

SIMOPRIME Reliable Medium-Voltage Switchgear For Fail-Safe Operation



Technology
Partner
SIMOPRIME

SIEMENS



SIMOPRIME switchgear, up to 17.5 kV and up to 24 kV

- Factory assembled, type tested switchgear
- according to IEC 62271 200
- Use of high quality, world-wide available components
- Design based on global best practice and 50 years of experience

Technical benefits

- Interlockings 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)
- Use of metallic, earthed shutters and partitions between the compartments
- Highest loss of service continuity of the switchgear (LSC2B according to IEC 62271 200) during maintenance
- Internal arc tested design according to IEC 62271 200, 17.5 kV up to 40 kA, 1 s
- Internal arc tested design according to IEC 62271 200, 24 kV, up to 25 kA, 1 s
- Use of maintenance free vacuum circuit breakers and vacuum contactors
- Flexibility due to two types of withdrawable unit design – withdrawable (cassette) type* – truck type
- Easy production of SIMOPRIME switchgear due to basic design without need of complex jigs and fixtures
- Safe operation due to high-voltage door closed during all switching operations, including emergency manual operations



SIMOPRIME switchgear, 17.5 kV version



Benefits for your customer

- Saves lives
- Fast return of investment
- Peace of mind due to fail-safe operation

APPLICATIONS

- Power stations
- Offshore installations
- Power distribution
- Smart grids
- Petroleum industry
- Gas industry
- Cement industry
- Iron and steel works

* Available up to 17.5 kV and soon up to 24kV

Ratings and classifications

- Mining industry
- Textile, paper and food industry
- Rolling mills
- Automobile industry
- Shipbuilding industry
- Electrochemical plants
- Petrochemical plants



SIMOPRIME switchgears are fully type-tested to comply with IEC standards as well as DIN and GOST standards.



Internal arc withstand acceptance 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 not ignite due to the effect of hot gases.

Criterion 5

The enclosure remains connected to its earthing point.

Internal arc classification according to IEC

IAC	Internal arc classification
A	300 mm distance of indicators for test (installation in closed electrical service location)
F	Front arrangement of indicators for test
L	Lateral arrangement of indicators for test
R	Rear arrangement of indicators for test
Isc	Test current for SIMOPRIME ≤ 17.5 kV up to 40 kA, ≤ 24 kV up to 25 kA
t	Arc duration 1 s, optionally 0.1 s



	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
Internal arcing tests	IEC 62271-200	VDE 0671-200	–
Devices	Circuit breaker	IEC 62271-100	VDE 0671-100
	Circuit breaker, generator switching	IEC / IEEE 62271-37-013	–
	Vacuum contactor	IEC 62271-106	VDE 0670-501
	Disconnecter and earthing switch	IEC 62271-102	VDE 0671-102
	HV HRC fuses	IEC 60282	VDE 0670-4
	Voltage detecting systems	IEC 61243-5	VDE 0682-415
	Internal arc classification	IEC 62271-200	VDE 0671-200
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 0671-1	DIN / EN 62271-1
	IEC 62271-200 ¹⁾	VDE 0671-200 ¹⁾	DIN / EN 62271-200 ¹⁾
Insulation	IEC 60071	VDE 0111	DIN / EN 60071
Current transformer	IEC 61869-2	VDE 0414-1	DIN / EN 61869-2
Voltage transformer	IEC 61869-3	VDE 0414-2	DIN / EN 61869-3
Installation	IEC 61936-1	VDE 0101	DIN / EN 61936-1
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, 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, some panel variants are provided with natural or forced ventilation.

2) Higher degree of protection IP 5x for enclosure on request.

Type 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

Loss of service continuity

Category	LSC 2B
Partition class	PM

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.

Accessibility to compartments

Busbar compartment	Tool based
Switching-device compartment	Interlock based
Connection compartment	Interlock and tool based (front access) or tool based (rear access)

Outside lockable electrical service locations

Outside lockable electrical service locations at places which are not accessible to the public.

Enclosures of switchgear can only be removed with tools.

Technical specifications

Dielectric strength	kV	7.2	12	15	17.5	24
Rated short-duration power-frequency withstand voltage (rms value)						
Across isolating distances	kV	23	32	39	45	60
Between phases and to earth	kV	20	28	35	38	50
Rated lightning impulse withstand voltage (peak value)						
Across isolating distances	kV	70	85	105	110	145
Between phases and to earth	kV	60	75	95	95	125

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 (1,013 hPa, 20 °C, 11 g/m³ humidity in accordance with IEC 60071 / VDE 0111).

The dielectric strength decreases with increasing altitude. For site altitudes above 1,000 m (above sea level) the standards do not provide any guidelines for the insulation rating. Instead, special arrangements apply to these altitudes.

Site altitude:

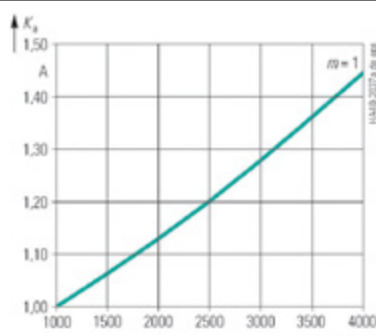
- As the altitude increases, the dielectric strength in air decreases due to the decreasing air density. This reduction is permitted up to a site altitude of 1,000 m according to IEC and VDE.
- For site altitudes above 1,000 m, a higher insulation level must be selected. It results from the multiplication of the rated insulation level for 0 to 1,000 m with the altitude correction factor Ka.



Technical corrections

Altitude correction factor Ka

For site altitudes above 1,000 m, the altitude correction factor Ka is recommended, depending on the actual site altitude above sea level.



Rated short-duration power-frequency withstand voltage to be selected for site altitudes $> 1,000\text{ m} \geq \text{Rated short-duration power-frequency withstand voltage up to } \leq 1,000\text{ m} \cdot K_a$

Rated lightning impulse withstand voltage to be selected for site altitudes $> 1,000\text{ m} \geq \text{Rated lightning impulse withstand voltage up to } \leq 1,000\text{ m} \cdot K_a$

Example	Result
1,800 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 $75\text{ kV} \times 1.10 = 82.5\text{ kV}$	According to the above table, a switchgear for a rated voltage of 17.5 kV is to be selected.

Climate and environmental influences

The switchgear may be used under the following environmental influences and climate classes:

Environmental influences	Climate classes
– Natural foreign materials 3)	– 3K22
– Chemically active pollutants 3)	– 3K23
– Small animals	

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

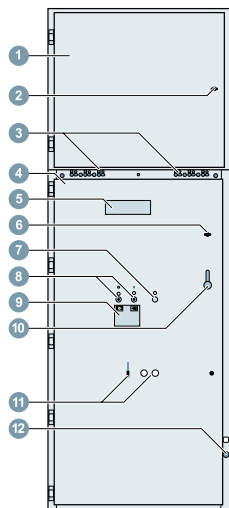
³⁾ Depending on the size of foreign material or active pollutants additional measures may apply



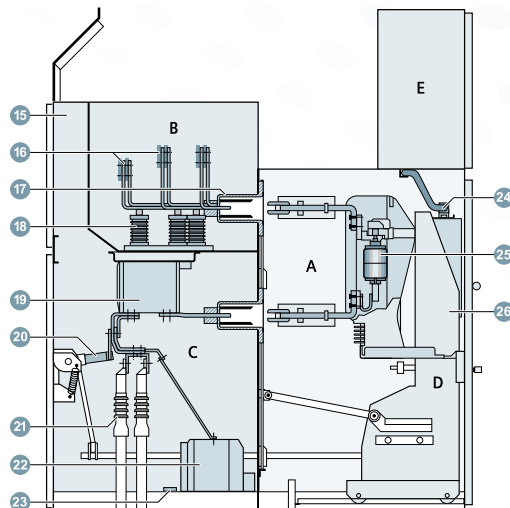
SIMOPRIME 17.5 kV

Basic panel design

Basic panel design (example)



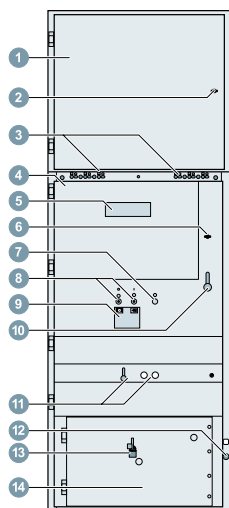
Circuit breaker panel 12 kV, 1,250 A, 40 kA



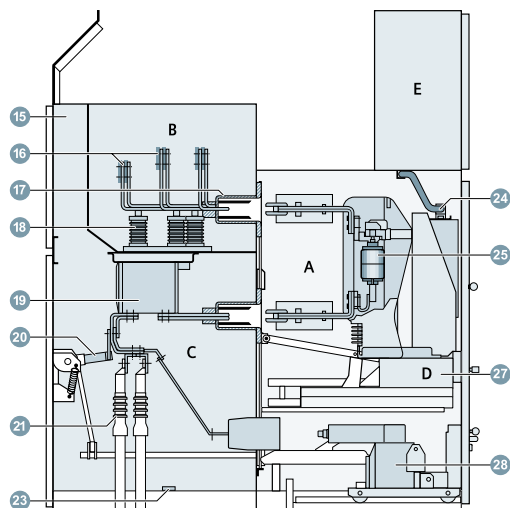
Legend for panel design

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 switching device truck operation
12. Opening for earthing-switch operation
13. Withdrawable VT operation opening lever
14. Withdrawable VT compartment door
15. Pressure relief duct
16. Busbars
17. Bushings
18. Post insulators
19. Block-type current transformer
20. Option: Make-proof earthing switch
21. Cable sealing ends
22. Option: Voltage transformer
23. Earthing busbar
24. Low-voltage plug connector
25. Vacuum interrupters
26. Switching device truck
27. Switching device withdrawable element
28. Withdrawable VT

Basic panel design (example)



Circuit breaker panel with withdrawable VT feature



- A. Switching device compartment
 B. Busbar compartment
 C. Connection compartment
 D. Vacuum circuit breaker truck / withdrawable part
 E. Low-voltage compartment

SIMOPRIME 17.5 kV

Features

SIMOPRIME switchgear	kV	7.2	12	17.5
Rated frequency	Hz	50/60	50/60	50/60
Rated short-duration power-frequency withstand voltage	kV	20 ¹⁾	28 ¹⁾	38
Rated lightning impulse withstand voltage	kV	60	75 ²⁾	95
Rated short-time withstand current in 3 s	kA	40	40	40
Rated peak withstand current at 50/60 Hz	kA	100/104	100/104	100/104
Rated short-circuit breaking current	kA	40	40	40
Rated short-circuit making current at 50/60 Hz	kA	100/104	100/104	100/104
Rated normal current of busbar	A	4,000 ³⁾	4,000 ³⁾	4,000 ³⁾
Rated normal current of feeders	A	4,000 ³⁾	4,000 ³⁾	4,000 ³⁾
•with circuit breaker		as per fuse	as per fuse	-
•with vacuum contactor				



¹⁾ Option: Higher values acc. to GOST standards

²⁾ 60 kV for vacuum contactor

³⁾ With forced ventilation

Switching device compartment

- All switching operations with high-voltage door closed
- Pressure relief upwards
- Powder-coated panel with epoxy resin transformers
- Shutter operating mechanisms separately for
 - Busbar compartment
 - Connection compartment
- Pressure resistant high voltage door 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
- Optional test:
 - test sockets for capacitive voltage detecting system

Busbar compartment

- Pressure relief upwards and through rear pressure relief duct
- Busbars made of flat copper, bolted from panel to panel
- Bolted rear and top covers provide tool-based access
- Optional:
 - Coupling electrode for capacitive voltage detecting system
 - Busbar transverse partition between panels

Connection compartment

- Pressure relief upwards through rear pressure relief duct
- Suitable for connection of
 - Single-core XLPE cables up to max. 6 x 500 mm² per phase
 - Three-core XLPE cables up to max. 3 x 300 mm² per panel
 - Bars made of flat copper with bushings
- Earthing busbar
- Connection from front or rear
- Optional: Pressure-resistant floor cover
- Use of block-type current transformers
- Interlock and tool-based access for panels with connection from front
- Tool-based access for panels with connection from rear
- 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

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
- Optional: Partition between panels

Voltage transformer compartment

- VT compartment to accommodate withdrawable voltage transformers
- VT compartment located under VCB in switching device compartment and has a separate door which has tool based access
- Voltage transformers
 - Cast-resin insulated
 - Max. 3 x 1-pole
 - fixed-mounted on withdrawable part, with primary fuses

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 circuitbreaker “OPEN” and earthing switch “OPEN”
- Coding on the LV-plug on circuit breaker. Prevents insertion of similar circuit breakers for lower rated currents into panels with higher rated 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

Low-voltage cables

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



SIMOPRIME 17.5 kV

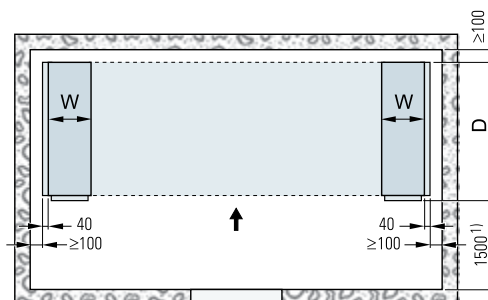
Panel installation options

SIMOPRIME switchgear	up to 31.5 kA	up to 40 kA
Width in mm		
Circuit breaker panel		
< 1250 A	600	800
1250 A, 1800A, 2200 A, 3000 A, 4000 A	800	800
Contactor panel	435 / 600	435
Disconnecting panel		
< 1250 A	600	800
1250 A, 1800A, 2200 A, 3000 A, 4000 A	800	800
Bus sectionalizer / circuitbreaker panel		
< 1250 A	600	800
1250 A, 1800A, 2200 A, 3000 A, 4000 A	800	800
Bus sectionalizer / bus riser panel		
1250 A, 1800A, 2200 A, 3000 A, 4000 A	600	800
Metering panel	600	800
Height in mm		
H1 With standard low-voltage compartment and IAC 0.1 s	2,253	2,253
H2 With standard low-voltage compartment and IAC 1.0 s	2,425	2,460
H3	1,780	1,780
Depth in mm		
D Standard	1,860	1,860

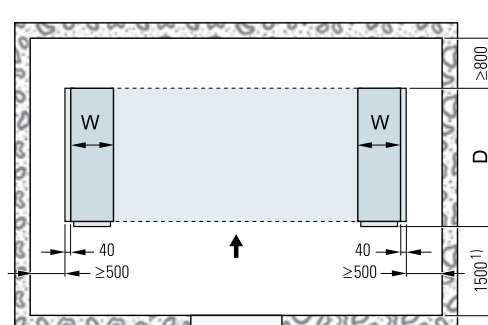
Classification according to IEC 62271 200

Internal arc classification		
Classification	IAC	
Accessibility	Type A	
• 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)	Tool based	
• Busbar compartment	Interlock based	
• Switching device compartment	Interlock based	
• Low-voltage compartment	Interlock and tool based	
• Connection compartment	Tool based	
– Front access		
– Rear access		

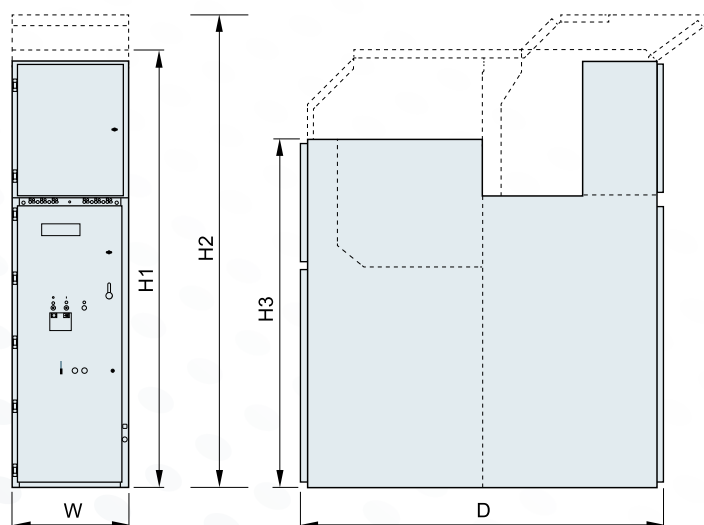
Front Connection



Rear Connection



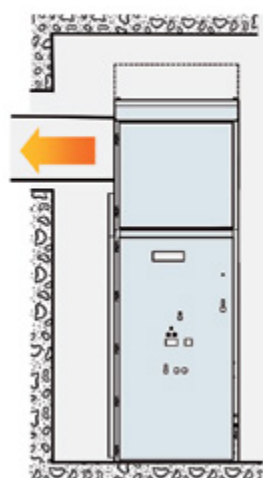
1) Control aisle widths:
 ≤ 31.5 kA and ≤ 3,000 A versions: ≥ 1,500 mm
 40 kA or 4,000 A versions: ≥ 1,700 mm
 For panel replacement: ≥ 2,000 mm



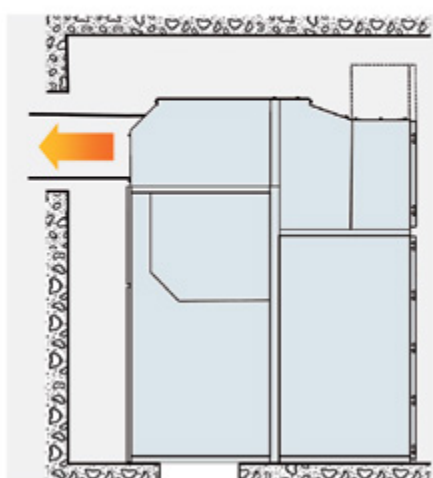
Pressure relief		Ceiling height D in mm for short-circuit current ³⁾			Pressure relief configuration	Arc duration in s
Type of pressure relief	Rated voltage in kV	25 kA	31.5 kA	40 kA		
Pressure relief out of the switchgear room through a pressure relief channel	12.0 ¹⁾	≥ 2,800	≥ 2,800	≥ 2,800	Lateral 1.0	
	17.5 ²⁾	≥ 2,800	≥ 2,800	≥ 2,800	Rear	1.0
Pressure relief into the switchgear room via flaps	≤ 17.5	≥ 2,800	≥ 2,800	≥ 3,400	Vertical	1.0
					Flaps	1.0
					No-flaps	0.1

¹⁾ with 600 mm panels
²⁾ with 800 mm panels
³⁾ in case of a lower than minimum ceiling height, please contact your Technical Support

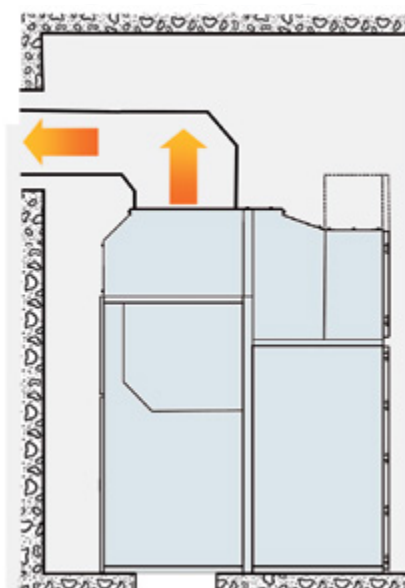
Pressure relief out of the switchgear room through a pressure relief duct



Lateral pressure relief duct

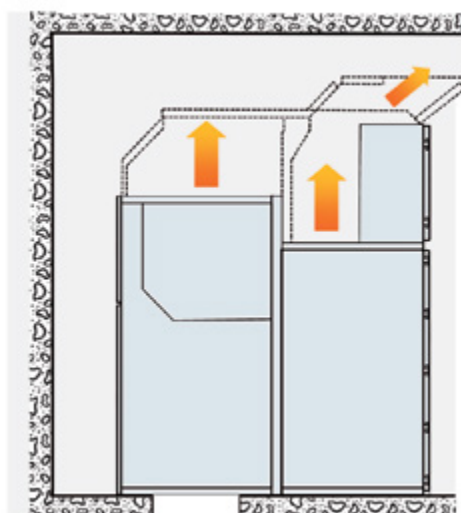
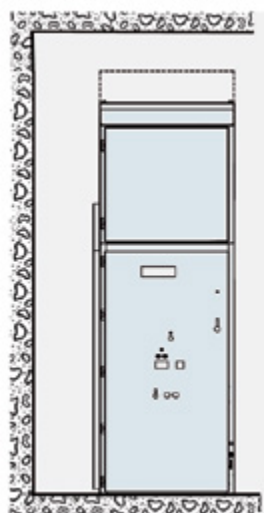


Rear pressure relief duct



Upper pressure relief duct

Pressure relief into the switchgear room with/without flaps

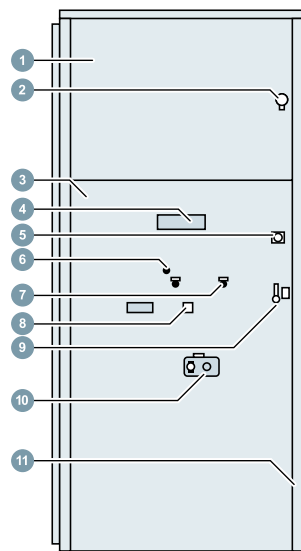


For designs with a closed pressure relief duct to the outside, a distance of ≥ 500 mm is required on the side of exhaustion directed.

SIMOPRIME 24 kV

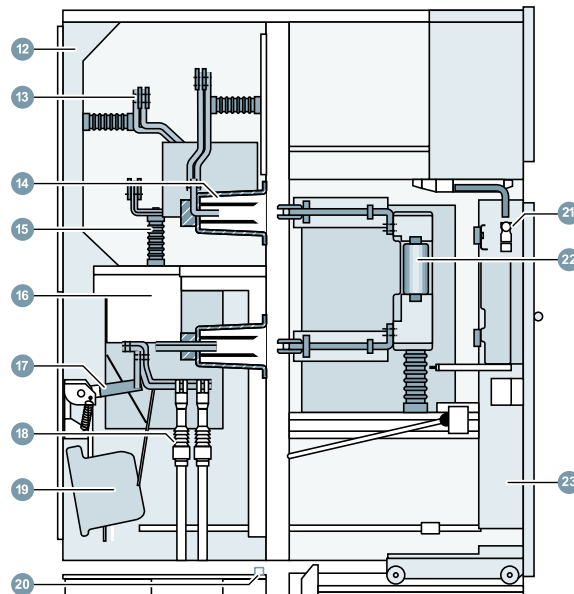
Design & features

Basic panel design (example)



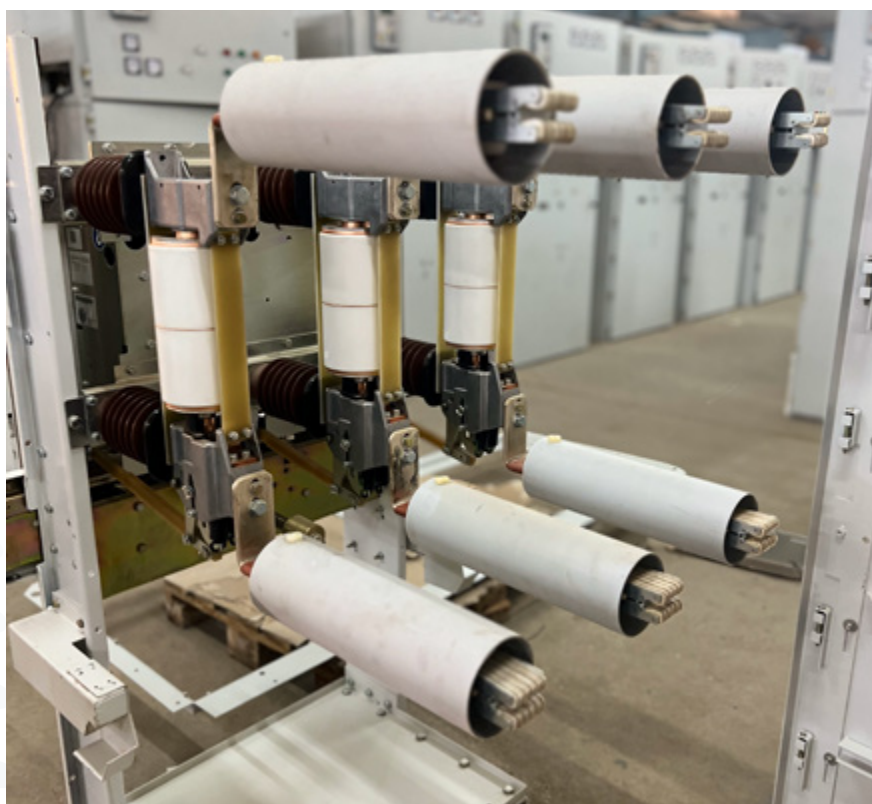
Circuit breaker panel

Design: Connection from front with block current transformer



Legend for panel design

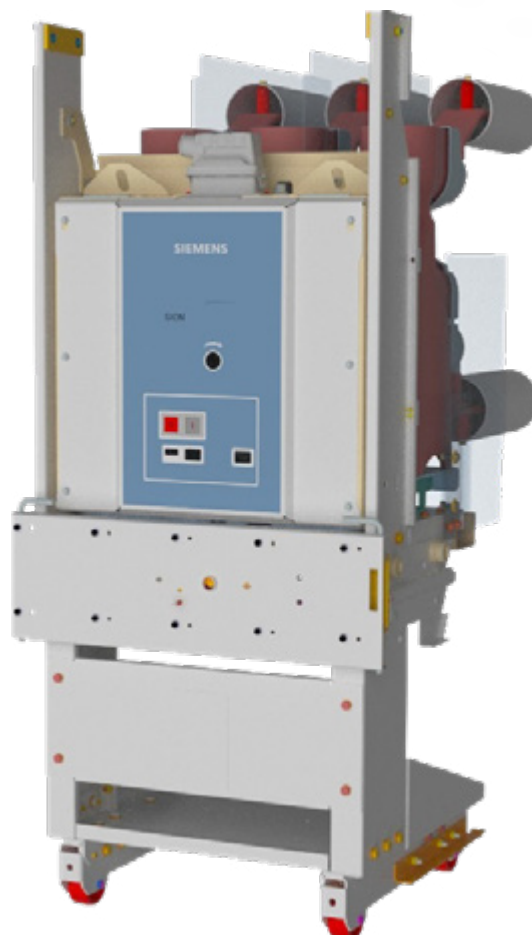
1. Door of low-voltage compartment
2. Opening for locking or unlocking the low-voltage compartment door
3. High-voltage door
4. Inspection window for checking the switching device truck
5. Opening for locking or unlocking the high-voltage door
6. Opening for mechanical charging of circuit breaker closing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



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

SIMOPRIME switchgear 24 kV

Rated frequency	Hz	50/60
Rated short-duration power-frequency withstand voltage	kV	50
Rated lightning impulse withstand voltage	kV	125
Rated short-time withstand current in 3 s	kA	25
Rated peak withstand current at 50/60 Hz	kA	63
Rated short-circuit breaking current	kA	25
Rated short-circuit making current at 50/60 Hz	kA	63
Rated normal current of busbar	A	2,500
Rated normal current of feeders	A	2,500
• with circuit breaker		as per fuse
• with three position switch disconnecter		



Switching device compartment

- All switching operations with high-voltage door closed
- Pressure relief upwards
- Powder-coated panel with epoxy resin transformers
- 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

Busbar compartment

- Pressure relief upwards and through rear pressure relief duct
- Busbars made of flat copper, bolted from panel to panel
- For rated normal currents up to 2,500 A
- Bolted top covers provide tool-based access
- Optional:
 - Coupling electrode for capacitive voltage detecting system
 - Insulated busbars
 - Busbar transverse partition between panels

Connection compartment

- Pressure relief upwards through rear pressure relief duct
- Suitable for connection of
 - Single-core XLPE cables up to max. 4 x 500 mm² per phase
 - Three-core XLPE cables up to max. 3 x 300 mm² per panel
- Shutters to be opened separately to permit cable testing
- Earthing busbar
- Connection from front or rear
- 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 and tool based access for panels with connection from front
- Optional:
 - Coupling electrode for capacitive voltage detecting system
 - Voltage transformers
 - Cast-resin insulated
 - Max. 3 x 1-pol
 - 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 electro-magnetic interlock
 - Surge arresters
 - Surge arresters for protecting the switchgear against external overvoltages

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

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 circuitbreaker 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
- Optional:
 - Electromagnetic interlocks

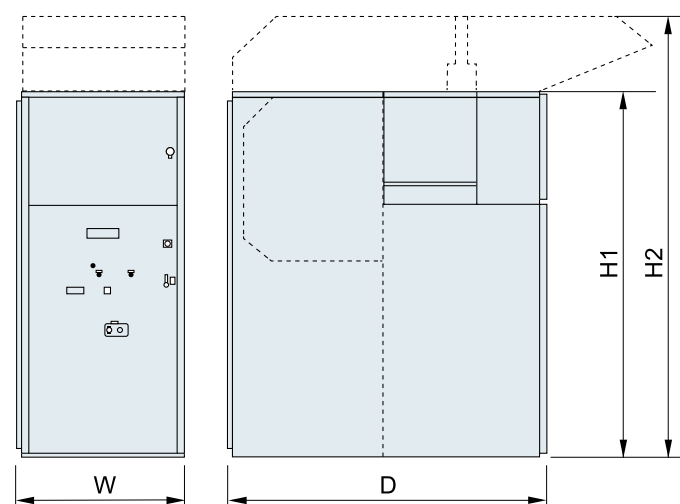
SIMOPRIME 24 kV

Panel installation & configuration

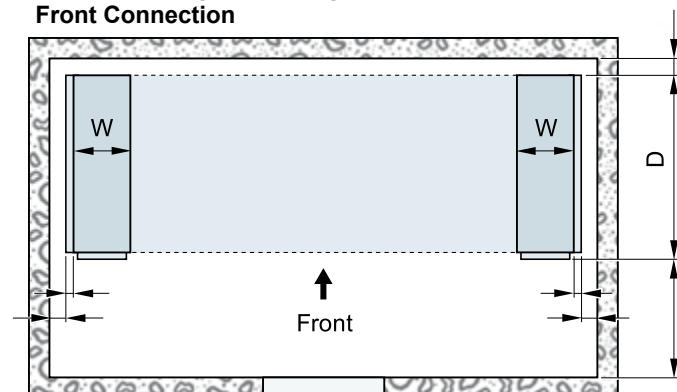
SIMOPRIME switchgear	25 kA
Width in mm	
Circuit-breaker panel	
less than 1250 A	800
for 1250 A	800
for 2500 A	1,000
Load break switch	500
Height in mm	
H1 With standard low-voltage compartment and IAC 0.1 s	2,250
H2 With additional pressure relief channel for IAC 1.0 s	2,728
Depth in mm	
D Standard	1,900

Classification according to IEC 62271 200

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



Room planning (room height $\geq 2,850$ mm) Front Connection



Single-row arrangement (plan view)

For dimensions W (width) and D (depth) refer to table on this page

- 1) For panel replacement: Control aisle 2,000 mm
- 2) Minimum distance to wall 150 mm

