position switch-disconnector.

### Auxiliary switch (option)

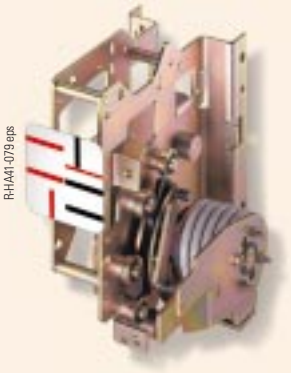
Each operating mechanism of the three-position switch-disconnector can be optionally equipped with an auxiliary switch for the switch position indication:
– 1NO + 1NC for "CLOSED/EARTH"
– 2NO for "OPEN"

Separate earthing switch:
– 2NO and 1NC for "EARTH"
– 2NO for "OPEN"

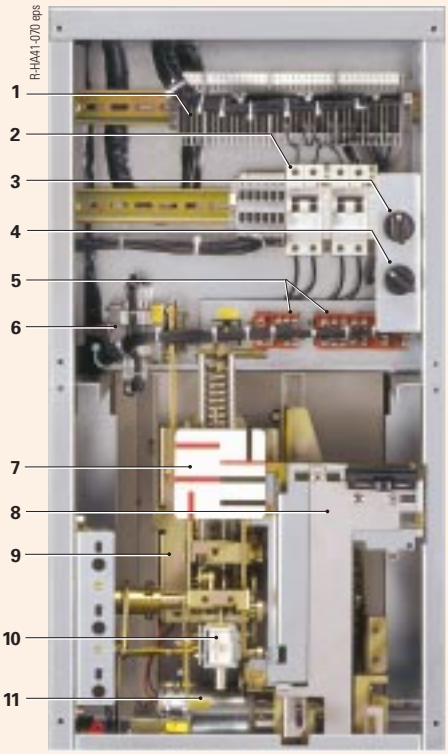
Abbreviations:

NO = normally-open contact
NC = normally-closed contact

### Operating mechanisms (examples)




**Detachable lever mechanism as spring-operated mechanism**
for ring-main feeders




**Operating mechanism parts in transformer feeder**

**1** Terminal strip located in the low-voltage niche (optionally in the low-voltage compartment)
**2** M.c.b. (option) in the low-voltage niche
**3** Local-remote switch (option)
**4** Actuation for the motor operating mechanism of the three-position switch-disconnector
**5** Auxiliary contactors of the motor operating mechanism for locking the motor
**6** Auxiliary switch
**7** Switch position indicator for the three-position switch-disconnector
**8** Locking device (standard for motor operating mechanism)
**9** Operating mechanism for the three-position switch-disconnector coupled with the motor operating mechanism
**10** Shunt release (option)
**11** Motor operating mechanism

### Technical data of the auxiliary switch

**Breaking capacity**

| AC operation at 40 Hz to 60 Hz | | DC operation | | |
|---|---|---|---|---|
| Operating voltage | Normal current | Operating voltage | Normal current resistive | inductive: T=20 ms |
| V | A | V | A | A |
| up to 230 | 10 | 24 | 10 | 10 |
| | | 48 | 10 | 9 |
| | | 60 | 9 | 7 |
| | | 110 | 5 | 4 |
| | | 220 | 2.5 | 2 |

**Rated switching capacity**

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

## Indicating and measuring equipment

**Short-circuit/earth-fault indicator** (option)

The ring-main feeders can be equipped with a 3-phase short-circuit or earth-fault indicator:

- Optical signal when a preselected pickup value is exceeded
- With ring-type sensors
- Display panel, withdrawable housing, depending on the type
- Short-circuit pickup values: e.g. 400, 600, 800 or 1000 A

Option: Remote electrical indication via contact (1NO + 1NC contact, passing contact), applied to terminal

**Ready-for-service indicator** (option for three-position switch)

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

Mode of operation

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

A coupling magnet, which is fitted to the bottom end of the measuring box, transmits its position to an outside armature through the stainless steel switchgear 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 insulating capacity, are displayed, temperature-dependent changes in the gas pressure are not. The gas in the measuring box has the same temperature as that in the switchgear.

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

**Verification of safe isolation from supply**

Voltage detection systems

For voltage detection according to IEC 61 243-5 / VDE 0682 Part 415 with:

- Standard: HR system
- Option: LRM system
- Option: LRM system as CAPDIS-S1 or CAPDIS-S2

Features of the HR/LRM system

- Voltage indicator
  – HR system (standard) or
  – LRM system (option)
- Verification of safe isolation from supply phase by phase through insertion in each socket pair
- For continuous operation
- Safe-to-touch
- Measuring system and voltage indicator can be tested
- Voltage indicator flashes if high voltage is present
- Fixed-mounted capacitive voltage divider in bushings

Features of CAPDIS-S1, -S2

- Maintenance-free
- Without auxiliary power
- Self-checking
- Option: With remote indication of the voltage state (auxiliary power required for CAPDIS-S2)

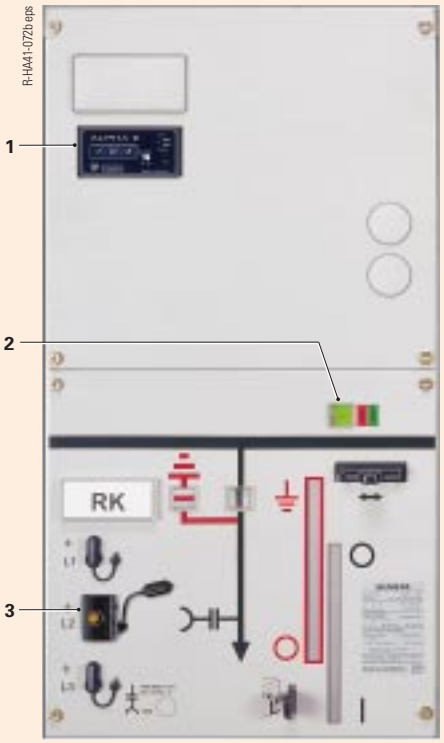
Mounting of voltage detection systems

- Standard:
  In all ring-main and circuit-breaker feeders
- Option:
  In transformer feeders

**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

**Indicating and measuring equipment** (examples)



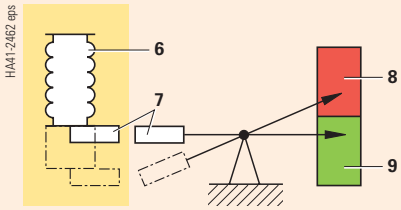

**Control board of a ring-main panel**
(example)

Mounting locations in the control board for

**1** Short-circuit / earth-fault indicator (option)
**2** Ready-for-service indicator (option)
**3** Voltage indicator, HR system, plugged-in (standard)


**Short-circuit indicator ALPHA M**
(example)

- Reset: manual
- For phase indications L1, L2 and L3




Stainless-steel vessel filled with $SF_6$ gas, gauge pressure 500 hPa at 20 °C

Ready-for-service indicator

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

**6** Measuring box
**7** Magnetic coupling
**8** Red indication: not ready for service
**9** Green indication: ready for service


**Voltage indicator, HR system**
(standard)

# Components

## Interlocking systems and locking devices

### Interlocking of connection compartment

Ring-main and circuit-breaker panel

- Access to the cable connection compartment (e.g. for cable testing) is only possible provided that the feeder is isolated and earthed (three-position switch-disconnector in "EARTHED" position)
- Option: Closing lock-out
  This prevents the three-position switch-disconnector from being switched from "OPEN" to "CLOSED" position, when the cable compartment cover is removed

Transformer panel

- Access to the cable connection compartment and to the HV HRC fuse compartment (e.g. for replacement of HV HRC fuse links) is only possible provided that the feeder is isolated and earthed (three-position switch-disconnector in "EARTHED" position)
- Option: De-earthing lock-out
  This prevents the three-position switch-disconnector from being switched from position "EARTHED" to "OPEN".

### Switchgear interlocking

- Dependent on the vacuum circuit-breaker operating mechanism with
  – Spring-operated or
  – Stored-energy mechanism
- Option: Switchgear-side mechanical interlocking with three-position switch-disconnector
- Vacuum circuit-breaker cannot be closed when three-position switch-disconnector is in the "OPEN" position:
  – Spring-operated mechanism: Hand crank opening is blocked
  – Stored-energy mechanism with closing solenoid 3AY15 10: Pushbutton (S12) operated by mechanical interlock prevents continuous command to closing solenoid

Interlocking in circuit-breaker panel types LS1, LS1-U and LT10 (with 3AH5 fixed-mounted vacuum circuit-breaker)

- Option: Logical mechanical interlocking with three-position switch-disconnector
- Earthing of feeder via three-position switch-disconnector in "EARTHED" position

Interlocking in circuit-breaker panels (with 3AH6 removable vacuum circuit-breaker)

- Option: For 630 A panel types LS11, LS11-U and LT11: Logical mechanical interlocking with three-position switch-disconnector
- Standard: For 1250 A panel types LS31, LS31-U, LS32 and LT31: Logical mechanical interlocking with three-position disconnector
- Logical mechan. interlocking of cable compartment cover: Opening of cable compartment cover only possible provided that the feeder is earthed

Feeder earthing

- Standard: Earthing by switching of vacuum circuit-breaker 3AH6 [1]) in position "CLOSED" and of three-position switch [2]) in position "EARTHED"
- Option: For circuit-breaker panel types LS11, LS31 and LS32: Earthing by means of an additional make-proof earthing switch at the feeder with inspection window in the cable compartment cover

### Locking devices

The three-position switch-disconnector can be locked on the operating mechanism side in any position (option).

1) With additional locking device – optionally with signalling switch – for securing the "CLOSED" position of the vacuum circuit-breaker for feeder "EARTHED"

2) Three-position switch as
   – Switch-disconnector in panel types LS11, LS11-U and LT11
   – Disconnector in panel types LS31, LS31-U, LS32 and LT31

### Interlocking systems

R-HA41-064c eps

**Interlocking for cable compartment cover**
Removed cable compartment cover with earthed bus sectionalizer panel

### Locking device (option)

R-HA41-081 eps


**Locking device of the detachable lever mechanism**
e.g. for padlock

# 4MC63 three-phase current transformers for panel types LS ... and LT ...

## Application

- For circuit-breaker panels type LS ...
- For bus sectionalizer panels type LT ...
- Option: For ring-main panels type RK ...

## Features

- According to IEC 60 044-1/ VDE 0414 Part 1
- 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 inside the panel

## Installation

- Arranged outside the switch-gear vessel on the bushings
- Factory-assembled

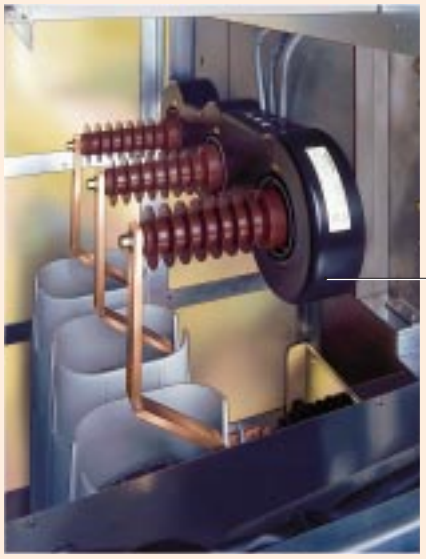
## Other designs

(option)

Three-phase current transformers for protection equipment based on c.t. operation:

- 7SJ4 protection relay as definite-time overcurrent protection
- Definite-time overcurrent protection relay, make SEG, type WIP 1

R-HA41-049.eps



4MC63 53 three-phase current transformer on the bushings of the three-position switch-disconnector

R-HA41-044.eps

**4MC63 53 three-phase current transformer**

| Technical data | 4MC63 53 three-phase current transformer | | |
|---|---|---|---|
| | for $I_N \leq 150$ A for $I_D = 630$ A | for $I_N \leq 400$ A for $I_D = 630$ A | for $I_N \leq 1000$ A for $I_D = 1250$ A |
| **Primary data** | | | |
| Max. equipment operating voltage $U_m$ | 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 thermal short-time withstand current $I_{th}$ | 25 kA | 25 kA | 25 kA |
| 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 peak withstand current $I_{dyn}$ | unlimited | unlimited | 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 |
| Protection core: Overcurrent factor | 10 | 10 | 10 |

Other values available on request

# 4MC70 33, 4MC70 31 cable-type current transformers and 4MC70 32 bus-type current transformers

## Application

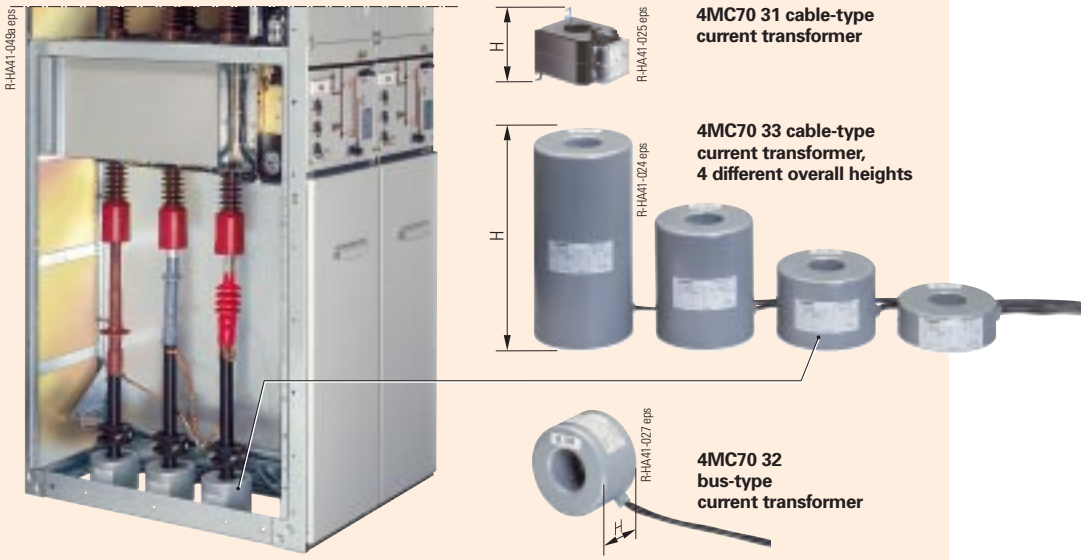
- For circuit-breaker panels type LS ...
- For ring-main panels type RK ...
- For transformer panels type TR ...

## Features

- According to IEC 60 044-1/ VDE 0414 Part 1
- Designed as a single-pole ring-core current transformer
- Only for shielded cables
- Climate-independent
- Free of dielectrically stressed cast-resin parts (due to design)
- Insulation class E
- Inductive type
- Secondary connection by means of a terminal strip inside the panel

## Installation

- 4MC70 33 cable-type current transformer and 4MC70 32 bus-type current transformer for panel type LS ...
- 4MC70 31 cable-type current transformer: e.g. for panel types RK ..., K ... and TR ...
- Arranged on the cable at the panel connection
- Transformers mounted on a supporting plate at our factory; final assembly on the cables on site




4MC70 33 cable-type current transformers on the cable at the panel connection

| Technical data | 4MC70 33 cable-type current transformer | 4MC70 31 cable-type current transformer | 4MC70 32 bus-type current transformer |
|---|---|---|---|
| **Primary data** | | | |
| Max. equipment operating voltage $U_m$ | 0.72 kV | 0.72 kV | 0.72 kV |
| Rated current $I_N$ A | 30 A to 600 A | 50 A to 600 A | 200 A to 600 A |
| Rated short-duration power-frequency withstand voltage (winding test) | 3 kV | 3 kV | 3 kV |
| Rated thermal short-time withstand current $I_{th}$ | 25 kA | 25 kA | 25 kA |
| Rated continuous thermal current $I_D$ | max. 1.2 x $I_N$ | max. 1.2 x $I_N$ | max. 1.2 x $I_N$ |
| Transient overload current | 1.5 x $I_D$ / 1 h or 2 x $I_D$ / 0.5 h | 1.5 x $I_D$ / 1 h or 2 x $I_D$ / 0.5 h | 1.5 x $I_D$ / 1 h or 2 x $I_D$ / 0.5 h |
| Rated peak withstand current $I_{dyn}$ | unlimited | unlimited | unlimited |
| **Secondary data** | | | |
| Rated current | 1 A (option: 5 A) | 1 A (option: 5 A) | 1 A (option: 5 A) |
| Measuring core – Class | 0.2 \| 0.5 \| 1 | 1 | 0.2 \| 0.5 \| 1 |
| Measuring core – Overcurrent factor | FS10 (option: FS5) | FS5 (option: FS10) | FS10 (option: FS5) |
| Measuring core – Rating | 2.5 VA to 10 VA | 2.5 VA to 10 VA | 2.5 VA to 10 VA |
| Protection core – Class | 10 P \| 5 P | – | 10 P \| 5 P (on request) |
| Protection core – Overcurrent factor | 10 \| 10 | – | 10 \| 10 |
| Protection core – Rating | 2.5 VA to 10 VA | – | 2.5 VA to 15 VA |
| Option: Secondary tap | 1 : 2 (e.g. 150 A – 300 A) | 1 : 2 | 1 : 2 (e.g. 150 A – 300 A) |
| **Dimensions** | | | |
| Overall height H ** mm | 50* \| 100* \| 170* \| 285* | 89 | 80 * \| 150 * |
| Outside diameter | Ø 145 mm | 85 mm x 114 mm | Ø 125 mm |
| Inside diameter | Ø 55 mm | Ø 40 mm | Ø 55 mm |
| For cable diameter | Ø 50 mm | Ø 36 mm | Ø 50 mm |

Other values available on request

* Depending on the core data

** Available installation height inside panel types RK or RK1: Approx. 285 mm, depending on make, type and cross-section of sealing end

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

## Application

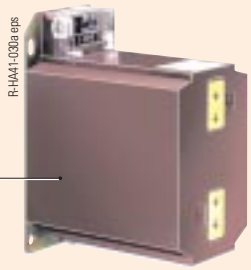
- For billing metering panels type ME1 ...
- For bus riser panel type HF ...
- For mounting at the feeder

## Features

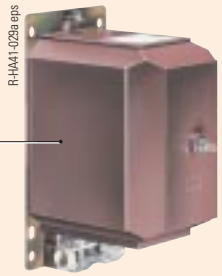
- 4MA7 current transformer
- According to IEC 60 044-1/ VDE 0414 Part 1
- Dimensions according to DIN 42 600 Part 8
- Designed as a single-pole indoor block-type current transformer
- Cast-resin insulated
- Insulation class E
- Secondary connection by means of screw-type terminals

4MR voltage transformer

- According to IEC 60 044-2/ VDE 0414 Part 2
- Dimensions according to DIN 42 600 Part 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


**4MA7 block-type current transformer,** single-pole




**4MR14 voltage transformer,** single-pole

4MR voltage transformer and 4MA7 block-type current transformer installed in billing metering panel type ME1

## Technical data

### 4MA7 single-pole block-type current transformer

**Primary data**

| | | |
|---|---|---|
| Max. equipment operating voltage $U_m$ | **12 kV** | **24 kV** |
| Rated short-duration power-frequency withstand voltage | 38 kV | 50 kV |
| Rated lightning impulse withstand voltage | 95 kV | 125 kV |
| Rated current $I_N$ | 25 A to 1250 A | |
| Rated thermal short-time withstand current $I_{th}$ | up to 25 kA | |
| Rated continuous thermal current $I_D$ | up to 1.2 x $I_N$ | |
| Rated peak withstand current $I_{dyn}$ | max. 2.5 x $I_{th}$ | |

**Secondary data**

| | | |
|---|---|---|
| Rated current | | 1 A or 5 A |
| Measuring core | Class | 0.2 \| 0.5 \| 1 |
| | Overcurrent factor | FS5 or FS10 |
| | Rating | 10 VA to 15 VA |
| Protection core | Class | 5 P or 10 P |
| | Overcurrent factor | 10 |
| | Rating | 5 VA or 15 VA |

Other values available on request

### 4MR single-pole voltage transformer

**Primary data**

| | |
|---|---|
| Max. equipment operating voltage $U_m$ (= 1.2 x $U_N$) | **12 kV** |
| Rated voltage $U_N$ at max. rated short-duration power-frequency withstand voltage $U_d$ | $3.3/\sqrt{3}$ kV at 10 kV<br>$3.6/\sqrt{3}$ kV at 10 kV |
| | $4.8/\sqrt{3}$ kV at 20 kV<br>$5.0/\sqrt{3}$ kV at 20 kV<br>$6.0/\sqrt{3}$ kV at 20 kV<br>$6.6/\sqrt{3}$ kV at 20 kV<br>$7.2/\sqrt{3}$ kV at 20 kV |
| | $10.0/\sqrt{3}$ kV at 28 kV<br>$11.0/\sqrt{3}$ kV at 28 kV |
| Rated lightning impulse withstand voltage $U_p$ | 75 kV |
| Rated voltage factor (8 h) | 1.9 x $U_N$ |
| Max. equipment operating voltage $U_m$ (= 1.2 x $U_N$) | **24 kV** |
| Rated voltage $U_N$ at max. rated short-duration power-frequency withstand voltage $U_d$ | $13.8/\sqrt{3}$ kV at 38 kV<br>$15.0/\sqrt{3}$ kV at 38 kV |
| | $17.5/\sqrt{3}$ kV at 50 kV<br>$20.0/\sqrt{3}$ kV at 50 kV<br>$22.0/\sqrt{3}$ kV at 50 kV |
| Rated lightning impulse withstand voltage | 125 kV |
| Rated voltage factor (8 h) | 1.9 x $U_N$ |

**Secondary data**

| | |
|---|---|
| Rated voltage | $100/\sqrt{3}$ V<br>$110/\sqrt{3}$ V<br>$120/\sqrt{3}$ V |
| Rated voltage for auxiliary winding (option) | 100/3 V<br>110/3 V<br>120/3 V |
| Rating | 20 VA \| 50 VA \| 100 VA |
| Class | 0.2 \| 0.5 \| 1 |

Other values available on request

# Components

## Cable connection

### 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 50 024
- Access to the cable connection compartment only if feeder has been isolated and earthed

### Special features

– In ring-main panels
– In circuit-breaker panels
– In cable panels

- For thermoplastic-insulated cables
- For paper-insulated mass-impregnated cables with adapter systems
- For connection cross-sections up to 300 mm²
- Cable routing downwards

– In transformer panels:

- For thermoplastic-insulated cables
- For connection cross-sections up to 120 mm²: Cable lug max. 32 mm wide
- For rated normal currents of 200 A

For options see figures

### Cable cross-sections

| Panel type | | Connectable cables x connection cross-sections No. x mm² for rated voltage | | |
|---|---|---|---|---|
| | | **12 kV** | **17.5 kV** | **24 kV** |
| K | Standard | 1x300 | 1x300 | 1x300 |
| | on request | 2x300 | – | – |
| K1 | | 2x400 | 2x400 | 2x400 |
| RK, K-E | | 2x300 | 1x300 | 1x300 |
| RK1, K1-E | | 2x300 | 2x300 | 2x300 |
| LS1 | | 2x300 | 2x300 | 2x300 |
| LS11, LS31 | | 2x400 | 2x400 | 2x300 |
| LS32 | Standard | 3x400 | 3x400 | 3x300 |
| | Option | 4x300 | 4x300 | – |
| | on request | – | – | 4x300 |
| ME1-K, ME1-KS | | 3x400 | 3x400 | 3x300 |

1) Only with ring-main panel type RK1

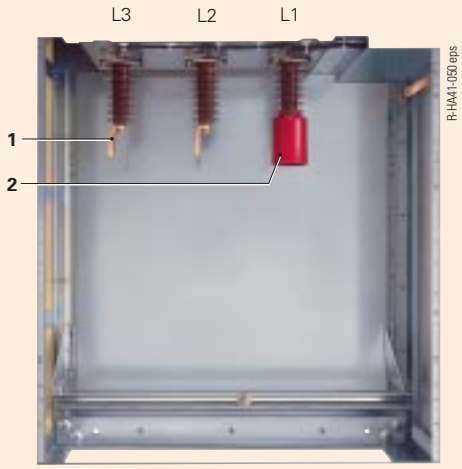
2) Cable clamps with transformer panels type TR ... partly mounted underneath the panel in the cable basement

3) Make Siemens, type 3EK7, other makes on request

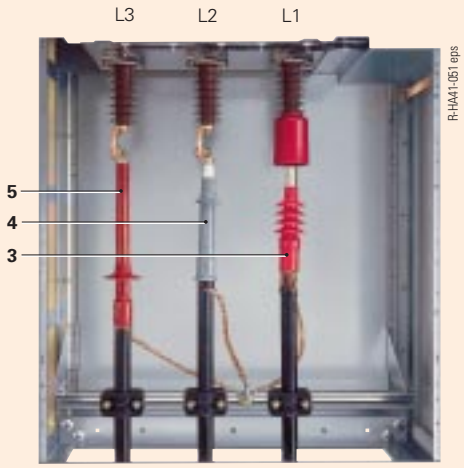
Note

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

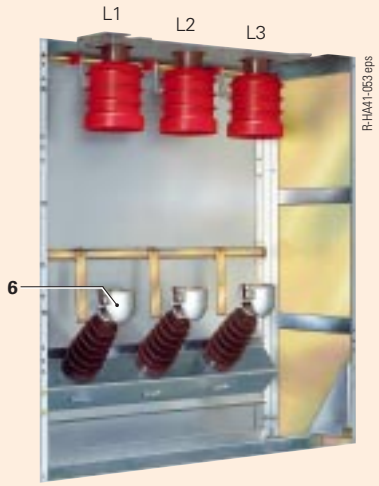
### Cable connection (examples)



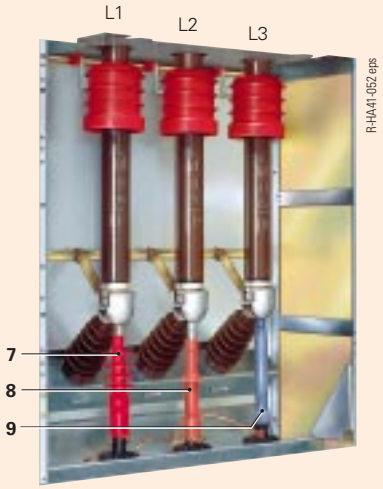

**Ring-main panel type RK**
Cable connection compartment as delivered



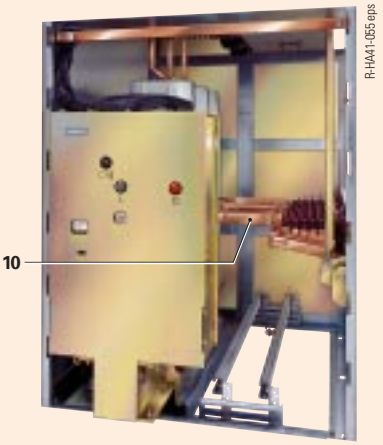

Cable connection compartment with cable sealing ends (options: A, B, C [1]) and D [1]), see below)



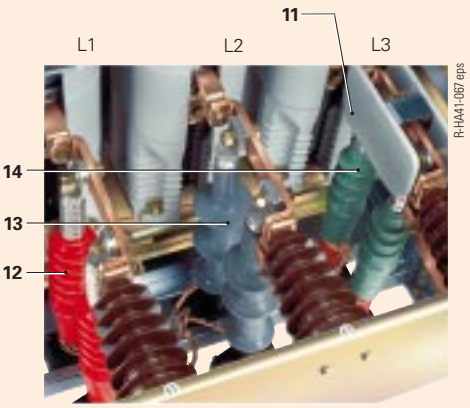

**Transformer panel type TR**
Cable connection compartment as delivered




Cable connection compartment with cable sealing ends (option: A [2]), see below)




**Circuit-breaker panel type LS11**
Cable connection compartment as delivered




Cable connection compartment with cable sealing ends (options: A, B, C and D, see below)

**Options**

**A** Mounted cable clamps [2])
**B** Short-circuit / earth-fault indicator
**C** Double cable connection
**D** Suitable for connection of surge arresters [3])

# Selection data for various cable sealing ends

## Cable sealing ends
(examples)

**1** As-delivered condition, prepared for cable sealing end ≤ 12 kV

**2** As-delivered condition, prepared for cable sealing end > 12 kV, ≤ 24 kV, additionally with insulating sleeve

**3** Phase L1:
Make: Corning Cables (RXS)
Type IAEM 20,
240 mm² (20 kV)

**4** Phase L2:
Make: Tyco Electronics Raychem
Type EPKT 24 C / 1X,
185 mm² (24 kV),
as shrink-on sealing end,
for severe ambient conditions

**5** Phase L3:
Make: Pirelli
Type ELTI mb-1C-2h-C-T3,
240 mm² (24 kV)

**6** As-delivered condition, prepared for cable sealing end

**7** Phase L1:
Make: Corning Cables (RXS)
Type IAEM 20,
95 mm² (20 kV)

**8** Phase L2:
Make: Tyco Electronics Raychem
Type TFTI/5131,
95 mm² (24 kV),
as push-on sealing end

**9** Phase L3:
Make: Euromold
Type AIN, 95 mm² (24 kV)

**10** As-delivered condition, prepared for cable sealing end ≤ 12 kV

**11** As-delivered condition, prepared for cable sealing end > 12 kV, ≤ 24 kV, additionally with insulating cap

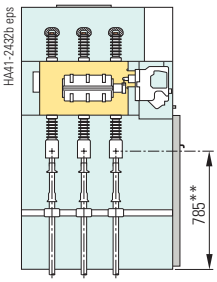
**12** Phase L1:
Make: Corning Cables (RXS)
Type IAES 20,
240 mm² (20 kV)

**13** Phase L2:
Make: Pirelli
Type ELTI 1C-24-D-T3,
240 mm² (24 kV),
as indoor sealing end,
for severe ambient conditions

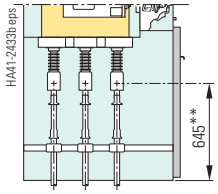
**14** Phase L3:
Make: Euromold
Type AIN 20,
240 mm² (24 kV)

| Cable sealing end, e.g. for panel types RK..., LS1..., LS11..., LS31..., LS32 and TR ...[1]) (for connection heights of cables see opposite dimension drawings) | | |
|---|---|---|
| Make | Type | Cross-section mm² |
| **Single-core thermoplastic-insulated cables for ≤ 12 kV** (6/10 kV) | | |
| Euromold | 35 MSC<br>35 MSC (option [3])) | 16–300 (500*)<br>25–300 (500*) |
| | AIN 10 | 25–300 (500*) |
| | ITK / S 212 | 35–300 (400*) |
| Pirelli | ELTI mb-1C-12 | 35–240 |
| | ELTI-1C-12 | 25–300 |
| Tyco Electronics Raychem | IXSU-F | 16–300 (500*) |
| | TFTI | 25–300 (400*) |
| | EPKT [1]) | 16–300 |
| Corning Cables (RXS) | IAEM 10 | 25–300 |
| | IAES 10 | 25–300 (500*) |
| 3M | 92-EP 6xx-1 | 35–300 (400*) |
| ABB Energiekabel | SEHDI 10.2 | 35–300 (500*) |
| Nkt cables | TI 12 | 25–240 |
| | AV 10 C | 25–300 (500*) |
| | AV 10 E | 25–300 (500*) |
| **Single-core thermoplastic-insulated cables for > 12 kV to ≤ 24 kV** (12/20 kV) | | |
| Euromold | 35 MSC<br>35 MSC (option [3])) | 25–70<br>25–185 |
| Euromold | 36 MSC [2])<br>36 MSC (option [3])) | 95–300 (500*)<br>95–300 (500*) |
| | AIN 20 | 25–300 (630*) |
| | ITK / S 224 | 35–240 |
| Pirelli | ELTI mb-1C-24 | 35–240 |
| Pirelli | ELTI-1C-24 | 25–300 |
| Tyco Electronics Raychem | IXSU-F | 25–300 (500*) |
| | TFTI | 25–300 (400*) |
| | EPKT | 16–300 (500*) |
| Corning Cables (RXS) | IAEM 20 | 25–300 |
| | IAES 20 | 25–300 (500*) |
| 3M | 93-EP 6xx-1 | 25–300 (400*) |
| ABB Energiekabel | SEHDI 20.2 | 35–300 (500*) |
| Nkt cables | TI 24 | 25–240 |
| | AV 20 E | 25–300 (500*) |
| | AV 10 E | 25–300 (500*) |
| **Three-core thermoplastic-insulated cables for ≤ 12 kV** (6/10 kV) | | |
| Euromold | AIN 10 | 25–300 (500*) |
| | SR-DI 12 | 35–300 (500*) |
| Pirelli | ELTI-3C-12 | 25–300 |
| Tyco Electronics Raychem | IXSU-F | 16–300 (500*) |
| **Three-core thermoplastic-insulated cables for > 12 kV to ≤ 24 kV** (12/10 kV) | | |
| Euromold | SR-DI 24 [2]) | 35–300 (500*) |
| Corning Cables (RXS) | GHKI | 25–300 (500*) |

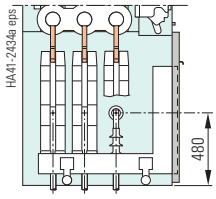
Connection height ** of cables above floor or above lower edge of panel:



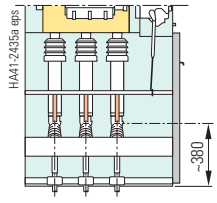

Panel type RK ...




Panel type LS1 ...




Panel type LS11 ...




Panel type TR ...

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).

1) Transformer panel types TR ...:
- Lower edge of sealing end below panel
- Cable lugs of sealing ends up to 32 mm width
- Owing to the various sealing end lengths, some of the mounted cable clamps are underneath the panel

2) Circuit-breaker panel types LS11, LS31 and LS32:
- Lower edge of sealing end below panel

3) Cable sealing end type with insulation shields

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

** Due to the installation of 4MA cast-resin insulated block-type current transformers in panels RK1 and LS1, the connection height of the cables is reduced to 380 mm

# Components

## Low-voltage equipment

### Low-voltage niche
(standard)

- Screwed-on cover as
  – Cover (available mounting depth behind of approx. 184 mm)
  – Frame cover, approx. 46 mm deeper version (available mounting depth behind of approx. 230 mm)
- For accommodation of terminals and standard protection devices, e.g. in circuit-breaker panels combined with frame cover for panels
  – Type LS1: Protection relays (with max. 75 mm wide mounting frame), e.g. type 7SJ45, 7SJ46 and 7SJ60, option: Protection relay make SEG
  – Type LS11: Protection relays (with max. 150 mm wide mounting frame), e.g. type 7SJ4..., 7SJ60 and 7SJ61 (on request type 7SJ62), option: Protection relay make SEG
- 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 IP 3X (standard)

### Low-voltage compartment
(option)

- Heights
  – 350 mm
  – 550 mm
- Available mounting depth: 442 mm
- For mounting on the panel
- Dependent on the panel-specific scope of the secondary equipment
- For accommodation of protection, control, measuring and metering equipment, e.g. multifunction protection relay SIPROTEC 4 type 7SJ62/ 7SJ63 or protection relay make SEG
- For 750 mm wide panel types LS31..., LS32 and LT31

### Electronic functions

Multifunction protection relay SIPROTEC 4 7SJ62 or 7SJ63 with the following features:

**1** User-programmable LEDs with application-specific label, for displaying any desired process and equipment data

**2** LCD for process and equipment data, e.g. for:
– Measuring and metering values
– Binary information on the status of switching point and device
– Protection data
– General indications
– Alarms

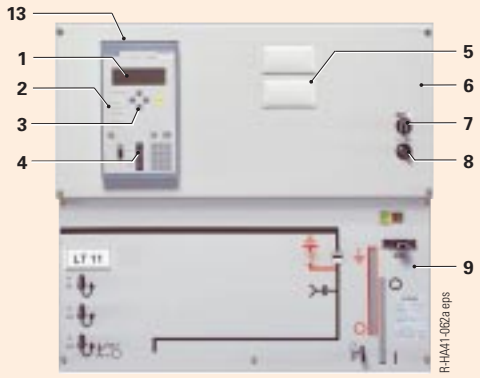
**3** Keys for navigation in menus and for entering values

**4** Four user-programmable function keys for frequently performed actions

### Low-voltage cables

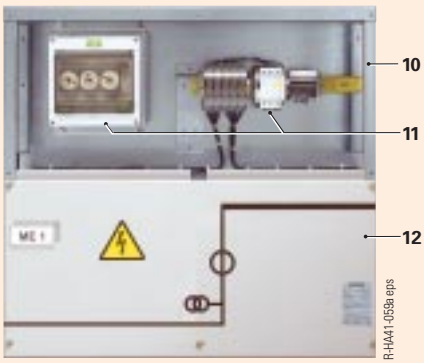
- Control cables of the panel to the low-voltage compartment are connected via multi-pole, coded module plug connectors
- Option: Plug-in bus wires from panel to panel inside the low-voltage niches, optionally in separate cable duct on the panel

**Low-voltage niche** (examples)




**In bus sectionalizer panel type LT11**
(low-voltage niche closed)


**In circuit-breaker panel type LS1**
(low-voltage niche open)




**In billing metering panel type ME1**
(low-voltage niche open)

**1** LED indications
**2** LCD
**3** Navigation keys
**4** Function keys
**5** Option: Short-circuit/ earth-fault indicator
**6** Frame cover of low-voltage niche (can be unscrewed)
**7** Momentary-contact rotary control switch ON-OFF for motor operating mechanism of the three-position switch-disconnector
**8** Local-remote switch for three-position switch-disconnector
**9** Control board
**10** Low-voltage niche open
**11** Option: Installed equipment
**12** Panel front
**13** Option: Multifunction protection relay SIPROTEC 4 7SJ61 on swing-out frame
**14** Option: Protection device make SEG, type WIC

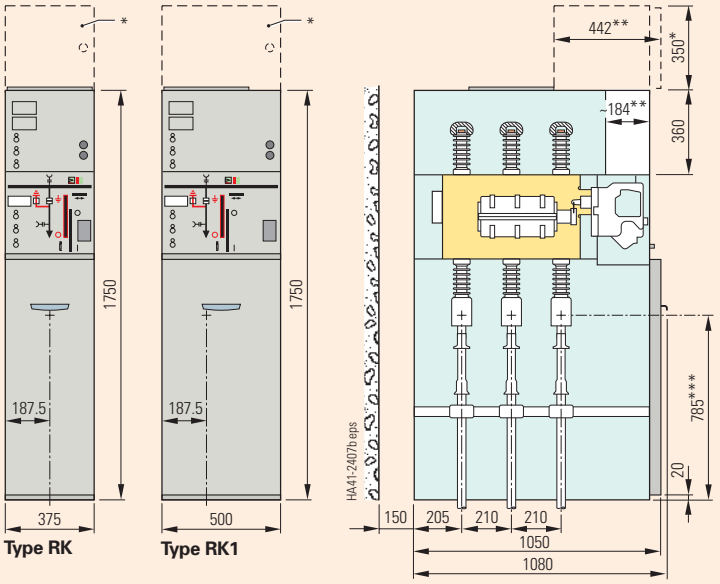
**Low-voltage compartment** (option)


**On circuit-breaker panel type LS1**
for additional low-voltage equipment

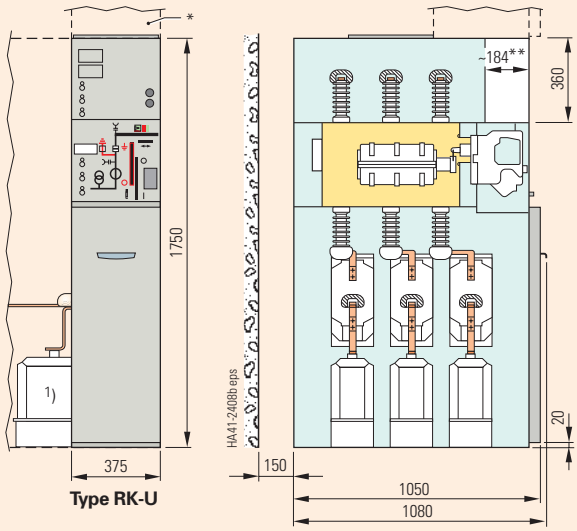
SIPROTEC 4 7SJ61:

**1** LED indications
**2** LCD
**3** Navigation keys
**4** Function keys

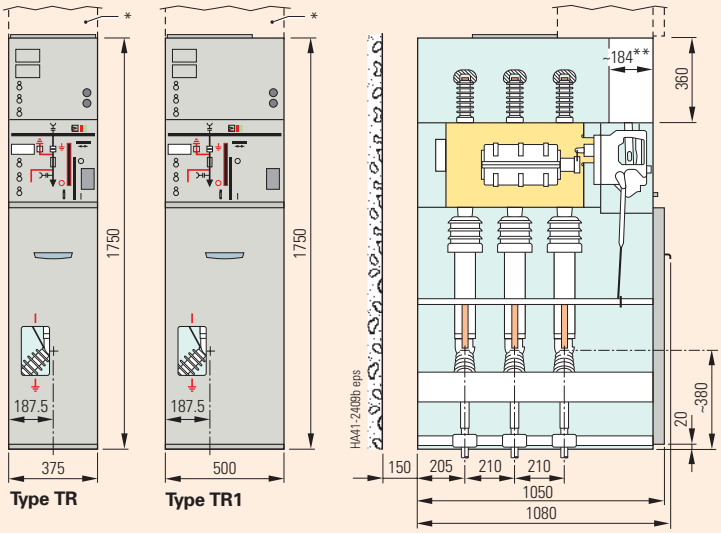
## Ring-main panels, transformer panels




**Ring-main panels**




**Ring-main panel for panel combinations**




**Transformer panels**

1) Location of voltage transformer in left-hand panel, e.g. in panel type LT10 or LT11

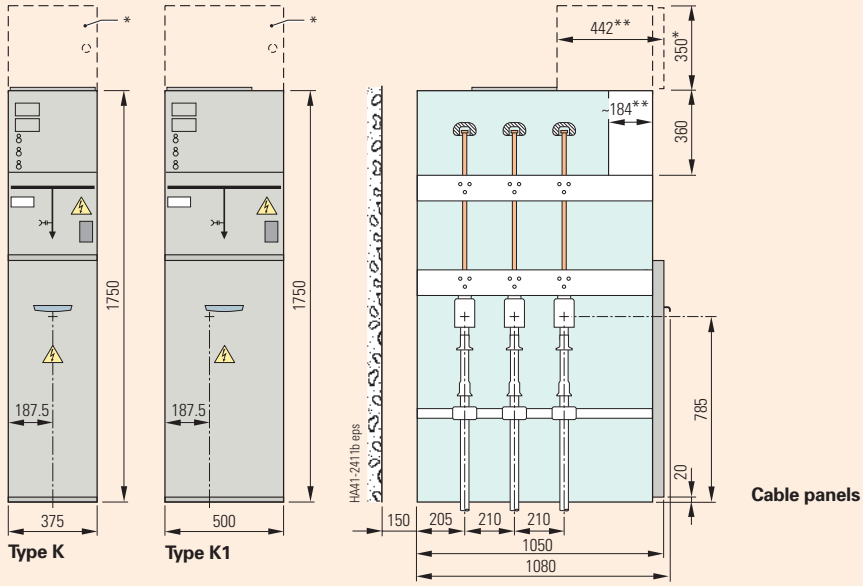
* Option:
Low-voltage compartment available in two heights: 350 mm or 550 mm

** Available mounting depth for low-voltage equipment

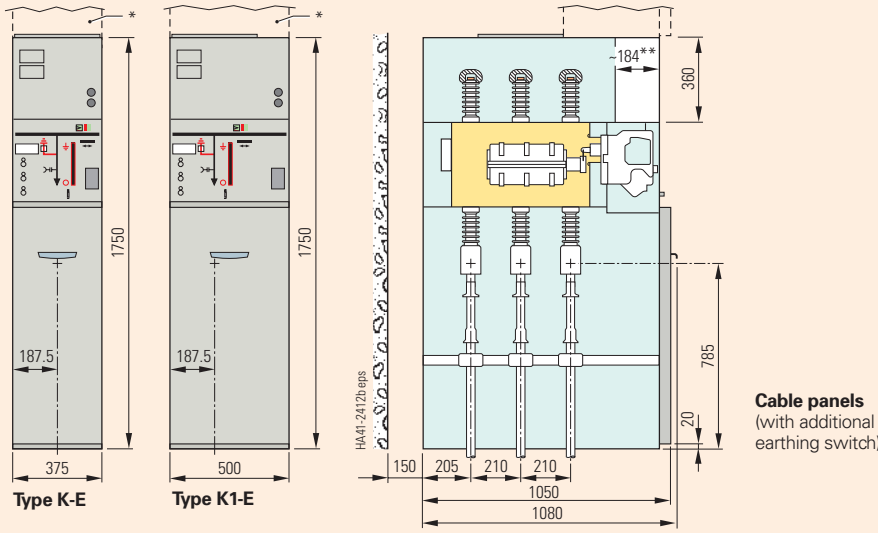
*** For panel type RK1 the cable connection height is reduced to approx. 380 mm for panel version with 4MA block-type current transformer

# Dimensions

## Cable panels




**Cable panels**

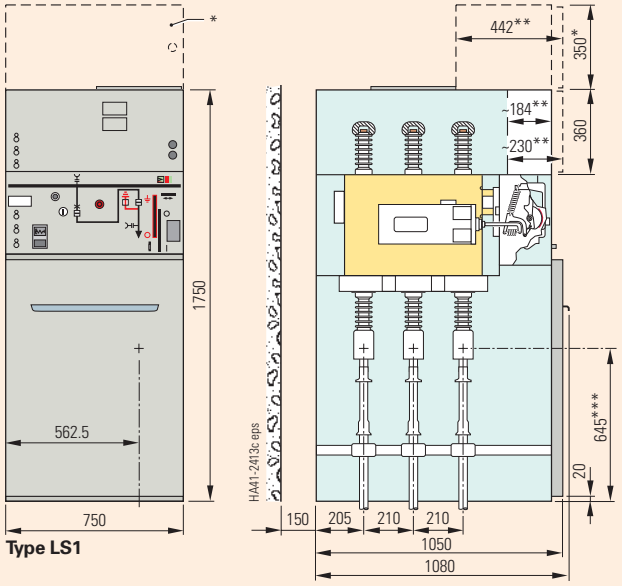



**Cable panels**
(with additional make-proof earthing switch)

* Option:
Low-voltage compartment available in two heights:
350 mm or 550 mm

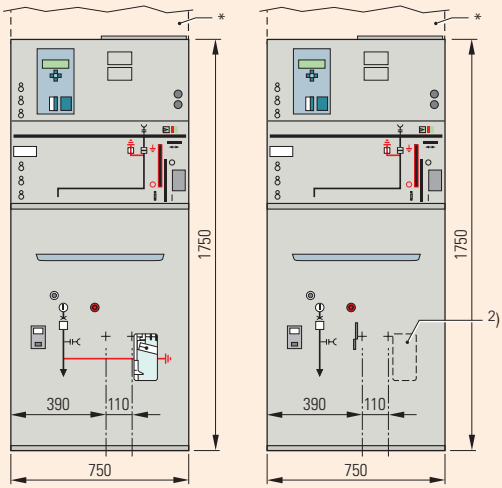
** Available mounting depth for low-voltage equipment

## Circuit-breaker panels



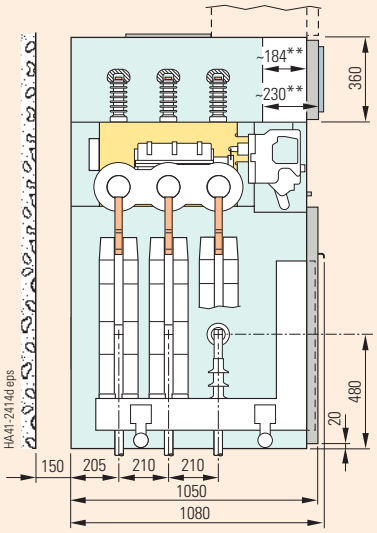

**Type LS1**

**Circuit-breaker panel**
**630 A**
**with 3AH5** 1)

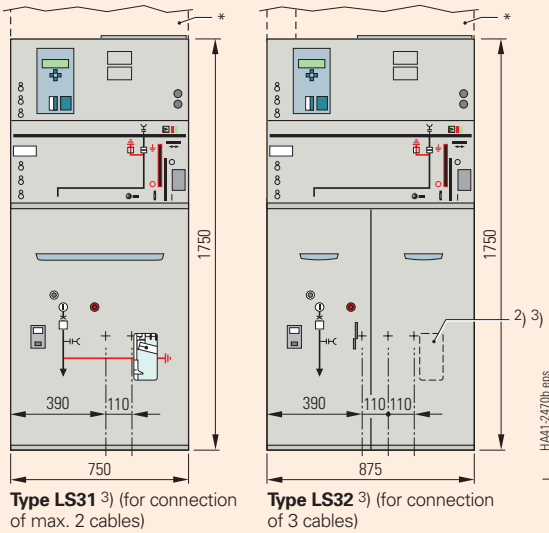



**Type LS11** (with make-proof earthing switch)

**Type LS11** (without earthing switch)




**Circuit-breaker panels**
**630 A**
**with 3AH6** 1)




**Type LS31** 3) (for connection of max. 2 cables)

**Type LS32** 3) (for connection of 3 cables)

1) Type designation of the vacuum circuit-breaker

2) Option: Inspection window

3) Option: With make-proof earthing switch

* Option: Low-voltage compartment available in two heights: 350 mm or 550 mm

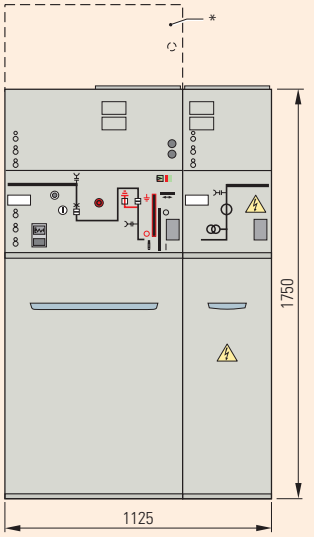
** Available mounting depth for low-voltage equipment
– Approx. 184 mm with cover
– Approx. 230 mm with extended frame cover

*** The cable connection height is reduced to approx. 380 mm for panel version with 4MA block-type current transformer

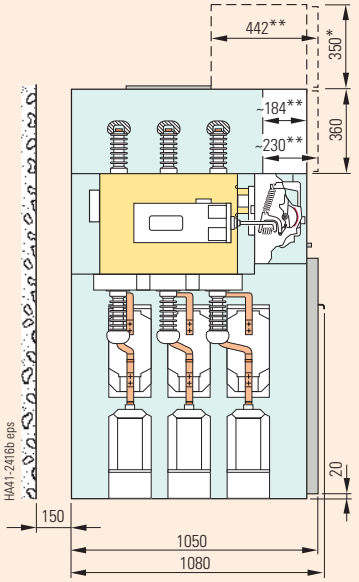
**Circuit-breaker panels**
**1250 A**
**with 3AH6** 1)

# Dimensions

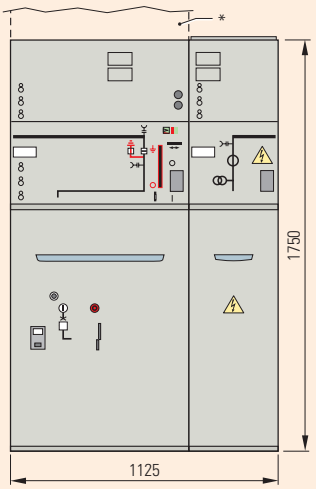
## Bus sectionalizer panels 630 A with bus riser panel



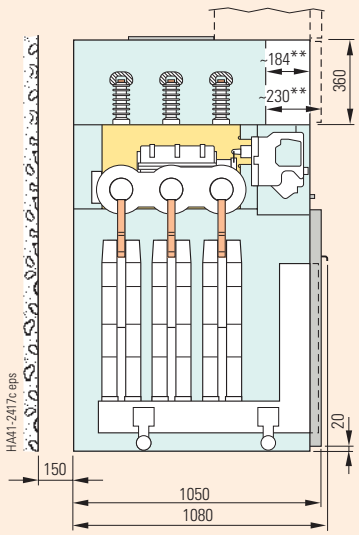

Type LT10 + type HF



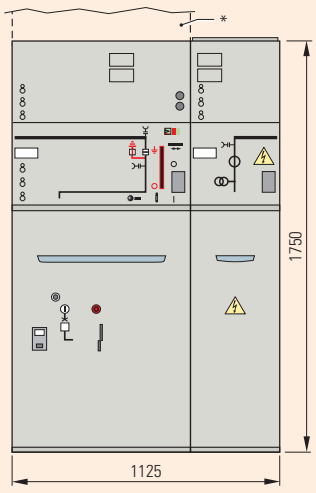

**Bus sectionalizer panel**
**630 A**
**with 3AH5** 1)



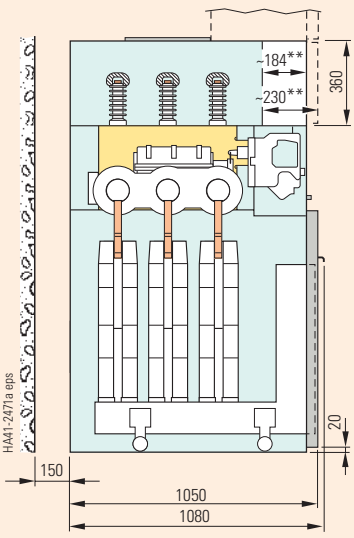

Type LT11 + type HF




**Bus sectionalizer panel**
**630 A**
**with 3AH6** 1)




Type LT31 + type HF



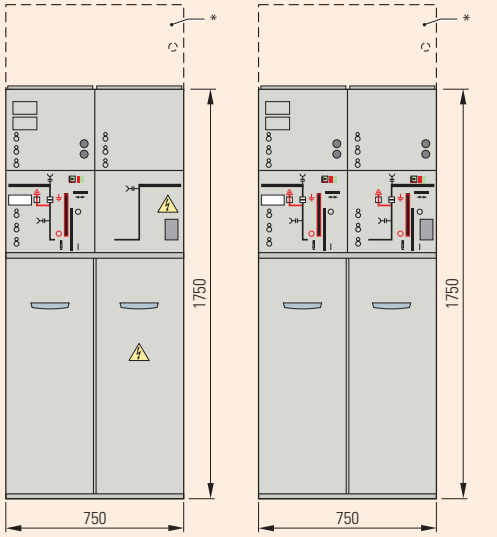

**Bus sectionalizer panel**
**1250 A**
**with 3AH6** 1)

1) Type designation of the vacuum circuit-breaker

* Option:
Low-voltage compartment available in two heights: 350 mm or 550 mm

** Available mounting depth for low-voltage equipment
– Approx. 184 mm with cover
– Approx. 230 mm with extended frame cover

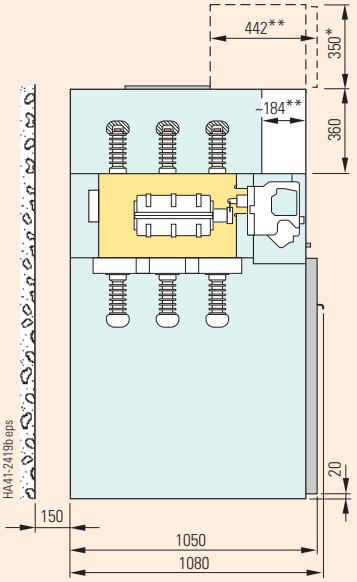
## Bus sectionalizer panels



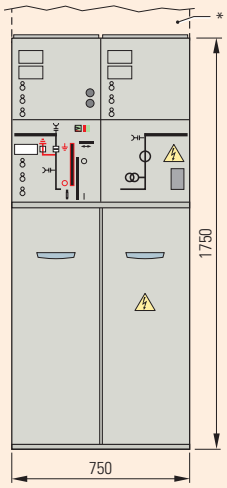

**Type LT2**
(≙ type RK-U with type HF)



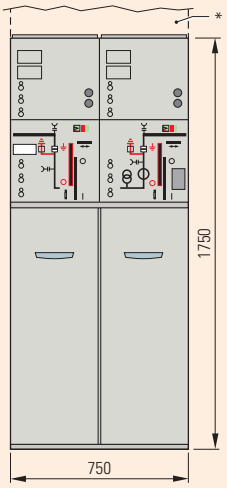

**Type LT22**
(≙ type RK-U with type RK-U)



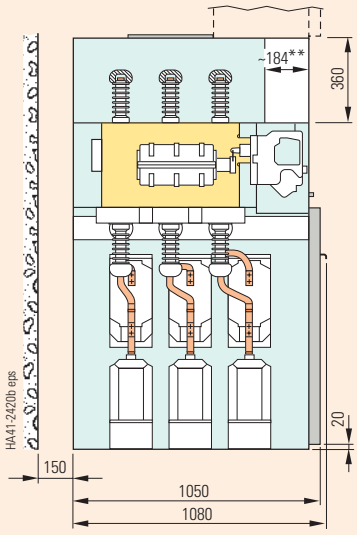

**Bus sectionalizer panels without transformers**




**Type LT2-W**




**Type LT22-W**



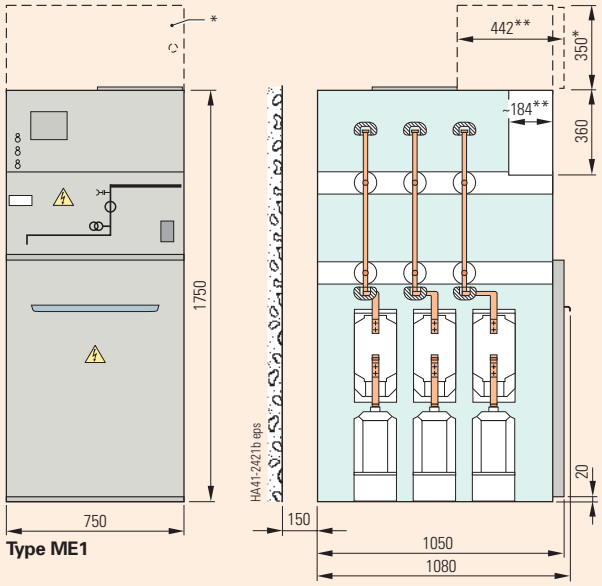

**Bus sectionalizer panels with transformers**

* Option:
Low-voltage compartment available in two heights: 350 mm or 550 mm

** Available mounting depth for low-voltage equipment

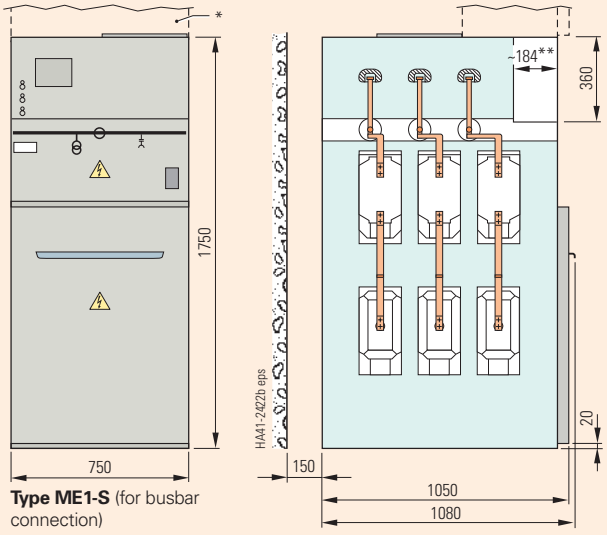
# Dimensions

## Billing metering panels

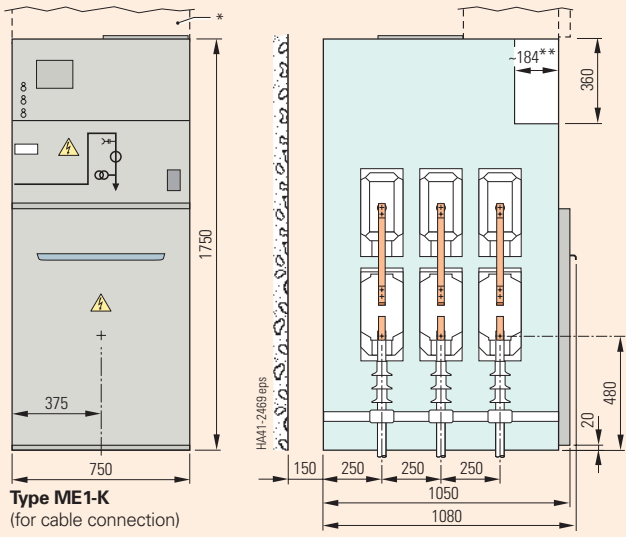



**Type ME1**

**Billing metering panel**
(standard)

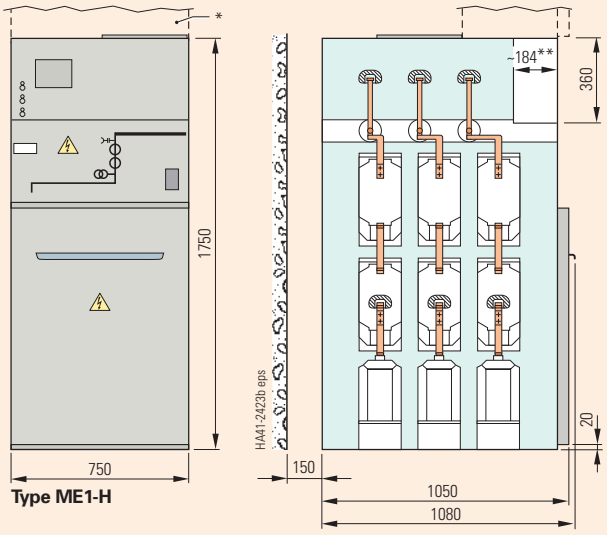



**Type ME1-S** (for busbar connection)




**Type ME1-K**
(for cable connection)

**Billing metering panels for busbar and cable connection**



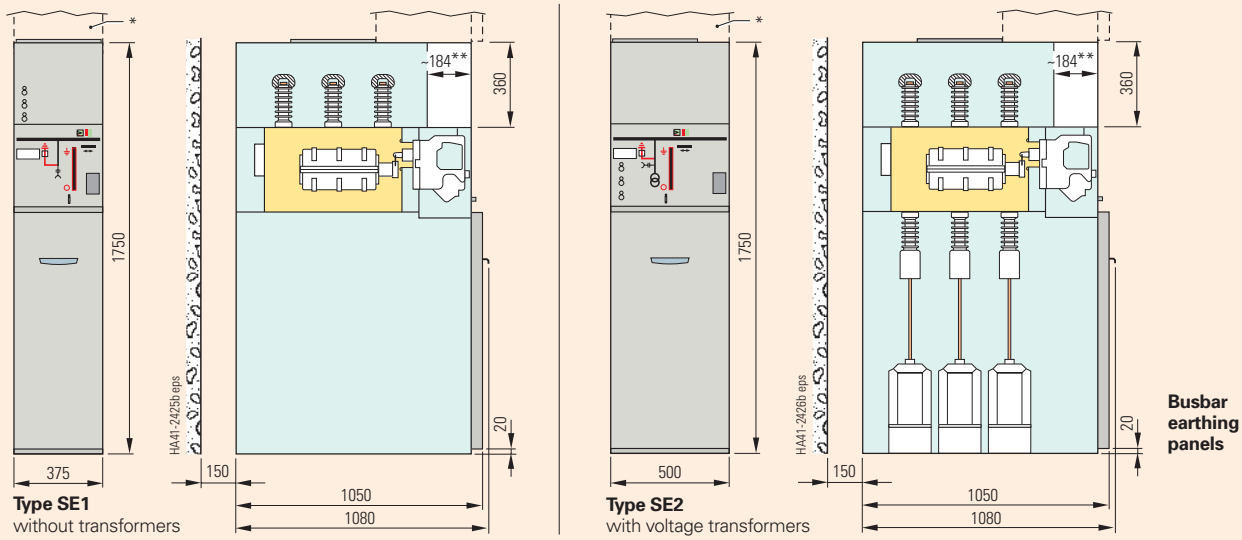

**Type ME1-H**

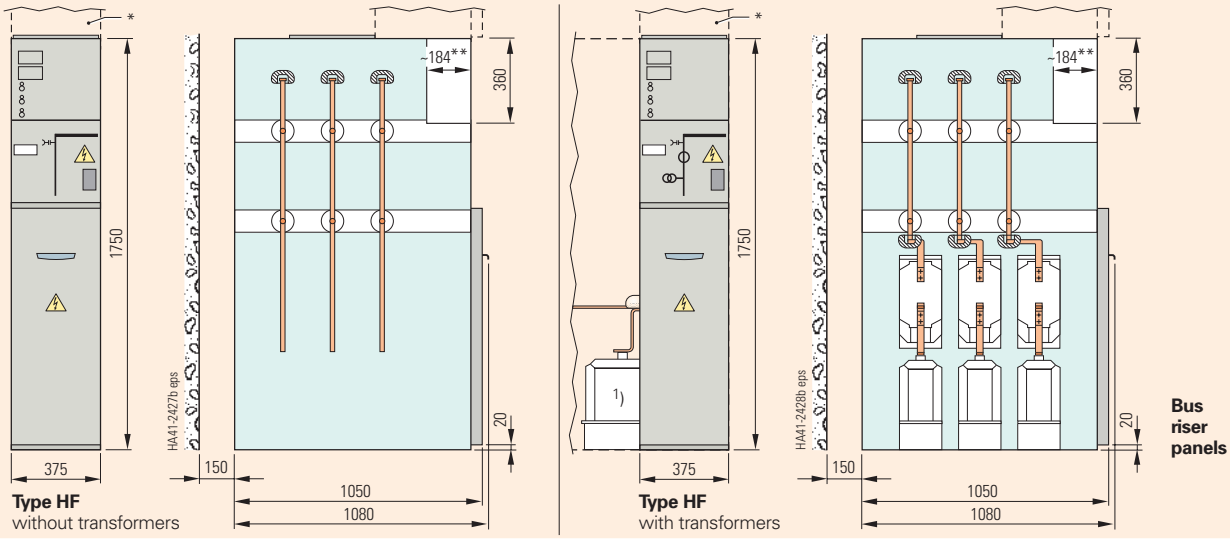
**Billing metering panel for 2nd current transformer set**

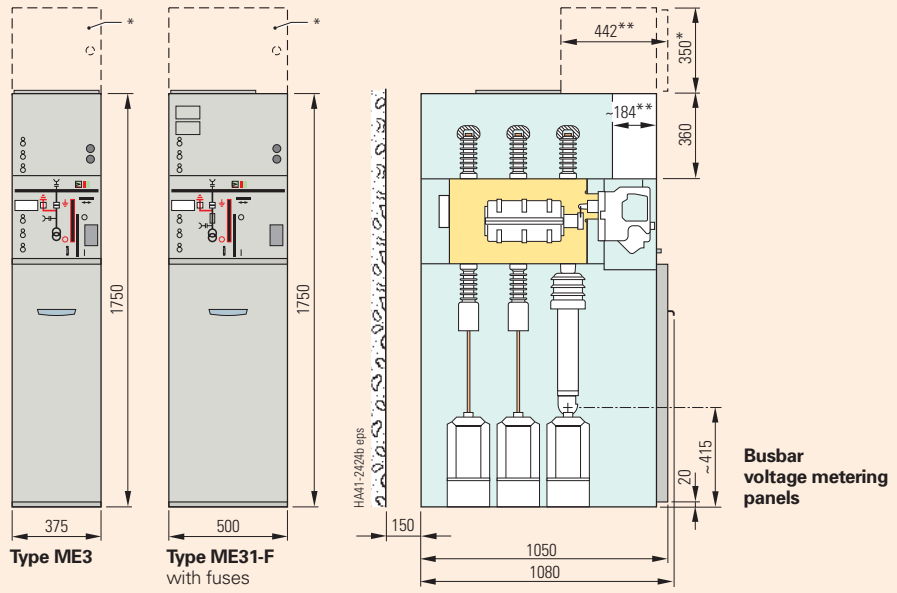
* Option:
Low-voltage compartment available in two heights: 350 mm or 550 mm

** Available mounting depth for low-voltage equipment

## Busbar voltage metering panels, busbar earthing panels, bus riser panels




1) Location of voltage transformer in left-hand panel

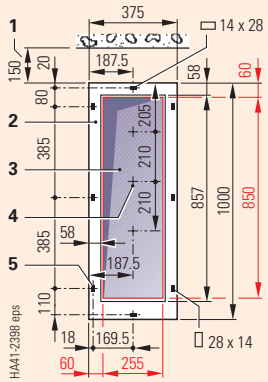
* Option:
Low-voltage compartment available in two heights: 350 mm or 550 mm

** Available mounting depth for low-voltage equipment

# Dimensions

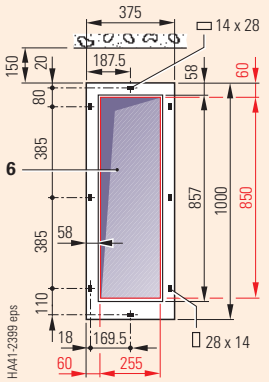
## Floor openings (dimensions in red) and fixing points

**For panel width 375 mm**




With cable connection

| For panel type |
|---|
| RK<br>K<br>K-E<br>TR |

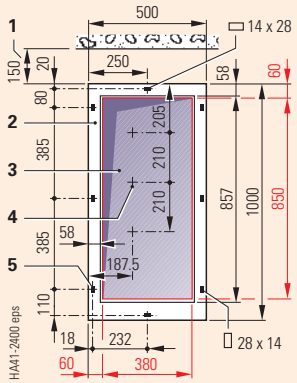



Without cable connection

| For panel type |
|---|
| RK-U<br>ME3<br>HF<br>SE1 |

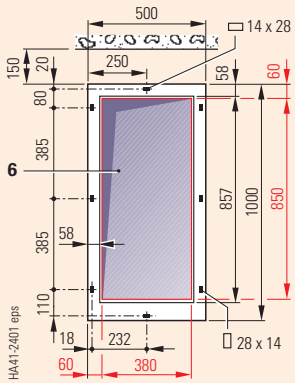
1 Wall distance
2 Fixing frame (base) of an individual panel or panel block
3 Floor opening for high-voltage cables and, where applicable, control cables; in panel types LS11, LS31 and LS31-K: floor opening also possible below floor cover
4 Position of the led-in cables for the feeder
5 Fixing points
6 Floor opening if required for panels without cable connection

**For panel width 500 mm**




With cable connection

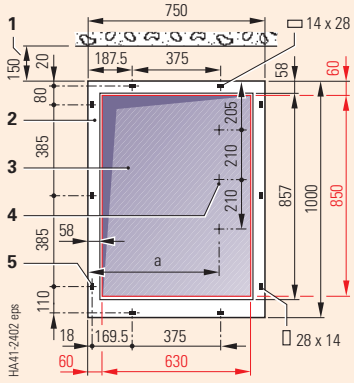
| For panel type |
|---|
| RK1<br>K1+<br>K1-E<br>TR1 |




Without cable connection

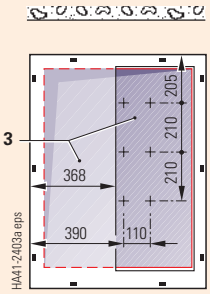
| For panel type |
|---|
| RK1-U<br>ME31-F<br>SE2 |

**For panel width 750 mm**




With cable connection

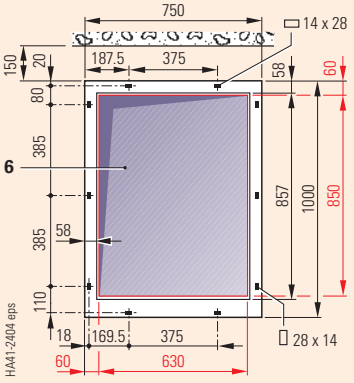
| For panel type |
|---|
| LS1<br>(Dim. a = 562.5) |
| ME1-K<br>(Dim. a = 375) |
| ME1-KS<br>(Dim. a = 375) |




For dimensions not shown see illustration on the left

With double cable connection

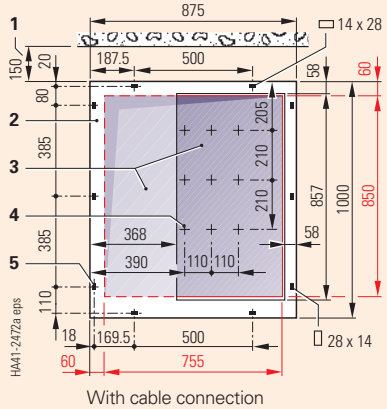
| For panel type |
|---|
| LS11 |
| LS31 |




Without cable connection

| For panel type |
|---|
| LS1-U<br>LS11-U<br>LT10<br>LT11<br>LT2<br>LT2-W<br>LT22<br>LT22-W<br>ME1<br>ME1-S<br>ME1-H |
| LS31-U<br>LT31 |

**For panel width 875 mm**




With cable connection

| For panel type |
|---|
| LS32 |

# Standards, specifications, guidelines

## Standards

The 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 Community, their national specifications conform to the IEC standard.

* In future, all standards for switching devices and switchgear will be summarized in IEC 62 271

** Withdrawn standard

**Overview of standards** (December 2002)

| | IEC standard | | | VDE standard | | EN standard |
|---|---|---|---|---|---|---|
| | up to now | current | in future | current | in future | current |
| Switchgear | IEC 60 694 * | IEC 60 694 * | IEC 62 271-1 | VDE 0670 Part 1000 | VDE 0671-001 | EN 60 694 |
| | IEC 60 298 * | IEC 60 298 * | IEC 62 271-200 | VDE 0670 Part 6 | VDE 0671-200 | EN 60 298 |
| Devices 1) | IEC 60 056 ** | IEC 62 271-100 | IEC 62 271-100 | VDE 0670 P. 101 to 106 | VDE 0671-100 | EN 60 056 |
| 2) | IEC 60 129 ** | IEC 62 271-102 | IEC 62 271-102 | VDE 0670 Part 2 | VDE 0671-102 | EN 60 129 |
| 3) | IEC 60 265-1 * | IEC 62 265-1 * | IEC 62 271-103 | VDE 0670 Part 301 | VDE 0671-103 | EN 60 265-1 |
| 4) | IEC 60 420 ** | IEC 62 271-105 | IEC 62 271-105 | VDE 0670 Part 303 | VDE 0671-105 | EN 60 420 |
| 5) | IEC 61 243-5 | IEC 61 243-5 | IEC 61 243-5 | VDE 0682 Part 415 | VDE 0682 Part 415 | EN 61 243-5 |
| 6) | IEC 60 282 | IEC 60 282 | IEC 60 282 | VDE 0670 Part 4 | VDE 0670 Part 4 | EN 60 282 |
| Degree of protection | IEC 60 529 | IEC 60 529 | IEC 60 529 | VDE 0470 Part 1 | VDE 0470 Part 1 | EN 60 529 |
| Insulation | IEC 60 071 | IEC 60 071 | IEC 60 071 | VDE 0111 | VDE 0111 | EN 60 071 |
| Current transformers | IEC 60 044-1 | IEC 60 044-1 | IEC 60 044-1 | VDE 0414 Part 1 | VDE 0414 Part 1 | EN 60 044-1 |
| Voltage transformers | IEC 60 044-2 | IEC 60 044-2 | IEC 60 044-2 | VDE 0414 Part 2 | VDE 0414 Part 2 | EN 60 044-2 |

1) Circuit-breaker
2) Disconnector and earthing switch
3) Switch-disconnector
4) Switch-disconnector / fuse combination
5) Voltage detection systems
6) HV HRC fuses

## Type of service location

SIMOSEC switchgear can be used as an indoor installation in accordance with IEC 61 936 (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.

## Terms

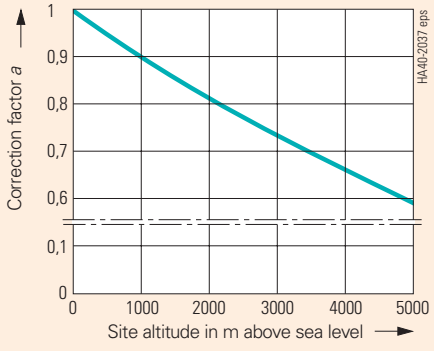
"Make-proof earthing switches" are earthing switches with short-circuit making capacity according to
– IEC 62 271-102
and
– VDE 0670 Part 2/ EN 60 129

## Table – Insulating capacity

| Rated voltage (rms value) | kV | **7.2** | **12** | **15** | **17.5** | **24** |
|---|---|---|---|---|---|---|
| Rated short-duration power-frequency withstand voltage (rms value) | | | | | | |
| – Across isolating distances | kV | 23 | 32 | 39 | 45 | 60 |
| – Between phases and to earth | kV | 20 | 28 | 36 | 38 | 50 |
| Rated lightning impulse withstand voltage (peak value) | | | | | | |
| – Across isolating distances | kV | 70 | 85 | 105 | 110 | 145 |
| – Between phases and to earth | kV | 60 | 75 | 95 | 95 | 125 |

## Correction factor *a* for the site altitude

For site altitudes above 1000 m, the adjacent correction factor *a* is recommended, depending on the actual site altitude above sea level.




Rated short-duration power-frequency withstand voltage to be selected

$$\geq \frac{\text{Rated short-dur. power-fre. withstand volt. (IEC 60 694 / VDE 0670 Part 1000)}}{1.1 \cdot a}$$

Rated lightning impulse withstand voltage to be selected

$$\geq \frac{\text{Rated lightning impulse withstand volt. (IEC 60 694 / VDE 0670 Part 1000)}}{1.1 \cdot a}$$

**Example:**

3000 m site altitude above sea level
17.5 kV switchgear rated voltage
95.0 kV rated lightning impulse withstand voltage

Rated lightning impulse withstand volt. to be selected $\frac{95\ \text{kV}}{1.1 \cdot 0.73} = 118\ \text{kV}$

*Result:*

According to the above table, a switchgear for a rated voltage of 24 kV is to be selected.

## Insulating capacity

- The insulating capacity is verified by testing the switchgear with rated values of short-duration power-frequency withstand voltage and lightning impulse withstand voltage according to IEC 60 694/ VDE 0670 Part 1000 (see table "Insulating capacity"
- The rated values are referred to sea level and to normal atmospheric conditions (1013 hPa, 20 °C, 11 g/m$^3$ humidity in accordance with IEC 60 071 and VDE 0111).
- The insulating capacity 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 insulating capacity of insulation in air decreases due to the decreasing air density.

For SIMOSEC switchgear the decreasing insulating capacity must be taken into account for site altitudes above 1000 m (above sea level), see also IEC 60 694/VDE 0670 Part 1000.

# 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 for rated voltages up to 24 kV can be subjected to cable tests at a max. DC test voltage of 96 kV (when switchgear is new) or 70 kV. The voltage at the busbar may be 24 kV in this case.

Test voltages:

| Rated voltage | Max. test voltage applied to cable | | |
|---|---|---|---|
| | 0.1 Hz | acc. to IEC | Standard in many companies |
| | AC | DC | DC |
| kV | kV | kV | kV |
| **12** | 19 | 24 | 48 |
| **24** | 38 | 48 | 70 |

For cable testing, the installation and operating instructions applicable to SIMOSEC switchgear and the standards IEC 60 298 / VDE 0670 Part 6 – Section 5.107 * must be observed.

### Tests for resistance to internal arc faults

- Safety of operating personnel ensured by tests to verify resistance to internal arc faults
- Internal arc tests in accordance with IEC 60 298 / VDE 0670 Part 6 * by agreement between operator and manufacturer
- Internal arc tests performed in accordance with IEC 60 298, Appendix AA / VDE 0670 Part 6, Appendix AA *
- The possibility of arc faults in SIMOSEC switchgear is much less due to:
  - Metal-enclosed and gas-insulated switching functions (e.g. of three-position switch-disconnector and 3AH5 vacuum circuit-breaker)
  - Logical arrangement of operating mechanism elements and mechanical interlocks
  - Short-circuit-proof feeder earthing by means of the three-position switch-disconnector
- Definitions of criteria:
  - Criterion 1
    Correctly secured doors, shutters etc. must not open
  - Criterion 2
    Parts of enclosed switchgear which may cause a hazard must not fly off
  - Criterion 3
    No holes in the freely accessible external parts of the enclosure as the result of burning in or tearing open
  - Criterion 4
    Vertically arranged indicators must not ignite
  - Criterion 5
    Horizontally arranged indicators must not ignite
  - Criterion 6
    The effectiveness of the earth connection must not be detrimentally influenced

In the event of an arc fault at the cable connection, pressure relief is effected to the rear and upwards.

For free-standing switchgear a pressure-relief duct fitted at the rear is optionally available up to 20 kA.

### Climate and ambient conditions

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

- Ambient conditions
  - Natural foreign materials
  - Chemically active pollutants
  - Small animals
- Climate classes
  The climate classes are classified according to IEC 60 721-3-3

SIMOSEC switchgear is largely insensitive to climate and ambient conditions by virtue of the following features:

- No cross insulation for isolating distances between phases
- Metal enclosure of switching devices (e.g. three-position switch) in gas-filled stainless-steel switchgear 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

* Standards see page 41

## Standards, specifications, guidelines

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

SIMOSEC switchgear fulfills acc. to the standards *

| | |
|---|---|
| IEC 60 694 | VDE 0670 Part 1000<br>EN 60 694 |
| IEC 60 298 | VDE 0670 Part 6 |
| IEC 60 529 | EN 60 529 |

the following degrees of protection **:

| Degree of protection | Type of protection |
|---|---|
| IP 2X (standard) | Enclosure of live parts under high-voltage |
| | Compartments |
| IP 3X (option) | Enclosure of live parts under high-voltage in switchgear with locking device |
| IP 3XD (on request) | Enclosure of live parts under high-voltage in switchgear with locking device |
| IP 65 | Metal enclosure of gas-filled switchgear vessels |

Type of installation:
Wall-standing arrangement

IEC 60 529 and EN 60 529:

| Type of protection | Degree of protection |
|---|---|

**IP 2X**

**Protection against solid foreign bodies**
Protected against the penetration of solid foreign bodies, diameter ≥ 12.5 mm

**Protection against electric shock**
Protected against access to dangerous parts by means of a finger (the distance between a test finger with a diameter of 12 mm to dangerous parts must be sufficient)

**Protection against the ingress of water**
No definition

**IP 3X**

**Protection against solid foreign bodies**
Protected against the penetration of solid foreign bodies, diameter ≥ 2.5 mm

**Protection against electric shock**
Protected against access to dangerous parts by means of a wire (the distance between a test rod with a diameter of 2.5 mm and a length of 100 mm to dangerous parts must be sufficient)

**Protection against the ingress of water**
No definition

**IP 3XD**

**Protection against solid foreign bodies**
Protected against the penetration of solid foreign bodies, diameter ≥ 2.5 mm

**Protection against the ingress of water**
No definition

**Protection against electric shock**
Protected against access to dangerous parts by means of a wire (the distance between a test rod with a diameter of 1 mm and a length of 100 mm to dangerous parts must be sufficient)

**IP 65**

**Protection against solid foreign bodies**
Dust-proof: no penetration of dust

**Protection against electric shock**
Protected against access to dangerous parts by means of a wire (test probe with a diameter of 1 mm may not penetrate)

**Protection against the ingress of water**
Protected against water jets, water which is directed towards the enclosure from any direction may not have a damaging effect

* Standards see page 41

** For explanations see adjacent table

### Notes

If not stated otherwise on the individual pages of this catalog, we reserve the right to include modifications, especially regarding the stated values, dimensions and weights.

Drawings are not binding.

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