



Catalog  
HA 41.43 •  
2022

MEDIUM-VOLTAGE SWITCHGEAR

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

[siemens.com/SIMOSEC](https://www.siemens.com/SIMOSEC)

**SIEMENS**

# Application

Typical uses



Transfer switchgear with integrated low-voltage niche



Utilities transfer substation for industrial plants



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

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

# Application, requirements

## Features

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

### Typical uses

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

The modular, space saving design enables application in

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

### Typical applications

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

### Modular design

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

### Reliability

- Type- and routine-tested \*
- Reduced dielectric stress thanks to stainless steel switching-device vessel
- Standardized and manufactured using numerically controlled machines
- Quality management system according to DIN EN ISO 9001
- More than 100,000 switchgear components in operation worldwide for many years.

### Personal safety

- All switching operations can be performed with closed panel front
- Metal-enclosed LSC 1 / LSC 2 panels
- HV HRC fuses and cable sealing ends are only accessible when the outgoing feeders are earthed
- Logical interlocks
- Capacitive voltage detecting system to verify safe isolation from supply
- Earthing of outgoing feeders by means of make-proof earthing switches.

### Compact design

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

Thus:

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

### Security of operation

- Components, e.g. operating mechanisms, three-position switches and vacuum circuit-breakers proven for years
- LSC 1 / LSC 2 panels:
  - Panels with metal partition (metal-clad) between busbar and switching device as well as between switching device and cable compartment (R, T, L)
  - Panels with metal partition between switching device and busbar compartment
- Metal-enclosed switching-device vessel with three-position switch, gas-insulated
  - Welded switching-device vessel, sealed-for-life
  - With welded-in rotary bushings for operation
  - Three-position switch-disconnector with gas-insulated switching functions
  - Three-position disconnector, gas-insulated
  - Switching functions CLOSE-OPEN-EARTH
- Operating mechanisms of switching devices accessible outside the switching-device vessel
- Maintenance-free operating mechanism parts (IEC 62271-1 \*)
- Mechanical position indication integrated in mimic diagram
- Switchgear interlocking system with logical interlocks.

### Re-availability

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

\* For standards, see page 6

## Cost-efficiency

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

- Minimum space requirements
- Easy switchgear extension, without gas work
- Maintenance-free gas-insulated switching functions of the three-position switch (gas-insulated quenching principle)
- Modular product range and design, e.g. circuit-breaker panels
- Low maintenance.

## Quality and environment

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

## Service life

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

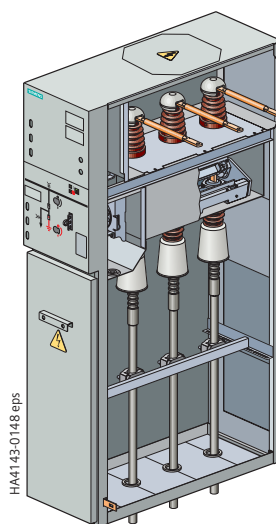
- For circuit-breakers, according to the endurance class defined in IEC 62271-100
- For three-position disconnectors and earthing switches, according to the endurance class defined in IEC 62271-102
- For three-position switch-disconnectors, according to the endurance class defined in IEC 62271-103.

## Insulating system

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

## General design

- Air-insulated indoor switchgear
- Gas-insulated, maintenance-free switching functions for the three-position switch as switch-disconnector
- Three-pole primary enclosure
- Phases arranged one behind the other
- Three-position switch, metal-enclosed, with air-insulated primary terminals and gas-insulated switching functions
- Vacuum circuit-breaker up to 1250 A, metal-enclosed, fixed-mounted in gas-insulated switching-device vessel or as removable design: easy to remove after loosening the fixing bolts
- Hermetically welded, stainless-steel switching-device vessels
  - for switching devices
  - with insulating gas SF<sub>6</sub> (fluorinated greenhouse gas)
- Factory-assembled, type-tested
- Metal-enclosed, with metal partitions
- Pressure relief
  - to the rear and upwards
  - separately for each compartment.



| Compartments            | Insulation      |
|-------------------------|-----------------|
| Busbar                  | Air             |
| Switching-device vessel | SF <sub>6</sub> |
| Cable connection        | Air             |

# Application, requirements

Features, classification, standards

## Electrical features

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

The rated continuous currents apply to ambient air temperatures of max. 40 °C. The 24-hour mean value is max. 35 °C (according to IEC 62271-1).

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

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

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

## Standards

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

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

| Overview of standards          |                                                          |               |              |
|--------------------------------|----------------------------------------------------------|---------------|--------------|
|                                |                                                          | IEC standard  | EN standard  |
| Switchgear                     | SIMOSEC                                                  | IEC 62271-1   | EN 62271-1   |
|                                |                                                          | IEC 62271-200 | EN 62271-200 |
| Devices                        | Circuit-breakers                                         | IEC 62271-100 | EN 62271-100 |
|                                | Disconnectors and earthing switches                      | IEC 62271-102 | EN 62271-102 |
|                                | Switch-disconnectors                                     | IEC 62271-103 | EN 62271-103 |
|                                | Switch-disconnector/fuse combination                     | IEC 62271-105 | EN 62271-105 |
|                                | HV HRC fuses                                             | IEC 60282-1   | EN 60282-1   |
|                                | Voltage detecting systems                                | IEC 61243-5   | EN 61243-5   |
|                                | Voltage presence indicating systems                      | IEC 62271-206 | EN 62271-206 |
| Degree of protection           | IP code                                                  | IEC 60529     | EN 60529     |
|                                | IK code                                                  | IEC 62262     | EN 50102     |
| Insulation                     | –                                                        | IEC 60071     | EN 60071     |
| Instrument transformers        | General requirements                                     | IEC 61869-1   | EN 61869-1   |
|                                | Current transformers                                     | IEC 61869-2   | EN 61869-2   |
|                                | Voltage transformers                                     | IEC 61869-3   | EN 61869-3   |
| Power installations            | Common rules                                             | IEC 61936-1   | EN 61936-1   |
|                                | Earthing of power installations                          | –             | EN 50522     |
| Insulating gas SF <sub>6</sub> | Specification for sulfur hexafluoride (SF <sub>6</sub> ) | IEC 60376     | EN 60376     |

| Common electrical data                                                                                                           |                                          |                                                             |                                     |          |            |      |        |      |      |      |     |    |    |
|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|-------------------------------------------------------------|-------------------------------------|----------|------------|------|--------|------|------|------|-----|----|----|
| Rated insulation level                                                                                                           |                                          | Rated voltage $U_r$                                         |                                     | kV       | 7.2        |      | 12     |      | 17.5 |      | 24  |    |    |
|                                                                                                                                  |                                          | Rated short-dur. power-frequency withstand voltage $U_d$    |                                     |          |            |      |        |      |      |      |     |    |    |
|                                                                                                                                  |                                          | – phase-to-phase, phase-to-earth, open contact gap          |                                     | kV       | 20         |      | 28, 42 |      | 38   |      | 50  |    |    |
|                                                                                                                                  |                                          | – across the isolating distance                             |                                     | kV       | 23         |      | 32, 48 |      | 45   |      | 60  |    |    |
|                                                                                                                                  |                                          | Rated lightning impulse withstand voltage $U_p$             |                                     |          |            |      |        |      |      |      |     |    |    |
|                                                                                                                                  |                                          | – phase-to-phase, phase-to-earth, open contact gap          |                                     | kV       | 60         |      | 75     |      | 95   |      | 125 |    |    |
|                                                                                                                                  |                                          | – across the isolating distance                             |                                     | kV       | 70         |      | 85     |      | 110  |      | 145 |    |    |
| Rated frequency $f_r$                                                                                                            |                                          |                                                             |                                     | Hz       | 50/60      |      |        |      |      |      |     |    |    |
| Rated continuous current $I_r$ for busbar                                                                                        |                                          | Standard                                                    |                                     | A        | 630        |      |        |      |      |      |     |    |    |
|                                                                                                                                  |                                          | Option                                                      |                                     | A        | 800, 1250  |      |        |      |      |      |     |    |    |
| 50 Hz                                                                                                                            | Rated short-time withstand current $I_k$ | for rated duration of short-circuit $t_k = 1$ s, 2 s        |                                     | up to kA | 21         | 25   | 21     | 25   | 21   | 25   | 16  | 20 | 25 |
|                                                                                                                                  |                                          | for rated duration of short-circuit $t_k = 3$ s (20 kA/4 s) |                                     | up to kA | 21         | –    | 21     | –    | 21   | –    | 16  | 20 | –  |
|                                                                                                                                  | Rated peak withstand current $I_p$       |                                                             |                                     |          | up to kA   | 52.5 | 63     | 52.5 | 63   | 52.5 | 63  | 40 | 50 |
| 60 Hz                                                                                                                            | Rated short-time withstand current $I_k$ | for rated duration of short-circuit $t_k = 1$ s, 2 s        |                                     | up to kA | 21         | 25   | 21     | 25   | 21   | 25   | 16  | 20 | 25 |
|                                                                                                                                  |                                          | for rated duration of short-circuit $t_k = 3$ s             |                                     | up to kA | 21         | –    | 21     | –    | 21   | –    | 16  | 20 | –  |
|                                                                                                                                  | Rated peak withstand current $I_p$       |                                                             |                                     |          | up to kA   | 55   | 65     | 55   | 65   | 55   | 65  | 42 | 52 |
| Pressure values, temperature                                                                                                     |                                          |                                                             |                                     |          |            |      |        |      |      |      |     |    |    |
| Pressure in gas-insulated switching-device vessel for SF <sub>6</sub> gas-insulated switching devices (pressure values at 20 °C) |                                          | Rated filling level for insulation $p_{re}$ (absolute)      |                                     | kPa      | 140        |      |        |      |      |      |     |    |    |
|                                                                                                                                  |                                          | Minimum functional level for insulation $p_{me}$ (absolute) |                                     | kPa      | 120        |      |        |      |      |      |     |    |    |
|                                                                                                                                  |                                          | Signal of filling level for insulation $p_{ae}$ (absolute)  |                                     | kPa      | 120        |      |        |      |      |      |     |    |    |
|                                                                                                                                  |                                          | Minimum functional level for switching $p_{sw}$ (absolute)  |                                     | kPa      | 120        |      |        |      |      |      |     |    |    |
| Ambient air temperature T (minimum/maximum ambient air temperature depends on the secondary equipment used)                      |                                          | Operation                                                   | Standard                            | °C       | –5 to +55  |      |        |      |      |      |     |    |    |
|                                                                                                                                  |                                          |                                                             | Option (if panel heating available) | °C       | –25        |      |        |      |      |      |     |    |    |
|                                                                                                                                  |                                          | Storage/transport                                           | Standard                            | °C       | –5 to +55  |      |        |      |      |      |     |    |    |
|                                                                                                                                  |                                          |                                                             | Option                              | °C       | –25, +70   |      |        |      |      |      |     |    |    |
|                                                                                                                                  |                                          |                                                             | Option                              | °C       | –40        |      |        |      |      |      |     |    |    |
|                                                                                                                                  |                                          |                                                             |                                     | °C       |            |      |        |      |      |      |     |    |    |
| Degree of protection                                                                                                             |                                          | for gas-filled switching-device vessel                      |                                     |          | IP65       |      |        |      |      |      |     |    |    |
|                                                                                                                                  |                                          | for switchgear enclosure                                    |                                     |          | IP2X/IP3X  |      |        |      |      |      |     |    |    |
|                                                                                                                                  |                                          | for low-voltage compartment                                 |                                     |          | IP3X/ IP4X |      |        |      |      |      |     |    |    |

# Technical data

Electrical data of the switchgear

| Common electrical data of the switchgear panels                                                                                   |                                               |                                                                            |                                      |          |      |      |      |      |      |    |    |    |    |
|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|----------------------------------------------------------------------------|--------------------------------------|----------|------|------|------|------|------|----|----|----|----|
| Rated insulation level                                                                                                            |                                               | Rated voltage $U_r$                                                        | kV                                   | 7.2      | 12   | 17.5 | 24   |      |      |    |    |    |    |
| Ring-main panel types R, R1, R(T), R1(T), cable panel types K and K1, disconnecter panel types D1, D1(T)                          |                                               |                                                                            |                                      |          |      |      |      |      |      |    |    |    |    |
| Rated continuous current $I_r$                                                                                                    |                                               | Standard                                                                   | A                                    | 630      |      |      |      |      |      |    | →  |    |    |
|                                                                                                                                   |                                               | D1, D1(T), K1                                                              | A                                    | 1250     |      |      |      |      |      |    | →  |    |    |
| 50 Hz                                                                                                                             | Rated short-time withstand current $I_k$      | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}$       | up to kA                             | 21       | 25   | 21   | 25   | 21   | 25   | 16 | 20 | 25 |    |
|                                                                                                                                   |                                               | for rated duration of short-circuit $t_k = 3 \text{ s}$ (4 s)              | up to kA                             | 21       | –    | 21   | –    | 21   | –    | 16 | 20 | –  |    |
|                                                                                                                                   | Rated peak withstand current $I_p$            |                                                                            | up to kA                             | 52.5     | 63   | 52.5 | 63   | 52.5 | 63   | 40 | 50 | 63 |    |
|                                                                                                                                   | Rated short-circuit making current $I_{ma}$   |                                                                            | for ring-main feeders                | up to kA | 52.5 | 63   | 52.5 | 63   | 52.5 | 63 | 40 | 50 | 63 |
| 60 Hz                                                                                                                             | Rated short-time withstand current $I_k$      | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}$       | up to kA                             | 21       | 25   | 21   | 25   | 21   | 25   | 16 | 20 | 25 |    |
|                                                                                                                                   |                                               | for rated duration of short-circuit $t_k = 3 \text{ s}$                    | up to kA                             | 21       | –    | 21   | –    | 21   | –    | 16 | 20 | –  |    |
|                                                                                                                                   | Rated peak withstand current $I_p$            |                                                                            | up to kA                             | 55       | 65   | 55   | 65   | 55   | 65   | 42 | 52 | 65 |    |
|                                                                                                                                   | Rated short-circuit making current $I_{ma}$   |                                                                            | for ring-main feeders                | up to kA | 55   | 65   | 55   | 65   | 55   | 65 | 42 | 52 | 65 |
| Circuit-breaker panel types L, L1, L(T), L1(T), L1(r), L1(r, T), metering panel types M, bus riser panel types H, H1              |                                               |                                                                            |                                      |          |      |      |      |      |      |    |    |    |    |
| Rated continuous current $I_r$                                                                                                    |                                               | L, L(T), L1, L1(T), L1(r), L1(r, T), M, M(-K), M(-B), M(-BK), M(KK), H, H1 | A                                    | 630      |      |      |      |      |      |    | →  |    |    |
|                                                                                                                                   |                                               | L1, L1(T), L2(r), L2(r, T), M, M(-K), M(-B), M(-BK), H, H1                 | A                                    | 1250     |      |      |      |      |      |    | →  |    |    |
| 50 Hz                                                                                                                             | Rated short-time withstand current $I_k$      | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}$       | up to kA                             | 21       | 25   | 21   | 25   | 21   | 25   | 16 | 20 | 25 |    |
|                                                                                                                                   |                                               | for rated duration of short-circuit $t_k = 3 \text{ s}, 4 \text{ s}$       | up to kA                             | 21       | –    | 21   | –    | 21   | –    | 16 | 20 | –  |    |
|                                                                                                                                   | Rated peak withstand current $I_p$            |                                                                            | up to kA                             | 52.5     | 63   | 52.5 | 63   | 52.5 | 63   | 40 | 50 | 63 |    |
|                                                                                                                                   | Rated short-circuit making current $I_{ma}$   |                                                                            | for circuit-breaker panel L, L1..... | up to kA | 52.5 | 63   | 52.5 | 63   | 52.5 | 63 | 40 | 50 | 63 |
| 60 Hz                                                                                                                             | Rated short-circuit breaking current $I_{sc}$ |                                                                            | for circuit-breaker panel L, L1..... | up to kA | 21   | 25   | 21   | 25   | 21   | 25 | 16 | 20 | 25 |
|                                                                                                                                   | Rated short-time withstand current $I_k$      | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}$       | up to kA                             | 21       | 25   | 21   | 25   | 21   | 25   | 16 | 20 | 25 |    |
|                                                                                                                                   |                                               | for rated duration of short-circuit $t_k = 3 \text{ s}$                    | up to kA                             | 21       | –    | 21   | –    | 21   | –    | 16 | 20 | –  |    |
|                                                                                                                                   | Rated peak withstand current $I_p$            |                                                                            | up to kA                             | 55       | 65   | 55   | 65   | 55   | 65   | 42 | 52 | 65 |    |
|                                                                                                                                   | Rated short-circuit making current $I_{ma}$   |                                                                            | for circuit-breaker panel L, L1..... | up to kA | 55   | 65   | 55   | 65   | 55   | 65 | 42 | 52 | 65 |
| Rated short-circuit breaking current $I_{sc}$                                                                                     |                                               | for circuit-breaker panel L, L1.....                                       | up to kA                             | 21       | 25   | 21   | 25   | 21   | 25   | 16 | 20 | 25 |    |
| Busbar voltage metering panel types M(VT), M1(VT), M(VT-F), M1(VT-F), transformer panel types T, T1, busbar earthing panel type E |                                               |                                                                            |                                      |          |      |      |      |      |      |    |    |    |    |
| Rated continuous current $I_r$                                                                                                    |                                               | Standard (except busbar earthing panel type E)                             | A                                    | 200      |      |      |      |      |      |    | →  |    |    |
| 50 Hz                                                                                                                             | Rated short-time withstand current $I_k$      | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}$       | up to kA                             | 21       | 25   | 21   | 25   | 21   | 25   | 16 | 20 | 25 |    |
|                                                                                                                                   |                                               | for rated duration of short-circuit $t_k = 3 \text{ s}, 4 \text{ s}$       | up to kA                             | 21       | –    | 21   | –    | 21   | –    | 16 | 20 | –  |    |
|                                                                                                                                   | Rated peak withstand current $I_p$            |                                                                            | up to kA                             | 52.5     | 63   | 52.5 | 63   | 52.5 | 63   | 40 | 50 | 63 |    |
| 60 Hz                                                                                                                             | Rated short-time withstand current $I_k$      | for rated duration of short-circuit $t_k = 1 \text{ s}, 2 \text{ s}$       | up to kA                             | 21       | 25   | 21   | 25   | 21   | 25   | 16 | 20 | 25 |    |
|                                                                                                                                   |                                               | for rated duration of short-circuit $t_k = 3 \text{ s}, 4 \text{ s}$       | up to kA                             | 21       | –    | 21   | –    | 21   | –    | 16 | 20 | –  |    |
|                                                                                                                                   | Rated peak withstand current $I_p$            |                                                                            | up to kA                             | 55       | 65   | 55   | 65   | 55   | 65   | 42 | 52 | 65 |    |

### Switch-disconnector/fuse combination

| Switch-disconnector/fuse combination according to IEC/EN 62271-105                                       |       |     |                   |      |      |      |   |  |   |
|----------------------------------------------------------------------------------------------------------|-------|-----|-------------------|------|------|------|---|--|---|
| Rated voltage $U_r$                                                                                      |       | kV  | 7.2               | 12   | 17.5 | 24   |   |  |   |
| Rated continuous current $I_r$                                                                           |       | A   | 200 <sup>1)</sup> |      |      |      |   |  | → |
| Rated transfer current $I_{transfer}$                                                                    |       | A   | 1750              | 1750 | 1500 | 1400 |   |  |   |
| Maximum transformer rating                                                                               |       | kVA | 800               | 1600 | 1600 | 2500 |   |  |   |
| Switching capacity for make-proof earthing switch, arranged on feeder side, downstream from HV HRC fuses |       |     |                   |      |      |      |   |  |   |
| Rated short-time withstand current $t_k = 1$ s                                                           |       | kA  | 2                 |      |      |      | → |  |   |
| Rated short-circuit making current $I_{ma}$                                                              | 50 Hz | kA  | 5                 |      |      |      | → |  |   |
|                                                                                                          | 60 Hz | kA  | 5.2               |      |      |      | → |  |   |

### Make-proof earthing switch (air-insulated, arrangement on the cable feeder) [e.g. for circuit-breaker panel types L1(r), L2(r)]

| Technical data      |                                             |                                                 |          |    |      |    |    |    |    |
|---------------------|---------------------------------------------|-------------------------------------------------|----------|----|------|----|----|----|----|
| Rated voltage $U_r$ |                                             | kV                                              | 7.2      | 12 | 17.5 | 24 |    |    |    |
| 50 Hz               | Rated short-time withstand current $I_k$    | for rated duration of short-circuit $t_k = 1$ s | up to kA | 20 | 25   | 20 | 25 | 20 | 25 |
|                     |                                             | for rated duration of short-circuit $t_k = 3$ s | up to kA | 20 | –    | 20 | –  | 20 | –  |
|                     | Rated short-circuit making current $I_{ma}$ |                                                 | up to kA | 50 | 63   | 50 | 63 | 40 | 50 |
|                     | Rated peak withstand current $I_p$          |                                                 | up to kA | 50 | 63   | 50 | 63 | 40 | 50 |
| 60 Hz               | Rated short-time withstand current $I_k$    | for rated duration of short-circuit $t_k = 1$ s | up to kA | 20 | 25   | 20 | 25 | 16 | 20 |
|                     |                                             | for rated duration of short-circuit $t_k = 3$ s | up to kA | 20 | –    | 20 | –  | –  | 20 |
|                     | Rated short-circuit making current $I_{ma}$ |                                                 | up to kA | 52 | 65   | 52 | 65 | 42 | 52 |
|                     | Rated peak withstand current $I_p$          |                                                 | up to kA | 52 | 65   | 52 | 65 | 42 | 52 |

### Number of operating cycles, classification

| Three-position switch-disconnector, with functions: load breaking (CLOSE-OPEN) and earthing (EARTH)   |                                                         |                                |     |                   |      |    |  |  |  |
|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------|--------------------------------|-----|-------------------|------|----|--|--|--|
| Rated voltage $U_r$                                                                                   |                                                         | kV                             | 7.2 | 12                | 17.5 | 24 |  |  |  |
| General-purpose switches according to IEC/EN 62271-103                                                | Number of mechanical operating cycles                   |                                | n   | 1000              |      |    |  |  |  |
|                                                                                                       |                                                         |                                | n   | 2000 (on request) |      |    |  |  |  |
|                                                                                                       | Classification                                          | Mechanical endurance           |     | M1                |      |    |  |  |  |
|                                                                                                       | Number of electrical operating cycles with $I_{load}$   |                                | n   | 100               |      |    |  |  |  |
|                                                                                                       | Classification                                          | Electrical endurance           |     | E3                |      |    |  |  |  |
|                                                                                                       | Number of short-circuit making operations with $I_{ma}$ |                                | n   | 5                 |      |    |  |  |  |
| Disconnectors according to IEC/EN 62271-102                                                           |                                                         |                                |     | E3                |      |    |  |  |  |
|                                                                                                       | Classification                                          | Capacitive switching operation |     | C2                |      |    |  |  |  |
|                                                                                                       | Number of mechanical operating cycles                   |                                | n   | 1000              |      |    |  |  |  |
|                                                                                                       | Classification                                          | Mechanical endurance           |     | M0                |      |    |  |  |  |
| Earthing switches according to IEC/EN 62271-102                                                       |                                                         |                                | n   | 2000 (on request) |      |    |  |  |  |
|                                                                                                       | Classification                                          | Mechanical endurance           |     | M1                |      |    |  |  |  |
|                                                                                                       | Number of mechanical operating cycles                   |                                | n   | 1000              |      |    |  |  |  |
|                                                                                                       | Classification                                          | Mechanical endurance           |     | M0                |      |    |  |  |  |
| Earthing switches, arranged on feeder side, downstream from HV HRC fuses, for typical: T, T1, M(VT-F) | Number of short-circuit making operations with $I_{ma}$ |                                | n   | 5                 |      |    |  |  |  |
|                                                                                                       | Classification                                          | Electrical endurance           |     | E2                |      |    |  |  |  |
|                                                                                                       | Number of short-circuit making operations with $I_{ma}$ |                                | n   | 5                 |      |    |  |  |  |
|                                                                                                       | Classification                                          | Electrical endurance           |     | E1                |      |    |  |  |  |
| Earthing switches, arranged on feeder side, downstream from HV HRC fuses, for typical: T, T1, M(VT-F) | Number of mechanical operating cycles                   |                                | n   | 1000              |      |    |  |  |  |
|                                                                                                       | Classification                                          | Mechanical endurance           |     | M0                |      |    |  |  |  |

1) Depending on HV HRC fuse-link (depending on the let-through current of the HV HRC fuse-link)

# Technical data

Technical data, switching capacity and classification of switching devices

## Number of operating cycles, classification (continued)

| Three-position disconnector, with functions: disconnecting (CLOSE-OPEN) and earthing (OPEN-EARTH) |                                                         |                      |    |                   |    |      |    |
|---------------------------------------------------------------------------------------------------|---------------------------------------------------------|----------------------|----|-------------------|----|------|----|
| Rated voltage $U_r$                                                                               |                                                         |                      | kV | 7.2               | 12 | 17.5 | 24 |
| Disconnectors according to IEC/EN 62271-102                                                       | Number of mechanical operating cycles                   |                      | n  | 1000              |    |      |    |
|                                                                                                   | Classification                                          | Mechanical endurance |    | M0                |    |      |    |
|                                                                                                   | Number of mechanical operating cycles                   |                      | n  | 2000 (on request) |    |      |    |
|                                                                                                   | Classification                                          | Mechanical endurance |    | M1 (on request)   |    |      |    |
| Earthing switches according to IEC/EN 62271-102                                                   | Number of mechanical operating cycles                   |                      | n  | 1000              |    |      |    |
|                                                                                                   | Classification                                          | Mechanical endurance |    | M0                |    |      |    |
|                                                                                                   | Number of short-circuit making operations with $I_{ma}$ |                      | n  | 5                 |    |      |    |
|                                                                                                   | Classification                                          | Electrical endurance |    | E2                |    |      |    |

| Earthing switch according to IEC/EN 62271-102 (air-insulated, arrangement on the cable feeder in panel types L1(r), L2(r)) |                                                         |                      |   |      |  |  |
|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|----------------------|---|------|--|--|
| Earthing switch according to IEC/EN 62271-102                                                                              | Number of mechanical operating cycles                   |                      | n | 1000 |  |  |
|                                                                                                                            | Classification                                          | Mechanical endurance |   | M0   |  |  |
|                                                                                                                            | Number of short-circuit making operations with $I_{ma}$ |                      | n | 5    |  |  |
|                                                                                                                            | Classification                                          | Electrical endurance |   | E1   |  |  |

## Vacuum circuit-breaker

| Classification and number of operating cycles for circuit-breaker <sup>1)</sup> according to IEC/EN 62271-100 |                                                                             |                                |                            |                             |    |      |    |
|---------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|--------------------------------|----------------------------|-----------------------------|----|------|----|
| Rated voltage $U_r$                                                                                           |                                                                             |                                | kV                         | 7.2                         | 12 | 17.5 | 24 |
| Circuit-breaker<br>CB-f NAR                                                                                   | Number of mechanical operating cycles                                       |                                | n                          | 2000                        |    |      |    |
|                                                                                                               | Classification                                                              | Mechanical endurance           |                            | M1                          |    |      |    |
|                                                                                                               | Number of electrical operating cycles                                       |                                | n                          | 2000                        |    |      |    |
|                                                                                                               | Classification                                                              | Electrical endurance           |                            | E2                          |    |      |    |
|                                                                                                               |                                                                             | Capacitive switching operation |                            | C1                          |    |      |    |
|                                                                                                               | Number of short-circuit breaking operations with $I_{sc}$ for CB-f NAR      |                                | n                          | 20                          |    |      |    |
|                                                                                                               | Rated operating sequence                                                    |                                |                            | O – 3 min – CO – 3 min – CO |    |      |    |
| Circuit-breaker<br>CB-f AR,<br>CB-r (SION L)                                                                  | Number of mechanical operating cycles                                       |                                | n                          | 10,000                      |    |      |    |
|                                                                                                               | Classification                                                              | Mechanical endurance           |                            | M2                          |    |      |    |
|                                                                                                               | Number of electrical operating cycles                                       |                                | n                          | 10,000                      |    |      |    |
|                                                                                                               | Classification                                                              | Electrical endurance           |                            | E2                          |    |      |    |
|                                                                                                               |                                                                             | Capacitive switching operation |                            | C2                          |    |      |    |
|                                                                                                               | Number of short-circuit breaking operations with $I_{sc}$ for CB-f AR       |                                | n                          | 30 or 50                    |    |      |    |
|                                                                                                               | Number of short-circuit breaking operations with $I_{sc}$ for CB-r (SION L) |                                | n                          | 30                          |    |      |    |
|                                                                                                               | Rated operating sequence                                                    | CB-f                           |                            | O – 0.3 s – CO – 3 min – CO |    |      |    |
| CB-f                                                                                                          |                                                                             |                                | O – 0.3 s – CO – 30 s – CO |                             |    |      |    |
| CB-r (SION L)                                                                                                 |                                                                             |                                | O – 0.3 s – CO – 15 s – CO |                             |    |      |    |

|                                                                          |               |                                                                                                   |           |          |
|--------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------|-----------|----------|
| 1) Definition of the different types of vacuum circuit-breakers (= VCB): |               |                                                                                                   |           |          |
| Panel type                                                               | VCB type      | Vacuum circuit-breaker design:                                                                    | CB-...NAR | CB-...AR |
| L, L1                                                                    | CB-f          | fixed-mounted in gas-insulated switching-device vessel, combined with three-position disconnecter | CB-f NAR  | CB-f AR  |
| L1(r), L2(r)                                                             | CB-r (SION L) | air-insulated, removable, separate three-position disconnecter                                    |           | CB-r AR  |

Definition of the different types of vacuum circuit-breakers (= VCB):  
VCB version: without auto-reclosing      with auto-reclosing

## Standard panels (examples)



Ring-main panel, type R



Transformer panel, type T

## Circuit-breaker panel



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



Circuit-breaker panel L1(r)

| Panel designation                                               | Panel type | Panel width mm | Rated current        | LSC category (Loss of service continuity category) |
|-----------------------------------------------------------------|------------|----------------|----------------------|----------------------------------------------------|
| <b>Application as: Cable feeder panels</b>                      |            |                |                      |                                                    |
| Ring-main panel <sup>1)</sup>                                   | R          | 375            | 630 A, 800 A         | LSC 2                                              |
|                                                                 | R1         | 500            | 630 A, 800 A         |                                                    |
| Transformer panel <sup>1)</sup>                                 | T          | 375            | 200 A                | LSC 2                                              |
|                                                                 | T1         | 500            | 200 A                |                                                    |
| Cable panel                                                     | K          | 375            | 630 A                | LSC 1                                              |
|                                                                 | K1         | 500            | 630 A, 1250 A        |                                                    |
| Circuit-breaker panel (fixed-mounted CB-f AR/NAR) <sup>1)</sup> | L          | 500            | 630 A                | LSC 2                                              |
|                                                                 | L1         | 750            | 630 A, 1250 A        |                                                    |
| Circuit-breaker panel (removable CB-r (SION L))                 | L1(r)      | 750            | 630 A                | LSC 2                                              |
|                                                                 | L2(r)      | 875            | 1250 A               |                                                    |
| Disconnecter panel <sup>1)</sup>                                | D1         | 500            | 1250 A               | LSC 2                                              |
| <b>Application as: Transfer panels</b>                          |            |                |                      |                                                    |
| Ring-main transfer panel <sup>1)</sup>                          | R(T)       | 375            | 630 A, 800 A         | –                                                  |
| Ring-main transfer panel <sup>1)</sup>                          | R1(T)      | 500            | 630 A                | –                                                  |
| Circuit-breaker transfer panel <sup>1)</sup>                    | L(T)       | 500            | 630 A                | –                                                  |
| Circuit-breaker transfer panel <sup>1)</sup>                    | L1(T)      | 750            | 630 A, 1250 A        | –                                                  |
| Circuit-breaker transfer panel                                  | L1(r, T)   | 750            | 630 A                | –                                                  |
|                                                                 | L2(r, T)   | 875            | 1250 A               |                                                    |
| Disconnecter transfer panel <sup>1)</sup>                       | D1(T)      | 500            | 1250 A               | –                                                  |
| <b>Application as: Metering panels and other panel types</b>    |            |                |                      |                                                    |
| Metering panel as billing metering panel                        | M          | 750            | 630 A, 800 A, 1250 A | –                                                  |
| Metering panel with cable connection                            | M(-K)      | 750            | 630 A, 800 A, 1250 A | LSC 1                                              |
| Metering panel with busbar connection                           | M(-B)      | 750            | 630 A, 800 A, 1250 A | LSC 1                                              |
| Metering panel with busbar and cable connection                 | M(-BK)     | 750            | 630 A, 800 A, 1250 A |                                                    |
| Metering panel with cable connection: individual panel          | M(KK)      | 750            | 630 A, 800 A         | LSC 1                                              |
| Busbar voltage metering panel                                   | M(VT)      | 375            | 200 A                |                                                    |
| Busbar voltage metering panel                                   | M1(VT)     | 500            | 200 A                | –                                                  |
| Busbar voltage metering panel with fuses                        | M(VT-F)    | 375            | 200 A                | –                                                  |
| Busbar voltage metering panel with fuses                        | M1(VT-F)   | 500            | 200 A                | –                                                  |
| Bus riser panel                                                 | H          | 375            | 630 A, 800 A, 1250 A | –                                                  |
| Metering panel / bus riser panel                                | H1         | 500            | 630 A, 1250 A        | –                                                  |
| <b>Application as: Busbar earthing panel</b>                    |            |                |                      |                                                    |
| Busbar earthing panel                                           | E          | 375            | –                    | –                                                  |

1) Panel design with metal partitions (metal-clad)

2) Type designation of vacuum circuit-breaker

# Product range

Ring-main panels, cable panels, busbar earthing panel



Three-position  
switch-disconnector



Make-proof  
earthing switch



Fixed earthing point



Capacitive voltage  
detecting 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 connection  
for 1, 2 or 3 cables  
per phase



2<sup>nd</sup> cable



2<sup>nd</sup> cable, 3<sup>rd</sup> cable

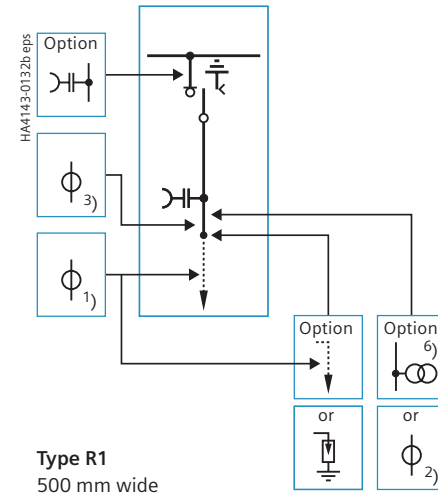
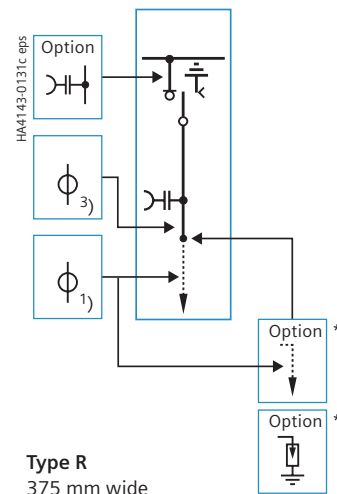


Surge arrester

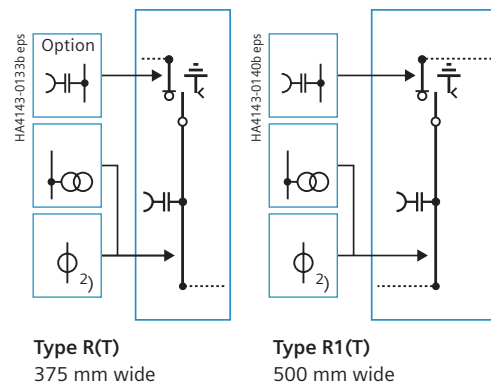
\* Option: Up to  $U_n=17.5$  kV

Installation options for block-type  
CTs, VTs are dependent on rated  
voltages and rated currents

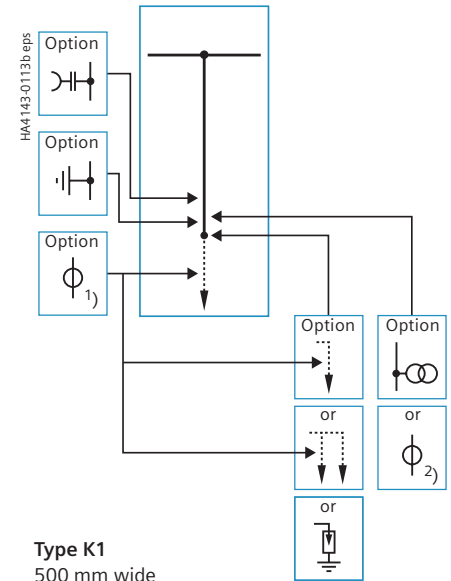
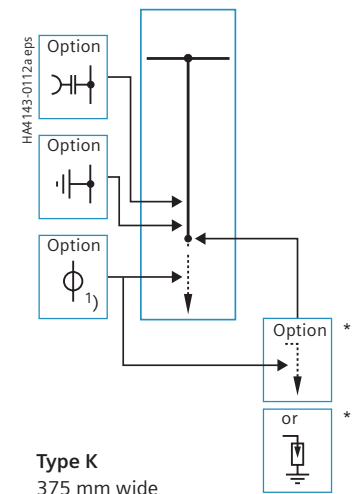
## Ring-main panels as feeder panels



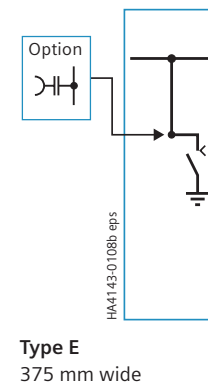
## Ring-main panel as transfer panel for attachment to panel types M, M(-K), H types L1(r, T)



## Cable panels as feeder panels, 1250 A



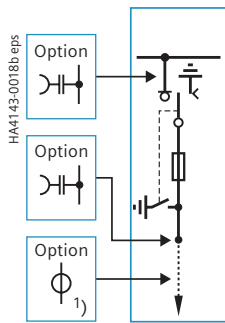
## Busbar earthing panel



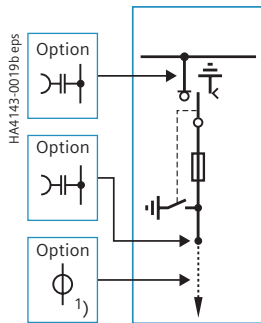
## Product range

Transformer panels, disconnector panels

### Transformer panels as feeder panels

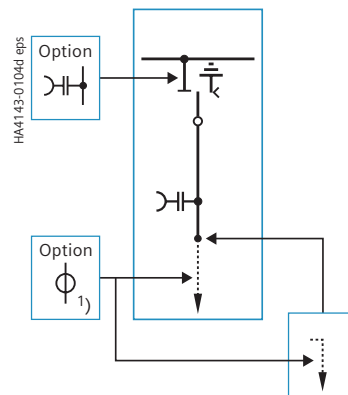


**Type T**  
375 mm wide

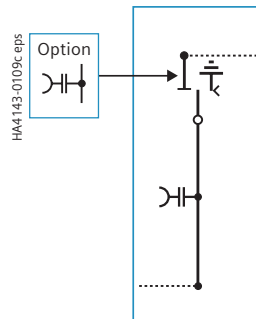


**Type T1**  
500 mm wide

### Disconnector panels as feeder panels



**Type D1**  
500 mm wide



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

as transfer panel for attachment to  
panel types D1(T)-D1(T), D1(T)-H,  
D1(T)-M, D1(T)-M(-K), L1(T)-D1(T),  
L2(r,T)-D1(T)



Three-position  
switch-disconnector



Three-position  
disconnector



Discharge switch



HV HRC fuse



Capacitive voltage  
detecting system



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



Cable



2<sup>nd</sup> cable

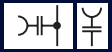


Surge arrester

Installation options for block-type  
CTs, VTs are dependent on rated  
voltages and rated currents

# Product range

Metering panels as billing metering panels



Capacitive voltage detecting system



Fixed earthing point



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



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



Cable



2<sup>nd</sup> cable



Surge arrester

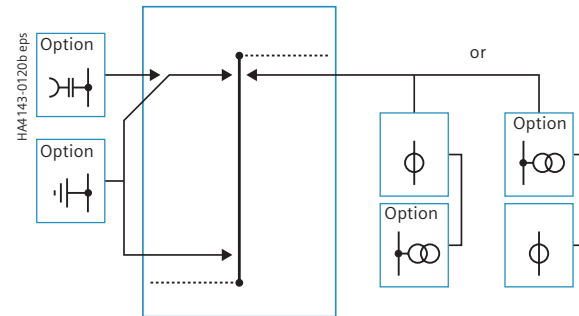
Option:



Individual metering panel type M(KK)

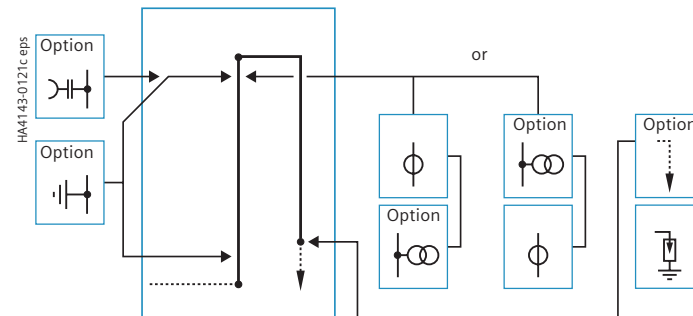
Installation options for block-type CTs, VTs are dependent on rated voltages and rated currents

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



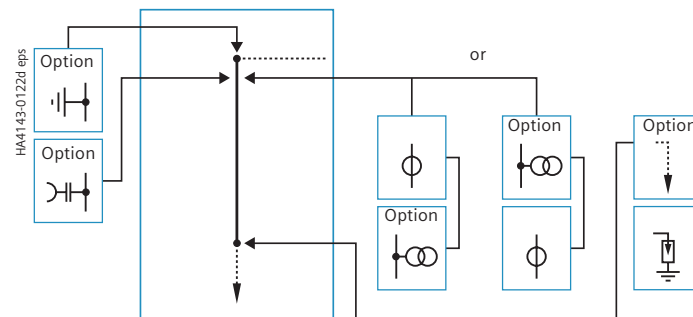
Type M 750 mm wide

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



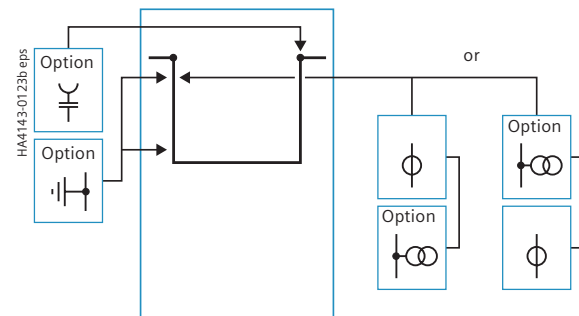
Type M(-K) 750 mm wide

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



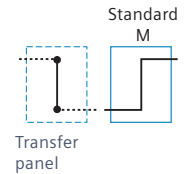
Type M(-BK) 750 mm wide

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



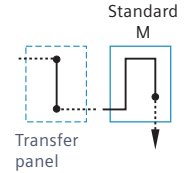
Type M(-B) 750 mm wide

## Panel design M



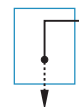
Standard:  
For transfer to the right

## Panel design M(K)



Standard:  
For transfer to the right

## Panel design M(-BK)



## Panel design M(-B)

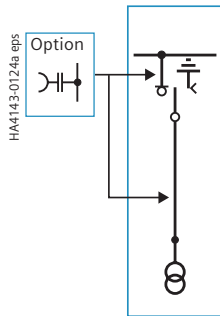


## Product range

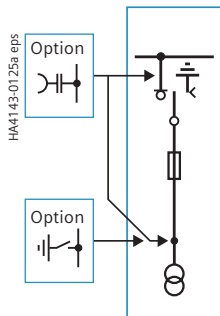
Busbar voltage metering panels, bus riser panels

### Busbar voltage metering panels

up to 17.5 kV

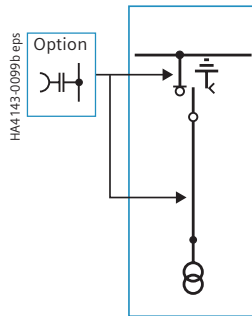


**Type M(VT)**  
375 mm wide

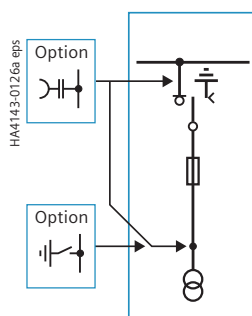


**Type M(VT-F)**  
375 mm wide

up to 24 kV

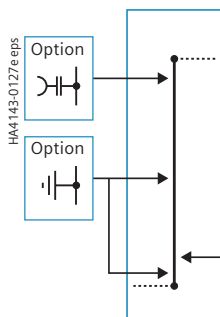


**Type M1(VT)**  
500 mm wide



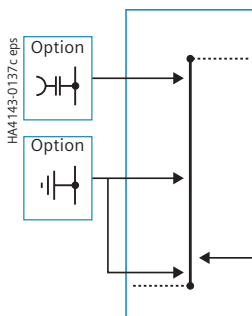
**Type M1(VT-F)**  
500 mm wide

### Metering panel and/or bus riser panels



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

as transfer panel for attachment  
to panel types R(T)-H, L(T)-H, L1(T)-H, D1(T)-H



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

as transfer panel for attachment  
to panel types L1(r,T)-H1, L2(r,T)-H1



Three-position  
switch-disconnector



Capacitive voltage  
detecting system



Fixed earthing point



HV HRC fuse



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



Discharge switch



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



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

Installation options for block-type  
CTs, VTs are dependent on rated  
voltages and rated currents

# Product range

## Circuit-breaker panels



Three-position disconnecter



Vacuum circuit-breaker (type 3AH5 (CB-f) fixed-mounted)



Vacuum circuit-breaker (type 3AE6 (CB-r) removable)



Make-proof earthing switch



Capacitive voltage detecting system



Fixed earthing point



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



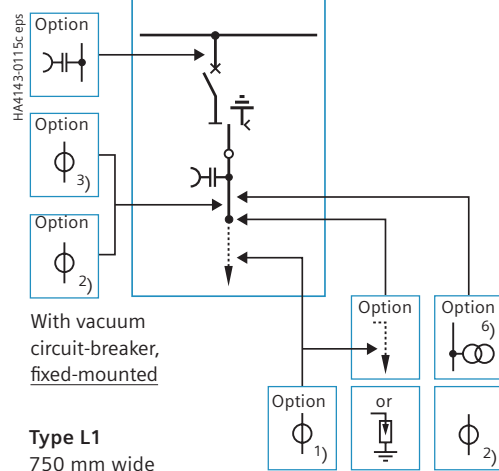
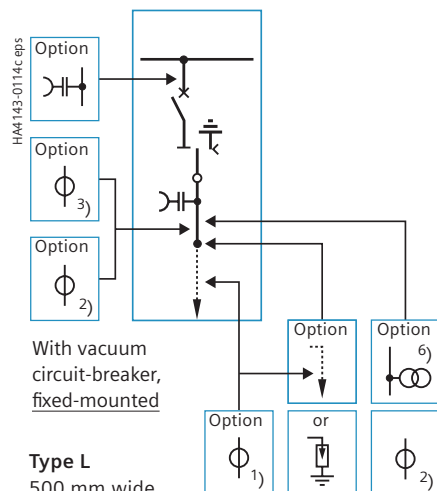
2<sup>nd</sup> cable



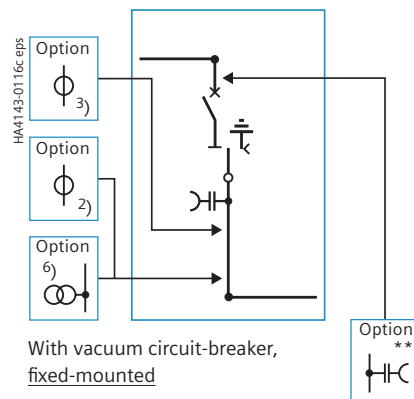
Surge arrester

Installation options for block-type CTs, VTs are dependent on rated voltages and rated currents

## Circuit-breaker panels 630 A as feeder panels



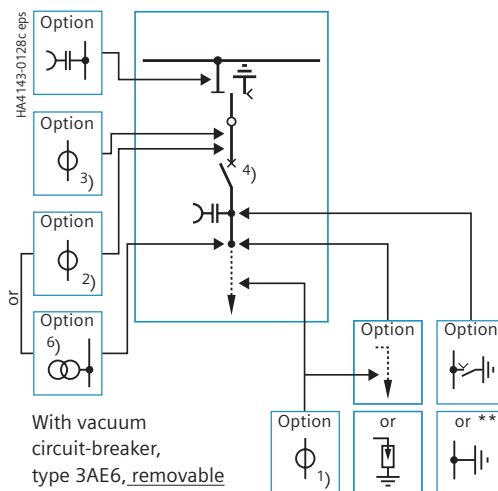
## as transfer panel for attachment to panel types M, M(-K) or H or R(T), D1(T)



Type L1(T)  
750 mm wide

Type L(T):  
500 mm wide

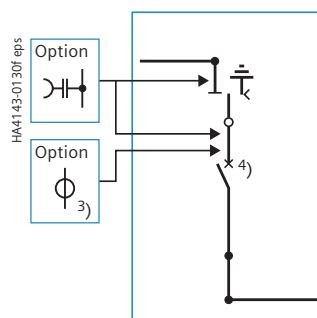
## Circuit-breaker panels 630 A, 1250 A as feeder panels



With vacuum circuit-breaker, type 3AE6, removable  
Type L1(r), 630 A  
750 mm wide, 1-2 cables per phase

Type L2(r), 1250 A  
875 mm wide, 2-3 cables per phase

## as transfer panel for attachment to panels (see types in the table below)



With vacuum circuit-breaker, type 3AE6

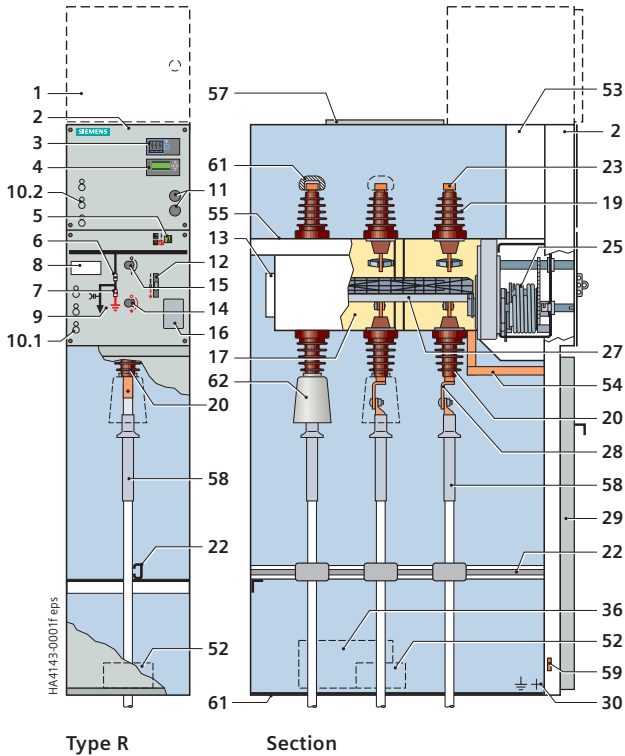
Type L1(r, T), 630 A  
750 mm wide

Type L2(r, T), 1250 A  
875 mm wide

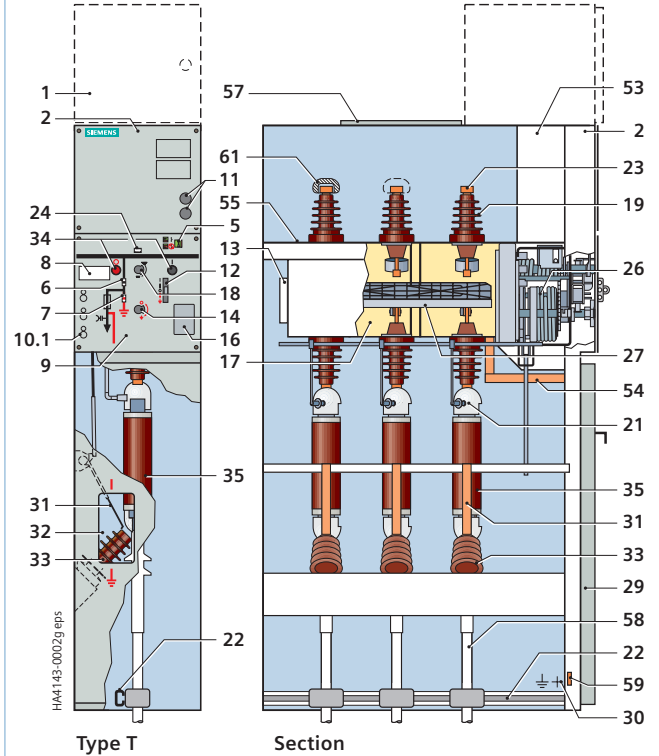
\*\* Standard: Feeder earthing via the vacuum circuit-breaker type 3AE6 (with interlocks, without earthing switch)

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

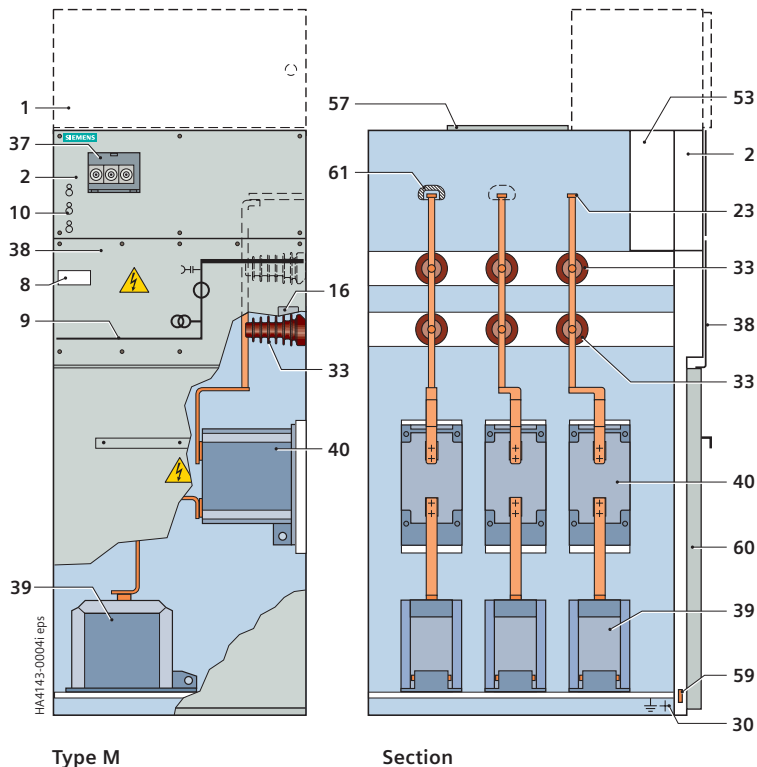
### Ring-main panel as feeder



### Transformer panel as feeder



### Billing metering panel



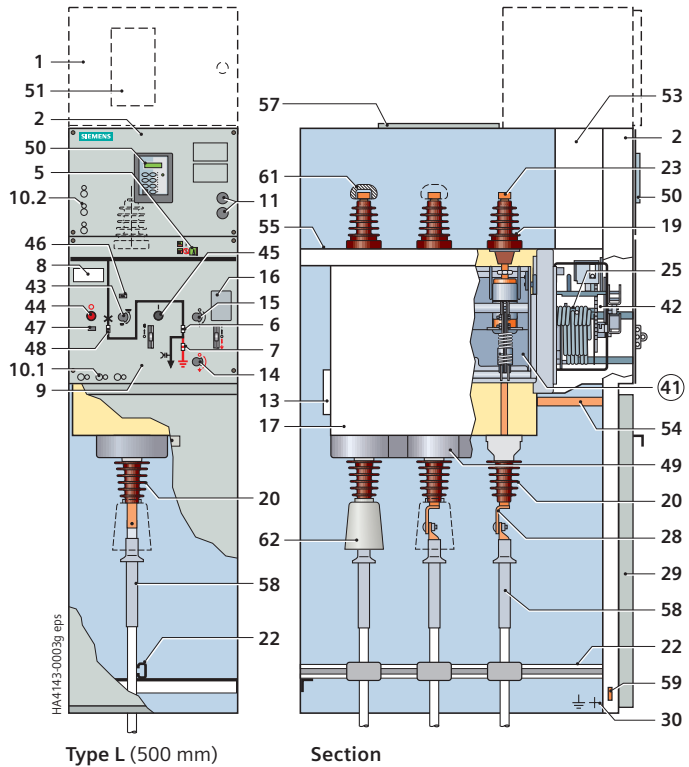
#### Legend for pages 17 and 18 (continued on page 18)

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

# Design

Panel design (examples)

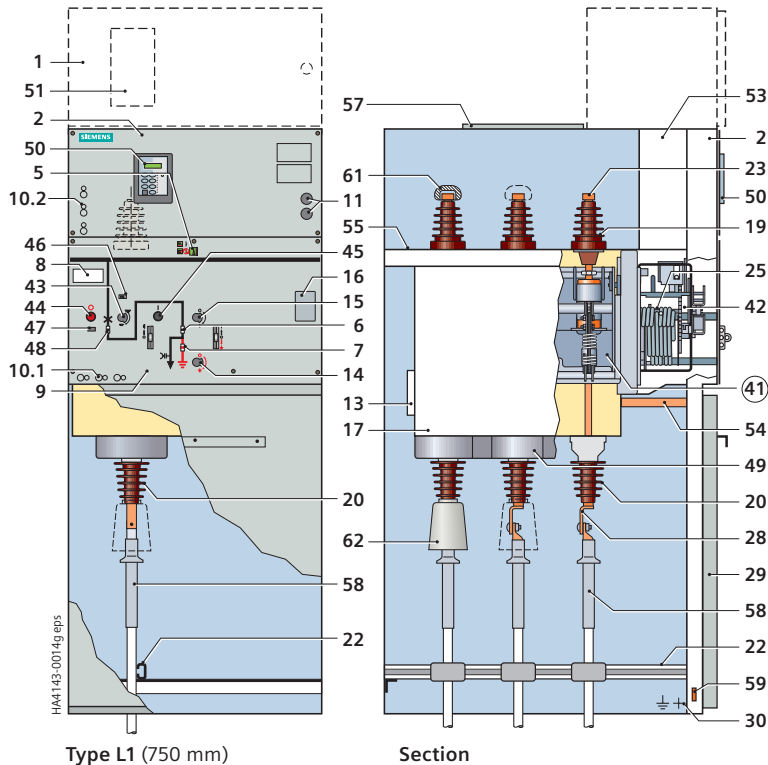
## Circuit-breaker panel (with vacuum circuit-breaker type CB-f NAR)



### Legend for pages 17 and 18

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

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



Vacuum circuit-breaker:

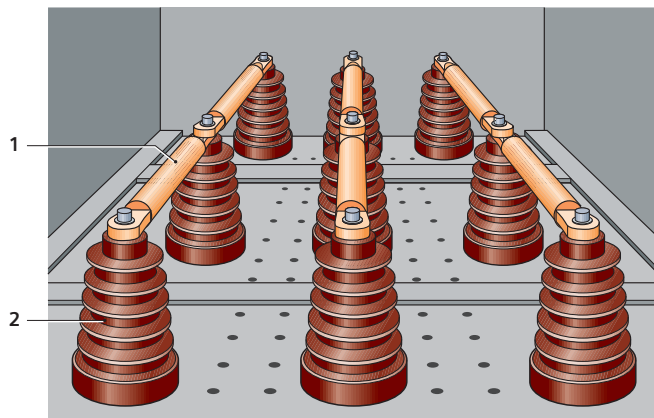
- 41 Vacuum circuit-breaker (VCB), fixed-mounted
- 42 Operating mechanism box
- 43 Manual operation for "spring charging"
  - for closing with manual operating mechanism
  - for emergency operation with motor operating mechanism
- 44 Mechanical "OFF" pushbutton
- 45 Mechanical "ON" pushbutton (not supplied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

### Busbars

- Safe-to-touch due to metal enclosure
- Busbar compartment with metal partitions
- Three-pole design, can be bolted together from panel to panel
- Easy switchgear extension
- Made of copper: round E-Cu.

### Busbar compartment extending over 3 panels

(example  $\leq 17.5$  kV)

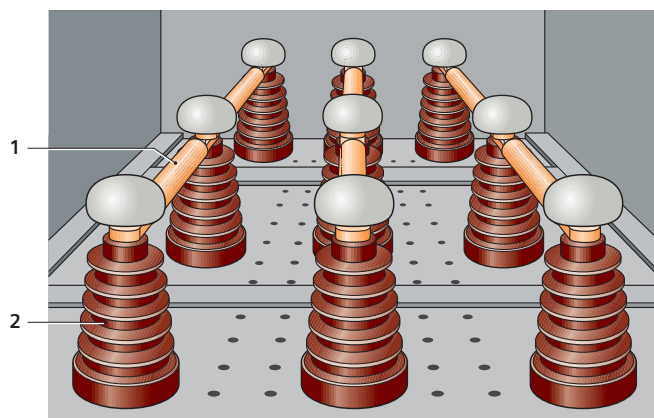


Side view

- 1 Busbar
- 2 Bushing-type insulator for busbar

### Busbar compartment extending over 3 panels

(example 24 kV)



Side view

- 1 Busbar
- 2 Bushing-type insulator for busbar

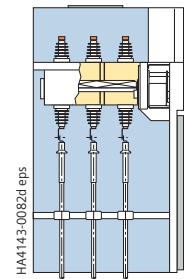
# Components

Selection data for various cable sealing ends

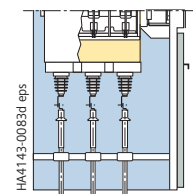
## Cable sealing ends for all feeder types with cable connection

| Make                                                                                          | Type                  | Cross-section in mm <sup>2</sup> |
|-----------------------------------------------------------------------------------------------|-----------------------|----------------------------------|
| <b>Single-core thermoplastic-insulated cables for ≤ 12 kV (6/10 kV); acc. to IEC standard</b> |                       |                                  |
| Euromold                                                                                      | AIN 10, AFN 10        | 25–300 (500)                     |
|                                                                                               | AIS, AIP              | 150–300; 50–300                  |
|                                                                                               | 12 MONOi              | 25–300 (500)                     |
| Prysmian Kabel und Systeme                                                                    | ELTI-1C-12            | 25–300                           |
| TE Connectivity                                                                               | IXSU-F                | 16–300 (500)                     |
|                                                                                               | MVTI-31xx-            | 25–240 (300)                     |
|                                                                                               | EPKT                  | 16–300                           |
| 3M                                                                                            | 92-EB 6x-1            | 35–300 (400)                     |
| Südkabel                                                                                      | SEHDI 10.2            | 35–300 (500)                     |
| nkt cables                                                                                    | TI 12                 | 25–240                           |
|                                                                                               | TO 12                 | 25–300 (500)                     |
| <b>Three-core thermoplastic-insulated cables for ≤ 12 kV (6/10 kV); acc. to IEC standard</b>  |                       |                                  |
| Euromold                                                                                      | AIN 10, AFN 10        | 25–300 (500)                     |
|                                                                                               | 12 MONOi              | 35–300 (500)                     |
| Prysmian Kabel und Systeme                                                                    | ELTI-3C-12            | 25–300                           |
| TE Connectivity                                                                               | IXSU-F33xx            | 16–300 (500)                     |
| <b>Single-core thermoplastic-insulated cables for &gt; 12 kV to ≤ 24 kV (12/20 kV)</b>        |                       |                                  |
| Euromold                                                                                      | AIN 20, AFN 20        | 25–300 (630)                     |
|                                                                                               | AIS, AIP              | 70–300; 25–300                   |
|                                                                                               | ITK-224               | 25–240                           |
| Prysmian Kabel und Systeme                                                                    | ELTI mb-1C-24         | 35–240                           |
|                                                                                               | ELTI-1C-24            | 25–300                           |
| TE Connectivity                                                                               | IXSU-F                | 25–300 (500)                     |
|                                                                                               | MVTI-51xx-            | 25–300                           |
|                                                                                               | EPKT                  | 16–300 (500)                     |
| Lovink-Enertech                                                                               | IAEM 20               | 25–300                           |
|                                                                                               | IAES 20               | 25–300 (500)                     |
| 3M                                                                                            | 93-EB 6x-1            | 50–300 (400)                     |
| Südkabel                                                                                      | SEHDI 20.2            | 35–300 (500)                     |
|                                                                                               | SEI 24                | 25–240                           |
| nkt cables                                                                                    | TI 24                 | 25–240                           |
|                                                                                               | TO 24                 | 25–300 (500)                     |
| <b>Three-core thermoplastic-insulated cables for &gt; 12 kV to ≤ 24 kV (12/20 kV)</b>         |                       |                                  |
| Lovink-Enertech                                                                               | GHKI                  | 25–300 (500)                     |
| TE Connectivity                                                                               | on request IXSU-F53xx | on request                       |

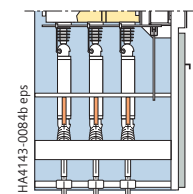
Examples for cable connection in R, L and T:



Panel type R ...



Panel type L ...



Panel type T ...

### Note:

For cable connections, the manufacturer information about the sealing end and the design of the cable must be taken into account (e.g. operating voltage, rated power-frequency withstand voltage, cable type, core material). Depending on make and type, the termination of the cable sealing end (= shield earth) for the cables and the fitted cable clamps may be located underneath the panel in the cable basement. This must be taken into account in panels with floor cover (option).

### Cable cross-sections and instrument transformer combination

| Panel type    | Panel width in mm | Feeder current | Max. cables per phase |         |       | Cable connection height (+/- 10 mm) | Instrument transformer combination in the connection compartment |       |     |     |
|---------------|-------------------|----------------|-----------------------|---------|-------|-------------------------------------|------------------------------------------------------------------|-------|-----|-----|
|               |                   |                | 12 kV                 | 17.5 kV | 24 kV |                                     | 4MC63                                                            | 4MC70 | 4MA | 4MR |
| <b>K</b>      | 375               | 630 A          | 1–2                   |         | 1     | 931 mm                              | –                                                                | x     | –   | –   |
| <b>K1</b>     | 500               | 630 A          | 1–3                   |         |       | 931 mm                              | –                                                                | x     | –   | –   |
|               |                   |                | 1                     |         |       | 450 mm                              | –                                                                | x     | x   | –   |
|               |                   | 1250 A         |                       |         |       | 313 mm                              | –                                                                | *     | –   | x   |
|               |                   |                | 2–3                   |         |       | 931 mm                              | –                                                                | x     | –   | –   |
| <b>R</b>      | 375               | 630 A          | 1–2                   |         | 1     | 931 mm                              | –                                                                | x     | –   | –   |
|               |                   |                |                       |         |       | 854 mm                              | x                                                                | x     | –   | –   |
| <b>R1</b>     | 500               | 630 A          | 1–2                   |         |       | 931 mm                              | –                                                                | x     | –   | –   |
|               |                   | 630 A          |                       |         |       | 854 mm                              | x                                                                | x     |     |     |
|               |                   | 630 A          | 1                     |         |       | 450 mm                              | –                                                                | x     | x   | –   |
|               |                   | 630 A          |                       |         |       | 313 mm                              | –                                                                | *     | –   | x   |
| <b>D1</b>     | 500               | 1250 A         | 2                     |         |       | 931 mm                              | –                                                                | x     | –   | –   |
| <b>T</b>      | 375               | 200 A          | 1                     | –       |       | 384 mm                              | –                                                                | **    | –   | –   |
|               |                   |                | –                     | 1       |       | 534 mm                              | –                                                                | **    | –   | –   |
| <b>T1</b>     | 500               | 200 A          | 1                     | –       |       | 384 mm                              | –                                                                | **    | –   | –   |
|               |                   |                | –                     | 1       |       | 534 mm                              | –                                                                | **    | –   | –   |
| <b>L</b>      | 500               | 630 A          | 1–3                   |         |       | 646 mm                              | –                                                                | x     | –   | –   |
|               |                   |                | 1                     |         |       | 215 mm                              | –                                                                | *     | x   | –   |
|               |                   |                | 1                     | –       |       | 646 mm                              | –                                                                | x     | –   | x   |
|               |                   |                | 1–3                   |         |       | 569 mm                              | x                                                                | x     | –   | –   |
|               |                   |                | 1                     |         |       | 130 mm                              | x                                                                | *     | x   | –   |
|               |                   |                | 1                     | –       |       | 569 mm                              | x                                                                | x     | –   | x   |
| <b>L1</b>     | 750               | 630 A          | 1–2                   |         |       | 646 mm                              | –                                                                | x     | –   | –   |
|               |                   |                |                       |         |       | 460 mm                              | –                                                                | x     | x   | –   |
|               |                   |                |                       |         |       | 646 mm                              | –                                                                | x     | –   | x   |
|               |                   |                |                       |         |       | 460 mm                              | –                                                                | x     | x   | x   |
|               |                   | 1250 A         | 2–4                   |         |       | 646 mm                              | –                                                                | x     | –   | –   |
|               |                   |                | 2–3                   |         |       | 460 mm                              | –                                                                | x     | x   | –   |
|               |                   |                |                       |         |       | 646 mm                              | –                                                                | x     | –   | x   |
|               |                   |                | 2–3                   | 2       |       | 460 mm                              | –                                                                | x     | x   | x   |
|               |                   | 630 A          |                       |         |       | 569 mm                              | x                                                                | x     | –   | –   |
|               |                   |                | 1–2                   |         |       | 460 mm                              | x                                                                | x     | x   | –   |
|               |                   |                |                       |         |       | 569 mm                              | x                                                                | x     | –   | x   |
|               |                   |                |                       |         |       | 460 mm                              | x                                                                | x     | x   | x   |
|               |                   | 1250 A         | 2–4                   |         |       | 569 mm                              | x                                                                | x     | –   | –   |
|               |                   |                | 2–3                   |         |       | 460 mm                              | x                                                                | x     | x   | –   |
|               |                   |                |                       |         |       | 569 mm                              | x                                                                | x     | –   | x   |
|               |                   |                | 2–3                   | 2       |       | 460 mm                              | x                                                                | x     | x   | x   |
| <b>L1(r)</b>  | 750               | 630 A          | 1–2                   |         |       | 494 mm                              | x                                                                | x     | –   | –   |
|               |                   |                |                       |         |       |                                     | x                                                                | x     | x   | –   |
|               |                   |                |                       |         |       |                                     | x                                                                | x     | –   | x   |
| <b>L2(r)</b>  | 875               | 1250 A         | 2–3                   |         |       | 494 mm                              | x                                                                | x     | –   | –   |
|               |                   |                |                       |         |       |                                     | x                                                                | x     | x   | –   |
|               |                   |                |                       |         |       |                                     | x                                                                | x     | –   | x   |
| <b>M(-K)</b>  | 750               | 630 A / 1250 A | 2                     |         |       | 495 mm                              | –                                                                | –     | x   | x   |
|               |                   |                | 3                     |         |       | 368 mm ***                          | –                                                                | –     | x   | x   |
|               |                   |                |                       |         |       |                                     | –                                                                | –     | x   | x   |
| <b>M(-BK)</b> | 750               | 630 A          | 2–3                   |         |       | 590 mm                              | –                                                                | –     | x   | x   |
|               |                   | 1250 A         | 2                     |         |       |                                     | –                                                                | –     | x   | x   |
|               |                   |                | 3                     |         |       | 460 mm                              | –                                                                | –     | x   | x   |
| <b>M(KK)</b>  | 750               | 630 A / 800 A  | 1–2                   | –       |       | 590 mm                              | –                                                                | –     | x   | x   |
|               |                   |                | –                     | 1–2     |       | 460 mm                              | –                                                                | –     | x   | x   |

\* Mounting possible underneath the panel

\*\* Mounting possible underneath the panel. For 17.5 kV also possible in the panel

\*\*\* Depending on the transfer combination

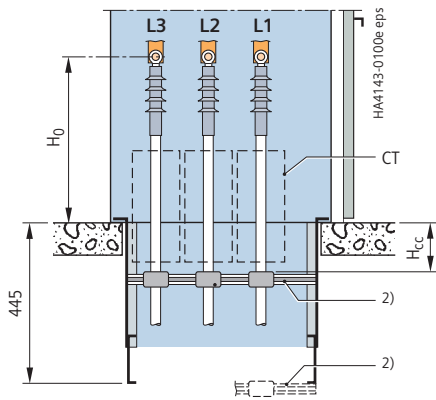
# Components

## Cable fixing

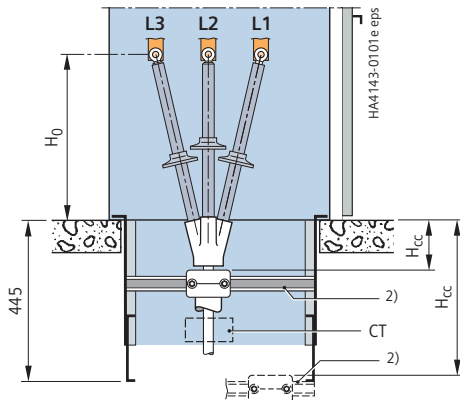
### Cable fixing

Depending on the cable type, the panel type, and the panel components, the cables may also be fixed in the cable basement. This must be taken into account for the room planning.

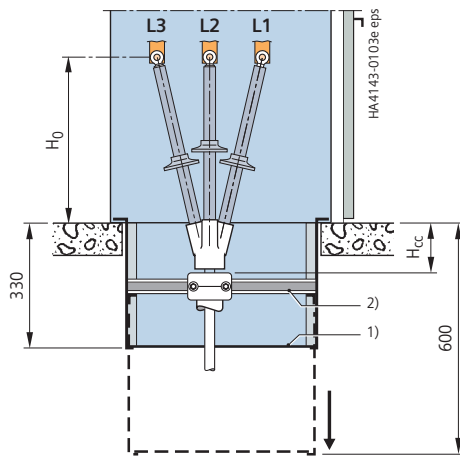
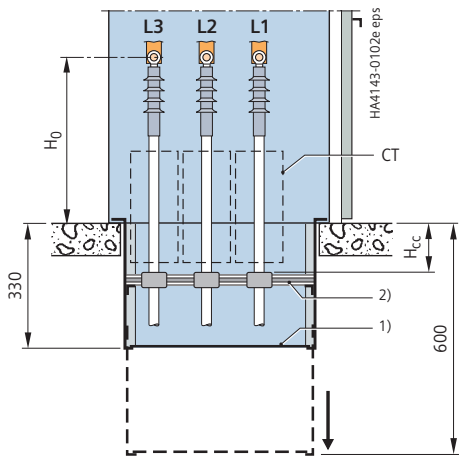
1-core cable



3-core cable



Optionally, a deep floor cover is also possible:

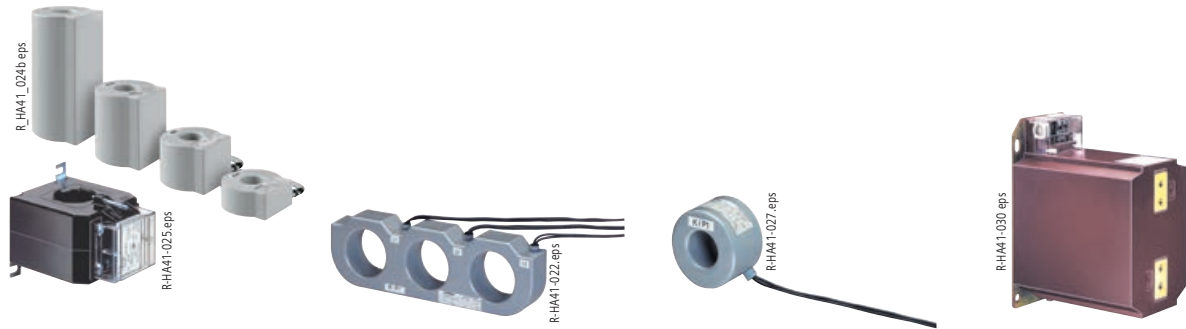


| Max. dimensions $H_{cc}$<br>in mm         | Cable design |        |
|-------------------------------------------|--------------|--------|
|                                           | 1-core       | 3-core |
| Standard                                  | 435          | 425    |
| Option:<br>With additional<br>floor cover | 469          | 459    |
| Height of cable<br>clamp (= option)       | 60           | 77     |

$H_{cc}$  = Height available for cable connection, from the mounted cable clamp

- 1) Deep floor cover
  - 2) Cable bracket, additionally movable downwards
- $H_0$  = Height of cable connection in the panel

## Current transformers according to IEC/EN 61869-1 and -2



| Type         | Cable-type current transformers 4MC7033 and 4MC7031 (single-pole)                                                                                                                                                                              | Three-phase current transformer 4MC63 (three-pole)                                                                                             | Bus/cable-type current transformer 4MC7032 (single-pole)                                                                                                                                                                                       | Current transformer 4MA7 (single-pole)                                                                                                                                                                                                                                       |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Features     | <ul style="list-style-type: none"> <li>Designed as ring-core current transformers</li> <li>Insulation class E</li> <li>Inductive type</li> <li>Free of dielectrically stressed cast-resin parts (due to design)</li> </ul>                     |                                                                                                                                                |                                                                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>Dimensions according to DIN 42600-5</li> <li>Insulation class E</li> <li>Cast-resin insulated</li> <li>Designed as an indoor block-type current transformer</li> <li>Secondary connection by means of screw-type terminals</li> </ul> |
| Installation | <ul style="list-style-type: none"> <li>Arranged on the cable at the panel connection</li> <li>For shielded cables</li> <li>Current transformers factory-assembled on a mounting plate</li> <li>Final assembly on the cables on site</li> </ul> | <ul style="list-style-type: none"> <li>Arranged outside the switching-device vessel at the bushings</li> <li>Mounted at the factory</li> </ul> | <ul style="list-style-type: none"> <li>Arranged on the cable at the panel connection</li> <li>For shielded cables</li> <li>Current transformers factory-assembled on a mounting plate</li> <li>Final assembly on the cables on site</li> </ul> | <ul style="list-style-type: none"> <li>For installation at various positions depending on the panel type</li> </ul>                                                                                                                                                          |

## Voltage transformer according to IEC/EN 61869-1 and -3



| Type         | 4MR (single-pole or, as an option, two-pole)                                                                                                                                                                                                                                    |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Features     | <ul style="list-style-type: none"> <li>Dimensions according to DIN 42600-9 (small model)</li> <li>Designed as an indoor voltage transformer</li> <li>Cast-resin insulated</li> <li>Insulation class E</li> <li>Secondary connection by means of screw-type terminals</li> </ul> |
| Installation | <ul style="list-style-type: none"> <li>For installation at various positions depending on the panel type</li> </ul>                                                                                                                                                             |

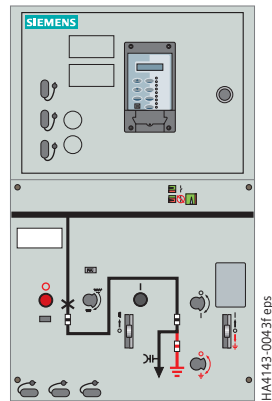
# Components

## Low-voltage niche

### Low-voltage niche (standard)

- Inside the panel
- Cover for low-voltage niche:
  - Standard: Screwed-on cover
  - With door (option)
- For accommodation of terminals and standard protection devices, e.g. in circuit-breaker panels
- Protection relays, e.g.
  - Type 7SR45, 7SR10
- On request:
  - Type 7SJ82, 7SX800
- For bus wires and / or control cables; niche open at the side to the adjacent panel
- Partitioned safe-to-touch from the high-voltage part of the panel
- Degree of protection IP3X (standard).

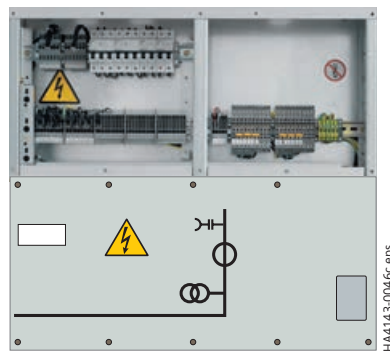
### Low-voltage niche (examples)



In circuit-breaker panel  
type L (500 mm)



In circuit-breaker panel  
type L1(T) (750 mm)



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

## Low-voltage compartment (option)

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

## Low-voltage cables

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

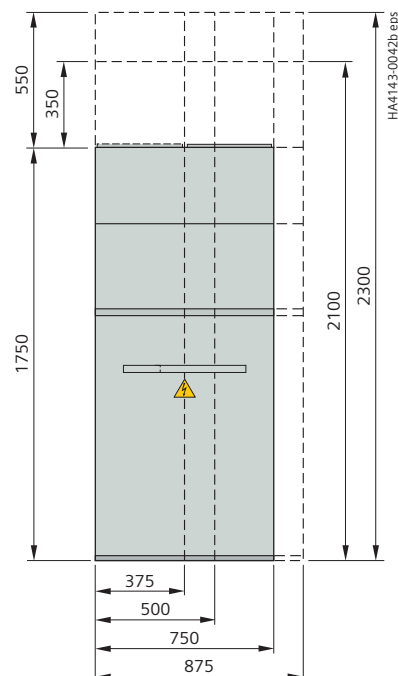
## Low-voltage compartment door (example 750 x 350 mm)



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



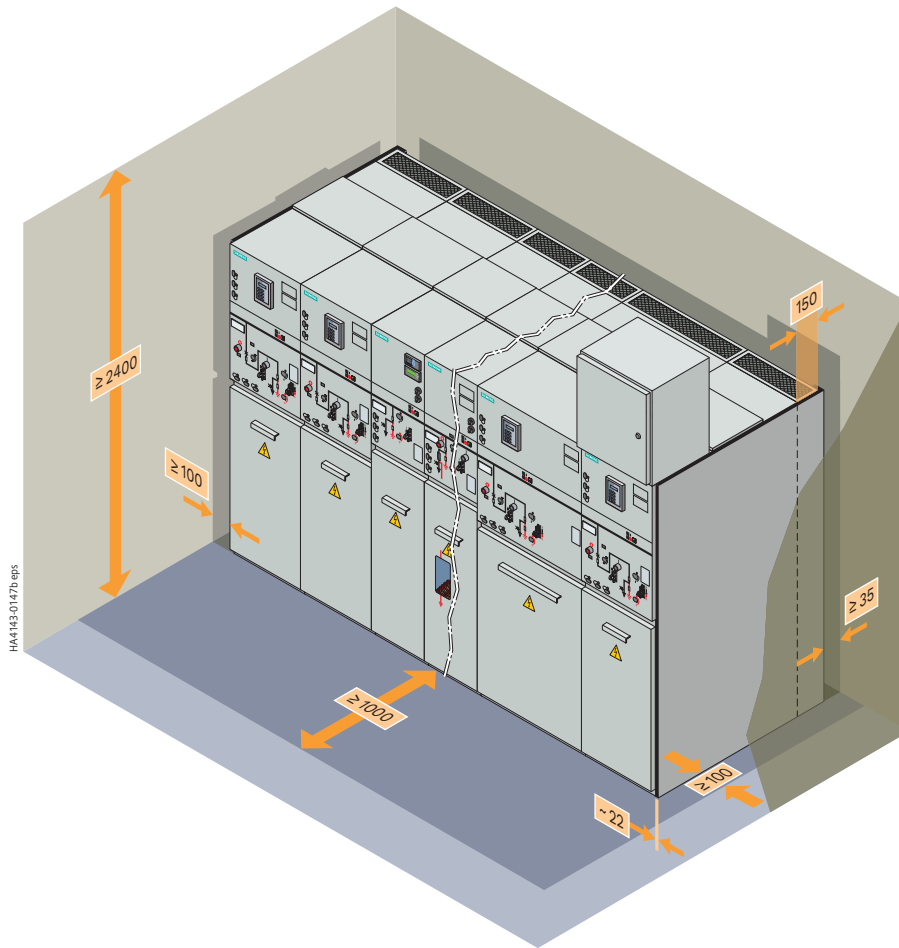
## Overall panel dimensions





# Dimensions

## Room planning



### Switchgear installation

Wall-standing arrangement, free-standing arrangement

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

### Room dimensions

See dimensional drawing.

### Room door dimensions

The door dimensions depend on:

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

### Switchgear fastening

- Foundations:
  - Steel girder construction
  - Steel-reinforced concrete.

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Voltage  
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