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Fixed-Mounted Circuit-Breaker Switchgear Type NXPLUS C Wind up to 36 kV, Gas-Insulated

Medium-Voltage Switchgear · Catalog HA 35.61 · 2013

Answers for infrastructure and cities.

R-HA35-158.eps

Application:
Onshore wind park

R-HA35-157.eps

R-HA35-156.eps

Application:
Offshore wind park

R-HA35-159.eps

Contents

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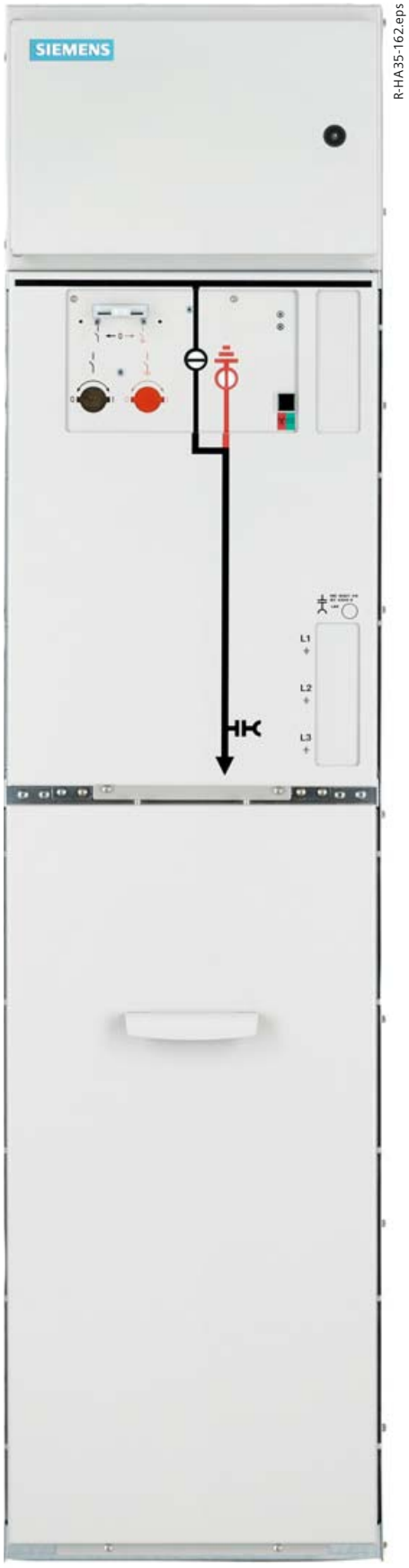
ISO 9001
ISO 14001
DNV
Certified Company

OHSAS 18001
DNV
Certified Company

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

Types



Disconnector panel 450 mm

Circuit-breaker panel 600 mm

Typical uses, ratings

Fixed-mounted circuit-breaker switchgear NXPLUS C Wind is a factory-assembled, type-tested, metal-enclosed, SF_6-insulated switchgear for single-busbar applications for indoor installation.

They are mainly used in wind turbines and in substations for connecting the wind turbines to the wind park network. Additionally, they can also be used in transformer and switching substations for other applications.

Electrical data (maximum values) and dimensions

Rated voltage	kV	**36**
Rated frequency	Hz	50/60
Rated short-duration power-frequency withstand voltage	kV	70
Rated lightning impulse withstand voltage	kV	170
Rated peak withstand current	kA	63
Rated short-circuit making current	kA	63
Rated short-time withstand current		
1 s	kA	25
3 s	kA	20
Rated short-circuit breaking current	kA	25
Rated normal current of the busbar	A	1000
Rated normal current of feeders	A	630/800/1000
Width	mm	450/600
Depth with pressure relief duct at the rear	mm	1000
Height	mm	1900/2250 [1)]

1) Panels with high low-voltage compartment and switchgear with voltage transformers at the busbar

Requirements

Features

Environmental independence
Hermetically tight, welded switchgear vessels made of stainless steel as well as single-pole solid insulation make the parts of the primary circuit under high voltage of NXPLUS C Wind switchgear
- Insensitive to certain aggressive ambient conditions, such as:
  – Saline air
  – Air humidity
  – Dust
  – Condensation
- Tight to ingress of foreign objects, such as:
  – Dust
  – Pollution
  – Small animals
  – Humidity
- Independent of the site altitude.

Compact design
Thanks to the use of SF_6 insulation, compact dimensions are possible. This is the basic prerequisite for application in wind turbines. For installation or removal, it must be possible to bring the switchgear in through the door of the wind turbine.

Maintenance-free design
Switchgear vessels designed as sealed pressure systems, maintenance-free switching devices and enclosed cable plugs ensure:
- Maximum supply reliability
- Personnel safety
- Sealed-for-life design according to IEC 62271-200 (sealed pressure system)
- Installation, operation, extension and replacement without SF_6 gas work
- Reduced operating costs
- Cost-efficient investment
- No maintenance cycles.

Innovation
The use of digital secondary systems and combined protection and control devices ensures:
- Clear integration in process control systems
- Flexible and highly simplified adaptation to new system conditions and thus to cost-efficient operation.

Service life
Under normal operating conditions, the expected service life of the gas-insulated switchgear NXPLUS C Wind is at least 35 years, probably 40 to 50 years, taking the tightness of the hermetically welded switchgear 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 and earthing switches according to the endurance class defined in IEC 62271-103 and IEC 62271-102.

Safety

Personal safety
- Safe-to-touch and hermetically sealed primary enclosure
- Cable terminations, busbars and voltage transformers are surrounded by earthed layers
- All high-voltage parts including the cable terminations, busbars and voltage transformers are metal-enclosed
- Capacitive voltage detecting system to verify safe isolation from supply
- Operating mechanisms and auxiliary switches safely accessible outside the primary enclosure (switchgear vessel)
- Due to the system design, operation is only possible with closed switchgear enclosure
- Standard degree of protection IP 65 for all high-voltage parts of the primary circuit, IP 3XD for the switchgear enclosure according to IEC 60529 and VDE 0470-1
- High resistance to internal arcs by logical mechanical interlocks and tested switchgear enclosure
- Panels tested for resistance to internal faults up to 25 kA
- Logical mechanical interlocks prevent maloperation
- Make-proof earthing by means of the circuit-breaker or the three-position switch-disconnector.

Security of operation
- Hermetically sealed primary enclosure independent of environmental effects (pollution, humidity and small animals)
- Maintenance-free in an indoor environment (IEC 62271-1 and VDE 0671-1)
- Operating mechanisms of switching devices accessible outside the primary enclosure (switchgear vessel)
- Metal-enclosed, plug-in inductive voltage transformers mounted outside the SF_6 switchgear vessel
- Current transformers as ring-core current transformers mounted outside the SF_6 switchgear vessel
- Complete switchgear interlocking system with logical mechanical interlocks
- Welded switchgear vessels, sealed for life
- Minimum fire load
- Type and routine-tested
- Standardized, NC production processes
- Quality assurance in accordance with DIN EN ISO 9001
- More than 500,000 switchgear panels of Siemens in operation worldwide for many years
- Option: Aseismic design.

Reliability
- Type and routine-tested
- Standardized, NC production processes
- Quality assurance in accordance with DIN EN ISO 9001
- More than 500,000 switchgear panels of Siemens in operation worldwide for many years.

General
- 3-pole enclosure of the primary part consisting of a switchgear vessel made of stainless steel
- Insulating gas SF_6
- Three-position switch as busbar disconnector and feeder earthing switch
- Make-proof earthing by means of the vacuum circuit-breaker
- Compact dimensions due to SF_6 insulation
- Hermetically tight, welded switchgear vessel made of stainless steel
- 1-pole, solid-insulated, screened busbars, plug-in type
- Cable connection with outside-cone plug-in system
- Wall-standing or free-standing arrangement
- Cable connection access from front
- Low-voltage door hinge on the left and on the right
- Installation and extension of existing switchgear at both ends without gas work and without modification of existing panels.

Interlocks
- According to IEC 62271-200 and VDE 0671-200
- Logical mechanical interlocks prevent maloperation
- Three-position disconnector can only be operated with circuit-breaker in OPEN position
- Circuit-breaker can only be operated with three-position switch in end position and operating lever removed
- Three-position disconnector interlocked against the circuit-breaker in circuit-breaker panels
- "Feeder earthed" locking device
- Locking device for three-position switch
  The following interlocks can be fulfilled by placing the padlock accordingly:

– Padlock on the left:
  Three-position switch "DISCONNECTING" function cannot be operated,
  three-position switch "READY-TO-EARTH" function can be operated
– Padlock in the center:
  Control gate blocked, no switching operations possible
– Padlock on the right:
  Three-position switch "DISCONNECTING" function can be operated,
  three-position switch "READY-TO-EARTH" function cannot be operated

- Option: Cable compartment cover interlocked against the three-position switch (circuit-breaker panel, disconnector panel, ring-main panel)
- Option: Electromagnetic interlocks
- Option: Actuating openings can be padlocked
- Option: "Feeder earthed" locking device.

Modular design
- Panel replacement possible without SF_6 gas work
- Low-voltage compartment removable, plug-in bus wires.

Instrument transformers
- Current transformers not subjected to dielectric stress
- Easy replacement of current transformers designed as ring-core transformers
- Voltage transformers metal-enclosed, plug-in type.

Vacuum circuit-breaker
- Maintenance-free under normal ambient conditions according to IEC 62271-1 and VDE 0671-1
- No relubrication or readjustment
- Up to 2000 operating cycles
- Vacuum-tight for life.

Secondary systems
- Customary protection, measuring and control equipment
- Option: Numerical multifunction protection relay with integrated protection, control, communication, operating and monitoring functions
- Can be integrated in process control systems.

Standards (see page 32)

Technical data

Electrical data, filling pressure, temperature for single-busbar switchgear

Common electrical data, filling pressure and temperature	Rated insulation level	Rated voltage U_r	kV	**36**
		Rated short-duration power-frequency withstand voltage U_d: – phase-to-phase, phase-to-earth, open contact gap – across the isolating distance	 kV kV	 70 80
		Rated lightning impulse withstand voltage U_p: – phase-to-phase, phase-to-earth, open contact gap – across the isolating distance	 kV kV	 170 180
	Rated frequency f_r		Hz	50 / 60 [3]
	Rated normal current I_r [1]	for the busbar	up to A	1000
	Rated filling level p_{re} [2]			150 kPa (absolute) at 20 °C
	Minimum functional level p_{me} [2]			130 kPa (absolute) at 20 °C
	Ambient air temperature			–25 °C to +55 °C [3]

Data of the switchgear panels

Circuit-breaker panel 630 A 800 A	Rated normal current I_r [1]		A A	630 800	
	Rated short-time withstand current I_k	for switchgear with t_k = 1 s	up to kA	20	25
		for switchgear with t_k = 3 s	up to kA	20	–
	Rated peak withstand current I_p	50 Hz	up to kA	50	63
		60 Hz	up to kA	52	65
	Rated short-circuit making current I_{ma}	50 Hz	up to kA	50	63
		60 Hz	up to kA	52	65
	Rated short-circuit breaking current I_{sc}		up to kA	20	25
	Electrical endurance of vacuum circuit-breakers	at rated normal current		2000 operating cycles	
		at rated short-circuit breaking current		20 breaking operations	
Disconnector panel 630 A 1000 A	Rated normal current I_r [1]		A A	630 1000	
	Rated short-time withstand current I_k	for switchgear with t_k = 1 s	up to kA	20	25
		for switchgear with t_k = 3 s	up to kA	20	–
	Rated peak withstand current I_p	50 Hz	up to kA	50	63
		60 Hz	up to kA	52	65
Ring-main panel [3]	Rated normal current I_r [1]	for feeder	A	630	
	Rated short-time withstand current I_k	for switchgear with t_k = 1 s	up to kA	20	25
		for switchgear with t_k = 3 s	up to kA	20	–
	Rated peak withstand current I_p	50 Hz	up to kA	50	63
		60 Hz	up to kA	52	–
	Rated short-circuit making current I_{ma}	50 Hz	up to kA	50	63
		60 Hz	up to kA	52	–

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

2) Pressure values for SF_6-insulated switchgear vessels

3) Ambient air temperature of –35 °C on request

Switchgear installation
- For single-busbar applications:
– Wall-standing arrangement or
– Free-standing arrangement.

Room dimensions
See opposite dimension drawings.

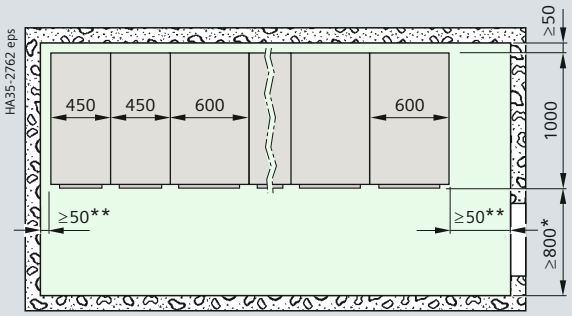
Room height
≥ 2400 mm all switchgear assemblies without busbar voltage transformer
≥ 2700 mm all switchgear assemblies with busbar voltage transformer

Door dimensions
The door dimensions depend on the dimensions of the individual panels (see page 11).

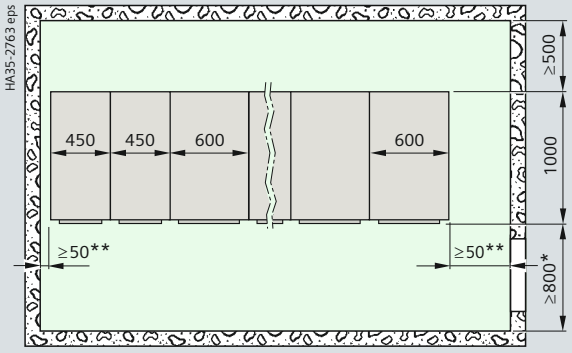
Switchgear fixing
- For floor openings and fixing points of the switchgear, see page 11
- Foundations:
– Steel girder construction
– Steel-reinforced concrete with foundation rails, welded or bolted on.

Panel dimensions
See page 11.

Room planning for single-busbar switchgear



Wall-standing arrangement (top view)



Free-standing arrangement (top view)

* Depending on national requirements; for extension/panel replacement: Control aisle ≥ 1200 mm recommended

** Lateral wall distances on the left or on the right: ≥ 500 mm is recommended

Technical data

Shipping data, classification

Transport
NXPLUS C Wind switchgear is delivered in form of individual panels, or as a panel combination with a maximum width of 1500 mm.
Please observe the following:
- Transport facilities on site
- Transport dimensions and transport weights
- During the transport of panel groups, the corresponding transport rods must be used
- Size of door openings in building.

Packing
Means of transport: Rail and truck
– Panels on pallets
– Open packing with PE protective foil.

Means of transport: Ship
– Panels on pallets
– In closed crates with sealed upper and lower PE protective foil
– With desiccant bags
– With sealed wooden base
– Max. storage time: 6 months.

Means of transport: Container
– Panels on pallets
– With sealed upper and lower PE protective foil
– With desiccant bags.

Means of transport: Airplane
– Panels on pallets
– In wooden latticed crate with sealed upper and lower PE protective foil
– With desiccant bags.

1) Average values depending on the degree to which panels are equipped

Transport dimensions, transport weights [1)]

Panel widths	Transport dimensions Width × Height × Depth	Transport weight with packing	without packing
mm	mm × mm × mm	approx. kg	approx. kg
NXPLUS C Wind transport inside Germany or to European countries Transport with rail or truck			
1 × 450	1100 × 2120 × 1450	500	400
1 × 600	1100 × 2120 × 1450	600	500
2 × 450	1450 × 2470 × 1450	1000	800
1 × 600 + 1 × 450	1450 × 2470 × 1450	1100	900
2 × 600	1776 × 2470 × 1400	1200	1000
1 × 600 + 2 × 450	1776 × 2470 × 1400	1600	1300
3 × 450	1776 × 2470 × 1400	1500	1200
NXPLUS C Wind transport to overseas Transport with ship or airplane			
1 × 450	1130 × 2650 × 1450	500	400
1 × 600	1130 × 2650 × 1450	600	500
2 × 450	1450 × 2650 × 1480	1000	800
1 × 600 + 1 × 450	1450 × 2650 × 1480	1100	900
2 × 600	1776 × 2410 × 1426	1200	1000
1 × 600 + 2 × 450	1776 × 2410 × 1426	1600	1300
3 × 450	1776 × 2410 × 1426	1500	1200

Classification of NXPLUS C switchgear according to IEC 62271-200

Design and construction

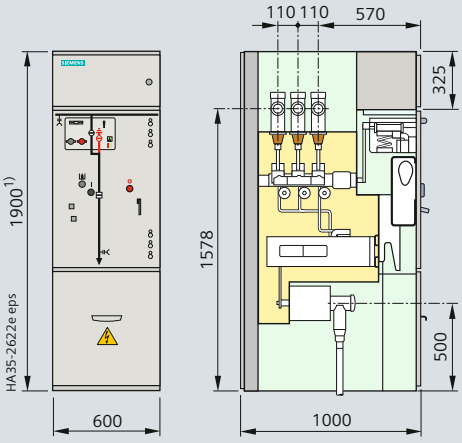
Partition class	PM (partition of metal)
Loss of service continuity category	LSC 2
Accessibility to compartments (enclosure) Busbar compartment Switching device compartment Low-voltage compartment Cable compartment	 Tool-based Non-accessible Tool-based Tool-based

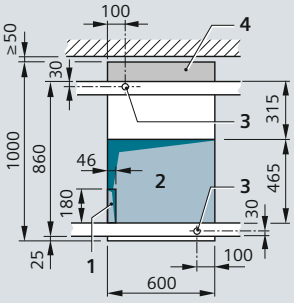
Internal arc classification

Designation of the internal arc classification IAC IAC class for: Wall-standing arrangement Free-standing arrangement	 IAC A FL 25 kA, 1 s IAC A FLR 25 kA, 1 s
Type of accessibility A – F – L – R	Switchgear in closed electrical service location, access “for authorized personnel only” according to IEC 62271-200 Front Lateral Rear (for free-standing arrangement)
Arc test current	25 kA
Test duration	1 s

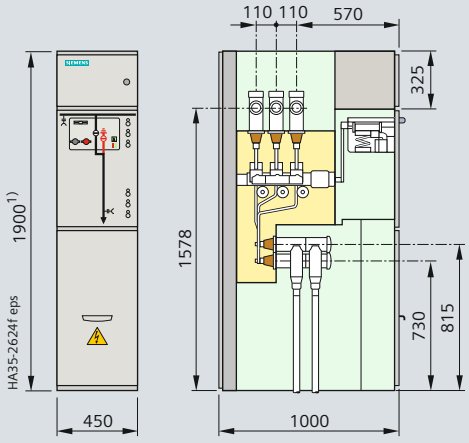
Front views, sections, floor openings, fixing points for single-busbar switchgear

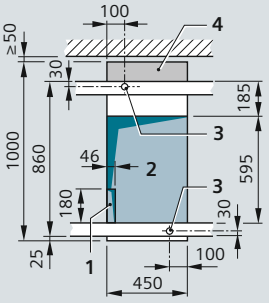
Circuit-breaker panel



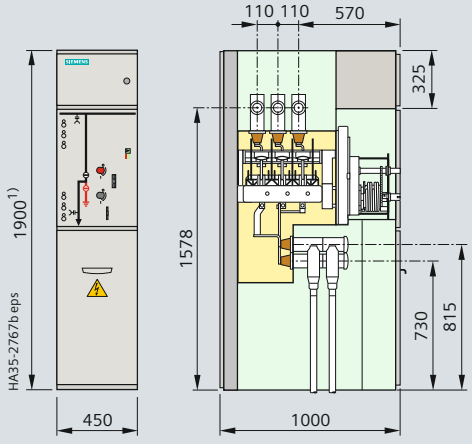


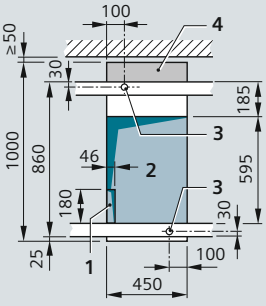
Disconnector panel





Ring-main panel
(switch-disconnector panel without HV HRC fuses)





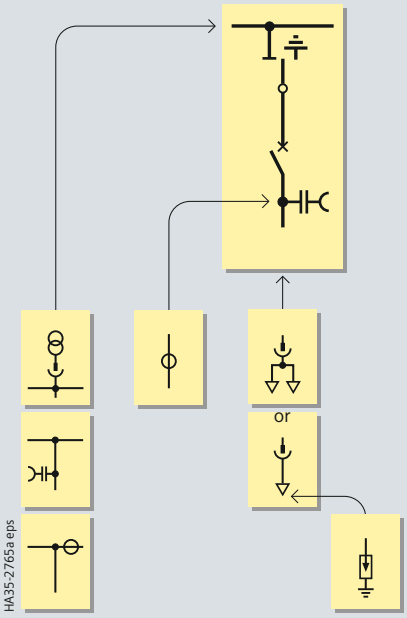
1 Floor opening for control cables
2 Floor opening for high-voltage cables
3 Fixing hole for M8 / M10
4 Pressure relief duct

1) 2225 mm for panels with 650 mm high low-voltage compartment and for panels with busbar voltage transformer

Product range

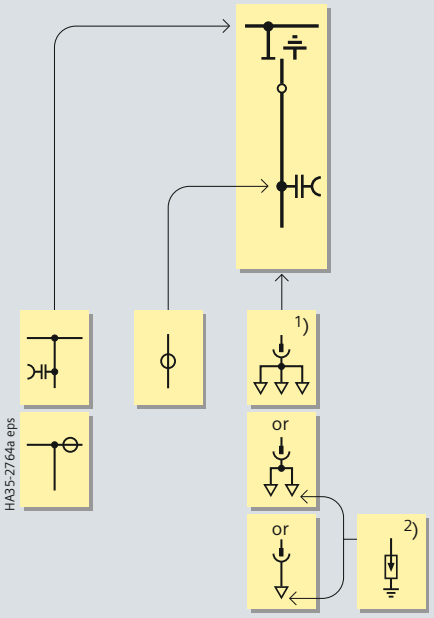
Single-busbar panels

Circuit-breaker panel



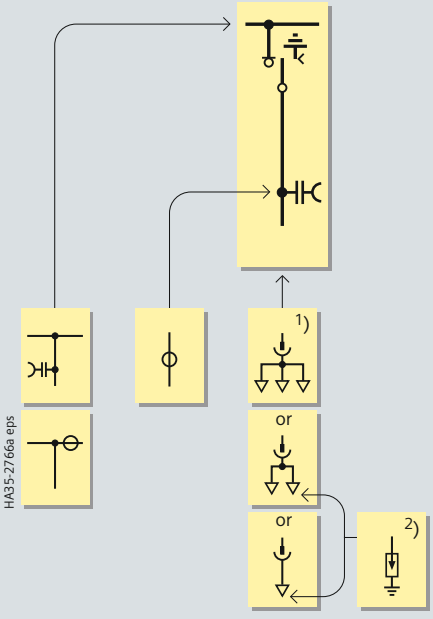
630 A and 800 A

Disconnector panel



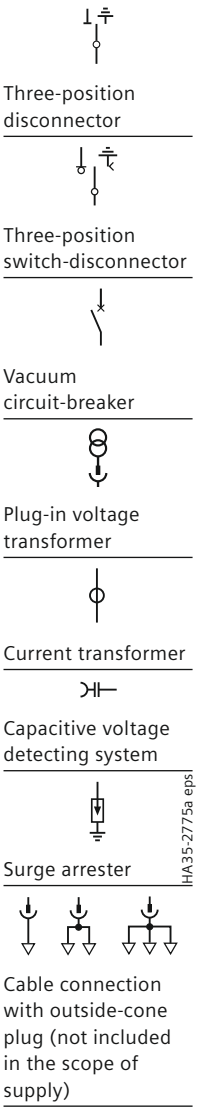
630 A and 1000 A

Ring-main panel



630 A

1) Depending on the type of cable T-plug, three cables are possible
2) Depending on the type of cable T-plug, an additional surge arrester can be installed at the double cable connection



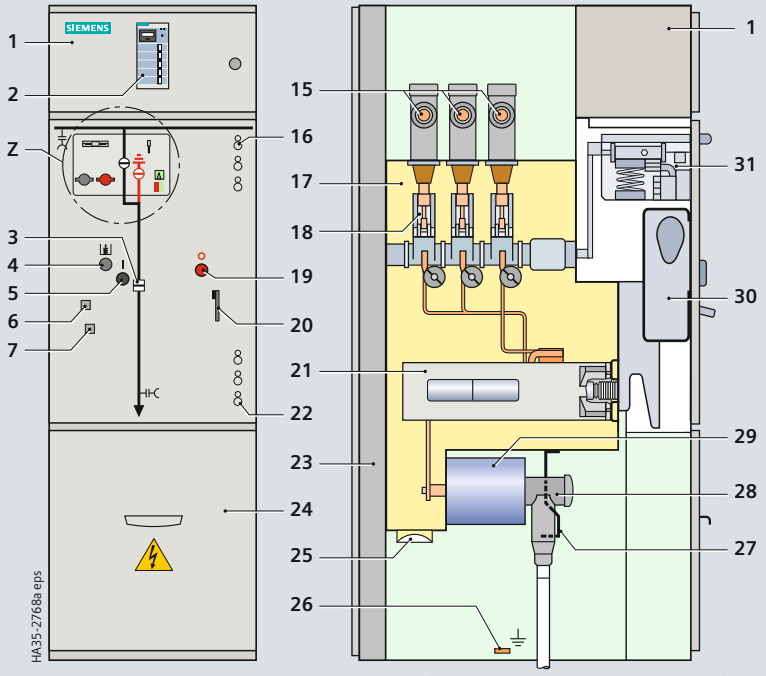
Insulating system

- Switchgear vessel filled with SF_6 gas
- Features of SF_6 gas:
  - Non-toxic
  - Odorless and colorless
  - Non-inflammable
  - Chemically neutral
  - Heavier than air
  - Electronegative (high-quality insulator)
- Pressure of SF_6 gas in the switchgear vessel (absolute values at 20 °C):
  - Rated filling level: 150 kPa
  - Design pressure: 180 kPa
  - Design temperature of the SF_6 gas: 80 °C
  - Operating pressure of bursting disc: ≥ 300 kPa
  - Bursting pressure: ≥ 550 kPa
  - Gas leakage rate: < 0.1 % per year.

Panel design

- Factory-assembled, type-tested
- Metal-enclosed
- Hermetically tight, welded switchgear vessel made of stainless steel
- 1-pole, solid-insulated, screened busbars, plug-in type
- Maintenance-free
- Degree of protection
  - IP 65 for all high-voltage parts of the primary circuit
  - IP 3XD for the switchgear enclosure
- Vacuum circuit-breaker
- Three-position disconnector for disconnecting and earthing by means of the circuit-breaker
- Make-proof earthing by means of the vacuum circuit-breaker
- Three-position switch-disconnector
- Cable connection with outside-cone plug-in system according to DIN EN 50 181
- Wall-standing or free-standing arrangement
- Installation and possible later extension of existing panels without gas work
- Replacement of switchgear vessel without gas work
- Replacement of instrument transformers without gas work, as they are located outside the gas compartments
- Enclosure made of sendzimir-galvanized sheet steel, front cover, rear cover and end walls powder-coated in color "light basic" (SN 700)
- Low-voltage compartment removable, plug-in bus wires
- Lateral, metallic wiring ducts for control cables.

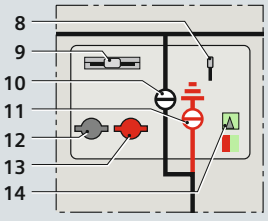
Circuit-breaker panel (example)



Front view

Side view (cable connection from the front)

Detail Z:



1 Low-voltage compartment
2 Multifunction protection relay 7SJ45 (example)
3 Position indicator for circuit-breaker
4 Actuating opening for charging the circuit-breaker springs
5 ON pushbutton for circuit-breaker
6 "Spring charged" indicator
7 Operations counter for circuit-breaker
8 Interrogation lever
9 Control gate and locking device for "disconnecting/earthing" functions of three-position switch
10 Position indicator for "disconnecting" function of three-position switch
11 Position indicator for "ready-to-earth" function of three-position switch
12 Actuating opening for "disconnecting" function of three-position switch
13 Actuating opening for "ready-to-earth" function of three-position switch
14 Ready-for-service indicator
15 Busbar, 1-pole, fully insulated, plug-in type, earthed on the outside
16 Capacitive voltage detecting system at the busbar
17 Switchgear vessel, hermetically welded, filled with SF_6 gas
18 Three-position disconnector
19 OFF pushbutton for circuit-breaker
20 Feeder locking device (suitable for padlocking)
21 Circuit-breaker with vacuum interrupters
22 Capacitive voltage detecting system at the cable connection
23 Pressure relief duct
24 Cable compartment
25 Pressure relief (bursting disc)
26 Earthing busbar with earthing connection
27 Air guides for cable connection
28 Cable connection with cable T-plug
29 Feeder current transformer
30 Operating mechanism for circuit-breaker
31 Operating mechanism for three-position switch

Components

Vacuum circuit-breaker

Features
- According to IEC 62271-100 and VDE 0671-100 (for standards, see page 32)
- Application in hermetically welded switchgear vessel in conformity with the system
- Climate-independent vacuum interrupter poles in the SF_6-filled switchgear vessel
- Maintenance-free for indoor installation according to IEC 62271-1 and VDE 0671-1
- Individual secondary equipment
- A metal bellows is used for gasketless separation of the SF_6 insulation and the operating mechanism (already used with success for over 2 million vacuum interrupters).

Trip-free mechanism
The vacuum circuit-breaker is fitted with a trip-free mechanism according to IEC 62271 and VDE 0671.

Operating mechanisms
Several operating mechanism types are available for the vacuum circuit-breaker:
- Manual spring-operated mechanism
- Motor operating stored-energy mechanism

Further operating mechanism features
- Located outside the switchgear vessel in the operating mechanism box and behind the control board
- Operating mechanism for 2000 operating cycles.

Operating mechanism functions
- Manual spring-operated mechanism
  In the case of manual spring-operated mechanism, the closing spring is charged by means of a hand crank. When the spring is completely charged, the circuit-breaker closes automatically.
- Motor operating stored-energy mechanism [1] (M1 *)
  In the case of motor operating stored-energy mechanism, the closing spring is charged by means of a motor and latched in the charged position ("spring charged" indication is visible). Closing is effected either by means of an ON pushbutton or a closing solenoid. The closing spring is recharged automatically.

Endurance class of circuit-breaker

Function	Class	Standard	Property of NXPLUS C Wind
BREAKING	M1	IEC 62271-100	2000 times mechanically without maintenance
	E2 with and without ARE	IEC 62271-100	2000 times rated normal current without maintenance 20 times short-circuit breaking current without maintenance
	C2	IEC 62271-100	Very low probability of restrikes

Operating times

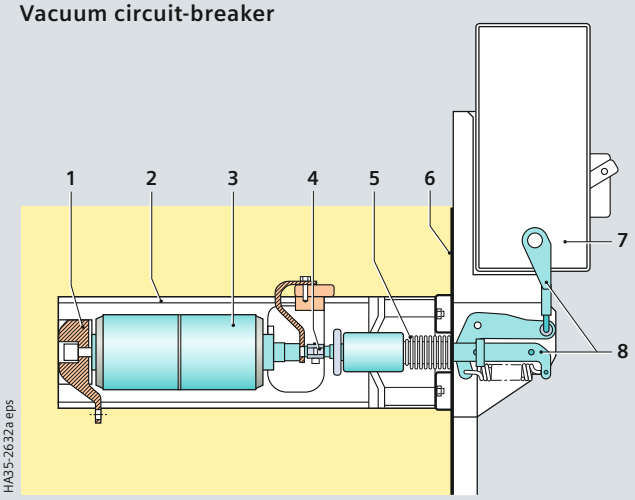
Closing time	Closing solenoid	< 75 ms
Opening time	1st release 2nd release	< 65 ms < 50 ms
Arcing time at 50 Hz		< 15 ms
Break time	1st release 2nd release	< 80 ms < 65 ms
Dead time		300 ms
Total charging time		< 15 s

ARE = Auto-reclosing

1) Motor rating at 24 V to 240 V DC: 600 W
   100 V and 240 V AC: 750 VA

* Item designation

Vacuum circuit-breaker



Section through the vacuum circuit-breaker

1 Fixed terminal
2 Pole support
3 Vacuum interrupter
4 Moving terminal
5 Metal bellows
6 Switchgear vessel, SF_6-insulated, with vacuum interrupter
7 Operating mechanism box
8 Operating kinematics

For further technical data and description of typical applications, please refer also to Catalog HG 11.05 "3AH5 Vacuum Circuit-Breakers".

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

Closing solenoid
(only for motor operating stored-energy mechanism)
- Type 3AY15 10 (Y9 *)
- For electrical closing.

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

C.t.-operated release
- Type 3AX11 02 (Y4 *), 0.5 A
- Type 3AX11 04 (Y6 *) for tripping pulse ≥ 0.1 Ws in conjunction with suitable protection systems
- Used if external auxiliary voltage is missing, tripping via protection relay.

Undervoltage release
- Type 3AX11 03 (Y7 *)
- Comprising:
– Energy store and unlatching mechanism
– Electromagnetic system, which is permanently connected to voltage while the vacuum circuit-breaker is closed; tripping is initiated when this voltage drops
- Connection to voltage transformers possible.

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

Circuit-breaker tripping signal
- For electrical signaling (as pulse > 10 ms), e.g. to remote control systems, in the case of automatic tripping (e.g. protection)
- Via limit switch (S6 *) and cut-out switch (S7 *).

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

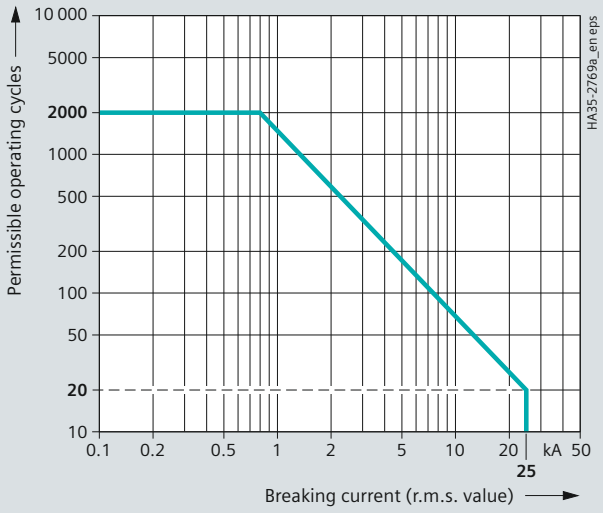
Auxiliary switch
- Type 3SV9 (S1 *)
- Standard: 6 NO + 6 NC, free contacts thereof [1] 3 NO + 4 NC
- Option: 12 NO + 12 NC, free contacts thereof [1] 9 NO + 6 NC.

Position switch
- Type 3SV9 (S4 *)
- For signaling "closing spring charged".

Mechanical interlock
- Mechanical interlocking to the three-position disconnector
- During operation of the three-position switch, the vacuum circuit-breaker cannot be operated.

1) For utilization by the customer
* Item designation
Abbreviations: NO = normally open contact
NC = normally closed contact

Switching rate of the vacuum interrupter



Electrical data
Rated voltage 36 kV
Rated short-circuit breaking current ≤ 25 kA
Rated normal current ≤ 800 A

Rated operating sequences
O - *t'* - CO - *t'* - CO (*t'* 3 min)
O - *t* - CO - *t'* - CO (*t* 0.3 sec, *t'* 3 min)

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

Possible release combinations

Release	Release combination 1	2	3	4	5	6
1st shunt release type 3AY15 10	•	•	•	•	•	•
2nd shunt release type 3AX11 01	–	•	–	–	•	•
3rd shunt release type 3AX11 01	–	–	–	–	–	•
C.t.-operated release type 3AX11 02, 0.5 A, or type 3AX11 04, 0.1 Ws	–	–	•	–	•	–
Undervoltage release type 3AX11 03	–	–	–	•	–	–

1 unit of each release, a maximum of 3 releases can be combined.

Components

Three-position switches

Common features

- According to IEC 62271-102 and VDE 0671-102 (for standards, see page 32)
- Application in hermetically welded switchgear vessel in conformity with the system
- Climate-independent contacts in the SF_6-filled switchgear vessel
- Maintenance-free for indoor installation according to IEC 62271-1 and VDE 0671-1
- Individual secondary equipment
- A metal bellows is used for gasketless separation of the SF_6 insulation and the operating mechanism (already used with success for over 2 million vacuum interrupters)
- A rotary bushing is used for separation of the SF_6 insulation and the operating mechanism (already used with success millions of times in medium-voltage and high-voltage switchgear)
- Compact design due to short contact gaps in SF_6 gas
- Operation via gas-tight rotary bushing at the front of the switchgear vessel
- Reliable mechanical switch position up to the operating front of the panel.

Three-position disconnector

- Application in:

– Circuit-breaker panel 630 A and 800 A (with interlock against the circuit-breaker)
– Disconnector panel 630 A and 1000 A

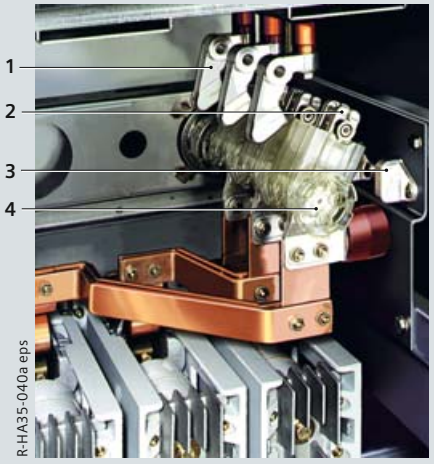
- 1000 mechanical operating cycles for CLOSED / OPEN / READY-TO-EARTH.

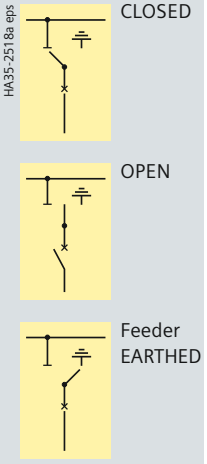
Three-position switch-disconnector

- Application in ring-main panel
- Switch positions: CLOSED – OPEN – EARTHED
- Switching functions as general-purpose switch-disconnector (class E3) according to IEC 62271-103 / VDE 0671-103
- Switching function as earthing switch (class E2) according to IEC 62271-102 / VDE 0671-102 (for standards, see page 32)
- Designed as a three-position switch with the functions:

– Switch-disconnector and
– Make-proof earthing switch.

Switch positions of the three-position switches

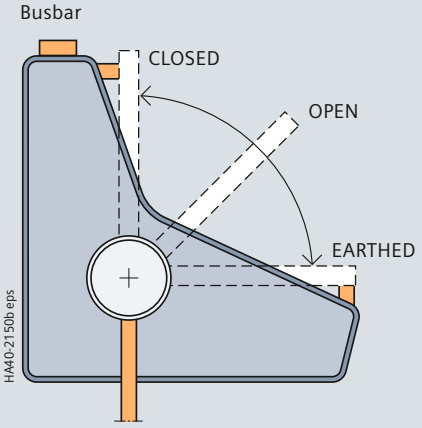




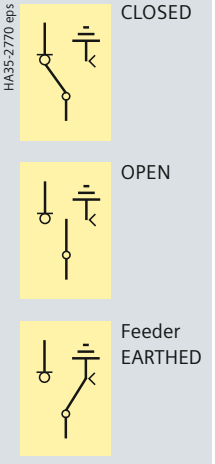
Three-position disconnector
(in OPEN position)
with vacuum circuit-breaker arranged below (view into the switchgear vessel opened at the rear)

Switch positions

1 Fixed contact at the busbar
2 Swivel-mounted contact blade
3 Fixed contact for "feeder EARTHED"
4 Operating shaft



Three-position switch-disconnector



Switch positions

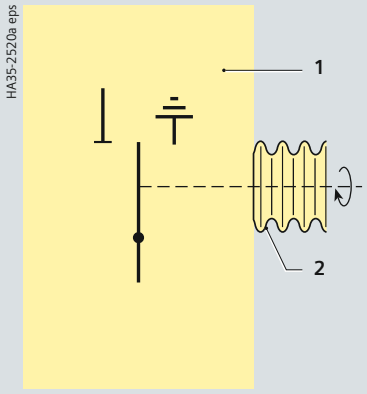
Interlocks
- Selection of permissible switching operations by means of a control gate with mechanically interlocked vacuum circuit-breaker
- Corresponding operating shafts are not released at the operating front until they have been pre-selected with the control gate
- Operating lever cannot be removed until switching operation has been completed
- Circuit-breaker cannot be closed until control gate is in neutral position again
- Switchgear interlocking system also possible with electromechanical interlocks if switchgear is equipped with motor operating mechanisms (mechanical interlocking for manual operation remains).

Switch positions
- "CLOSED", "OPEN", "EARTHED" or "READY-TO-EARTH"
- In circuit-breaker panels, earthing and short-circuiting the cable connection is completed by closing the vacuum circuit-breaker.

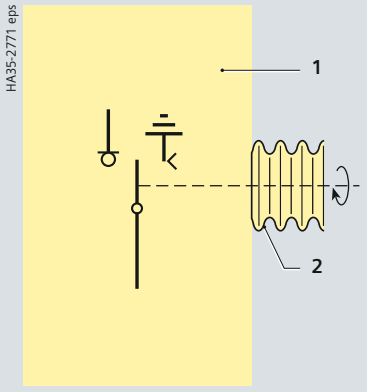
Operating mechanism
- Spring-operated mechanism, used in ring-main panel
- Slow motion mechanism, used in:
– Circuit-breaker panels
– Disconnector panels 630 A, 800 A, 1000 A
- Spring-operated and slow motion mechanism actuated via operating lever at the operating front of the panel
- Separate operating shafts for the DISCONNECTING and EARTHING or READY-TO-EARTH functions
- Option: Motor operating mechanism for the DISCONNECTING and EARTHING or READY-TO-EARTH functions
- Maintenance-free due to non-rusting design of parts subjected to mechanical stress
- Bearings which require no lubrication.

Transmission principle for operating mechanisms
(see illustration)
- Transmission of operating power from outside into the gas-filled switchgear vessel by means of a rotary bushing
- Gas-tight
- Maintenance-free.

Transmission principle for operating mechanisms



Three-position disconnector



Three-position switch-disconnector

1 Gas-filled switchgear vessel
2 Gas-tight welded-in rotary bushing

Endurance class of three-position disconnector

Function	Class	Standard	Property of NXPLUS C Wind
DISCONNECTING	M1	IEC 62271-102	1000 times mechanically without maintenance
READY-TO-EARTH	M0 E0	IEC 62271-102 IEC 62271-102	1000 times mechanically without maintenance
EARTHING	E2 [1)]	IEC 62271-200 IEC 62271-102	5 times rated short-circuit making current I_{ma} without maintenance

Endurance class of three-position switch-disconnector

Function	Class	Standard	Property of NXPLUS C Wind
DISCONNECTING	M0	IEC 62271-102	1000 times mechanically without maintenance
LOAD BREAKING	M1	IEC 62271-103	1000 times mechanically without maintenance
	E3	IEC 62271-103	100 times rated mainly active load breaking current I_1 without maintenance 5 times rated short-circuit making current I_{ma} without maintenance
EARTHING	MO	IEC 62271-102	1000 times mechanically without maintenance
	E2	IEC 62271-102	5 times rated short-circuit making current I_{ma} without maintenance

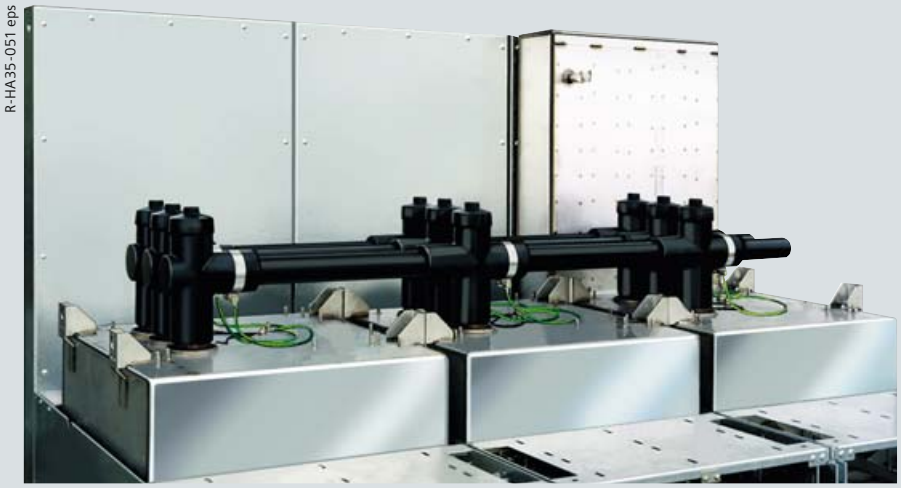
1) The EARTHING function with endurance class E2 is reached by closing the circuit-breaker in combination with the three-position disconnector (endurance class E0).

Components

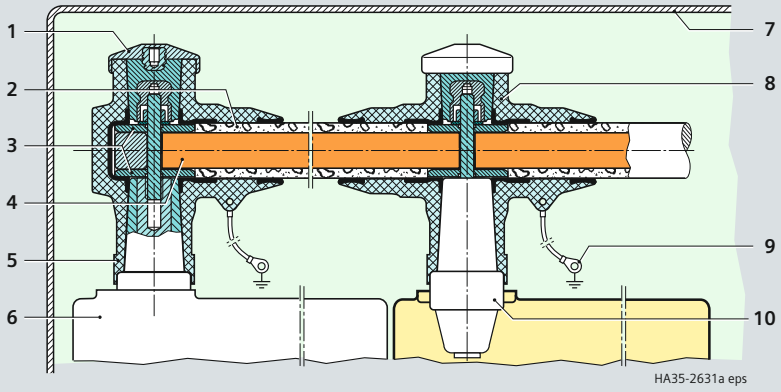
Busbars

Features
- 1-pole, plug-in and bolted design
- Consisting of round-bar copper, insulated by means of silicone rubber
- Busbar joints with cross and end adapters, insulated by means of silicone rubber
- Field control by means of electrically conductive layers on the silicone-rubber insulation (both inside and outside)
- Touchable as the external layers are earthed with the switchgear vessel
- Insensitive to pollution and condensation
- Safe-to-touch due to metal cover
- Switchgear extension or panel replacement is possible without SF_6 gas work.

Busbars (example)



Busbars 1000 A, plug-in type, fully insulated
(as front view of three panels, without low-voltage compartments)



Section of 1000 A busbar (basic design)
Panel width 450/600 mm

1 Cap
2 Busbar insulation made of silicone rubber
3 Clamps
4 Busbar (round-bar copper)
5 End adapter or coupling end adapter
6 Switchgear vessel
7 Metal cover of busbars
8 Cross adapter
9 Bushing
10 Earthing connection

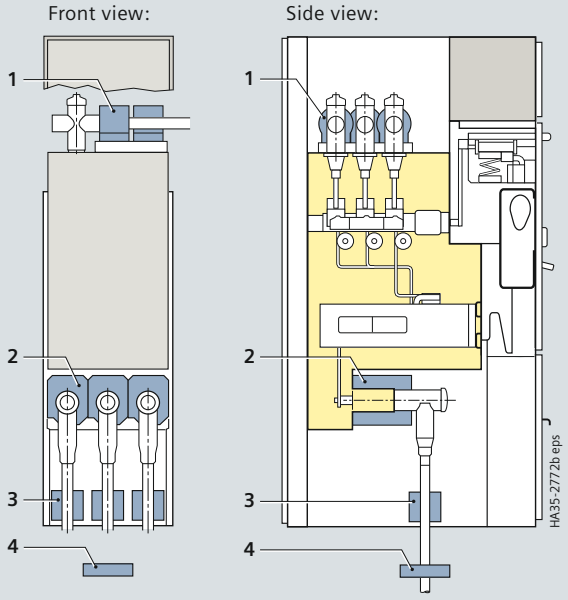
Features
- According to IEC 61869-2 and VDE 0414-9-2
- Designed as ring-core current transformers, 1-pole
- Free of dielectrically stressed cast-resin parts (due to design)
- Insulation class E
- Inductive type
- Certifiable
- Climate-independent
- Secondary connection by means of a terminal strip in the low-voltage compartment of the panel.

Installation
- Arranged outside the primary enclosure (switchgear vessel).

Mounting locations
- At the busbar (1)
- At the panel connection (2)
- Around the cable (3).

Current transformer types
- Busbar current transformer (1)
– Inside diameter of transformer 56 mm
– Max. usable height 170 mm
- Feeder current transformer (2):
– Inside Ø of transformer 106 mm
– Max. usable height 205 mm
- Cable-type current transformer (3) for shielded cables:
– Inside Ø of transformer 55 mm
– Max. usable height 170 mm
- Zero-sequence current transformer (4) underneath the panels (included in the scope of supply); on-site installation.

Current transformers



1 Busbar current transformer
2 Feeder current transformer at the panel connection
3 Cable-type current transformer
4 Zero-sequence current transformer

Current transformer installation in circuit-breaker panel (basic scheme)

Electrical data

Designation		Type 4MC
Operating voltage		max. 0.8 kV
Rated short-duration power-frequency withstand voltage (winding test)		3 kV
Rated frequency		50/60 Hz
Rated continuous thermal current		max. 1.0, 1.2, 1.33, 1.5; 2.0 × rated current (primary)
Rated thermal short-time current		max. 20 kA/3 s max. 25 kA/1 s
Rated current		
	dynamic	unlimited
	primary	40 A to 800 A
	secondary	1 A to 5 A
Multiratio (secondary)		200 A – 100 A to 800 A – 400 A
Core data according to rated primary current:		max. 3 cores
Measuring core	Rating	2.5 VA to 30 VA
	Class	0.2 to 1
	Overcurrent factor	FS 5, FS 10
Protection core	Rating	2.5 VA to 30 VA
	Class	5 P or 10 P
	Overcurrent factor	10 to 30
Permissible ambient air temperature		max. 60 °C
Insulation class		E

Voltage transformers

Features

- According to IEC 61869-3 and VDE 0414-9-3
- 1-pole, plug-in design
- Connection system with plug-in contact
- Inductive type
- Safe-to-touch due to metal enclosure
- Certifiable
- Climate-independent
- Secondary connection by means of plugs inside the panel
- Cast-resin insulated
- Arranged outside the primary enclosure (switchgear vessel)
- Mounting locations:

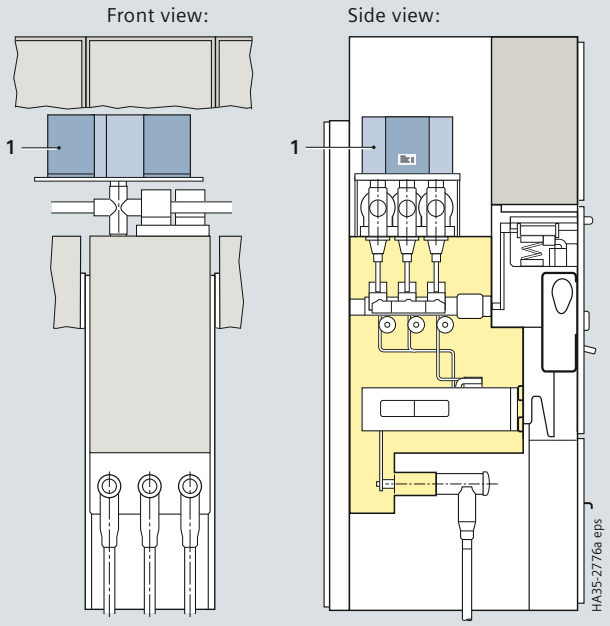
– At the busbar.

Voltage transformer types

- Busbar voltage transformer 4MT2:

– Pluggable in the cross adapters of the busbar ≤ 1000 A using additional adapters
– No separate metering panel required
– Suitable for 80 % of the rated short-duration power-frequency withstand voltage at rated frequency
– Repeat test at 80 % of the rated short-duration power-frequency withstand voltage possible with mounted voltage transformer.

Voltage transformer installation (basic design)



1 Busbar voltage transformer

Busbar voltage transformer
(metal-enclosed)
4MT2

Electrical data

Primary data

For type 4MT2 for operating voltages to 33 kV,
rated voltage factor U_n / 8h = 1.9; U_n / continuous = 1.2

Rated voltage	Rated short-duration power-frequency withstand voltage	Rated lightning impulse withstand voltage	Standard	Operating voltage
kV	kV	kV		kV
36	70	170	IEC	$30/\sqrt{3}$; $33/\sqrt{3}$

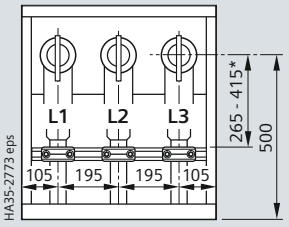
Secondary data

For type	Operating voltage	Auxiliary winding	Thermal limit current (measuring winding)	Rated long-time current 8 h	Rating at accuracy class			
					0.2	0.5	1	3
	V	V	A	A	VA	VA	VA	VA
4MT2	$100/\sqrt{3}$; $110/\sqrt{3}$; $120/\sqrt{3}$	100/3; 110/3; 120/3	6	4	IEC			
					10,15, 20, 25, 30	10, 15, 20, 25, 30, 45, 50, 60, 75, 90	10, 15, 20, 25, 30, 45, 50, 60, 75, 90, 100, 120, 150, 180	10, 15, 20, 25, 30, 45, 50, 60, 75, 90, 100, 120, 150, 180

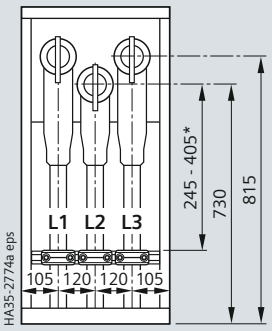
Features
- Bushings with outside cone
- With bolted contact (M16) as interface type "C" according to EN 50 180/EN 50 181
- For cable connection heights, see table on the right
- Max. connection depth:
  – 408 mm in circuit-breaker panel
  – 540 mm in ring-main panel and disconnector panel
- With cable bracket, e.g. type C40 according to DIN EN 50 024
- Option: Access to the cable compartment only if the feeder has been isolated and earthed
- For thermoplastic-insulated cables
- For shielded cable T-plugs with bolted contact
- For connection cross-sections up to 630 mm²
- Larger cross-sections on request
- Cable routing downwards, cable connection from the front
- Cable plugs and cable sealing ends are not included in the scope of supply.

Surge arresters
- Pluggable on cable T-plug
- Surge arresters recommended if, at the same time,
  – the cable system is directly connected to the overhead line,
  – the protection zone of the surge arrester at the end tower of the overhead line does not cover the switchgear.

Cable compartment



Panel width 600 mm



Panel width 450 mm

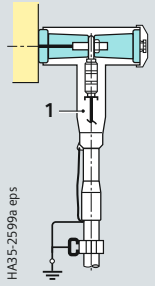
Cable connection heights

Panels	Height of cable compartment mm	Distance between bushing and cable bracket mm
450 mm	730/815	245-405 *
600 mm	500	265-415 *

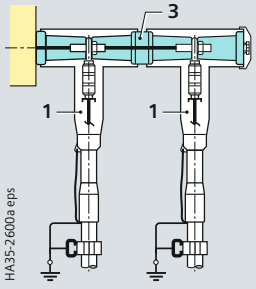
* The height of the cable brackets is adjustable. The distance depends on the position of the cable brackets.

Connectable cables

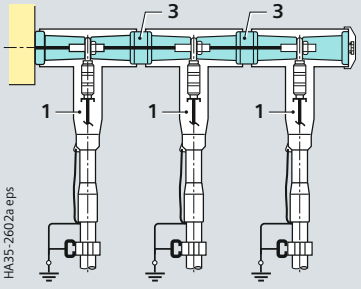
Cable T-plug with coupling insert



Connection with 1 cable per phase

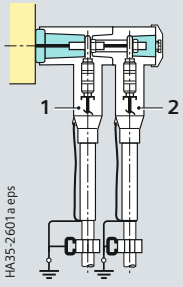


Connection with 2 cables per phase

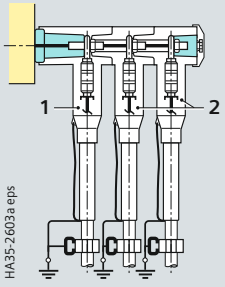


Connection with 3 cables per phase

Cable T-plug with coupling T-plug



Connection with 2 cables per phase



Connection with 3 cables per phase

Legend
1 Cable T-plug
2 Coupling T-plug
3 Screw-type coupling insert

Components

Installation possibilities for cable connections and surge arresters, single-core PE and XLPE-insulated

Number of cables per panel and phase	Make	Rated voltage	Conductor cross-section [1]	Insulation	T-plugs/phase	Coupling inserts/coupling plugs	Surge arresters with coupling inserts	
		KV	mm²				Arresters/phase	Coupling unit
Circuit-breaker panel 630 A • Circuit-breaker panel 800 A								
1	Nexans Euromold	36	50 to 240	EPDM	1× M400TB/G	–	1× 400PB 5(10) SA-xxx	–
		36	50 to 240	EPDM	1× M430TB/G	–	1× 300SA-10-xx	–
		36	50 to 630	EPDM	1× M484TB/G	–	1× 800SA-10-xx	–
		36	300 to 630	EPDM	1× M440TB/G	–	1× 400PB 5(10) SA-xxx	–
	Südkabel	36	70 to 300	Silicone	1× SET 36	–	–	–
		36	70 to 500	Silicone	1× SEHT 33	–	1× MUT33	1× KU33
	nkt cables	36	25 to 300	Silicone	1× CB36-630	–	1× CSA36-10	–
		36	400 to 630	Silicone	1× CB36-630 (1250)	–	1× CSA36-10	–
	Tyco Electronics Raychem	36	25 to 300	Silicone	1× RSTI-68xx	–	RSTI-CC-68SAxxxx	–
		36	400 to 800	Silicone	1× RSTI-69xx	–	RSTI-CC-68SAxxxx	RSTI-SA-PIN
2	Nexans Euromold	36	50 to 240	EPDM	2× M400TB/G	1× M400CP	–	–
		36	50 to 240	EPDM	1× M430TB/G	1× M300PB/G	–	–
		36	50 to 630	EPDM	1× M484TB/G	1× M804PB/G	–	–
		36	300 to 630	EPDM	2× M440TB/G	1× M440CP	–	–
	Südkabel	36	70 to 500	Silicone	2× SEHT 33	1× KU33	–	–
	nkt cables	36	25 to 300	Silicone	1× CB36-630	1× CC 36-630	–	–
		36	25 to 300	Silicone	2× CB36-630	1× CP 630-C	–	–
		36	400 to 630	Silicone	1× CB36-630 (1250)	1× CC 36-630 (1250)	–	–
		36	400 to 630	Silicone	2× CB36-630 (1250)	1× CP 630-M16	–	–
	Tyco Electronics Raychem	36	25 to 300	Silicone	1× RSTI-68xx	1× RSTI-CC-68xx	–	–
		36	400 to 800	Silicone	1× RSTI-69xx	1× RSTI-CC-69xx	–	–
Diconnector panel 630 A • Disconnector panel 1000 A • Ring-main panel 630 A								
1	Euromold	36	50 to 240	EPDM	1× M400TB/G	–	1× 400PB 5(10) SA-xxx	–
		36	50 to 240	EPDM	1× M430TB/G	–	1× 300SA-10-xx	–
		36	50 to 630	EPDM	1× M484TB/G	–	1× 800SA-10-xx	–
		36	300 to 630	EPDM	1× M440TB/G	–	1× 400PB 5(10) SA-xxx	–
	Südkabel	36	70 to 500	Silicone	1× SET 36	–	–	–
		36	70 to 500	Silicone	1× SEHDT 33	–	1× MUT33	1× KU33
	nkt cables	36	25 to 300	Silicone	1× CB 36-630	–	1× CSA36-10	–
		36	400 to 630	Silicone	1× CB 36-630 (1250)	–	1× CSA36-10	–
	Tyco Electronics Raychem	36	25 to 300	Silicone	1× RSTI-68xx	–	RSTI-CC-68SAxxxx	–
		36	400 to 800	Silicone	1× RSTI-69xx	–	RSTI-CC-68SAxxxx	RSTI-SA-PIN
2	Euromold	36	50 to 240	EPDM	2× M400TB/G	1× M400CP	–	–
		36	50 to 240	EPDM	1× M430TB/G	1× M300PB/G	–	–
		36	50 to 630	EPDM	1× M484TB/G	1× M804PB/G	1× 800SA-10-xx	–
		36	300 to 630	EPDM	2× M440TB/G	1× M440CP	–	–
	Südkabel	36	70 to 500	Silicone	2× SEHT 33	1× KU33	–	–
	nkt cables	36	25 to 300	Silicone	1× CB 36-630	1× CC 36-630	1× CSA36-10	–
		36	25 to 300	Silicone	2× CB 36-630	1× CP 630-C	1× CSA36-10	–
		36	400 to 630	Silicone	1× CB 36-630 (1250)	1× CC 36-630 (1250)	1× CSA36-10	–
		36	400 to 630	Silicone	2× CB 36-630 (1250)	1× CP 630-M16	1× CSA36-10	–
	Tyco Electronics Raychem	36	25 to 300	Silicone	1× RSTI-68xx	1× RSTI-CC-68xx	RSTI-CC-68SAxxxx	–
		36	400 to 800	Silicone	1× RSTI-69xx	1× RSTI-CC-69xx	–	–

1) Observe the actual short-circuit and current carrying capacity of the cables and sealing ends

Installation possibilities for cable connections and surge arresters, single-core PE and XLPE-insulated, panel connection

Number of cables per panel and phase	Make	Rated voltage KV	Conductor cross-section [1] mm²	Insulation	T-plugs/phase	Coupling inserts/coupling plugs	Surge arresters with coupling inserts	
							Arresters/phase	Coupling unit
Diconnector panel 630 A • Diconnector panel 1000 A • Ring-main panel 630 A								
3	Euromold	36	50 to 240	EPDM	1× M430TB/G	2× M300PB/G	–	–
		36	50 to 630	EPDM	1× M484TB/G	2× M804PB/G	–	–
	nkt cables	36	25 to 300	Silicone	1× CB36-630	2× CC36-630	–	–
		36	25 to 300	Silicone	3× CB36-630	2× CP 630C	–	–
		36	400 to 630	Silicone	1× CB36-630 (1250)	2× CC36-630 (1250)	–	–
		36	400 to 630	Silicone	1× CB36-630 (1250)	2× CP 630-M16	–	–
	Tyco Electronics Raychem	36	25 to 300	Silicone	1× RSTI-68xx	2× RSTI-CC-68xx	–	–
		36	400 to 800	Silicone	1× RSTI-69xx	2× RSTI-CC-69xx	–	–

Panel connection

Cable type	Cable sealing end			Comment
	Make	Type	Cross-section mm²	
Thermoplastic-insulated cables 36 kV according to IEC 60502-2 and VDE 0276-620				
Single-core cable, PE and XLPE-insulated N2YSY (Cu) and N2XSY (Cu) or NA2YSY (Al) and NA2XSY (Al)	Nexans Euromold	M400TB/G M430TB/G M484TB/G M440TB/G	50 to 240 50 to 240 70 to 630 300 to 630	EPDM with semi-conductive layer EPDM with semi-conductive layer EPDM with semi-conductive layer EPDM with semi-conductive layer
	Südkabel	SEHDT 33	70 to 500	Silicone with semi-conductive layer (optionally with metal housing)
		SET 36	70 to 300	Silicone with semi-conductive layer (optionally with metal housing)
	nkt cables	CB 36-630 CB 36-630 (1250)	25 to 300 400 to 630	Silicone with semi-conductive layer (optionally with metal housing) Silicone with semi-conductive layer (optionally with metal housing)
	Tyco Electronics Raychem	RSTI-68xx RSTI-69xx	25 to 240 400 to 800	Silicone with semi-conductive layer, with capacitive measuring point Silicone with semi-conductive layer, with capacitive measuring point

1) Observe the actual short-circuit and current carrying capacity of the cables and sealing ends

Indicating and measuring equipment

Voltage detecting systems according to IEC 61243-5 or VDE 0682-415, IEC 62271-206 or VDE 0671-206 (WEGA ZERO)

- To verify safe isolation from supply
- LRM detecting systems
  – with plug-in indicator
  – with integrated indicator, type VOIS+, VOIS R+, WEGA ZERO
  – with integrated indicator, with integrated repeat test of the interface, with integrated function test, type CAPDIS-S1+, WEGA 1.2, WEGA 1.2 Vario, with integrated signaling relays type CAPDIS-S2+, WEGA 2.2.

Plug-in voltage indicator
- Verification of safe isolation from supply phase by phase
- Indicator suitable for continuous operation
- Measuring system and voltage indicator can be tested
- Voltage indicator flashes if high voltage is present.

VOIS+, VOIS R+
- Integrated display, without auxiliary power
- With indication "A1" to "A3" (see legend)
- Maintenance-free, repeat test required
- With integrated 3-phase LRM test socket for phase comparison
- With integrated signaling relays (only VOIS R+)
- Degree of protection IP54.

Common features CAPDIS-Sx
- Maintenance-free
- Integrated display, without auxiliary power
- Integrated repeat test of the interfaces (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the "Display-Test" pushbutton
- Adjustable for different operating voltages (adjustable capacitance C2)
- With integrated 3-phase LRM test socket for phase comparison
- With connectable signal-lead test
- With overvoltage monitoring and signaling (1.2 times operating voltage)
- Degree of protection IP54.

CAPDIS-S1+
- Without auxiliary power
- With indication "A1" to "A7" (see legend)
- Without ready-for-service monitoring
- Without signaling relays (without auxiliary contacts).

CAPDIS-S2+
- With indication "A0" to "A8" (see legend)
- Only by pressing the "Display-Test" pushbutton: "ERROR" indication (A8), e.g. in case of missing auxiliary voltage
- With ready-for-service monitoring (auxiliary power required)
- With integrated signaling relay for signals (auxiliary power required).

Indicators and detecting systems

Plug-in voltage indicator per phase at the panel front

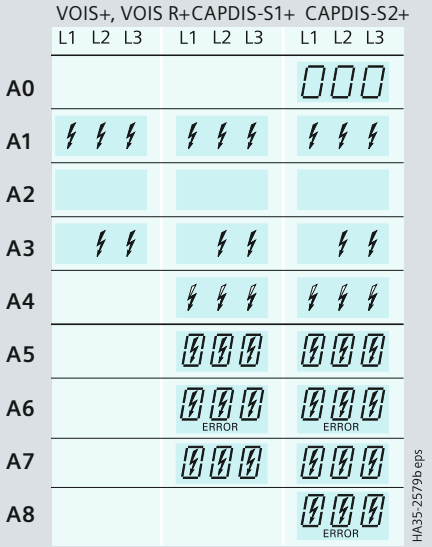
R-HA40-104 eps

Integrated voltage indicator VOIS+, VOIS R+

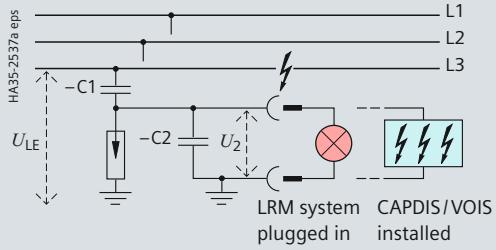
R-HA35-154 eps R-HA35-155 eps

Integrated voltage detecting system CAPDIS-S1+, -S2+

Symbols shown



A0 CAPDIS-S2+: Operating voltage not present
A1 Operating voltage present
A2 – Operating voltage not present
– For CAPDIS-S2+: Auxiliary power not present
A3 Failure in phase L1, operating voltage at L2 and L3 (for CAPDIS-Sx+ also earth-fault indication)
A4 Voltage (not operating voltage) present
A5 Indication "Test" passed (lights up briefly)
A6 Indication "Test" not passed (lights up briefly)
A7 Overvoltage present (lights up permanently)
A8 Indication "ERROR", e.g.: in case of missing auxiliary voltage



Voltage indication
via capacitive voltage divider (principle)

– C1 Capacitance integrated into bushing
– C2 Capacitance of the connection leads and the voltage indicator to earth
$U_{LE} = U_N/\sqrt{3}$ during rated operation in the three-phase system
$U_2 = U_A$ = Voltage at the capacitive interface of the switchgear or at the voltage indicator

WEGA ZERO
- Voltage detecting system according to IEC 62271-206 or VDE 0671-206
- With indication "A1" to "A4" (see legend)
- Maintenance-free
- With integrated 3-phase test socket for phase comparison
- Degree of protection IP54.

WEGA 1.2, WEGA 1.2 Vario
- Voltage detecting system according to IEC 61243-5 or VDE 0682-415
- With indication "A1" to "A5" (see legend)
- Maintenance-free
- Integrated repeat test of the interface (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the "Display-Test" pushbutton
- With integrated 3-phase LRM test socket for phase comparison
- Without integrated signaling relay
- Without auxiliary power
- Degree of protection IP54
- Adjustable for different operating voltages (adjustable capacitance C2) (only for WEGA 1.2 Vario).

WEGA 2.2
- Voltage detecting system according to IEC 61243-5 or VDE 0682-415
- With indication "A0" to "A6" (see legend)
- Maintenance-free
- Integrated repeat test of the interface (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the "Display-Test" pushbutton
- With integrated 3-phase LRM test socket for phase comparison
- With integrated signaling relay (auxiliary power required
- Degree of protection IP54.

R-HA35-151.eps

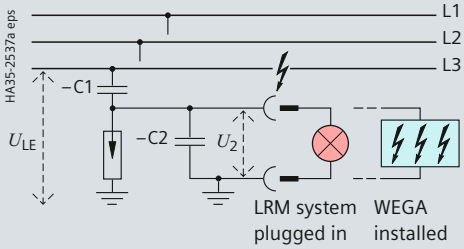
Integrated voltage indicator WEGA ZERO

R-HA35-152.aeps

Integrated voltage detecting system WEGA 1.2, WEGA 1.2 Vario

R-HA35-153b.eps

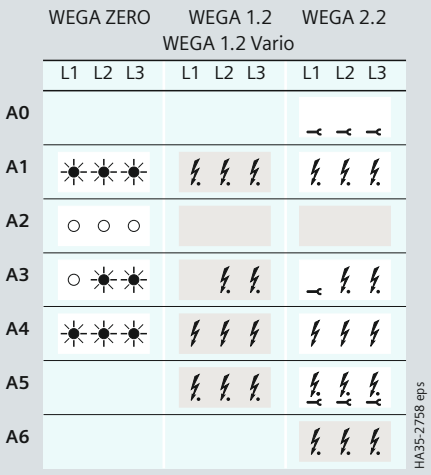
Integrated voltage detecting system WEGA 2.2



Voltage indication
via capacitive voltage divider (principle)

– C1 Capacitance integrated into bushing
– C2 Capacitance of the connection leads and the voltage indicator to earth
$U_{LE} = U_N/\sqrt{3}$ during rated operation in the three-phase system
$U_2 = U_A$ = Voltage at the capacitive interface of the switchgear or at the voltage indicator

Symbols shown



LC display gray: not illuminated
LC display white: illuminated

A0 For WEGA 2.2:
Operating voltage not present, auxiliary power present, LCD illuminated
A1 Operating voltage present
For WEGA 2.2: Auxiliary power present, LCD illuminated
A2 Operating voltage not present
For WEGA 2.2: Auxiliary power not present, LCD not illuminated
A3 Failure in phase L1, operating voltage at L2 and L3
For WEGA 2.2: Auxiliary power present, LCD illuminated
A4 Voltage present, current monitoring of coupling section below limit value
For WEGA 2.2: Auxiliary power present, LCD illuminated
A5 Indication "Display-Test" passed
For WEGA 2.2: Auxiliary power present, LCD illuminated
A6 For WEGA 2.2: LCD for missing auxiliary voltage is not illuminated

Components

Indicating and measuring equipment

Verification of correct terminal-phase connections

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

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

R-HA40-059.eps

Phase comparison test unit make Pfisterer, type EPV
as combined test unit (HR and LRM) for
– Voltage detection
– Phase comparison
– Interface test
– Integrated self-test
– Indication via LED

R-HA40-089.tif

Phase comparison test unit make Horstmann, type ORION 3.1
as combined test unit (HR and LRM) for:
– Phase comparison
– Interface testing at the switchgear
– Voltage detection
– Integrated self-test
– Indication via LED and acoustic alarm
– Phase sequence indicator

R-HA35-127.eps

Phase comparison test unit make Kries, type CAP-Phase
as combined test unit (HR and LRM) for:
– Voltage detection
– Repeat test
– Phase comparison
– Phase sequence test
– Self-test
The unit does not require a battery

R-HA35-127.eps

Phase comparison test unit make Hachmann, type VisualPhase LCD
as combined test unit (HR and LRM) for:
– Voltage detection with measured-value indication
– Interface test
– Low voltage detection
– Documentable repeat test
– Phase comparison with LED signal and measured-value indication
– Phase angle from –180° to +180°
– Phase sequence evaluation
– Frequency quality
– Complete self-test

Ready-for-service indicator

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

Mode of operation
For the ready-for-service indicator, a gas-tight measurement box is installed inside the switchgear vessel.
A coupling magnet, which is fitted to the bottom end of the measurement box, transmits its position to an outside armature through the non-magnetizable switchgear vessel. This armature moves the ready-for-service indicator of the switchgear.
While changes in the gas density during the loss of gas, which are decisive for the dielectric strength, are displayed, temperature-dependent changes in the gas pressure are not.
The gas in the measurement box has the same temperature as that in the switchgear.
The temperature effect is compensated via the same pressure change in both gas volumes.

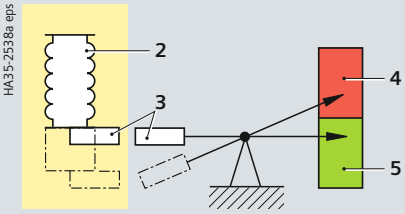
Low-voltage compartment
- For accommodation of protection, control, measuring and metering equipment
- Partitioned safe-to-touch from the high-voltage part of the panel
- Low-voltage compartment can be removed, bus wires and control cables are plugged in
- Option: Higher low-voltage compartment (650 mm instead of 325 mm) possible.

Gas monitoring

R-HA35-161 eps

Control board (detail)
with red / green ready-for-service indicator

HA35-2538a eps



Stainless-steel vessel filled with SF_6 gas, relative pressure 50 kPa at 20 °C

Ready-for-service indicator

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

1 Ready-for-service indicator
2 Measurement box
3 Magnetic coupling
4 Red indication: not ready for service
5 Green indication: Ready for service

Low-voltage compartment

R-HA35-184 eps

Low-voltage compartment with multifunction protection relay SIPROTEC 4 7SJ61 (example)

For description of the SIPROTEC 4 multifunction protection relays, see page 29

Components

Protection, control, measuring and monitoring equipment

Protecting, controlling and monitoring are the basic requirements placed on a complete bay controller across all technology generations. The properties the user expects from modern bay controllers are: multifunctionality, reliability, safety and communication capability.
The increasing integration of many functions in one multifunctional device leads to an optimally supported engineering process, IT security, service and testability, or simple and safe operability of the devices and tools.
On the following pages you will find functional descriptions for some selected devices. The low-voltage compartment can accommodate all customary protection, control, measuring and monitoring equipment available on the market:

Overview of the device types of the SIPROTEC device series: SIPROTEC 5, SIPROTEC Compact and SIPROTEC 4

SIPROTEC 5		
	Overcurrent protection with PMU, control and power quality	7SJ82, 7SJ85
	Distance protection with PMU and control	7SA84, 7SA86, 7SA87
	Line differential protection with PMU and control	7SD84, 7SD86, 7SD87
	Combined line differential and distance protection with PMU and control	7SL86, 7SL87
	Circuit-breaker management device with PMU and control	7VK87
	Overcurrent protection for lines	7SJ86
	Transformer protection with PMU, control, monitoring	7UT85 7UT86 7UT87
	Motor protection with PMU	7SK82, 7SK85
	Central busbar protection	7SS85
	Bay controllers for control/interlocking tasks with PMU and monitoring, optionally with protection funktions	6MD85, 6MD86
	Digital fault recorder	7KE85
SIPROTEC Compact		
	Overcurrent protection	7SJ80, 7SJ81
	Motor protection	7SK80, 7SK81
	Voltage and frequency protection	7RW80
	Line differential protection	7SD80
	Distribution system controller	7SC80
SIPROTEC 4		
	Overcurrent protection	EASY 7SJ45/7SJ46
		7SJ600, 7SJ601, 7SJ602
		7SJ61, 62, 63, 64
	Distance protection	7SA522
		7SA6
	Line differential protection	7SD600, 7SD610
		7SD52, 53
	Transformer differential protection	7UT612, 613, 63
	Busbar protection	7SS60, 7SS522
		7SS52
	Generator and motor protection	7UM61, 7UM62, 7VE6
		7UM518
	Accessories for generator and motor protection	7UW50; 7XR, 3PP, 7KG61, 7XT, 4NC
	Rapid changeover device	7VU683
	Bay controllers	6MD61, 6MD63
		6MD662, 663, 664
		6MB525
	U/f relay	7RW600
	Transient earth-fault relay	7SN600
	Breaker failure protection	7SV600
	Automatic reclosing, synchrocheck	7VK61
	High-impedance protection	7VH60

SIPROTEC 5 device series

- Powerful automation with graphical CFC (Continuous Function Chart)
- Secure serial protection data communication, also over large distances and all available physical media (fiber-optic cable, 2-wire connections and communication networks)
- Recognition of static and transient earth faults (passing contact function in resonant-earthed and isolated systems)
- Measurement of operational values
- Phasor Measurement Unit (PMU) for synchrophasor measured values and IEEE C37.118 protocol
- Powerful fault recording
- Control of switching devices.

Overcurrent protection device SIROTEC 7SJ82

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

Distance protection SIPROTEC 7SA86

- Line protection for all voltage levels with 3-pole tripping
- Very short tripping time
- Selective protection of overhead lines and cables with single- and multi-ended infeeds
- Time-graded backup protection to differential protection relays
- Suitable for radial, ring-shaped, or any type of meshed systems of any voltage level with earthed, resonant-earthed or isolated neutral point
- Main protection function: 6-system distance protection
- Detection of current transformer saturation for fast tripping with high accuracy at the same time.

Differential protection SIPROTEC 7SD86

- Line protection for all voltage levels with 3-pole tripping
- Phase-selective protection of overhead lines and cables with single- and multi-ended infeeds of all lengths with up to 6 line ends
- Transformers and shunt reactors within the protection zone are possible
- Suitable for radial, ring-shaped, or any type of meshed systems of any voltage level with earthed, resonant-earthed or isolated neutral point
- Protection of lines with capacitive series compensation
- Directional backup protection and various additional functions.

SIPROTEC 7SJ82

SIPROTEC 7SA86

SIPROTEC 7SD86

1 Modularly expandable
2 Pluggable and retrofittable communication ports
3 Pluggable current and voltage terminal blocks

Components

Protection, control, measuring and monitoring equipment

Transformer differential protection SIPROTEC 7UT85

- Transformer differential protection for two-winding transformers with versatile additional protection functions
- Universal utilization of the permissible measuring points
- Flexible adjustment to the transformer vector group, controlling of making and overexcitation processes, secure performance in case of current transformer saturation with different saturation degrees.
- Protection of standard power transformers and auto-transformers
- Increased sensitivity in case of earth short-circuits close to the neutral point by means of a separate earth-fault differential protection
- Additional current and voltage inputs can be provided for standard protection functions such as overcurrent, voltage, frequency, etc.
- In the standard version, two communication modules can be plugged in, and different protocols can be used (IEC 61850, IEC 60870-5-103, DNP3 (serial, TCP), Modbus RTU Slave).

Motor protection SIPROTEC 7SK82

- Motor protection functions: start-time supervision, thermal overload protection for stator and rotor, restart inhibit, unbalanced load protection, load-jump protection
- Stator and bearing temperature monitoring via a temperature sensor with an external RTD box
- Directional and non-directional time-overcurrent protection (short-circuit protection) with additional functions
- Overvoltage and undervoltage protection in all required variations
- Power protection, configurable as active or reactive power protection
- Control, synchrocheck and switchgear-interlocking system
- Firmly integrated electrical Ethernet port J for DIGSI
- Complete IEC 61850 (reporting and GOOSE) via integrated port J
- Two optional, pluggable communication modules usable for different and redundant protocols (IEC 61850, IEC 60870-5-103, DNP3 (serial+TCP), Modbus RTU Slave, protection data communication).

Digital fault recorder SIPROTEC 7KE85

- Fast-scan recorder
- Up to 2 slow scan recorders
- Up to 5 continuous recorders
- Usable as Phasor Measurement Unit (PMU) according to IEEE C37.118 Standard
- Transfer of recordings and triggering via IEC 61850
- Variable sampling rates programmable between 1 kHz – 16 kHz
- No-loss data compression
- Time synchronization via IRIG-B, DCF77 and SNTP
- Free mapping of measured values to the individual recorders
- Free combination of measuring groups for power calculation
- Quality bits for displaying the momentary channel quality
- The trigger functions of a function block are the fundamental value, r.m.s. value, zero-sequence, positive-sequence, negative-sequence system, active, reactive and apparent power
- Level trigger and gradient trigger for each trigger function
- Flexible cross and network trigger
- Creation of trigger functions with the graphical automation editor CFC (Continuous Function Chart)
- Trigger functions by combination of single signals, double signals, analog values, binary signals, Bool signals and GOOSE messages.

SIPROTEC 7UT85

SIPROTEC 7SK82

SIPROTEC 7KE85

1 Modularly expandable

SIPROTEC Compact series
Overcurrent protection SIPROTEC 7SJ80
- Pluggable current and voltage terminals
- Binary input thresholds settable using DIGSI (3 stages)
- Secondary current transformer values (1A/5A) settable using DIGSI
- 9 programmable function keys
- 6-line display
- Buffer battery exchangeable from the front
- USB front port
- 2 additional communication ports
- IEC 61850 with integrated redundancy (electrical or optical)
- Relay-to-relay communication through Ethernet with IEC 61850 GOOSE
- Millisecond-accurate time synchronization through Ethernet with SNTP.

SIPROTEC 4 series
Overcurrent and motor protection SIPROTEC 7SJ61/7SJ62
- For stand-alone or master operation
- Communications and bus capability
- Functions: Protection, control, signaling, communication and measuring
- LC text display (4 lines) for process and equipment data, as text, e.g. for

– Measuring and metering values
– Information on status of switchgear and switching device
– Protection data
– General indications
– Alarms

- Four freely programmable function keys for frequently performed functions
- Seven freely programmable LEDs for displaying any desired data
- Keys for navigation in menus and for entering values
- Fault recorder.

Overcurrent and motor protection SIPROTEC 7SJ63
- For stand-alone or master operation
- Communications and bus capability
- Functions: Protection, control, signaling, communication and measuring
- LC display for process and equipment data in the form of a feeder control diagram and as text, e.g. for

– Measuring and metering values
– Information on status of switchgear and switching device
– Protection data
– General indications
– Alarms

- Four freely programmable function keys for frequently performed functions
- Fourteen freely programmable LEDs for displaying any desired data
- Two key-operated switches to switch between “local and remote control” and “interlocked and non-interlocked operation”
- Keys for navigation in menus and for entering values
- Integrated motor control by special relays with enhanced performance
- Fault recorder.

R-HA35-176.eps

SIPROTEC 7SJ80

R-HA35-103 eps

SIPROTEC 7SJ61 / 7SJ62

R-HA35-102 eps

SIPROTEC 7SJ63

Standards

Standards, specifications, guidelines

Type of service location

The switchgear can be used as indoor installation according to 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
- In lockable electrical service locations. A lockable electrical service location is a place outdoors or indoors that is reserved exclusively for housing electrical equipment and which is kept under lock and key. Access is restricted to authorized personnel and persons who have been properly instructed in electrical engineering. Untrained or unskilled persons may only enter under the supervision of authorized personnel or properly instructed persons.

Terms

"Make-proof earthing switches" are earthing switches with short-circuit making capacity according to IEC 62271-102 and VDE 0671-102 / EN 62 271-102.

Standards

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

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, 11g/m^3 humidity according to IEC 60071 and VDE 0111).

The gas insulation at a relative gas pressure of 50 kPa permits switchgear installation at any desired altitude above sea level without the dielectric strength being adversely affected. This also applies to the cable connection when plug-in sealing ends are used.

Table – Dielectric strength

Rated voltage (r.m.s. value)	kV	**36**
Rated short-duration power-frequency withstand voltage (r.m.s. value)		
– Between phases and to earth	kV	70
– Across isolating distances	kV	80
Rated lightning impulse withstand voltage (peak value)		
– Between phases and to earth	kV	170
– Across isolating distances	kV	180

Overview of standards (June 2013)

		IEC standard	VDE standard	EN standard
Switchgear	NXPLUS C Wind	IEC 62271-1	VDE 0671-1	EN 62 271-1
		IEC 62271-200	VDE 0671-200	EN 62 271-200
		IEC 62271-304	–	eLC / TS 62271-304
Devices	Circuit-breakers	IEC 62271-100	VDE 0671-100	EN 62 271-100
	Disconnectors and earthing switches	IEC 62271-102	VDE 0671-102	EN 62 271-102
	Switch-disconnectors	IEC 60265-1	VDE 0670-301	EN 60 265-1
	Voltage detecting systems	IEC 62271-103	VDE 0671-103	EN 62 271-103
Degree of protection	IP code	IEC 60529	VDE 0470-1	EN 60 529
	IK code	IEC 62262	VDE 0470-100	EN 50 102
Insulation	–	IEC 60071	VDE 0111	EN 60 071
Instrument transformers	–	IEC 61869-1	VDE 0414-9-1	EN 61 869-1
	Current transformers	IEC 61869-2	VDE 0414-9-2	EN 61 869-2
	Voltage transformers	IEC 61869-3	VDE 0414-9-3	EN 61 869-3
Installation, erection	–	IEC 61936-1	VDE 0101	–
Insulating gas SF_6	Specification for new SF_6	IEC 60376	VDE 0373-1	EN 60 376

Current carrying capacity
- According to IEC 62271-200 or IEC 62271-1, VDE 0671-200 or VDE 0671-1, the rated normal current refers to the following ambient air temperatures:

– Maximum of 24-hour mean + 35 °C
– Maximum + 40 °C

- The current carrying capacity of the panels and busbars depends on the ambient air temperature outside the enclosure.

Internal arc classifications
- Protection of operating personnel by means of tests for verifying the internal arc classification
- Internal arcing tests must be performed in accordance with IEC 62271-200 or VDE 0671-200
- Definition of criteria:

– Criterion 1:
Correctly secured doors and covers do not open, limited deformations are accepted.
– Criterion 2:
No fragmentation of the enclosure, no projection of small parts above 60 g
– Criterion 3:
No holes in accessible sides up to a height of 2 m
– Criterion 4:
No ignition of indicators due to hot gases
– Criterion 5:
The enclosure remains connected to its earthing point.

Resistance to internal faults
Due to the single-pole enclosure of external components and the SF_6 insulation of switching devices, the possibility of faults in SF_6-insulated switchgear is improbable and a mere fraction of that typical of earlier switchgear types:
- There are no effects due to external influences, such as:

– Pollution layers
– Humidity
– Small animals and foreign objects

- Maloperation is practically excluded due to logical arrangement of operating elements
- Short-circuit-proof feeder earthing by means of the circuit-breaker or the three-position switch-disconnector.

In the unlikely event of a fault within the switchgear vessel, the energy conversion in the case of an internal arc fault is minor thanks to the SF_6 insulation and the shorter arc length, i.e. approximately only $^1/_3$ compared to air. The escaping gases are discharged upwards through a pressure relief duct (option).

Aseismic capacity (option)
NXPLUS C Wind switchgear can be upgraded for regions at risk from earthquakes.
For upgrading, earthquake qualification testing has been carried out in accordance with the following standards:
- IEC 60068-3-3 "Guidance – seismic test methods for equipment"
- IEC 60068-2-57 "Test Ff: Vibration – Time-history method"
- IEC 60068-2-59 "Test Fe: Vibration – Sine-beat method"
- IEEE 693-2005 "Recommended Practice for Seismic Design of Substations".

For installation on even and rigid concrete or steel structure (without considering building influences), the tested ground accelerations meet the following requirements:
- Uniform Building Code 1997 (UBC) – Zone 4
- California Building Code 1998 (CBC) – Zone 4
- IEEE 693-2005 – High required response spectrum (Figure A.1).

Color of the panel front
Siemens standard (SN) 47 030 G1, color no. 700 / light basic (similar to RAL 7047 / telegrey).

Climate and environmental influences
The parts of the primary circuit of NXPLUS C Wind switchgear under high voltage are completely enclosed and insensitive to climatic influences.
- All medium-voltage devices are installed in a gas-tight, welded stainless-steel switchgear vessel which is filled with SF_6 gas
- Live parts outside the switchgear vessel are provided with single-pole enclosure
- At no point can creepage currents flow from high-voltage potentials to earth
- Operating mechanism parts which are functionally important are made of corrosion-resistant materials
- Bearings in the operating mechanism are designed as dry-type bearings and do not require lubrication.

The NXPLUS C Wind switchgear is suitable for application in indoor installations under normal operating conditions as defined in the standard IEC 62271-1.
Furthermore, the high-voltage part of the NXPLUS C Wind switchgear can be used in environmental conditions of the climatic category 3C2 according to the standard IEC 60721-3-3.

Protection against solid foreign objects, electric shock and water
NXPLUS C Wind switchgear fulfills according to the standards

IEC 62271-1	VDE 0671-1, EN 62 271-1
IEC 62271-200	VDE 0671-200, EN 62 271-200
IEC 60529	VDE 0470-1, EN 60 529
IEC 62262	VDE 0470-100, EN 50 102

the following degrees of protection:

Degree of protection IP	Type of protection
IP 65	for parts of the primary circuit under high voltage
IP 3XD	for switchgear enclosure
IP 31D	for low-voltage compartment (option)
IP 4X	for switchgear enclosure (option)

Degree of protection IK	Type of protection
IK 07	for switchgear enclosure

Notes

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