

SIEMENS

SION®

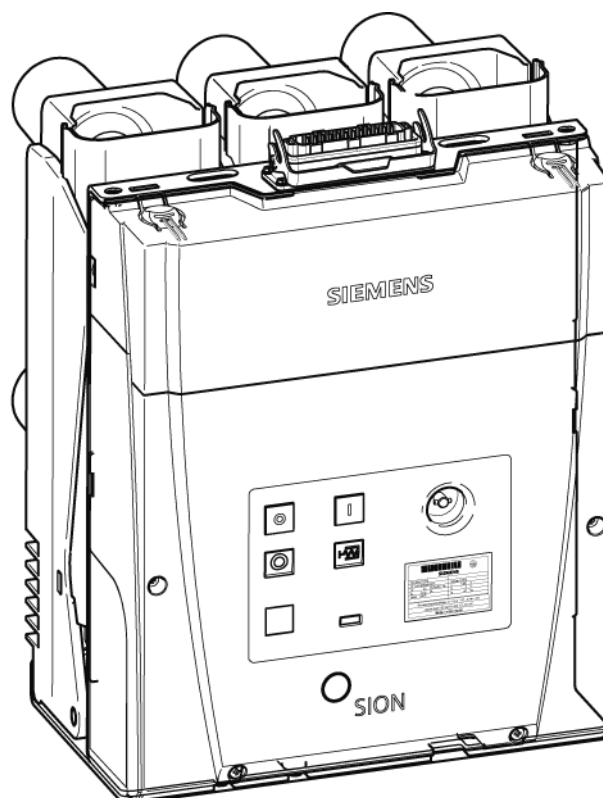
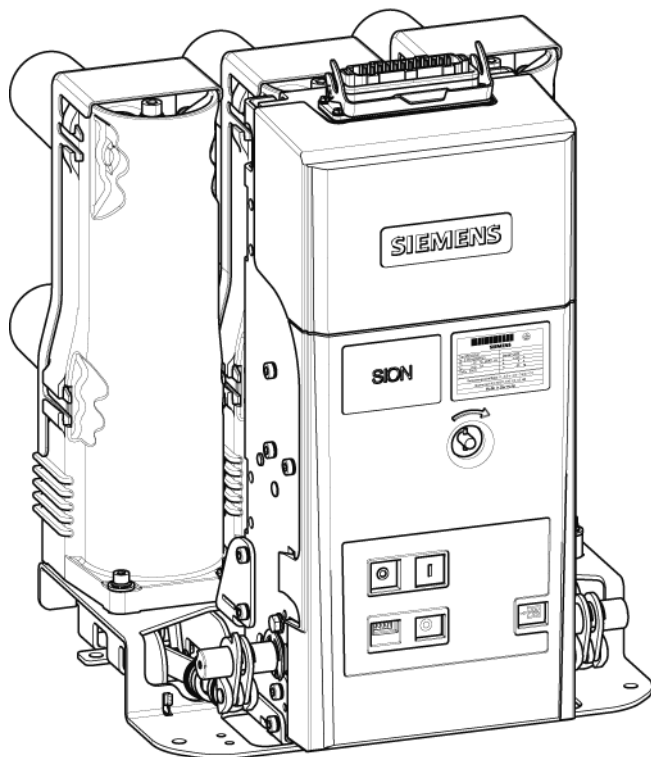
Vacuum circuit-breaker

7.2 – 17.5 kV, 12.5 – 31.5 kA

7.2 – 17.5 kV, 40 kA

24 kV, 16 – 25 kA

OPERATING INSTRUCTIONS



Order no.: 9229 0001 176 0E
Ordering location: IC LMV LP PO P C41
AG 07.2013 en

For your safety

Signal terms and definitions

Hazards are classified in accordance with ISO 3864-2 using the following keywords:

- DANGER, WARNING or CAUTION, where there is a risk of personal injury
- NOTE, where there is a risk of material damage.

Hazards are classified and indicated in the operating instructions and on the vacuum circuit-breaker as follows:

DANGER

signal word used to indicate an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

signal word used to indicate a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

signal word used to indicate a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

Note

indicates a potentially damaging situation.

If the damaging situation is not avoided, the product or something in its vicinity may sustain damage.

Qualified personnel

are, for the purposes of this manual or the warning notices on the vacuum circuit-breaker, persons who are familiar with the transport, storage, placement, assembly, commissioning, operation and maintenance of the product and have the qualifications corresponding to their activity, such as:

- training and authorization to energise, de-energise, clear, earth and tag circuits and equipment in accordance with established safety practices.
- training in the proper care and use of protective equipment in accordance with established safety practices;
- training in providing first aid.

Product liability

Note

Product liability claims are upheld only if the replacement of the purchased spare parts is performed by personnel that have been trained and certified by Siemens.

Table of contents

- For your safety**2
 - List of abbreviations4
- Transport, storage and packing**5
 - Transport5
 - Unpacking6
 - Reusing the transport unit10
 - Storage10
- General information** 11
 - Range of application 11
 - Standards12
 - Design approval as per X-Ray Ordinance12
 - Scope of delivery12
- Description** 13
 - Design13
 - Locking devices29
 - Rating plate32
 - Technical data32
 - Ambient conditions33
 - Installation altitudes33
 - Switching times34
 - Circuit diagrams35
- Installation**39
 - Attachment in the switching cubicle40
 - Earthing47
 - Connecting low-voltage48
 - Electrical connection of the main conductor51
 - Installing the SION[®] vacuum circuit-breaker with cartridge insert56
- Operation**59
 - Commissioning59
 - First closing operation60
 - Closing62
 - Opening62
- Maintenance**63
 - Maintenance and servicing63
 - Interrupter service life64
 - Accessories and spare parts64
 - Manufacturer's product liability65
 - Disposal65
 - Service65
- Index of keywords**67
- Legend for all pages**69

List of abbreviations

BGBI	Bundesgesetzblatt (Federal Law Gazette)
CO	Close-Open
DIN	Deutsches Institut für Normung (German Institute for Standardisation)
IEC	International Electrotechnical Commission
NC	Normally closed contact
NO	Normally open contact
O	Open
RöV	Röntgenverordnung (X-ray Ordinance)
VDE	Verband Deutscher Elektrotechniker (Association of German Electrical Engineers)

Transport, storage and packing

Transport

WARNING

Heavy transport weight

Transport unit may fall and fail and sling gear may break.

Use lifting gear, transporting and sling gear suited to the requirements and load-carrying capacity. Observe transport symbols.

Transport weight Refer to the delivery slip for the weight of the transport unit.

Note

Observe stacking height

For transport, no more than three constructionally identical transport units must be piled on top of each other.

Observe the loads specified on the transport unit.

Note

Secure load

For transport, secure the load in such a way that the transport unit is not at risk.

Place the transport unit on a level, non-slip and pressure-resistant surface for intermediate storage.

Transport vacuum circuit-breaker in the original transport unit up to the installation site or storage location.

Transporting with crane or fork lift

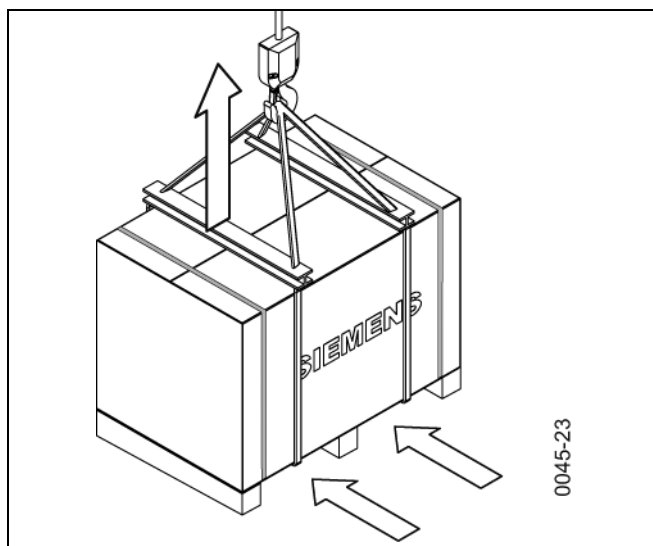


Fig. 1 Transporting the pallet with carton

Transport, storage and packing

- Transporting with packing** Transport the transport unit to the installation site or storage location
- with a fork lift or
 - with sling gear suspended from a crane
 - at an angle of twist of approx. 60° or
 - with a spreader bar.
- After receipt of delivery:**
- Checking the transport unit**
- Check transport unit for damage.
 - Major damage must be documented photographically.
 - Ensure that any damage to the transport unit is confirmed by the transport company.
- Unpacking**
- Working equipment** Required tools:
- Knife/scissors
 - Lifting equipment with lifting gear
 - Pliers or lever.

CAUTION

Risk of injury from sharp edges!

Fasteners may break, leaving sharp edges.

Always use a suitable tool to lever out fasteners.

Note

Do not cut open or damage the carton, since it is designed to be reused and because of the belt straps located underneath.

Belt straps could be severed on the pallet floor when cutting open the carton.

The vacuum circuit-breaker is attached to the pallet with belt straps. It is not possible to transport the vacuum circuit-breaker on the pallet without using belt straps (see Fig. 5).

Note

Danger of tipping over due to shift in centre of gravity!

Vacuum circuit-breakers with mounted contact arms may tip onto the contact system if not fixed.

Before undoing the belt straps, ensure that the vacuum circuit-breaker is positioned safely and hook sling gear to the points marked with crane hooks (see Fig. 8 and Fig. 9).

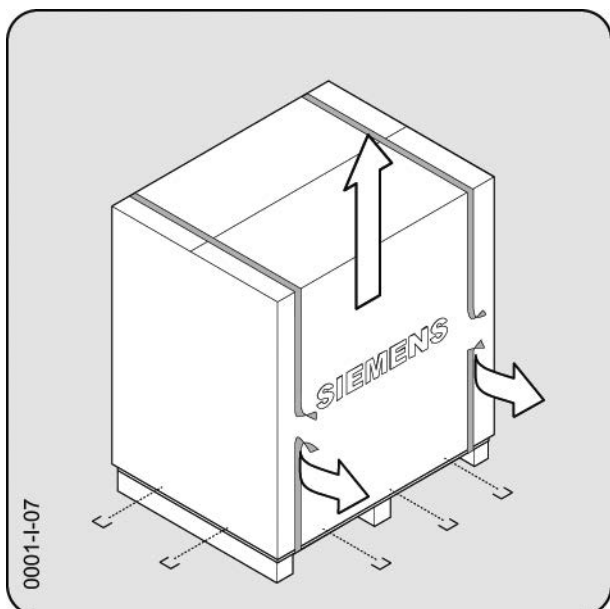


Fig. 2 Removing the fixing from the carton

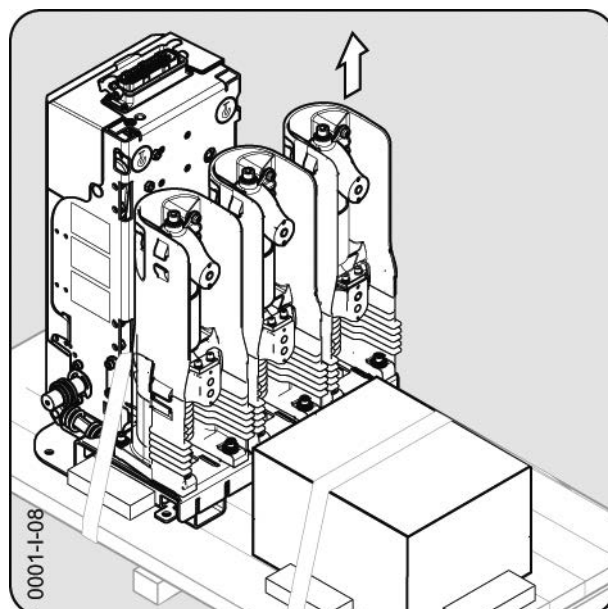


Fig. 3 Example - transport unit without carton

Opening the transport unit

- Place the transport unit on a level, non-slip and pressure-resistant surface.
- Remove lifting gear or transport means.
- Remove plastic wrap.
- Lever out fasteners from the carton and lift off carton.
- Remove film from the vacuum circuit-breaker.
- In the case of overseas packaging, push the lower film onto the pallet floor.
- Check the delivery is complete.
- Check vacuum circuit-breaker for damage.

Note

Do not use the vacuum circuit-breaker if parts are broken, i.e. if you find cracks, flaking, bent metal parts, damaged plug-in contacts, tears or bare cables.

Send it back in its original transport unit (see "Reusing the transport unit", page 10).

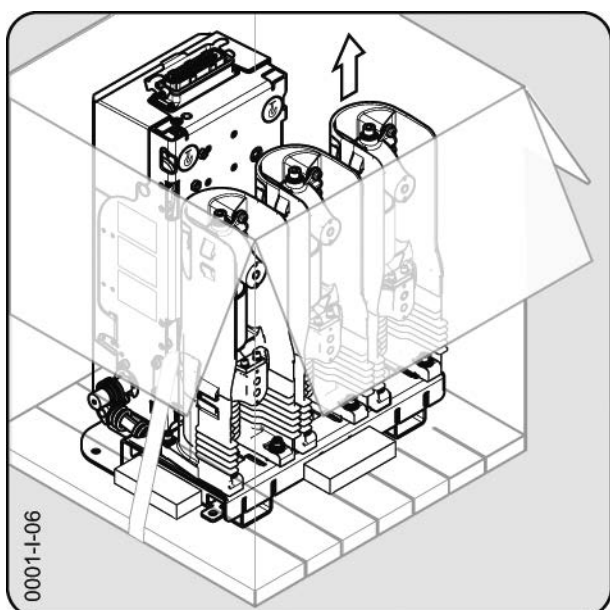


Fig. 4 3AE5 - Unpacking the fixed installation

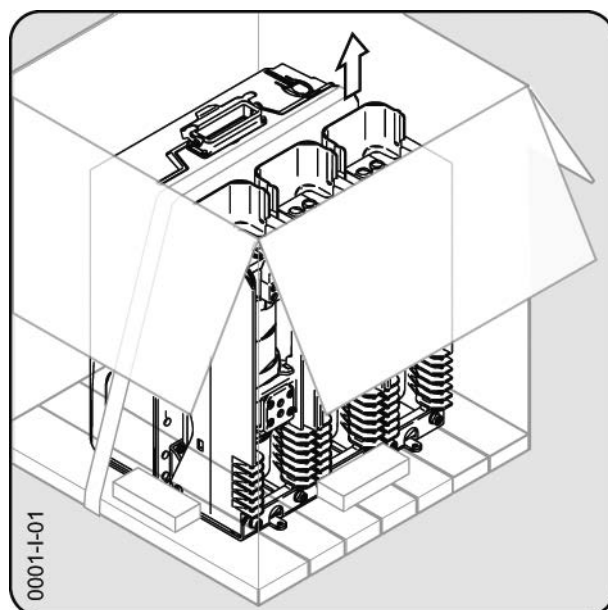


Fig. 5 3AE1 - Unpacking the fixed installation

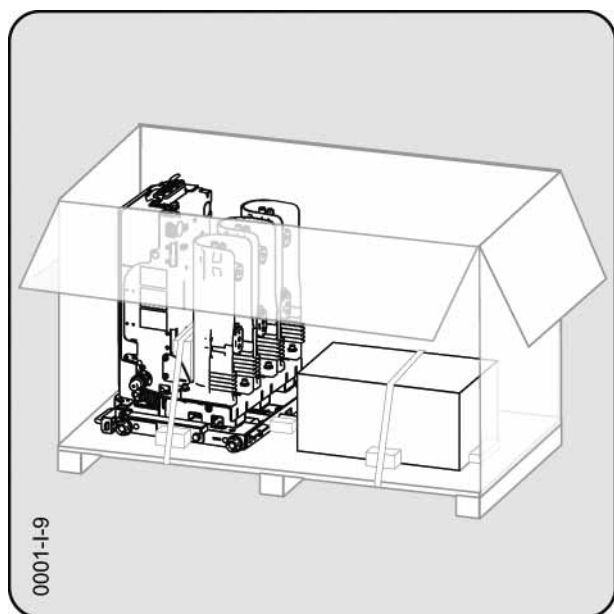


Fig. 6 3AE5 - Unpacking the version with withdrawable section

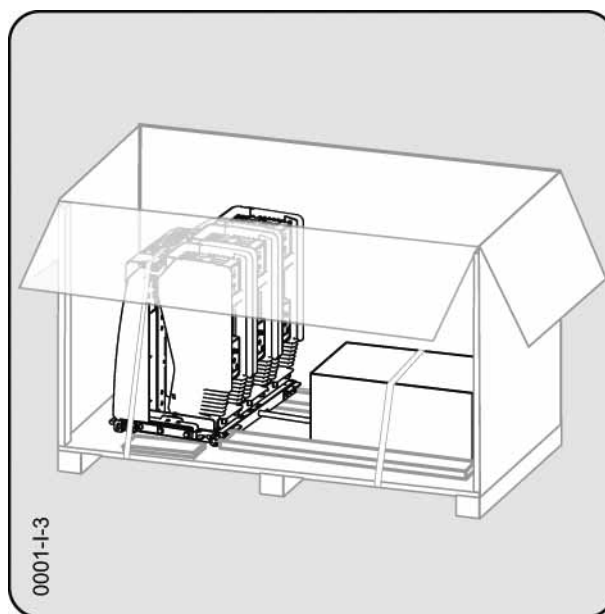


Fig. 7 3AE1 - Unpacking the version with withdrawable section

Transport to installation site

- Remove all tensioning belts and bits of fastening wood.
- Remove accessory pack and store safely in the packaging for later attachment.

Note

Shifted centre of gravity!

If the vacuum circuit-breakers are lifted with contact arms mounted, the centre of gravity will be towards the contact arms.

The unit is transported in an inclined position.

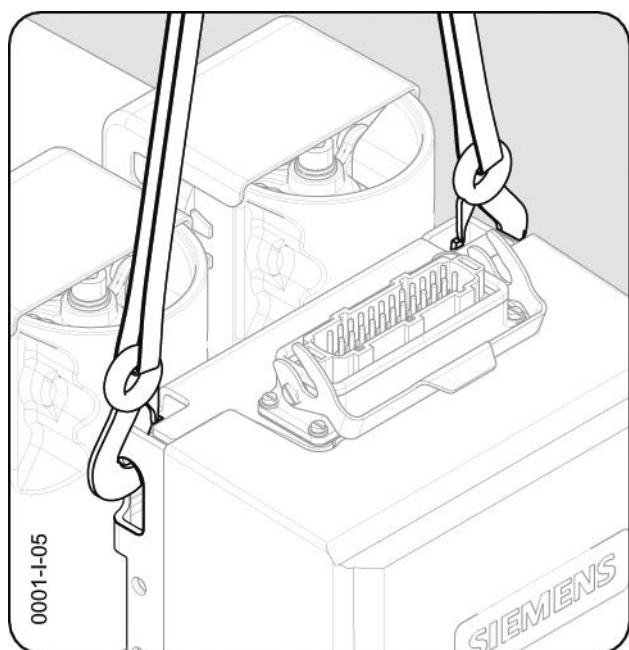


Fig. 8 Transporting 3AE5

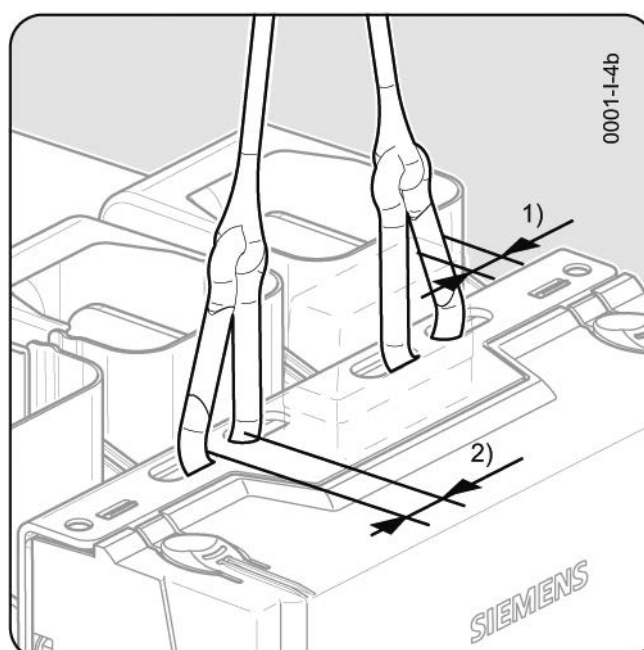


Fig. 9 Transporting 3AE1

- 1) Diameter of the hook cross-section max. 19 mm
- 2) Opening width of the hook min. 18 mm

- Hang sling gear into the crane eyes.
- Transport to installation site or leave suspended from crane for further work steps.



Note

Keep accessory pack on hand for the installation.

Reusing the transport unit

Reusing the transport unit To transport the vacuum circuit-breaker again, the pallet with carton and most of the components can be reused.

Do not reuse severed tensioning belts or plastic wrap.

Pack the vacuum circuit-breaker in reverse order:

- Attach the vacuum circuit-breaker safely to the pallet using the appropriate tools.
- Cover with film and seal with adhesive tape.
- Attach accessories pack.
- Carefully close carton.
- Before returning to the factory, ask the responsible sales representative for a returned goods number (see also "Service", on page 65).
- When returning a vacuum circuit-breaker, always indicate the type and serial number (see "Rating plate", on page 32).

Storage

Note

Store the vacuum circuit-breaker in the following condition:

- OPEN switching position
- Closing spring discharged



Note

Risk of corrosion damage if stored improperly!

If the storage conditions listed below are met, the vacuum circuit-breaker can be stored for up to a year in its transport unit.

If the storage conditions are not met, the vacuum circuit-breaker cannot be stored in the transport unit any longer than 6 months.

If storage of longer than one year is planned, unpack the vacuum circuit-breaker from the transport unit. Further storage may necessitate fresh corrosion protection, and it must be ensured that the vacuum circuit-breaker cannot be damaged.

Storage room	Transport unit	Storage time	Temperature range	Comments	Number of units per stack
Enclosed, dry, well ventilated and as free from dust as possible, with a relative humidity of less than 60 %.	unopened	max. 6 months	-40 °C to +55 °C	—	max. 4
	unopened	max. 1 year	-5 °C to +40 °C	—	max. 4
	open	over 1 year	-5 °C to +40 °C	if necessary, with new corrosion protection	—

General information

WARNING

Dangerous voltage and mechanical movements

When operating electrical devices, certain parts will always be live, and mechanical parts may move very quickly, even when remotely controlled.

If the warnings are not observed, serious injury or damage to material may be the result.

Only personnel with the relevant qualifications may work on or in the vicinity of this device. These personnel must be familiar with all the warnings and servicing measures specified in these operating instructions.

Smooth and safe operation of this device requires proper transport and storage, and professional installation and assembly, as well as careful operation and maintenance.

The basic version and all listed configurations of the vacuum circuit-breakers are type-tested devices as per IEC.

Note

In the event of subsequent attachments or integrations, e. g. locking parts in connection with switchgears, ensure that

- fast-moving parts are not additionally loaded with mass or force, and
- additional parts have sufficient clearance, especially from moving and live parts.

If vacuum circuit-breakers are to be equipped with additional functions by the customer, we recommend consulting the factory, since tried and tested solutions are frequently available (see also “Additional equipment” on page 18).

Range of application

SION[®] vacuum circuit-breakers are 3-pole interior circuit-breakers for a rated voltage range of 7.2 kV - 24 kV.

Under normal operating conditions, the vacuum circuit-breaker (as per IEC 62271-1 and VDE 0671-1) is maintenance-free up to 10 000 operating cycles.

Intended use

SION[®] vacuum circuit-breakers are suitable for switching any type of alternating current circuits under normal operating conditions, such as:

- Overhead lines
- Cables
- Transformers
- Capacitors
- Motors

SION[®] vacuum circuit-breakers operate in continuous, periodic and short-term operation.

Standards

The SION[®] vacuum circuit-breakers comply with the regulations:

- IEC 62271-1
- IEC 62271-100

All SION[®] vacuum circuit-breakers comply with the specifications for C2, E2, M2 and S1-class circuit-breakers in accordance with IEC 62271-100.

Country and standard-specific deviations from the standards mentioned must be observed.

Design approval as per X-Ray Ordinance

The interrupters installed in the vacuum circuit-breakers are of a design approved under the X-Ray Ordinance (RöV) of the Federal Republic of Germany. They meet the requirements of RöV of 8 January 1987 (BGBl. I, page 114) § 8 and Annex II No. 5 up to the level of the rated voltage stipulated according to DIN VDE/IEC.

Scope of delivery

Delivery includes:

- SION[®] vacuum circuit-breaker
- or SION[®] vacuum circuit-breaker on withdrawable section
- Panels separating from unit (optional)
- Hand crank for circuit-breaker 3AX1530-2B (optional)
- Handle for withdrawable section 3AX1430-2C (optional)
- Accessory pack with mounting brackets (3AE1) or mounting angles (3AE5) and fasteners (optional for fixed installation)
- Accessory pack for plug top with fasteners (optional)
 - with 24-pole plug or
 - with 64-pole plug
- Guard plate (optional 3AE5)
- Operating instructions and unpacking instructions
- Circuit-breaker-specific circuit diagrams

Description

Design

The images shown are examples; not all the variants of the vacuum circuit-breaker are shown here.

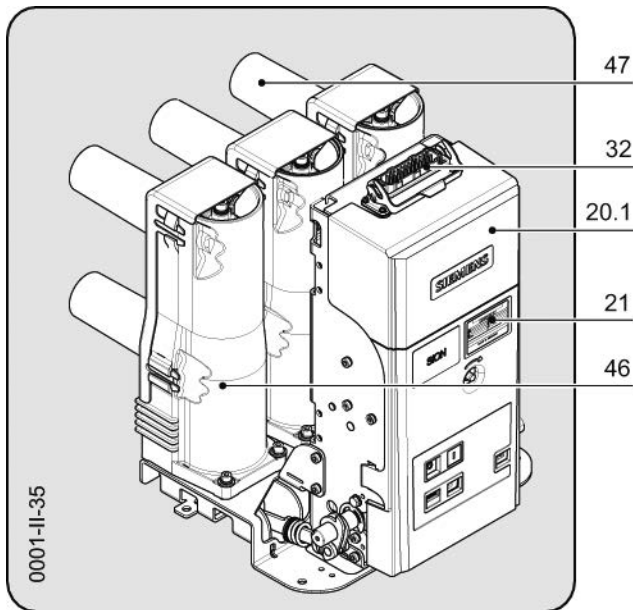


Fig. 10 3AE5 - to 1250 A, operating mechanism side with separating panels (separating from the unit)

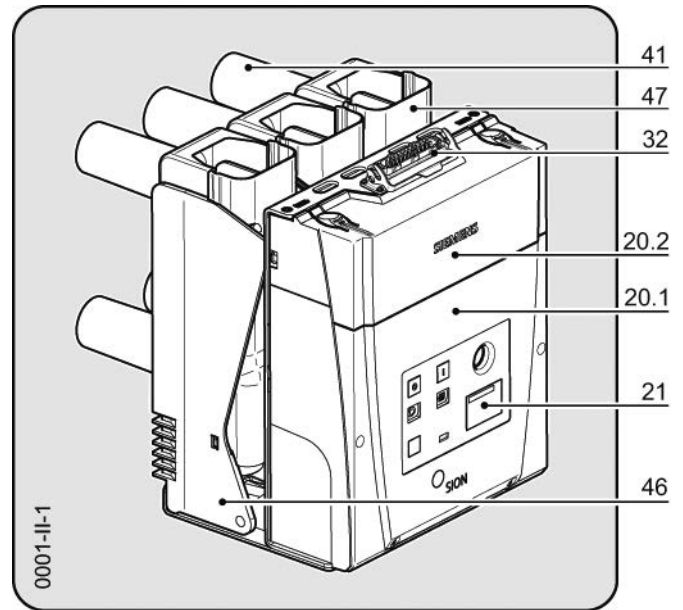


Fig. 11 3AE1 - to 1250 A, operating mechanism side with separating panels (separating from unit and operating mechanism side)

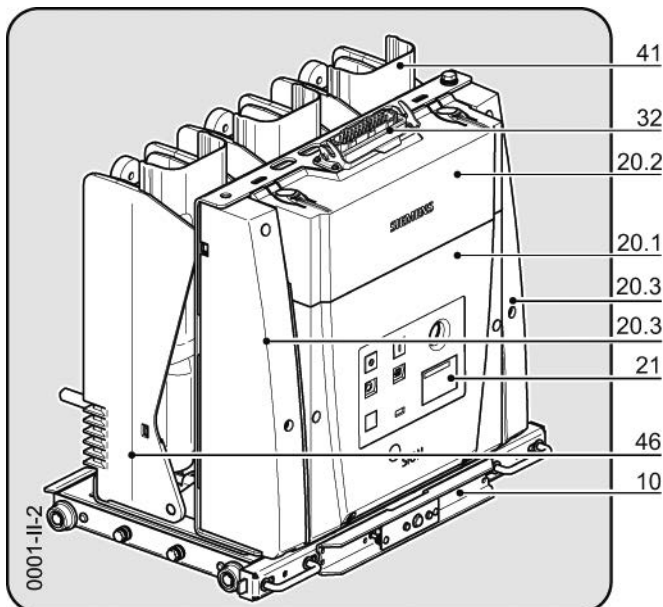


Fig. 12 3AE1 - 1250 A, operating mechanism side with separating panels (separating from the operating mechanism side) and cartridge insert

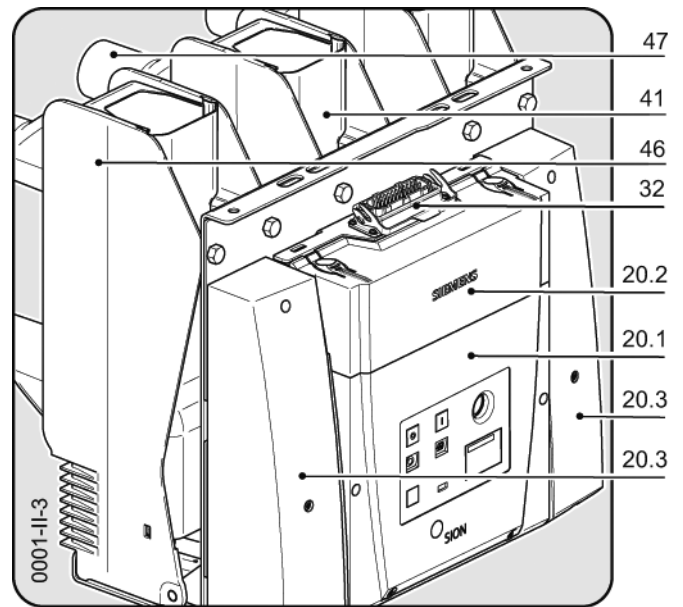


Fig. 13 3AE1 - 2500 A, 24 kV, operating mechanism side with separating panels (separating from unit and operating mechanism side)

10	Cartridge insert
20.1	Cover
20.2	Cover for low-voltage interface
20.3	Side panel
21	Rating plate

32	Low-voltage plug-connector (-X0), (optional)
41	Panel separating from operating mechanism side (optional)
46	Pole shell
47	Panel separating from the unit side

Pole assembly

The images shown are examples; not all the variants of the vacuum circuit-breaker are shown here.

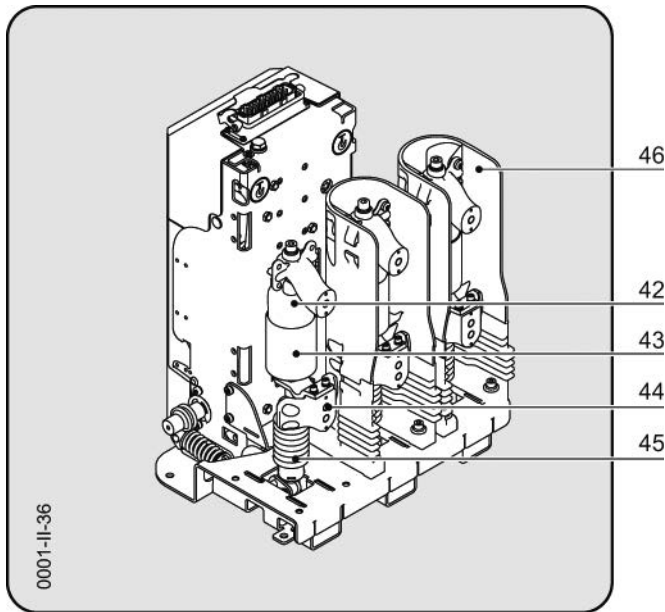


Fig. 14 3AE5 - to 1250 A, pole side

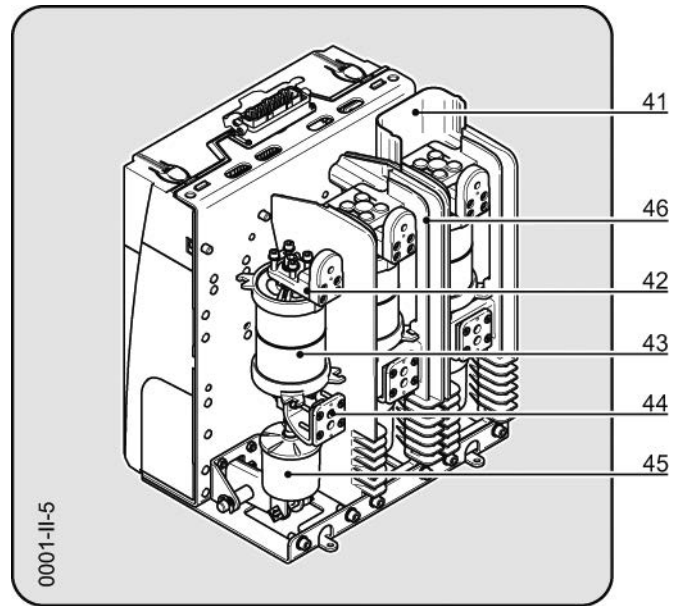


Fig. 15 3AE1 - to 1250 A, pole side

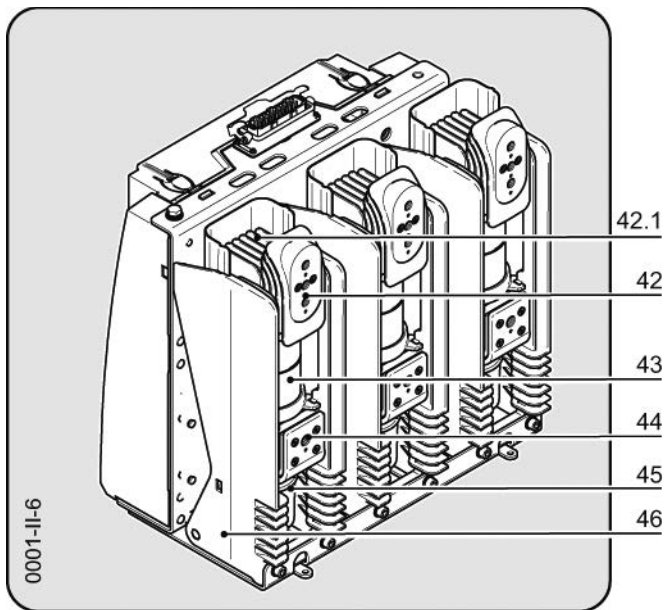


Fig. 16 3AE1 - 2500 A, pole side

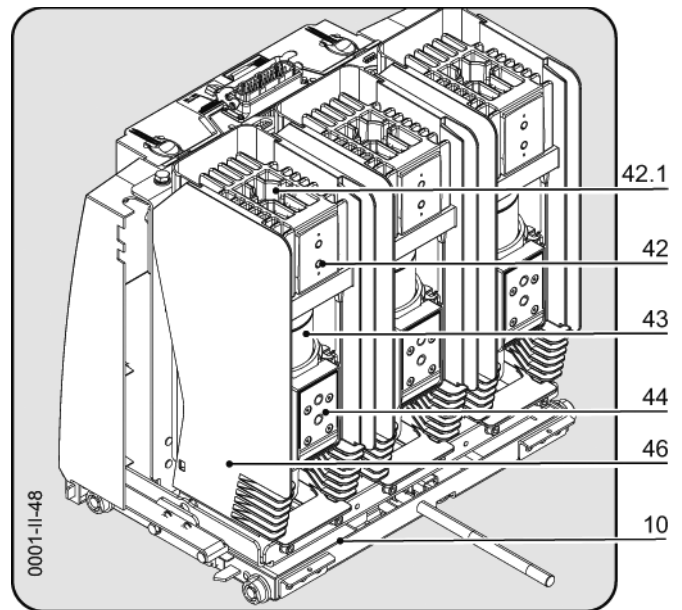


Fig. 17 3AE1 - 40 kA, pole side with cartridge insert

- | | | | |
|------|--|----|--------------------------|
| 10 | Cartridge insert | 44 | Pole contact plate |
| 41 | Panel separating from operating mechanism side | 45 | Insulating operating rod |
| 42 | Pole head with pole contact plate | 46 | Pole shell |
| 42.1 | Pole head cooler | | |
| 43 | Interrupter | | |

Contact system in the interrupters

A slight change in the contact stroke that occurs over the entire useful life of the interrupter has no effect on the function of the vacuum circuit-breaker.

Operating mechanism

The operating mechanism contains all the electrical and mechanical components required to close or open the vacuum circuit-breaker. Insulating operating rods transfer the switching movements to the pole assemblies.

The operating mechanism is closed with a removable cover (20.1).

Operating and indicator elements

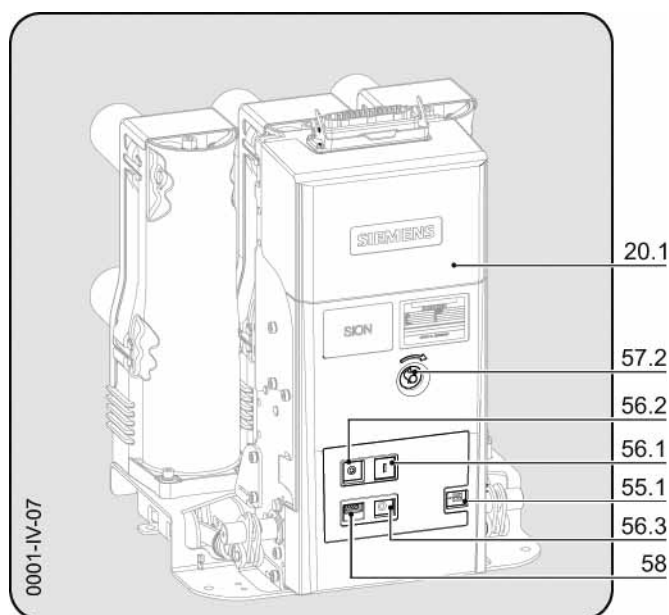


Fig. 18 Control panel 3AE5

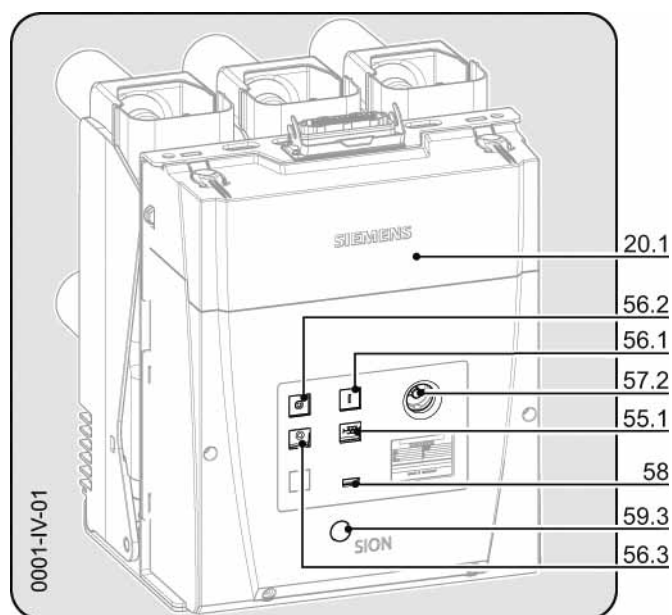


Fig. 19 Control panel 3AE1

20.1	Cover	57.2	Hand crank coupling
55.1	Spring state indicator	58	Operating cycle counter
56.1	CLOSE pushbutton	59.3	Key-operated locking device (optional, only 3AE1)
56.2	OPEN pushbutton		
56.3	Position indicator CLOSED-OPEN		

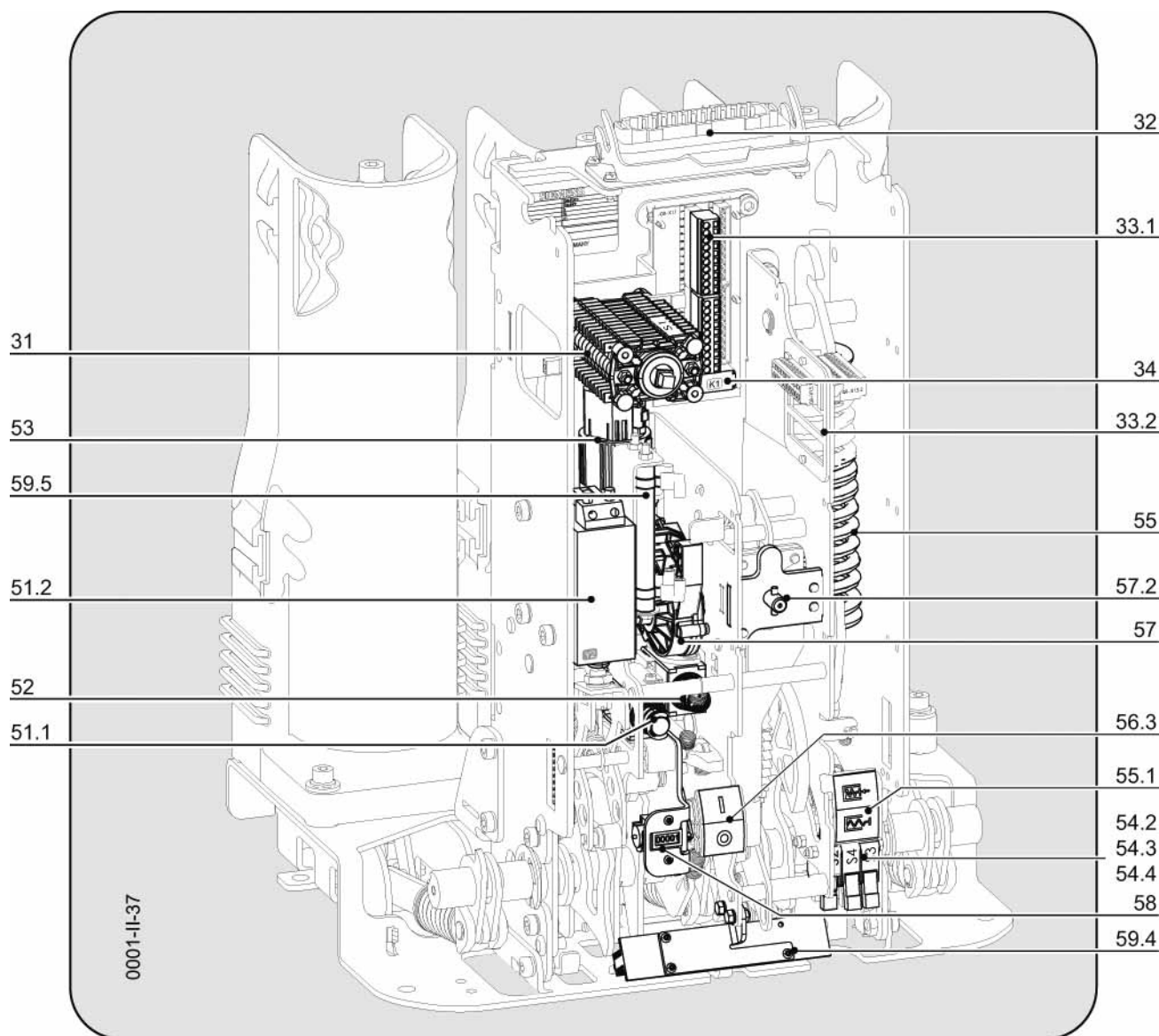
There are openings in the cover (20.1) for the operating and indicator elements.

Functions The CLOSE pushbutton (56.1) is used to close the vacuum circuit-breaker. The motor immediately charges the closing spring. If the supply voltage for the motor fails, the closing spring can be tensioned with a hand crank. There is an opening for this in the cover (20.1), behind which you will find the hand crank coupling (57.2) of the gear unit.

You can use a key-operated locking device to avoid manual closing (59.3, only 3AE1).

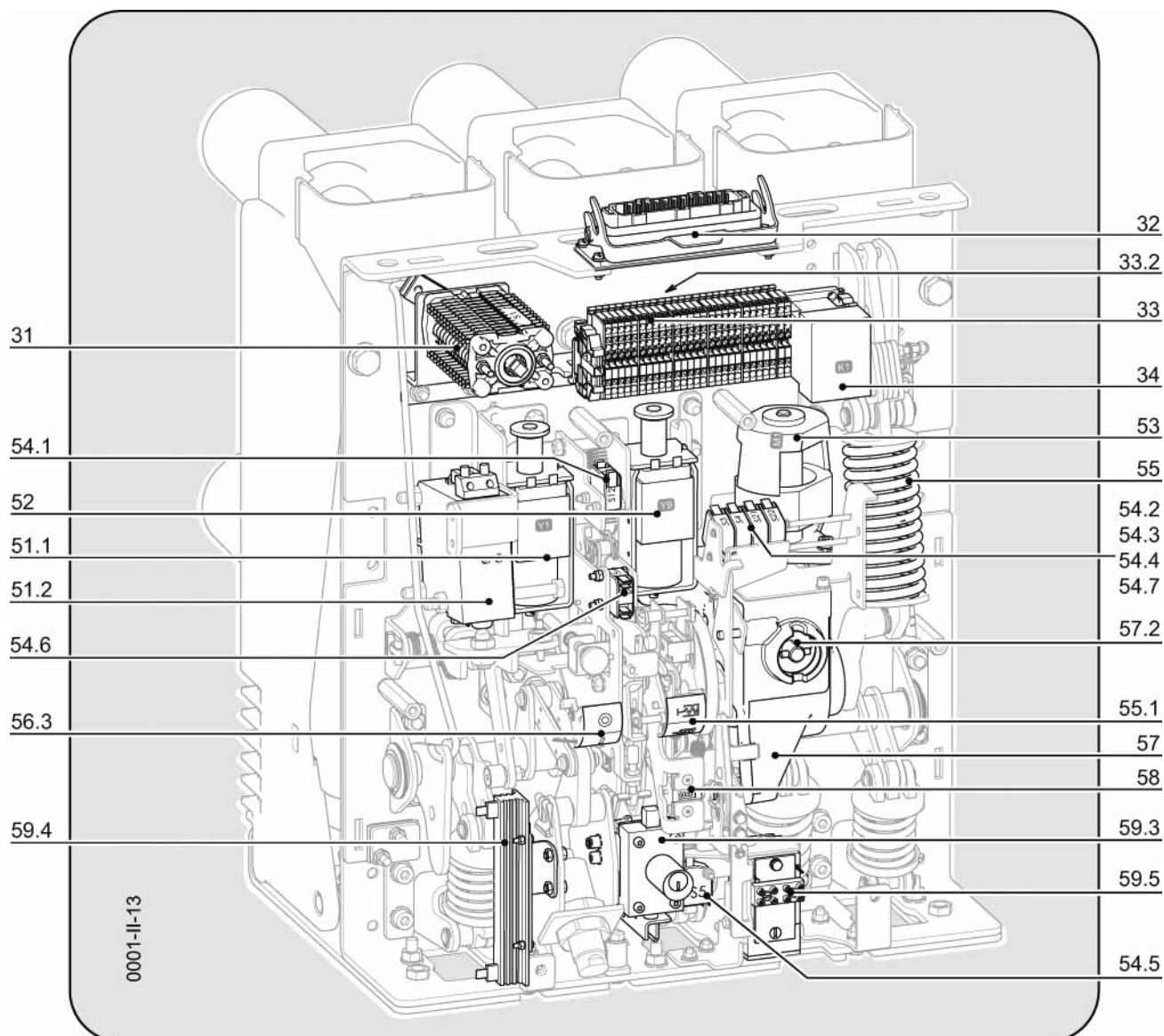
Indicators The charge state of the springs is indicated by the spring state indicator (55.1). The position indicator (56.3) shows the CLOSED or OPEN state. The operating cycle counter (58) indicates the number of operating cycles. An operating cycle consists of one closing and one opening.

Secondary equipment



- | | | | |
|------|---|------|--|
| 31 | Auxiliary switch (-S1) | 54.6 | Position switch (-S6), circuit-breaker tripping signal (not shown) |
| 32 | Low-voltage plug-connector (-X0), (optional) | 55 | Closing spring |
| 33.1 | Connector strip (-X1) | 55.1 | Spring state indicator |
| 33.2 | Plug (-X01) and (-X02) for withdrawable section (optional) | 56.3 | Position indicator CLOSED-OPEN |
| 34 | Contacting relay (-K1), cut-off (-Y9) and anti-pumping device | 57 | Gear unit |
| 51.1 | 1st shunt release (-Y1) | 57.2 | Hand crank coupling |
| 51.2 | 2nd release (-Y2) | 58 | Operating cycle counter |
| 52 | Closing solenoid (-Y9) | 59.4 | Heater (-R01), condensation water protection (optional) |
| 53 | Motor (-M1), charging the closing spring | 59.6 | Resistor (-R1), for undervoltage release (-Y7), (optional) |
| 54.1 | Position switch (-S12), prevents electrical closing when there is a mechanical locking device (not shown) | | |
| 54.2 | Position switch (-S21), motor control | | |
| 54.3 | Position switch (-S3), control for (-K1) | | |
| 54.4 | Position switch (-S4), signal "Closing spring charged" | | |

Fig. 20 Open operating mechanism 3AE5



31	Auxiliary switch (-S1)	54.5	Position switch (-S5), electrical closing lock-out (optional)
32	Low-voltage plug-connector (-X0), (optional)	54.6	Position switch (-S6), circuit-breaker tripping signal (not shown)
33	Terminal strip (-X1), (optional)	54.7	Position switch (-S22), motor control
33.2	Plug (-X01) and (-X02) for withdrawable section (optional, not shown)	55	Closing spring
34	Contacteur relay (-K1), cut-off (-Y9) and anti-pumping device	55.1	Spring state indicator
51.1	1st shunt release (-Y1)	56.3	Position indicator CLOSED-OPEN
51.2	2nd release (-Y2)	57	Gear unit
52	Closing solenoid (-Y9)	57.2	Hand crank coupling
53	Motor (-M1), charging the closing spring	58	Operating cycle counter
54.1	Position switch (-S12), prevents electrical closing when there is a mechanical locking device (not shown)	59.3	Key-operated locking device (optional)
54.2	Position switch (-S21), motor control	59.4	Heater (-R01), condensation water protection (optional)
54.3	Position switch (-S3), control for (-K1)	59.5	Electrical closing lock-out (-F1), (optional)
54.4	Position switch (-S4), signal "Closing spring charged"	59.6	Resistor (-R1), for undervoltage release (-Y7), (optional, not shown)

Fig. 21 Open operating mechanism 3AE1

Equipment

Basic equipment	<p>The basic equipment of the SION[®] vacuum circuit-breaker contains:</p> <p>Motor 3AY1711, for charging the closing spring (-M1)</p> <p>Position switch SWB: 46677, for motor control</p> <ul style="list-style-type: none"> • 3AE5 (-S21) • 3AE1 (-S21, -S22) <p>Contactor relay SWB: 556... , cut-out (-Y9) and electrical anti-pumping device (-K1)</p> <p>Position switch SWB: 46677, control of the contactor relay (-K1) (-S3)</p> <p>Closing solenoid 3AX1410 (3AE5), 3AX1510 (3AE1) (-Y9)</p> <p>Shunt release 3AX1410 (3AE5), 3AX1510 (3AE1) (-Y1)</p> <p>Auxiliary switch optional (-S1)</p> <ul style="list-style-type: none"> • 6NO + 6NC (3SV92773) • 12NO + 12NC (3SV92774) <p>Position switch SWB: 46677, for signal "Closing spring charged" (-S4)</p> <p>Low-voltage interface 3AX1134 optional (-X0)</p> <ul style="list-style-type: none"> • Plug-connector with sleeve housing 64-pin • Plug-connector with sleeve housing 24-pin • Terminal strip 27-pin (3AE1, only with PG fitting) (-X1) • Connector strip 20-pin (3AE5) (-X1) <p>Operating cycle counter</p> <p>Mechanical anti-pumping device</p> <p>Mechanical manual closing and opening</p>
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Additional equipment	<p>Every SION[®] vacuum circuit-breaker can also be fitted with the following equipment:</p> <p>Shunt release 3AX1101 (-Y2)</p> <p>Transformer-operated release 3AX1102 (-Y4, -Y5)</p> <p>Transformer-operated release 3AX1104 (0.1 Ws) (-Y6)</p> <p>Undervoltage release 3AX1103 (-Y7)</p> <ul style="list-style-type: none"> • with resistor for undervoltage release (-Y7) (-R1) <p>Heater (condensation water protection) (-R01)</p> <p>Electrical closing lock-out 3AX1405 (only 3AE1) (-F1)</p> <ul style="list-style-type: none"> • with position switch, electrical closing lock-out (only 3AE1) (-S5) <p>Circuit-breaker tripping signal SWB: 46677 (-S6)</p> <p>Mechanical locking device 3AX1420 for withdrawable section</p> <p>Position switch SWB: 46677, prevents electrical closing if there is a mechanical locking device (-S12)</p> <p>Key-operated locking device 3AX1437 (only 3AE1)</p> <p>Guard plate 3AX1456 (only 3AE5)</p> <p>PG fitting 3AX1458</p>
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In addition to the serial shunt release (-Y1), the vacuum circuit-breaker can be equipped with a maximum of one release of the type 3AX11].

For the permitted possible combinations of the additional equipment as well as special designs, refer to catalogue HG11, or contact the responsible sales representative.

Motor (-M1)

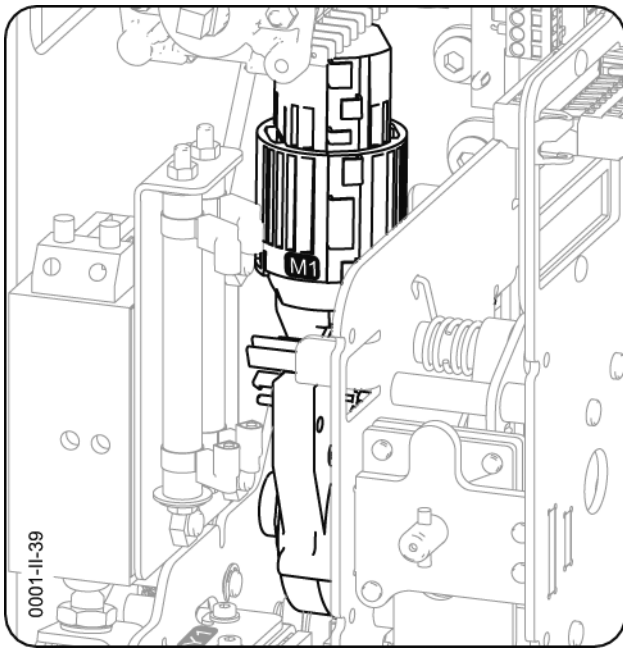


Fig. 22 3AE5 - motor (53)

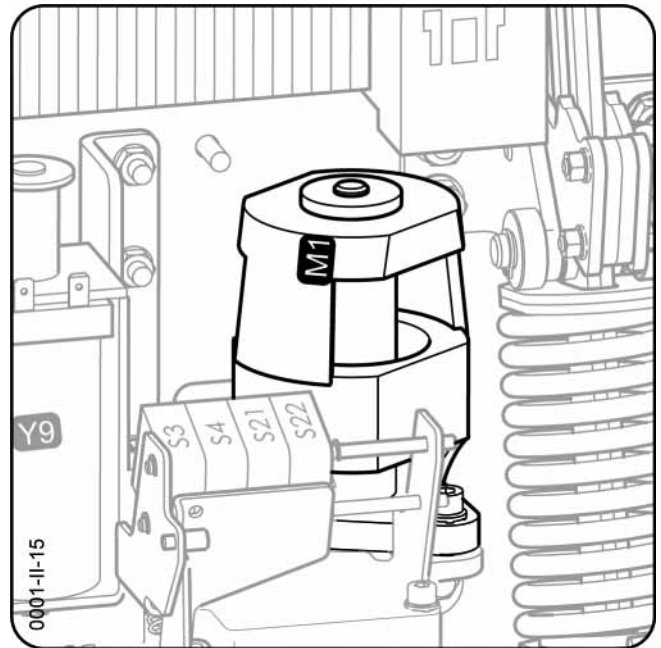


Fig. 23 3AE1 - motor (53)

After the supply voltage is applied and if the closing spring is discharged, the motor starts immediately and is automatically deactivated internally after charging has taken place. For power consumption see table Fig. 24.

In the short charging time, the motor operates in the overload range. See Fig. 25 for the rated current for the required motor short-circuit protection.

Note The motor protection devices are not included in the delivery of the vacuum circuit-breaker and must be ordered separately.

Rated supply voltage U ^{*)}	V	DC					AC ¹⁾		DC		AC ¹⁾		DC		AC ¹⁾	
		24	30	48	60	110	110	120	120	125	220	230	240	240		
3AE5 ²⁾	W/VA	140	180	110	130	100	170	110	210	120	110	200	130	200		
3AE1 ²⁾	W/VA	590	620	470	520	650	670	500	580	700	610	620	500	680		
3AE1 40 kA ²⁾	W/VA	3)	3)	600	610	740	740	750	800	740	900	960	770	1000		
3AE1 24 kV ²⁾	W/VA	520	550	550	520	620	670	510	680	610	670	780	500	680		

Fig. 24 Power consumption of motor

Rated supply voltage U ^{*)}	V	DC	DC	DC	DC	AC ¹⁾	DC	AC ¹⁾
		24	48	60	110	110	220	230
3AE5 - Rated current of the protective device I ^{**)}	A	2	1	1	0.5	0.315	0.315	0.250
3AE1 - Rated current of the protective device I ^{**)}	A	8	6	4	4	2	1.6	

Fig. 25 Recommendation for motor protection device

*) The operator's supply voltage may deviate from the rated supply voltage of the vacuum circuit-breaker by -15 % to +10 %.

***) Built-in automatic circuit-breaker with C characteristic

1) 50/60 Hz.

2) ±50 W (empirically determined values)

3) cannot be ordered

Contactor relay (-K1)

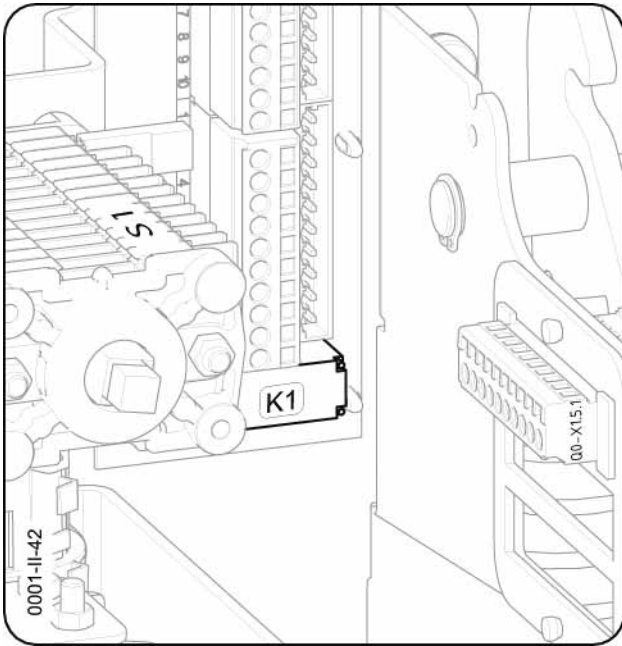


Fig. 26 3AE5 - contactor relay (34)

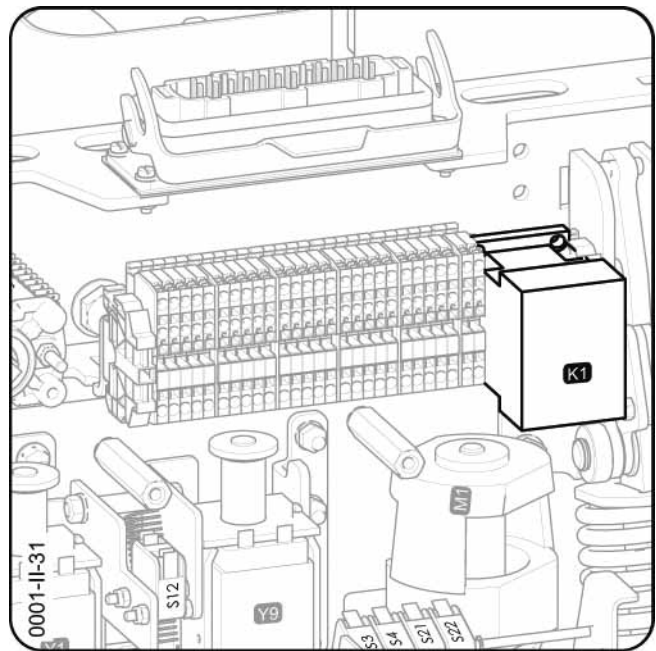


Fig. 27 3AE1 - contactor relay (34)

If simultaneous electrical CLOSE and OPEN commands are continuously applied to the vacuum circuit-breaker, it returns to the open position after being closed.

The function of the contactor relay (-K1) causes the vacuum circuit-breaker to pause at this point until the CLOSE command is given again.

This prevents continuous closing and opening (pumping).

Closing solenoid (-Y9)

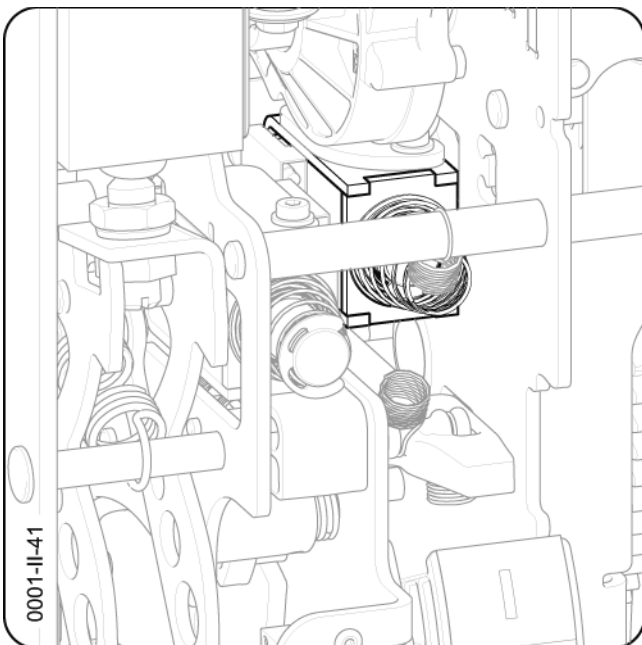


Fig. 28 3AE5 - closing solenoid (52)

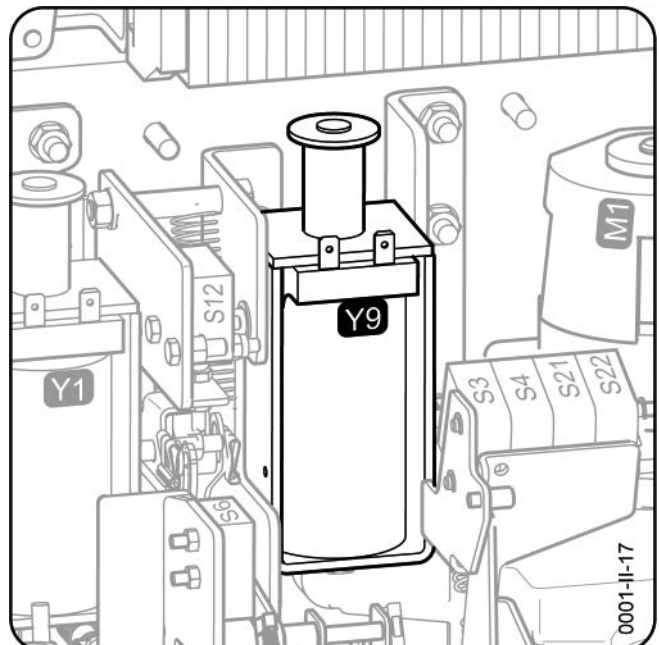


Fig. 29 3AE1 - closing solenoid (52)

The closing solenoid (-Y9) unlatches the charged closing spring and closes the vacuum circuit-breaker electrically. It is available for DC or AC voltage.

The closing solenoid (-Y9) is not designed for continuous operation and is terminated within the circuit-breaker via the auxiliary switch (-S1) at the factory.

The operator's supply voltage may deviate from the rated supply voltage of the vacuum circuit-breaker by -15 % to 10 %.

The closing solenoid (-Y9) can be operated using AC or DC voltage and is protected against overvoltage.

Power consumption 3AE5 - 300 to 370 W / VA (3AY1410)
3AE1 - 140 to 210 W / VA (3AY1410)

1st shunt release (-Y1)

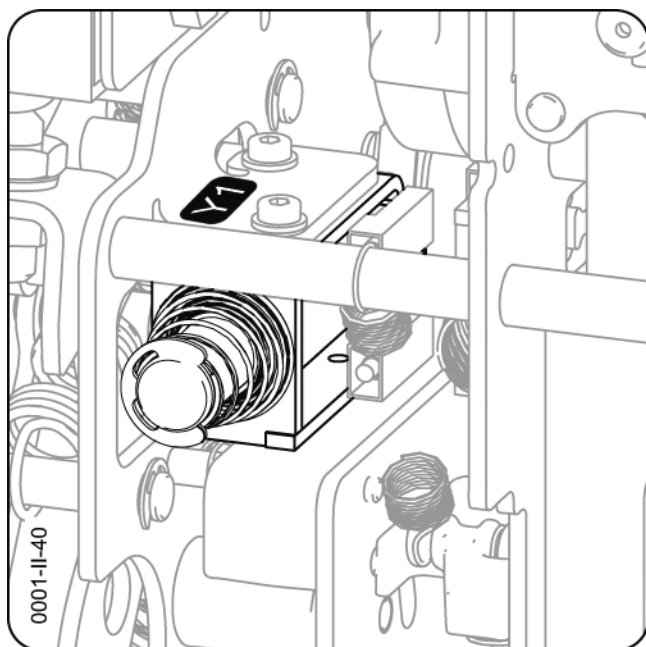


Fig. 30 3AE5 - 1. shunt release (51.1)

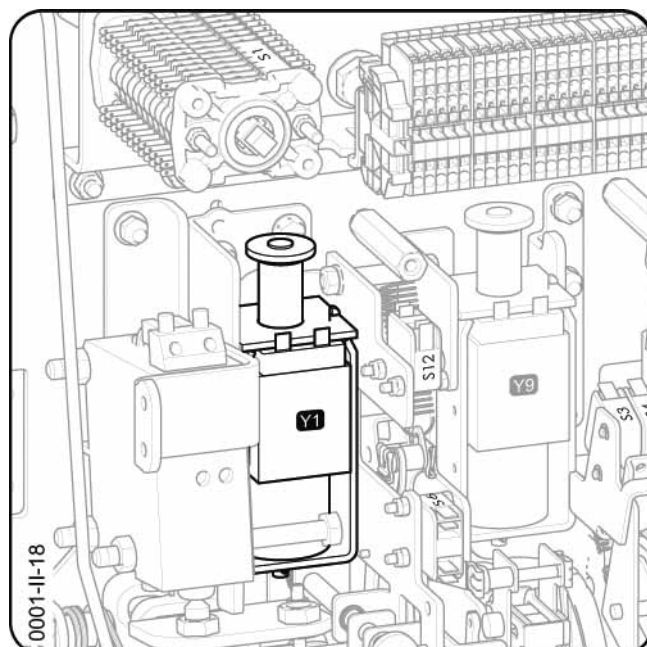


Fig. 31 3AE1 - 1st shunt release (51.1)

In the case of the 1st shunt release (-Y1), the electrically fed tripping pulse is passed to the "OPEN" latch by means of a directly acting magnet armature, thus opening the vacuum circuit-breaker.

The 1st shunt release (-Y1) is not designed for continuous operation and is terminated within the circuit-breaker via the auxiliary switch (-S1) at the factory.

The operator's supply voltage may deviate from the rated supply voltage of the vacuum circuit-breaker by -30 % to +10 % in the event of DC voltage and by -15 % to +10 % in the event of AC voltage.

The 1st shunt release (-Y1) can be operated using AC or DC voltage and is protected against overvoltage.

Power consumption 3AE5 - 300 W / VA (3AY1410)
3AE1 - 140 W / VA (3AY1510)

Auxiliary switch (-S1)

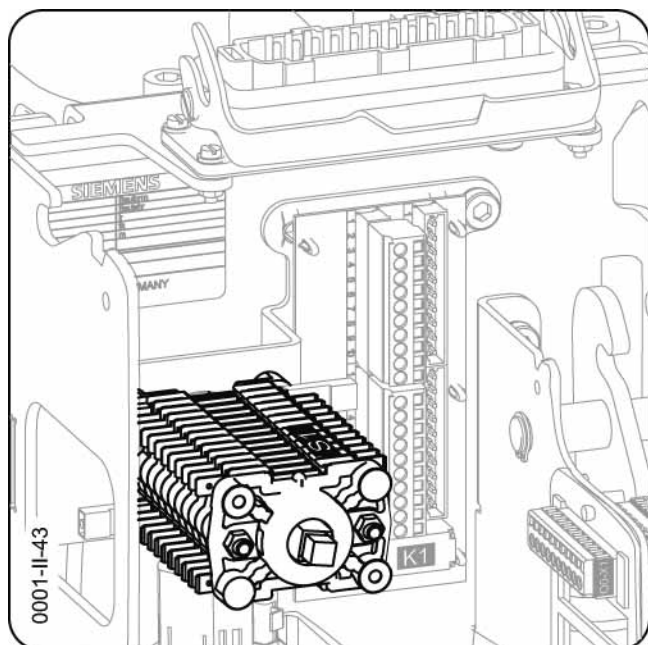


Fig. 32 3AE5 - auxiliary switch (31)

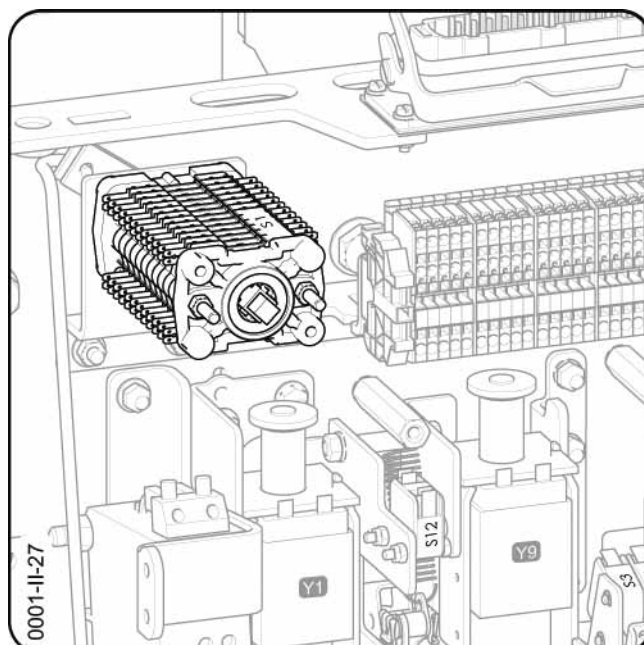


Fig. 33 3AE1 - auxiliary switch (31)

Two versions of the auxiliary switch (-S1) are available for delivery: with 6 or 12 NO/NC contacts each. Contacts available on the customer's premises - see circuit diagram supplied.

Power consumption

Rated insulation voltage:	250 V AC/DC
Insulation group:	C as per VDE 0110
Continuous current:	10 A
Closing capacity:	50 A

Breaking capacity

Rated operating voltage up to U (V)	Rated operating current I (A)	
	Ohmic load	Inductive load (T = 20 ms)
230 AC	10	10
24 DC	10	10
48 DC	10	9
60 DC	9	7
110 DC	5	4
220 DC	2.5	2

Fig. 34 Breaking capacity of the auxiliary switch (-S1) 3SV92

Position switch SWB: 46677

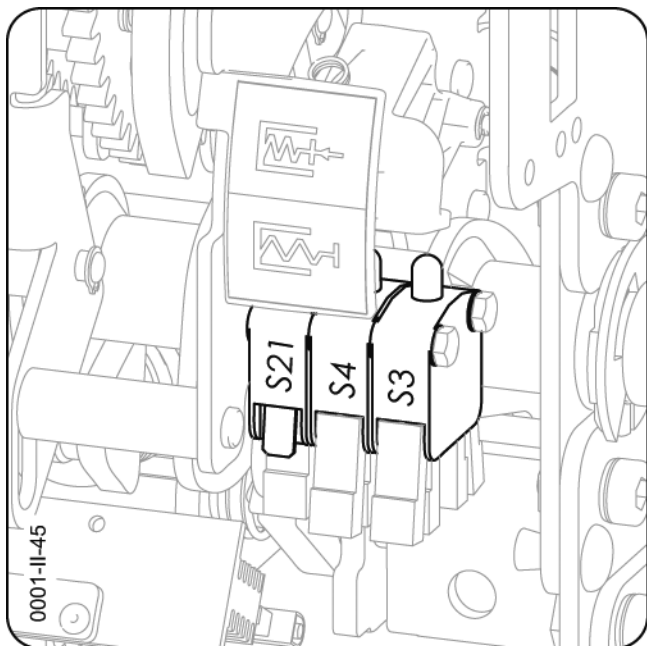


Fig. 35 3AE5 - Position switch (54.2-4)

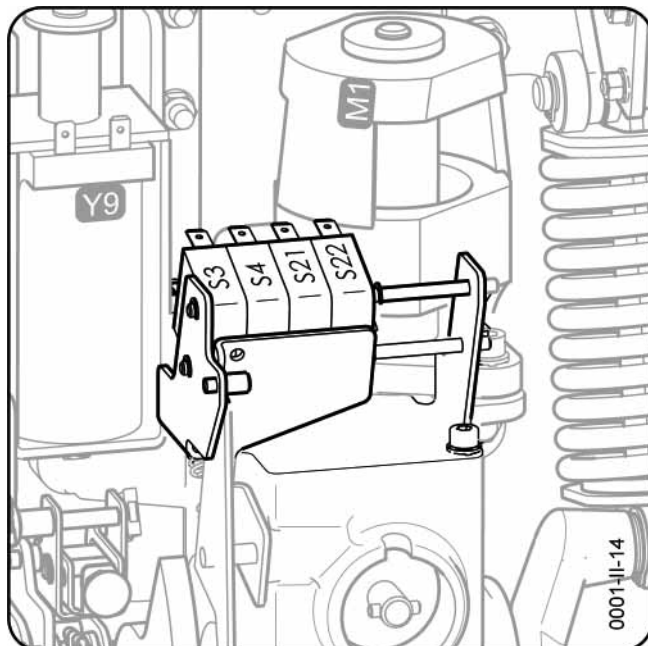


Fig. 36 3AE1 - Position switch (54.1-4)

Position switch (-S21) and (-S22) switch off the motor after charging the closing spring.

Position switches (-S3) and (-S4) open when the closing spring is charged.

Circuit-breaker tripping signal (-S6) SWB: 46677

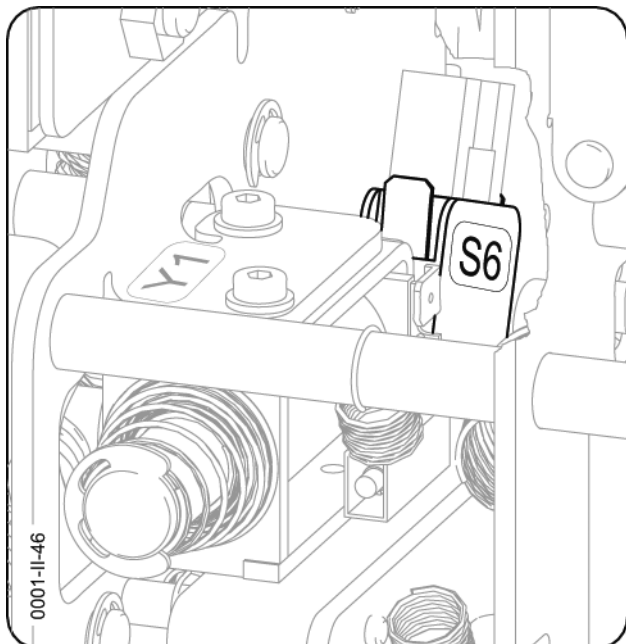


Fig. 37 3AE5 - circuit-breaker tripping signal (54.6)

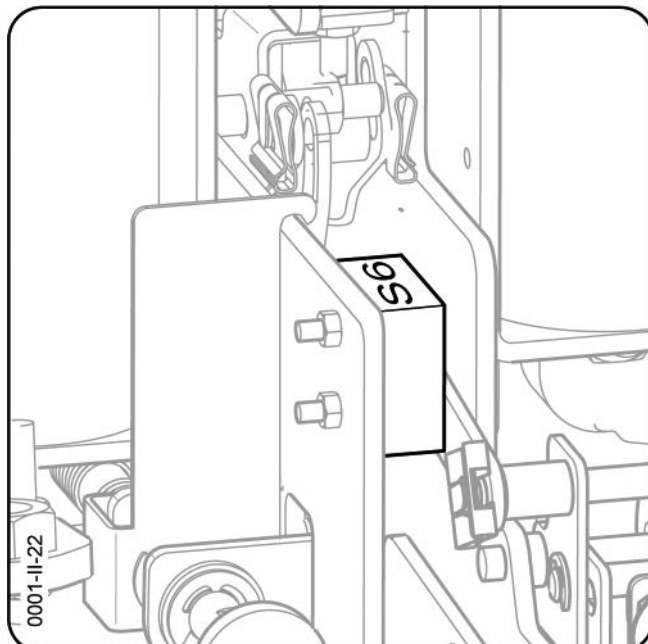


Fig. 38 3AE1 - circuit-breaker tripping signal (54.6)

The position switch (-S6) makes contact briefly when the vacuum circuit-breaker is opened by means of an electrical release.

This contact can be used for a signal.

Low-voltage interface (-X0), 64-pin 3AX1134

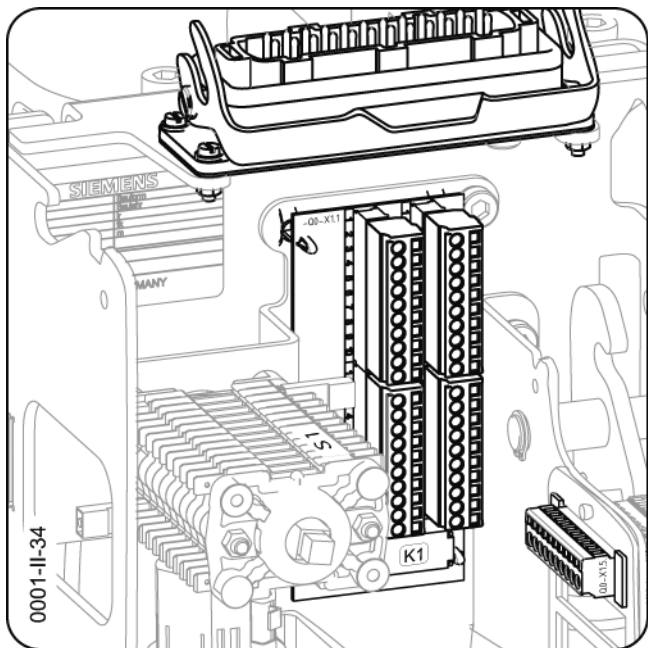


Fig. 39 3AE5 - Low-voltage interface (-X0) (32) with connector strip -X1 (33.1)

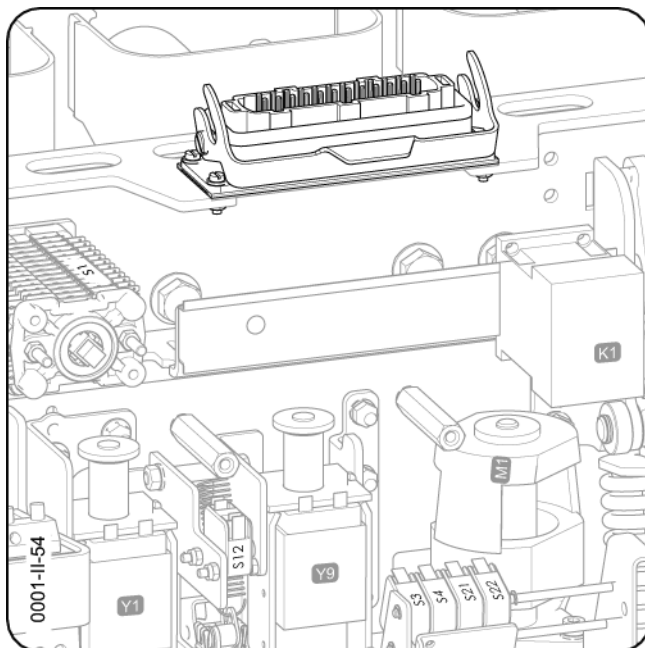


Fig. 40 3AE1 - Low-voltage interface (-X0) (32)

For connection of the control line, the standard version of the vacuum circuit-breakers is equipped with a 64-pin low-voltage interface (-X0).

The 64-pin plug, for the external terminal, is suitable for crimp termination of control lines with a nominal cross-section of 1.5 mm².

A further shunt release, transformer-operated release or undervoltage release can be installed as a 2nd release.

2nd shunt release (-Y2) 3AX1101

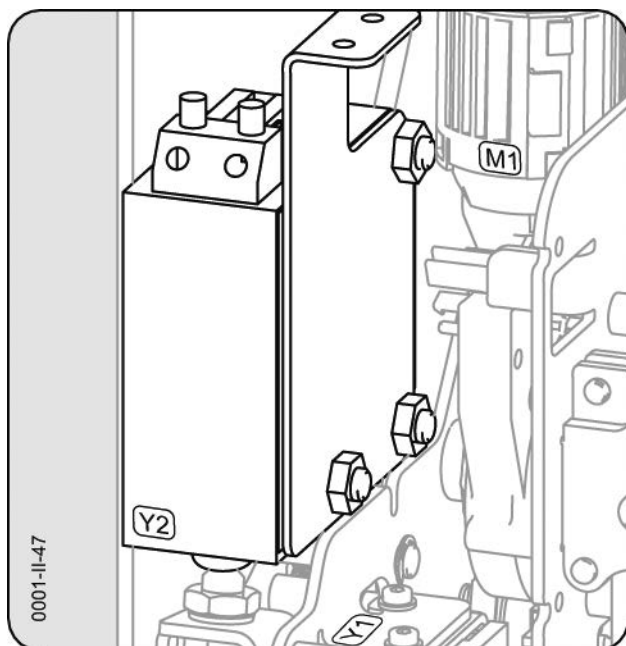


Fig. 41 3AE5 - 2nd shunt release (51.2)

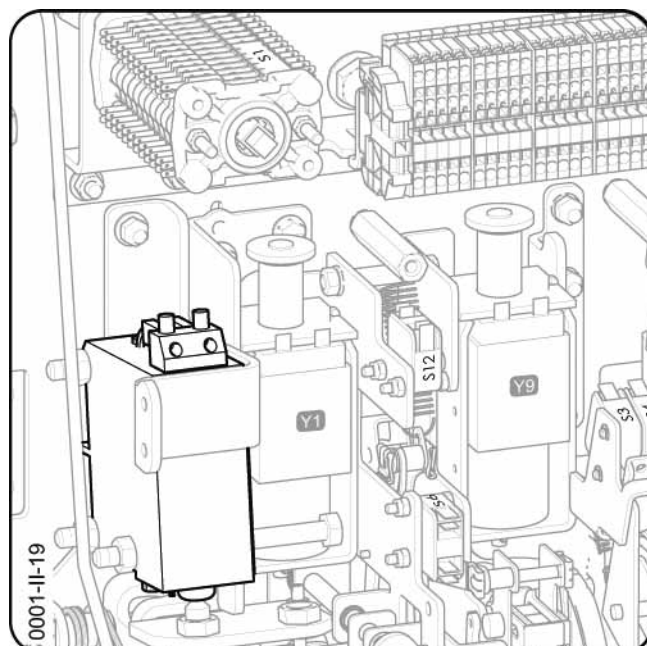


Fig. 42 3AE1 - 2nd shunt release (51.2)

The second shunt release (-Y2) is installed whenever more than one shunt release is needed.

In this version, the electrical "open" command is passed by means of a magnet armature to the "OPEN" latch by release of an energy storage mechanism, thus opening the vacuum circuit-breaker. This opening solenoid is not designed for continuous operation. Any necessary varistors and rectifiers are integrated in the release.

Power consumption 10 W / VA

Transformer-operated releases (-Y4), (-Y5) 3AX1102, (-Y6) 3AX1104

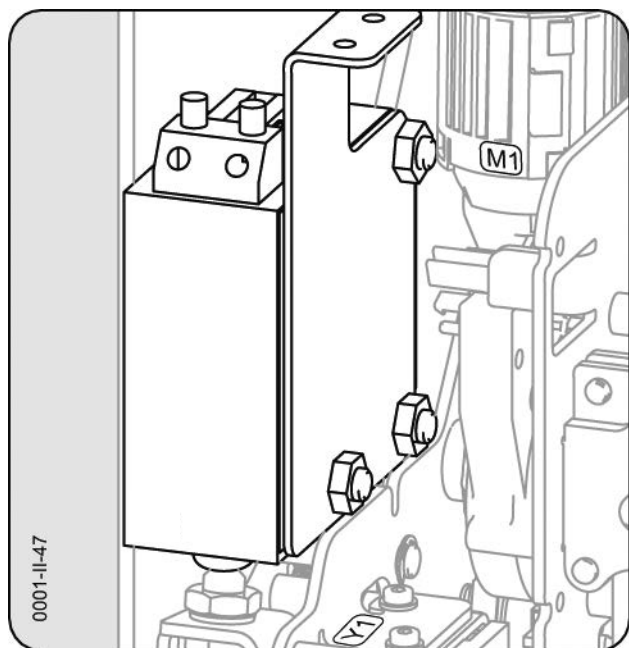


Fig. 43 3AE5 - transformer-operated release (51.3)

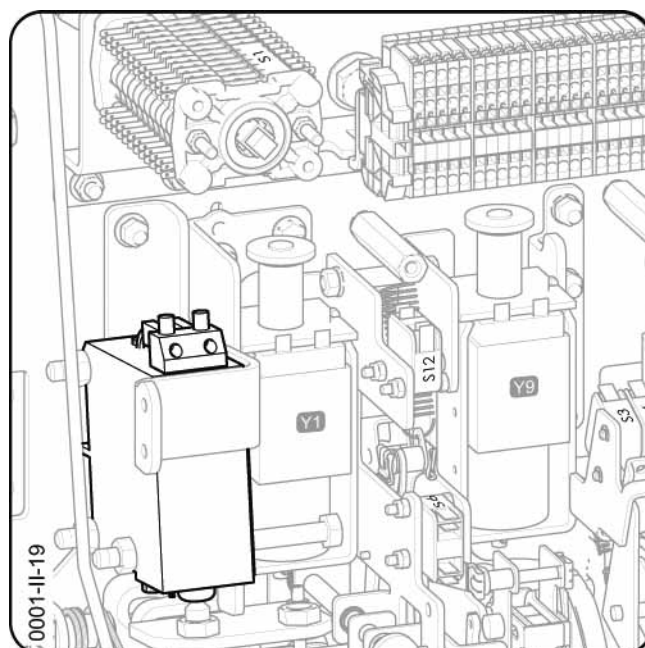


Fig. 44 3AE1 - transformer-operated release (51.3)

The transformer-operated releases (-Y4), (-Y5) or (-Y6) consist of an energy storage mechanism, an unlatching fixture and an electromagnetic system. If the tripping current is exceeded (90 % of the transformer-operated release's rated current), the energy storage mechanism is unlatched, thus initiating opening of the vacuum circuit-breaker.

For use of the transformer-operated release, matching transformers are also needed for matching, in addition to the main current transformers.

Power consumption for 0.5 A and 1 A ≤ 6 VA at ≤ 90 % of the transformer-operated release's rated current of with open armature.

Power consumption 10 W / VA

Undervoltage release (-Y7) 3AX1103

 **Note**

The undervoltage release (-Y7) must only be operated with the supplied series resistor (-R1).

 **Note**

For switching operations (mechanical or electrical), the undervoltage release 3AX1103... must be connected to control voltage, as otherwise closing is not possible (see "Removing the transport securing device from the undervoltage release", page 50).

The undervoltage release (-Y7) has an electromagnet system that is always live when the vacuum circuit-breaker is in the closed state. If the voltage drops below a certain value, the undervoltage release (-Y7) is unlatched, thus initiating opening of the vacuum circuit-breaker via the energy storage mechanism.

Random tripping of the undervoltage release (-Y7) is generally performed by an NC contact in the tripping circuit, but can also be done with the aid of an NO contact by short-circuiting the solenoid coil. If this latter method is used, the solenoid coil's short-circuit current is limited by the built-in resistor.

The undervoltage release (-Y7) can also be connected to voltage transformers.

The undervoltage release (-Y7) automatically trips the vacuum circuit-breaker if the rated supply voltage drops to an inadmissible value. Any necessary varistors and rectifiers are integrated in the release.

Power consumption 20 W / VA

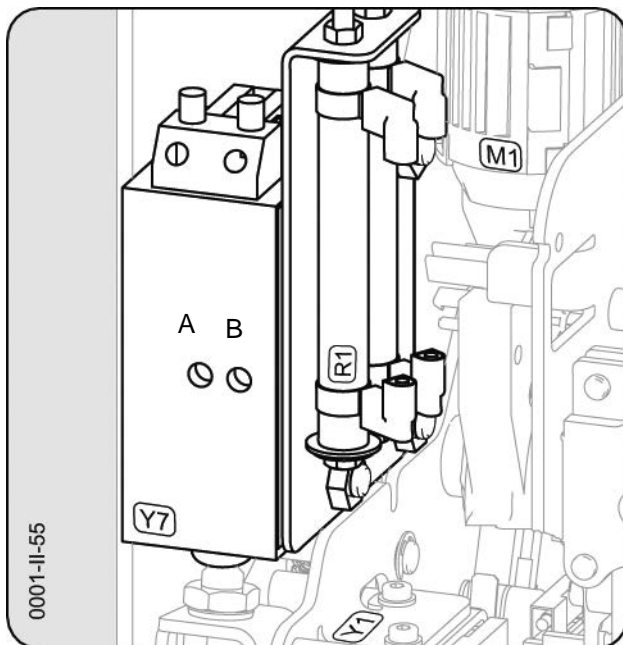


Fig. 45 Undervoltage release (51.7)

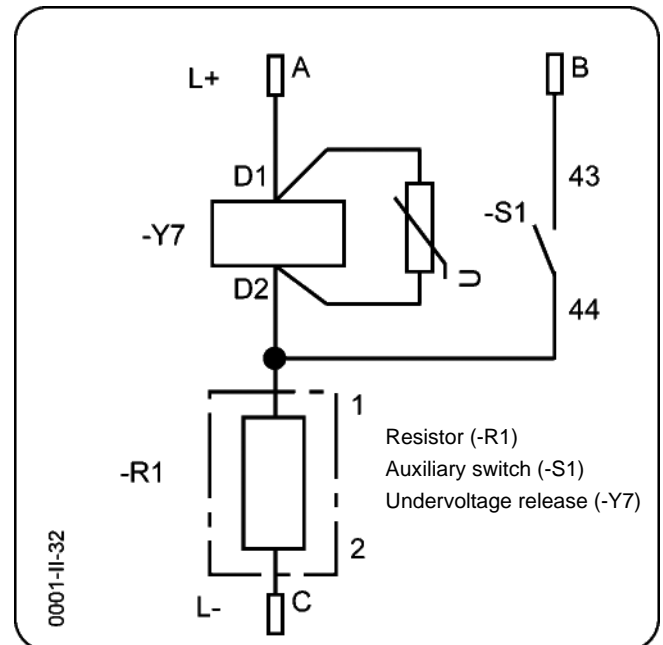


Fig. 46 Typical circuit for connection of the undervoltage release (-Y7)

Heater (-R01) for condensation water protection (optional)

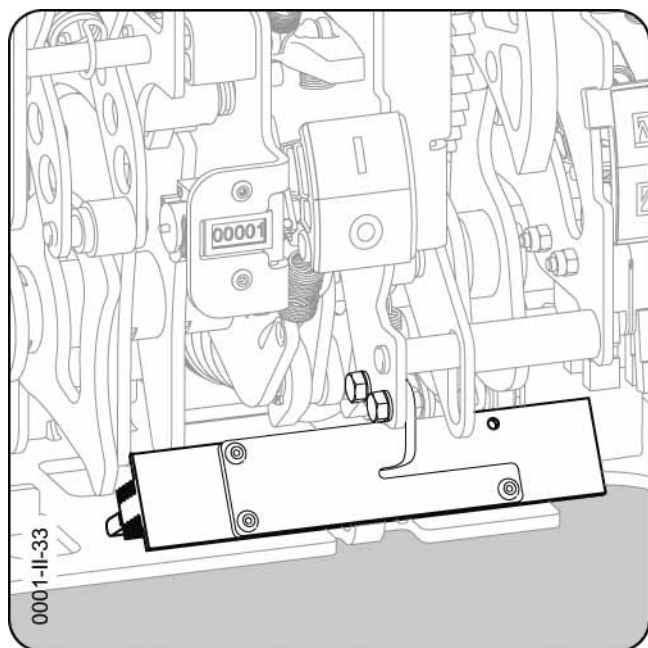


Fig. 47 3AE5 - Heater (59.4)

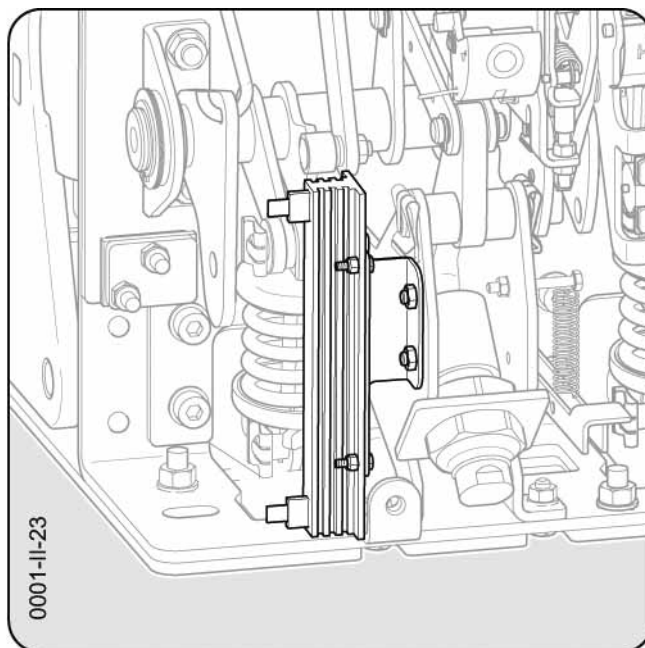


Fig. 48 3AE1 - Heater (59.4)

The heater limits condensation and corrosion of the vacuum circuit-breaker.

To this end, the heater has to be connected to the supply voltage (see circuit diagram included with the delivery).

⚠ WARNING

Danger of burns!

Touching the hot heater will cause burns.

Do not touch the heater before it has cooled off.

The surface temperature of the heater is approx. 180 °C.

Power consumption 50 W, rated voltage 230 V AC

Locking devices

To lock vacuum circuit-breakers as a function of the switching position, the spring charge mechanisms of the vacuum circuit-breaker can be equipped with a locking device. This is also the case for vacuum circuit-breakers on switch gear trucks, in withdrawable sections or with disconnectors.

Conditions The vacuum circuit-breaker must only be switched on in operating or disconnected position. The operating or disconnected position is the position of the vacuum circuit-breaker on the switchgear truck or withdrawable section in the switchgear. At the same time, the vacuum circuit-breaker may be moved on the switchgear truck or withdrawable section only when it is open.

 **Note****Material damage due to incorrect operation (only 3AE5)!**

Simultaneous actuation of the "CLOSE" and "OPEN" pushbuttons is not permitted.

This causes irreversible damage to the vacuum circuit-breaker.

Positions of the vacuum circuit-breaker in the switchgear

Disconnected position The isolating distance between the vacuum circuit-breaker contacts and the switchgear counter-contacts is attained fully .

Operating position The circuit-breaker is inserted fully into the switchgear and the vacuum circuit-breaker contacts overlap completely with the switchgear counter-contacts.

Mechanical locking device (optional)

A sensing and actuation component (b) on the system side detects the operating position (CLOSED/OPEN) of the vacuum circuit-breaker.

CLOSED switching position

If the vacuum circuit-breaker is closed, actuation of the system's sensing and actuation component (b) is prevented. A mechanical system in the switchgear truck or withdrawable section reliably blocks movements of the circuit-breaker on the switchgear truck or withdrawable section.

OPEN switching position

If the vacuum circuit-breaker is open, the sensing and actuation component (b) on the system side actuates, via the stroke (a), the vacuum circuit-breaker's mechanical locking device and reliably blocks closing of the vacuum circuit-breaker.

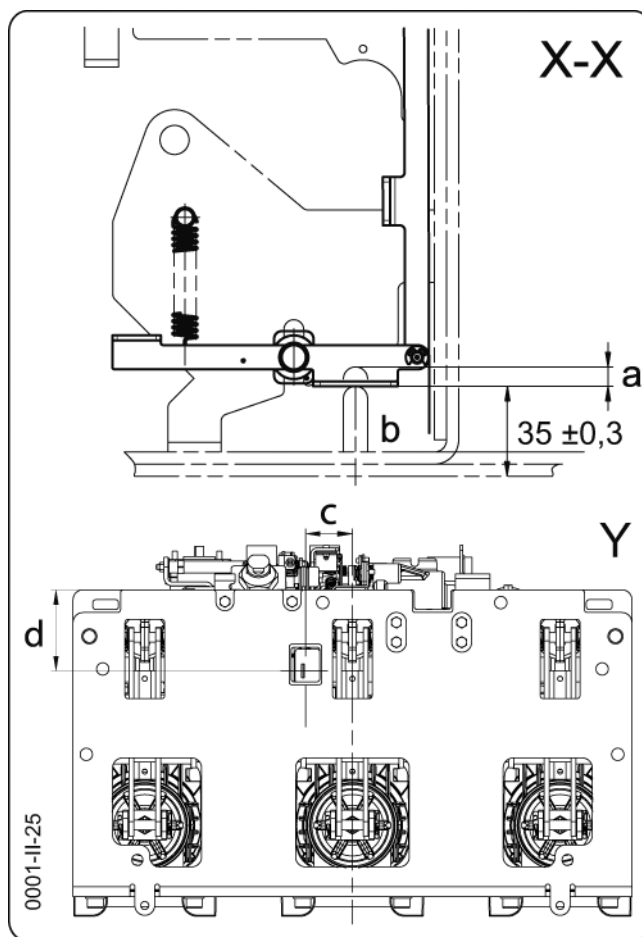
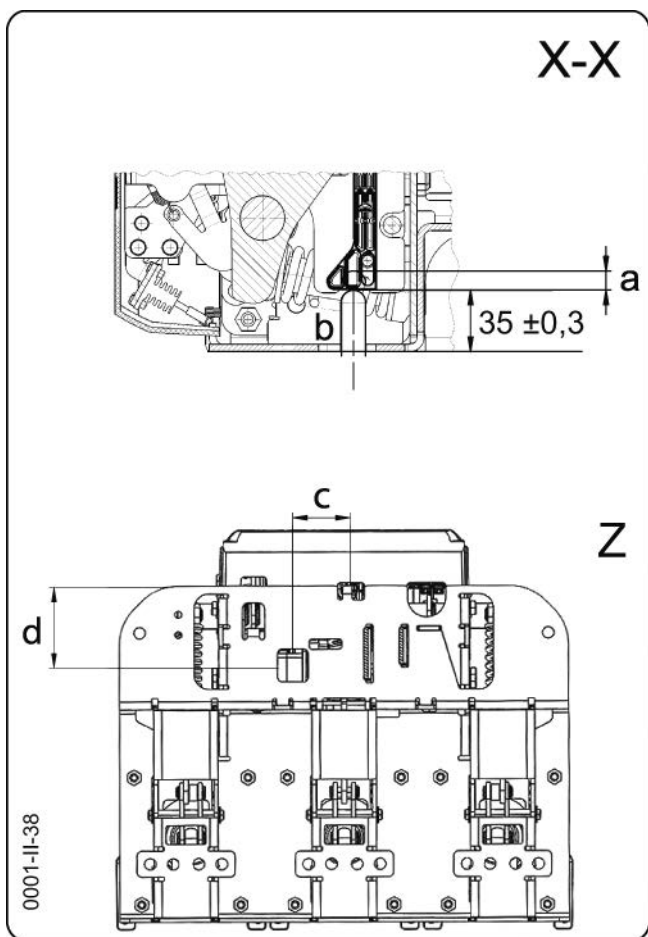


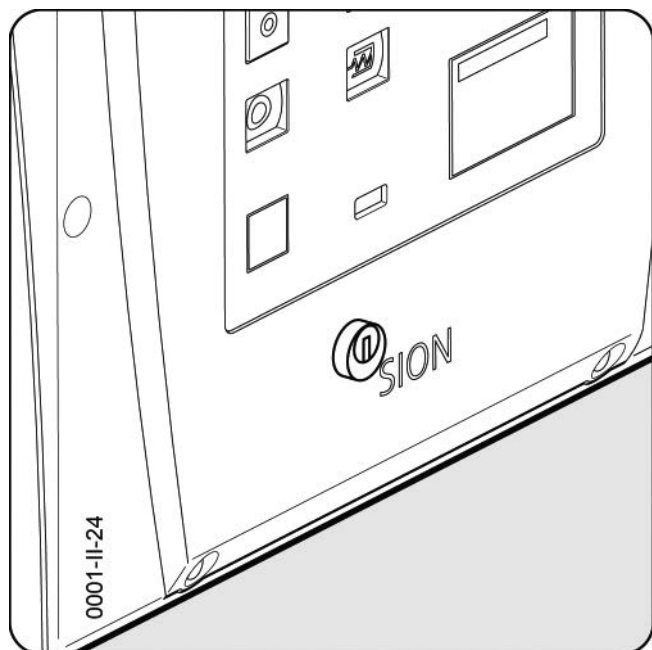
Fig. 49 3AE5 - Mechanical locking device

Fig. 50 3AE1 - Mechanical locking device

X-X	Sectional view	a	Stroke (min. 5 mm, max. 10 mm)
Y	3AE1 view from below	b	Sensing or actuation component (cross-section max. 14 mm x 3 mm, 3AE5 actuation force at least 50 N)
Z	3AE5 view from below	c + d	see dimension drawing

Fig. 51 Mechanical locking device

The installation dimensions (c + d) for the sensing and actuation component (b) are in the dimension drawing.

Key-operated locking device 3AX1437 (optional, only 3AE1)

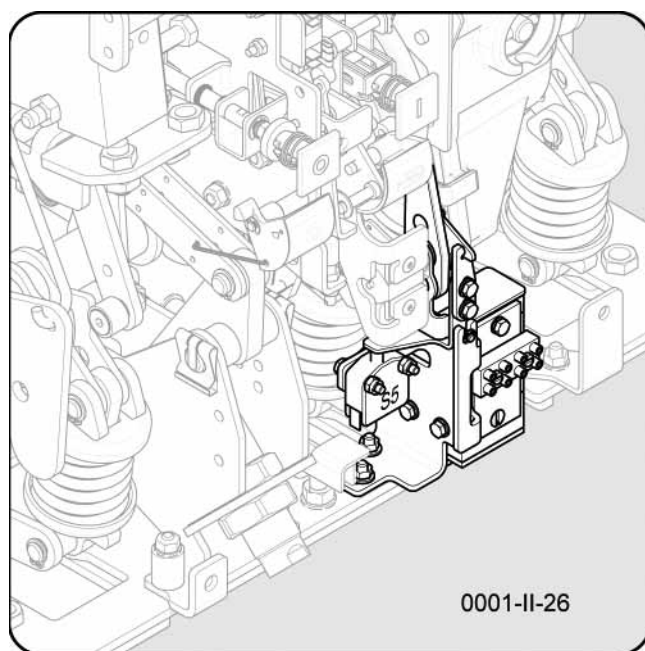
If the vacuum circuit-breaker is equipped with a mechanical locking device, manual switching can be prevented with the key-operated locking device.

Turning the key to the right/left or horizontally/vertically locks the key-operated locking device.

The key can be pulled out in the locked position.

Note: The key-operated locking device protrudes from the cover by 14 mm.

Fig. 52 Key-operated locking device (59.3)

Electrical closing lock-out (-F1) 3AX1415 (optional, only 3AE1)

Instead of or in addition to the mechanical closing lock, closing of the vacuum circuit-breaker can be prevented with the electrical closing lock-out (-F1).

The electrical closing lock-out (-F1) enables operation of the vacuum circuit-breaker if auxiliary voltage is available and mechanically locks both manual closing and electrical closing if auxiliary voltage is not available (position switch -S5).

Note: For mechanical or electrical switching operations the electrical closing lock-out 3AX1415 must be connected to control voltage, as otherwise closing is not possible.

Fig. 53 Electrical closing lock-out (59.5)

Rating plate

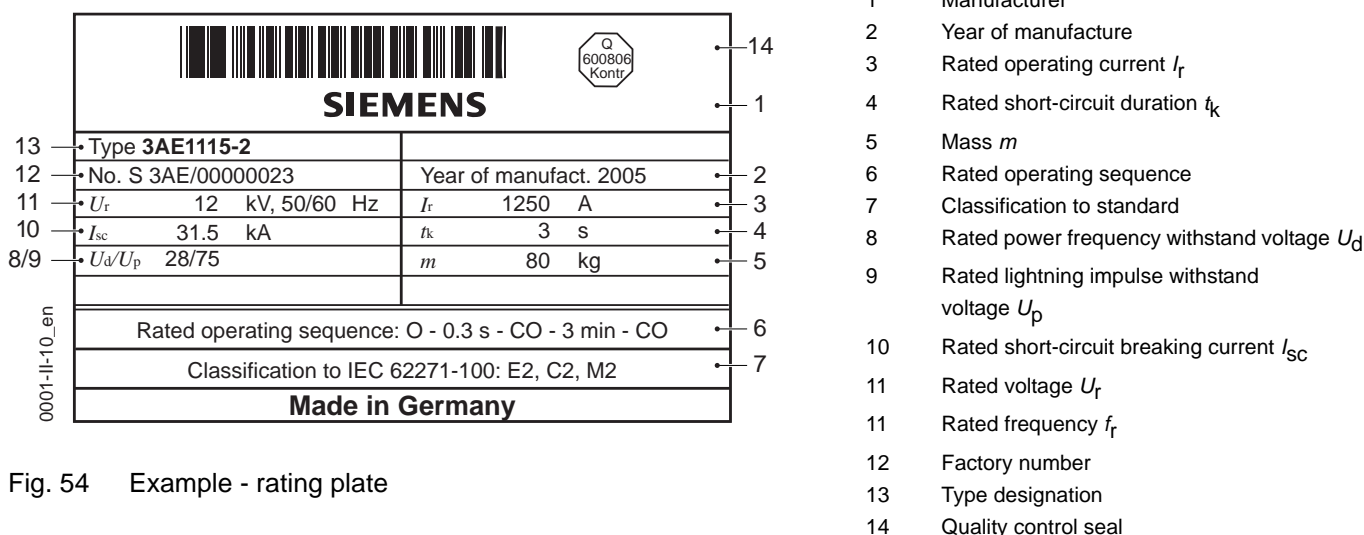


Fig. 54 Example - rating plate

Technical data

Rated voltage* U_r	kV	7.2	12	17.5	7.2	12	17.5	24
Rated operating current I_r	A	800 - 2500***			1250 - 3150***			800 - 2500***
Rated lightning impulse withstand voltage (peak value) U_p	kV	60	75 (95****)	95	60	75	95	125
Rated power frequency withstand voltage (effective value) U_d	kV	20 (32**)	28 (42**)	38	20 (32**)	28 (42**)	38	50
Rated short-circuit breaking current I_{sc}	kA	12.5 - 31.5			40			16 - 25
Distance between pole centres	mm	150, 160, 210, 275			210, 275			210, 275
Distance between the lower and the upper terminal	mm	205, 275, 310			310			310
Rated operating sequence		A, B, C			A, B, C			A, B, C

- A O - 3 min - CO - 3 min - CO
- B O - 0.3 s - CO - 3 min - CO; standard rated operating sequence
- C O - 0.3 s - CO - 15 s - CO
- * In the event of a rated frequency f_r of 50/60 Hz
- ** On request
- *** From 2000 A upwards only with 310 mm space between the lower and the upper terminal and a distance between pole centres of 210/275 mm
- **** On request, only 3AE5

Fig. 55 Technical data (excerpt from the catalogue)

Dimensions and weights

The dimensions of the vacuum circuit-breaker can be taken from the relevant dimension drawing. If required, these are available from your sales representative. The weight is given on the rating plate of the vacuum circuit-breaker (see Fig. 54) or can be taken from the relevant dimension drawing.

Ambient conditions

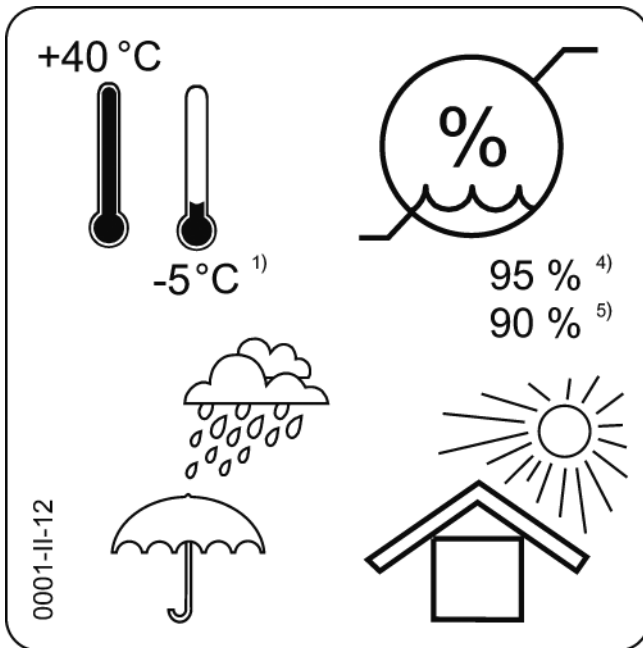


Fig. 56 Ambient conditions

Occasional condensation may occur under these ambient conditions.

SION[®] vacuum circuit-breakers are suitable for use in the following climate classes in accordance with IEC 60721, Part 3-3:

	Class
• Climatic ambient conditions:	3K4 ¹⁾
• Biological ambient conditions:	3B1
• Mechanical ambient conditions:	3M2
• Chemically active substances:	3C2 ²⁾
• Mechanically active substances:	3S2 ³⁾

- 1) Lower temperature limit: -5 °C (with Addendum A40 to -25 °C)
- 2) Without occurrence of salt fog and simultaneous condensation
- 3) Restriction: clean insulating parts
- 4) Average value, measured over 24 hours
- 5) Average value, measured over 1 month

Installation altitudes

Insulating capacity

The insulating capacity of insulation in air decreases with rising altitude due to the lower air density. In conformity with IEC 62271-1, the rated lightning impulse voltage values given in Fig. 55 are valid up to an installation altitude of 1,000 m above sea level.

At altitudes of 1,000 m and higher, the insulation level must be corrected as shown in Fig. 57:

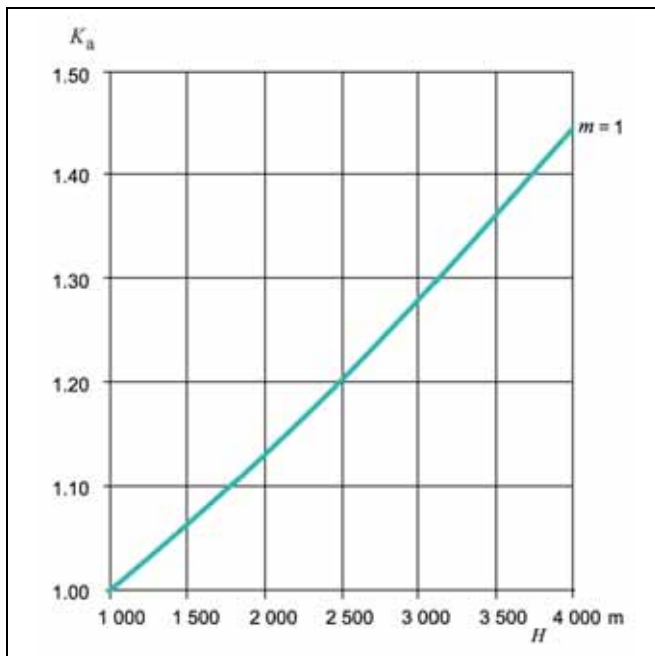


Fig. 57 Altitude correction factor K_a

$$U \geq U_0 \cdot K_a$$

U Rated withstand voltage U under standard reference atmosphere

U_0 Required rated withstand voltage for the installation location

K_a Altitude correction factor

$$K_a = e^m \cdot (H - 1,000)/8,150$$

Calculating the altitude correction factor K_a :

H = Installation altitude in metres

$m = 1$ for AC voltage, lightning impulse voltage (between phases, phase-to-earth, applied longitudinally)

Example

For a required rated withstand voltage of 75 kV at an altitude of 2,500 m, an insulation level of at least 90 kV under standard reference atmosphere conditions is required:

$$90 \text{ kV} \geq 75 \text{ kV} \cdot e^1 \cdot (2,500 - 1,000)/8,150 \\ \approx 75 \text{ kV} \cdot 1.2$$

Switching times

Closing time (closing time)		< 75 ms
Opening time (opening time)		
1st shunt release	(-Y1)	< 65 ms
2nd release	(-Y2, -Y4, -Y6, -Y7)	< 50 ms
Arcing time		< 15 ms
Break time		
1st shunt release	(-Y1)	< 80 ms
2nd release	(-Y2, -Y4, -Y6, -Y7)	< 65 ms
Dead time		300 ms
Close/Open time		
1st shunt release	(-Y1)	< 75 ms
2nd release	(-Y2, -Y4, -Y6, -Y7)	< 60 ms
Minimum command duration		
Closing solenoid	(-Y9)	45 ms
1st shunt release	(-Y1)	40 ms
2nd release	(-Y2, -Y4, -Y6, -Y7)	20 ms
Shortest pulse time for circuit-breaker tripping signal (-S6)		
1st shunt release (3AE5)	(-Y1)	> 10 ms
1st shunt release (3AE1)	(-Y1)	> 15 ms
2nd release (3AE5)	(-Y2, -Y4, -Y6, -Y7)	> 6 ms
2nd release (3AE1)	(-Y2, -Y4, -Y6, -Y7)	> 10 ms
Charging time if actuated electrically	(-M1)	< 15 s
Synchronous operation error between the poles		≤ 2 ms

Fig. 58 Switching times

Closing time = period between starting (command) of the closing movement and the moment of contact touch in all poles.

Opening time = period between starting (command) of the opening movement and opening of the last pole.

Arcing time = period from the start of the first arc to extinction of the arcs in all poles.

Break-time = period between starting (command) of the opening movement and extinction of the arc in the last pole to become extinct (= opening time + arcing time).

Close/Open time = period in an OPEN/CLOSE cycle between the moment of contact touch in the first pole during closing and the time when contact touch has been cancelled in all poles during subsequent opening.

Dead-time = period from the end of the current flow in all poles up to the start of current flow in the first pole.

Circuit diagrams

The circuit diagrams show all the available components with their wiring options.

Fig. 59 to Fig. 63 show some non-binding examples of vacuum circuit-breakers.

The circuit diagrams for the vacuum circuit-breaker are compiled depending on your order.

Mechanical manual closing and electrical closing

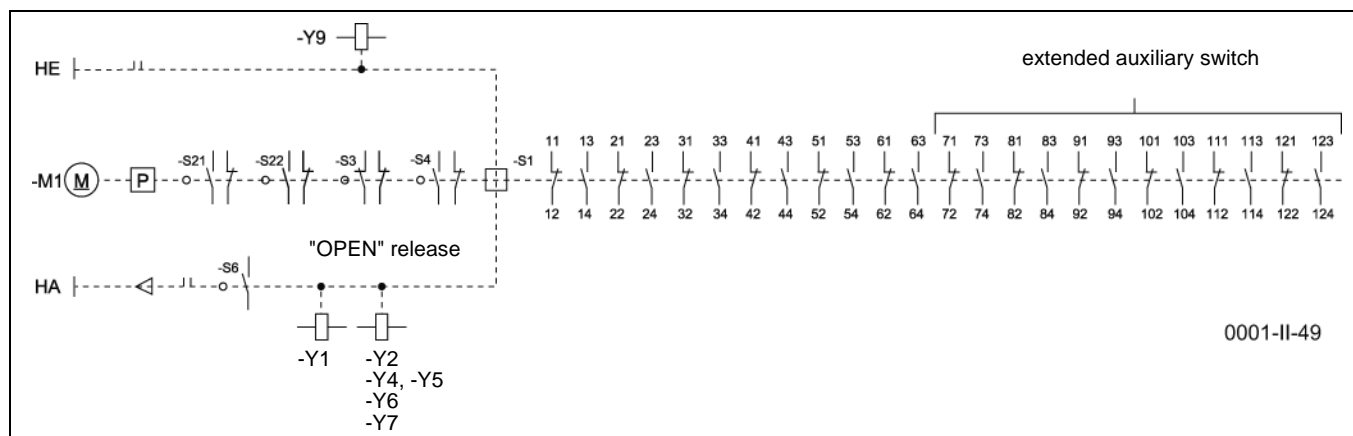
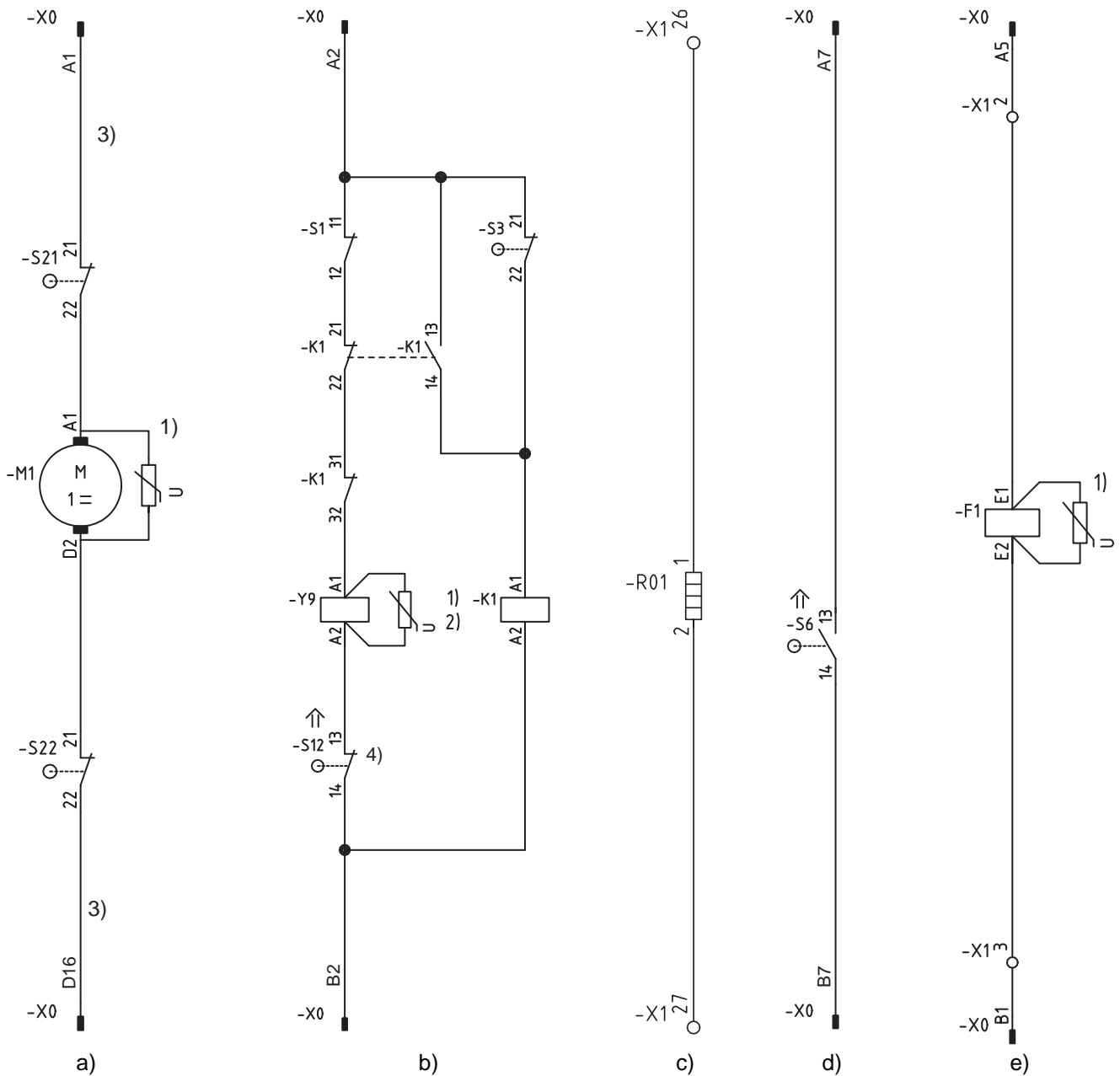


Fig. 59 3A1 sample circuit diagram 64-pole plug connector (part 1) of the vacuum circuit-breaker

-F1	Electrical closing lock-out (only 3AE1)	-S3	Position switch (opens when closing spring is charged)
HA	Manual opening	-S4	Position switch (signal "Closing spring charged")
HE	Manual closing	-S6	Position switches (for circuit-breaker tripping signal)
-K1	Contacting relay (anti-pumping device)	-X0	Low-voltage interface
-M1	Motor	-Y1	1st shunt release
P	Energy storage mechanism	-Y2	2nd shunt release
-R1	Resistor	-Y4,	Transformer-operated release
-S1	Auxiliary switch	-Y5,	Transformer-operated release
-S12	Position switch (prevents electrical closing if there is a mechanical locking device)	-Y6	Transformer-operated release
-S21,		-Y7	Undervoltage release
-S22	Position switches (switch off the motor after charging)	-Y9	Closing solenoid

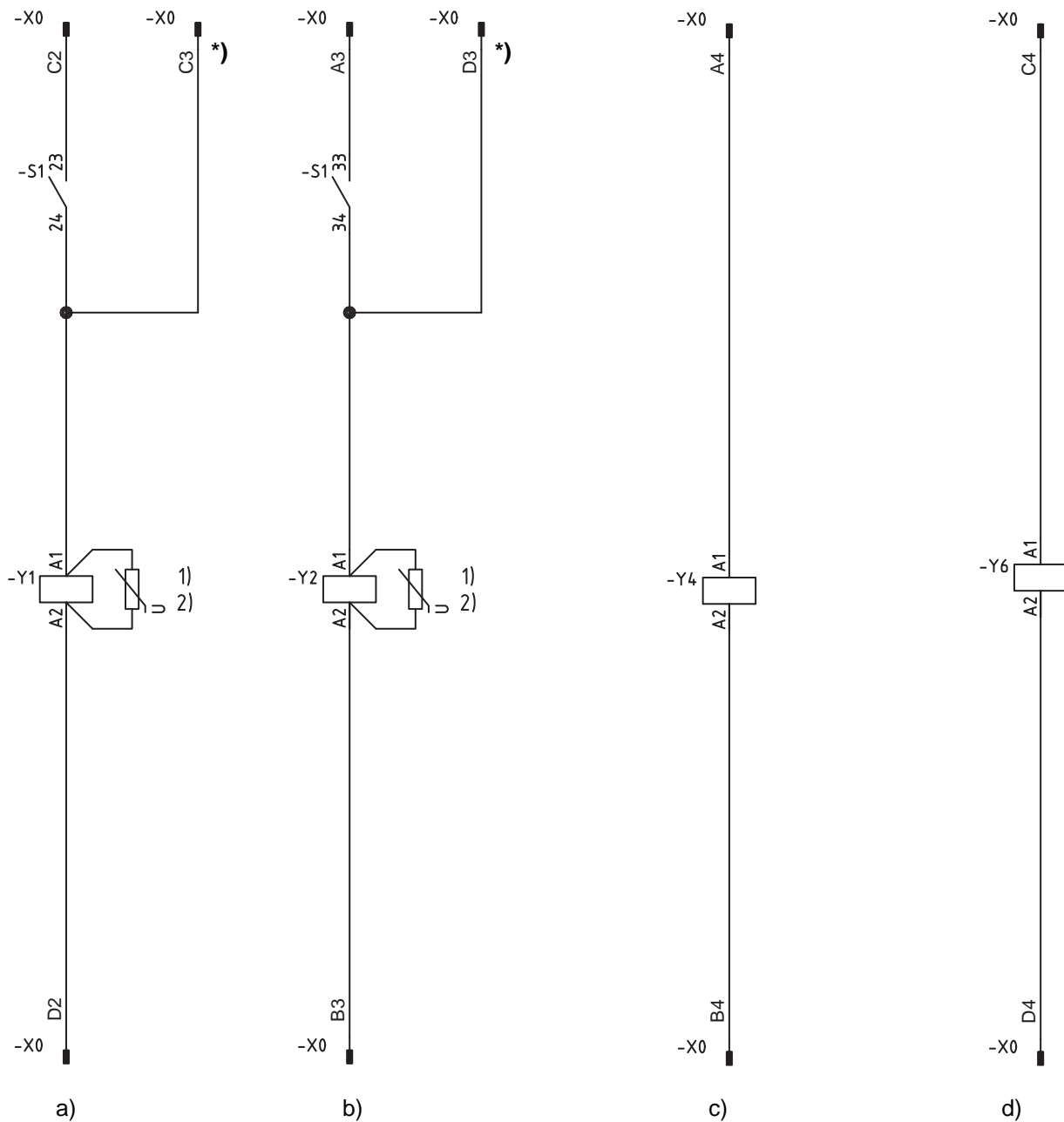
This legend is also valid for the following circuit diagrams.



- 1) Integrated varistor
- 2) Integrated rectifier for AC/DC ≥ 100 V
- 3) Line H07V-K1x2.5sw (as per EN 50525-2-31) when motors are used with DC 24 V/48 V and 60 V
- 4) Only if a mechanical closing lock is ordered at the same time

- a) Motor winding for DC
- b) Closing with anti-pumping device
- c) 230 V AC heater
- d) Circuit-breaker tripping signal
- e) Electrical closing lock-out (optional, only 3AE1)

Fig. 60 3AE1 sample circuit diagram 64-pole plug connector (part 2) of the vacuum circuit-breaker



- 1) Integrated varistor
- 2) Integrated rectifier for AC/DC ≥ 100 V
- *) Terminal for monitoring the release coil

- a) 1st shunt release
- b) 2nd shunt release
- c) 1st transformer-operated release
- d) Low-energy release

Fig. 61 3AE1 sample circuit diagram 64-pole plug connector (part 3) of the vacuum circuit-breaker

The unassigned auxiliary switch terminals are wired up with the 64-pole plug bottom, as shown.

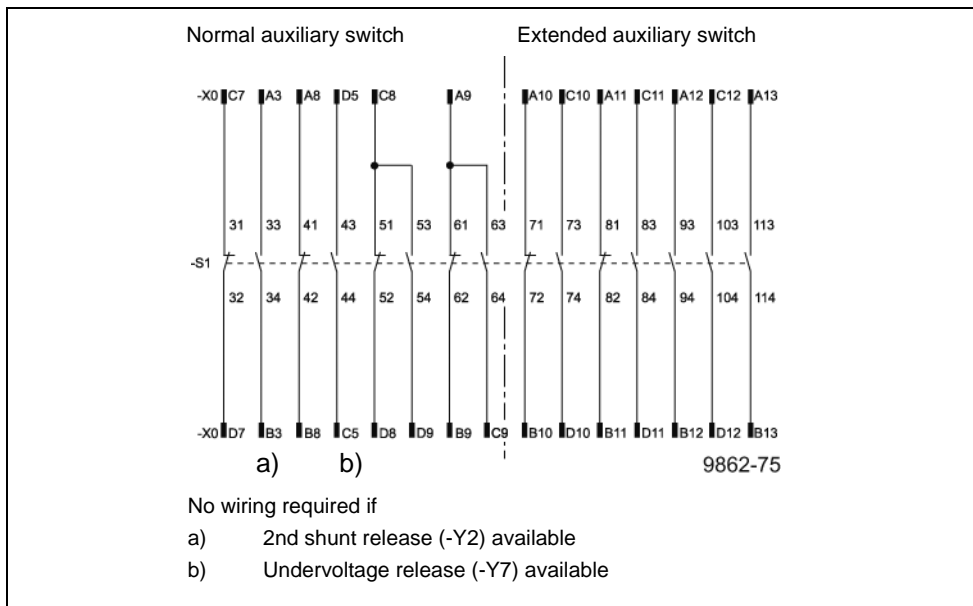


Fig. 62 Example – auxiliary switch terminals

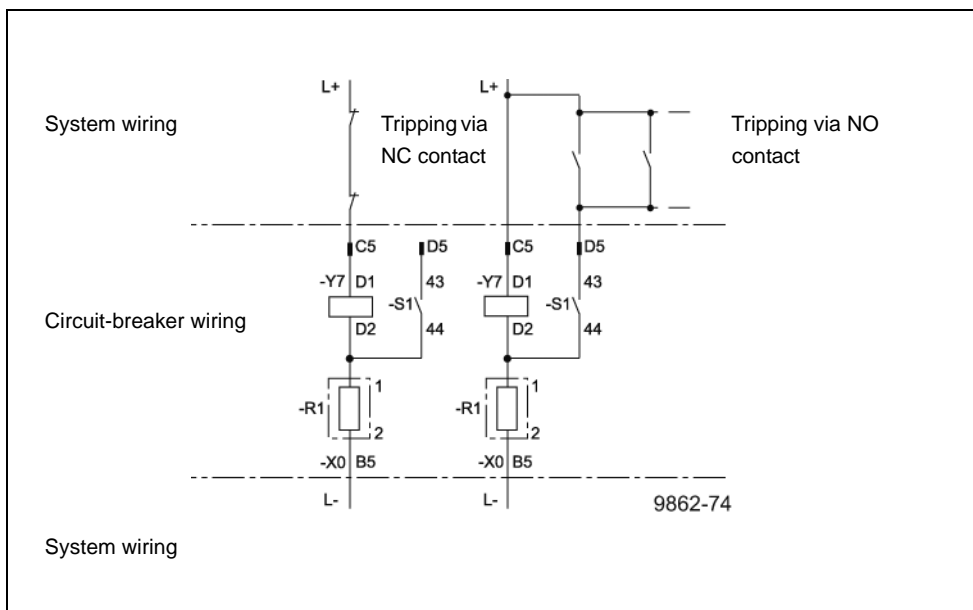


Fig. 63 Sample switching operation for connection of the undervoltage release (-Y7)

 **DANGER**
High-voltage - danger to life

Touching live parts causes an electric shock.

- Do not touch live parts!
- When performing work on the switchgear, de-energise it and earth it.
- The work described in the following sections must only be performed when the switchgear has been de-energised:
 - Take safety measures to prevent reclosing.
 - Observe industrial safety regulations.
 - Ensure that the vacuum circuit-breaker is installed and commissioned only by qualified personnel who are familiar with the operating instructions and observe the warning notices.

 **WARNING**
Risk of injury due to wrong transport means!

Using wrong transport means may cause the vacuum circuit-breaker to fall and injure persons.

- Observe weight.
- Use means of transport suited to the requirements and load-carrying capacity.
- The vacuum circuit-breaker must not fall over.
- Sharp edges may cause injury.

 **Note**

For preliminary work, the vacuum circuit-breaker must be

- secured against falling over,
- placed onto a suitable support or
- suspended from a crane to prepare for installation.

 **Note**
Material damage due to incorrect operation!

If the SION[®] vacuum circuit-breaker is triggered manually with the cover removed and the mechanical locking device actuated, the operating mechanism of the vacuum circuit-breaker will be irreversibly damaged. Any warranty claims are lost in the event of such incorrect operation.

Use suitable means to prevent the SION[®] vacuum circuit-breaker from closing if the cover has been removed and if the mechanical locking device has been operated.

 **WARNING**
Danger of burns!

Touching the hot heater will cause burns.

Do not touch the heater before it has cooled off.

Attachment in the switching cubicle

The vacuum circuit-breaker is delivered in the OPEN switching position. Before installing the vacuum circuit-breaker, remove the transport aids (see “Unpacking” on page 6).

Check data Before installing the vacuum circuit-breaker in a switching cubicle, check the details on the rating plate (see “Rating plate” on page 32) in order to avoid confusion.

Mounting position The SION® vacuum circuit-breaker can only be installed vertically (to the vacuum interrupter), as an indoor withdrawable section and as an indoor fixed installation.

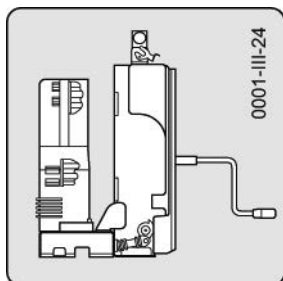


Fig. 64 Mounting position

Removing and mounting the covers

Remove the covers to mount the mounting brackets.

Removing and mounting cover 3AE5

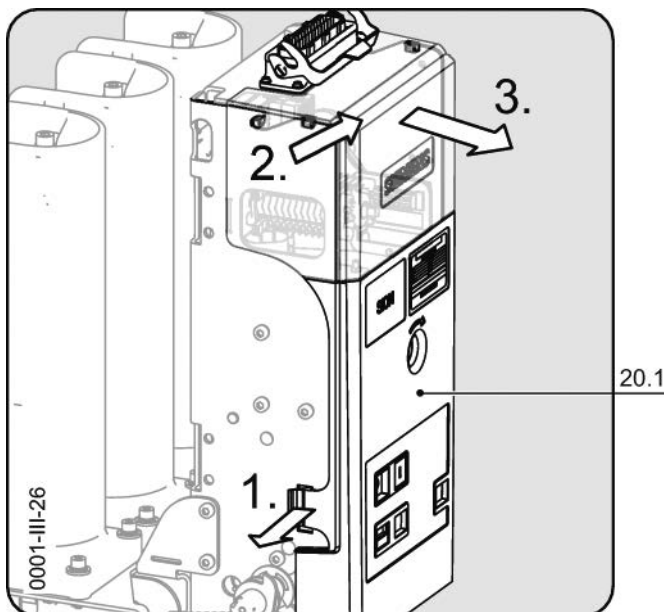


Fig. 65 3AE5 - Removing the cover

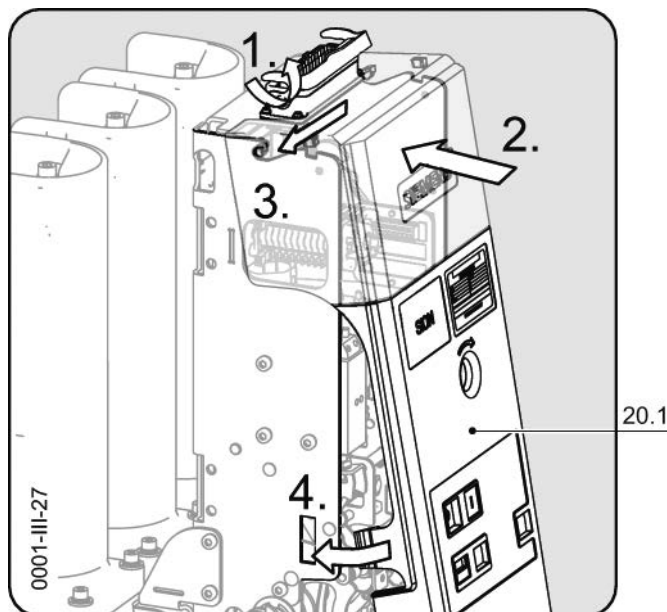


Fig. 66 3AE5 - Mounting the cover

- Removing**
- Pull off both the engaging hooks of the cover (20.1) simultaneously.
 - Remove the cover (20.1) forwards and upwards.

- Mounting**
- Flip up the bracket of the low-voltage interface.
 - Insert the cover (20.1) into the guide from the top; do not jam or swing it down.
 - Let both the engaging hooks of the cover (20.1) fully engage.

Removing the cover for the low-voltage interface 3AE1

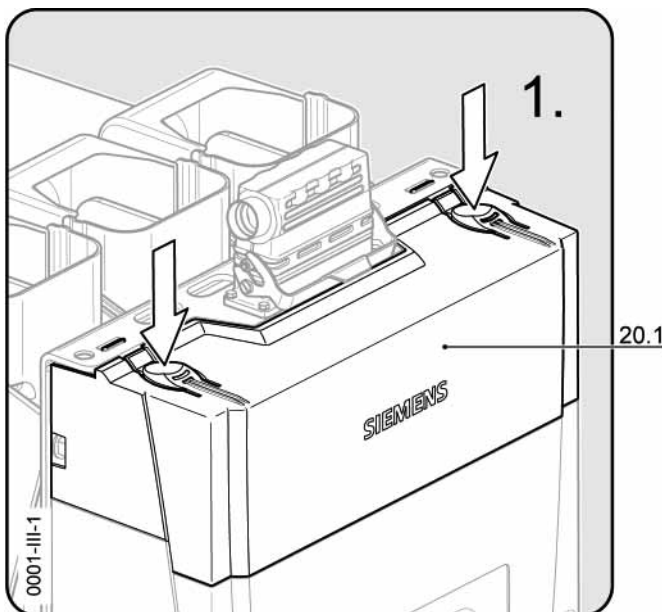


Fig. 67 3AE1 - Pressing in the engaging hook

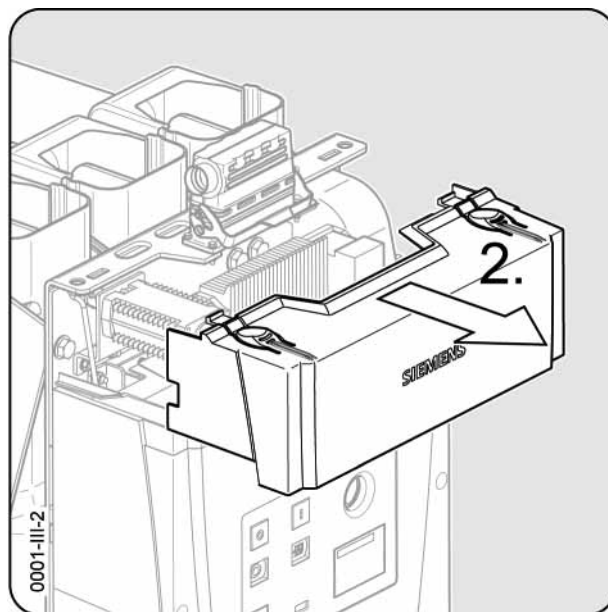


Fig. 68 3AE1 - Removing the cover

- Press in the engaging hooks of the cover for the low-voltage interface (20.2).
- Remove the cover for the low-voltage interface (20.2).

Mounting the cover for the low-voltage interface 3AE1

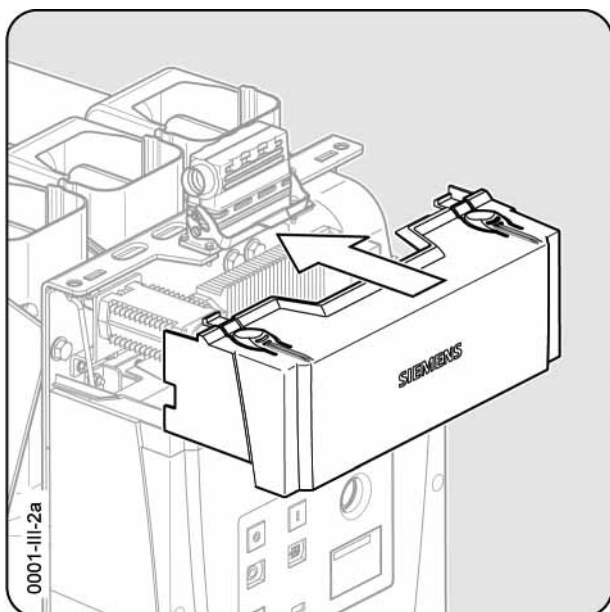


Fig. 69 3AE1 - Mounting the cover

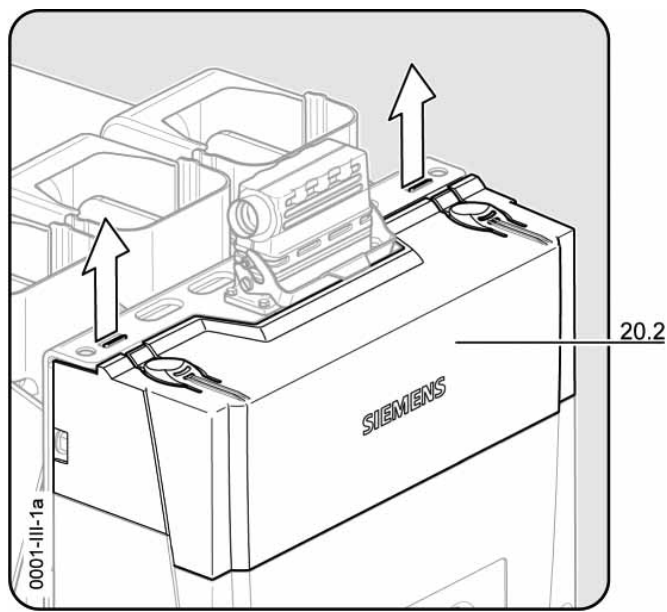


Fig. 70 3AE1 - Engaging the cover

- Position the cover for the low-voltage interface (20.2) and push in as far as it will go.
- Engage the engaging hooks of the cover for the low-voltage interface (20.2).

Removing and mounting the side panels 3AE1

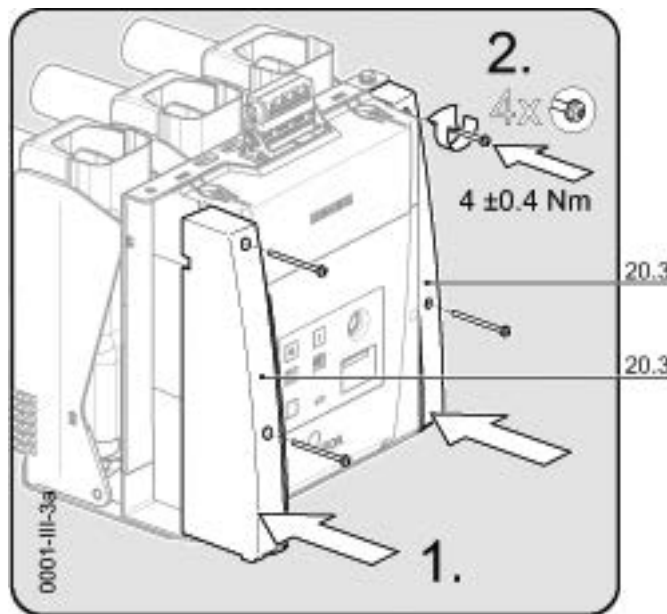
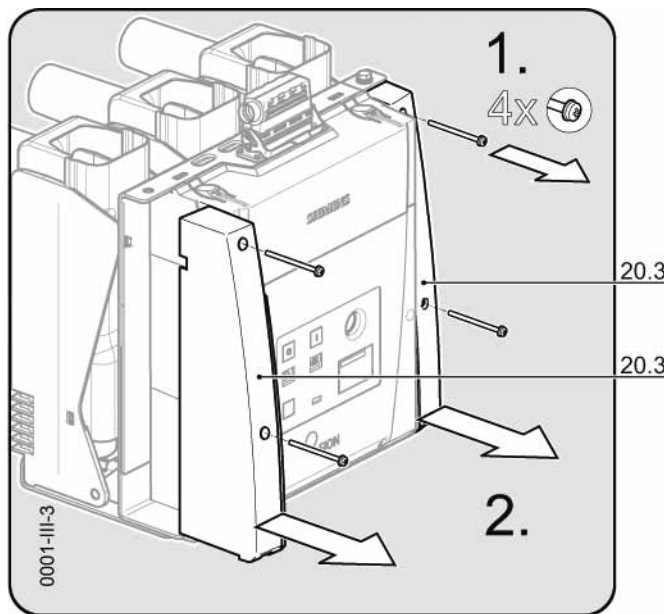


Fig. 71 3AE1 - Removing the side panels

Fig. 72 3AE1 - Mounting the side panels

Removing To mount the mounting brackets on the SION[®] vacuum circuit-breaker with a distance of 210 and 275 mm between pole centres, only remove the side panels (20.3):

- Screw out Phillips head screws (4x) with a Phillips head screwdriver size 3 (ISO 7045).
- Pull off the side panels (20.3).

Mounting

- Carefully position the side panels (20.3).
- Screw in the Phillips head screws (4x) with a Phillips head screwdriver size 3 (ISO 7045) and tighten to a torque of 4 ± 0.4 Nm.

Removing and mounting the cover 3AE1

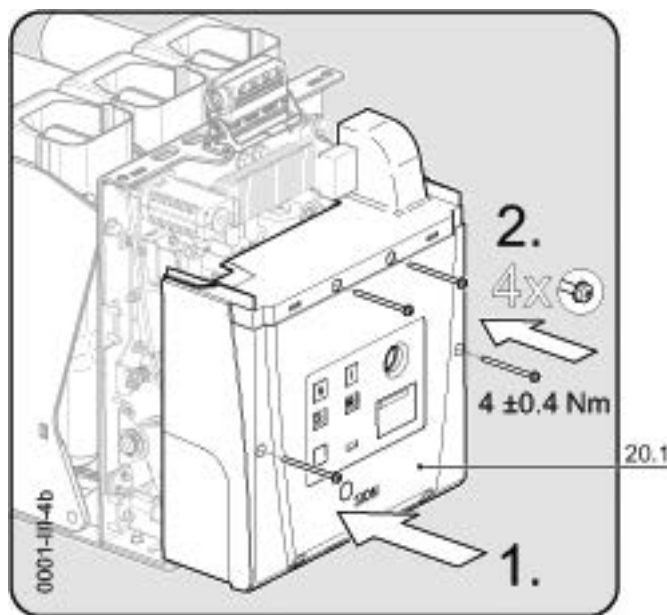
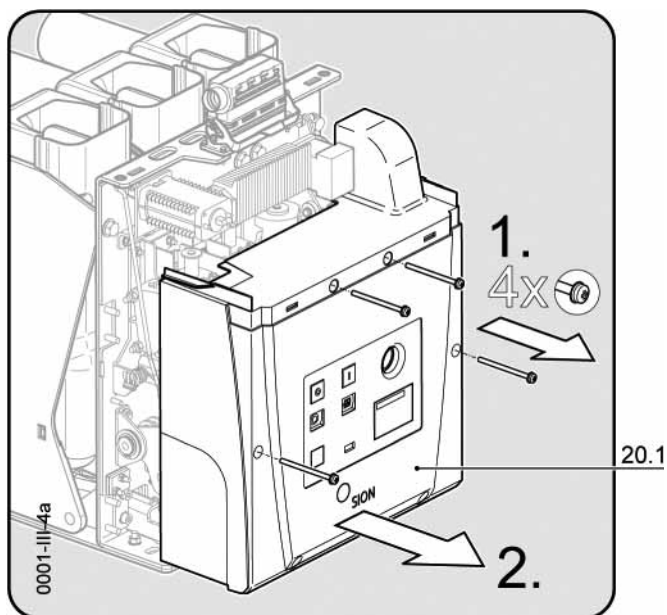


Fig. 73 3AE1 - Removing the cover

Fig. 74 3AE1 - Mounting the cover

Removing

- Screw out Phillips head screws (4x) with a Phillips head screwdriver size 3 (ISO 7045).
- Pull off the cover (20.3).

- Mounting**
- Carefully position the cover (20.3).
 - Screw in the Phillips head screws (4x) with a Phillips head screwdriver size 3 (ISO 7045) and tighten to a torque of 4 ± 0.4 Nm.

Mounting the PG fitting

The version with plug or terminal strip (without low-voltage plug) is supplied with a PG fitting and fasteners (in the accessories pack). The PG fitting serves to bundle and protect the cables coming from the low-voltage interface.

Note

Self-tapping screws are suitable for single use only.

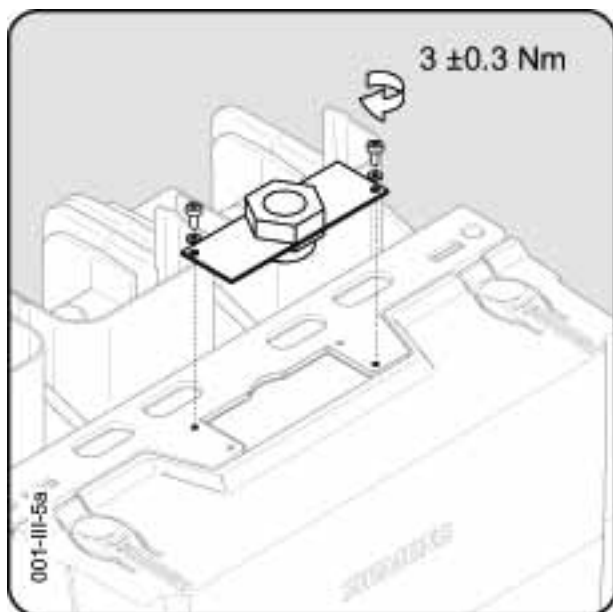


Fig. 75 Example - mounting the PG fitting

Screw on the supporting plate of the PG fitting with the self-tapping screws (Torx screwdriver size 20) and a tightening torque of 3 ± 0.3 Nm.

For the wiring of the plug or terminal strip, see page 48.

Mounting the panels separating from the unit

Panels separating from the unit (47) can be used to insulate the individual poles from each other if there is restricted terminal space.

When using panels (47) separating from the unit, you can use main conductors with a diameter or cross-section of max. 60 mm.

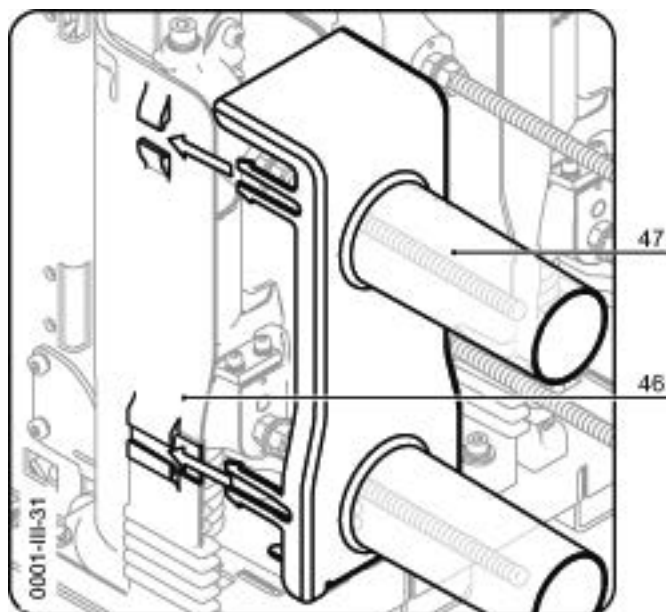


Fig. 76 3AE5 - Mounting separating panels (47)

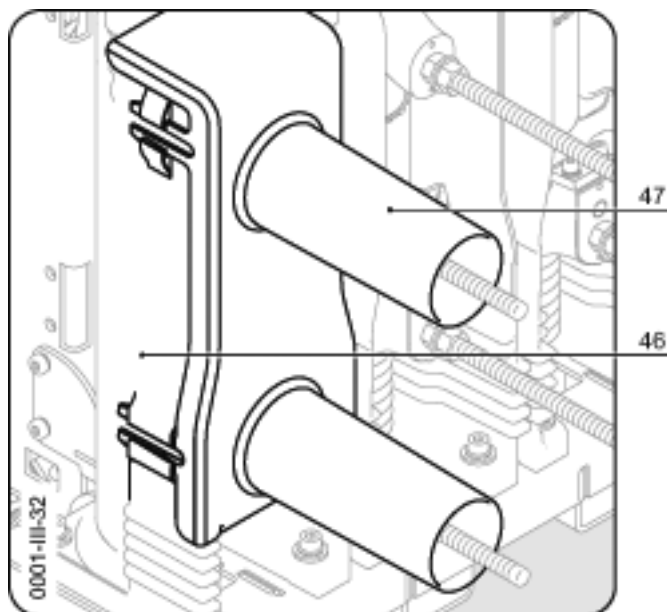


Fig. 77 3AE5 - Engaging separating panels (47)

- Push the separating panels onto the threaded rods already mounted on the main conductors (for instructions on installing the main conductors, see “Connecting the main conductor” page 52).
- Place the separating panel onto the pole shell (46) and engage into the guide.
- If necessary, engage the engaging hooks manually.

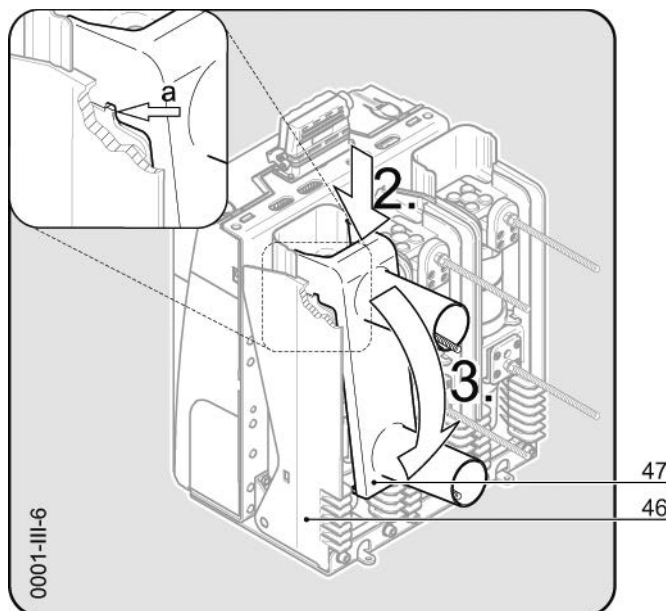


Fig. 78 3AE1 - Mounting separating panels (47). View without main conductor

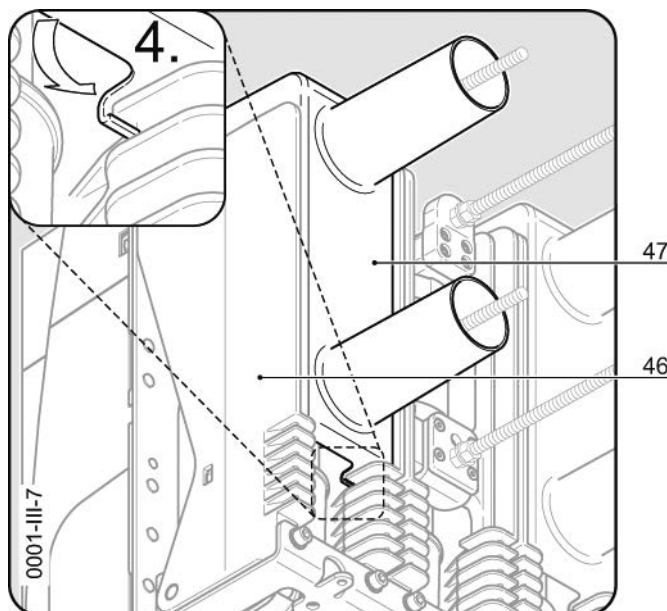


Fig. 79 3AE1 - Engaging separating panels (47)

- Place the separating panel onto the rib (arrow a) from the top, holding it at a slight angle.
- Press the bottom part of the separating panel against the pole shell (46) until it engages audibly.

- Check whether the engaging hooks of the separating panel (47) have fully engaged behind the insulation ribs. Engage the hooks by hand, if necessary.

Mounting the fixed-mounted circuit-breaker on a horizontal plane

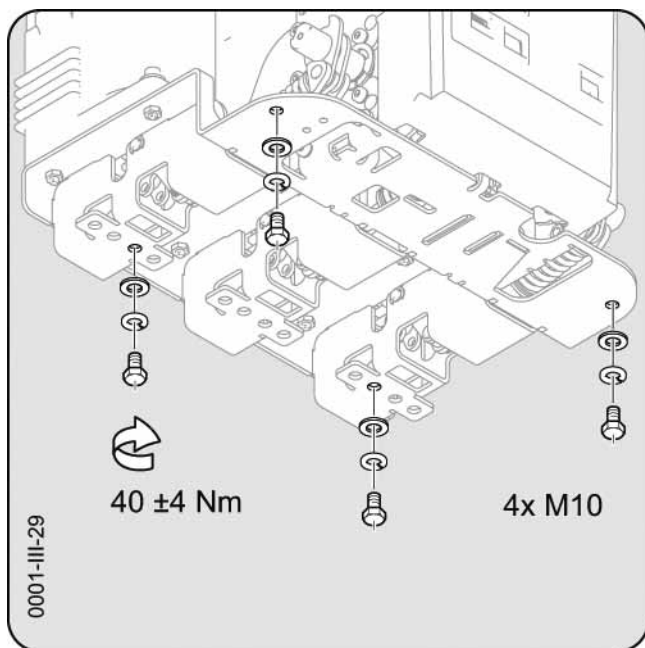


Fig. 80 3AE5 - Mounting for fixed installation from below

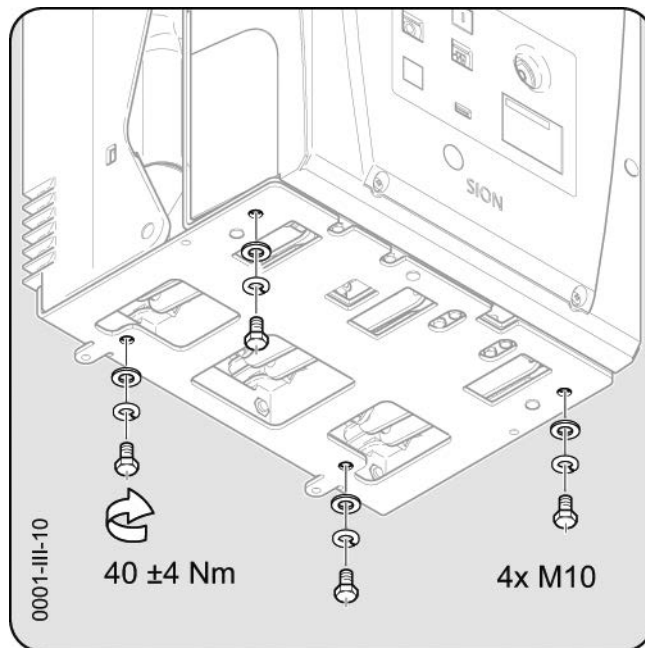


Fig. 81 3AE1 - Mounting for fixed installation from below

There are a total of 4 fixing holes on the base plate for the various installation types.

Use M10 screws – strength class 8.8 – for fastening. The binding dimension drawings are relevant.

Fastening on the mounting surface

Use 4 M10 screws to screw the fixed-mounted circuit-breaker onto the mounting surface from below. Tightening torque 40 ± 4 Nm (applies to greased threads only).

Fastening on the cartridge insert

To fasten to the cartridge insert, remove the cover prior to mounting (see “Removing and mounting the covers”, page 40) and fasten the wiring harness in the operating mechanism (see “Connecting low-voltage”, page 48).

Mounting the fixed-mounted circuit-breaker on a vertical plane (using mounting brackets)

The framework must be made to suit the operating conditions and have sufficient load bearing capacity and stability.

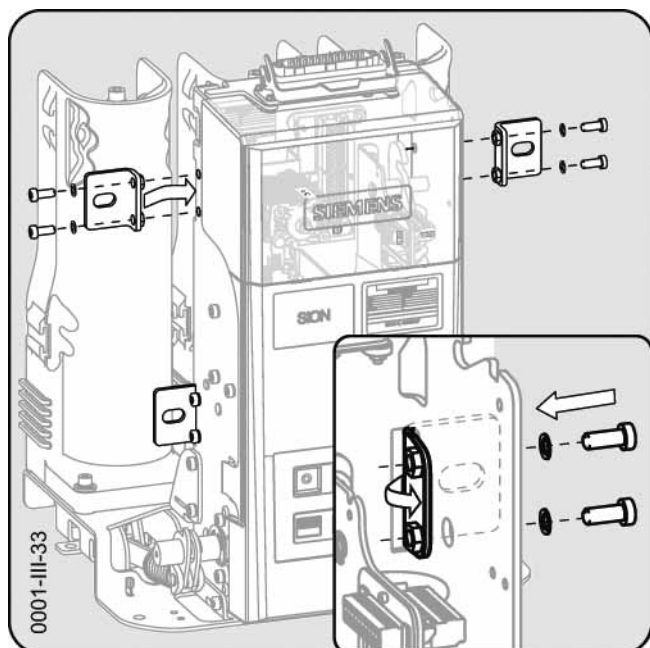


Fig. 82 3AE5 - Mounting the mounting brackets

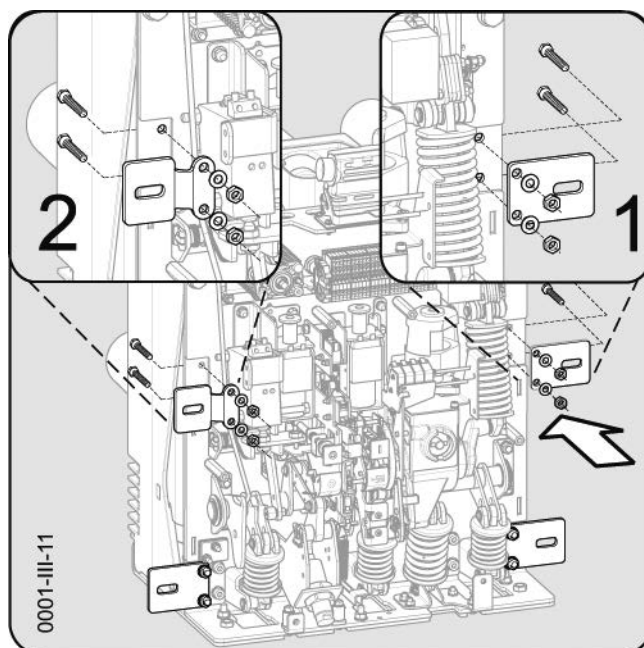


Fig. 83 3AE1 - Mounting the mounting brackets

- Remove the cover (only 3AE1) (see “Removing and mounting the covers” page 40).
- Take the fasteners out of the accessories pack and mount bent (only 3AE5), level or cranked (only 3AE1) mounting brackets, depending on installation drawing. Tightening torque 20 ± 2 Nm.
- Mount the cover (only 3AE1) in the reverse order (see “Removing and mounting the covers” page 40).
- Installing the vacuum circuit-breaker on a vertical plane.

Mounting the guard plate (optional, only 3AE5)

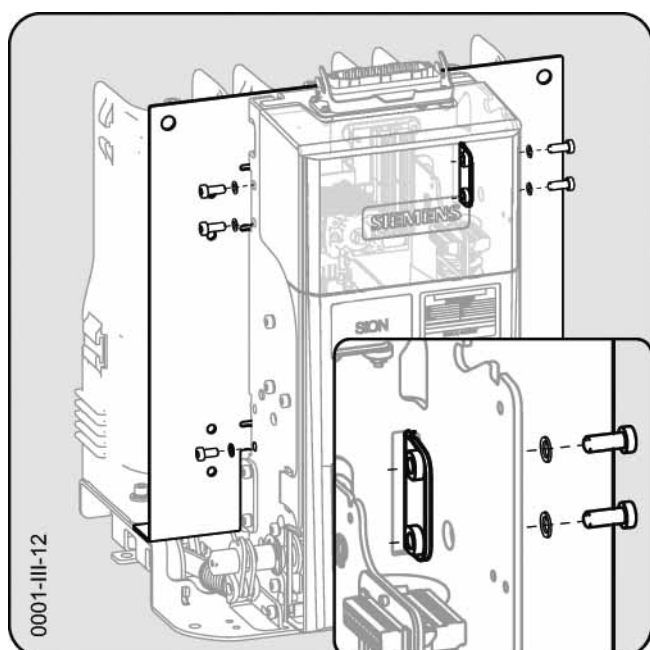


Fig. 84 3AE5 - Mounting the guard plate (optional)

To cover and to protect against burns and hot gas forming in the event of a failure, you can attach a guard plate.

Guard plates can also be fastened on vacuum circuit-breakers with cartridge inserts.

- Cover remains mounted.
- Take the fasteners out of the accessories pack and mount the guard plate as shown in the installation drawing. Tightening torque 20 ± 2 Nm.
- Insert guard plate between pole shell and mechanism box and fasten to the mechanism box.

Earthing

Connecting to earth

Connect the vacuum circuit-breaker on the earth terminal (70) to the high-voltage protective earth as specified (DIN EN 50341).

Select the cross-section of the earth wire so that a current of 30 A, with a maximum voltage drop of 3 V can be conducted to the provided earthing point (see IEC 62271-200).

Note

If the SION[®] vacuum circuit-breaker is installed into an earthed metal frame and is connected permanently and electrically conductive, no separate earthing is required.

Place serrated washers under the screw heads when fastening the vacuum circuit-breaker in this case.

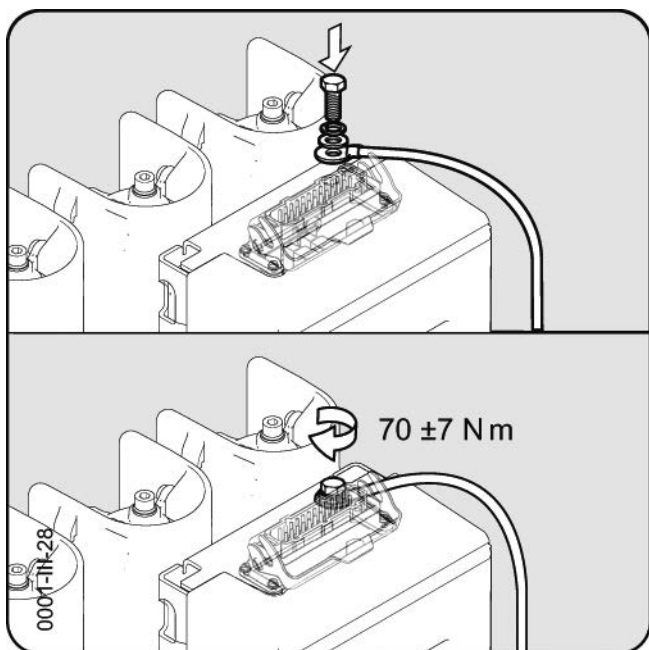


Fig. 85 3AE5 - Connecting the earth wire

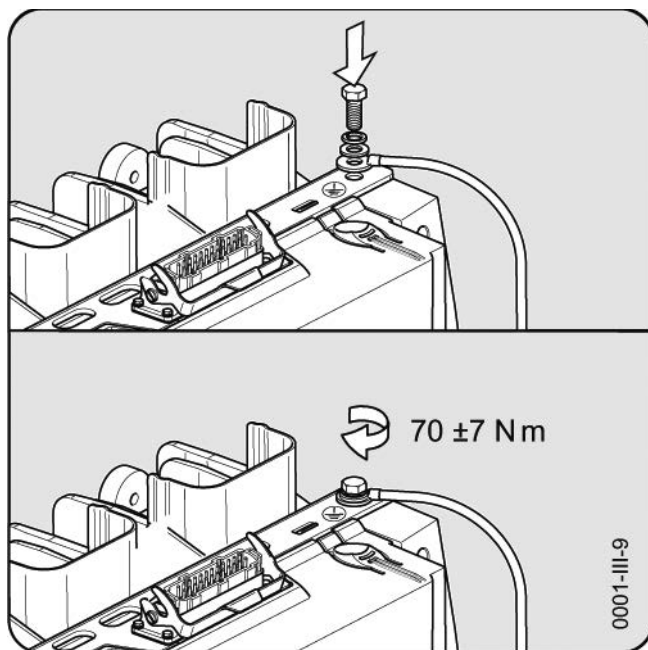


Fig. 86 3AE1 - Connecting the earth wire

- Fully unscrew hexagon screw M12 with washer on the earth terminal.
- Tighten the earth wire ring terminal with the M12 hexagon screw and washer on the earth terminal with 70 Nm.

Connecting low-voltage

Connect the low-voltage connecting cables in the customer's switchgear in such a way that safe operation as per the supplied circuit diagram is guaranteed.

Wiring the plug or terminal strip

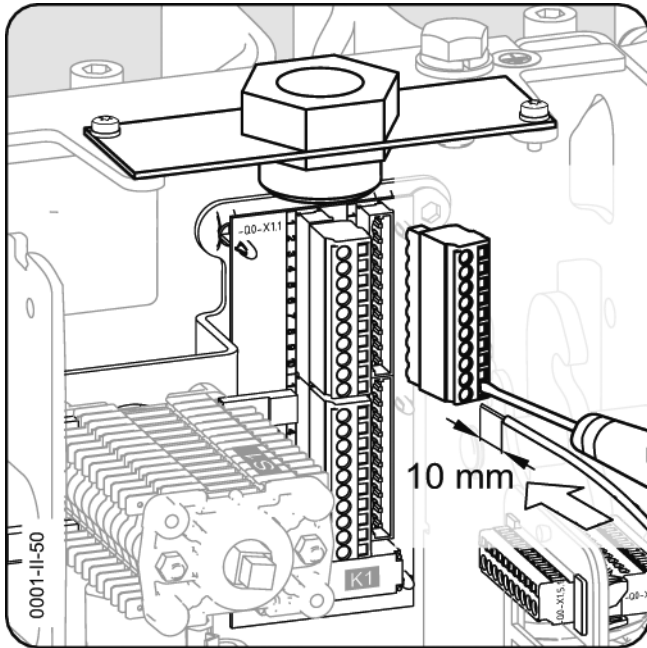


Fig. 87 3AE5 - Wiring the plug (33)

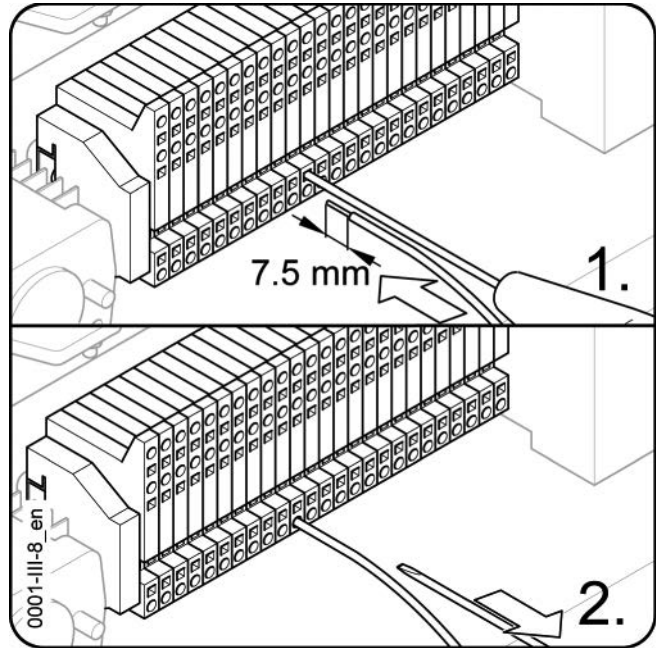


Fig. 88 3AE1 - Wiring the terminal strip (33)

- Remove the cover for the low-voltage interface (see “Removing and mounting the covers” page 40).
- Insert flat-head screwdriver (size 0.5 mm x 3 mm) into the terminal strip (3AE1) or plug (3AE5).
- Insulation-stripped connection wire (or with wire end ferrule) with a cross-section
 - Solid
 - 3AE5 from 1.5 mm² to 2.5 mm²
 - 3AE1 from 1.5 mm² to 4 mm²
 - Insert fine-wired from 1.5 mm² to 2.5 mm².
- Remove flat-head screwdriver.

Connecting low-voltage for cartridge insert

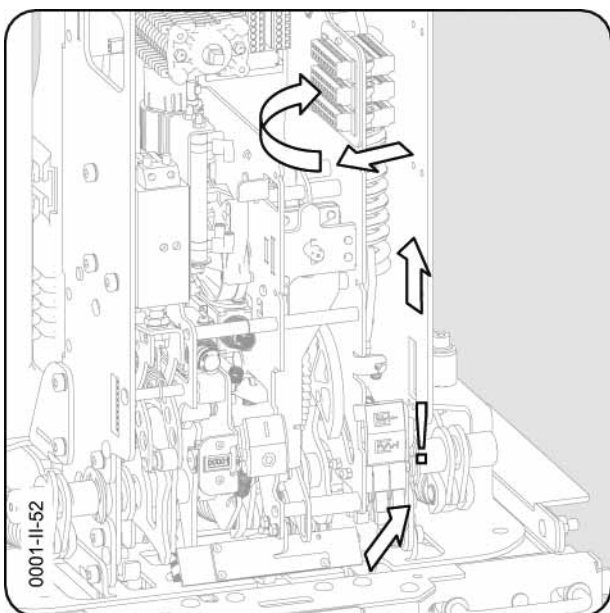


Fig. 89 3AE5 - Laying the wiring harness

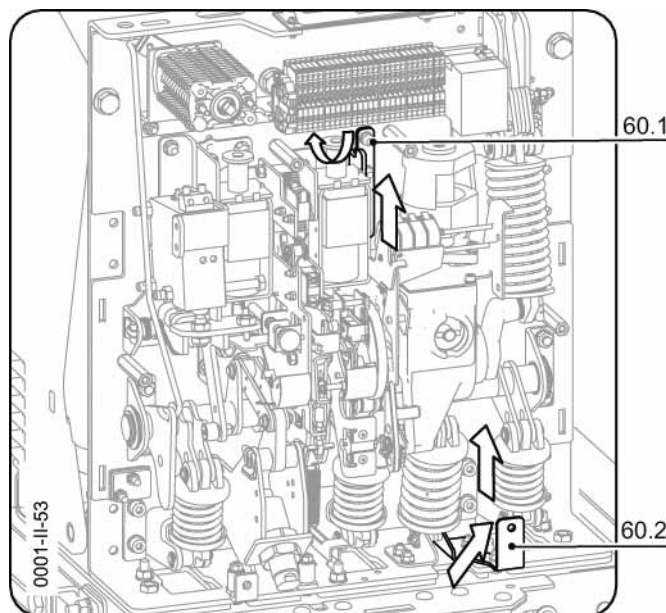


Fig. 90 3AE1 - Laying the wiring harness

Laying the 3AE5 wiring harness

- Feed the wiring harness of the cartridge insert with the plugs (-Q0) along the right-hand side panel through the vacuum circuit-breaker.
- Attach the wiring harness to the present wiring harness using cable straps and ensure there is sufficient distance from the spring state indicator.

Laying the 3AE1 wiring harness

- Feed the wiring harness of the cartridge insert with the plugs (-Q0) along the retaining brackets (60.1 and 60.2) through the vacuum circuit-breaker.
- Fasten the wiring harness using cable straps.

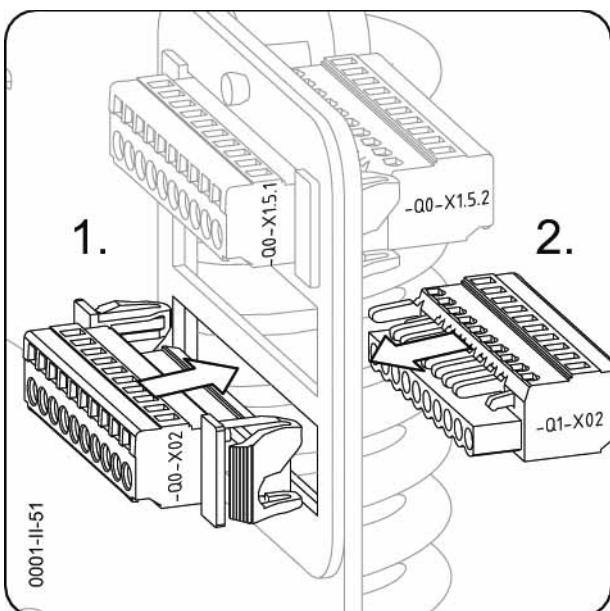


Fig. 91 3AE5 - Mounting the plug for the cartridge insert

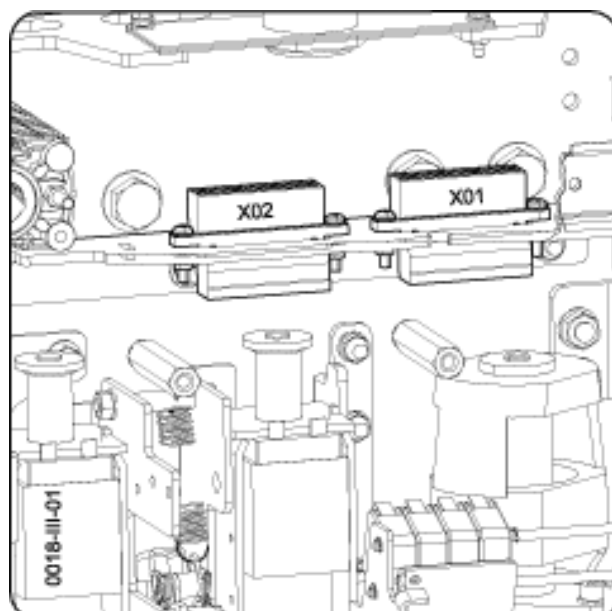


Fig. 92 3AE1 - Mounting the plug for the cartridge insert, illustration without terminal strip

3AE5 - Mounting the plug

- Insert plug bottom (-Q0) into the frame as far as it will go and let engage.
- Wire up plug (-Q0) (see "Wiring the plug or terminal strip" page 48) and fit.

3AE1 - Mounting the plug

- Mount plug and connect (see "Removal and mounting instructions for the 10-pin plugs X01 and X02", order no. 9229 0018).

Removing the transport securing device from the undervoltage release

Undervoltage release (-Y7) available?

The vacuum circuit-breaker with an undervoltage release (-Y7) 3AX1103 is supplied with a transport securing device.

- Remove the cover (see “Removing and mounting the covers” page 40).
- Shift the locking screw of the striker from position A to B (see reference note in operating mechanism of the vacuum circuit-breaker).
- Mount the cover in the reverse order (see “Removing and mounting the covers” page 40).

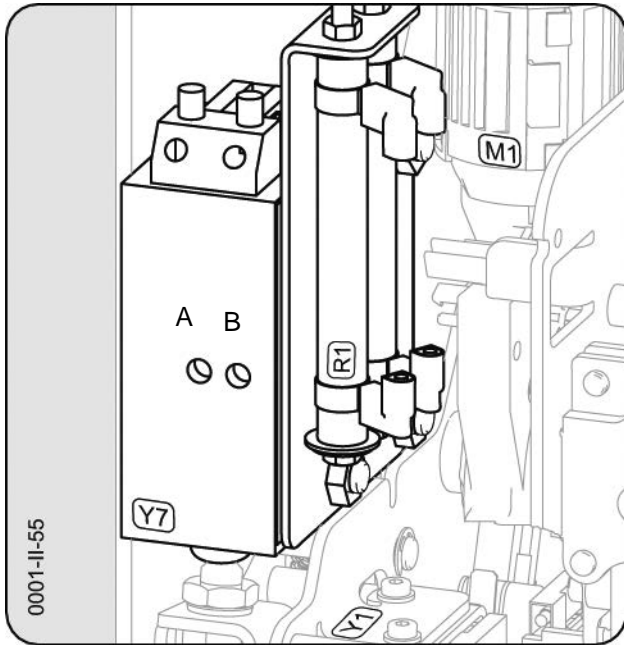


Fig. 93 3AE5 - Removing the transport securing device

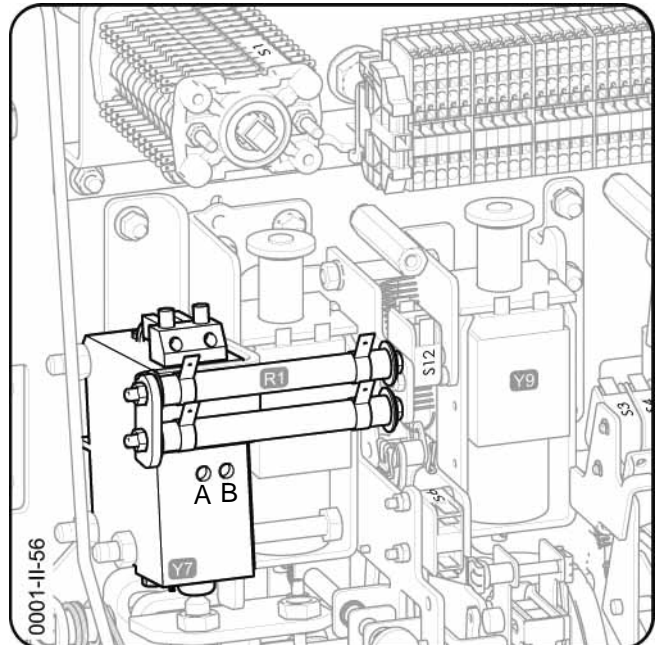


Fig. 94 3AE1 - Removing the transport securing device

Electrical connection of the main conductor

DANGER

High-voltage - danger to life

Test the vacuum circuit-breaker in the switchbay with high-voltage applied only after faultless functioning has been ascertained (see "Commissioning" on page 59).

Note

Grease the busbars with vase line prior to mounting.

Note

- For screw-in depths for screws or threaded rods and
- drive-in depth for dowel pins or spiral pins, see Table "Screw-in depths", Fig. 97.

The busbars can be purchased from the Siemens Service Center.

Preparing contact areas

Note

Clean silver spray-plated and copper spray-plated contact areas with a cloth; do not brush.

Different connection materials (Al/CU) must not be cleaned with the same cleaning tools.

Silver-plated parts must not be bolted to aluminium bars/rails.

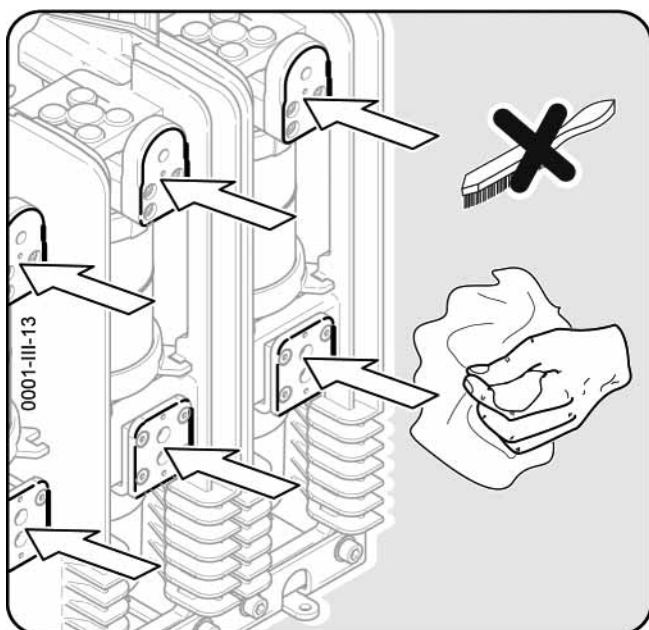


Fig. 95 Cleaning the contact areas

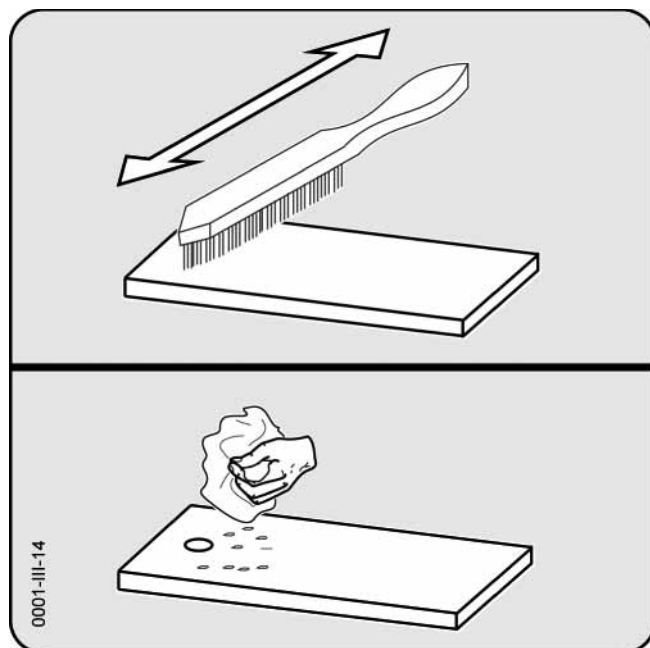


Fig. 96 Cleaning the contact areas of the busbars

Use a steel brush to carefully brush the contact areas (cross-wise) of the busbars until they are metallically bright and wipe off any residue using a clean cloth.

After cleaning, very lightly grease the bright contact areas with acid-free Vaseline (e. g. Shell-Vaseline 8420) and screw together immediately.

Screw-in depths in the upper and lower terminals

Rated voltage U_r	kV	7.2 - 12			17.5	7.2 - 17.5		24		
Rated operating current I_r	A	12.5 - 25	31.5	Up to 31.5	Up to 31.5		40		12.5 - 25	
Rated short-circuit breaking current I_{sc}	kA	800 - 1250	800 - 1250	2000 - 2500	800 - 1250	2000 - 2500	800 - 1250	2000 - 2500	800 - 1250	2000 - 2500
Terminal thread		M12		M16	M12	M16	M12	M16	M12	M16
Upper terminal (A)	mm	20 ±1								
Lower terminal (B)	mm	28 ±1				38 ±1		28 ±1		

Fig. 97 Screw-in depths

Connecting the main conductor

Note

For vacuum circuit-breakers with connecting bars, it is recommended to use the stainless steel screws or non-magnetisable stainless steel screws included in the accessory pack.

Mounting busbars

Adjust the busbars in such a way that, before fastening, they lie flat easily and fit the holes on the contact areas of the upper and lower terminal.

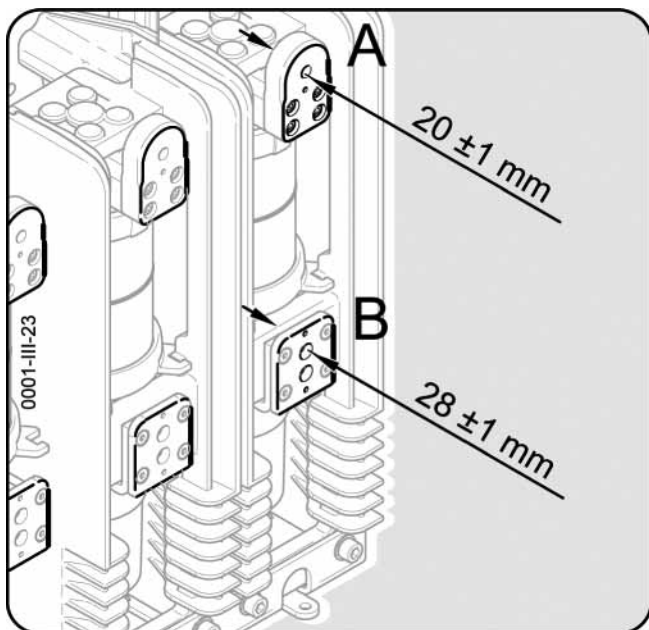


Fig. 98 Screw-in depths in the upper and lower terminals

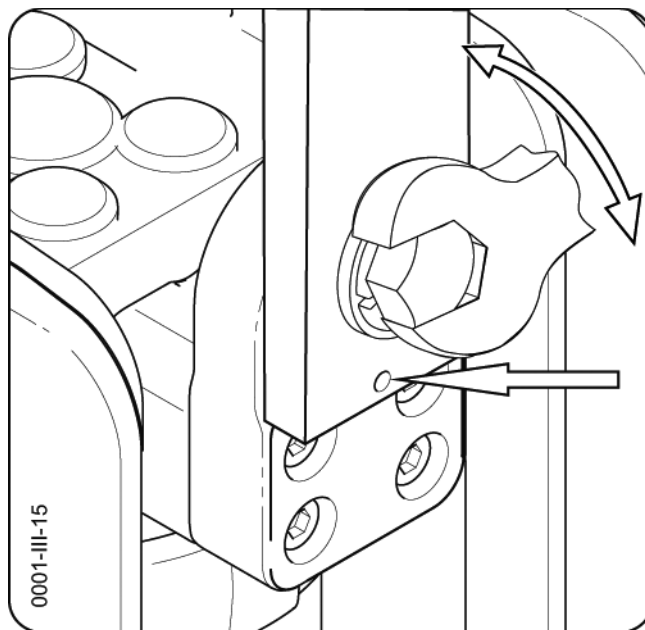


Fig. 99 Installing busbars (flat). Example for 1250 A

Corresponding to the rated current strength, use M12 or M16 screws and nuts - strength class 8.8 - for connection of the busbars and use the appropriate spring elements and washers.

When tightening the screws, hold the nuts against the tightening torque with a suitable screwdriver or socket wrench.

Tightening torque for

- M12: 40 ±4 Nm
- M16: 100 ±10 Nm

Tightening torques apply to greased threads only.

Securing with a spiral pin

The busbars can be secured against twisting with a spiral pin as per ISO 8748 or a dowel pin as per ISO 8752 - 4 x X*) mm - N -C.

Make a hole Ø 4H11 in the busbar (see Fig. 52, horizontal arrow).

See dimension drawings.

*) X = Length of the dowel pin depending on cross-section of the busbar in mm

Mounting contact arms and systems

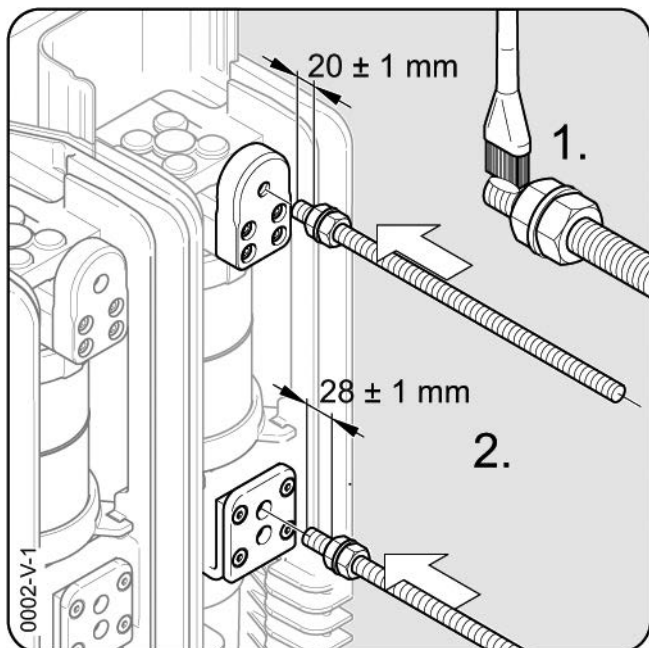


Fig. 100 Cleaning and mounting threaded rods for contact arms

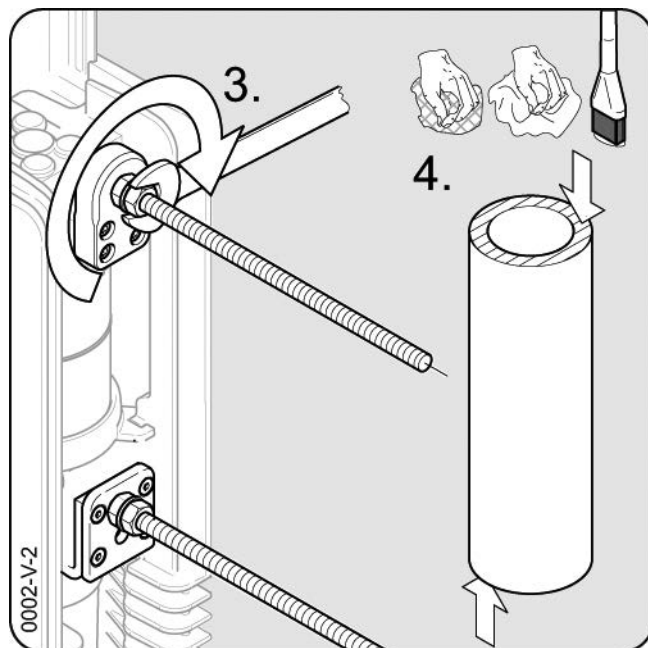


Fig. 101 Cleaning and mounting contact arms

- Grease the screw-in section of the threaded rods with vase line.
- Screw in threaded rod, observing screw-in depth for safe use (see Table "Screw-in depths in the upper and lower terminals", page 52).
- Screw threaded rods to the contact surfaces.
Tightening torque for
 - M12: 40 ±4 Nm
 - M16: 100 ±10 Nm
 Tightening torques apply to greased threads only.
- End faces of the copper contact arms must be
 - roughened
 - cleaned and
 - greased with vase line.
- End faces with silver-plated contact surfaces must be
 - cleaned and
 - greased with vase line.

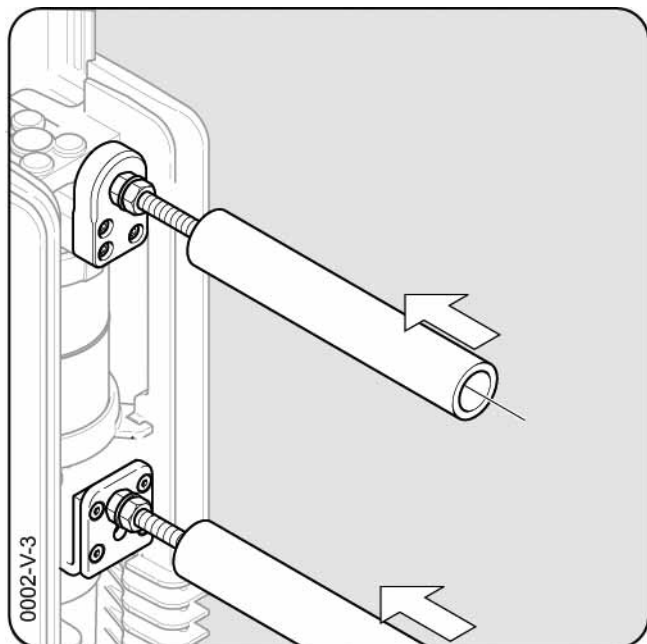


Fig. 102 Fitting the contact arms

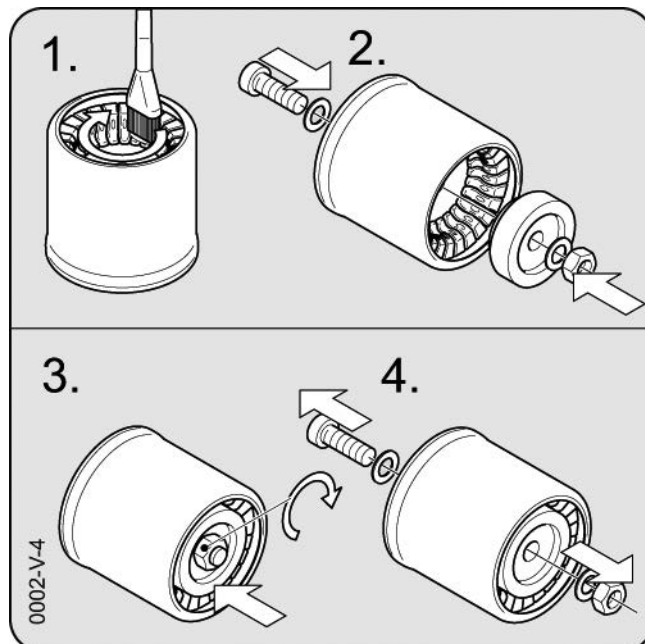


Fig. 103 For contact arms with a \varnothing of 40 mm, insert the contact arm adapter on the rear

- Fit the contact arms.
- Mount separating panels (if present, see “Mounting the panels separating from the unit” page 44)
- For contact arms (with rated operating current $I_r \leq 1250$ A) with a \varnothing of 40 mm insert contact arm adapter into contact system:
 - grease contact fingers in the contact system with Molykote Longterm 2
 - On the rear of the contact system, adjust the contact arm adaptor with screw, washer and nuts
 - Tighten contact arm adaptor in the contact system using an open-end wrench
 - Remove screw, washers and nut.

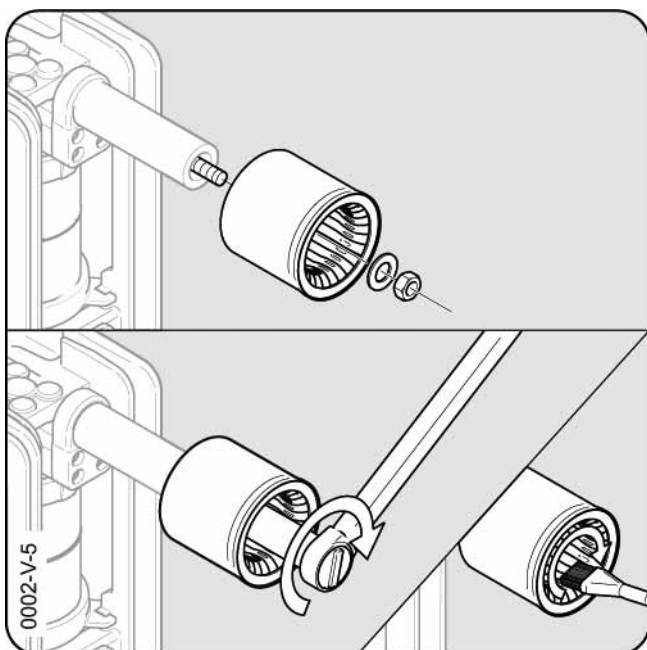


Fig. 104 Fastening contact systems with contact arm adaptors to contact arms with a \varnothing of 40 mm.

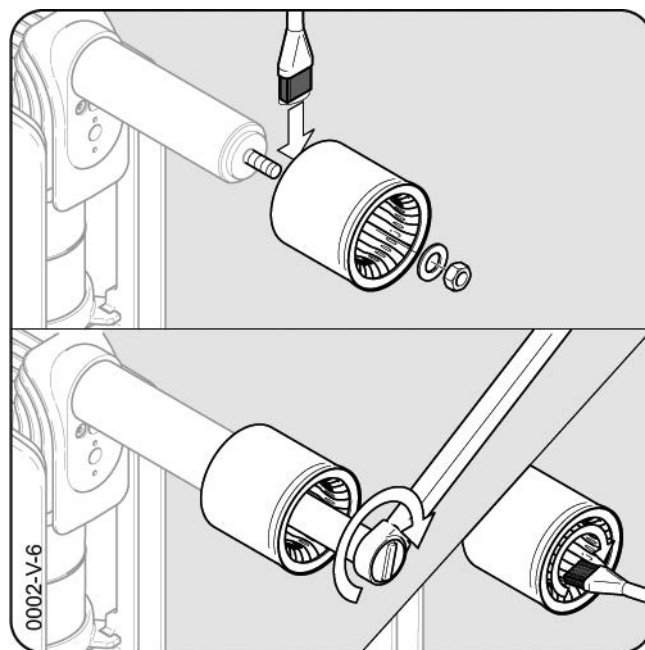


Fig. 105 Fastening contact systems to contact arms with a \varnothing of 60 mm.

- Grease contact systems for contact arms with a \varnothing of 60 mm (without contact

arm adapter) on one side of the inside (round outer edge) on the contact fingers with Molykote Longterm 2.

- Fit contact system onto threaded rod and contact arm, observing location of the contact system (round outer edge towards contact arm).
- Tighten contact system with torque wrench.

Tightening torque for

- M12: 40 ± 4 Nm
- M16: 100 ± 10 Nm

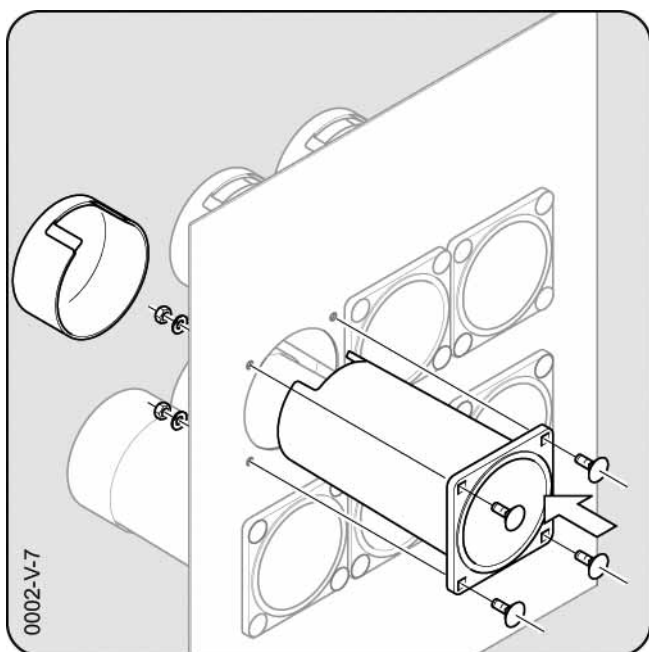
Tightening torques apply to greased threads only.

- Grease other side of the contact system with Molykote Longterm 2.

Mounting the bushing and mating contact

Note

The plate must be provided by the customer (for dimensions, see dimensional drawing supplied).



Screw bushings with mating contact, each with

- 4 DIN 603 M8x25-8.8 cup square bolts
- contact washers and
- hexagon nuts

to the plate (made of non-ferromagnetic steel) in the switchbay or the rear of the guide frame.

Tightening torque for

- M8: 25 ± 2 Nm

Tightening torques apply to greased threads only.

Fit bushing cap from the other side.

Fig. 106 Mounting a bushing with mating contact to the guide frame or the plate

Installing the SION[®] vacuum circuit-breaker with cartridge insert

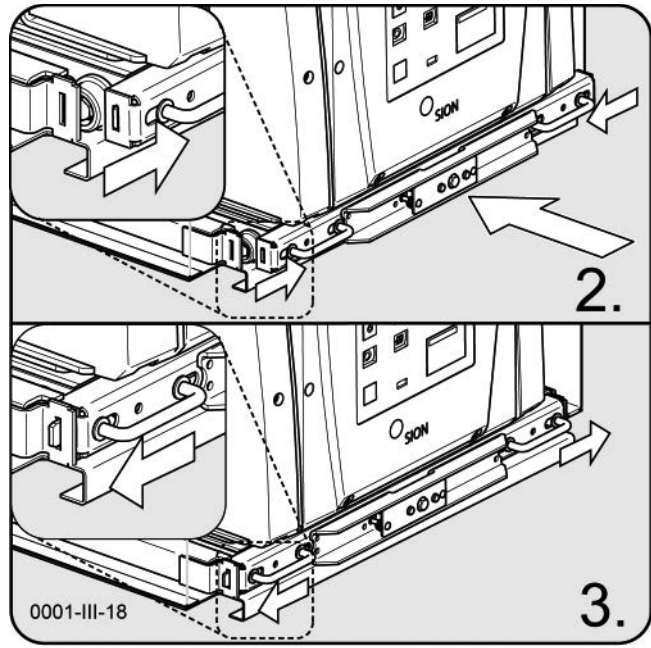
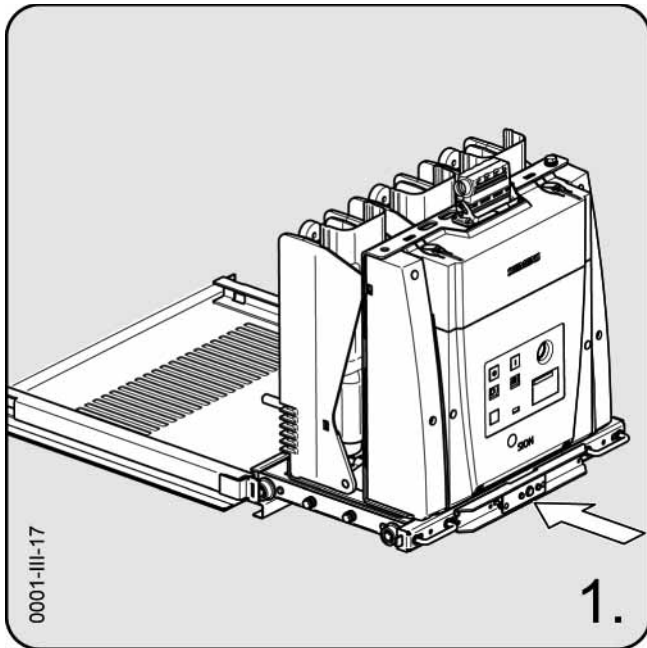


Fig. 107 Example 3AE1 - Inserting into guide rails

Fig. 108 Example 3AE1 - Inserting and locking

- Fit vacuum circuit-breakers with cartridge insert into the unit's guide rails.
- Push vacuum circuit-breaker with cartridge insert into the guide rails until they hit the side stops (large arrow), moving locking handles towards the middle of the withdrawable section (small arrows).
- After reaching the side stops, check that the locking handles have engaged properly.

Moving the vacuum circuit-breaker SION® on the withdrawable section

⚠ WARNING**Crushing hazard!**

Mechanical parts can move fast, even if they are remote-controlled.

Contact with mechanical parts or parts under spring charge may crush parts of the body.

- Do not remove covers.
- Do not reach into openings.
- Do not touch pole assemblies or circuit-breaker shafts.

👉 Note

Material damage due to incorrect switching position!

Mechanical parts may become damaged if the switching position is not observed.

Always move the vacuum circuit-breaker on the withdrawable section in the OPEN switching position.

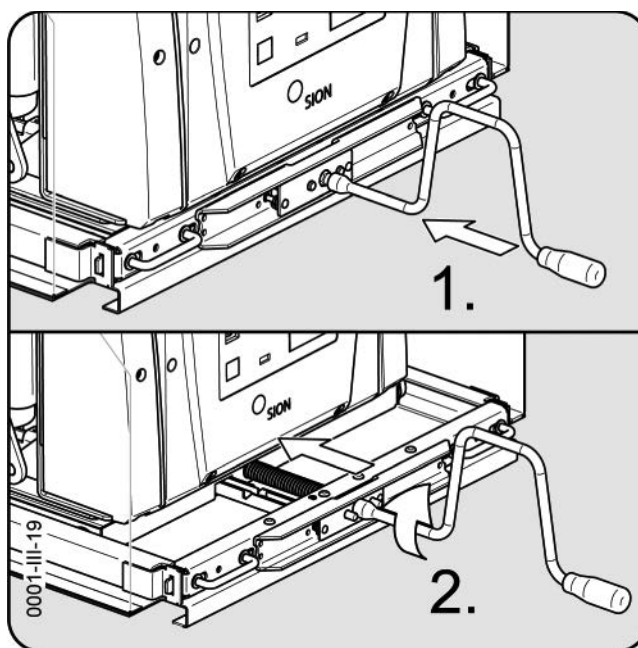


Fig. 109 Example 3AE1 - Moving in guide rails

- Insert the handle for withdrawable section 3AX1430-2C into the withdrawable section's coupling.
- Turn the inserted handle of the withdrawable section 3AX1430-2C clockwise in order to move the vacuum circuit-breaker to a perceivable stop.

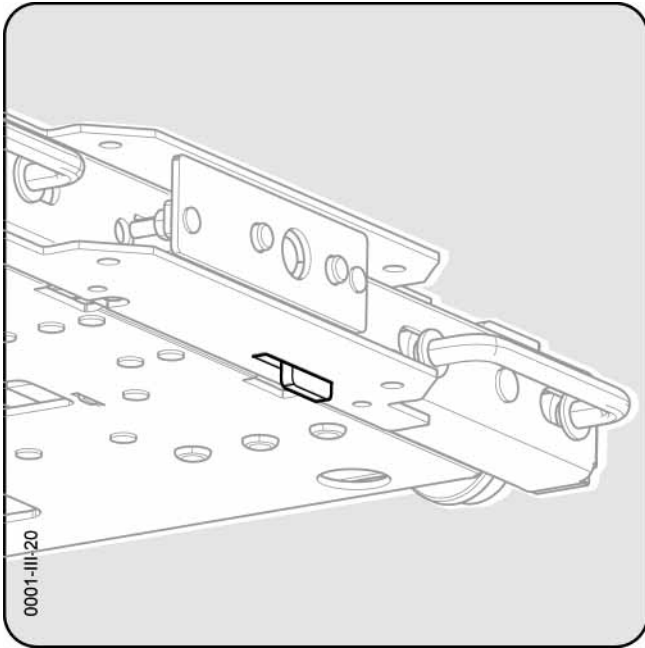
Travel path lengths (optional):

- 180, 200 and 220 mm for all vacuum circuit-breakers up to 17.5 kV and
- 260 mm for all vacuum circuit-breakers with 24 kV.

Position queries during travel

If the low-voltage interface has been connected on the customer's premises, the following positions of the vacuum circuit-breaker with withdrawable section are sensed during travel:

Disconnected position/test position	Intermediate position	Entering position/service position
Pushbuttons –S1.5; –S1.6; –S1.7; –S1.8 output a signal or a message	No signal	Pushbuttons –S1.0; –S1.1; –S1.2; –S1.3 output a signal or a message



For stabilisation purposes, a further bar is provided on the withdrawable section. This is automatically extended downwards by the handle of withdrawable section 3AX1430-2C during retraction.

For the size of the bar, refer to the dimensional drawing supplied.

Fig. 110 Bar on withdrawable section

 **DANGER**
High voltage – danger to life**Touching live parts causes an electric shock.**

- Do not touch live parts!
- Ensure that the vacuum circuit-breaker is operated only by qualified personnel who are familiar with the operating instructions and observe the warning notices.
- Check through all of the items on the checklist and ensure correct functioning before commissioning.

Commissioning

Before commissioning, check the following points to ensure that the SION® vacuum circuit-breaker is functioning faultlessly:

Checklist	✓	Notes
Does the information on the rating plate (see page 32) match the order data?		
Ensure correct operating voltage.		
If necessary, clean the vacuum circuit-breaker (details on this in section “Cleaning” on page 63).		
Check that screw connections are tightened securely.		
Check terminal strip plug-connection for tightness.		
If necessary, check and adjust the customer's devices.		
Test switching without supply voltage Charge the closing spring with the hand crank (see Fig. 112), then press the CLOSE pushbutton and, once closing has been performed, press the OPEN pushbutton.		
Test switching with supply voltage To perform test switching with the motor, switch on the supply voltage. The motor starts up immediately and charges the closing spring. Check the indicator for charge state of the closing spring (mechanically and electrically).		
Electrically check through auxiliary switch S1 and position switch in both end positions – operate the vacuum circuit-breaker to do so.		
Check functioning of the closing solenoid Y9 and all available shunt releases by operating them electrically.		
If there is an undervoltage release (Y7) 3AX1103 : has the locking screw of the striker been shifted from position A to B (see “Removing the transport securing device from the undervoltage release” on page 50)?		

⚠ WARNING

Do not commission the vacuum circuit-breaker if there are malfunctions.
 If the malfunctions or the damage cannot be remedied, contact a sales representative or Siemens Service and, if necessary, send back the vacuum circuit-breaker.

👉 Note

Material damage due to incorrect operation (only 3AE5)!
 Simultaneous actuation of the "CLOSE" and "OPEN" pushbuttons is not permitted.
 This causes irreversible damage to the vacuum circuit-breaker.

Position indicator and spring state indicator when charging the closing spring, closing and opening

	Input	Position indicator	Spring state indicator	
Charging	with hand crank, with motor operating mechanism		⇒	⇒
Closing	"CLOSE" pushbutton, remote tripping	⇒	⇒	⇒ *
Opening	"OPEN" pushbutton, remote tripping	⇒	⇒	⇒

* Spring only charged if motor voltage is applied

Fig. 111 Operating element indicators

First closing operation

👉 Note

If an undervoltage release 3AX1103... is fitted, it must be connected to the control voltage for switching operations (mechanical or electrical), as otherwise closing is not possible.

If all functions have been checked and are ok, switch on high-voltage while observing all of the safety regulations and operative requirements.

Charging the closing spring

WARNING

Risk of injury if hand cranks other than the original hand crank are used.

When the supply voltage is present, the motor immediately recharges the spring after a closing operation. If the hand crank does not have a slip coupling, the hand crank will also rotate.

To avoid injuries caused by the motor starting suddenly, the vacuum circuit-breaker must be charged only using the original hand crank.

If the supply voltage is applied, the closing spring is automatically charged by the motor.

Hand crank If the supply voltage fails, the closing spring can be charged with a hand crank.

- To do this, fit the hand crank onto the hand crank coupling through the opening with the adapter pushed forward.
- Turn clockwise until the spring state indicator changes over:

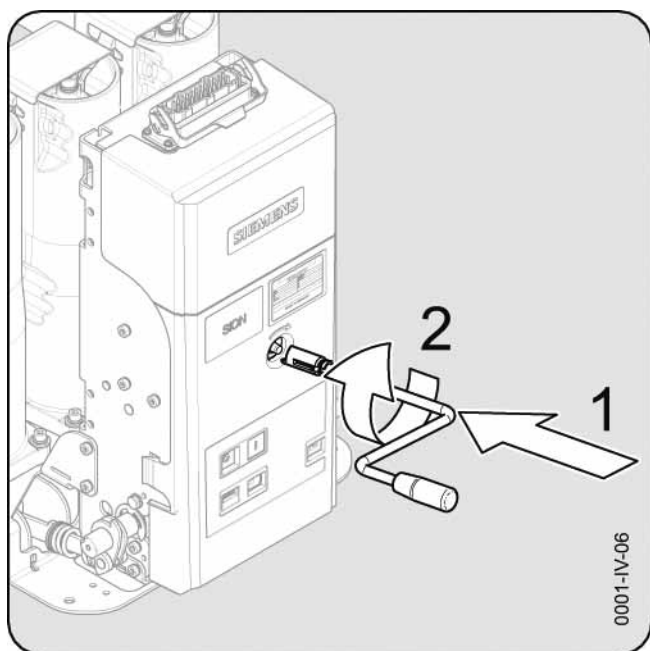
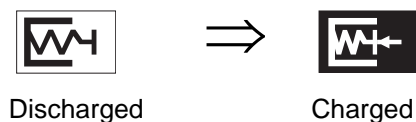


Fig. 112 3AE5 - Charging the closing spring with the hand crank

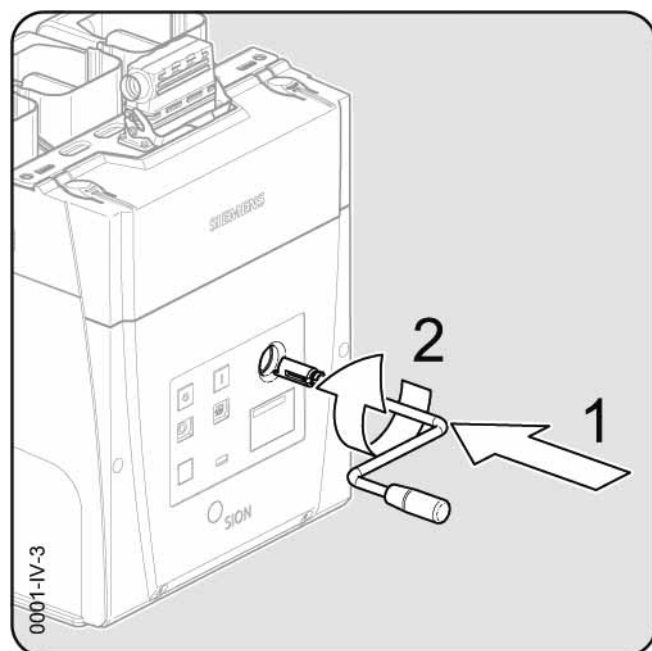


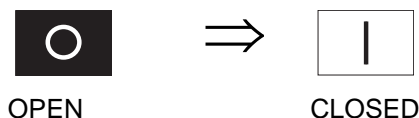
Fig. 113 3AE1 - Charging the closing spring with the hand crank

The adapter of the hand crank is designed in such a way that the hand crank becomes uncoupled when the motor supply voltage returns.

Closing

Provided there is no lock-out due to a mechanical locking device, send the closing command via the CLOSE pushbutton or the corresponding command element until the vacuum circuit-breaker is closed, and shows and signals the CLOSE switching position.

Change of the position indicator:



After closing and releasing the CLOSE pushbutton, if necessary, the closing spring is immediately automatically charged by the motor and the symbol for "Closing spring charged" becomes visible in the spring state indicator.

Change of the spring state indicator:

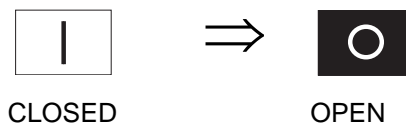


Opening

The opening spring is charged during the closing operation.

To open, send the opening command via the OPEN pushbutton or the corresponding command element until the vacuum circuit-breaker is open, and shows and signals the OPEN switching position.

Change of the switching position indicator after electrical opening:



The spring state indicator does not change.

Discharging the closing spring

To discharge the closing spring:

- Deactivate the supply voltage
- on the vacuum circuit-breaker, actuate the OPEN, CLOSE and OPEN pushbuttons manually one after the other.

This ensures that the vacuum circuit-breaker is open and the closing spring is discharged.

Maintenance and servicing

DANGER

High voltage – danger to life

Touching live parts is fatal or causes serious physical injury.

Before beginning maintenance work, note the five safety rules for high-voltage equipment specified in EN 50110-1, namely:

- Isolate from the power supply
- Secure against reclosing
- Verify safe isolation from the power supply
- Earth and short-circuit
- Cover or cordon off neighbouring live parts

Maintenance

The SION[®] vacuum circuit-breaker is maintenance-free under normal operating conditions (up to rated current). We do, however, recommend you carry out regular visual inspections. The maximum permissible mechanical operating cycle number is 10 000 (optionally 30 000 operating cycles can be ordered).

WARNING

Crushing hazard!

Mechanical parts can move fast, even if they are remote-controlled.

Contact with mechanical parts or parts under spring charge may crush parts of the body.

- Do not remove covers.
- Do not reach into openings.
- Do not touch pole assemblies or circuit-breaker shafts.

WARNING

Danger of burns!

Touching the hot heater will cause burns.

Do not touch the heater before it has cooled off.

Preliminary work

- Prior to starting work on the vacuum circuit-breaker, observe the local safety regulations for high-voltage devices and the "5 safety rules" as per EN 50110-1.
- Switch off the supply voltage and secure against reclosing,
- on the vacuum circuit-breaker, actuate the OPEN, CLOSE and OPEN pushbuttons manually one after the other. This ensures that the vacuum circuit-breaker is open and the closing spring is discharged.

Special operating conditions

If the vacuum circuit-breaker is operated under unfavourable conditions indoors (heavy and frequent condensation, dusty air, etc.), we recommend cleaning the insulating parts and possibly the outer parts of the circuit-breaker at shorter intervals.

Cleaning

The insulating parts must be clean if their insulating capacity is to be guaranteed. Rub insulating parts with a moist cloth.

As a cleaning agent, use only warm water with a mild, liquid household detergent added and leave to dry.

Joints and bearings that cannot be disassembled must not be washed out with a detergent prior to work.

Interrupter service life

If switching operations occur frequently under overload or short circuit, the service life of the vacuum interrupters may be reached prematurely.

Accessories and spare parts

Replacing spare parts

To ensure that the device operates reliably, spare parts must be replaced only by trained and certified personnel.

⚠ CAUTION
Risk of injury!
The vacuum circuit-breaker should be taken out of the switch cabinet or switchgear for servicing.
Separate vacuum circuit-breakers from the control feed voltage or switch it off and disconnect the low-voltage plug or clip connection.

Accessory/spare part	Order no.	Comments
Operating instructions	9229 0001 100	
Hand crank	3AX1530-2B	
Handle for withdrawable section	3AX1430-2C	
Molykote Longterm 2	3AX14 33-2L	
Vaseline (contact grease SN10611) e. g. Atlantic white, Atlantic Mineralölwerk GmbH		Pasty consistency, flame point 210 °C, low acid

Fig. 114 Accessories available for order

Always specify the vacuum circuit-breaker's type and serial no. (see "Rating plate" on page 32) when ordering spare parts.

Manufacturer's product liability

The manufacturer's product liability shall be excluded if at least one of the following criteria applies:

- Original Siemens spare parts are not used.
- Fitters carrying out replacements have not been trained and certified by Siemens.
- Parts have been incorrectly fitted or adjusted.
- Adjustments are not made in accordance with Siemens specifications.
- After installation and adjustment, no final test is performed with a tester approved by Siemens including documentation of the test results.

To keep documentation complete, it is important that measurement results are submitted to the responsible sales representative.

Disposal

The materials of the vacuum circuit-breaker should be recycled. Disposal of the vacuum circuit-breaker with minimum environmental impact is possible on the basis of existing legal regulations.

Metal The circuit breaker's metal components can be recycled as mixed scrap, although it is more environmentally sustainable to dismantle the unit as thoroughly as possible into sorted scrap and residual mixed scrap.

Electronics Electronic scrap must be disposed of in accordance with applicable regulations.

Materials The vacuum circuit-breaker consists of the following materials:

- Steel (partly phosphatised, galvanised and yellow chromated)
- Copper (partly silver-plated)
- Plastics (epoxy resin, polyamide, polyester, polycarbonate, ABS-PC mixture; partly glass fibre reinforced)
- Rubber materials
- Ceramics
- Lubricant

Packaging If the packaging is no longer needed, it can be fully recycled.

Hazardous substances When delivered by Siemens, the product does not contain any hazardous substances within the scope of the Hazardous Substances Ordinance applicable to the territory of the Federal Republic of Germany. For operation outside the Federal Republic of Germany, the applicable local laws and regulations must be complied with.

Further information Contact your Siemens Service Center if you require further information.

Service

For details of contacts for service work, consult Siemens IC LMV SE Service at

- Telephone: +49 180/5247000
- Fax: +49 180/5242471 or
- on the Internet at the Web address: www.siemens.com/energy-support
- by e-mail: support.ic@siemens.com
- or any local sales representative.

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Index of keywords

A	
Accessories available for order	64
Altitude correction factor	33
Ambient conditions	33
Anti-pumping device	
electrical	18
mechanical	18
Auxiliary switch (-S1)	16– 17, 22
B	
Basic equipment	18
Busbar	52
Bushing	55
C	
Cartridge insert	13– 14, 45, 56
Circuit-breaker tripping signal (-S6)	16– 17, 23
Climate classes	33
CLOSE pushbutton	15
Closing lock-out (-F1), electrical	17– 18
Closing solenoid	20
Closing solenoid (-Y9)	16– 17
Closing spring	16– 17, 61– 62
Connecting bar	52
Connector strip (-X1)	16, 18, 24
Contact arm	53– 54
Contact arm adaptor	54
Contact surface, pole	52
Contact system	14, 54– 55
Contact relay (-K1)	16– 17, 20
Cover	13, 15
D	
Disconnected position	29
Distance between pole centres	32
Dowel pin	53
E	
Earth terminal	47
Electrical closing lock-out (-F1)	31
F	
Factory number	32
G	
Gear unit	16– 17
Guard plate	18, 46
H	
Hand crank	15, 61
Hand crank coupling	15– 17
Handle of withdrawable section	57– 58
Heater (-R01)	16– 18, 28
High-voltage protective earth	47
I	
Installation altitudes	33
Insulating capacity	33
Insulating operating rod	14
Interrupter	12, 14
J	
Contact stroke	14
Contact system	14
Service life	64
K	
Key-operated locking device	17– 18, 31
L	
Locking device, mechanical	18, 30
Locking devices	29
Low-voltage	
interface (-X0)	13, 18, 24
plug connector (-X0)	13, 16– 17
M	
Manual closing, mechanical	18
Manual opening, mechanical	18
Mating contact	55
Motor (-M1)	16– 17, 19
Mounting position	40
N	
O	
OPEN pushbutton	15
Opening spring	62
Operating cycle counter	15– 18
Operating position	29
P	
PG fitting	18, 43
Plug (-X01) and (-X02)	16– 17
Pole assembly	14
Pole contact plate	14
Pole head	14
Pole head cooler	14
Pole shell	13– 14, 44
Position indicator CLOSED-OPEN	15, 17
Position indicator CLOSE-OPEN	16
Position switch	23
(-S12)	16– 18
(-S21)	16– 17, 23
(-S22)	17, 23
(-S3)	16– 17, 23
(-S4)	16– 17, 23
(-S5)	17– 18
(-S6)	16– 17, 23
R	
Range of application	11
Rated frequency	32
Rated lightning impulse withstand voltage	32
Rated operating current	32, 52
Rated operating sequence	32
Rated power frequency withstand voltage	32
Rated short-circuit breaking current	32, 52
Rated short-circuit duration	32
Rated voltage	32, 52
Rating plate	13, 32
Resistor (-R1)	16– 17, 27

Index of keywords

S

Separating panel	13– 14, 44
Shunt release	
(-Y1), 1st shunt release	16– 17, 21
(-Y2), 2nd shunt release	16– 18, 25
Side panel	13
Spiral pin	53
Spring state indicator	15– 17
Standards	12
Switching times	34

T

Terminal strip (-X1)	17
Terminal thread	52
Threaded rod	53
Transformer-operated release	
(-Y4)	18, 26
(-Y5)	18, 26
(-Y6)	18, 26
Travel	58
Type designation	32

U

Undervoltage release (-Y7)	18, 27, 50
----------------------------------	------------

Legend for all pages

10	Withdrawable section	56.3	Position indicator
20	Operating mechanism	57	Gear unit
20.1	Cover	57.1	Opening for hand crank
20.2	Cover for low-voltage interface	57.2	Hand crank coupling
20.3	Side panel	58	Operating cycle counter
21	Rating plate	59.2	Mechanical locking device or sensing (optional)
22	Contact arm	59.3	Key-operated locking device (optional)
22.1	Threaded bolt	59.4	Heater (-R01), for condensation water protection (optional)
22.2	Contact arm adaptor	59.5	Electrical closing lock-out (-F1), (optional)
23	Break contact	59.6	Resistor (-R1), for undervoltage release (-Y7), (optional)
23.1	Contact system		
31	Auxiliary switch (-S1)		
32	Low-voltage plug-connector (-X0), (optional)		
33	Terminal strip (-X1), (optional)		
33.1	Connector strip (-X1)		
33.2	Plug (-X01) and (-X02), (optional)		
34	Contact relay (-K1)		
41	Panel separating from operating mechanism side (optional)		
42	Pole head with pole contact plate		
42.2	Pole head with cooling ribs		
42.1	Pole head cooler		
43	Interrupter		
44	Pole contact plate		
45	Insulating operating rod		
46	Pole shell		
47	Panel separating from unit (optional)		
48	Partition		
51.1	1st shunt release (-Y1)		
51.2	2nd release (-Y2)		
52	Closing solenoid (-Y9)		
53	Motor (-M1)		
54.1	Position switch (-S12)		
54.2	Position switch (-S21)		
54.3	Position switch (-S3)		
54.4	Position switch (-S4)		
54.5	Position switch (-S5)		
54.6	Circuit-breaker tripping signal (-S6)		
54.7	Position switch (-S22)		
55	Closing spring		
55.1	Spring state indicator		
56.1	CLOSE pushbutton		
56.2	OPEN pushbutton		

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