
MANTRA
The quality you can trust.
SIMOPRIME WORLD
Medium-Voltage Switchgear up to 17.5 kV
Manufactured by MANTRA SWITCHGEAR CO., LTD.
Licensed Partner of SIEMENS
Approved Partner
SIVACON S8
SIMOPRIME WORLD
SIMOPRIME A4
SIEMENS

SIEMENS
SIMOPRIME
Medium-Voltage Switchgear up to 17.5 kV

Application

Benefits (see also page 12 for details)

- Saves lives
- Peace of mind
- Increases productivity
- Saves money

The circuit-breaker switchgear type SIMOPRIME is a factory-assembled, type-tested switchgear for indoor installation according to IEC 62271-200 and VDE 0671-200.

Loss of service continuity category :	LSC 2B
Partition class :	PM
Internal arc classification :	IAC A FLR, I_{sc} 40 kA, arc duration: 1 or 0.1s

SIMOPRIME panel

Maximum ratings 17.5 kV / 40 kA / 3600 A

Typical uses

The SIMOPRIME circuit-breaker switchgear can be used in transformer and switching substations

Application: Power supply system

- Power supply companies

Application: Industries

- Power stations
- Cement industry
- Automobile industry
- Iron and steel works
- Rolling mills
- Mining industry
- Textile, paper and food industries
- Chemical industry
- Petroleum industry
- Pipeline installations
- Offshore installations
- Electrochemical plants
- Petrochemical plants
- Shipbuilding industry
- Diesel power plants
- Emergency power supply installations
- Lignite open-cast mines
- Traction power supplies

Typical Uses

● SIMOPRIME switchgear

● Application
Public power
supply system

Application ●
Industry

Technical Data

Ratings

Electrical data (maximum values) of SIMOPRIME

Ratings	Rated values (max.)
Switchgear up to 7.2 kV	
Rated voltage	7.2 kV
Rated frequency	50/60 Hz
Rated short-duration power-frequencywithstand voltage	20 kV [1)]
Rated lightning impulse withstand voltage	60 kV
Rated short-time withstand current, 3 s	40 kA
Rated peak withstand current at 50/60 Hz	100/104 kA
Rated short-circuit breaking current	40 kA
Rated short-circuitmaking current at 50/60 Hz	100/104 kA
Rated normal current of busbar	3600 A
Rated normal current of feeders	
– with circuit-breaker	3600 A
– with vacuum contactor	400 A [2)]

Ratings	Rated values (max.)
Switchgear 12 kV	
Rated voltage	12 kV
Rated frequency	50/60 Hz
Rated short-duration power-frequencywithstand voltage	28 kV [1)]
Rated lightning impulse withstand voltage	75 kV [3)]
Rated short-time withstand current, 3 s	40 kA
Rated peak withstand current at 50/60 Hz	100/104 kA
Rated short-circuit breaking current	40 kA
Rated short-circuitmaking current at 50/60 Hz	100/104 kA
Rated normal current of busbar	3600 A
Rated normal current of feeders	
– with circuit-breaker	3600 A
– with vacuum contactor	400 A [2)]

Ratings	Rated values (max.)
Switchgear 15 kV	
Rated voltage	15 kV
Rated frequency	50/60 Hz
Rated short-duration power-frequencywithstand voltage	35 kV
Rated lightning impulse withstand voltage	95 kV
Rated short-time withstand current, 3 s	40 kA
Rated peak withstand current at 50/60 Hz	100/104 kA
Rated short-circuit breaking current	40 kA
Rated short-circuitmaking current at 50/60 Hz	100/104 kA
Rated normal current of busbar	3600 A
Rated normal current of feeders	
– with circuit-breaker	3600 A

Ratings	Rated values (max.)
Switchgear 17.5 kV	
Rated voltage	17.5 kV
Rated frequency	50/60 Hz
Rated short-duration power-frequencywithstand voltage	38 kV
Rated lightning impulse withstand voltage	95 kV
Rated short-time withstand current, 3 s	40 kA
Rated peak withstand current at 50/60 Hz	100/104 kA
Rated short-circuit breaking current	40 kA
Rated short-circuitmaking current at 50/60 Hz	100/104 kA
Rated normal current of busbar	3600 A
Rated normal current of feeders	
– with circuit-breaker	3600 A

1) Option : Higher values acc. to GOST standards
2) Depending on the rated current of the HV HRC fuses installed
3) 60 kV for vacuum contactor

Classification of the SIMOPRIME switchgear according to IEC 62271-200

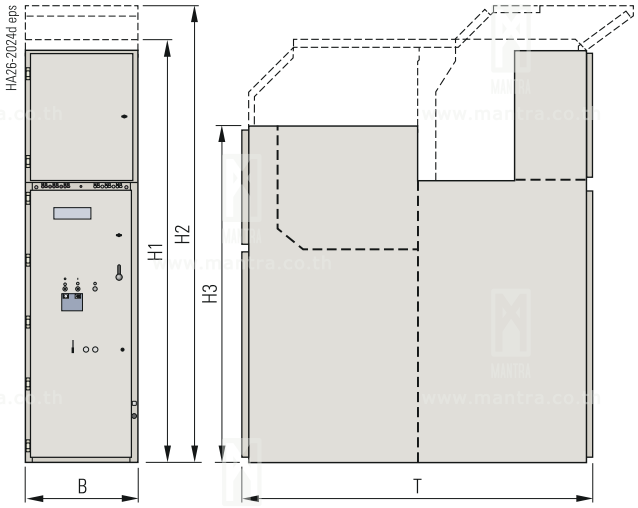
Internal arc classification

Classification		IAC
Accessibility		
– Front		Type A
– Rear		Type A
– Lateral		Type A
Test current	kA	25/31.5/40
Arc duration s		0.1/1.0

Construction and design

Partition class	PM (metallic partition)
Loss of service continuity category	LSC2B (metal-clad)
Compartment accessibility (standard)	
– Busbar compartment	Tool-based
– Switching-device compartment	Interlock-based
– Low-voltage compartment	Tool-based
– Connection compartment	Interlock and
– Front connection	tool-based
– Rear connection	Tool-based

Dimensions



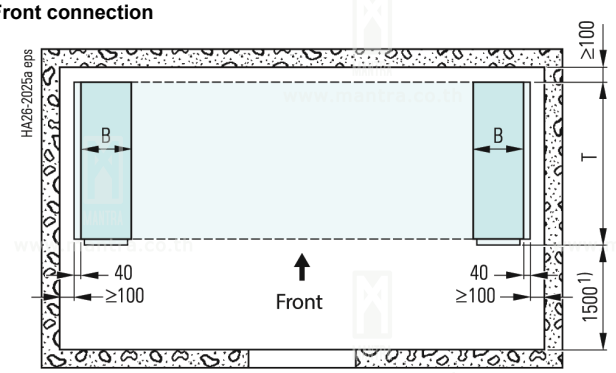
All panel types

Dimensions in mm

		up to 31.5 kA	40 kA
Width B	Circuit-breaker panel		
	≥ 1250 A	600	800
	2500 A, 3150 A, 3600 A	800	800
	Contactor panel	435/600	435
	Disconnecting panel		
	≥ 1250 A	600	800
	2500 A, 3150 A, 3600 A	800	800
	Bus sectionalizer/circuit-breaker		
	panel ≥ 1250 A	600	800
	2500 A, 3150 A, 3600 A	800	800
	Bus sectionalizer/bus riser panel		
	≤ 2500 A <	600	800
	3150 A, 3600 A	800	800
	Metering panel	600	800
Height H1	With standard low-voltage		
	compartment and IAC 0.1 s	2253	2253
H2	With standard low-voltage		
	compartment and IAC 1.0 s	2425	2460
H3	-	1780	1780
Depth T	Standard	1860	1860

Room planning (room height ≥ 2800 mm)

Front connection



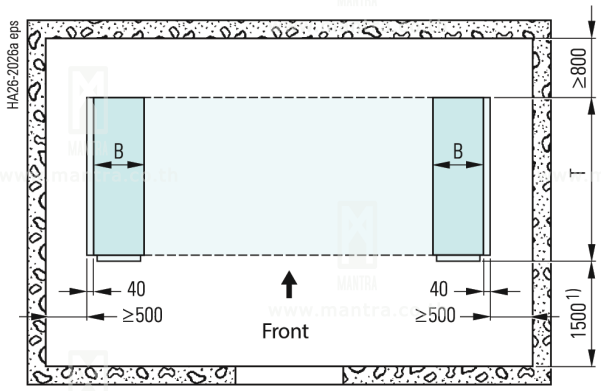
Single-row arrangement (plan view)

For dimensions B (width) and T (depth) refer to table on this page

1) Control aisle widths

≥ 31.5 kA and ≥ 3150 A versions :	≥ 1500 mm
40 kA or 3600 A versions :	≥ 1700 mm
For panel replacement :	≥ 2000 mm

Rear connection



Single-row arrangement (plan view)

For dimensions B (width) and T (depth) refer to table on this page

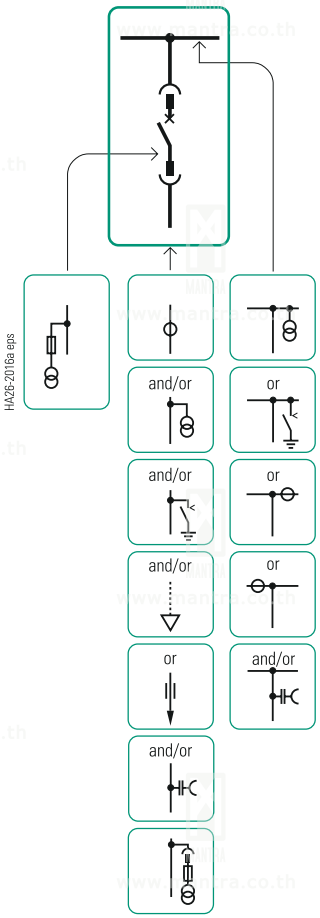
1) Control aisle widths

w31.5 kA andw3150 A versions :	≥ 1500 mm
40 kA or 3600 A versions :	≥ 1700 mm
For panel replacement :	≥ 2000 mm

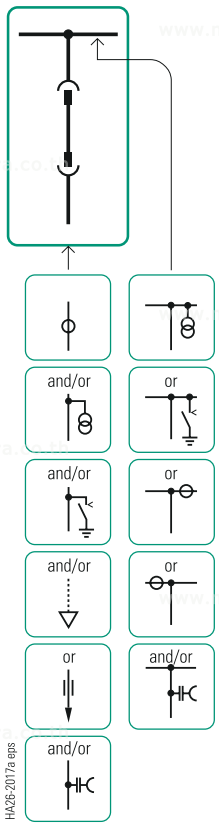
Product Range

Panels

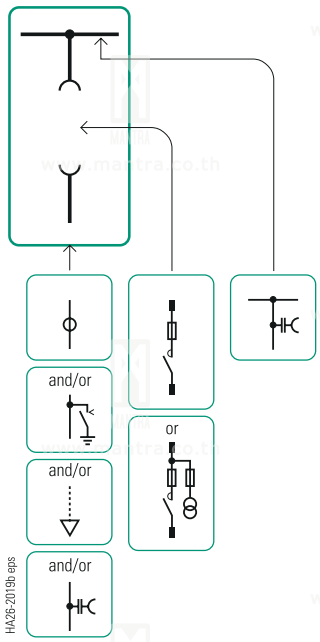
Circuit-breaker panel



Disconnecting panel



Vacuum contactor panel

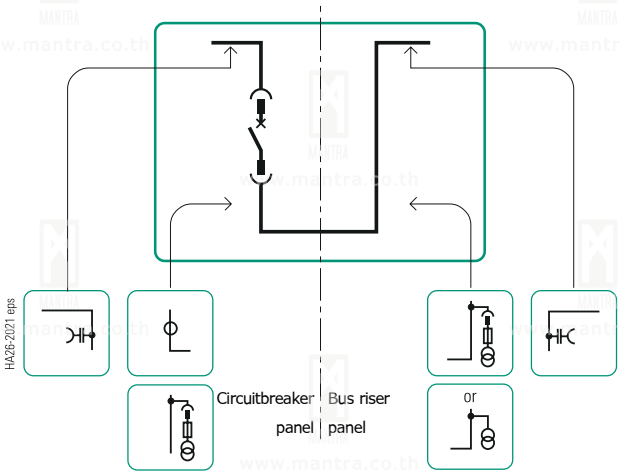


Components

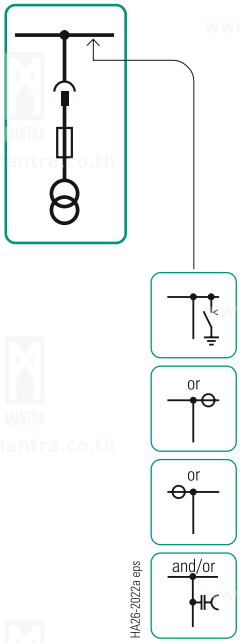
	Current transformer		Vacuum contactor with HV HRC fuses		Vacuum circuit-breaker
	Voltage transformer without primary fuses		Vacuum contactor with control transformer and HV HRC fuses		Disconnector
	Current transformer in run of busbar		Make-proof earthing switch		HV HRC fuse
	Voltage transformer with primary fuses		Cable sealing ends [1] max. 4 x 500 mm^2 per phase		
	Capacitive voltage detecting system		Bar connection		

1) The details refer to conventional single-core sealing ends.

Bus sectionalizer (mirror-image installation also possible)



Metering panel



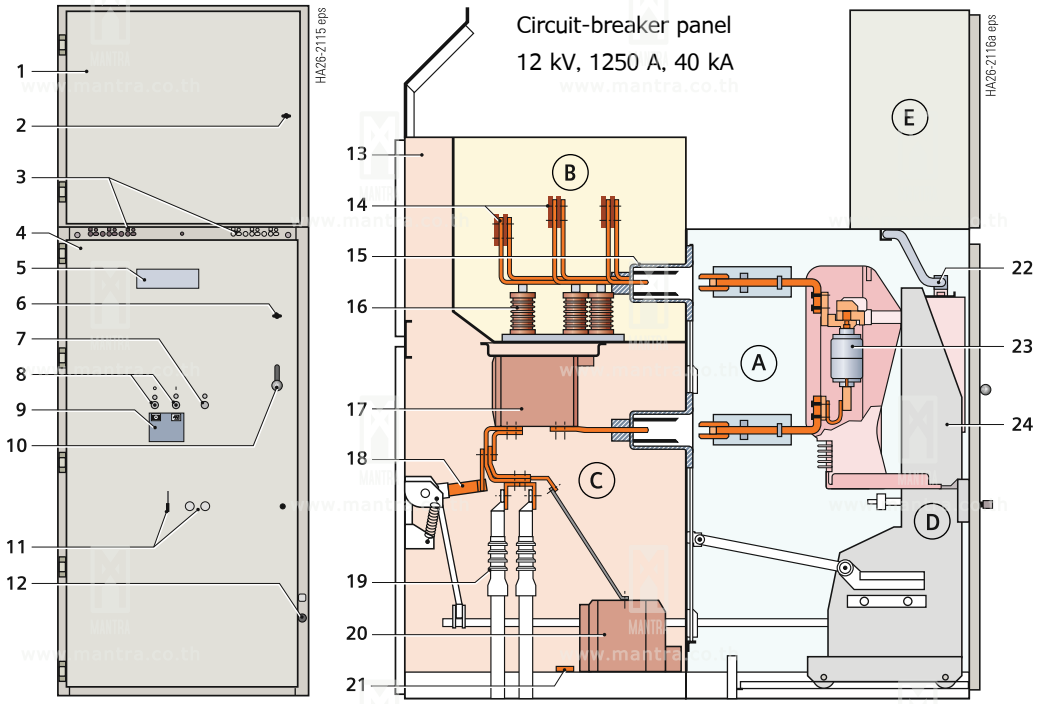
Components

Current transformer	Withdrawable voltage transformer with primary fuses	Make-proof earthing switch
Voltage transformer without primary fuses	Capacitive voltage detecting system	Vacuum circuit-breaker
Current transformer in run of busbar		

HA26-2023a eps

Design

Basic panel design (example)



Panel design

Legend for panel design :

1. Door of low-voltage compartment
2. Opening for locking or unlocking the low-voltage compartment door
3. Option : Capacitive voltage detecting system for feeder and busbar
4. High-voltage door
5. Inspection window for checking the switching device truck
6. Opening for locking or unlocking the high-voltage door
7. Opening for mechanical charging of circuit-breaker closing spring
8. Openings for manual operation (ON/OFF) of the circuit-breaker
9. Inspection window for reading the indicators
10. Door handle
11. Openings for switchingdevice truck operation
12. Opening for earthing-switch operation
13. Pressure relief duct
14. Busbars
15. Bushings
16. Post insulators
17. Block-type current transformer
18. Option : Make-proof earthing switch
19. Cable sealing ends
20. Option : Voltage transformer
21. Earthing busbar
22. Low-voltage plug connector
23. Vacuum interrupters
24. Switching-device truck

A : Switching-device compartment
B : Busbar compartment
C : Connection compartment
D : Vacuum circuit-breaker truck
E : Low-voltage compartment

Switching-device compartment

- All switching operations with high-voltage door closed
- Pressure relief upwards
- Shutter operating mechanisms separately for
  - Busbar compartment
  - Connection compartment
- Metallic, earthed shutters and partitions ensure partition class PM
- High-voltage door pressure resistant in the event of internal arcs in the panel
- Metallic ducts on the side for laying control cables
- Interlocking between high-voltage door and circuit-breaker truck ensures interlock-based access
- Option : Test sockets for capacitive voltage detecting system
- Switching-device compartment to accommodate components for implementing various panel versions with
  - Vacuum circuit-breaker with or without voltage transformers on the truck
  - Disconnector truck
  - Vacuum-contactor truck
  - Metering truck

Busbar compartment

- Pressure relief upwards and through rear pressure relief duct
- Option : Busbar transverse partition between panels
- Busbars made of flat copper, bolted from panel to panel
  - For rated normal currents up to 3600 A
  - Option : Insulated busbars
- Bolted rear and top covers provide tool-based access
- Option : Coupling electrode for capacitive voltage detecting system
- Options : Possibility of installing the following components
  - Voltage transformers
  - Busbar earthing switch
  - Current transformers in the run of busbars

Connection compartment

- Pressure relief upwards through rear pressure relief duct
- Suitable for connection of
  - Single-core XLPE cables up to max. 4 x 500 mm^2 per phase
  - Three-core XLPE cables up to max. 3 x 300 mm^2 per panel
  - Bars made of flat copper with bushings in a floor cover or fully-insulated bars including floor cover
- Shutters to be opened separately to permit cable testing
- Earthing busbar
- Connection from front or rear
- Option : Pressure-resistant floor cover
- Use of block-type current transformers
- Bolted rear covers of the connection compartment provide tool-based access for panels with connection from rear
- Interlocked high-voltage door and bolted partitions between connection compartment and switching-device compartment provide interlock-based and tool-based access for panels with connection from front

Components at the panel connection (option)

- Coupling electrode for capacitive voltage detecting system
- Voltage transformers
  - Cast-resin insulated
  - Max. 3 x 1-pole
  - Fixed-mounted, without primary fuses
- Make-proof earthing switches
  - With manual operating mechanism
  - In addition to standard interlocking of earthing switch/circuit-breaker truck, optionally lockable or with electromagnetic interlock
- Surge arresters or limiters
  - Surge arresters for protecting the switchgear against external overvoltages
  - Surge limiters for protecting consumers against switching overvoltages
- Panels painted with epoxy resin powder coating. Standard shade : RAL7035
  Other shades as OPTION

Interlocks

- Interlocking conditions are satisfied according to IEC 62271-200 / VDE 0671-200
- Earthing switch can only be operated with circuit-breaker truck in test position
- Circuit-breaker truck can only be moved with circuit-breaker "OPEN" and earthing switch "OPEN"
- Mechanical coding on the circuit-breaker truck prevents insertion of similar circuit breaker trucks for lower rated normal currents into panels with higher rated normal currents
- Interlocking of high-voltage door against circuit-breaker truck
- The high-voltage door can only be opened when the circuit-breaker truck is in test position
- Option : Electromagnetic interlocks

Low-voltage compartment

- For accommodation of all protection, control, measuring and metering equipment
- Partitioned safe-to-touch from the high-voltage part
- Low-voltage compartment can be removed, bus wires and control cables are plugged in
- Option : Partition between panels

Low-voltage cables

- Control cables of the panel are flexible and have metallic covers
- Connection of switching device truck and panel wiring to low-voltage compartment via 64-pole coded plug connectors
- Bus wires are pluggable from panel to panel

Benefits and features

Benefits	Features
Saves lives	■ All switching operations including emergency manual operations with high-voltage door closed ■ Interlocking between high-voltage door and switching devices ■ Rack-in, rack-out operations of the circuit-breaker truck with high-voltage door closed ■ Metallic, earthed shutters and partitions, partition class: PM (metallic partition) ■ Internal arc tested design up to 40 kA, 1 s, according to IEC 62271-200, VDE 0671-200 ■ Use of vacuum circuit-breakers
Peace of mind	■ Factory-assembled, type-tested switchgear according to IEC 62271-200 ■ Type testing of the circuit-breaker inside the panel ■ Use of standard, world-wide available components ■ Use of maintenance-free vacuum circuit-breakers ■ Quality management according to DIN EN ISO 9001 ■ Design based on global best practice sharing and experience ■ More than 300,000 air-insulated switchgear panels from Siemens in operation world-wide
Increases productivity	■ Use of metallic, earthed shutters and partitions between the compartments ensures highest loss of service continuity of the switchgear (LSC2B according to IEC 62271-200) during maintenance ■ Use of maintenance-free vacuum circuit-breakers
Saves money	■ Use of maintenance-free vacuum circuit-breakers

Standards

The switchgear complies with the relevant standards and specifications applicable at the time of type tests. In accordance with the harmonization agreement reached by the EU countries, their national specifications conform to the IEC standard.

Overview of standards

		IEC standard	VDE standard	DIN / EN standard
	SIMOPRIME Switchgear	IEC 62271-1	VDE 0671-1	DIN / EN 62271-1
		IEC 62271-200	VDE 0671-200	DIN / EN 62271-200
Devices	Internal arcing tests	IEC 62271-200	VDE 0671-200	-
Devices	Circuit breaker	IEC 62271-100	VDE 0671-100	DIN / EN 62271-100
Devices	Vacuum contactor	IEC 60470	VDE 0670-501	DIN / EN 62271-106
Devices	Disconnector and earthing switch	IEC 62271-102	VDE 0671-102	DIN / EN 62271-102
Devices	HV HRC fuses	IEC 60282	VDE 0670-4	DIN / EN 62271-103
Devices	Voltage detecting systems	IEC 661243-5	VDE 0682-415	DIN / EN 62271-105
Devices	Internal arc classification	IEC 62271-200	VDE 0671-200	DIN / EN 60282-1
	Degree of protection	IEC 60529	VDE 0470-1	DIN / EN 61243-5
		IEC 62271-200	VDE 0671-200	DIN / EN 60529
	Current-carrying capacity	IEC 62271-1	VDE 0670-1	DIN / EN 62271-1
		IEC 62271-200 [1)]	VDE 0671-200 [1)]	DIN / EN 62271-200 [1)]
	Insulation	IEC 60071	VDE 0111	DIN / EN 61869-2
	Current transformer	IEC 61869-2	VDE 0414-1	DIN / EN 61869-3
	Voltage transformer	IEC 61869-3	VDE 0414-2	DIN / EN 61936-1
	Installation	IEC 62271	VDE 0101	-
	Enclosure	IP 4X [2)] (protection against solid foreign bodies) Compartments: IP 2X (protection against solid foreign bodies)		

[1)] Ambient air temperatures: Maximum of 24 H mean + 35 °C I Maximum + 40 °C
- The current-carrying capacity of the panels and busbars depends on the ambient air temperature outside the enclosures.
- To attain the maximum rated normal currents, the panels are provided with natural or forced ventilation.

[2)] Higher degree of protection IP 5x for enclosures on request.

Types of service location

The switchgear can be used for indoor installation in accordance with IEC 61936 (Power installations exceeding 1 kV AC) and VDE 0101

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

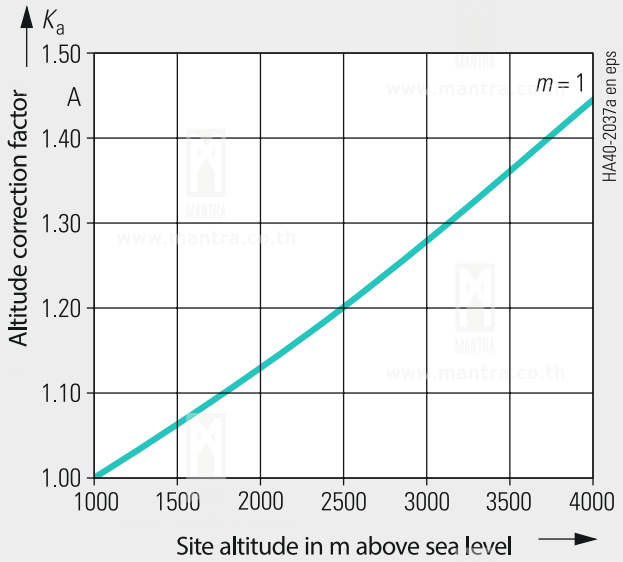


Table – Dielectric strength

Rated voltage (rms value)	kV	7.2	12	15	17.5
Rated short-duration power-frequency withstand voltage (rms value)					
– Across isolating distances	kV	23	32	39	45
– Between phases and to earth	kV	20	28	35	38
Rated lightning impulse withstand voltage (peak value)					
– Across isolating distances	kV	70	85	105	110
– Between phases and to earth	kV	60	75	95	95

Altitude correction factor K_a

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



Rated short-dur. power-freq. withstand volt. to be selected for site altitudes > 1000 m

≥ Rated short-duration power-frequency withstand voltage up to ≥ 1000m· K_a

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

≥ Rated lightning impulse withstand voltage up to ≥ 1000 m· K_a

Example :

1800 m site altitude above sea level

12 kV switchgear rated voltage

75 kV rated lightning impulse withstand voltage

Rated lightning impulse withstand voltage to be selected 75 kV · 1.10 = 82.5 kV

Result :

According to the above table, a switchgear for a rated voltage of 17.5 kV is to be selected.

Dielectric strength

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

Terms

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

- IEC 62271-102 and
- VDE 0671-102 / EN 62271-102

Internal arc classification

- Protection of operating personnel by means of tests for verifying the internal arc classification
- Internal arcing tests must be performed in accordance with IEC 62271-200 / VDE 0671-200
- The switchgear complies with criteria 1 to 5 specified in the mentioned standards for the basic version up to 40 kA.
- Definitions of the criteria:
  - Criterion 1
    Correctly secured doors and covers do not open. Limited deformations are accepted.
  - Criterion 2
    No fragmentation of the enclosure. Projection of small parts up to an individual mass of 60 g are accepted.
  - Criterion 3
    Arcing does not cause holes in the accessible sides up to a height of 2 m.
  - Criterion 4
    Horizontal and vertical indicators do no ignite due to the effect of hot gases.
    Criterion 5
  - The enclosure remains connected to its earthing point.

Current-carrying capacity

- According to IEC 62271-1 / VDE 0671-1 and IEC 62271-200 / VDE 0671-200 current carrying capacities refer to the following ambient air temperatures:
  - Maximum of 24-hour mean + 35 °C
  - Maximum + 40 °C
- The current-carrying capacity of the panels and busbars depends on the ambient air temperature outside the enclosure.
- To attain the maximum rated normal currents, the panels are provided with natural or forced ventilation.

Climate and environmental influences

The switchgear may be used, subject to possible additional measures, under the following environmental influences and climate classes :

Environmental influences

- Natural foreign materials
- Chemically active pollutants
- Small animals

Climate classes

- 3K3
- 3K5

The climate classes are classified according to IEC 60721-3-3.

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

SIMOPRIME switchgear fulfills acc. to the standards

- IEC 62271-200
- IEC 60529
- VDE 0470-1
- VDE 0671-200

the following degrees of protection:

- Enclosure :
  IP 4X, IP 5X (protection against solid foreign bodies)
  IP X1, IP X2 (protection against ingress of water)
- Compartments :
  IP 2X (protection against solid foreign bodies)
  Higher degree of protection for enclosure on request.

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