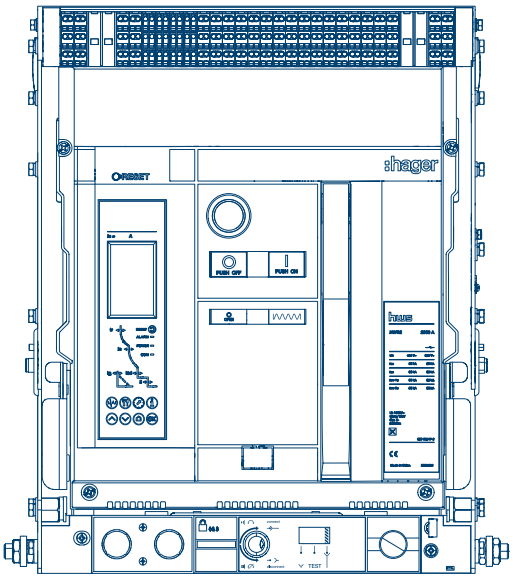
Installation and operating manual

hws

HWS2 / HWS4



Air circuit breakers 630 A to 4000 A

CE

:hager

EN

1 About this document

1.1 Safety instructions

Warnings and instructions

This documentation contains safety advice which must be respected for your own safety and to prevent property damage.
Safety instructions relating to your own safety are identified by a safety warning symbol in the documentation.
Safety instructions referring to material damage are indicated by the mention “**Notice**”.
The safety alert symbols and the statements below are classified according to the degree of risk.

Danger

DANGER indicates a situation of imminent danger which, unless averted, will result in death or serious injuries.

Warning

Warning indicates a potentially dangerous situation which, unless averted, may result in serious injuries or even death.

Caution

Caution indicates a potentially dangerous situation which, unless averted, may result in minor or moderate injuries.

Notice

Notice indicates a warning message about possible mechanical or electrical damage.

Information

Information also indicates important instructions for use and particularly relevant information regarding the product, which must be respected to ensure effective and safe use.

Qualified personnel

The product or the system described in this documentation must be installed, operated and maintained by qualified personnel only. Hager Electro accepts no responsibility regarding the consequences of this equipment being used by unqualified personnel. Qualified personnel are those people who have the necessary skills and knowledge for building, operating and installing electrical equipment, and who have received training enabling them to identify and avoid the risks incurred.

Appropriate use of Hager products

Hager products are designed to be used only for the applications described in the catalogues and in the technical documentation relating to them. If products and components from other manufacturers are used, they must be recommended or approved by Hager.

Appropriate use of Hager products during transport, storage, installation, assembly, commissioning, operation and maintenance is required to guarantee problem-free operation in complete safety.

The permissible ambient conditions must be respected. The information contained in the technical documentation must be respected.

Publication liability

The contents of this documentation have been reviewed in order to ensure that the information is correct at the time of publication.

Hager cannot, however, guarantee the accuracy of all the information contained in this documentation. Hager assumes no responsibility for printing errors and any damage they may cause.

Hager reserves the right to make the necessary corrections and modifications to subsequent versions.

1.2 Use of this document

Purpose of the document

This manual is designed to provide users, electrical installers, panel builders and maintenance personnel with the technical information necessary for the installation and commissioning of HWS2 and HWS4 circuit breakers with electronic trip units.

Field of application

This document is applicable to the HWS2 and HWS4 air circuit breakers of the hw+ range.

Revisions

Version	Date
6LE089905A	2025-07

Documents to consult

Document	Reference
hws Technical catalogue	6LE089908A

For the installation of accessories and auxiliaries or for quick installation of the circuit breaker, refer to the following manuals:

Accessory	Reference
Quick installation manual for HWS2 / HWS4 circuit breaker	6LE089868A
Terminal block protection cover TBC	6LE089877A
AX Auxiliary Contact	6LE089870A
SH shunt trip coil	6LE089872A
UV undervoltage release coil	6LE089872A
UVTC Undervoltage Time Delay Controller	6LE007626A
CC closing coil	6LE089872A
MO Spring charging motor	6LE089871A
RTC Ready-to-Close contact	6LE089878A
External neutral current sensor ENCT HWS2 630-1600A	6LE089874A
External neutral current sensor ENCT HWS2 2000A	6LE089875A
External neutral current sensor ENCT HWS4 4000A	6LE089876A
CYC Operation Cycle Counter	6LE007868A

Accessory	Reference
PS Position contact	6LE089970A
PBC Push-button cover	6LE007871A
RI Open-door racking interlock accessory	6LE007874A
Accessory for locking the circuit breaker in OFF by OLK keylock	6LE089873A
CL position-locking accessory to lock the circuit breaker in its chassis	6LE007877A
WIP wrong-insertion preventer for drawout circuit breaker	6LE007878A
HWS2 DF Door flange	6LE007882A
HWS4 DF Door flange	6LE009126A
IB interphase barriers	6LE007870A
TB connection terminal block	6LE089879A
Rear vertical / horizontal RC connections HWS2 circuit breaker	6LE007869A
Rear vertical / horizontal RC connections HWS2 switch	6LE009133A
Rear vertical / horizontal RC connections HWS4	6LE009122A

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www.hager.com

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2 Description of circuit breakers

Two types of circuit breakers are available in the HWS range, fixed circuit breakers and drawout circuit breakers.

A drawout circuit breaker has 2 parts:

– A fixed part, the chassis.
– A mobile part, the circuit breaker itself which is inserted into the chassis.

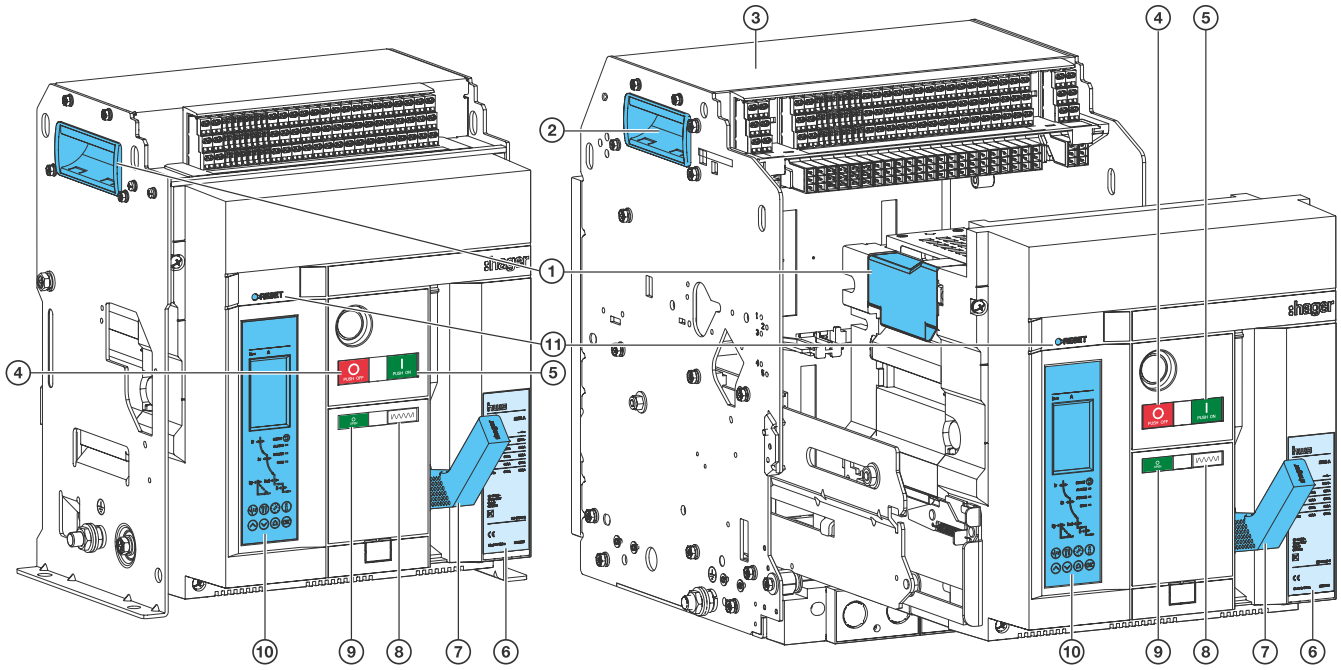
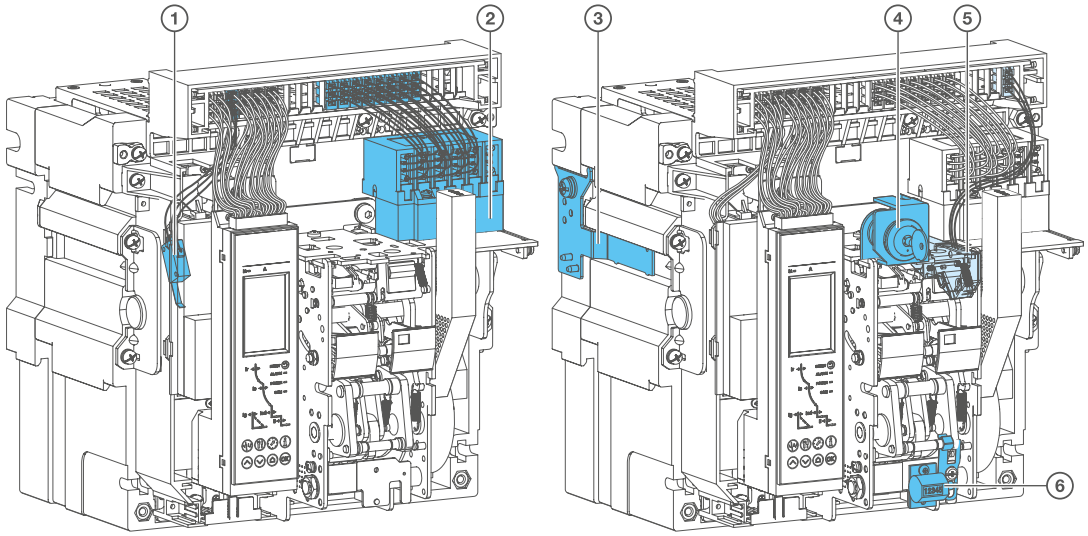


Fig. 1: Description of fixed and drawout circuit breakers

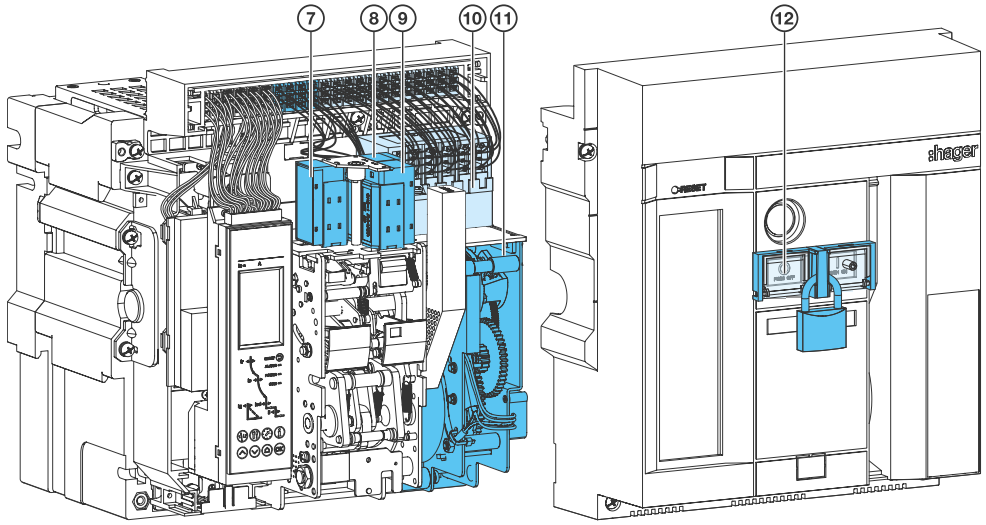
1. Circuit breaker lifting handle
2. Chassis lifting handle
3. Chassis
4. Opening push button (OFF)
5. Closing push button (ON)
6. Circuit breaker rating label
7. Charging handle
8. Closing spring status indicator
9. Contact opening and closing indicator
10. Trip unit
11. RESET re-arm button

3 Description of the circuit breaker accessories

The FS Fault trip contact as well as a block of 4 AX auxiliary contacts are integrated in the circuit breaker as standard. All other accessories can be added as additional items.

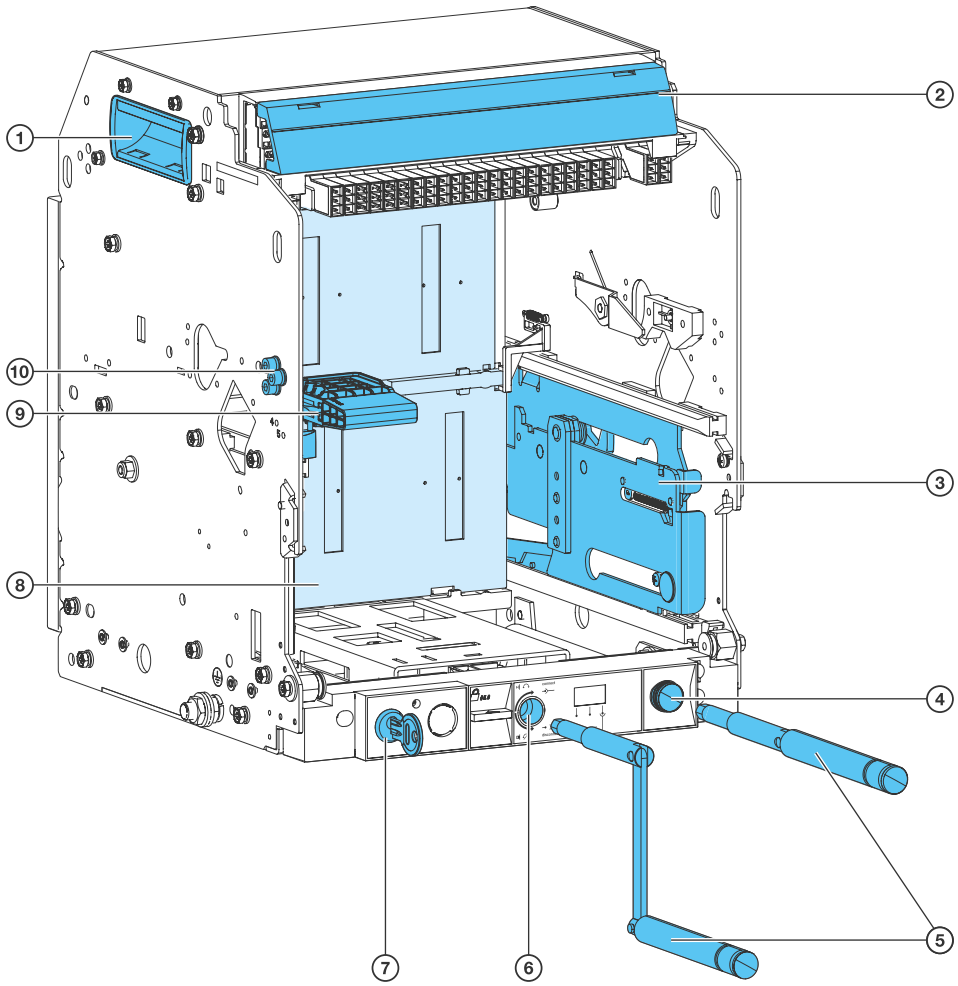


1. FS fault trip contact (standard)
2. Block of 4 AX Auxiliary contacts (standard)
3. WIP wrong insertion preventer chassis / circuit breaker (Drawout circuit breaker only)
4. Locking the circuit breaker in open position using OLK key locks
5. RTC Ready-to-Close contact
6. CYC Operation Cycle Counter

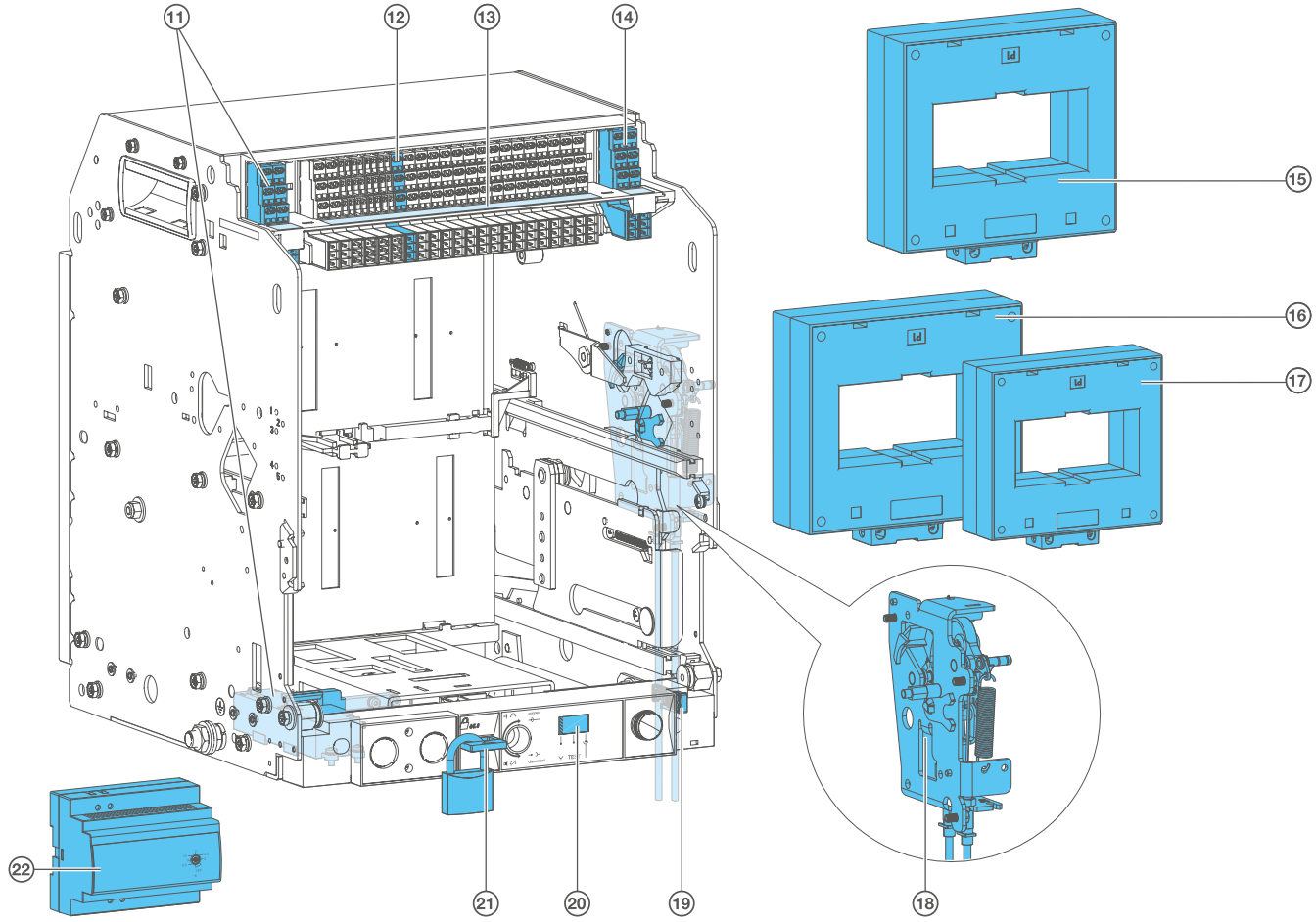


7. SH shunt trip coil
8. UV undervoltage release coil
9. CC closing coil
10. Block of 6 auxiliary contacts AX
11. MO charging motor
12. Opening and closing PBC push-button locking cover

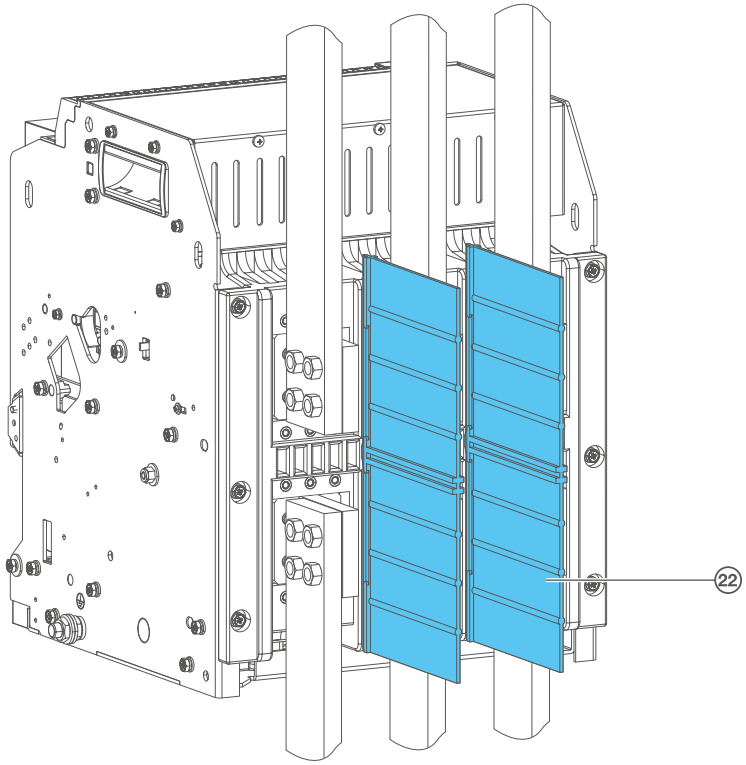
4 Description of the chassis and its accessories



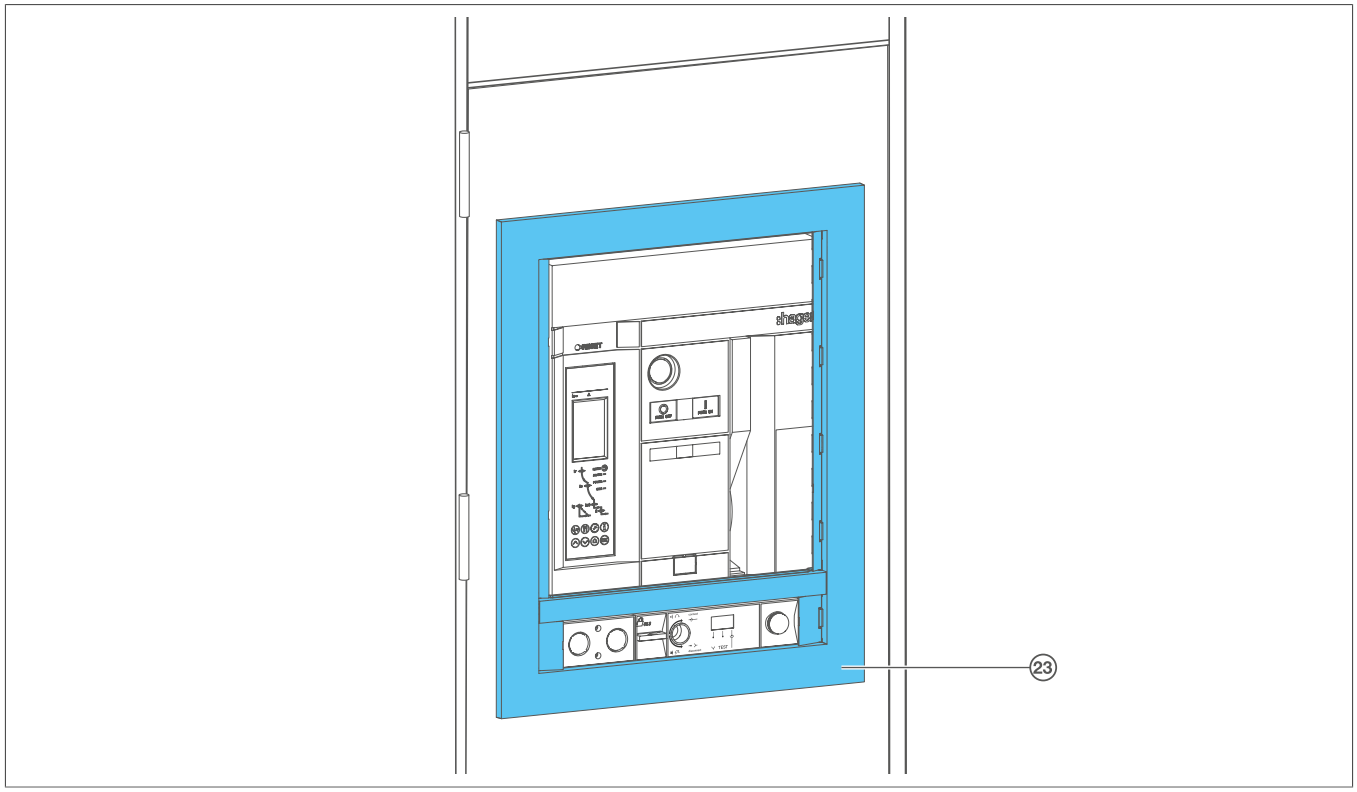
1. Lifting handle
2. Terminal block protection cover TBC
3. Guide rail
4. Handle storage space
5. Handle
6. Place to insert/withdraw the racking handle
7. Locking of the position of the moving part using CL key locks
8. Insulated safety shutters
9. Locking of the insulating safety shutters
10. WIP wrong insertion preventer chassis / circuit breaker



(11) PS position contacts
(12) TB Terminal blocks
(13) Terminal block label
(14) Terminal blocks reserved for future use
(15) External neutral current sensor ENCT HWS4
(16) External neutral current sensor ENCT HWS2 2000A
(17) External neutral current sensor ENCT HWS2 630-1600A
(18) MI mechanical interlock
(19) RI open door racking interlock
(20) Mechanical position indicator of the moving part
(21) Locking of the position of the moving part with padlocks
(22) UVTC Undervoltage Time Delay Controller



22 IB interphase barrier

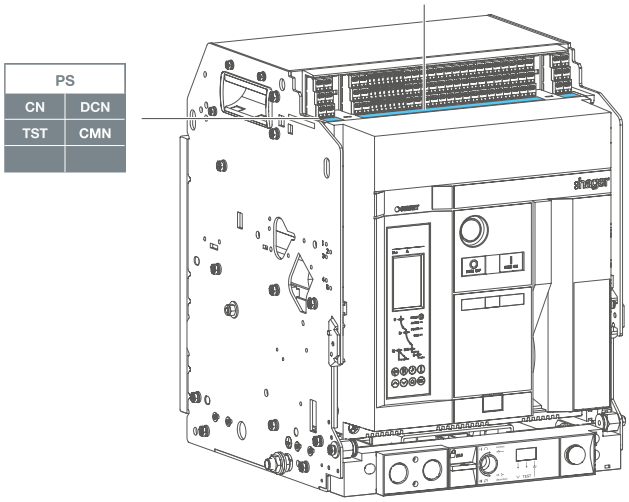


23 DF door flange

5 Description of the terminal blocks

The chassis of the drawout circuit breakers as well as the fixed circuit breakers HWS2 and HWS4 are equipped with terminal blocks designed to connect accessories.
The terminal blocks are identified by a set of labels located on the top of the circuit breaker.

TU 240V AC	V~	FS	Close/ Open		ZSI IN	ZSI OUT	COM DO		ENCT	UV	CC	SH	MO	AX1		AX2		AX3		AX4		AX5		AX6 / RTC		
P1	V1	F2	CL1	OP1	Z1	Z3	D+	D-	S1	D1	A1	C1	M2	11	13	21	23	31	33	41	43	51	53	61	63	R2
P2	V2	F4	CL2	OP2	Z2	Z4	DO11	DO12	S2	D2	A2	C2	M4	12	14	22	24	32	34	42	44	52	54	62	64	R4
Vn	V3	F1			DO31	DO32	DO21	DO22					M1												R1	



PS	
CN	DCN
TST	CMN

Terminal blocks	Description
PS	DCN: Contact indicating the Disconnected position of the circuit breaker in the chassis. TST: Contact indicating the Test position of the circuit breaker in the chassis. CN: Contact indicating the Connected position of the circuit breaker in the chassis. CMN: Common

Information

The PS terminal block is only available on the HWS2 and HWS4 drawout circuit breakers.

TU 240V AC	V~	FS	Close/ Open		ZSI IN	ZSI OUT	COM DO	
P1	V1	F2	CL1	OP1	Z1	Z3	D+	D-
P2	V2	F4	CL2	OP2	Z2	Z4	DO11	DO12
Vn	V3	F1			DO31	DO32	DO21	DO22

Terminal blocks	Description
TU 240 V AC	Trip unit P1 and P2: An external 240V AC power supply is necessary to guarantee permanent operation of the trip unit. Vn: Connection to neutral potential. **Information** **Terminal block Vn** In the case of a 3P circuit breaker fitted with the type H trip unit and installed in an earthing system in which the neutral is distributed, the terminal block Vn must be connected to the neutral potential. This connection is essential to obtain correct measurement of phase-neutral voltages V1N, V2N, V3N, powers per phase and for operation of the advanced protections against active power feedback and undervoltage or overvoltage.
V~	Connection of the 3 phases V1, V2 and V3 (only for a circuit breaker equipped with type H trip unit).
FS	Fault trip contact. General tripping information.
Close / Open	Information about the closed (CL1 and CL2) or open (OP1 and OP2) status of the contacts.
ZSI IN ZSI OUT	Zone Selectivity function (only available with circuit breaker equipped with type A or type H trip unit). Connection to downstream circuit breakers: Z1/Z2: ZSI IN. Connection to the upstream circuit breaker: Z3/Z4: ZSI OUT. Digital output contacts (only available with circuit breaker equipped with type H trip unit). DO31/DO32: Digital output 3.
COM DO	Communication module (only available with circuit breaker equipped with type H trip unit). D+ and D-: Modbus connection. Digital output contacts (digital output 1 is available with circuit breaker equipped with type A or H trip unit. Digital output 2 is only available with circuit breaker equipped with type H trip unit). DO11/DO12: Digital output 1. DO21/DO22: Digital output 2.

ENCT	UV	CC	SH	MO
S1	D1	A1	C1	M2
S2	D2	A2	C2	M4
				M1

Terminal blocks	Description
ENCT	External neutral current sensors. S1 and S2: connection of an ENCT external neutral current sensor for 3-pole circuit breakers.
UV	Connection of UV undervoltage coil.
CC	Connection of CC closing coil.
SH	Connection of SH shunt trip coil.
MO	Power supply of the MO charging motor. The connection terminals M1 (Common) and M2 (+) power the drive mechanism of the MO motor. Terminal M4 is used to connect the SC “spring-loaded” signal contact. Note that terminal M4 is at the same potential as the drive mechanism power supply.

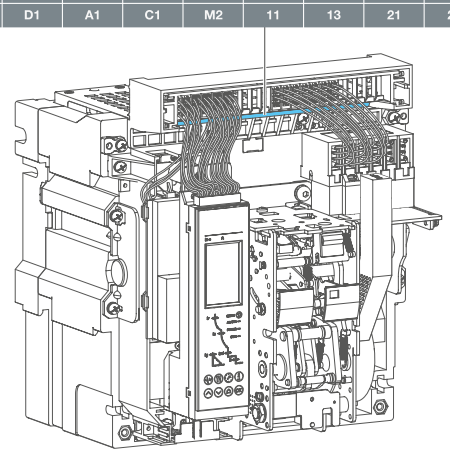
AX1		AX2		AX3		AX4		AX5		AX6 / RTC	
11	13	21	23	31	33	41	43	51	53	61	63 R2
12	14	22	24	32	34	42	44	52	54	62	64 R4
											R1

Terminal blocks	Description	Integrated or additional	
		HWS2	HWS4
AX1	Auxiliary contact No. 1 - Signals the circuit breaker open/closed status. Terminals 11/12: NC. Terminals 13/14: NO.	Integrated	Integrated
AX2	Auxiliary contact No. 2 - Signals the circuit breaker open/closed status. Terminals 21/22: NC. Terminals 23/24: NO.	Integrated	Integrated
AX3	Auxiliary contact No. 3 - Signals the circuit breaker open/closed status. Terminals 31/32: NC. Terminals 33/34: NO.	Integrated	Integrated
AX4	Auxiliary contact No. 4 - Signals the circuit breaker open/closed status. Terminals 41/42: NC. Terminals 43/44: NO.	Integrated	Integrated
AX5	Auxiliary contact No. 5 - Signals the circuit breaker open/closed status. Terminals 51/52: NC. Terminals 53/54: NO.	Additional	Additional
AX6 / RTC	Auxiliary contact No. 6 - Signals the circuit breaker open/closed status. Terminals 61/62: NC. Terminals 63/64: NO.	Additional	Additional

Terminal blocks	Description	Integrated or additional	
		HWS2	HWS4
	Ready-to-Close contact. R1: Common. R2: NC. R4: NO. These terminal blocks can be connected either for the use of a 6th AX6 auxiliary contact or for the use of an RTC ready-to-close contact.		

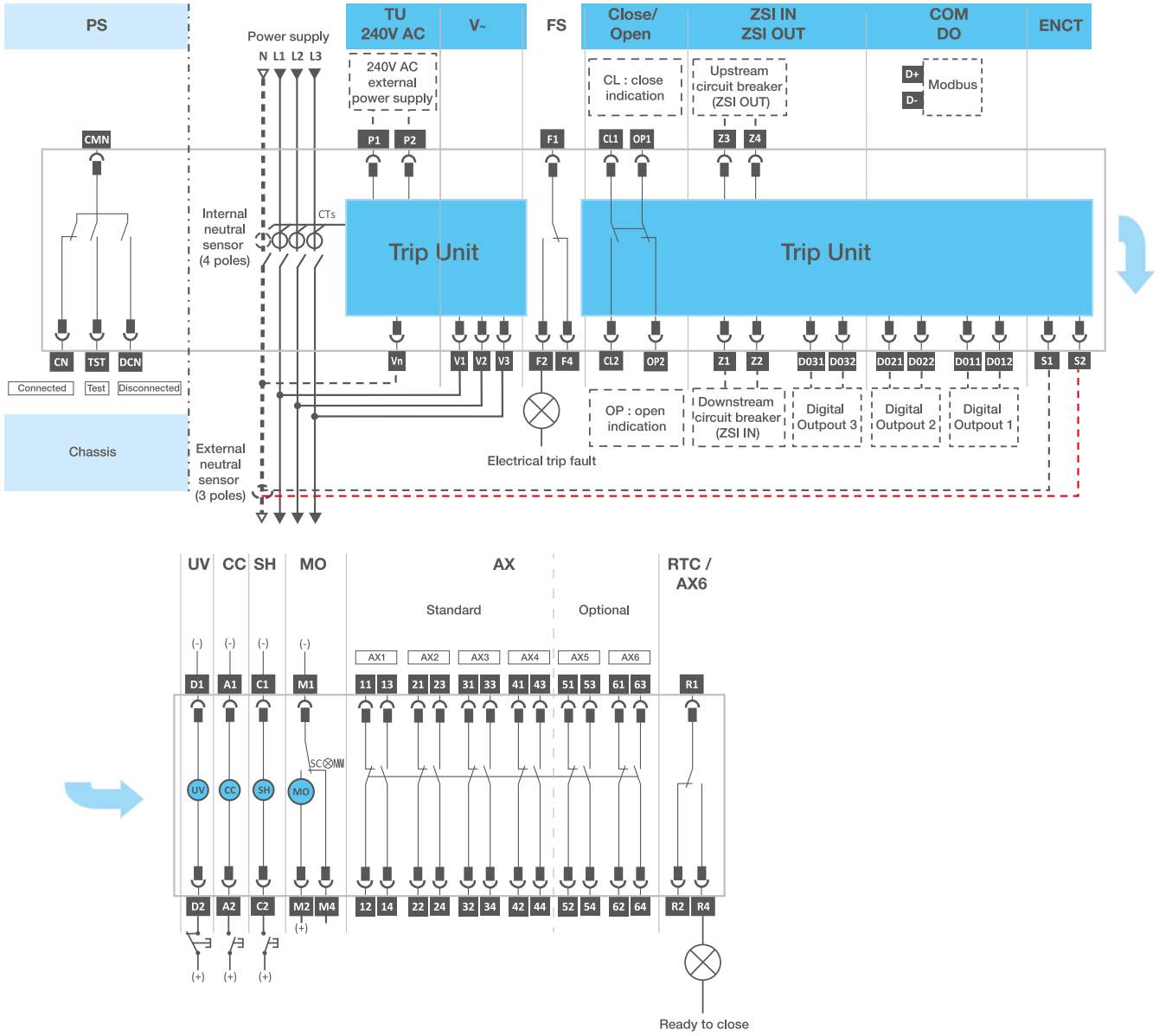
On HWS2 and HWS4 drawout circuit breakers, a 2nd label is located under the bottom connectors of the terminal blocks to facilitate connection of the accessories.

Vn	V3	F1			DO31	DO32	DO21	DO22					M1											R1
P2	V2	F4	CL2	OP2	Z2	Z4	DO11	DO12	S2	D2	A2	C2	M4	12	14	22	24	32	34	42	44	52	54	62	64 R4
P1	V1	F2	CL1	OP1	Z1	Z3	D+	D-	S1	D1	A1	C1	M2	11	13	21	23	31	33	41	43	51	53	61	63 R2



6 Electrical diagram

Electrical diagram of HWS2 and HWS4 circuit breakers



Information

The PS terminal block is only available on the HWS2 and HWS4 drawout circuit breakers.

Terminal blocks	Connection
PS	3 contacts indicating the position of the circuit breaker in the chassis.
TU 240 V AC	External power supply for the trip unit. Vn: Neutral potential (only for circuit breaker equipped with type H trip unit).
V~	Connection of the 3 phases V1, V2 and V3 (only for a circuit breaker equipped with type H trip unit).
FS	Fault trip contact.
Close / Open	Information about the closed (CL1 and CL2) or open (OP1 and OP2) status of the contacts.
ZSI IN ZSI OUT	Zone Selectivity Function. Digital output contacts (only available with circuit breaker equipped with type H trip unit). DO31/DO32: Digital output 3.
COM DO	MODBUS Communication. Digital output contacts (digital output 1 is available with circuit breaker equipped with type A or H trip unit. Digital output 2 is only available with circuit breaker equipped with type H trip unit). DO11/DO12: Digital output 1. DO21/DO22: Digital output 2.
ENCT	External neutral current sensors.
UV	UV undervoltage release coil.
CC	CC closing coil.
SH	SH shunt trip coil.
MO	MO charging motor and SC spring-charged signalling contact.
AX	Auxiliary contact: integrated, block of 4 NO contacts and 4 NC contacts signalling the open/closed status of the circuit breaker. In addition, the original 4-contact block can be replaced by a block of 6 NO contacts and 6 NC contacts signalling the open/closed status of the circuit breaker.
RTC/AX6	Contact ready to close or 6th auxiliary contact.

The cables (flexible or rigid) used must have a cross section between 0.6 mm^2 and 2.5 mm^2.

In order to be properly held in place in the terminals, the connected cables must first be stripped from 10 to 12 mm and fitted with crimp terminals. The cables must not be twisted and only one cable is allowed per terminal.

7 Circuit breaker usage conditions

Compliance with standards
hws air circuit breakers and the related auxiliary devices comply with the following standards:

International standards
- IEC 60947-1: General rules
- IEC 60947-2: Circuit breakers
- IEC 60947-3: Switch disconnectors
- IEC 60947-5-1: Control circuit devices and switching elements

Pollution Degree
hws air circuit breakers are certified for operation in pollution degree 4 environments as defined by IEC standard 60664-1.

Temperature
hws circuit breakers can be used at temperatures between -25°C and 70°C.
For ambient temperatures above 50°C, the devices must be derated, refer to the values given in the Technical Catalogue 6LE089908A.
The acceptable storage temperature range in the original packing is from -40°C to 85°C for a circuit breaker without trip unit.
The acceptable storage temperature range in the original packing is from -25°C to 85°C for a circuit breaker with trip unit.

Humidity
hws air circuit breakers can be used in an atmosphere with a relative humidity of 45 to 85% max.

Altitude
hws air circuit breakers can be used without derating up to an altitude of 2000 m. Above this, refer to the values provided in the Technical Catalogue 6LE089908A.

Vibration
hws air circuit breakers are resistant to mechanical vibration.
They meet the requirements of IEC 60068-2-6:
- 2.0 to 13.2 Hz and amplitude +/- 1 mm.
- 13.2 to 100 Hz acceleration +/- 0.7 g.
- Resonance frequency (+/- 1 mm / +/- 0.7 g) for 90 minutes

Excessive vibration may cause nuisance (false) tripping and/or damage to connections and/or mechanical parts.

Shocks
hws air circuit breakers can withstand shocks with an acceleration of 200 m/s2 (20G) max.

Environment
hws air circuit breakers must be used in an environment without excess water vapour, oil vapour, dust or corrosive gases.
Without sudden temperature fluctuations and without condensation.

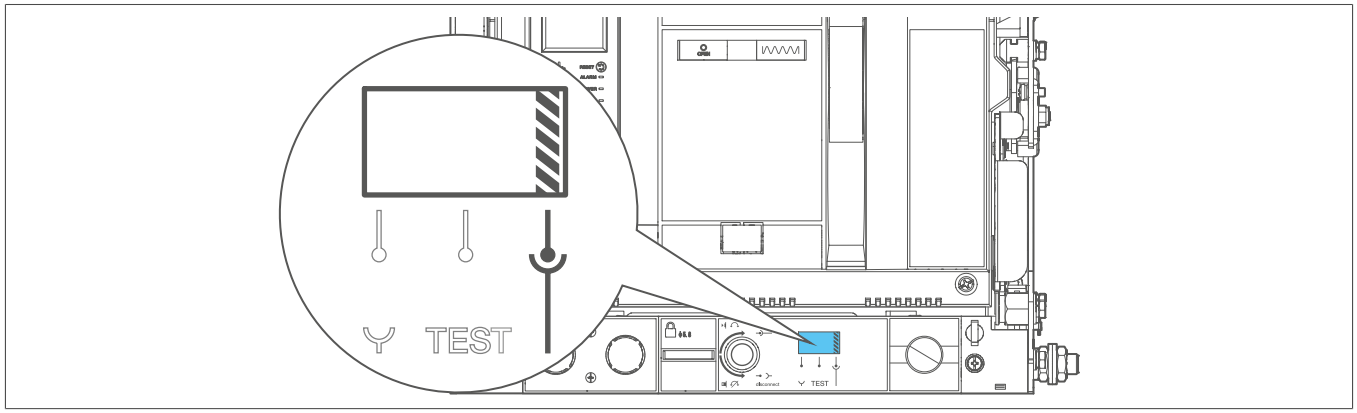
With the following levels of chemical compounds:
- Ammonia (NH3): 0.5 ppm max.
- Hydrogen sulphide (H2S)/sulphur dioxide (SO2)/hydrogen chloride (HCl): 0.1 ppm max.
- Chlorine (Cl2): 0.05 ppm max.

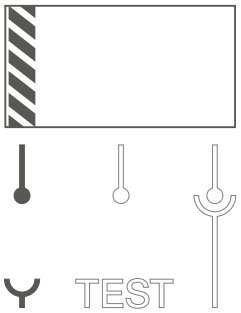
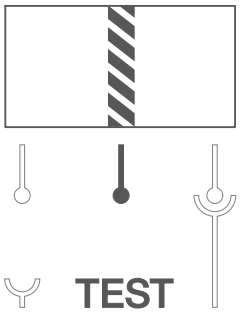
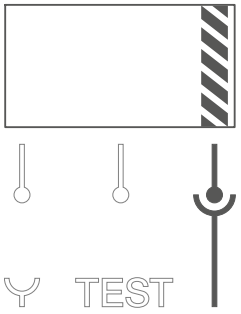
IP rating

The protection rating can be increased to IP20 by installing DF door flanges on the cut-out of the electrical cabinet's door.

8 Positions of the drawout circuit breaker in the chassis

The position of the circuit breaker in the chassis is shown by the mechanical position indicator of the moving part on the front. There are three different positions, connected, test and disconnected.



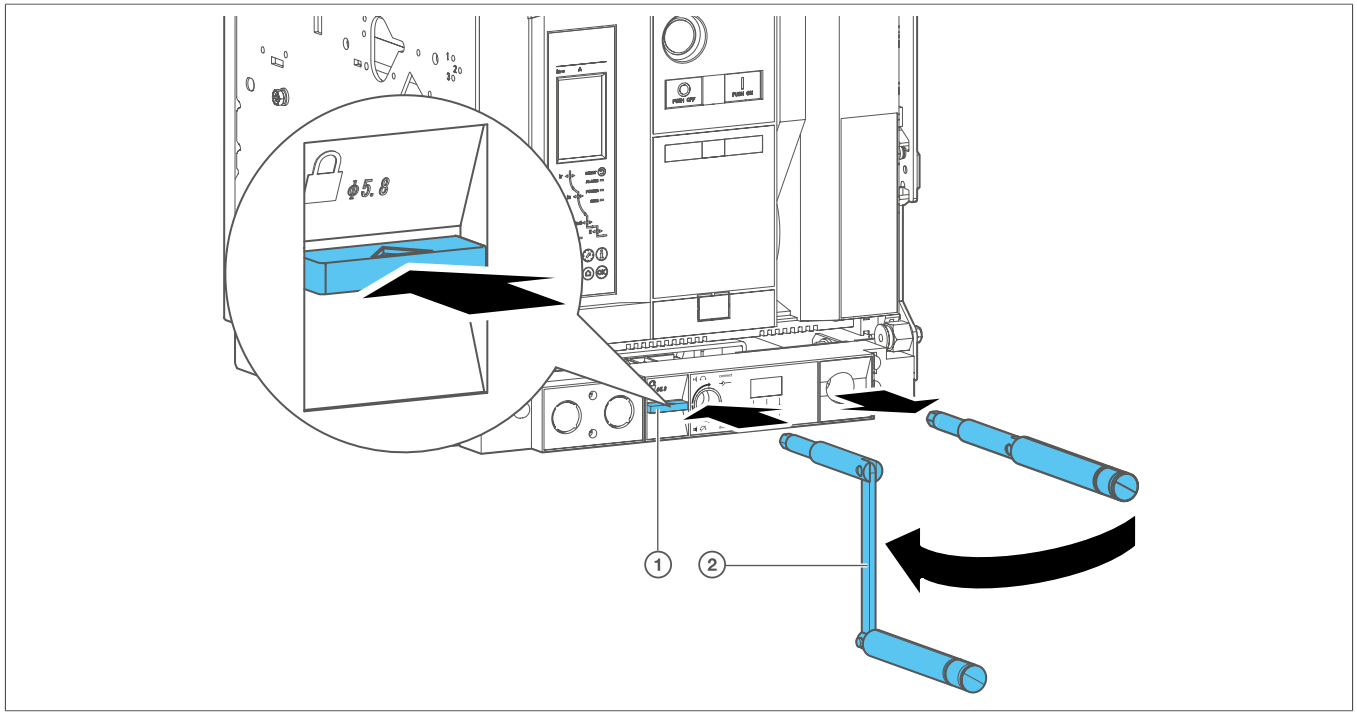
Circuit breaker position	Circuit breaker status	Mechanical position indicator of the moving part
Disconnected	The circuit breaker can be withdrawn from or inserted into the chassis.	
Test	The circuit breaker's power contacts are isolated. All of the auxiliaries remain electrically connected so that they remain functional.	
Connected	The connections on the circuit breaker are connected to the jaw contacts on the chassis. The circuit breaker is ready for operation.	

9 Operation of the drawout circuit breaker in the chassis

Warning

Hazard due to electric shock.
Make sure that the device is only operated by qualified personnel in accordance with the installation standards in force in the relevant country.

Changing from one position to another is done using a racking handle.
Before changing from one position to another, the padlocking and position acknowledgement tab must be pressed.



① Padlocking and position acknowledgement tab
② Handle

Moving from the Connected position to the Test position.

1. Verify that the mechanical position indicator signals that the circuit breaker is in the Connected position see Chapter 8, Positions of the drawout circuit breaker in the chassis .
2. Open the circuit breaker by pressing the opening push button .
3. Take the racking handle out of its housing and insert it in the racking-in/racking-out hole.
4. Press the padlocking and position acknowledgement tab.
5. Turn the racking handle anti-clockwise until:
   – the mechanical position indicator displays the Test position,
   – the padlock latch and position acknowledgement tab comes out of its housing.

Moving from the Test position to the Disconnected position.

Notice

Risk of circuit breaker falling.
Risk of mechanical damage.
If the chassis is not fitted in an electrical panel, ensure it is correctly fastened before changing position.

Danger

Risk of circuit breaker falling.
Risk of crushing injury.
If the chassis is not mounted in an electrical panel, make sure it is properly secured before changing position.

1. Verify that the mechanical position indicator signals that the circuit breaker is in the Test position see Chapter 8, Positions of the drawout circuit breaker in the chassis .
2. Press the padlocking and position acknowledgement tab.
3. Turn the racking handle anti-clockwise until:
   – the mechanical position indicator displays the Disconnected position,
   – the padlock latch and position acknowledgement tab comes out of its housing.

Moving from the Disconnected position to the Test position.

1. Verify that the mechanical position indicator signals that the circuit breaker is in the Disconnected position see Chapter 8, Positions of the drawout circuit breaker in the chassis .
2. Press the padlocking and position acknowledgement tab.
3. Turn the racking handle clockwise until:
   – the mechanical position indicator displays the Test position,
   – the padlock latch and position acknowledgement tab comes out of its housing.

Moving from the Test position to the Connected position.

1. Verify that the mechanical position indicator signals that the circuit breaker is in the Test position see Chapter 8, Positions of the drawout circuit breaker in the chassis .
2. Press the padlocking and position acknowledgement tab.
3. Turn the racking handle clockwise until:
   – the mechanical position indicator displays the Connected position,
   – the padlock latch and position acknowledgement tab comes out of its housing.

At the end of the operation, remove and store the racking handle in its housing.

10 Removing the drawout circuit breaker

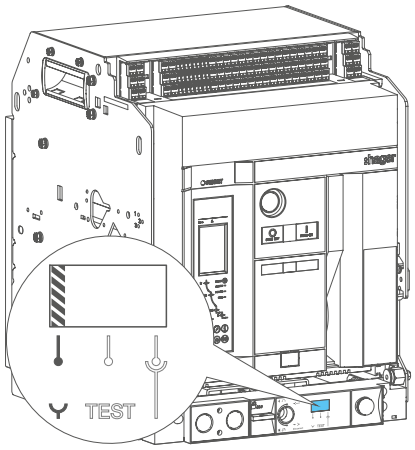
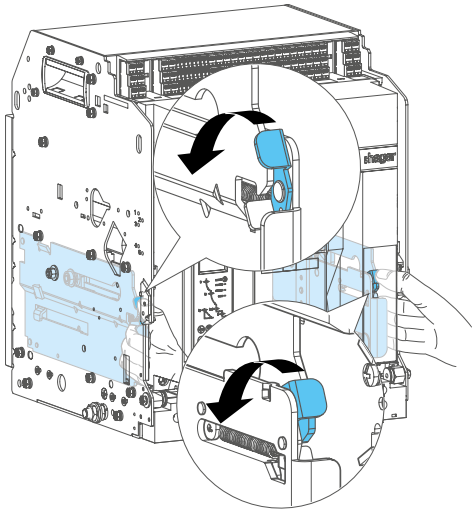
Notice

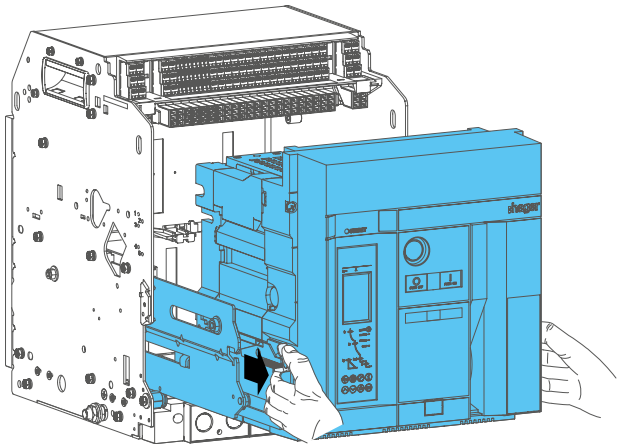
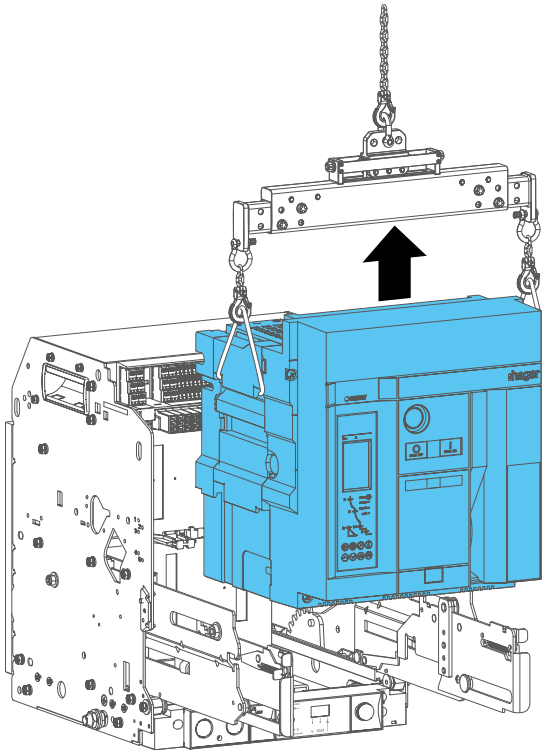
Risk of circuit breaker falling.
Risk of mechanical damage.
Before handling the circuit breaker, ensure that the chassis is secured in the electrical panel. Ensure the device is only handled by qualified personnel equipped with lifting equipment and suitable safety equipment.

Danger

Risk of circuit breaker falling.
Risk of crushing injury.
Before handling the circuit breaker, ensure that the chassis is secured in the electrical panel. Ensure the device is only handled by qualified personnel equipped with lifting equipment and suitable safety equipment.

To remove the circuit breaker from the chassis:

	Action	Illustration
1	Check that the circuit breaker is in theDisconnected position.	
2	The circuit breaker remains in the frame in theDisconnected position. While pressing the toggles...	

	Action	Illustration
	pull on the handles to remove the circuit breaker from the receptacle.	
3	Remove the circuit breaker from the guide rails using an appropriate lifting device.	

11 Inserting the drawout circuit breaker

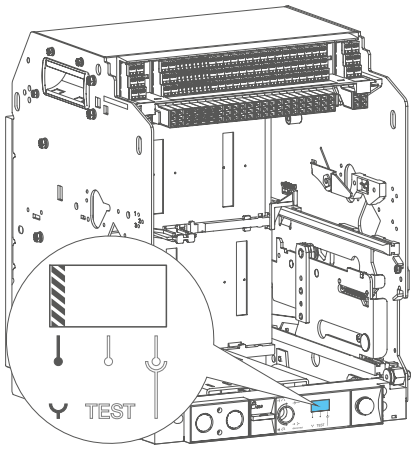
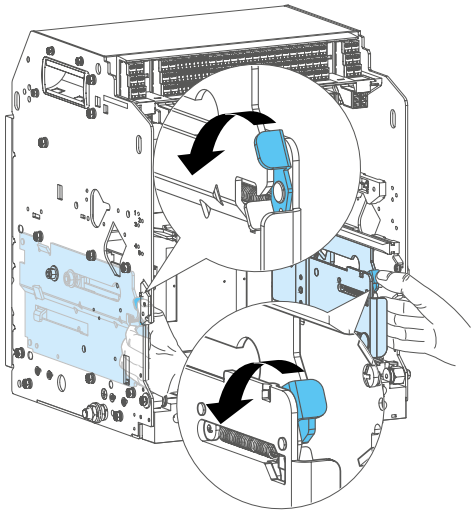
Notice

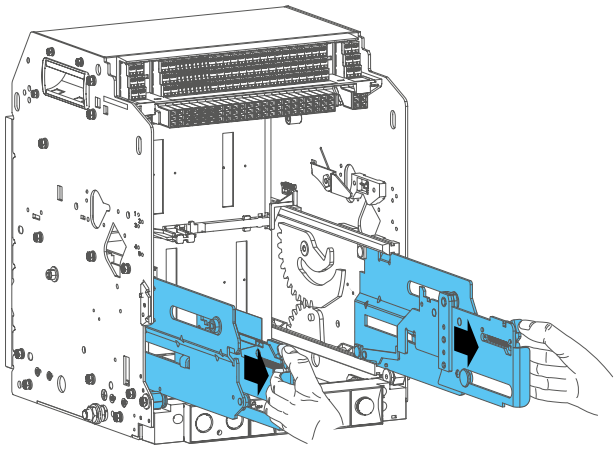
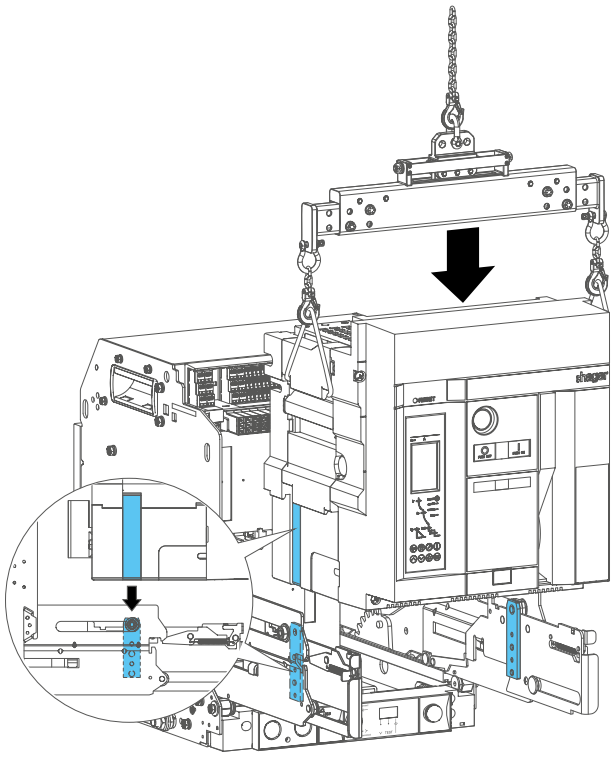
Risk of circuit breaker falling.
Risk of mechanical damage.
Before handling the circuit breaker, ensure that the chassis is secured in the electrical panel. Ensure the device is only handled by qualified personnel equipped with lifting equipment and suitable safety equipment.

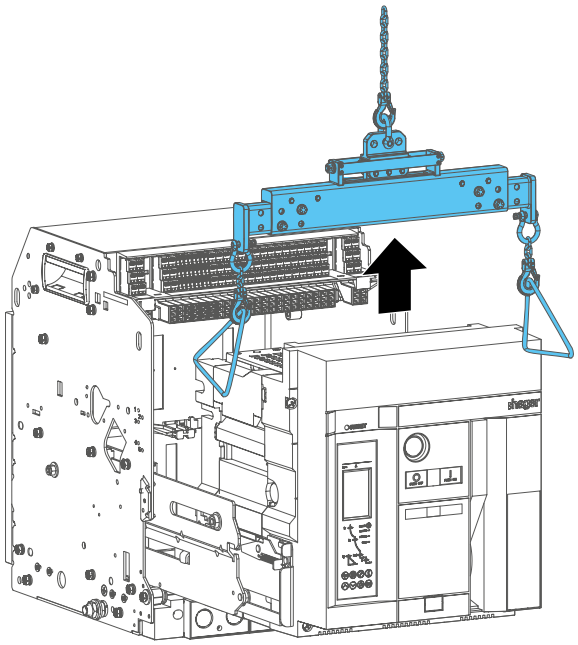
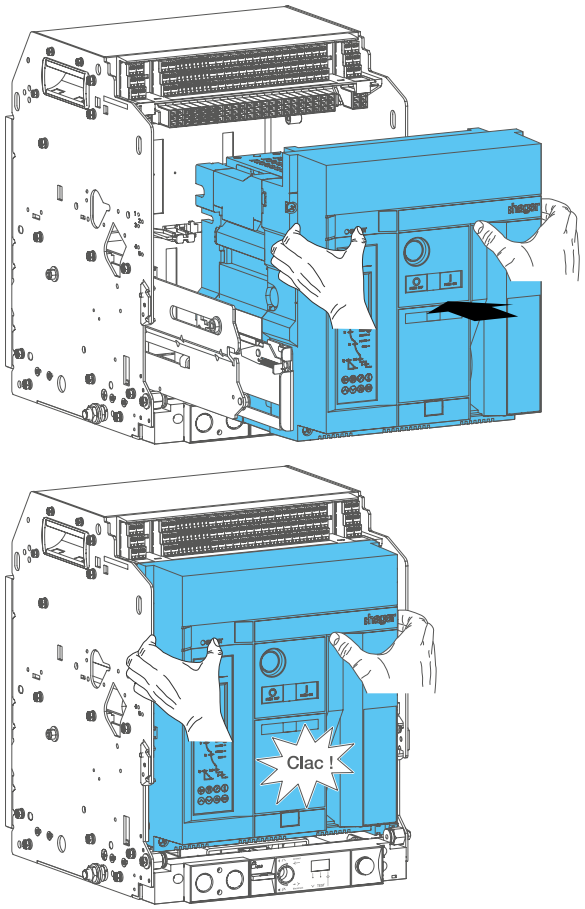
Danger

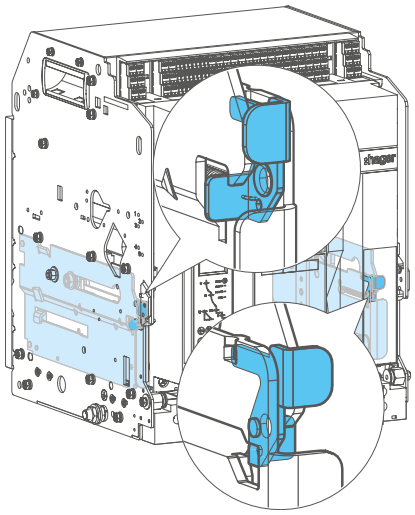
Risk of circuit breaker falling.
Risk of crushing injury.
Before handling the circuit breaker, ensure that the chassis is secured in the electrical panel. Ensure the device is only handled by qualified personnel equipped with lifting equipment and suitable safety equipment.

To insert the circuit breaker into the chassis:

	Action	Illustration
1	Ensure that the chassis is in the Disconnected position.	
2	While pressing the toggles...	

	Action	Illustration
2	(Continued) pull the racking handles to take out the guide rails.	
3	Using an appropriate lifting device, position the circuit breaker on the guide rails, having previously aligned the guides with the slots on the circuit breaker.	

	Action	Illustration
4	Remove the lifting equipment.	
5	Push the circuit breaker to the back of the chassis without pushing on the guide rails.	

	Action	Illustration
6	Verify that the guide rails are correctly positioned.	

12 Storage

- **Use a pallet truck to move the hws transport packaging.**
- **Handle the packaging with care and do not turn it over.**
- **Circuit breaker should be stored:**
  - in its original transport packaging,
  - the lid of the packaging always facing upwards,
  - indoors only,
  - at a temperature between -40°C and 70°C,
  - in conditions as described in chapter 7 "Circuit breaker usage conditions".

Notice

Risk of mechanical damage.
Do not store more than two circuit breakers in their original packaging one on top of the other.

13 Identification of the circuit breakers

HWS2 and HWS4 air circuit breakers can be identified by the various labels affixed to the product or packaging.

Information

For more information on the codification and the references indicated on the labels, refer to the Technical Catalogue 6LE089908A.

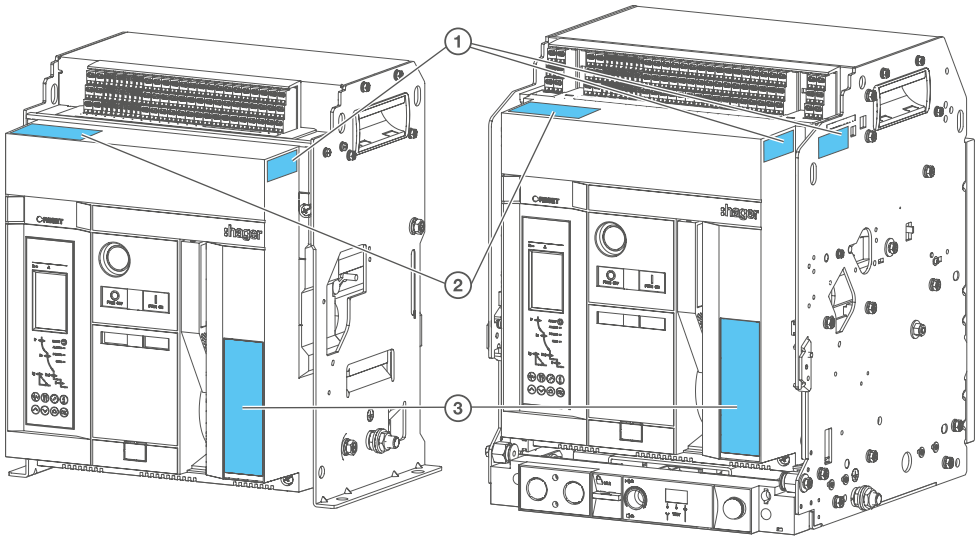


Fig. 2: Labels on fixed and drawout circuit breakers

1. Identification label on the circuit breaker and the chassis
2. Label for additional accessories
3. Circuit breaker rating label

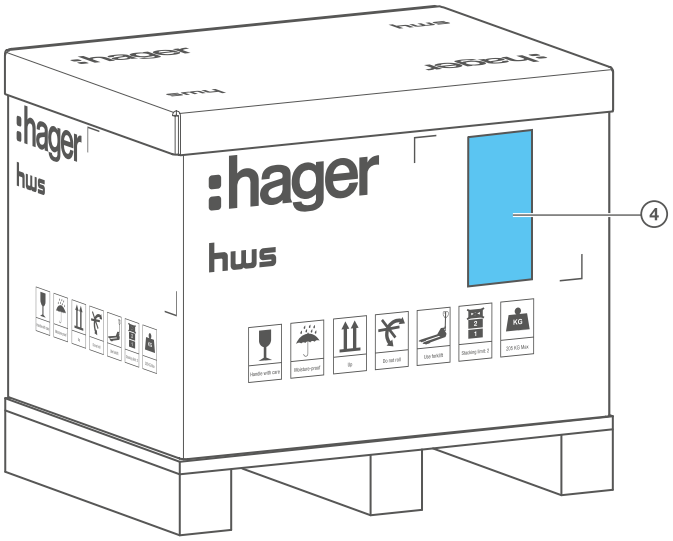


Fig. 3: Label on the packaging

4. Identification label on the packaging

Identification label on the circuit breaker and the chassis

Fig. 4: Identification label on the circuit breaker and the chassis

① Circuit breaker reference

Label for additional accessories

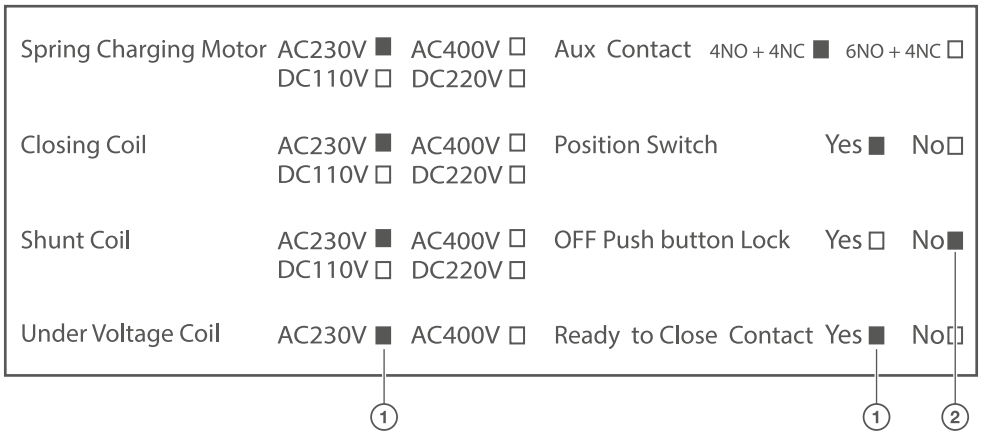


Fig. 5: Label for additional accessories

① Accessories fitted
② Accessory not fitted

Identification label for HWS2 and HWS4 circuit breakers and switch disconnectors

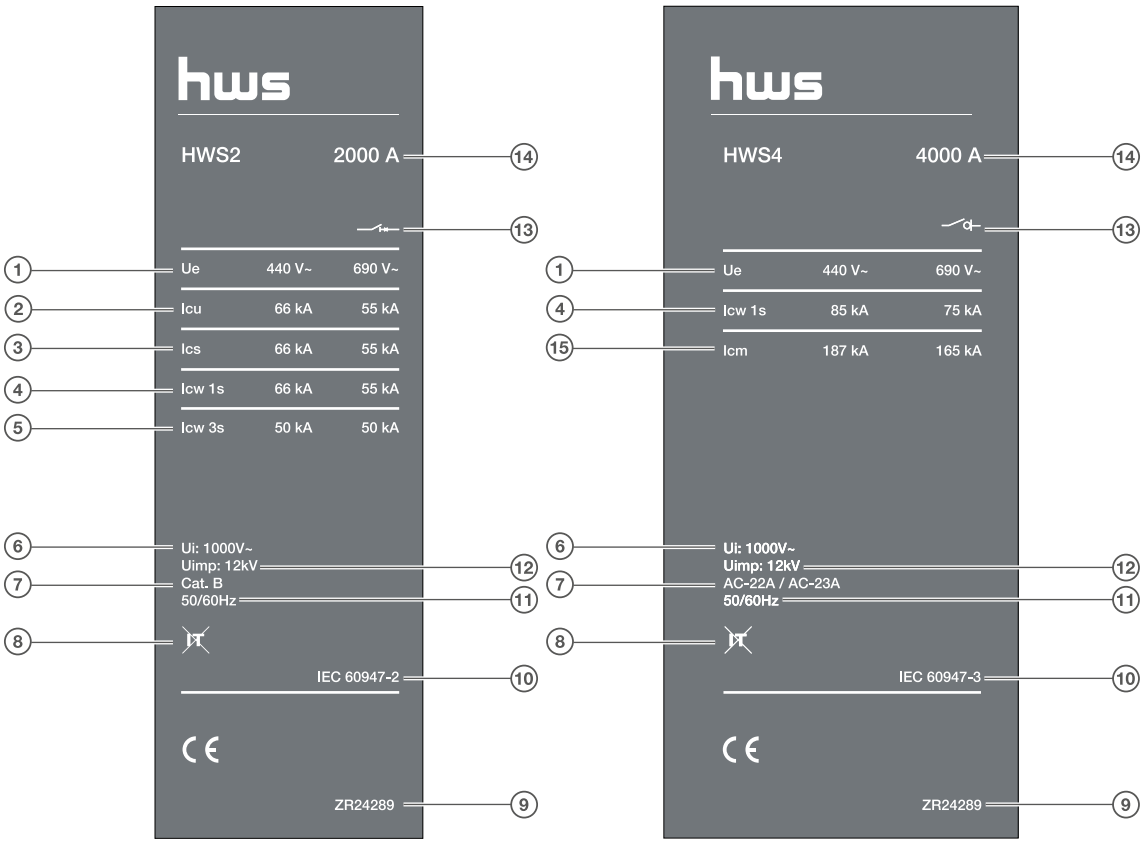


Fig. 6: Technical specification label for an HWS2 circuit breaker and an HWS4 switch-disconnector

1. Ue: Operating voltage
2. Icu: Rated ultimate short-circuit breaking capacity at the rated operating voltage Ue
3. Ics: Rated service short-circuit breaking capacity
4. Icw 1 s: Rated short-time withstand current for 1 second
5. Icw 3s: Rated short-time withstand current for 3 seconds
6. Ui: Rated insulation voltage
7. Category
8. Not suitable for protection in an IT earthing system
9. Manufacturing date code
10. Standards
11. Frequency
12. Uimp: Rated surge voltage
13. Symbol of a circuit breaker suitable for isolation or symbol of a switch-disconnector
14. Maximum rating of the circuit breaker
15. Icm: Rated short-circuit making capacity

Identification label on the packaging

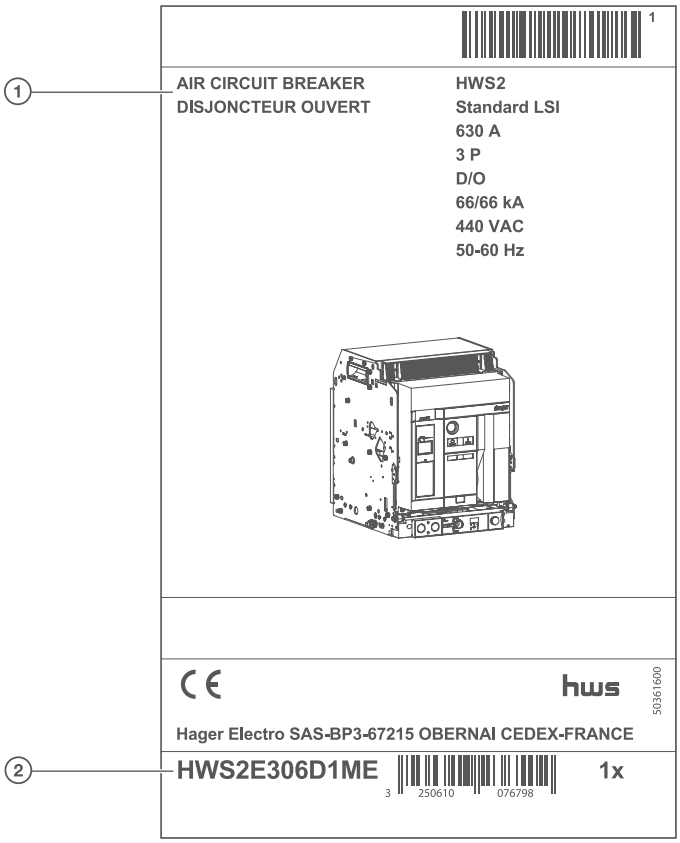


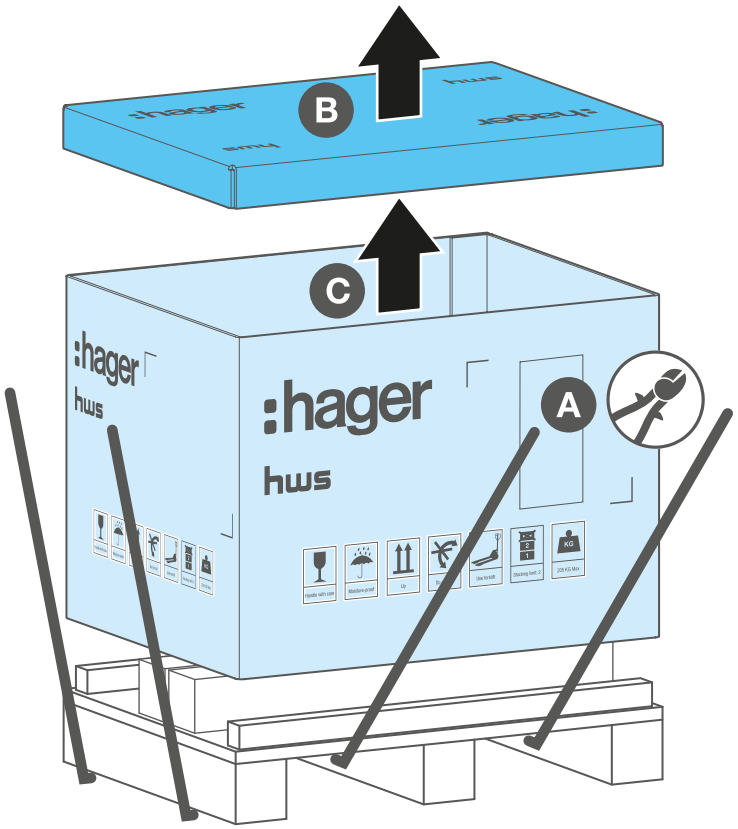
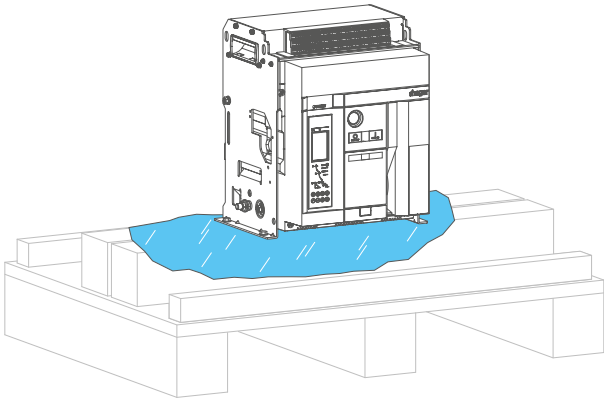
Fig. 7: Identification label on the packaging

1. Main characteristics of the circuit breaker
2. Circuit breaker reference

14 Unpacking

14.1 Removing the packaging

Remove the product from its case following the procedure below:

	Action	Illustration
1	a) Cut the straps with side cutters, b) Remove the cover, c) Remove the packaging.	
2	Remove the adhesive tape then open the plastic protection to gain access to the circuit breaker.	

14.2 Fixed circuit breaker

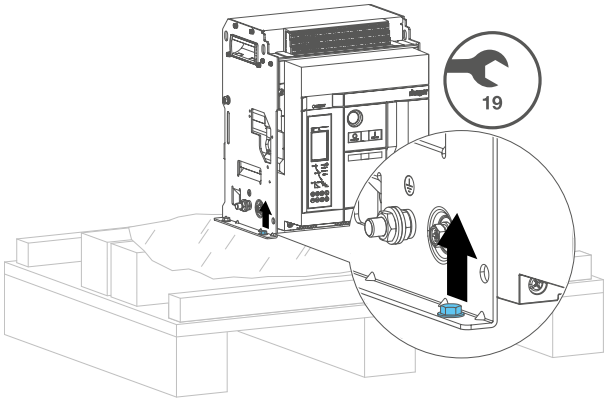
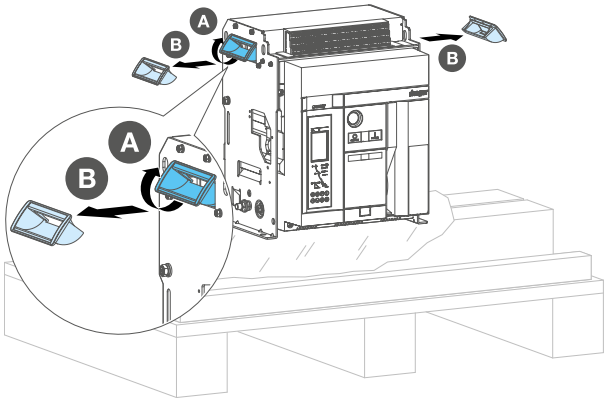
Notice

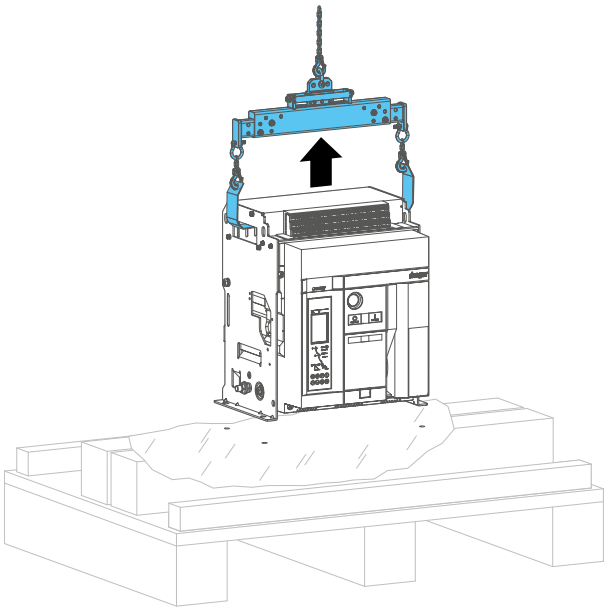
Risk of circuit breaker falling.
Risk of mechanical damage.
Make sure that the circuit breaker is handled only by qualified personnel equipped with proper lifting equipment and safety equipment.

Danger

Risk of circuit breaker falling.
Risk of crushing injury.
Make sure that the circuit breaker is handled only by qualified personnel equipped with proper lifting equipment and safety equipment.

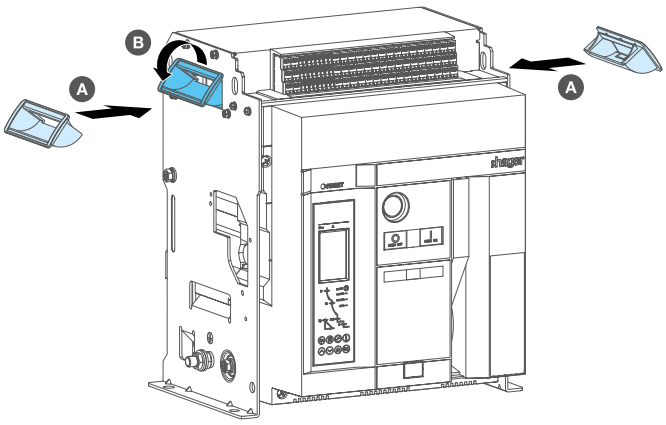
To remove a fixed circuit breaker from its pallet, proceed as follows:

	Action	Illustration
1	Remove the 4 screws holding the circuit breaker in place.	
2	a) Tilt the lifting handles upwards. b) Remove them.	

	Action	Illustration
3	Remove the circuit breaker from the pallet using an appropriate lifting device and place it in a suitable place.	

Notice

Risk of mechanical damage.
Always remove the handles before positioning the lifting system.

	Action	Illustration
4	Put the lifting handles back.	

14.3 Drawout circuit breaker

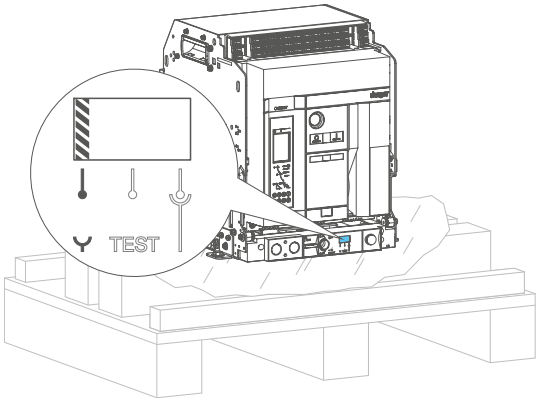
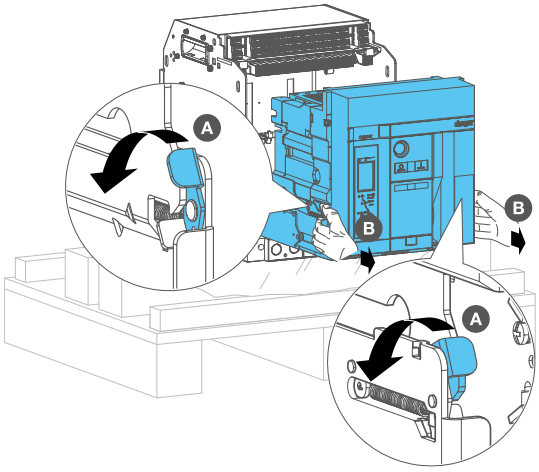
Notice

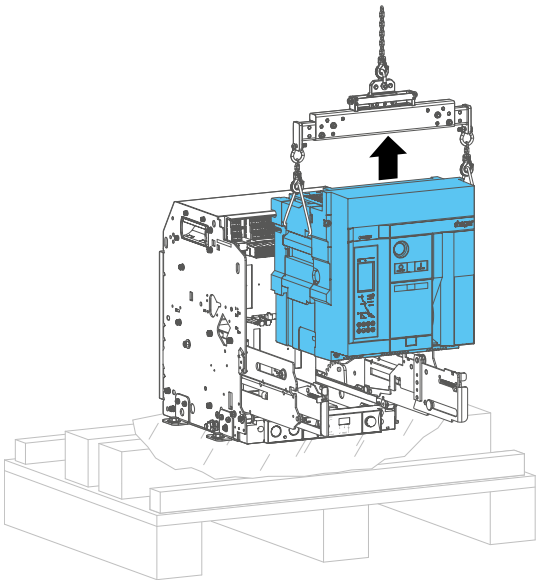
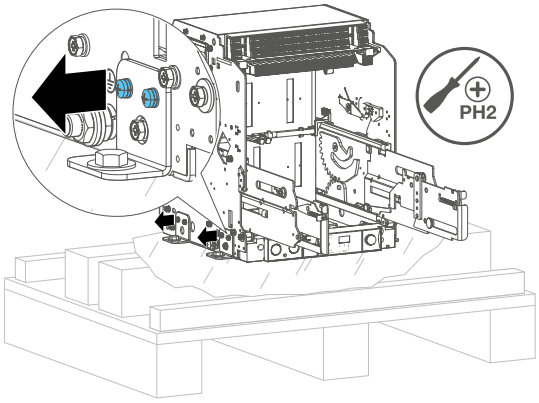
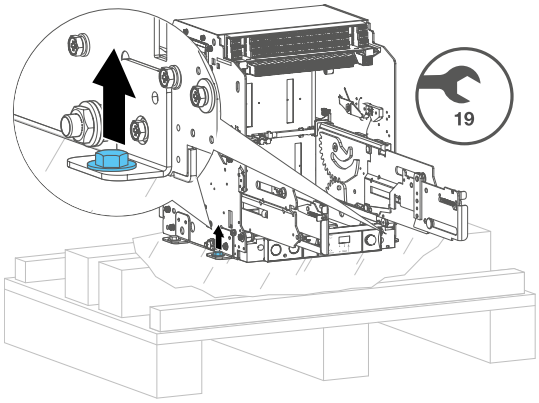
Risk of circuit breaker falling.
Risk of mechanical damage.
Make sure that the circuit breaker is handled only by qualified personnel equipped with proper lifting equipment and safety equipment.

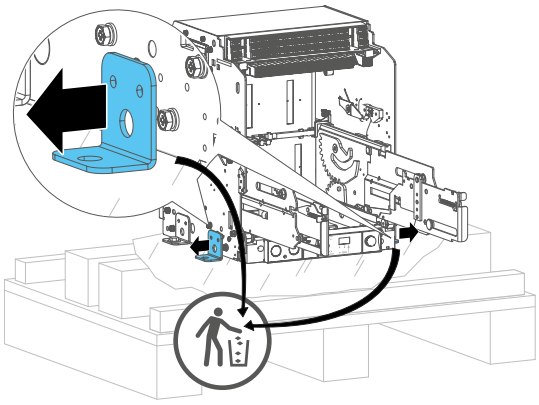
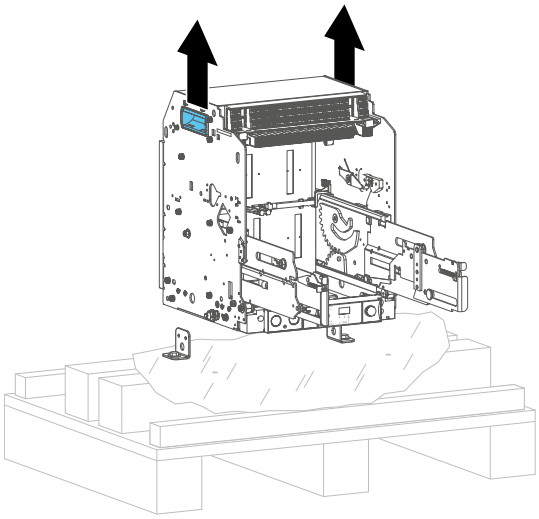
Danger

Risk of circuit breaker falling.
Risk of crushing injury.
Make sure that the circuit breaker is handled only by qualified personnel equipped with proper lifting equipment and safety equipment.

To remove a Drawout circuit breaker with chassis from its pallet, proceed as follows:

	Action	Illustration
1	Put the circuit breaker in the Disconnected position (Operation of the drawout circuit breaker in the chassis).	
2	a) Press the toggles. b) pull the handles to take the circuit breaker out of its holder.	

	Action	Illustration
3	Remove the circuit breaker from the guide rails using an appropriate lifting device.	
4	Remove the 8 screws attaching the chassis to the brackets.	
5	Remove the 2 screws holding the brackets to the pallet.	

	Action	Illustration
6	Remove the 2 brackets and put them in the bin.	
7	Remove the chassis from the pallet using the lifting handles and place it in a suitable place.	

15 Handling

15.1 Handling the circuit breakers

Notice

Risk of circuit breaker falling.
Risk of mechanical damage.
Make sure that the circuit breaker is handled only by qualified personnel equipped with proper lifting equipment and safety equipment.

Danger

Risk of circuit breaker falling.
Risk of crushing injury.
Make sure that the circuit breaker is handled only by qualified personnel equipped with proper lifting equipment and safety equipment.

The fixed circuit breaker, drawout circuit breaker and chassis have lifting handles to be used for handling.

Ensure you have a lifting system corresponding to the weight of the circuit breaker or chassis to be moved.

Weight of the HWS2 circuit breakers (without accessories)

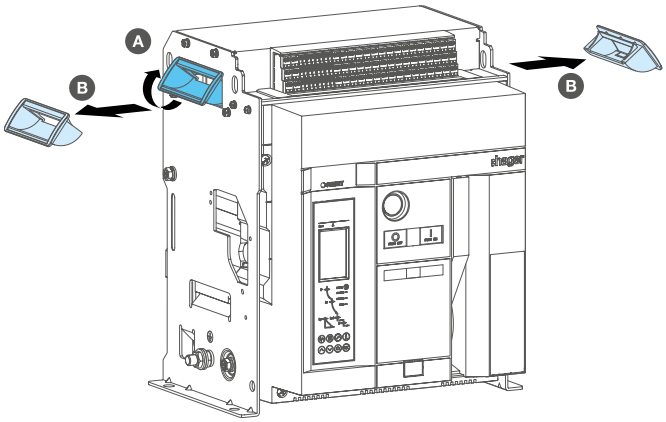
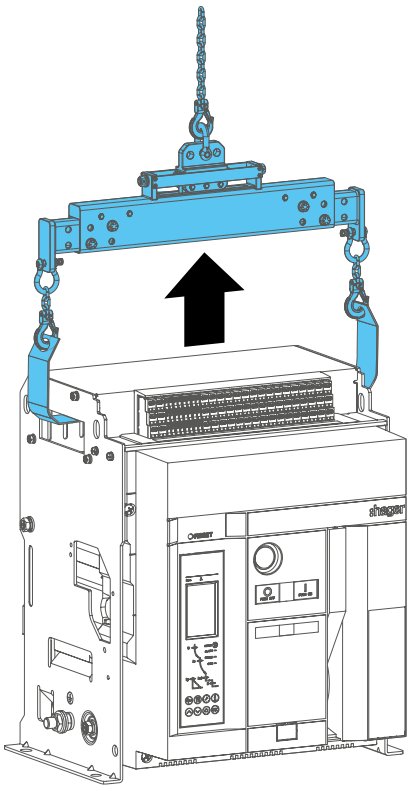
Product	Number of poles	Weight
Fixed circuit breaker	3-pole	40 kg
Drawout circuit breaker (without chassis)		38 kg
Chassis		38 kg
Fixed circuit breaker	4-pole	49 kg
Drawout circuit breaker (without chassis)		49 kg
Chassis		44 kg

Weight of the HWS4 circuit breakers (without accessories)

Product	Number of poles	Weight
Fixed circuit breaker	3-pole	51 kg
Drawout circuit breaker (without chassis)		51 kg
Chassis		48 kg
Fixed circuit breaker	4-pole	65 kg
Drawout circuit breaker (without chassis)		65 kg
Chassis		59 kg

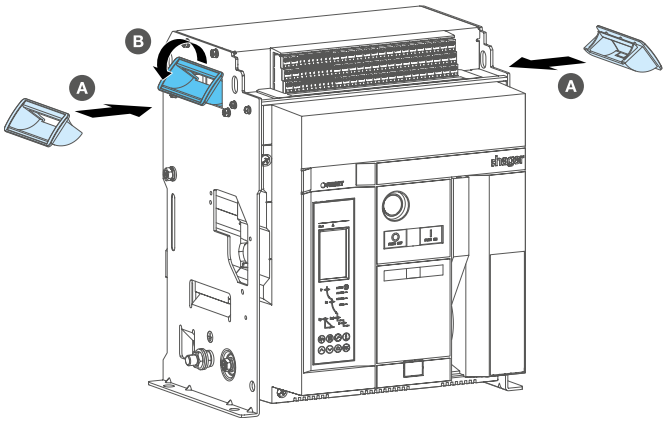
15.2 Handling fixed circuit breakers

It is recommended that a lifting system be used to move the circuit breaker. For this:

	Action	Illustration
1	Tilt the lifting handles upwards, then remove them.	
2	Use a lifting system to move the circuit breaker.	

Notice

Risk of mechanical damage.
Always remove the handles before positioning the lifting system.

	Action	Illustration
3	When the circuit breaker is in the desired place, remove the lifting system and put the handles back.	

15.3 Handling drawout circuit breakers

Notice

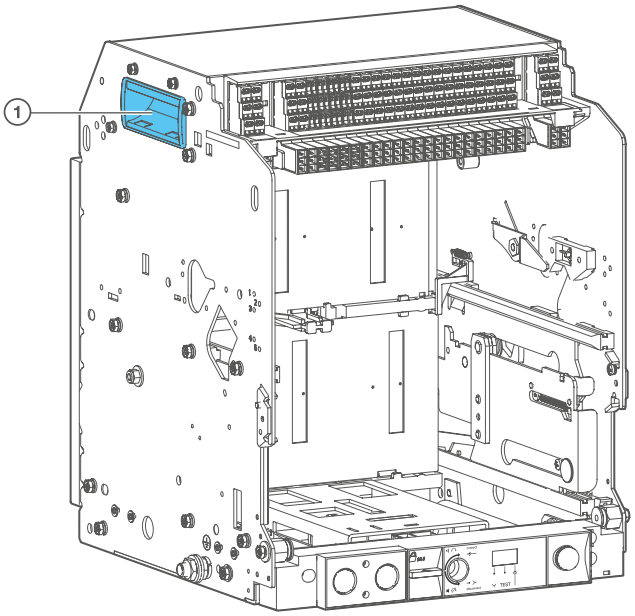
Risk of mechanical damage.
Never move a drawout circuit breaker in its chassis. Always move the two elements separately.

Danger

Risk of circuit breaker falling.
Risk of crushing injury.
Wear appropriate personal protective equipment (PPE) when handling circuit breakers.

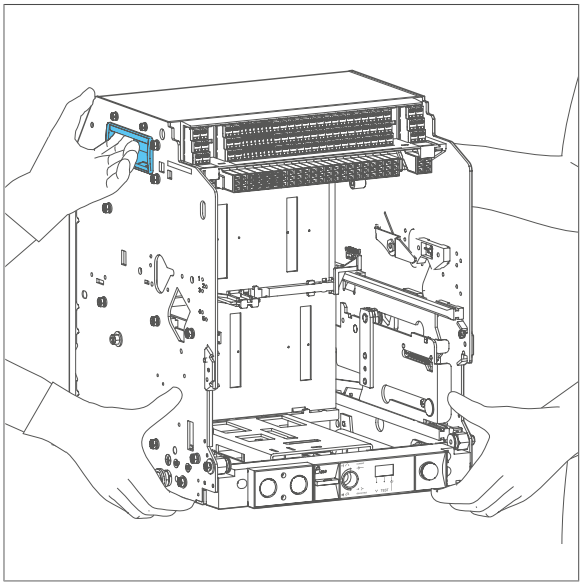
Handling the chassis

Use the lifting handles on the side of the circuit breaker.

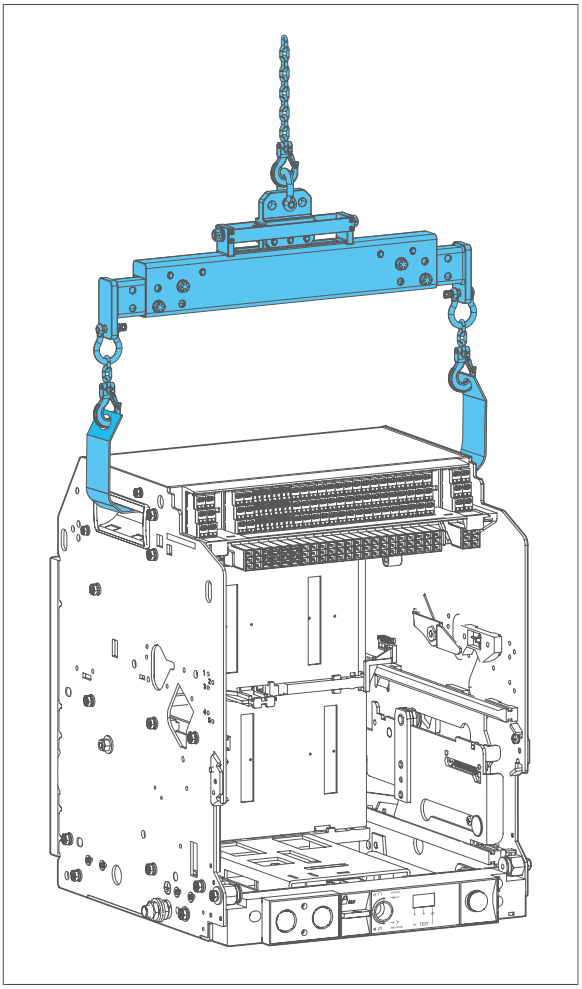


① Lifting handle

It is recommended that the chassis be handled by 2 persons or that a lifting system be used for HWS2 and HWS4 circuit breakers.

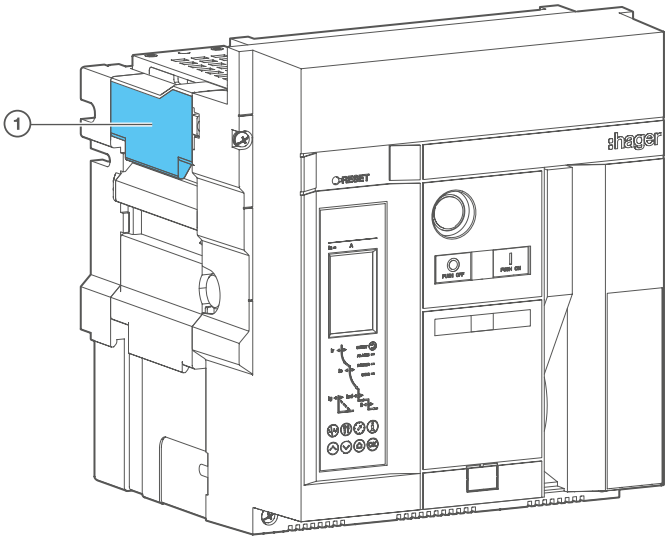


or



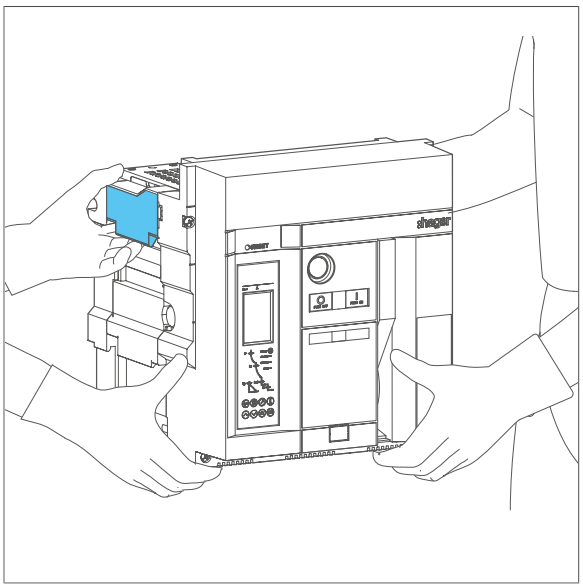
Handling the circuit breaker

Use the lifting handles on the side of the circuit breaker.

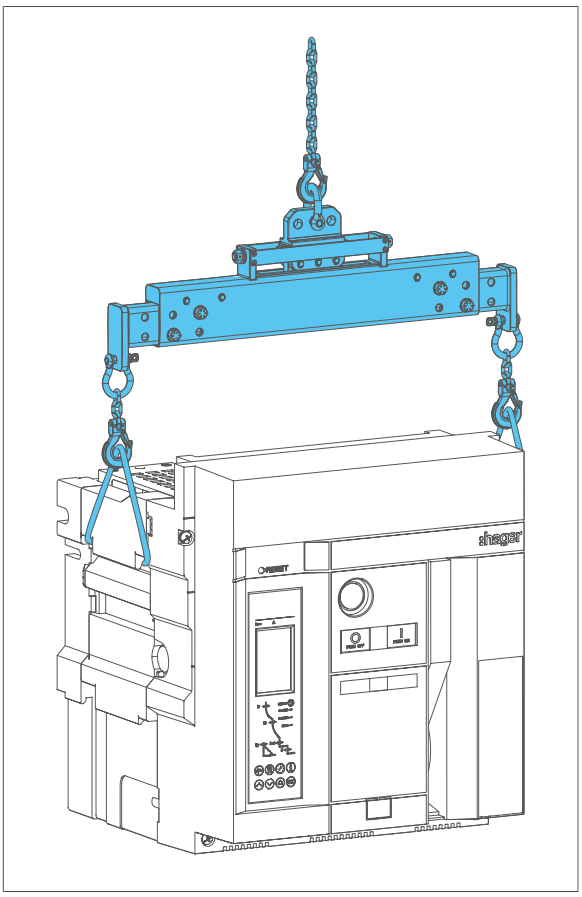


① Lifting handle

It is recommended that the circuit breaker be handled by 2 persons or that a lifting system be used for HWS2 and HWS4 circuit breakers.



or

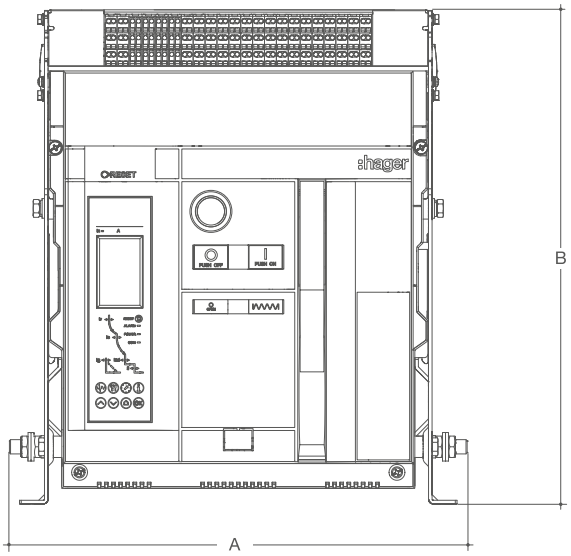


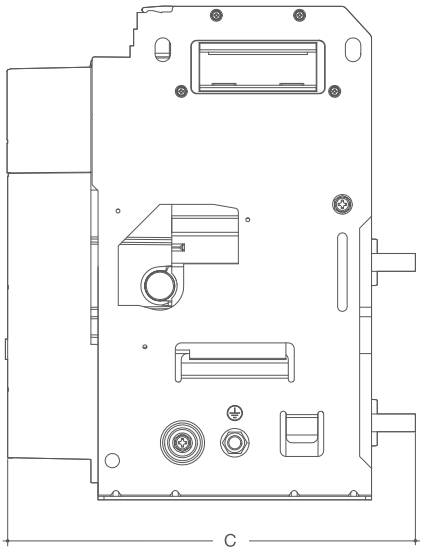
16 Mounting dimensions

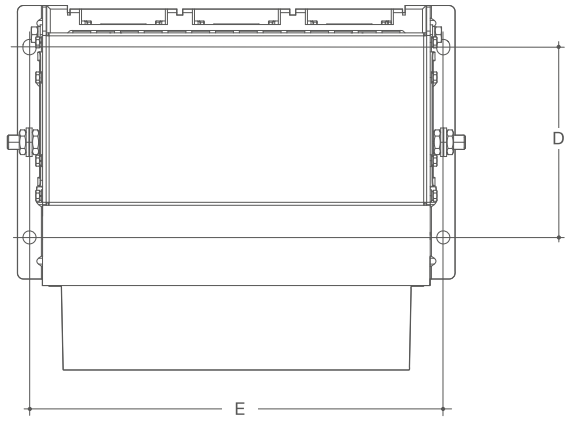
16.1 Circuit breaker dimensions

To install a fixed HWS2 or HWS4 circuit breaker, comply with the following dimensions for mounting:

Dimensions (max. value in mm)	HWS2		HWS4	
	3-pole	4-pole	3-pole	4-pole
Width A	385	480	478	604
Height B	416	416	416	416
Max depth C with connections	308	308	308	308
Pitch distance D mounting depth	160	160	160	160
Pitch distance E mounting width	348	443	441	567

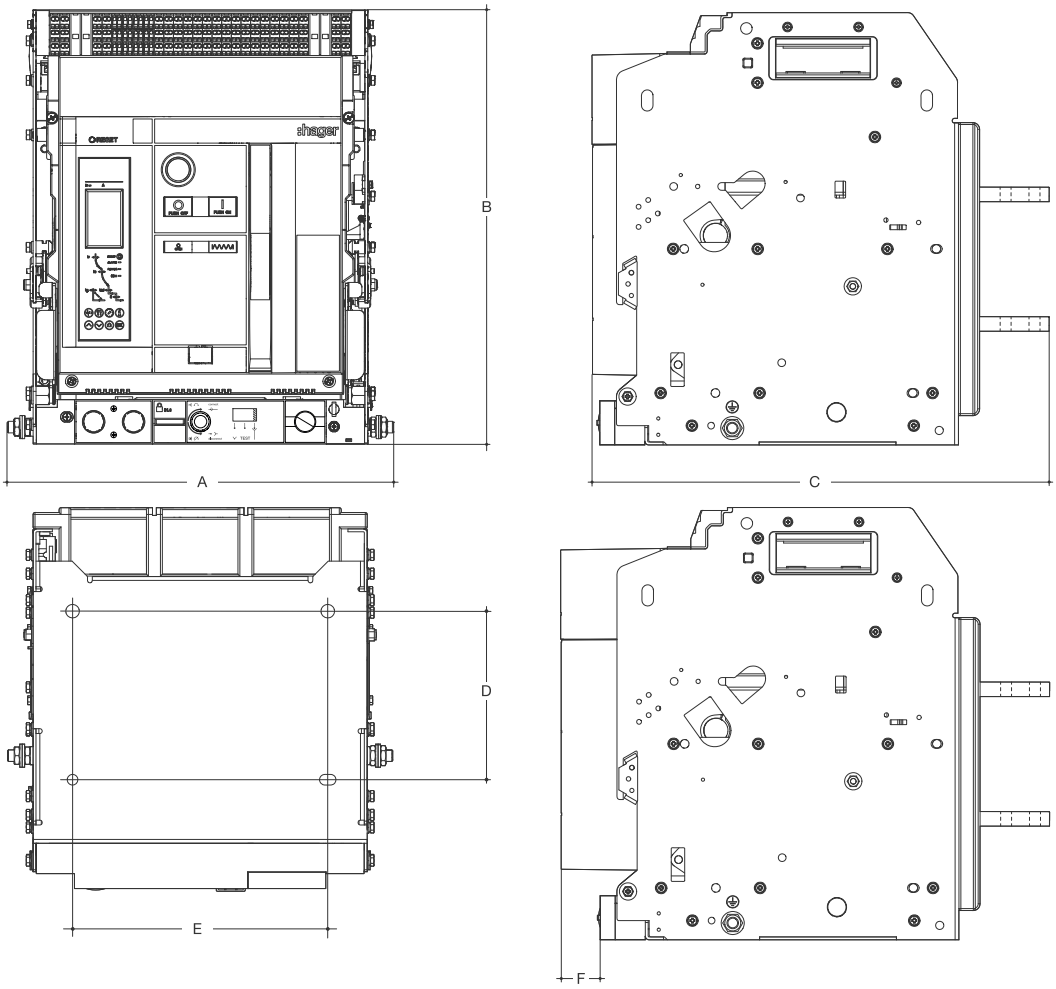






To install a drawout HWS2 or HWS4 circuit breaker, comply with the following dimensions for mounting:

Dimensions (max. value in mm)	HWS2		HWS4	
	3-pole	4-pole	3-pole	4-pole
Width A	400	495	493	619
Height B	450	450	450	450
Max depth C with connections	407	407	407	407
Pitch distance D mounting depth	175	175	175	175
Pitch distance E mounting width	265	360	325	440
Distance F - circuit breaker in the Test position	40	40	40	40
Distance F - circuit breaker in the Disconnected position.	56	56	56	56

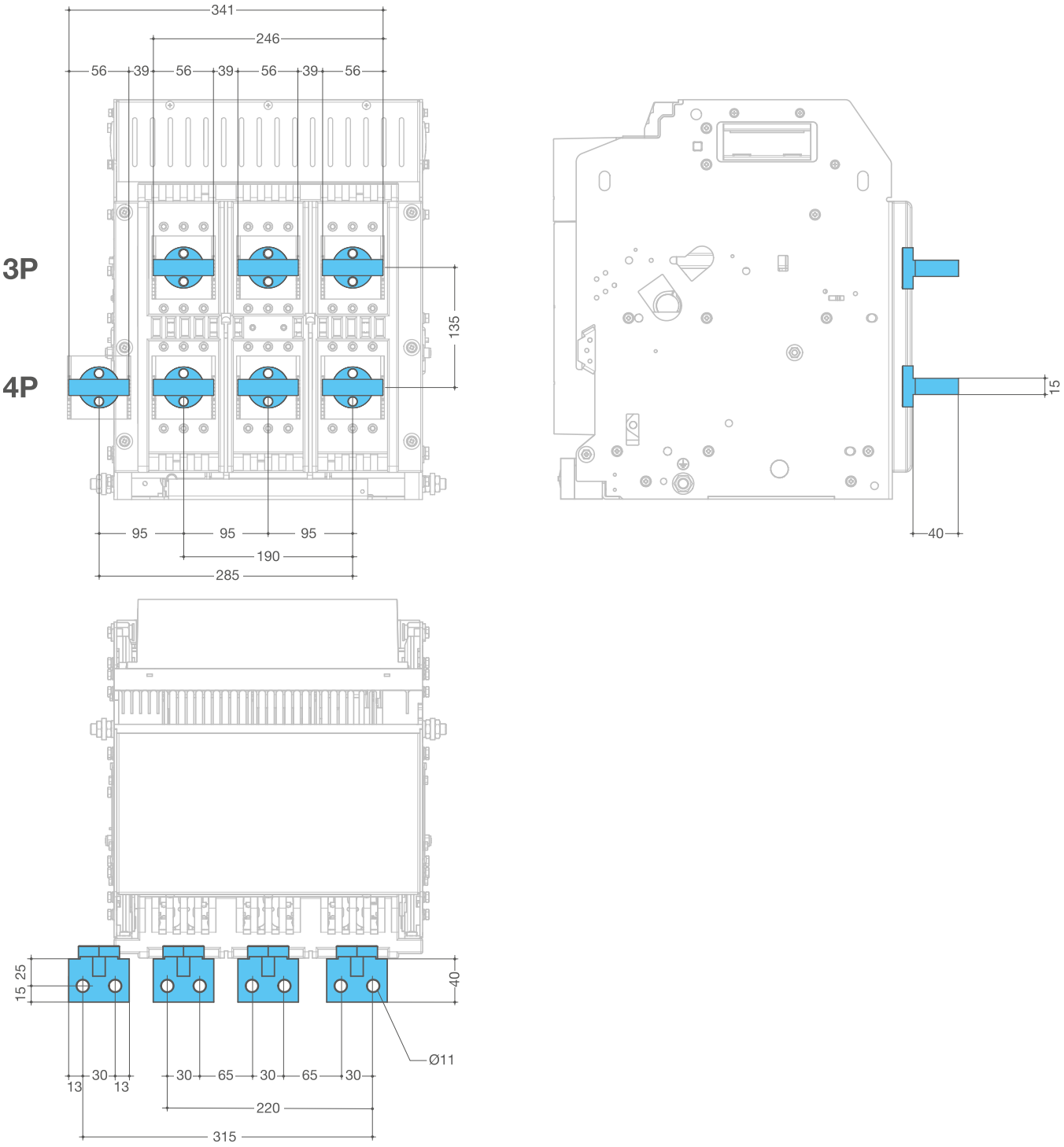


16.2 Connection dimensions

To connect an HWS2 circuit breaker, comply with the following connection dimensions. For more information on installing connections, refer to the instruction manuals 6LE009133A (630-2000A) and 6LE007869A.

HWS2 rear horizontal RC connections

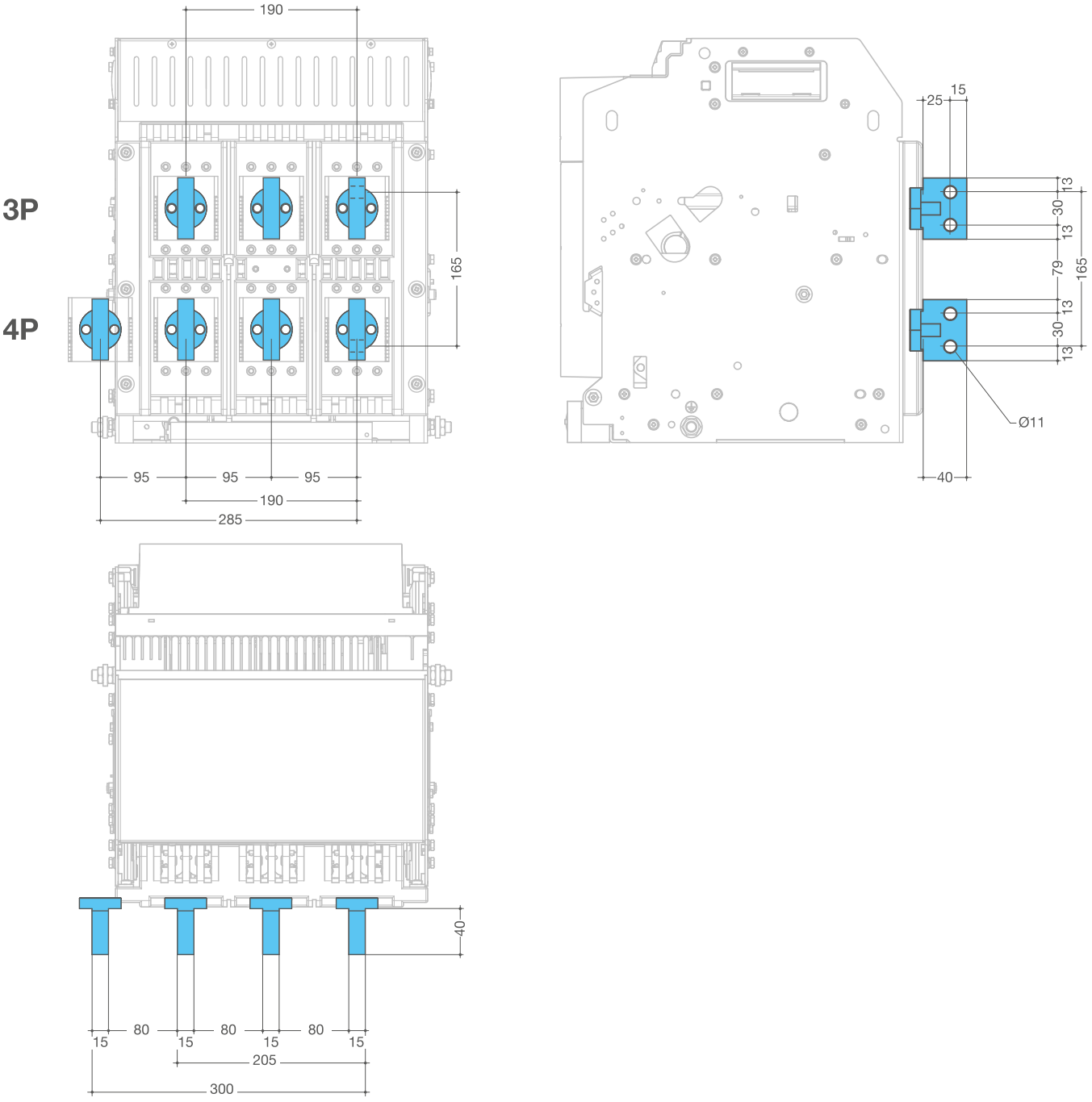
For fixed or drawout 3-pole or 4-pole version from 630 A to 2000 A.



The dimensions given are valid for the fixed and drawout versions.

HWS2 rear vertical RC connections

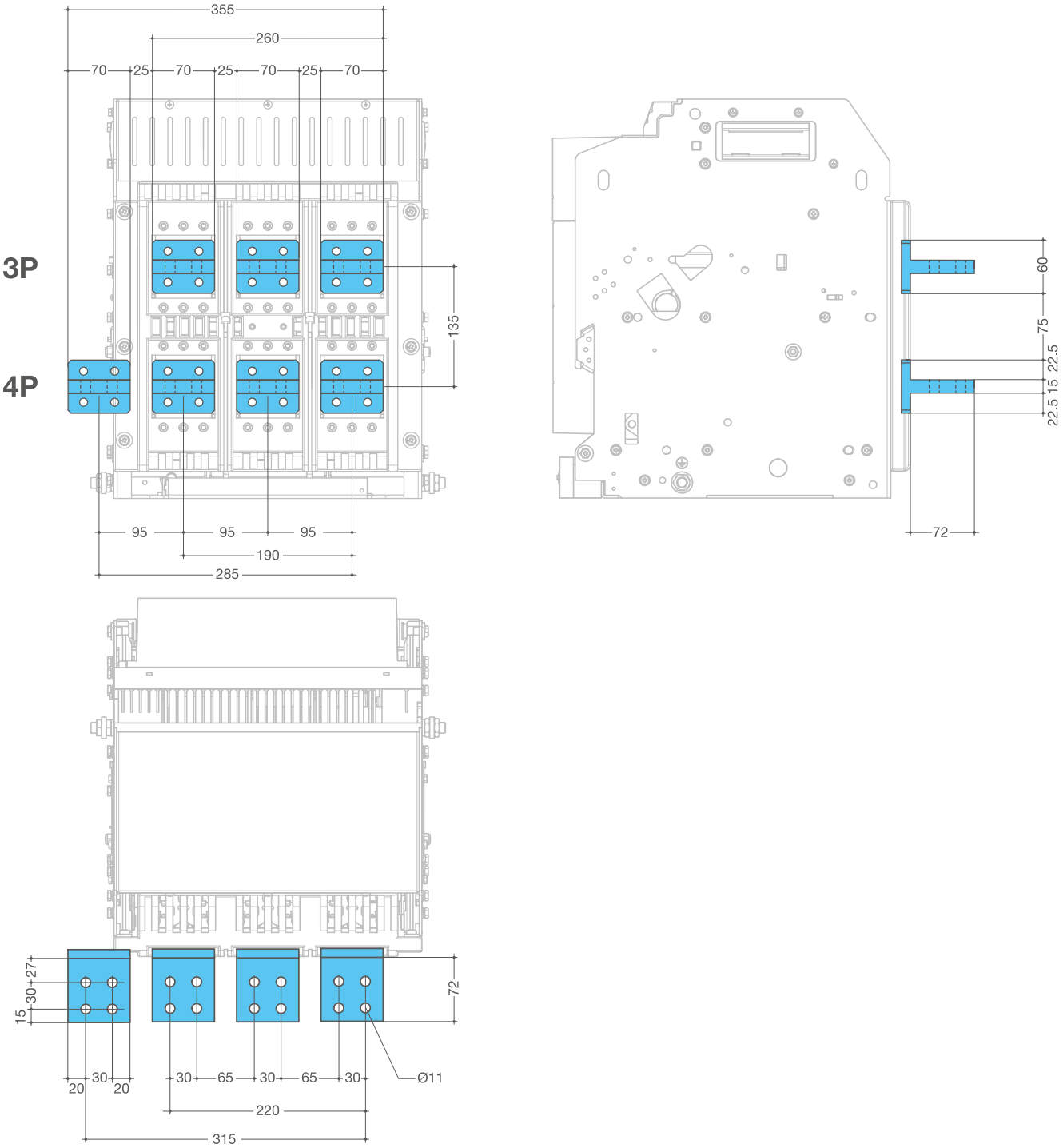
For fixed or drawout 3-pole or 4-pole version from 630 A to 2000 A.



The dimensions given are valid for the fixed and drawout versions.

HWS2 rear horizontal RC connections

For fixed or drawout 3-pole or 4-pole **switch-disconnector** version from 630 A to 2500 A.



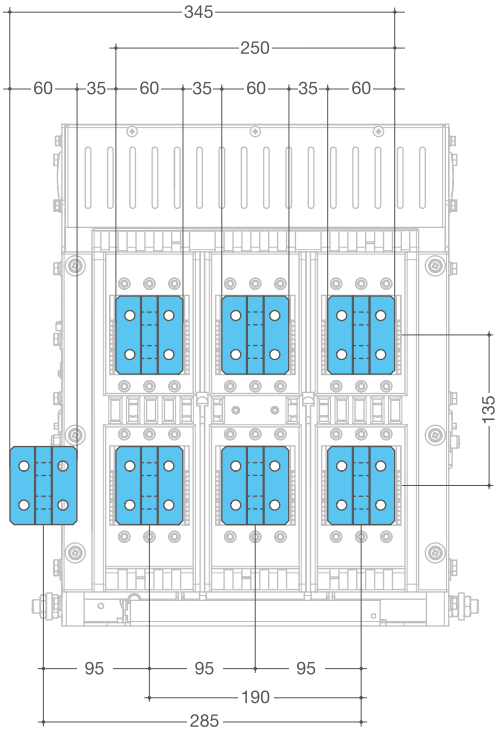
The dimensions given are valid for the fixed and drawout versions.

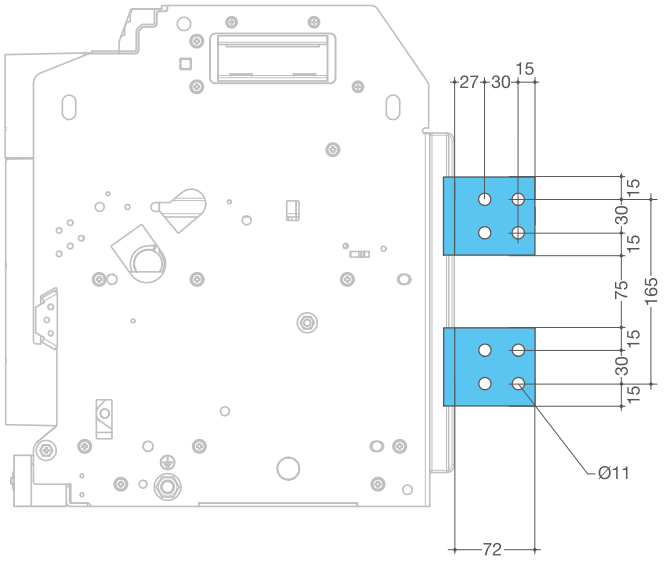
HWS2 rear vertical RC connections

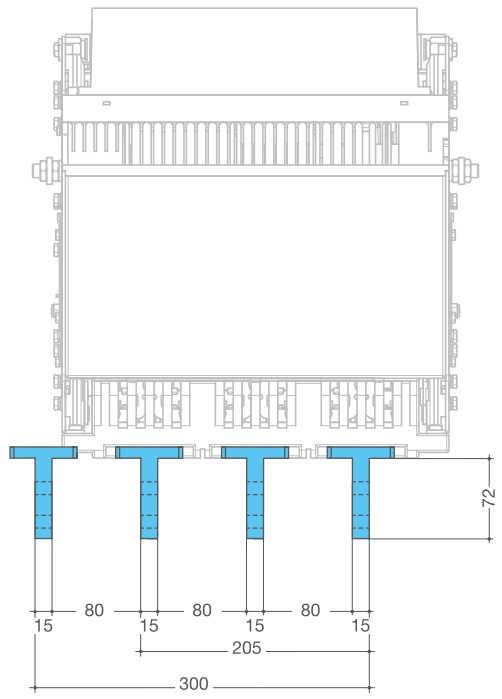
For fixed or drawout 3-pole or 4-pole switch-disconnector version from 630 A to 2500 A.

3P

4P





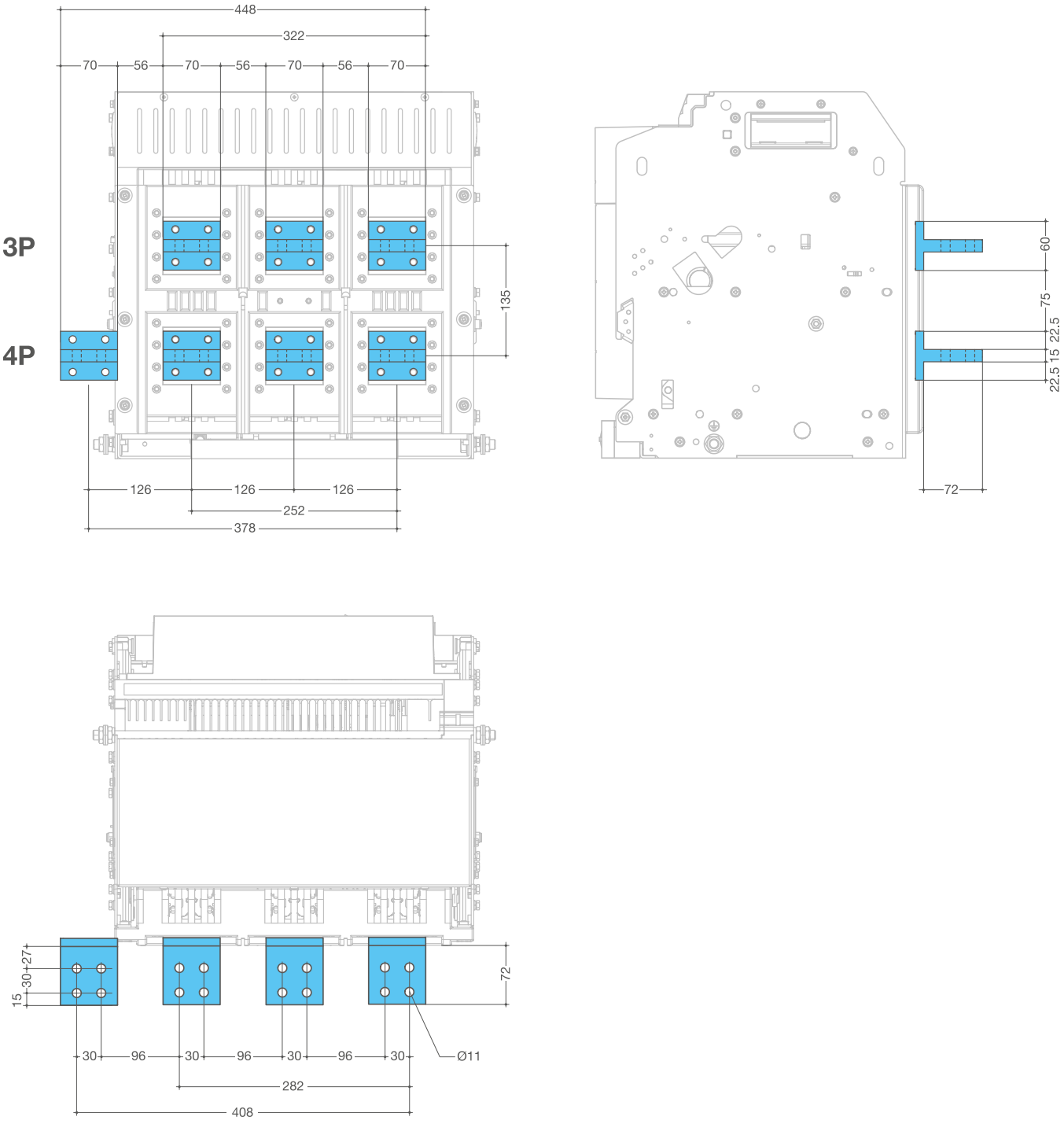


The dimensions given are valid for the fixed and drawout versions.

To connect an HWS4 circuit breaker, comply with the following connection dimensions. For further details on installing connections, refer to the instruction manual 6LE009122A.

HWS4 rear horizontal RC connections

For fixed or drawout 3-pole or 4-pole version from 2000 A to 3200 A.



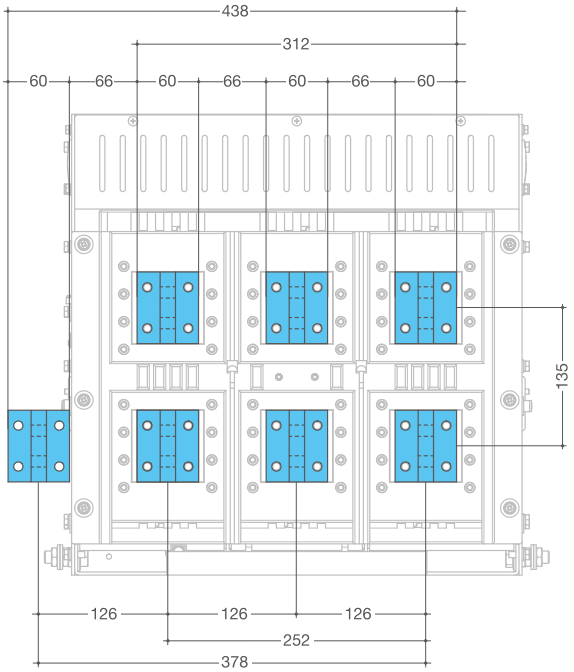
The dimensions given are valid for the fixed and drawout versions.

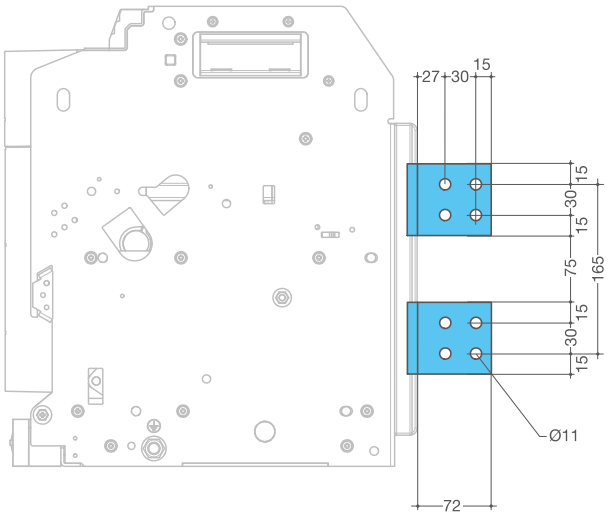
HWS4 rear vertical RC connections

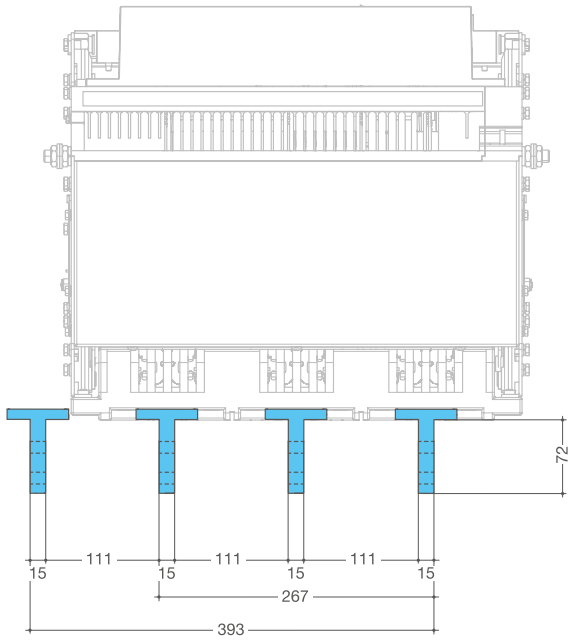
For fixed or drawout 3-pole or 4-pole version from 2000 A to 3200 A.

3P

4P



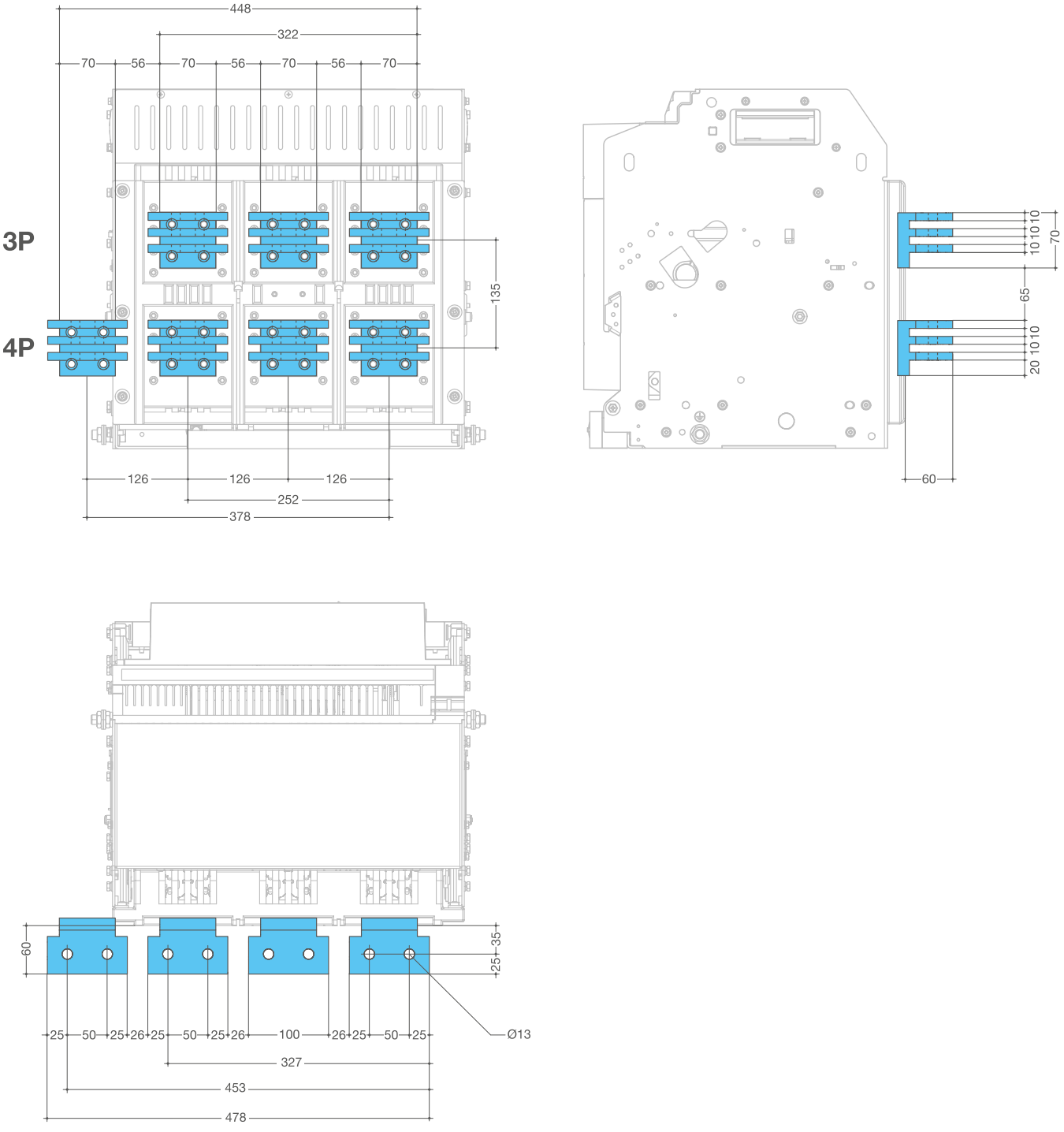




The dimensions given are valid for the fixed and drawout versions.

HWS4 rear horizontal RC connections

For fixed or drawout 3-pole or 4-pole version 4000 A.



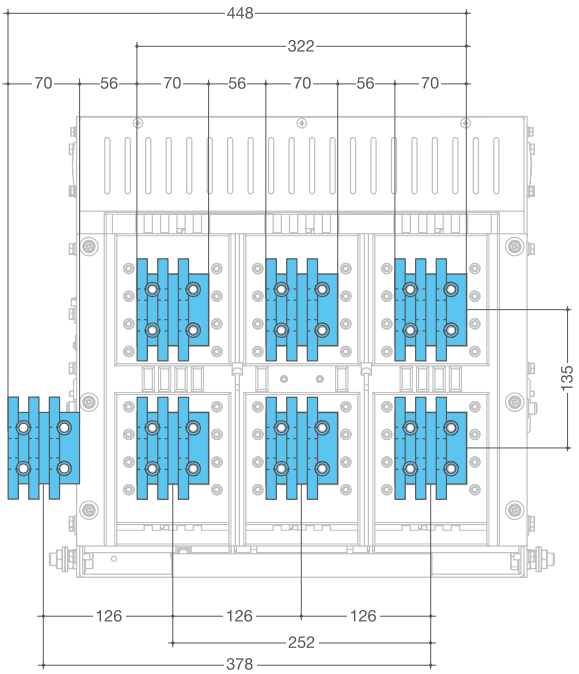
The dimensions given are valid for the fixed and drawout versions.

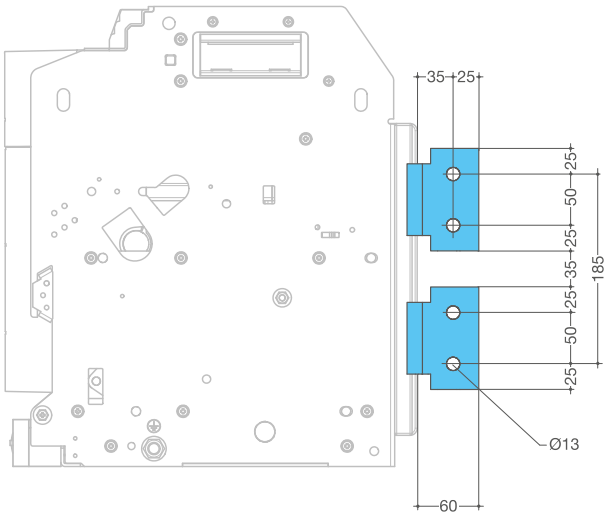
HWS4 rear vertical RC connections

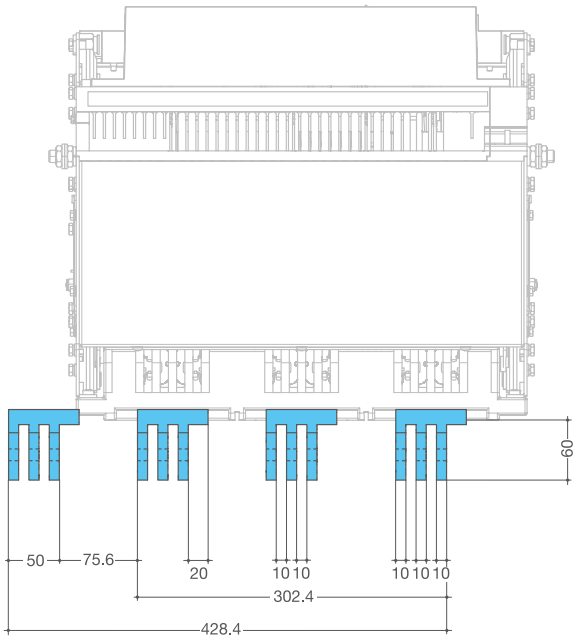
For fixed or drawout 3-pole or 4-pole version 4000 A.

3P

4P







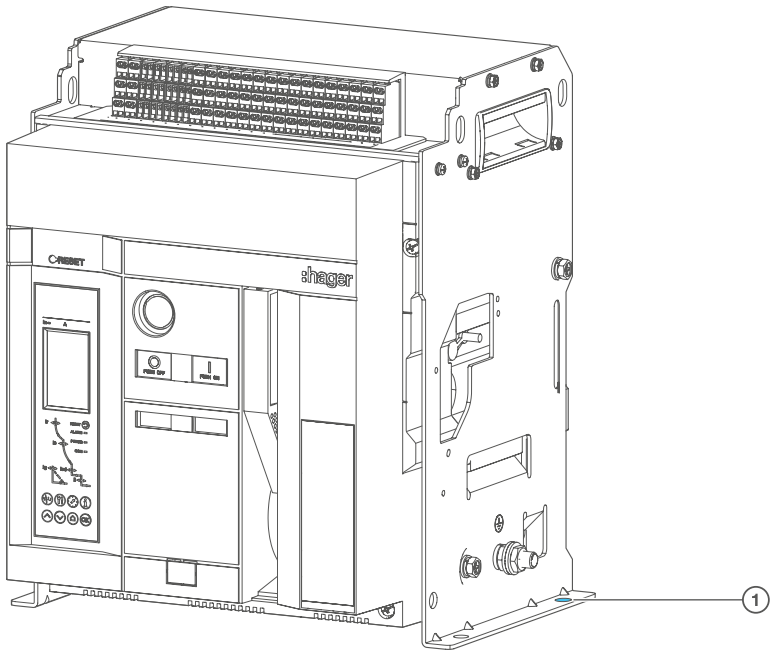
The dimensions given are valid for the fixed and drawout versions.

16.3 DF door flange cut-out

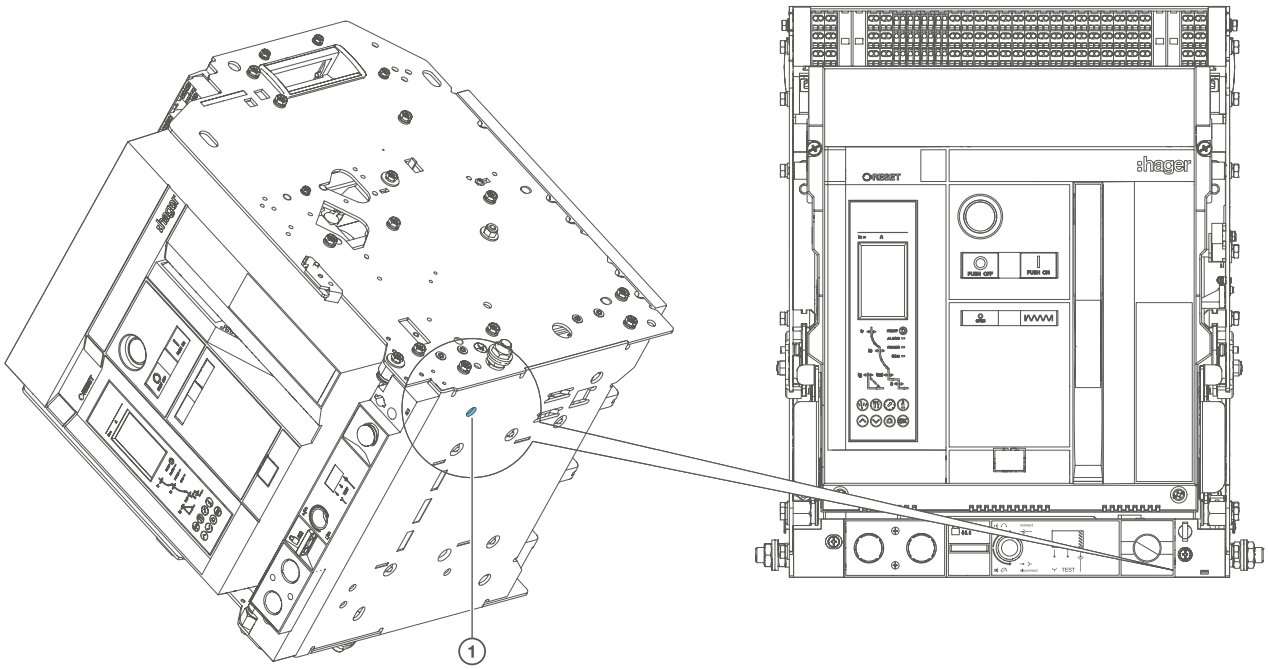
The door flange must be positioned in relation to the **reference point** between the circuit breaker and the distribution board door.

The **reference point** is one of the product's mounting holes.

Fixed 3-pole and 4-pole circuit breaker, mounted on a plate or mounting rails.



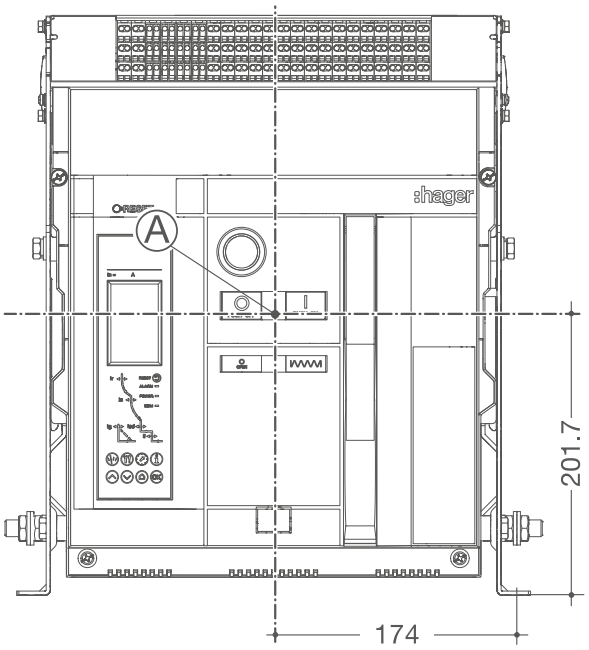
Drawout 3-pole and 4-pole circuit breaker, mounted on a plate or mounting rails.



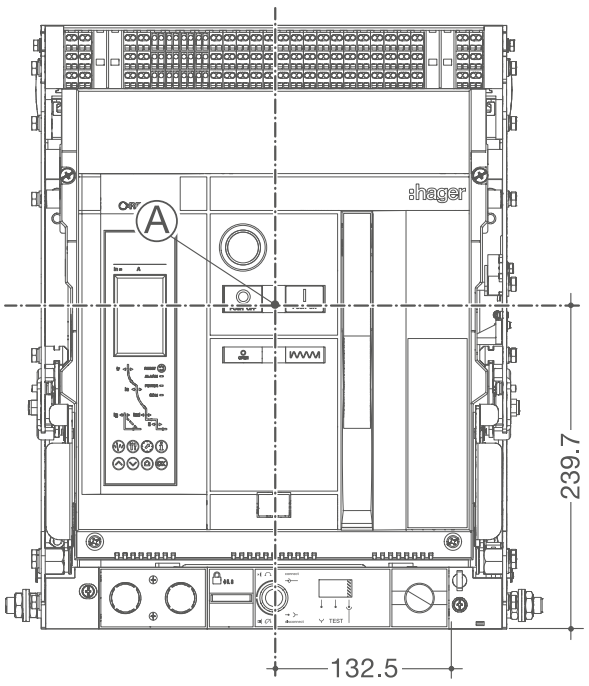
① Reference point

Comply with the following dimensions to install a door flange on an HWS2 circuit breaker:

Fixed 3-pole and 4-pole circuit breaker.

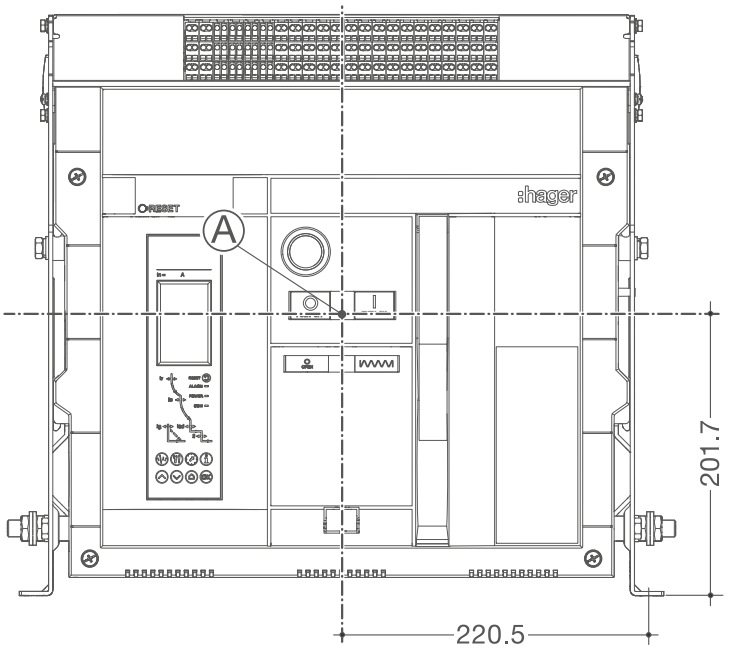


Drawout 3-pole and 4-pole circuit breaker.

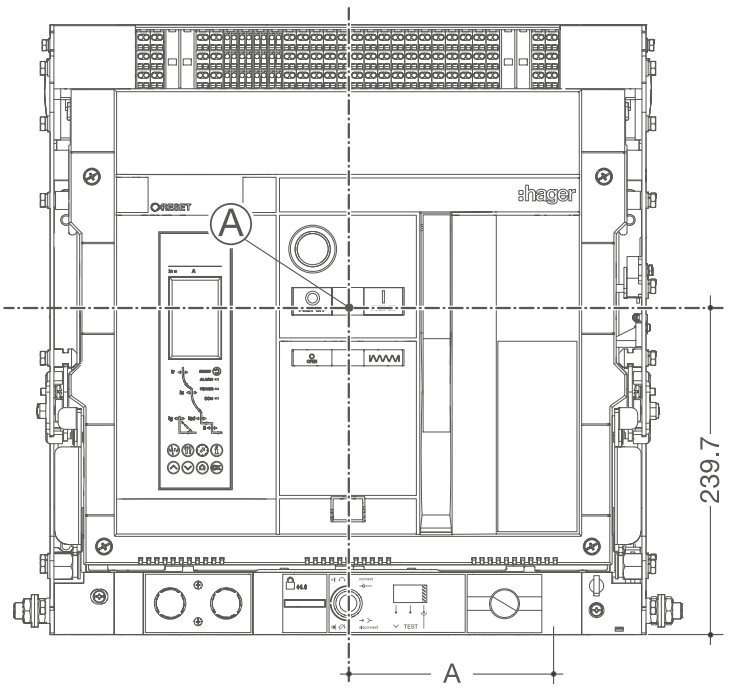


Comply with the following dimensions to install a door flange on an HWS4 circuit breaker:

Fixed 3-pole and 4-pole circuit breaker.



Drawout 3-pole and 4-pole circuit breaker.

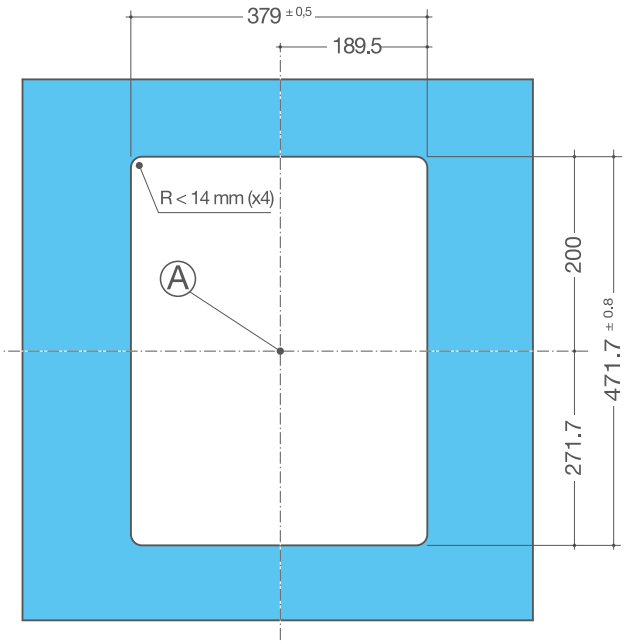


	A
3P	162.5
4P	157

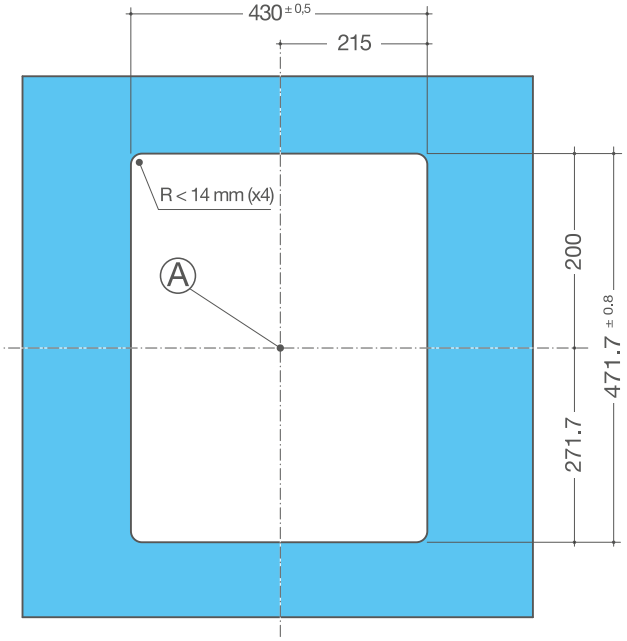
DF door flange

Provide a cut-out with the following dimensions in the distribution board door to install the DF door flange.

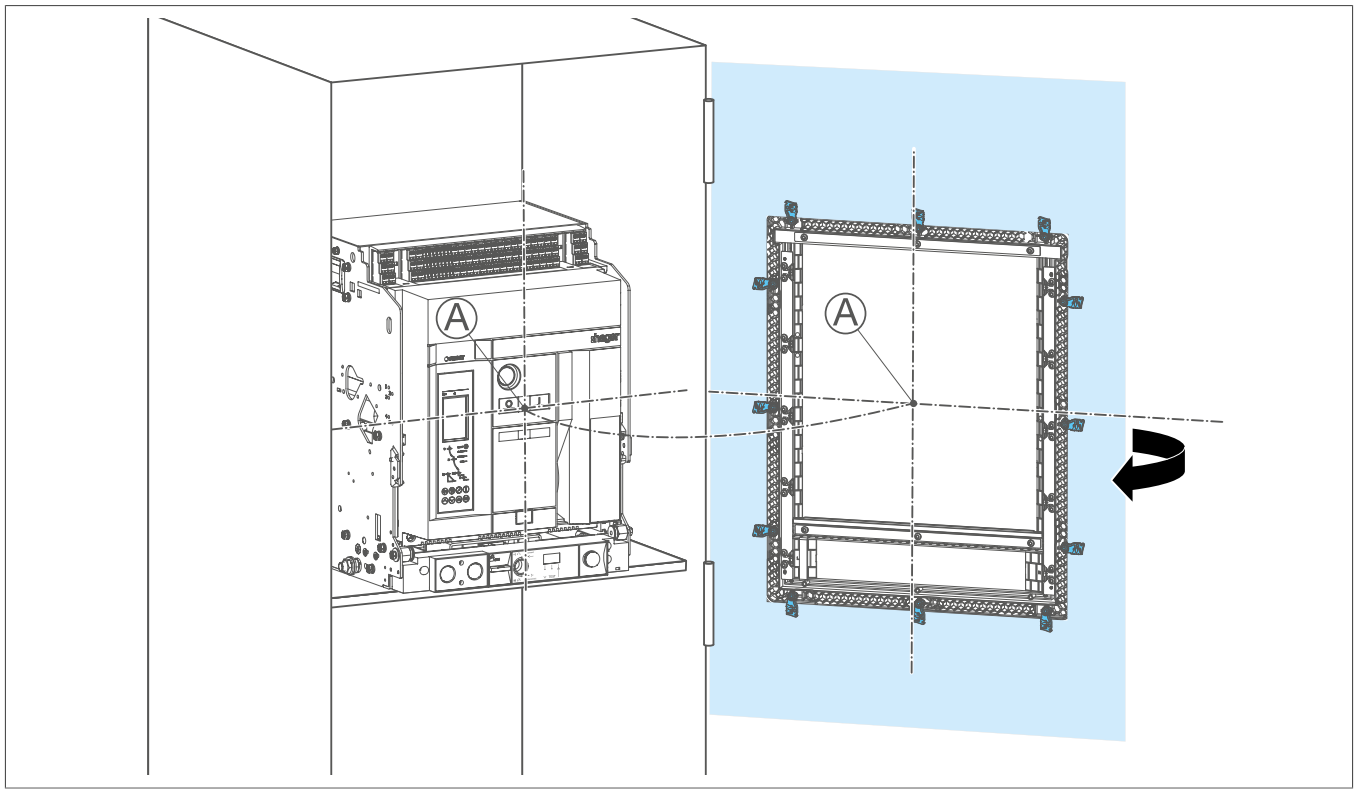
Fixed or drawout HWS2 air circuit breaker.



Fixed or drawout HWS4 air circuit breaker.



Align the centre A of the circuit breaker with the centre A of the door flange.



Information

For more information on installing the DF door flange, refer to the instruction manual 6LE007882A for HWS2 circuit breakers and instruction manual 6LE009126A for HWS4 circuit breakers.

17 Safety clearances to respect

Warning

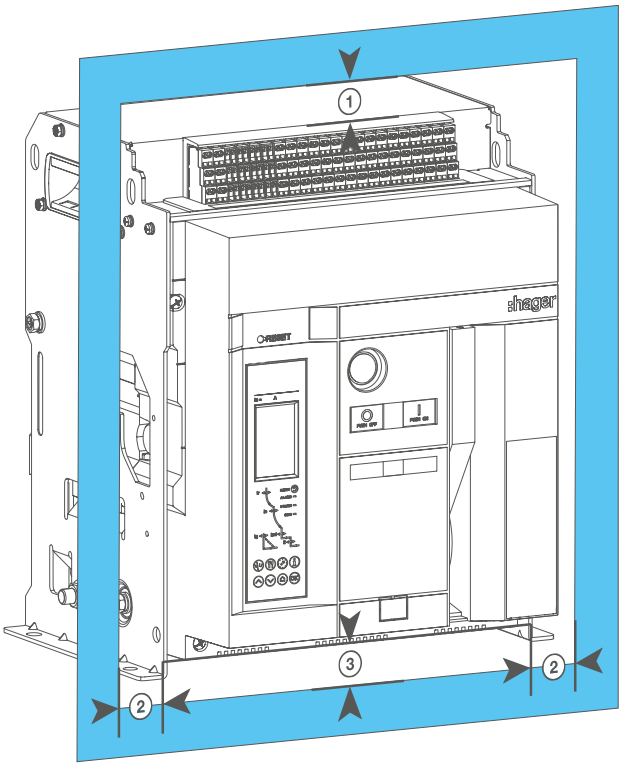
Risk of electric shock.

Danger to life, risk of injury due to electric shock, or risk of serious injury.

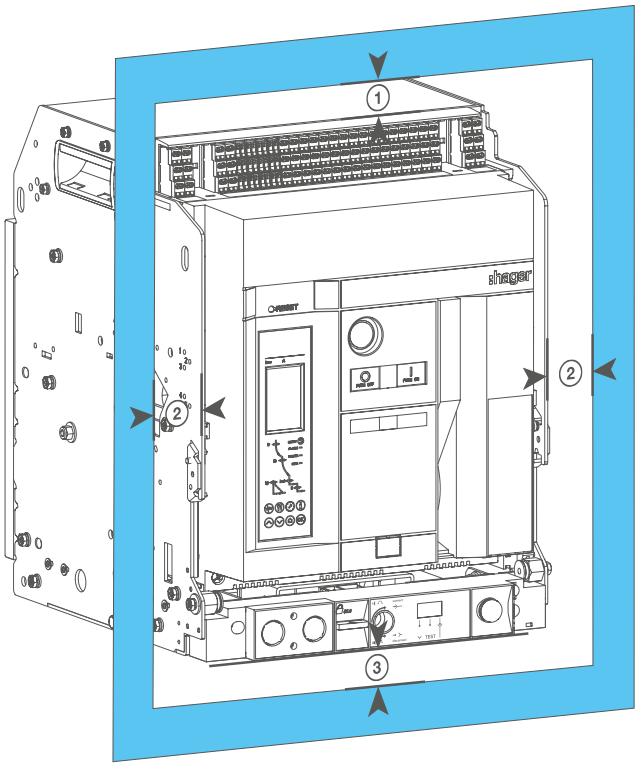
Make sure that the device is only operated by qualified personnel in accordance with the installation standards in force in the relevant country.

To ensure the safety of people and the installation, comply with the following safety clearances:

Fixed circuit breaker



Drawout circuit breaker



Air circuit breaker	Distance	Insulating material	Metallic material	Circuit breaker live (mm)
Fixed	1	0	0	0
	2	0	0	60
	3	0	0	0
Withdrawable	1	0	0	0
	2	0	0	60
	3	0	0	0

18 Installation

18.1 Prerequisites

Danger

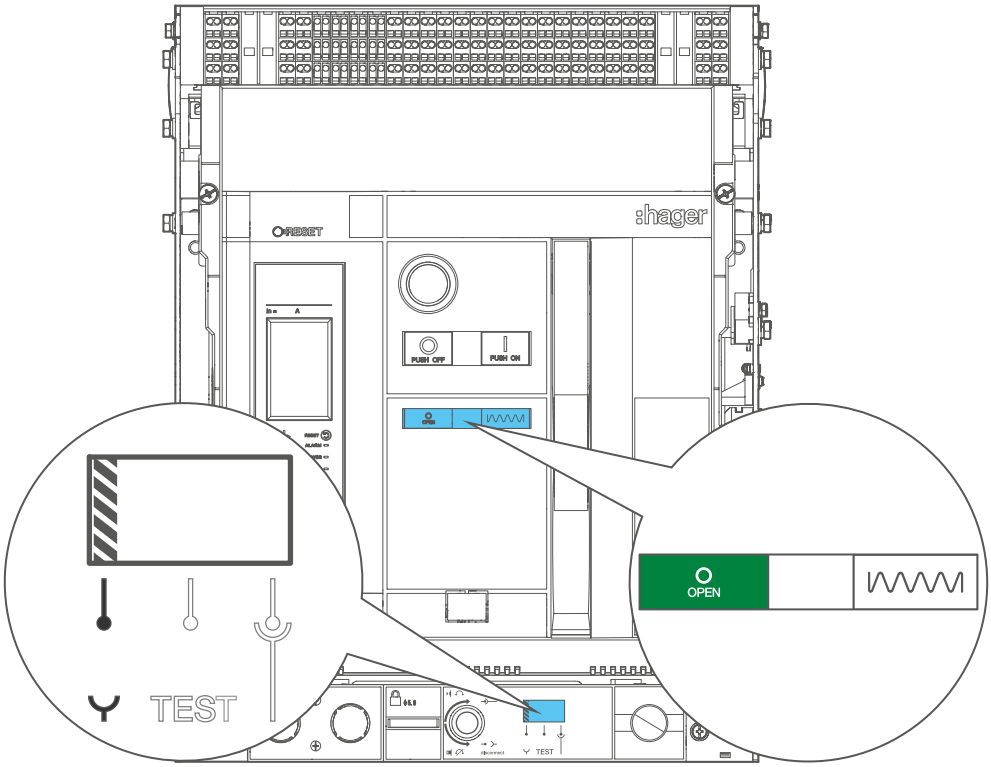
Risk of electric shock, electrocution or electric arc.

Danger to life, risk of injury due to electric shock, or risk of serious injury.

Ensure that the device is only installed by qualified personnel in accordance with the installation standards in force in the relevant country and that they are equipped with personal protective equipment (PPE).

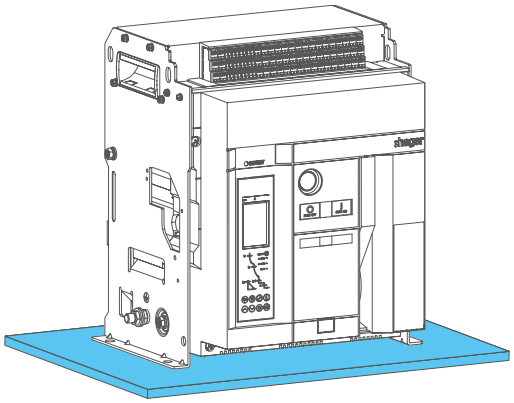
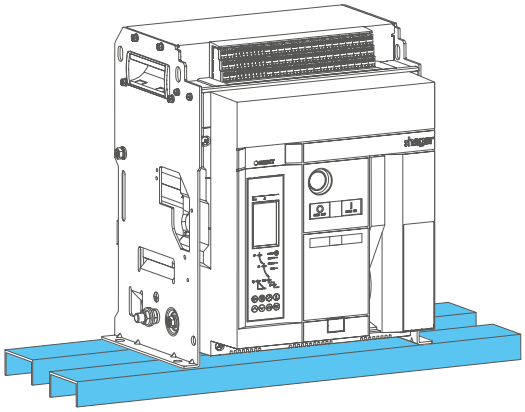
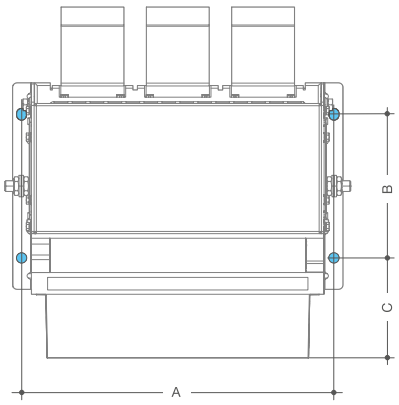
Before installing, ensure that:

- All the circuit breaker's power supplies are cut off,
- the circuit breaker is open, the spring is discharged and in the Disconnected position.

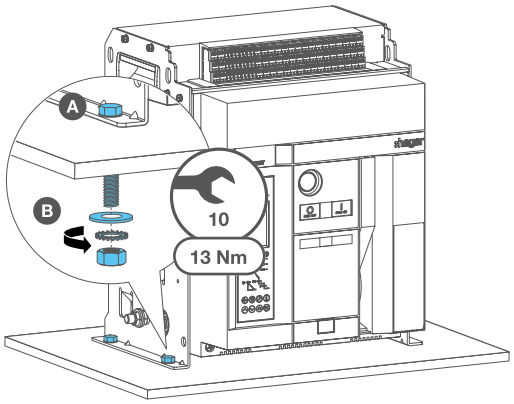
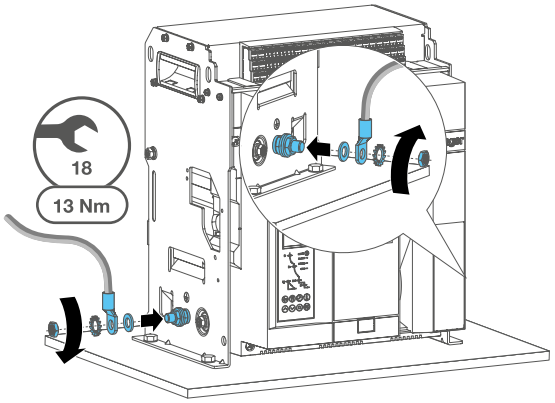


18.2 Mounting of fixed circuit breakers

To mount a fixed circuit breaker on a horizontal support, proceed as follows:

	Action	Illustration
1	Be sure to mount the circuit breaker on a plate with sufficient resistance, or on mounting brackets that are stable enough.	 
2	❶ Identify at least 4 mounting holes (2 on each side) for the 3-pole or 4-pole circuit breakers, complying with the following dimensions. ❷ Drill the fastening holes (Ø mini 6.5 mm).	

Dimensions (in mm)	HWS2		HWS4	
	3-pole	4-pole	3-pole	4-pole
A	348	443	441	567
B	160	160	160	160
C	111	111	111	111

	Action	Illustration
3	Mount the circuit breaker using M6 screws.	
4	If the plate is not earthed, connect an earthing conductor to each side of the mounting plate using an M10 screw. It is recommended that an earthing conductor with a cross-section of 16 mm^2 be used.	

18.3 Mounting drawout circuit breakers

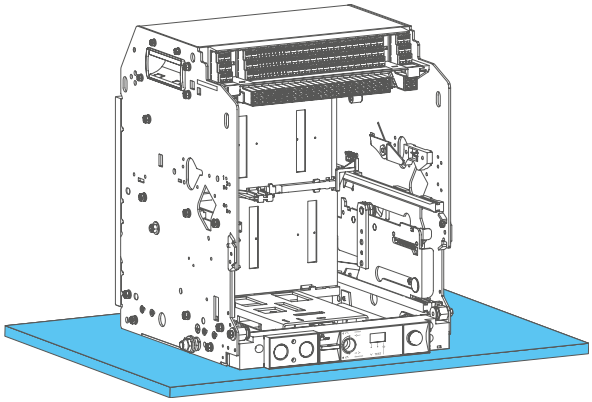
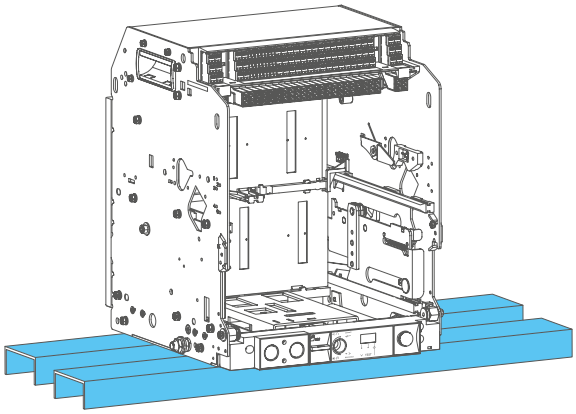
Notice

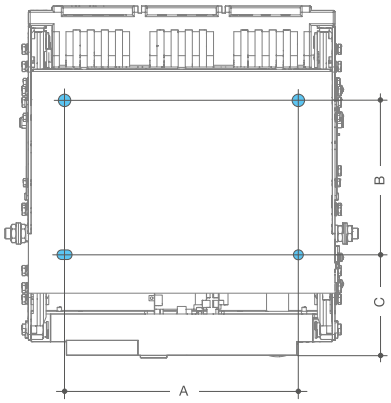
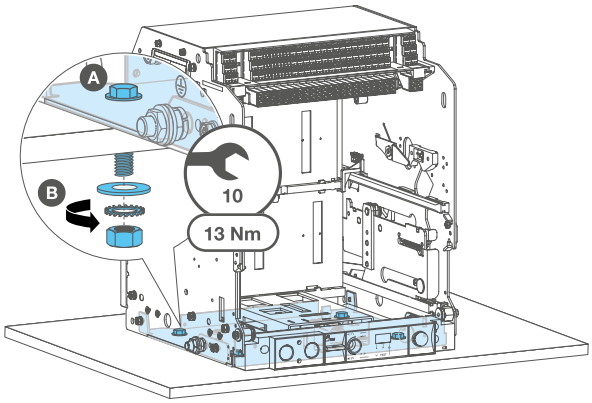
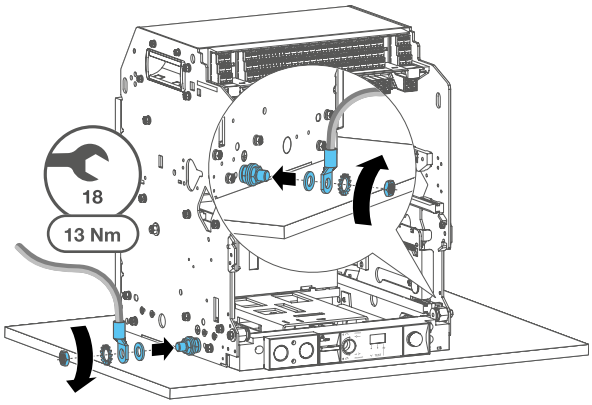
Risk of circuit breaker falling.
Risk of mechanical damage.
Always secure the chassis before inserting or removing the circuit breaker.

Danger

Risk of circuit breaker falling.
Risk of crushing injury.
Always secure the chassis before inserting or removing the circuit breaker.

To mount the chassis of a drawout circuit breaker, proceed as follows:

	Action	Illustration
1	The circuit breaker must first be removed from the chassis see Chapter 10, Removing the drawout circuit breaker . Be sure to mount the chassis on a mounting plate that is strong enough, or on mounting brackets that are stable enough.	 

	Action	Illustration
2	❶ Identify at least 4 mounting holes (2 on each side) for the HWS2 and HWS4 3-pole or 4-pole circuit breakers, complying with the following dimensions. ❷ Drill the fastening holes (Ø mini 6.5 mm).	
3	Mount the circuit breaker using M6 screws.	
4	If the plate is not earthed, connect an earthing conductor to each side of the mounting plate using an M10 screw. It is recommended that an earthing conductor with a cross-section of 16 mm² be used.	

Dimensions (in mm)	HWS2		HWS4	
	3-pole	4-pole	3-pole	4-pole
A	265	360	325	440
B	175	175	175	175
C	121	121	121	121

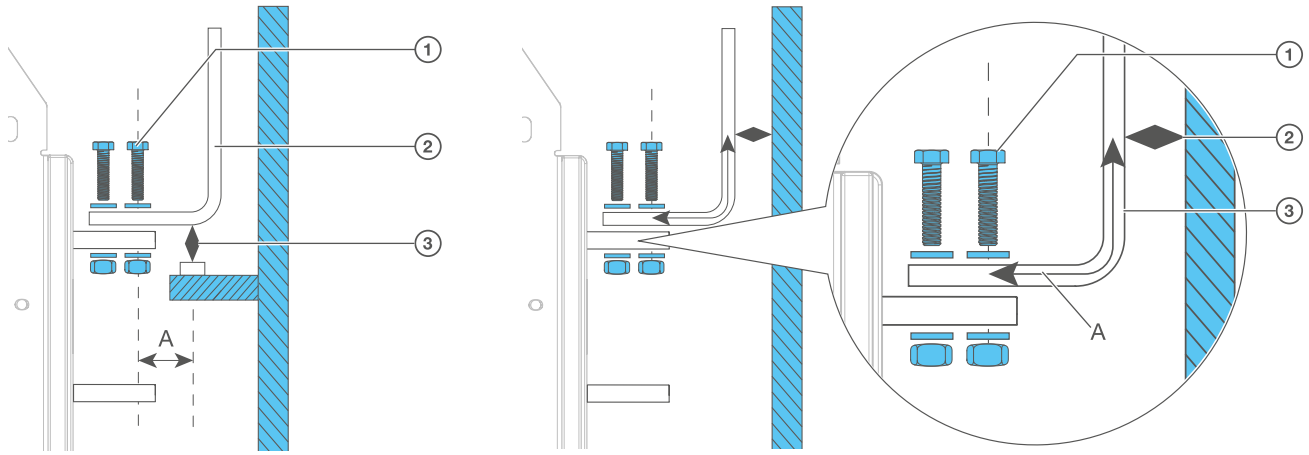
18.4 Connecting the connecting bars

Notice

risk of mechanical damage.
The connecting bars must be shaped and positioned so that they are perfectly adapted to the rear sockets before tightening using bolts. The connecting bars must be resting on a support attached to the electrical cabinet, not directly on the rear sockets.

If a short circuit occurs, the deformation of the connecting bars must not damage the fastening of the rear connections. To ensure this, one of the connecting bar supports should be used at maximum distance, according to the short-circuit currents as indicated below:

Presumed short circuit current (kA)	Distance A (mm)
55	300
66	250
85	150

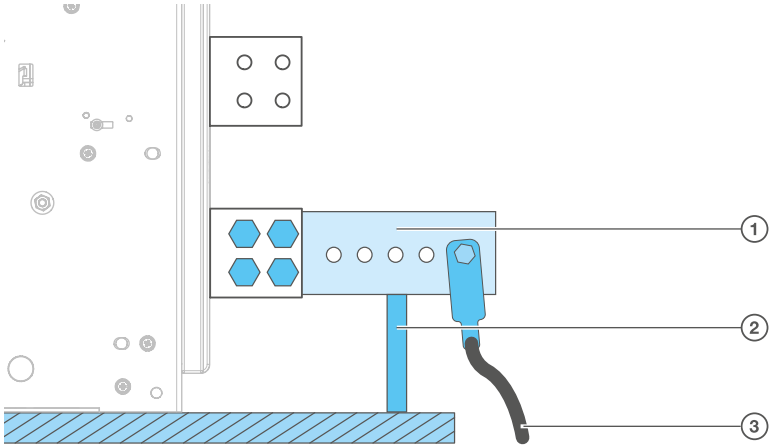


1 Pull stud
2 Connecting bar
3 Connecting bars holder

18.5 Connecting the cable connections

Notice

Risk of mechanical damage.
The connecting cables must be fastened to the electrical cabinet to avoid dragging on the rear connections. Cable retaining bars are indicated for this. If necessary, extend the rear sockets using terminal extensions for cables, then connect them to the cable connections.



1. Cable lug adapters
2. Connection cable support
3. Connection cable

Information
Hager does not provide either the lug adapters or the retaining bars for cables. To implement these parts, refer to Chapter 16, Mounting dimensions

18.6 Installation of protection accessories

For the installation of protection accessories, refer to the following instruction manuals:

Accessories	Instructions
IB interphase barrier	6LE007870A
HWS2 DF Door flange	6LE007882A
HWS4 DF Door flange	6LE009126A
Terminal block protection cover	6LE089877A

IB interphase barrier

The interphase barriers (see Chapter 4, Description of the chassis and its accessories) are safety accessories designed to strengthen the isolation between the phases at the rear connections.

Information
The use of interphase barriers is mandatory for supply voltages over 500 V AC.

DF door flange

The door flange see Chapter 4, Description of the chassis and its accessories) is fitted on the cut-out in the electrical cabinet door and raises the protection class to IP20. It is used for a fixed or drawout circuit breaker.

Terminal block protection cover

The cover (see Chapter 4, Description of the chassis and its accessories) offers protection and prevents accidental access to the terminal blocks.

18.7 Connection of accessories and auxiliary equipment

For the installation of accessories and auxiliaries, refer to the following instructions:

Accessories	Instructions
TB Terminal blocks	6LE089879A

TB Terminal blocks

TB terminal blocks (see Chapter 4, Description of the chassis and its accessories) are used to connect to the various circuit breaker accessories and auxiliary equipment. For a pre-configured circuit breaker, all the accessories, including TB terminal blocks, are delivered pre-fitted. If TB terminal blocks are replaced, they must be purchased separately. Care must then be taken to ensure they are fitted in the right place.

18.8 Connecting the digital output contacts

The HWS2 and HWS4 circuit breakers have 3 digital output contacts. These contacts can be assigned to an alarm, tripping or operating event (see Chapter 19.14, Using the interface of the trip unit with display).
The digital output contacts 1, 2 and 3 are available on a circuit breaker equipped with a type H trip unit. A circuit breaker equipped with a type A trip unit only has the digital output contact 1.

Digital output contacts wiring diagram

Information

The digital output contacts are acknowledged when resetting the trip screens on the trip unit.

18.9 Connecting the ZSI input and output contacts

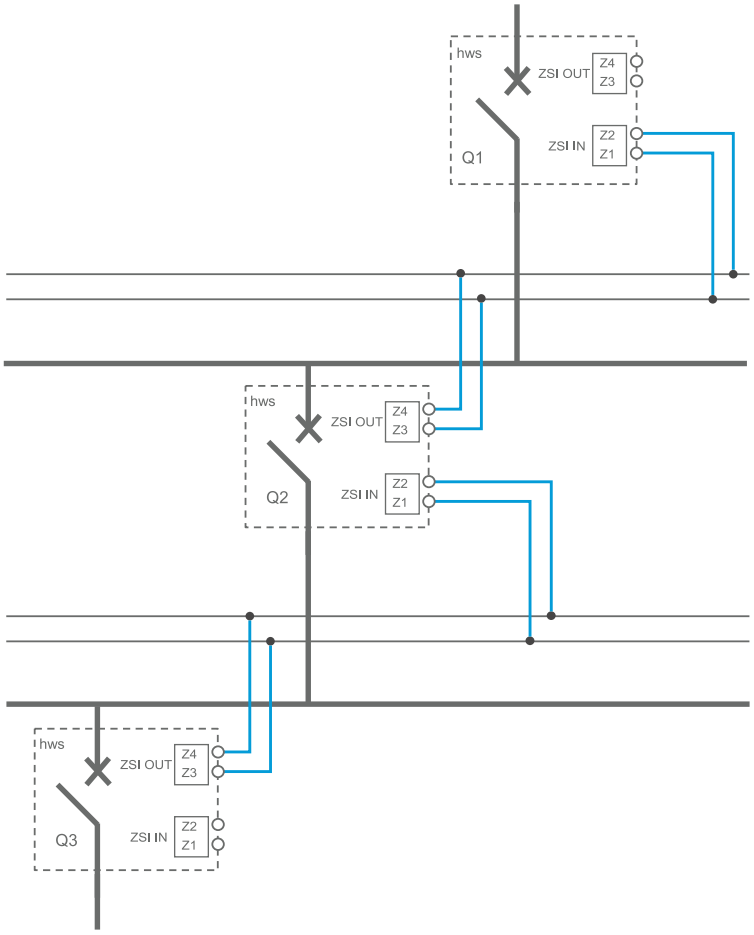
The Zone Selective Interlocking (ZSI) function is designed to limit the electro-dynamic constraints on the installation in case of a short circuit fault or earth fault.

The devices, conductors, busbars and busbar insulation and can thus benefit from this limitation.

The installed circuit breakers are linked together by cable to determine which circuit breaker should trip first. If an electrical fault appears between two linked circuit breakers connected together by the ZSI function, the downstream circuit breaker is unable to clear it. Thanks to zone selectivity, the circuit breaker upstream of the fault trips without waiting till the end of its time delay.

For zone selectivity to work correctly, the ZSI IN and ZSI OUT terminal blocks of all circuit breakers must be connected together among themselves. It is also necessary to install one or more connection terminal blocks inside the electrical cabinet to allow the connection between several circuit breakers connected to the same upstream circuit breaker.

ZSI inputs and outputs wiring diagram



Information

For more information on the ZSI function, refer to chapter 19.9 "Zone Selective Interlocking function (ZSI)".

For zone selectivity on the Short Time Delay and/or the earth-fault protection:

- Connection to downstream circuit breakers:
  – Z1/Z2: ZSI IN
- Connection to the upstream circuit breaker:
  – Z3/Z4: ZSI OUT

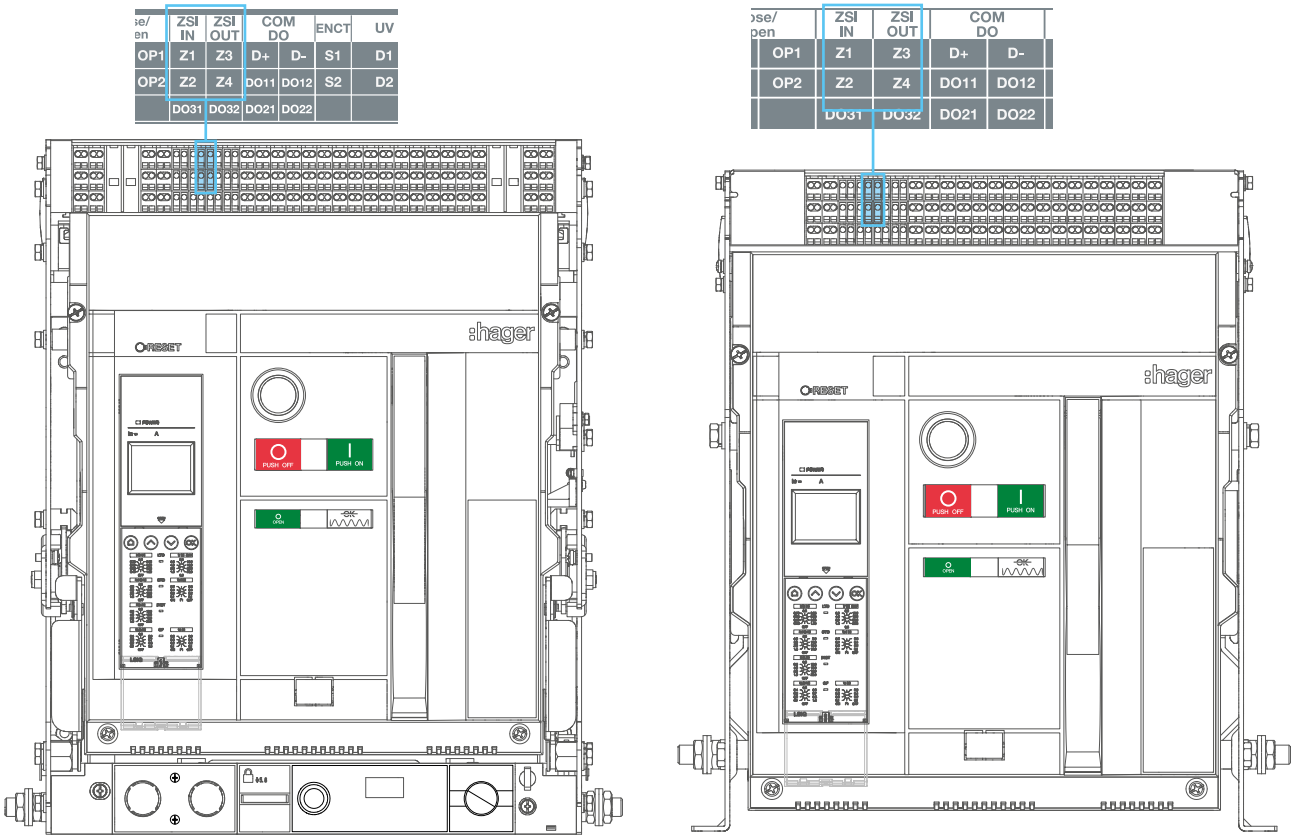
Connection of ZSI protection

hws circuit breakers have 4 ZSI terminal blocks enabling the upstream or downstream circuit breakers to be connected to deploy zone selectivity (ZSI).

Type of connection	Total number of circuit breakers	Max. distance between 2 circuit breakers
Upstream	10	300 m [1]
Downstream	100	300 m [1]

[1] Recommended connection cable: 1 to 1.5 mm² shielded twisted cable

On fixed or drawout circuit breakers, the ZSI input and output contacts are marked by the following terminal blocks:



18.10 Installation of the control accessories

For installation of control accessories, refer to the following manuals:

Accessories	Instructions
Coils	6LE089872A
MO charging motor	6LE089871A

Coils

Three types of coils (see Chapter 3, Description of the circuit breaker accessories) can be installed in the dedicated positions behind the front cover of the circuit breaker:

– SH shunt trip coil.
– CC closing coil.
– UV undervoltage release coil.

MO charging motor

The MO charging motor (see Chapter 3, Description of the circuit breaker accessories) is positioned on the right side of the charging handle and automatically charges the spring after each time the circuit breaker closes.

18.11 Installation of the signalling accessories

For installation of the signalling accessories, refer to the following manuals:

Accessories	Instructions
PS Position contact	6LE089970A
AX Auxiliary Contact	6LE089870A
RTC Ready-to-Close contact	6LE089878A
CYC Operation Cycle Counter	6LE007868A
FS Fault trip contact	Installed as standard on all products

PS Position contact

This contact indicates the connected, test orDisconnected position of the circuit breaker in its chassis (see Chapter 3, Description of the circuit breaker accessories).

AX Auxiliary Contact

The auxiliary contacts (see Chapter 3, Description of the circuit breaker accessories)indicate the open or closed position of the circuit breaker power contacts.
A block of 4 NO and 4 NC auxiliary contacts, are fitted as standard (AX1 to AX4) on HWS2 and HWS4 circuit breakers.
It can be replaced by a block of 6 NO and 6 NC auxiliary contacts (AX1 to AX6).

Information

If an RTC Ready-to-Close contact is connected, the AX6 auxiliary contact cannot be wired.

RTC Ready-to-Close contact

The Ready-to-Close contact (see Chapter 3, Description of the circuit breaker accessories) gives the information that the circuit breaker is ready to be closed.

Information

If an AX6 auxiliary contact is connected, the RTC Ready-to-Close contact cannot be wired.

CYC Operation Cycle Counter

The cycle counter (see Chapter 3, Description of the circuit breaker accessories) shows the number of ON-OFF operations completed by the circuit breaker.

FS Fault trip contact

The trip unit's fault trip contact (see Chapter 3, Description of the circuit breaker accessories) is used to remotely signal information about the tripped status of the circuit breaker.

18.12 Installation of the neutral protection accessories

For the installation of neutral protection accessories, refer to the following manuals:

Accessories	Instructions
External neutral current sensor ENCT HWS2 630-1600A	6LE089874A
External neutral current sensor ENCT HWS2 2000A	6LE089875A
External neutral current sensor ENCT HWS4 4000A	6LE089876A

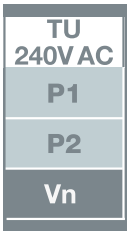
External neutral current sensor ENCT

The ENCT external neutral current sensor (see Chapter 4, Description of the chassis and its accessories) allows the circuit breaker to provide neutral protection on a 3-pole circuit breaker in a TN earthing system.
It is installed on the neutral distribution bar generally located on the left of the circuit breaker. It must be connected to the terminal blocks marked ENCT S1 and S2.

Information

Terminal block Vn

If the 3-pole circuit breaker is equipped with the type H trip unit, it is also necessary to connect the Vn terminal to the neutral potential.
This connection is essential to obtain correct measurement of phase-neutral voltages V1N, V2N, V3N, powers per phase and for operation of the advanced protections against active power feedback and undervoltage or overvoltage.



18.13 Installation of the interlocking accessories

For installation of the interlocking accessories, refer to the following instruction manuals:

Accessories	Instructions
PBC Push-button cover	6LE007871A
Locking the circuit breaker in OFF by OLK key lock	6LE089873A
WIP wrong insertion preventer chassis / circuit breaker	6LE007878A
Locking the position of the circuit breaker in its chassis using CL key locks	6LE007877A
MI mechanical interlock	6LE007624A Fixed Type 2S
	6LE007625A Fixed Type 3C
	6LE008127A Fixed Type 3S/3Sx
	6LE008138A Drawout Type 2S
	6LE008142A Drawout Type 3C
	6LE008140A Drawout Type 3S/3Sx
	6LE009728A Interlock 3 Circuit Breakers Type 3S + 3SX
	6LE009729A Interlock 3 Circuit Breakers Type 3C
RI open door racking interlock	6LE007874A

PBC Push-button cover

The closing PUSH ON and opening PUSH OFF push buttons can be locked against any operation using the PBC push button covers (see Chapter 3, Description of the circuit breaker accessories).
It prevents any inadvertent or unauthorised operations.

Information

For more information on operation, refer to chapter 23.5 "Locking the opening and closing push buttons".

Locking the circuit breaker in OFF by OLK key lock

This locking device prevents the circuit breaker from closing using a key lock (see Chapter 3, Description of the circuit breaker accessories).

Information

For more information on operation, refer to chapter Chapter 23.6, Interlocking of the circuit breaker using a lock .

WIP wrong insertion preventer chassis / circuit breaker

The WIP wrong insertion preventer is used when several circuit breakers of the same model are installed in an electrical panel and are configured differently. To prevent any confusion, all the circuit breakers and their chassis must be coded in such a way that each circuit breaker can be racked in its corresponding chassis.

It is composed of screws and pins which must be installed on the chassis and circuit breaker in one of the following 10 combinations:

Chassis	Air circuit breaker
123	DE
124	CE
125	CD
134	BE
135	BD

Chassis	Air circuit breaker
145	BC
234	AE
235	AD
245	AC
345	AB

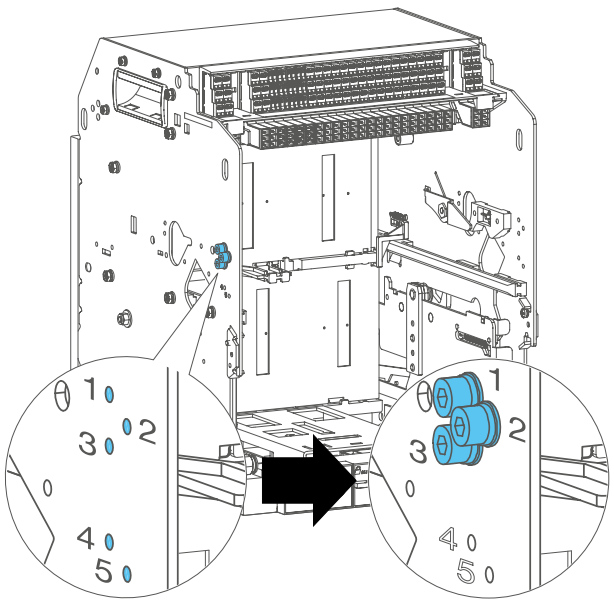
The combination chosen on the chassis must correspond to the combination of the circuit breaker in order for the 2 parts to be compatible.

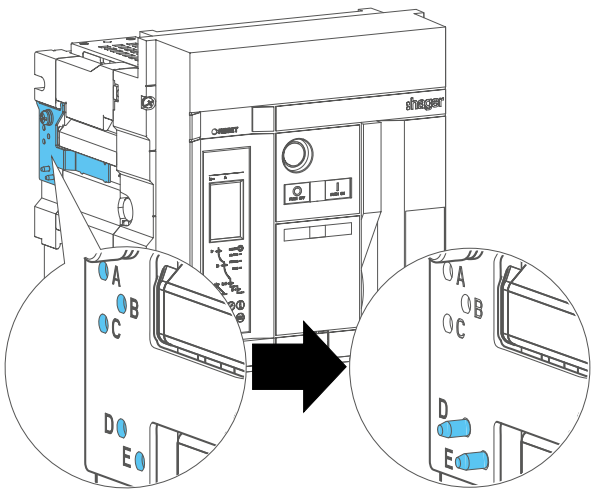
On the chassis side, the wrong insertion preventer is numbered 1 to 5.

On the circuit breaker side, the wrong insertion preventers are marked A to D.

Example of installation with the combinations 123 and DE:

Chassis	Air circuit breaker
123	DE





Locking the position of the circuit breaker in its chassis using CL key locks

This locking device locks the circuit breaker in the chassis and prevents the racking handle from being inserted (see Chapter 4, Description of the chassis and its accessories).

Information

For more information on operation, refer to chapter 23.8 "Locking the chassis using key-locks".

MI mechanical interlock

The mechanical interlocking kit is used to interlock 2 to 3 circuit breakers installed vertically or horizontally in the electrical cabinet (see Chapter 4, Description of the chassis and its accessories).

Information

For more information on operation, refer to chapter 23.11 "Mechanical interlock".

RI open door racking interlock

This locking device prevents the racking handle being inserted into the circuit breaker rack in/rack out mechanism when the door of the electrical cabinet is open (see Chapter 4, Description of the chassis and its accessories).

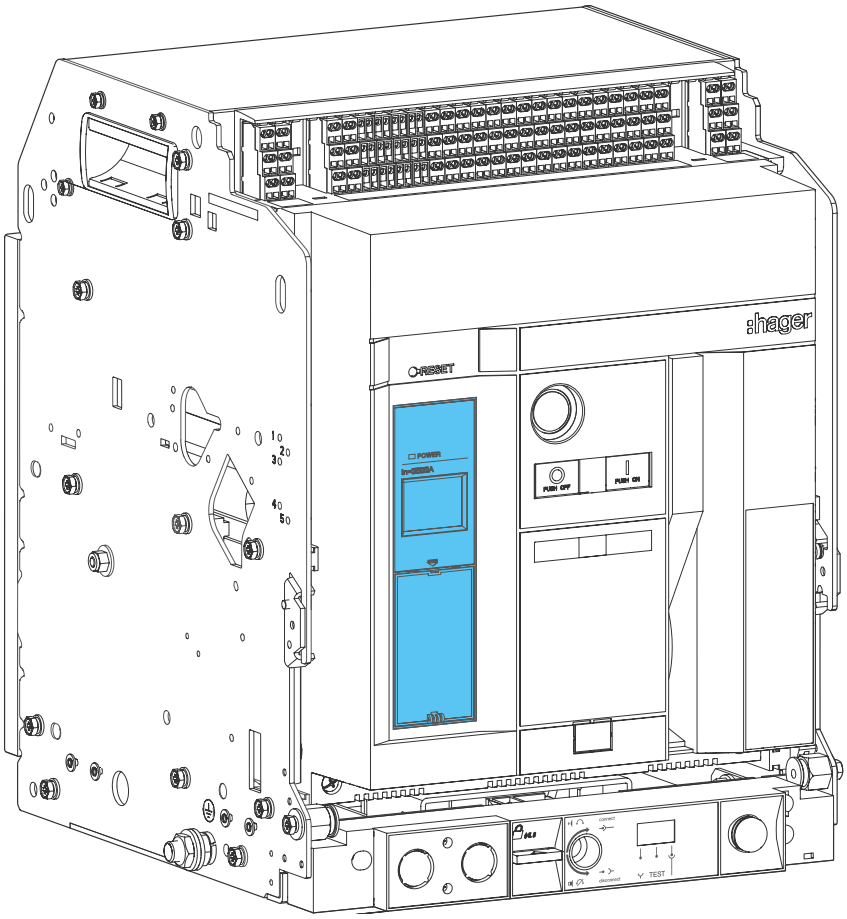
Information

For more information on operation, refer to chapter 23.10 "RI open door racking interlock".

19 Protection settings with a type A and L trip unit

19.1 Description of type L and A trip units

hws circuit breakers are equipped with a trip unit on the front to protect against overloads, short circuits and earth faults.
With or without a display, the trip unit is equipped with dials to configure the protection parameters and monitor proper operation.
Type A (with display) and type L (without display) trip units are available in two versions: LSI and LSIG.



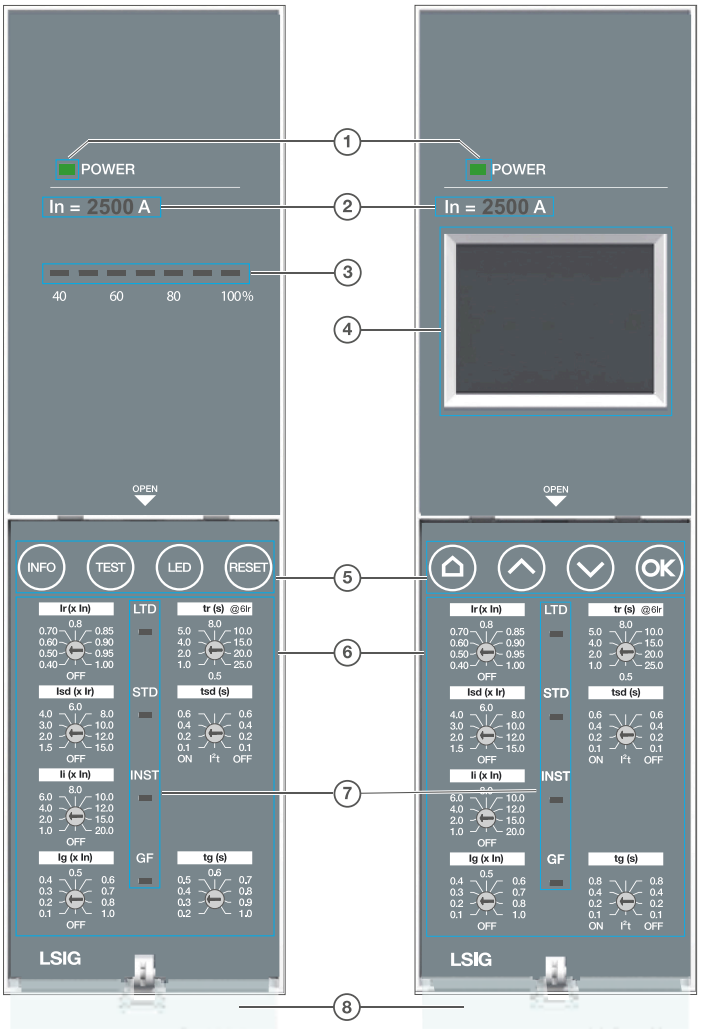
The standard functions are indicated in the following table.

Standard functions	Type L	Type A
Long Time Delay protection against overcurrent (L) with time delay (Tr)	✓	✓
Short delay overcurrent protection (S) with time delay (Tsd)	✓	✓
Instantaneous protection against overcurrent (I)	✓	✓
Earth fault protection (G) with time delay (Tg)	✓[1]	✓[1]
Neutral protection	✓	✓
Thermal memory for overload protection	✓	✓

[1] Only for LSIG version

Standard functions	Type L	Type A
Instantaneous protection trip test	✓	✓
Automatic analysis and conformity check of each indicator LED	✓	✓
Autodiagnosis of the backup function	✓	✓
Trip history	✓	✓
Autoprotection at closing on short circuit fault (MCR)	✓	✓
Load monitoring	-	✓
Overload pre-alarm	-	✓
Zone Selective Interlocking (ZSI)	-	✓

The following features are common to all trip unit versions without display (Type L) and with display (Type A):



1. Operation indicator light
2. Rated current value In of the circuit breaker
3. Signal lights indicating percentage of charge (Ir)
4. Display
5. **Type L**: 4 function keys (information, test, self-test, fault clearing)
   Type A: 4 function keys (back, up, down, confirm)
6. Setting dials of the trip unit
7. LSI or LSIG indicator lights depending on version
8. Trip unit cover

Information

The electronic trip unit must be powered in order for it to perform its protection functions. It is powered as long as a minimum current of 40% of the nominal current In passes through the circuit breaker.

Nevertheless, it is strongly recommended that an external 240 V AC power supply be connected to terminal block TU (P1,P2) to guarantee optimal operation of the trip unit

19.2 LSI, LSIG trip units

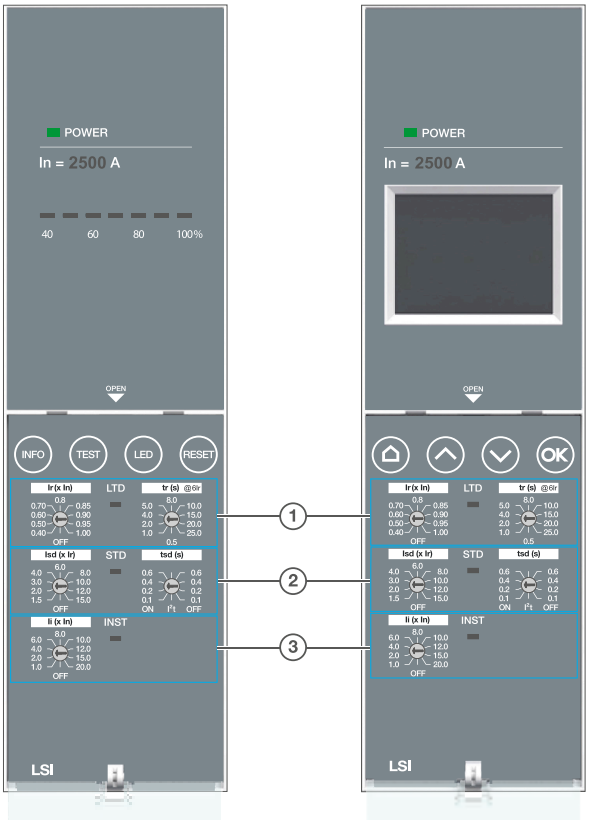
The type L (without display) and type A (with display) trip units are each available in 2 versions: **LSI** and **LSIG**

LSI trip unit

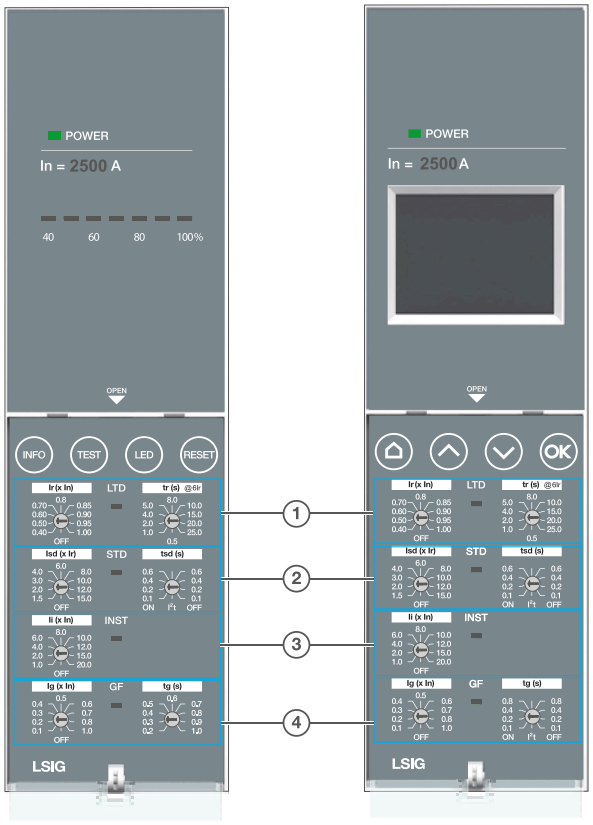
The LSI trip unit is used to protect cables lines and equipment requiring a wide variety of protection settings.
The dials are accessible from the front of the trip unit, allowing precise adjustment of the protection settings. The protection adjusted in this way is independent of the ambient temperature.

LSIG trip unit

The LSIG trip unit is used to protect cable lines and equipment in case of TN earthing system where earth fault protection is required.
The dials are accessible from the front of the trip unit, allowing precise adjustment of the protection settings. The protection adjusted in this way is independent of the ambient temperature.



1. LTD Long Time Delay protection setting
2. STD Short Time Delay protection setting
3. INST Instantaneous protection setting



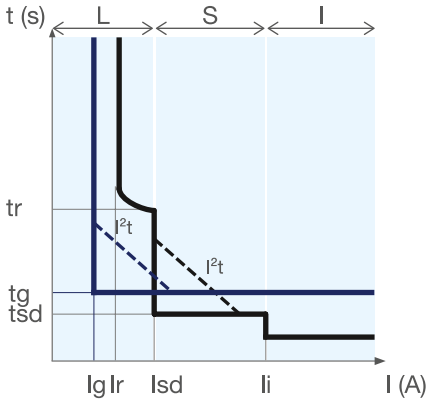
1. LTD Long Time Delay protection setting
2. STD Short Time Delay protection setting
3. INST Instantaneous protection setting
4. GF ground fault protection setting

19.3 List of protection devices

The trip unit protects against overcurrent and earth faults for all types of electrical distribution in accordance with the requirements of the standards IEC 60947-1 and 60947-2.

Protection system

- Long delay against overcurrent - **L**: Overload protection
- Short delay against overcurrent - **S**: Protection against low current short circuits
- Instantaneous against overcurrent - **I**: Protection against high current short circuits
- Earth fault - **G**: Phase-to-earth fault protection
- Neutral - **N**: Protection against overloads and short circuits which may flow through and damage the neutral conductors.



L	Ir	Long time delay protection threshold against overcurrent
	tr	Long time delay against overcurrent
S	Isd	Short time delay protection threshold against overcurrent
	tsd	Short time delay against overcurrent
	I²t ON/OFF	Short time delay protection I²t curve against overcurrent (activated/deactivated)
I	Ii	Instantaneous protection threshold against overcurrent
G	Ig	Earth-fault protection threshold
	tg	Earth-fault protection time delay
	I²t ON/OFF	Earth-fault protection I²t curve (activated/deactivated)
N	N	On 3P circuit breakers, protection can be obtained by connecting an external neutral pole (N).

Protection according to ANSI	Code
L	ANSI 49
S	ANSI 50TD/51
I	ANSI 50
G	ANSI 50N TD/51N

In addition to Instantaneous protection, all trip units include MCR protection (Making Current Release). This guarantees immediate tripping of the hws circuit breakers in cases of closing operation on a short-circuit.

Protection setting

The protection settings can be modified using the dials and the display depending on the version.
All protection functions are based on the RMS value of the current, thus taking into account the presence of current harmonics.
The wide range of protection curve setting options facilitates coordination in terms of selectivity.

19.4 Long Time Delay protection against overcurrent

Long time delay protection is designed to protect cables, busbars and busbar jackets from current overloads.
It is equipped with a thermal memory function that temporarily stores the calculated thermal values, so that the thermal effect of cable heating remains available. The phases and the neutral pole benefit independently from the Long time delay protection.
It can also be used to protect transformers or generators.

Long time delay protection curve

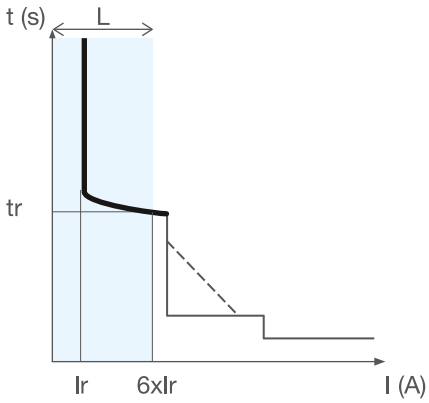


Fig. 8: Long time delay protection

Long time delay parameters

L	OFF	Deactivation of the Long time delay overcurrent protection
	Ir = ... x In (A)	Long time delay protection threshold against overcurrent
	tr (s)	Long time delay against overcurrent

Adjusting the Ir threshold

The Long Time Delay protection tripping range is: 1.05...1.20 Ir.
The IR trip threshold is adjusted using a dial.
When the Ir threshold is OFF, Long time delay protection is disabled.

Ir pick-up adjustment range (x In)

OFF	0.4	0.5	0.6	0.7	0.8	0.85	0.9	0.95	1.0

Rating (In)	Ir pick-up adjustment range = ... x In (A)
630 A	250 ... 630 A
800 A	320 ... 800 A
1000 A	400 ... 1000 A
1250 A	500 ... 1250 A
1600 A	640 ... 1600 A
2000 A	800 ... 2000 A
2500 A	1000 ... 2500 A
3200 A	1280 ... 3200 A
4000 A	1600 ... 4000 A

Adjusting the tr time delay

The tr time delay defines the tripping time of the long time delay protection for a current of 6 x Ir.
The tr time delay is adjusted using the tr dial.

tr adjustment range (s)

0.5	1.0	2.0	4.0	5.0	8.0	10.0	15.0	20.0	25.0

The tolerance of the trip time of the Long time delay protection is +10% to -10%.
Example: For tr = 5s and I = 6 x Ir, the trip time of the Long time delay protection will be between 4.5 s and 5.5 s.

Thermal image

Closure resulting from an overload, successive motor starts or a fluctuating load cause significant current swells that can potentially damage conductors (heating up, premature ageing).
Traditional Long time delay protection is not able to protect the conductors against repetitive faults of this kind because the duration of each detected overload is too short to cause effective tripping.
Thanks to its thermal memory and imaging function, the trip unit memorizes and integrates the thermal effects of the detected overloads whatever the current value. These functions are guaranteed even if the trip unit is not powered by an external power supply. This reduces the associated Long time delay time to cause effective tripping before the conductors overheat.
The thermal memory and image function of the trip unit provides optimal protection of the cables and busbars against overheating.

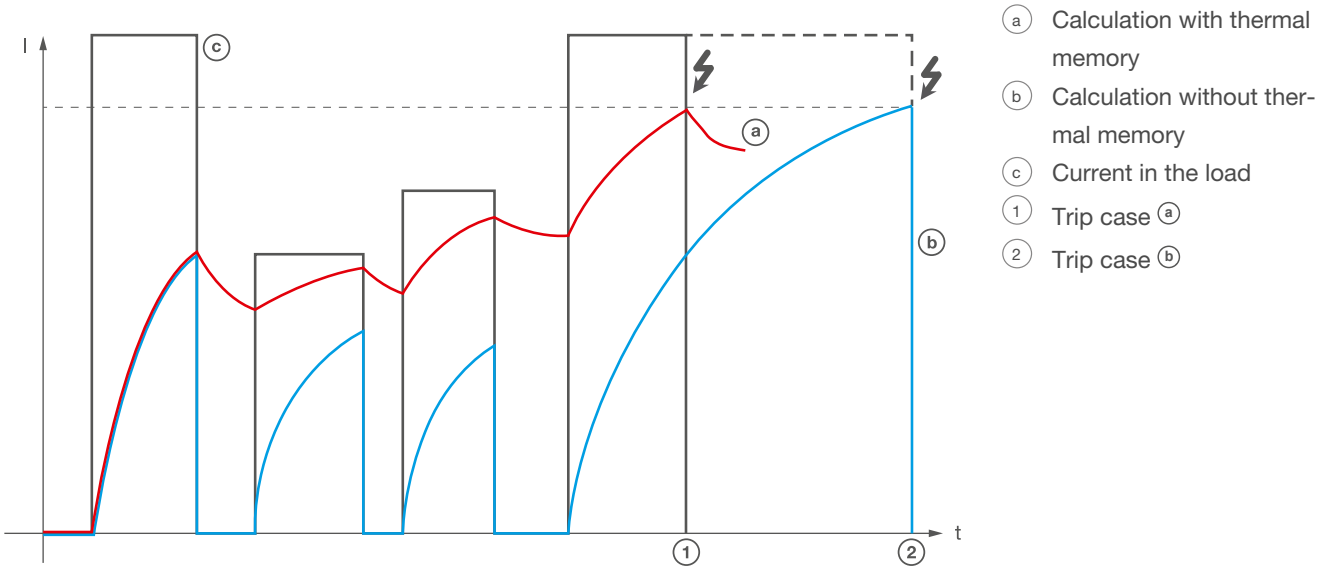


Fig. 9: Tripping with and without thermal image

The example above clearly shows that the trip unit ⓐ with thermal memory trips earlier and thus protects the conductors better than trip unit ⓑ without thermal memory.

Information

The thermal memory and imaging function of the trip units cannot be deactivated.

19.5 Short time delay protection against overcurrent

Short time delay protection is designed to protect against short circuits.

Short time delay protection curve

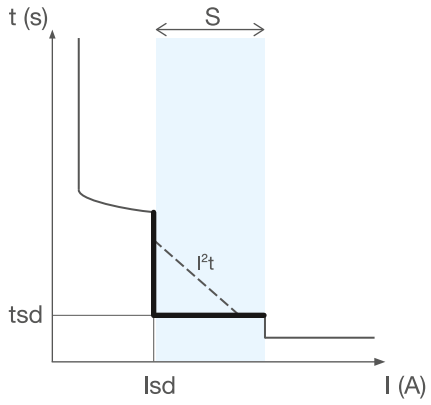


Fig. 10: Short time delay protection

Short time delay parameters

S	OFF	Deactivation of the short time delay overcurrent protection
	Isd = ... x Ir (A)	Short time delay protection threshold against overcurrent
	tsd (s)	Short time delay against overcurrent
	I²t (ON/OFF)	Short time delay protection I²t curve against overcurrent

Adjusting the Isd pick-up setting

The Isd pick-up is adjusted using the Isd dial.

Isd pick-up adjustment range (x Ir)

OFF	1.5	2.0	3.0	4.0	6.0	8.0	10.0	12.0	15.0

When the Isd setting is OFF, the Short time delay protection is deactivated.
The Isd tripping tolerance threshold for Short time delay protection is ±10%.

Adjusting the tsd time delay

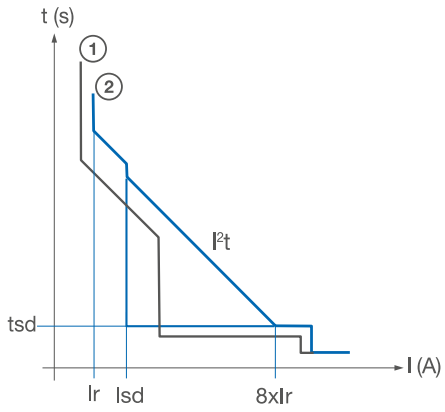
The tsd time delay is adjusted using the tsd dial.

Time delay (s)	tsd I²t OFF	0.1	0.2	0.4	0.6
	tsd I²t ON	0.1	0.2	0.4	0.6
Non-tripping time (s)		0.06	0.16	0.36	0.56
Maximum tripping time (s)		0.15	0.25	0.45	0.65
Maximum breaking time (s)		0.17	0.27	0.47	0.67

An inverse time function I²t=K can be activated or deactivated when adjusting the Short time delay.

This I²t function makes it possible to improve selectivity with downstream devices. It is activated from the Isd pick-up and functions up to 8xIr.

Example use of the I^2t function



1 h3+ circuit breaker
2 hws circuit breaker

Information

The I^2t function is deactivated by default. Activate it if selectivity needs to be improved.

19.6 Instantaneous protection against overcurrent

Instantaneous protection is designed to protect against high short circuit currents. This protection is time-independent.

Instantaneous protection curve

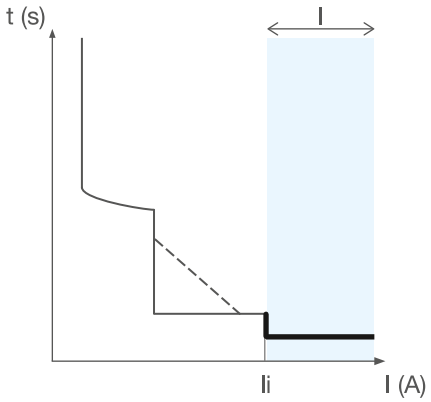


Fig. 11: Instantaneous protection

Instantaneous protection parameters

I	OFF	Instantaneous protection deactivation
	Ii = ... x In (A)	Instantaneous protection threshold against overcurrent

Adjusting the Ii pick-up setting

The Ii pick-up is adjusted using the Ii dial.

Ii pick-up adjustment range (x In)

OFF	1.0	2.0	4.0	6.0	8.0	10.0	12.0	15.0	20.0

When the Ii setting is OFF, Instantaneous protection is deactivated.
The Ii pick-up tolerance for Instantaneous protection is ±10 %.

Tripping time

Instantaneous protection has no adjustable time delay.
The maximum break time is 50 ms.

19.7 Earth-fault protection

Earth-fault protection is used against phase-to-earth faults.
Ground fault currents can reach such a high amplitude that they are similar to a short circuit.
It is based on the calculation of the sum of the phases and the neutral current.

Earth-fault protection curve

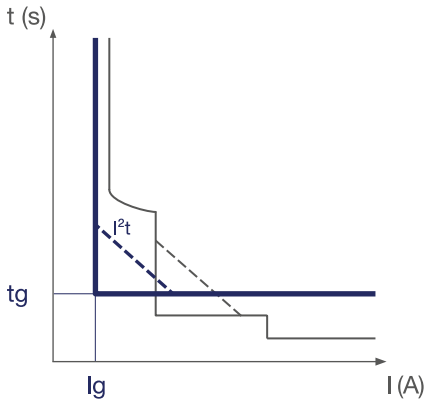


Fig. 12: Earth protection

Earth-fault protection parameters

G	OFF	Deactivation of the earth-fault protection
	Ig = ... x In (A)	Earth-fault protection threshold
	tg (s)	Earth-fault protection time delay
	I²t (ON/OFF) [1]	I²t earth-fault protection curve

Adjusting the Ig pick-up setting

The Ig pick-up is adjusted using the Ig dial.

Ig pick-up adjustment range (x In)

OFF	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0

The Ig trip threshold tolerance for earth fault protection is ±10%.

Time delay tg adjustment

The tg time delay is adjusted using the tg dial.

tg setting range (s) for a Type L trip unit (without display)

0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0

tg setting range (s) for a Type A trip unit (with display)

Time delay (s)	tg I²t OFF	0.1	0.2	0.4	0.8
	tg I²t ON	0.1	0.2	0.4	0.8
Non-tripping time (s)		0.06	0.16	0.36	0.56
Maximum tripping time (s)		0.15	0.25	0.45	0.85
Maximum breaking time (s)		0.17	0.27	0.47	0.87

[1] available with trip units equipped with a display

The i^2t earth-fault protection curve improves the selectivity of the earth faults with circuit breakers located upstream. This protection operates from the setting value Ir up to the nominal value In.
It can be adjusted using the tg dial.

Information

In the case of a 3-pole product, the earth fault protection is dependant on the presence of an ENCT external neutral sensor.

19.8 Neutral protection

Neutral protection is available from the factory on 4P circuit breakers and optionally with the addition of the ENCT external neutral sensor on 3P versions
It is particularly useful if the cross section of the neutral conductor is smaller than that of the phases, or if the neutral conductor is heavily loaded (for example, in office buildings).
It uses similar tripping curve characteristics as the Long time delay, Short time delay and instantaneous protection parameters.

Neutral protection curve

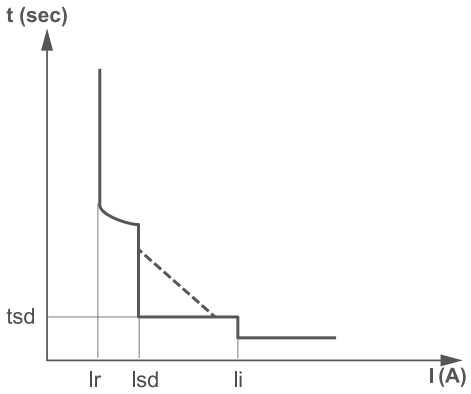


Fig. 13: Neutral protection

The Ir and Isd thresholds of the neutral protection remain identical to that of the phases.
Protection Ii (instantaneous protection) remains identical to that of the phases.

Time delay for neutral protection

The time delays for neutral protection remain identical to the phase time delay adjustment values.

Information
Neutral pole protection

For a 4 P circuit breaker, the neutral pole has the same protection as the phases.

For a 3 P circuit breaker, protection can be obtained by installing an external neutral pole (ENCT).

19.9 Zone Selective Interlocking function (ZSI)

The Zone Selective Interlocking (ZSI) function is designed to limit the electro-dynamic constraints on the installation in case of a short circuit fault or earth fault.
The devices, conductors, bar sheathing and busbars can thus benefit from this limitation.
It reduces electrical fault removal time while maintaining the selectivity and coordination provided by the protection settings.
The installed circuit breakers are linked together by cable to determine which circuit breaker should trip first. If an electrical fault appears between two linked circuit breakers connected together by the ZSI function, the downstream circuit breaker is unable to clear it. Thanks to zone selectivity, the circuit breaker upstream of the fault trips without waiting till the end of its time delay.
For zone selectivity to work correctly, the ZSI terminals of all circuit breakers must be connected together among themselves. The trip time delay of each circuit breaker must be adjusted according to the desired timed selectivity and the ZSI function must be activated (only on circuit breakers connected to their downstream circuit breakers).
Zone selectivity for Short time delay protection and/or earth-fault protection applies when connecting to circuit breakers located downstream (Z1/Z2: ZSI IN) and circuit breakers located upstream (Z3/Z4: ZSI OUT).

Here are two examples to explain the functioning.

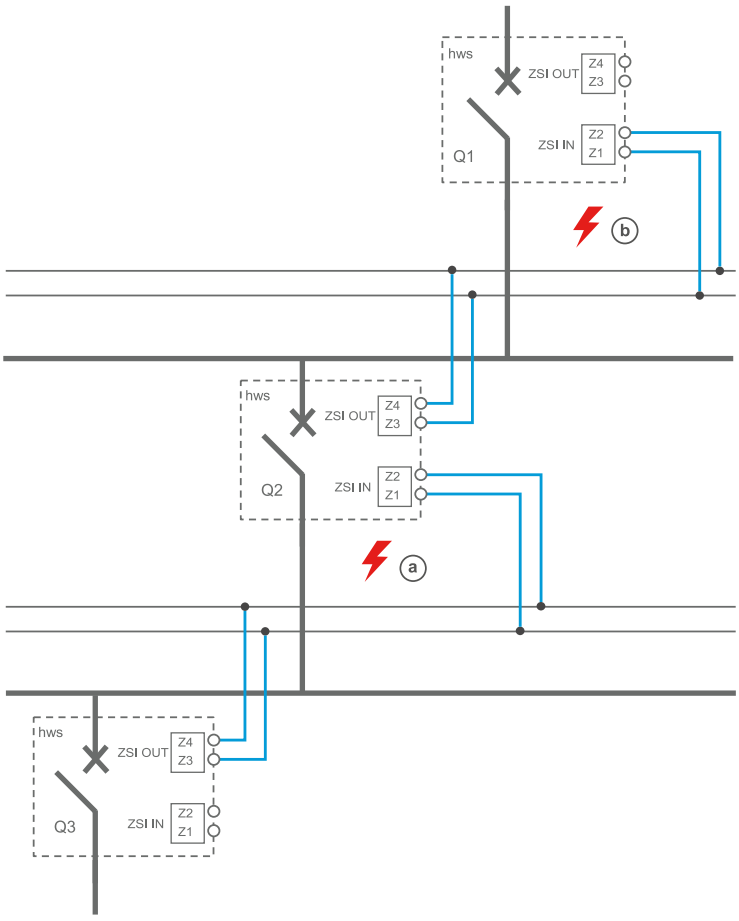


Fig. 14: Zone selectivity: Example

The circuit breakers Q1, Q2, Q3 are set beforehand to their respective thresholds enabling the expected chronometric selectivity to be implemented.
The ZSI function must only be activated on circuit breakers Q1 and Q2.

Case of a fault ⓐ :

If a fault occurs at point ⓐ, the Q1 and Q2 circuit breakers detect the electrical fault.
Thanks to ZSI wiring (blue), circuit breaker Q1 receives a signal from Q2 and remains closed to allow circuit breaker Q2 to eliminate the fault.
Circuit breaker Q2 does not receive a signal from Q3. It opens immediately, despite the previously set tripping time delay.

Case of fault ⓑ:

If a fault occurs at point ⓑ, only circuit breaker Q1 detects the electrical fault.
The Q1 circuit breaker does not receive a signal from Q2, it opens immediately, despite the previously set tripping time delay.

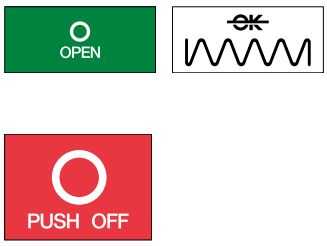
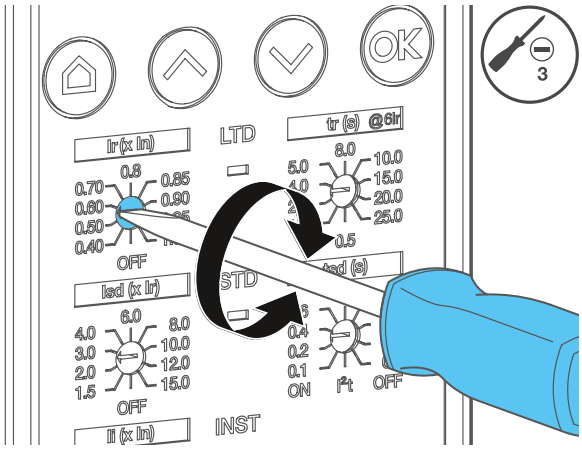
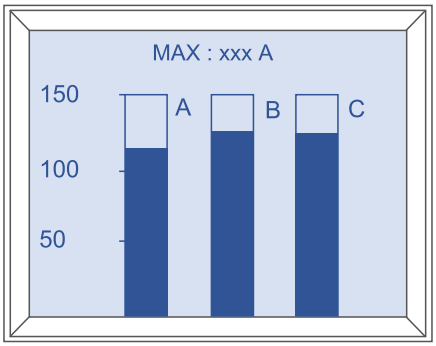
Adjusting the ZSI protection setting

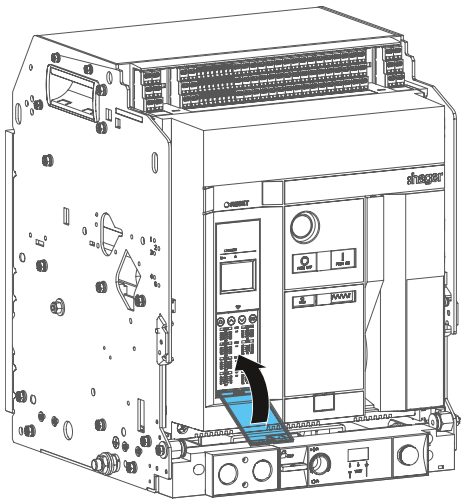
Information
It is important to keep the ZSI protection deactivated on an hws circuit breaker not connected to its downstream circuit breakers (Z1/Z2 terminals: ZSI IN not used).
If it is activated, the circuit breaker will trip immediately during an electrical fault without waiting for the end of the Short time delay and the earth-fault protection time delay.

ZSI Short time delay protection	ON-OFF (OFF by default)
ZSI Earth-fault protection	ON-OFF (OFF by default)

19.10 Principle

To adjust the protections on Type A and Type L trip units, follow the procedure below.

	Action	Illustration
	Information 1 First, ensure that the circuit breaker is switched off and displays the following information: 2 If this is not the case, open the circuit breaker by pressing the opening push button:	
1	Open the transparent window protecting access to the trip unit. Make the desired adjustment using the dials.	
	Warning **Risk of non-compliant settings** The dials must be accurately set on the indexed positions. If the positioning is incorrect (between the indexed positions), the protection setting will not comply with the requirements of the installation.	
2	For the trip unit with display, press the key OK to turn on the display and display the diagram of intensities Ia, Ib and Ic. Use the 4 function keys ⌂, ^, v, OK to navigate and view the settings on the display, see Chapter 19.14, Using the interface of the trip unit with display .	

	Action	Illustration
	Information To view the settings on the display, the trip unit must be powered from the TU / 240V AC terminal block (P1 and P2) of the circuit breaker.	
3	Once all the settings have been adjusted, close the transparent cover.	

19.11 Protection settings of LTD, STD, INST, GF

Warning

Risk of settings that are non-compliant with the short circuit and selectivity calculations.

This example is given on an illustrative basis only to show the behaviour of the display when the dials are used.
In order to correctly adjust the trip unit, a short circuit and selectivity calculation must be performed for the installation in advance by the electrical designer.
This will enable the circuit breaker to protect the installation securely.

Information

To view the settings on the display, see Chapter 19.14, Using the interface of the trip unit with display

Long time delay (LTD) protection setting

In our example:

- the circuit breaker rating is in = 1600 A.
- the time delay tr = 1 s.

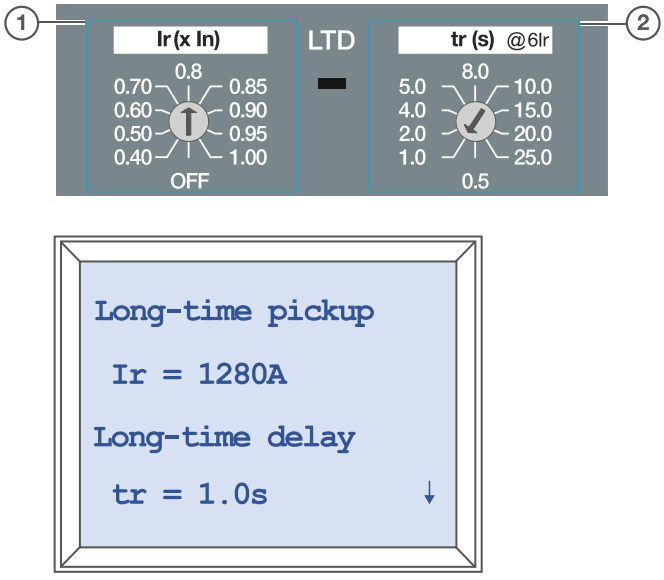


Fig. 15: LTD protection setting and display

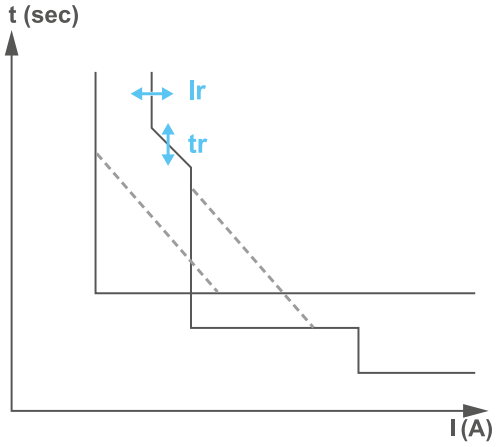


Fig. 16: Characteristics of the affected curve

① **Current setting Ir (LTD protection)**
Ir = 0.8 x in = 0.8 x 1600 = 1280 A.

② **Trip time delay tr (LTD protection)**
tr = 1 sec

Information

The actual trip time depending on the fault must be checked with the data from the protection curve (see Technical Catalogue 6LE089908A).

Short Time Delay (STD) protection setting

In our example:

- the circuit breaker rating is in = 1600 A.
- The current Ir=1280 A.
- the tsd time delay = 0.4 sec

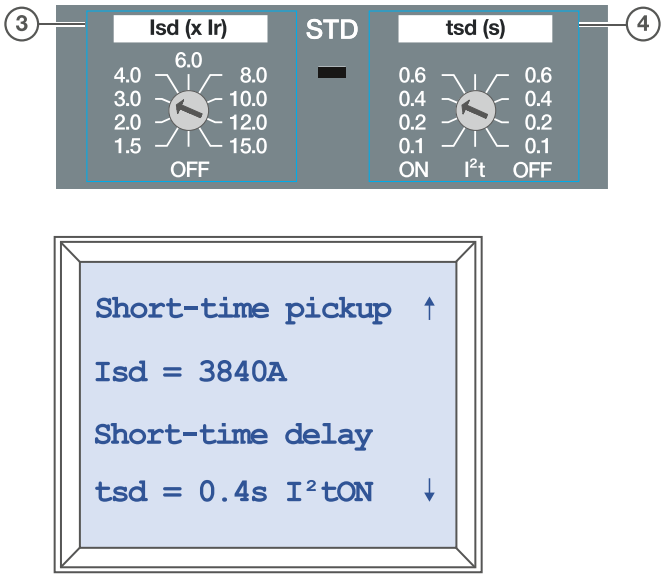


Fig. 17: STD protection setting and display

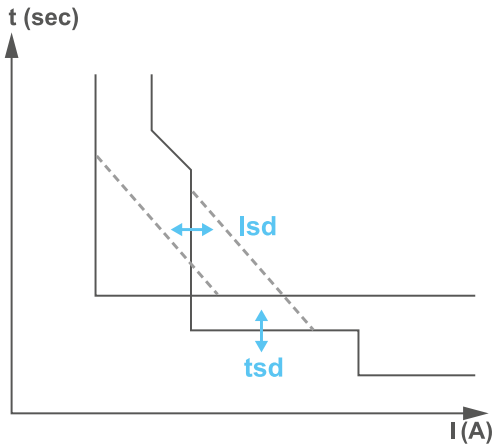


Fig. 18: Characteristics of the affected curve

③ Current setting Isd (STD protection)

Isd = 3 x Ir = 3 x 1280 = 3840 A.

④ Tripping time delay tsd (STD Protection)

the tsd time delay is adjustable with I²t on OFF or I²t on ON.

Instantaneous protection (INST) setting

In our example:

- the circuit breaker rating is in = 1600 A.

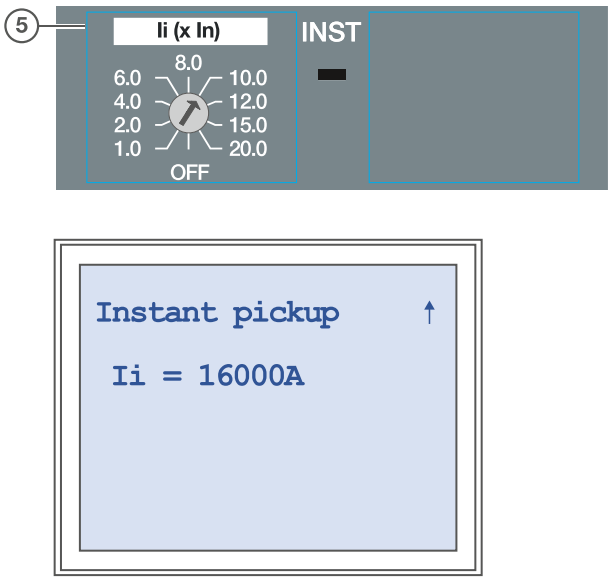


Fig. 19: INST protection setting and display

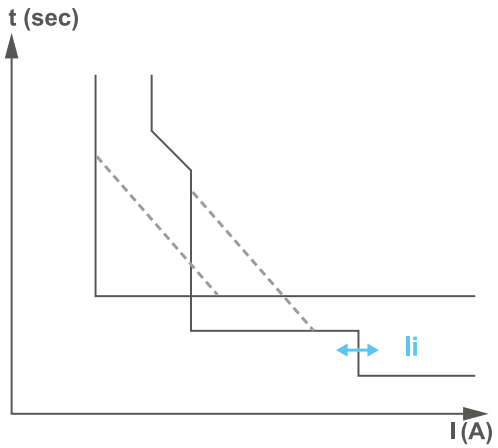


Fig. 20: Characteristic of the affected curve

⑤ Current setting Ii (INST protection)

Ii = 10 x in = 10 x 1600 = 16000 A.

Earth-fault (GF) protection setting

In our example:

- the circuit breaker rating is in = 1600 A.
- The time delay tg = 0.8 s with I²t on[1]

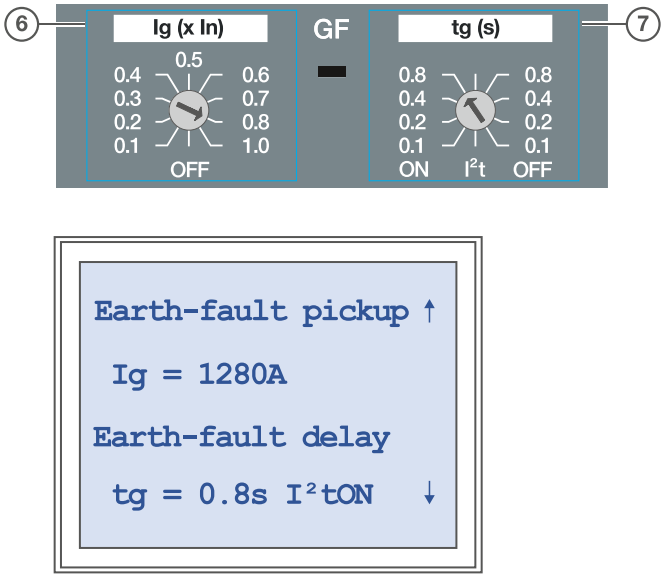


Fig. 21: GF protection setting and display

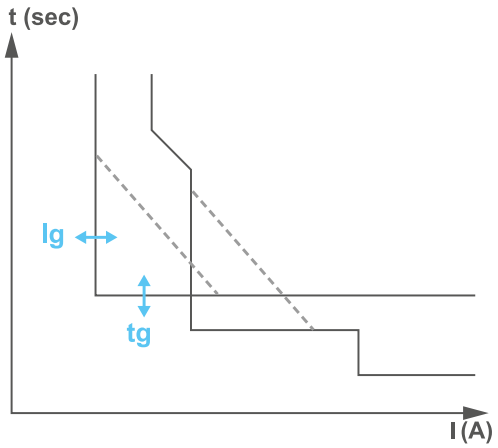


Fig. 22: Characteristics of the affected curve

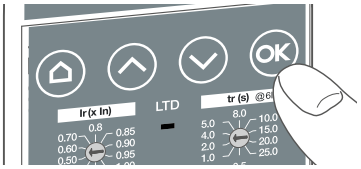
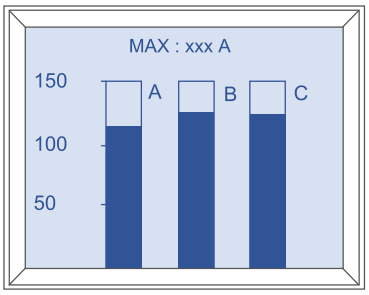
⑥Current setting Ig (GF protection)
Ig = 0.8 x in = 0.8 x 1600 = 1280 A.

⑦ Tripping time delay tg (GF protection)
The tg time delay is adjustable with I²t on OFF or I²t on ON[1].

[1] I²t on ON or on Off is available on the trip unit with display.

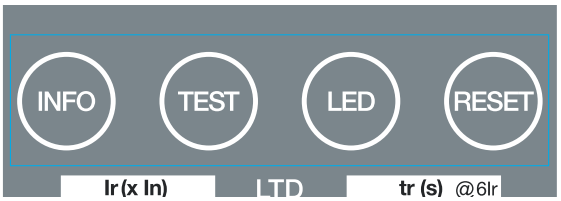
19.12 Review of settings

To review the settings made on the trip unit with display:

	Action	Illustration	
1	Briefly press the OK button. Verify that the following screen lights up. It displays the diagram of intensities Ia, Ib and Ic.		
2	Use the 4 function keys to navigate through the menu: • returns you to the previous menu, • and select the display in the menu, • reactivates the display's screen and confirms. **Information** To check the adjustments made, refer to Chapter 19.14, Using the interface of the trip unit with display .		

19.13 Using the interface of the trip unit without display

Function keys



INFO → INFO key.

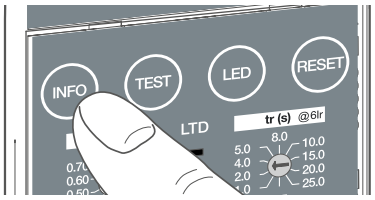
TEST →TEST key.

LED → LED key.

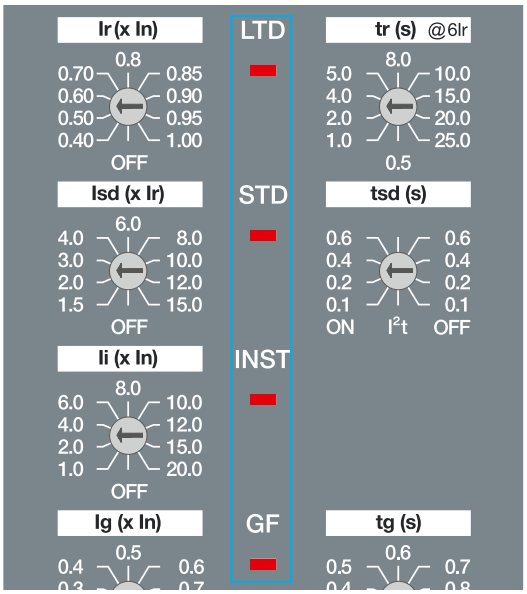
RESET → RESET key.

Operating concept

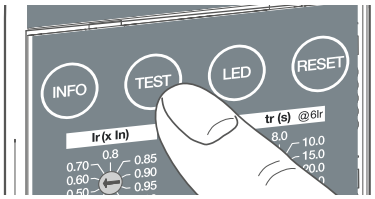
INFO → The INFO key is used to query the last stored fault.
The faults recorded are expressed in four types: Ir, Isd, Ii and Ig.



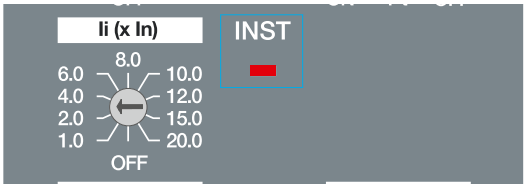
The fault light is lit to indicate the type of fault.
Press the RESET key to clear the fault.



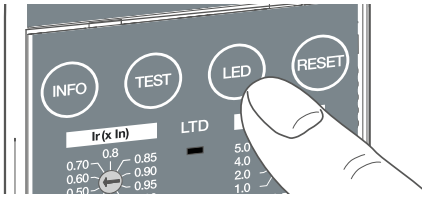
TEST → When the trip unit is in normal operation, pressing the TEST key opens the circuit breaker immediately.



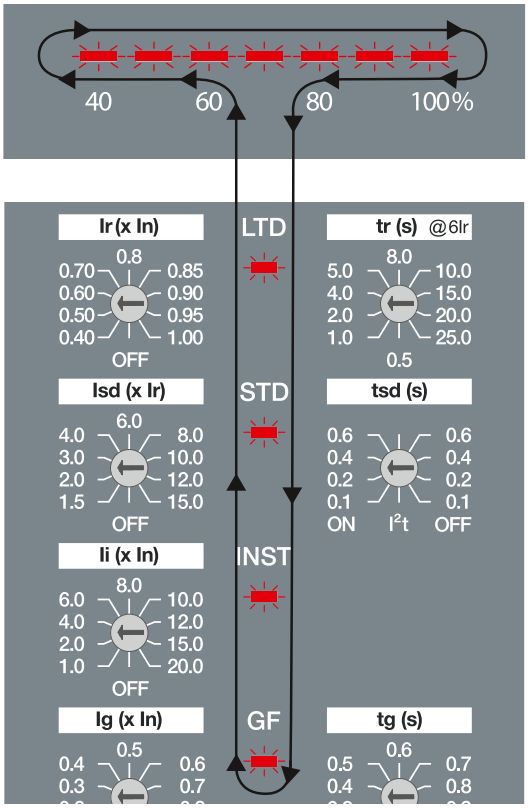
The fault indicator light Ii lights up on the display but the fault is not stored.
Press the RESET key to clear the fault.



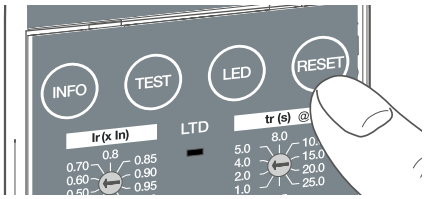
LED → Pressing the LED key allows a check of the internal function of the trip unit.



The indicator lights automatically scan and turn off after one minute.



RESET → Pressing the RESET key clears a stored fault.



19.14 Using the interface of the trip unit with display

Operating concept

To navigate through the main menu, use the following 4 keys:

→ the BACK key to return to the previous step.

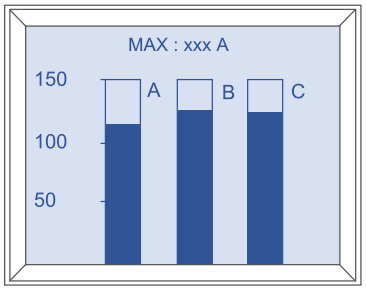
→ the move UP key to select the display.

→ the move DOWN key to select the display.

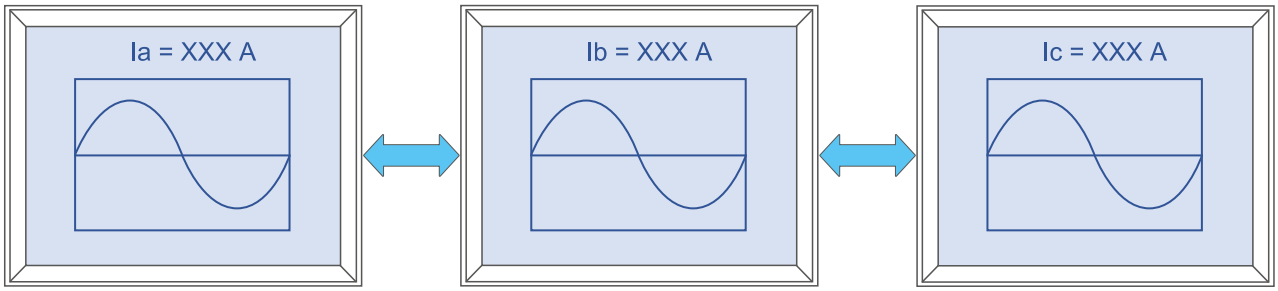
→ The OK key to activate the display and confirm a step.

Measurement display

When the trip unit is switched on, the interface immediately displays the diagram representing the load percentage of the currents for each phase: Ia, Ib, Ic.



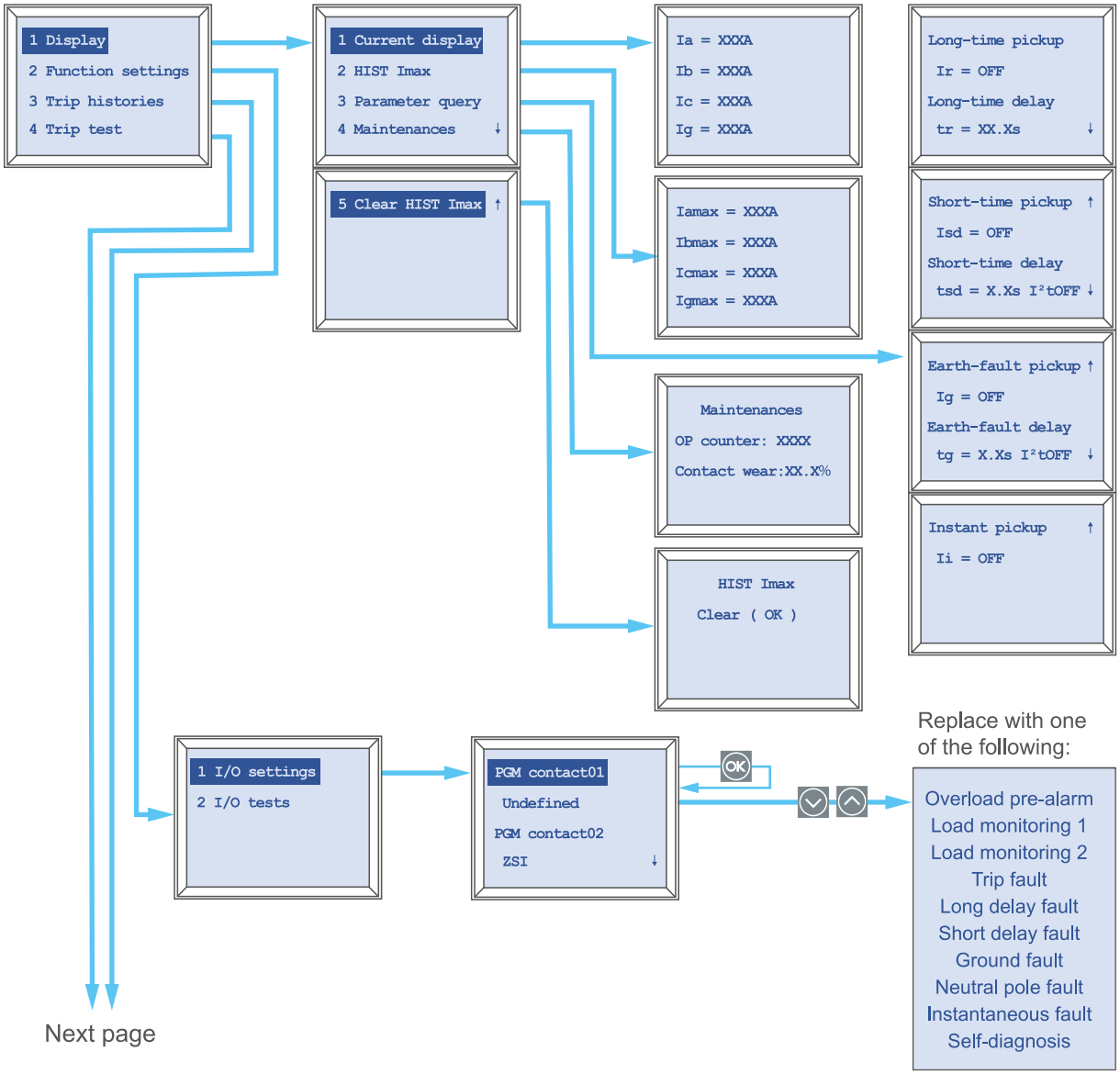
The keys , allow you to view the following displays representing the curves for each phase of the three-phase current Ia, Ib and Ic.

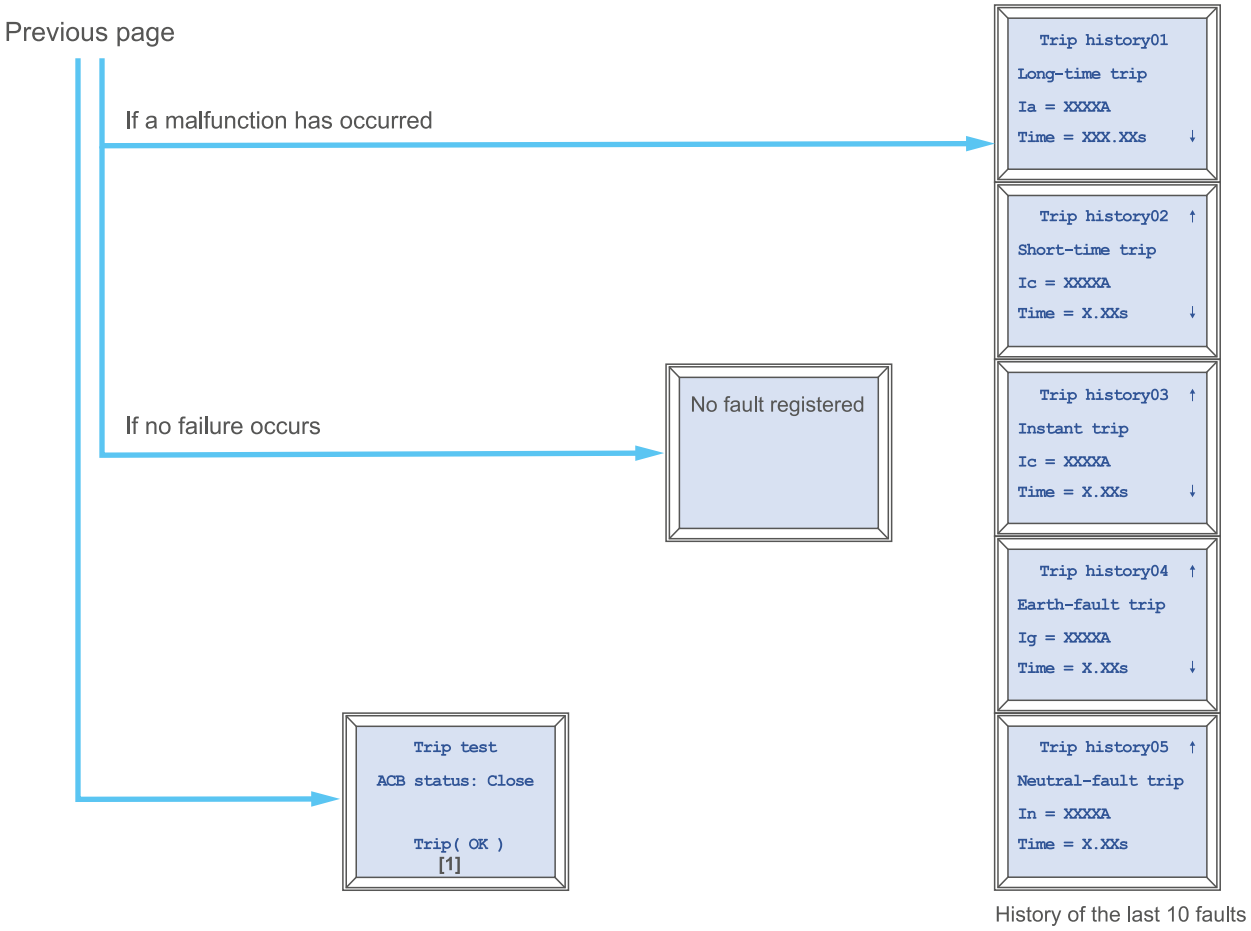


Menu flow chart

Press the key OK to enter the menu and then navigate through the different menus using the keys ^ and v.

Press the key OK to confirm or press the key ⌂ to return to the previous step.





[1] The software displays ‘closed’ or ‘open’ depending on whether the circuit breaker is closed or not (without the MCR function, only ‘open’ is displayed).

20 Commissioning the circuit breaker

Danger

Risk of electric shock, electrocution or electric arc.
Danger to life, risk of injury due to electric shock, or risk of serious injury.
Make sure that the appliance is commissioned only by qualified personnel equipped with appropriate safety equipment.

Here are the key steps to follow when installing air circuit breakers:

- **Verification of the circuit breaker technical specifications**
  - **Circuit breaker type:** Ensure that the circuit breaker used meets the specifications required for the application, such as breaking capacity, trip curve and specific configurations.
  - **Dimensions and space:** Verify that the circuit breaker is suitable for the panel or cabinet in which it will be installed, taking into account the dimensions and space required for ventilation and cooling.
- **Security and ground fault**
  - **Ground fault:** Ensure that the circuit breaker and its holder are properly grounded in accordance with the requirements of standards to avoid any electrical hazards.
  - **Wiring and connections:** Check that the connecting bars or cables are correctly dimensioned and that they comply with safety standards to avoid any risk of short circuit or overheating. Use connecting bars or cables that are suitable for the rating of the circuit breaker.
  - **Keeping safe distances:** Circuit breakers must be installed within the minimum distances specified by the standard to prevent thermal overload.
- **Mounting of air circuit breakers**
  - **Fastening of circuit breakers:** The circuit breaker must be securely fastened in its panel or cabinet using screws or other suitable fasteners. The mounting method must allow adequate ventilation of the circuit breaker to prevent overheating.
  - **Distribution bar positioning:** When bus bars are used, ensure that they are positioned correctly to allow easy and safe connection of the bus bars or cables.
- **Checks and tests after installation**
  - **Functional tests:** After installation is complete, functional tests should be performed to verify proper operation of the circuit breaker, including tripping under overload and short circuit conditions.
  - **Compliance verification:** A final check must be carried out to ensure that the installation meets all safety and performance specifications required by the standards.
- **Documentation and labeling**
  - **Circuit breaker labeling:** Each circuit breaker must be clearly labeled with information about its type, serial number, breaking capacity, etc.
  - **Documenting installation:** Maintain technical documentation of the installation, including wiring drawings and diagrams, as well as the results of the tests performed.

21 Alarm management

The trip unit is used to manage 4 types of alarms:

- Overload pre-alarm [1],
- Overload alarm,
- Trip alarm,
- System alarm,

21.1 Overload pre-alarm

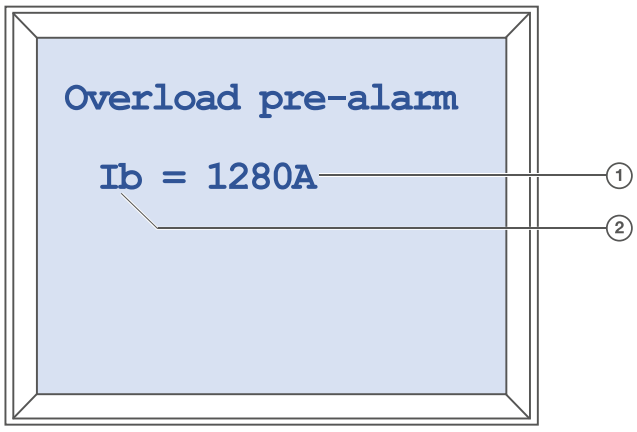
Information

- The overload pre-alarm is available on the trip unit with display.
- It is necessary to configure the overload pre-alarm function on the trip unit via the Contact 01 option, see Chapter 19.14, Using the interface of the trip unit with display .

The overload pre-alarm warns of an impending overload situation when the load current exceeds 113% of Ir. Preventive measures (load-shedding, maintenance, etc.) can then be taken before the circuit breaker trips, avoiding the power supply being cut off.

The PTA overload pre-alarm is defined by a threshold equivalent to 113% Ir.

The PTA overload pre-alarm is signalled by a screen of this type:



1. Value in amps of the current flowing through the circuit breaker on the most highly loaded phase
2. Relevant phase

Information

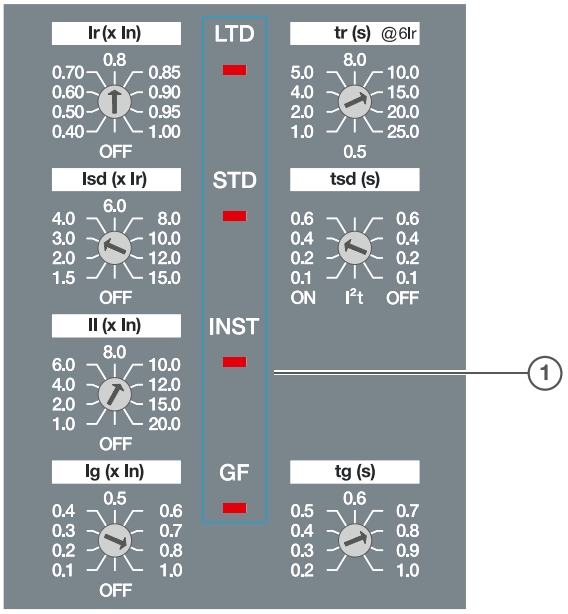
When an overload pre-alarm is activated, the signal is transferred to the contacts of the DO1 digital output .

[1] available with trip units equipped with a display.

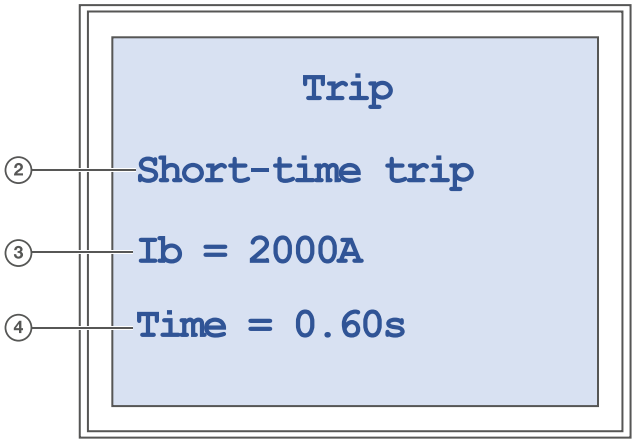
21.2 Trip alarm

In case of tripping (overload, short circuit, instantaneous, ground fault), the circuit breaker opens.
The trigger display is then powered by its mains supply TU 240 V AC.
In the event of an alarm, a fault LED indication and a screen[1] of this type is displayed:

LED signaling



Display



① and ②:	LED indication	Display	Tripping type
	LTD	Long-time trip	Long time delay protection
	STD	Short-time trip	Short time delay protection
	INST	MCR and trip	Instantaneous protection
	GF	Earth trip	Earth-fault protection

③ : Current value of fault (only for long time delay, short time delay, instantaneous and earth-fault protection trip causes) with indication of the phase affected by the fault.

④ : Phase concerned by the fault (only for Long time delay, Short time delay and Instantaneous tripping causes)

Information

- When a trip alarm is activated, the signal is transferred to the contacts of the digital outputs DO1 and DO2 (ZSI).
- For trip alarms, refer to Chapter 19.13, Using the interface of the trip unit without display and Chapter 19.14, Using the interface of the trip unit with display .

[1] available with trip units equipped with a screen

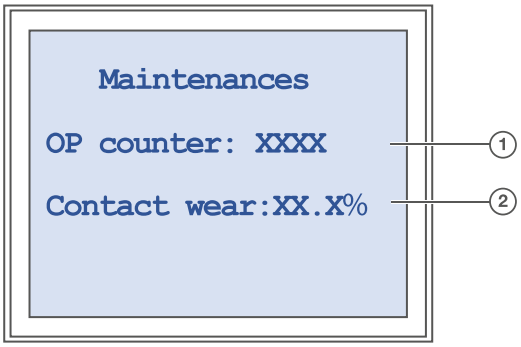
22 Maintenance indicator

Danger

Risk of electric shock, electrocution or electric arc.
Danger to life, risk of injury due to electric shock, or risk of serious injury.

Hager strongly recommends that the Standard and Advanced maintenance programmes are performed only by persons trained and authorised by Hager.
For any additional information, contact your Hager representative or local Hager technical support (contact details for your country can be found on the Hager website).

On Type A trip units (with display), it is possible to view the wear status of the power contacts and thus carry out maintenance operations on the circuit breaker.



1. Indicates the number of operations on the circuit breaker.
2. Indicates the wear rate of the power contacts.
   Example: If the rate is 40, it indicates that the contacts are 40% worn.

Information

For the maintenance indication on the Type A trip unit, refer to Chapter 19.14, Using the interface of the trip unit with display .

23 Circuit breaker operation

23.1 Description

The HWS2 and HWS4 circuit breakers have the following elements on the front.

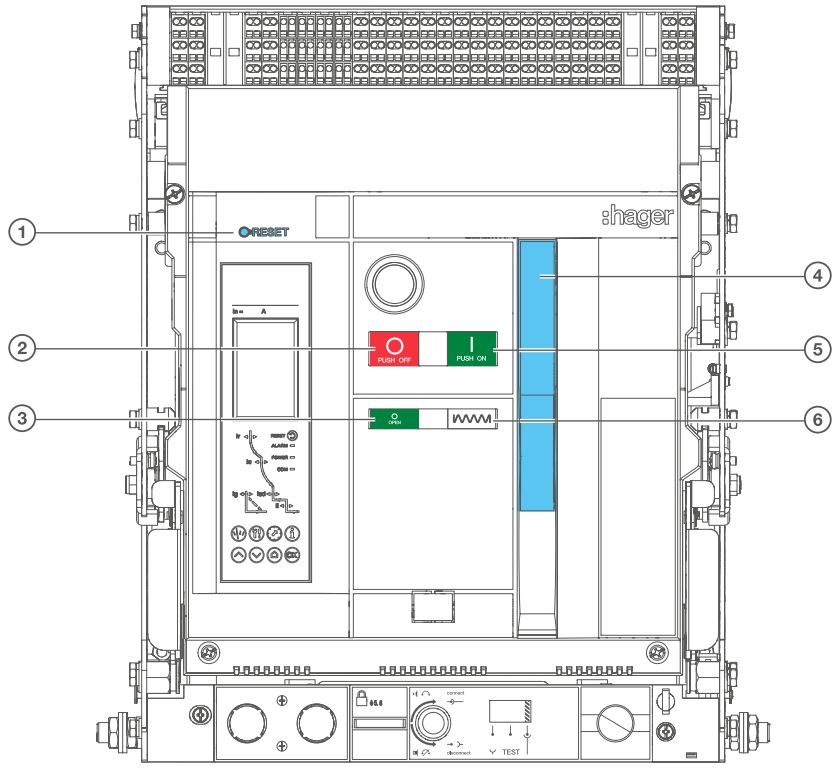
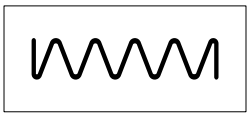
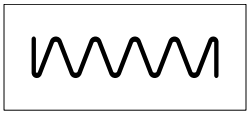


Fig. 23: Description of the front face of the circuit breaker

1. RESTET button (circuit breaker reset after tripping)
2. Opening push button
3. Contact opening and closing indicator
4. Charging handle
5. Closing push button
6. Closing spring status indicator

Status indicators

The combination of the two indicators shows the status of the circuit breaker.

Opening and closing indicator	Closing spring status indicator	Circuit breaker status
		Circuit breaker open. Closing spring discharged.
		Circuit breaker open. Closing spring loaded but not ready to close because: • Following a trip, the circuit breaker has not been reset see Chapter 23.3, Closing the circuit breaker after a trip operation . • The circuit breaker is mechanically locked in the open position using a lock or padlock.
		Circuit breaker open. Closing spring charged. The circuit breaker is ready to be closed.
		Circuit breaker closed. Closing spring discharged.
		Circuit breaker closed. Closing spring charged.

Closing spring

The closing spring is used to mechanically close the circuit breaker. It must be charged first, and there are two procedures for this:

- **Manual charging**
  Charge the closing spring using the charging handle (Fig. 23: Description of the front face of the circuit breaker) until the status of the indicator changes.

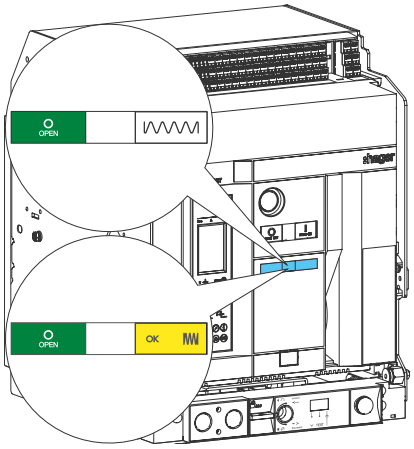
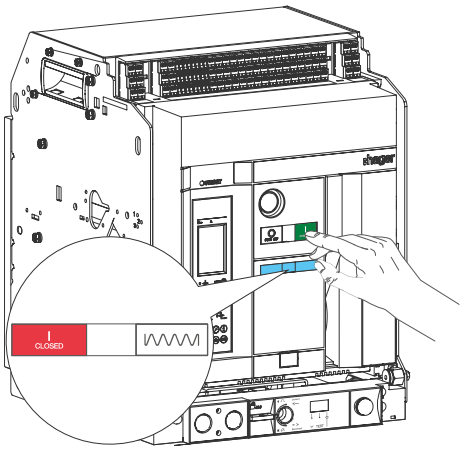
- **Automatic charging**
  If an MO charging motor is installed and powered (see Chapter 3, Description of the circuit breaker accessories), the closing spring charges automatically each time the circuit breaker closes.

23.2 Closing of the circuit breaker

Danger

Risk of electric shock, explosion or arc flash.
Inspect the electrical installation and eliminate the cause of the trip before closing the circuit breaker.
Never close a circuit breaker locally or remotely without first ensuring that the installation complies with safety standards.

To close the circuit breaker:

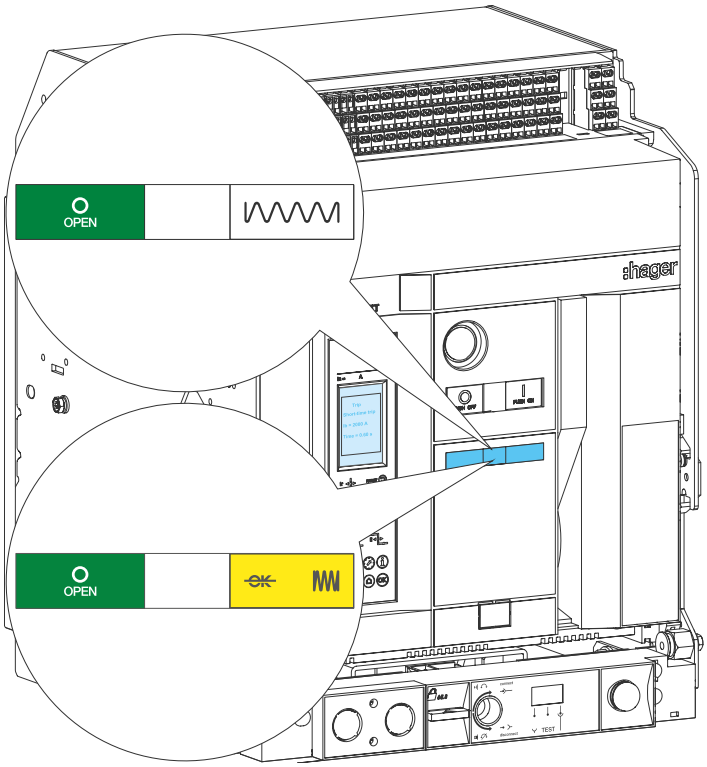
	Action	Illustration
1	Check that the circuit breaker is open, the closing spring is discharged or charged if a charging motor is installed.	
	Information If necessary, charge the closing spring using the charging handle until the indicators represented in step 1 appear.	
2	Close the circuit breaker by pressing the closing push button I. Verify that the indicators change status and signal that the circuit breaker is closed (CLOSED) and the closing spring discharged.	
	Information If a charging motor is installed and powered, the closing spring charges automatically.	

23.3 Closing the circuit breaker after a trip operation

Following a trip, the trip unit display flashes and the circuit breaker is opened with:

- the spring unloaded if a loading motor is not installed,
- the circuit breaker loaded if a charging motor is installed.

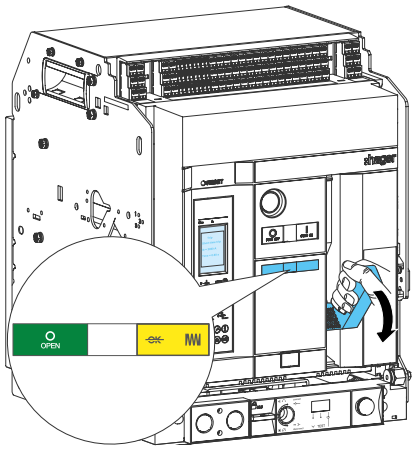
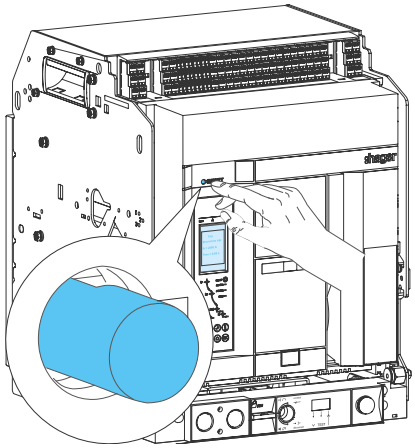
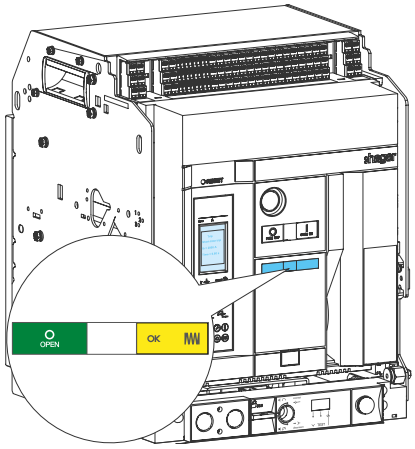
To identify what triggered the tripping, refer to chapter 21 "Alarm management".

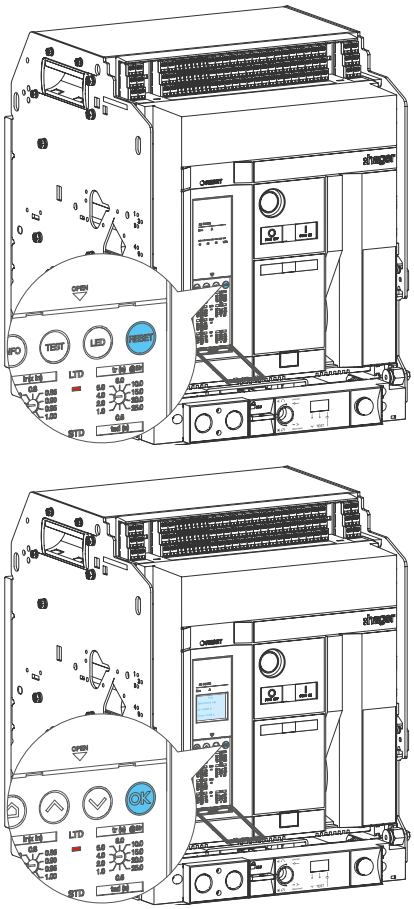
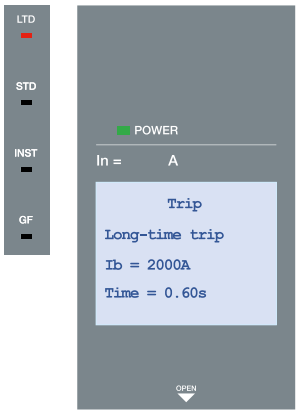
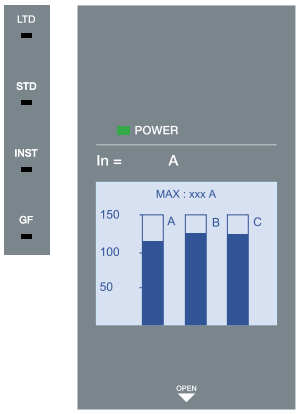


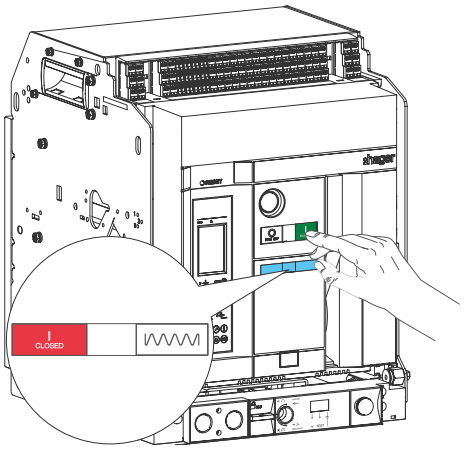
Danger

Risk of electric shock, explosion or arc flash.
Inspect the electrical installation and eliminate the cause of the trip before closing the circuit breaker.
Never close a circuit breaker locally or remotely without first ensuring that the installation complies with safety standards.

To close the circuit breaker:

	Action	Illustration
1	Load the closing spring using the charging handle until the indicator changes status. Check that the indicators indicate that the closing spring is loaded, but the circuit breaker is not ready to be closed.	
2	Press the circuit breaker RESET re-arm button.	
3	Check that the closing spring is charged. The circuit breaker is now ready to be closed.	

	Action	Illustration
4	Then reset the trip unit display. Briefly press the RESET key for a Type L trip unit and the OK key for a Type A trip unit.	
5	For Type A and L trip unit, the LED corresponding to the fault (STD, LTD, INST and GF) goes out. For Type A trip unit, the trip unit's display changes from this message... to this message.	 

	Action	Illustration
6	Close the circuit breaker by pressing the closing push button I. Verify that the indicators change status and signal that the circuit breaker is closed (CLOSED) and the closing spring discharged.	
	Information If a charging motor is installed and powered, the closing spring charges automatically.	I CLOSED OK

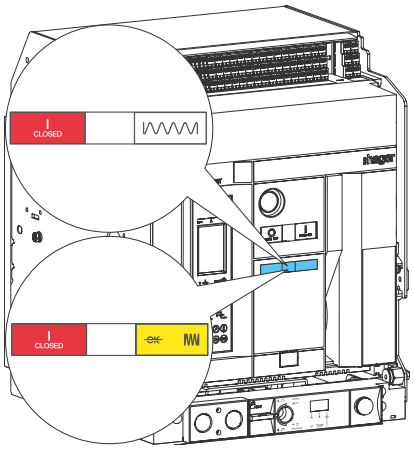
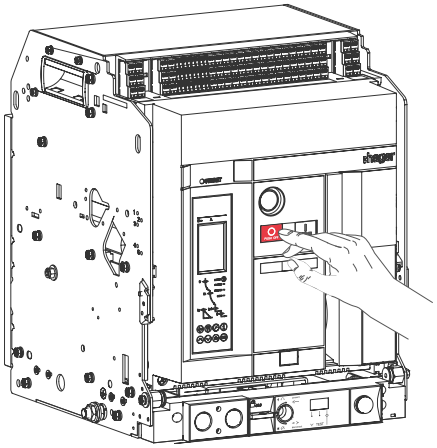
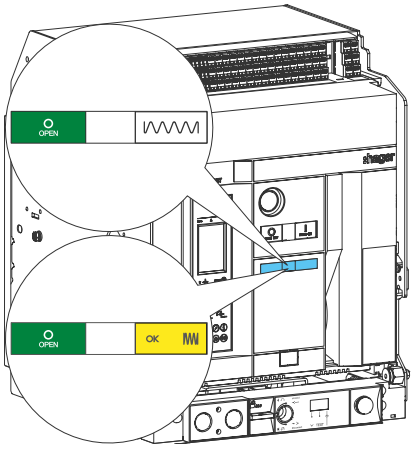
Information

The trip unit must be powered in order for it to perform its protection functions. It is powered as long as a minimum current of 40% of the nominal current In passes through the circuit breaker.

Nevertheless, it is strongly recommended that an external power supply be connected to terminal block TU 240V AC to guarantee optimal operation of the trip unit and prevent malfunctions in the electrical installation associated with a breach in the continuity of the trip unit operation.

23.4 Opening of the circuit breaker

To open the circuit breaker:

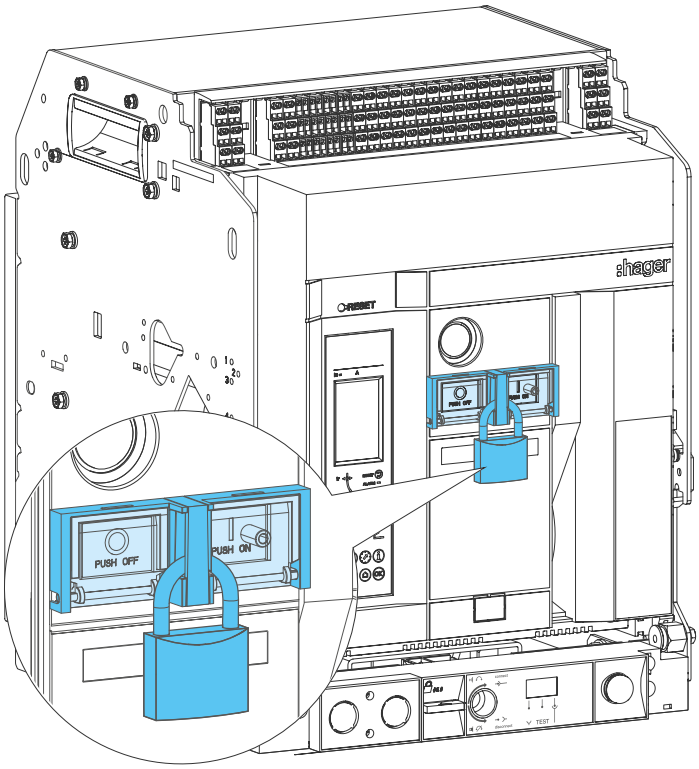
	Action	Illustration
1	Check that the circuit breaker is open, the closing spring is discharged or charged if a charging motor is installed.	
2	Open the circuit breaker by pressing the opening push button .	
3	Verify that the indicators change status and signal that the circuit breaker is open (OPEN) and: • If the circuit breaker is not equipped **with an MO spring charging motor,** that **the closing spring is discharged**. • If the circuit breaker is equipped **with an MO spring charging motor,** that **the closing spring is charged.**	

23.5 Locking the opening and closing push buttons

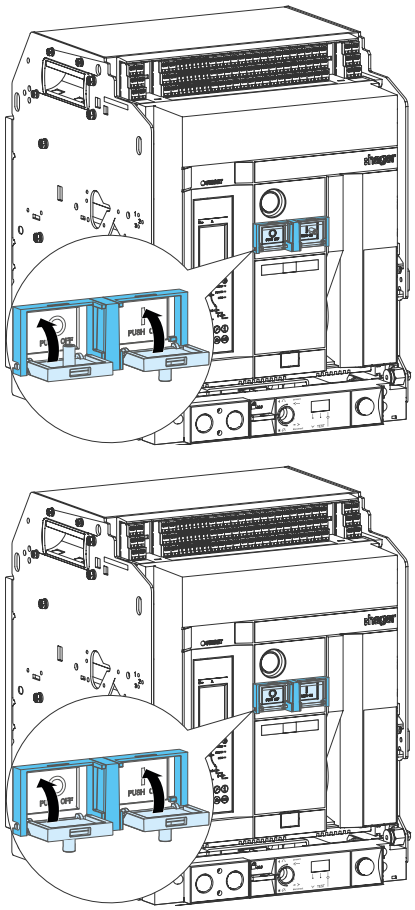
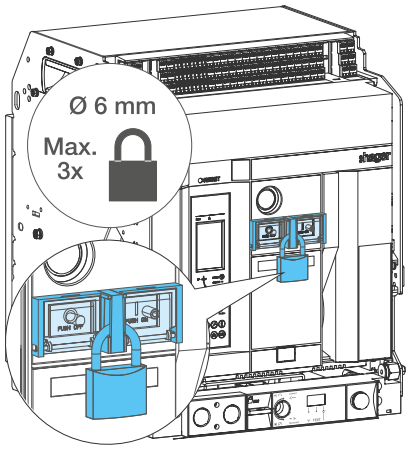
The closing PUSH ON and opening PUSH OFF push buttons can be locked against any operation using the PBC push button covers.
This prevents any inadvertent or unauthorised operations.

The transparent PBC push button covers have an additional function. They can be disengaged and turned so that the PUSH off opening push button remains mechanically forced at all times.
This lockout function is also guaranteed if the circuit breaker is operated remotely by a CC closing coil. Even if the CC closing coil is driven, the main contacts remain open.
This prevents any inadvertent or unauthorised operations.

The push buttons can be locked independently or jointly and up to 3 Ø 6 mm padlocks can be fitted.



To activate the locking device:

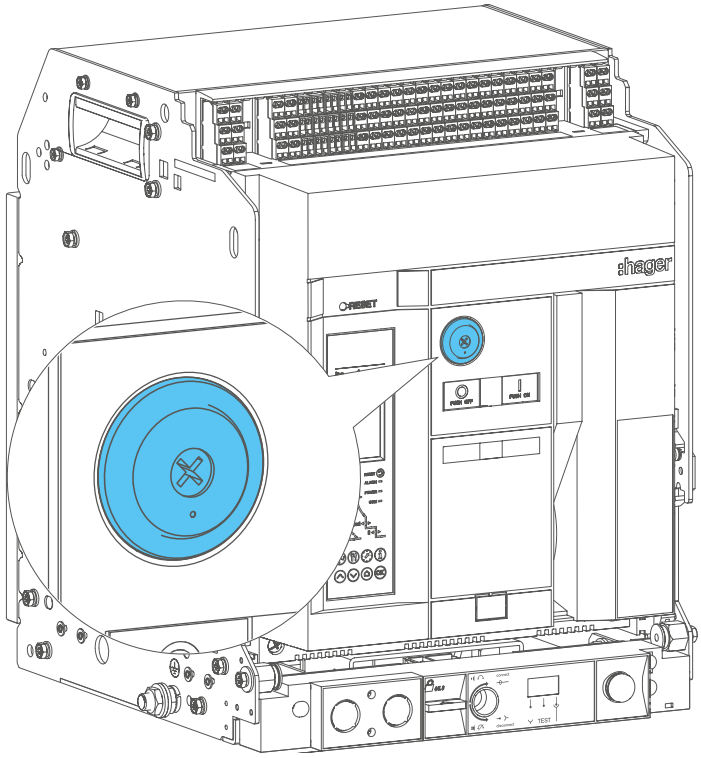
	Action	Illustration
1	Fold down the PBC push buttons according to the position you want to lock. **Case 1** The opening push button is pressed continuously and the closing push button is blocked. **Case 2** The opening and closing push buttons are blocked.	
2	Lock it using one or more padlocks.	

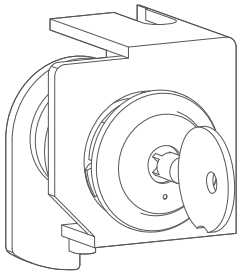
Information

- It is not possible to hold down the closing push button with this accessory.
- Refer to instruction manual 6LE007871A to install this locking accessory.

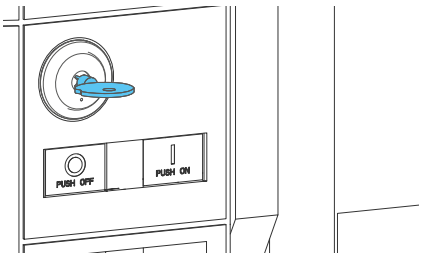
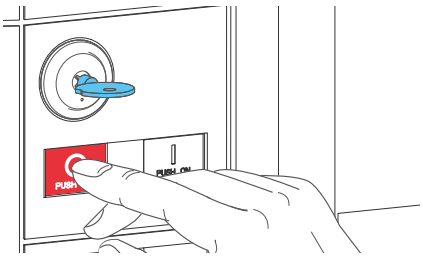
23.6 Interlocking of the circuit breaker using a lock

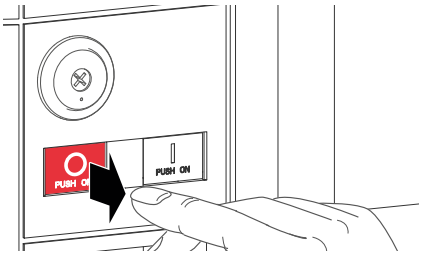
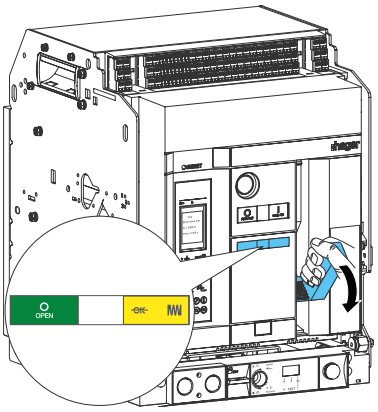
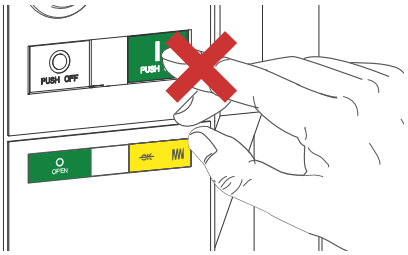
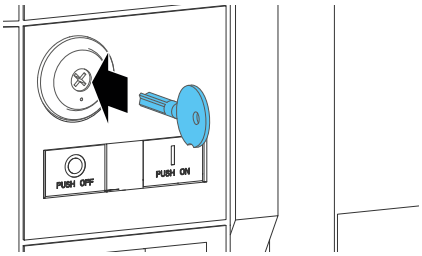
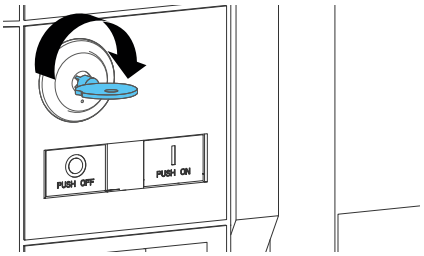
This locking device prevents the circuit breaker from closing using a key lock.





To activate or deactivate the locking device:

	Action	Illustration	
1	Check that the key is in the horizontal position. Press the opening push button. The circuit breaker opens.		
2	While pressing down the opening push button, put the key back into the vertical position by turning it counter-clockwise. Remove the key.		

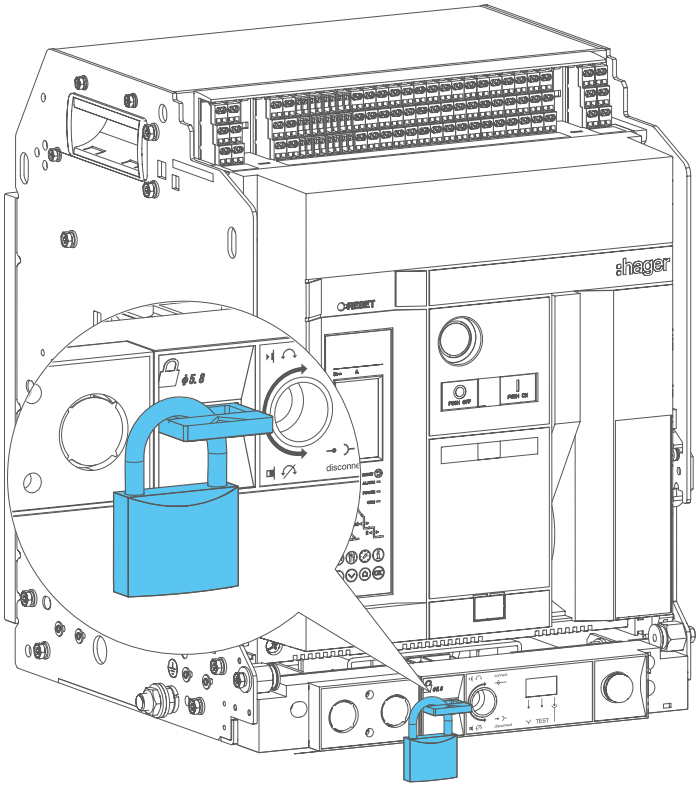
	Action	Illustration	
3	Then release the press on the opening push button .It returns to its initial position.		
4	If necessary, charge the closing spring using the charging handle until the following indicators appear. Check that it is no longer possible to close the circuit breaker by pressing the closing push button .		
5	To unlock the device, insert the key into the lock. Turn the lock key clockwise.		
6	Check that it is now possible to close the circuit breaker by pressing the closing push button .		

Information

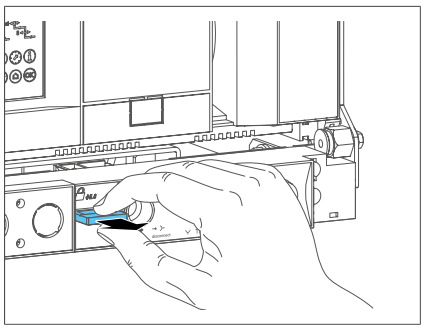
- The key remains locked in the lock. To remove it, follow steps 1 to 2.
- Refer to instruction manual 6LE089873A to install this locking accessory.

23.7 Locking the chassis using padlocks

This locking device locks the circuit breaker in the chassis and prevents the racking handle from being inserted.
Up to 3 Ø 6-8 mm padlocks can be installed.

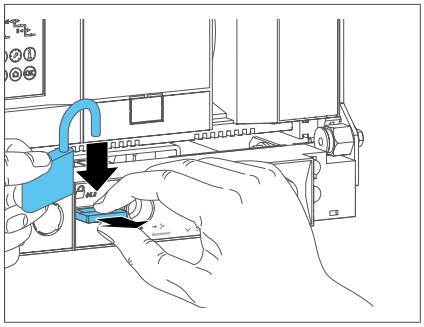
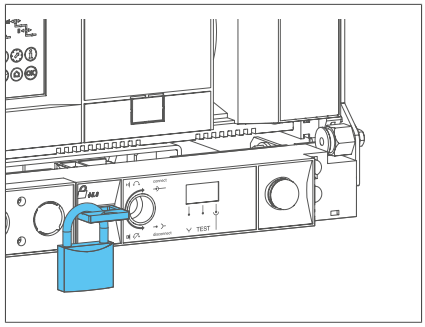
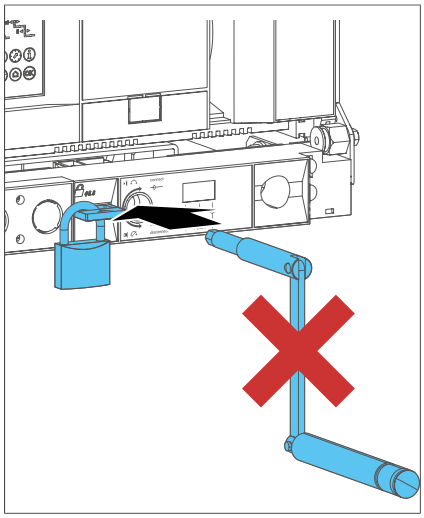
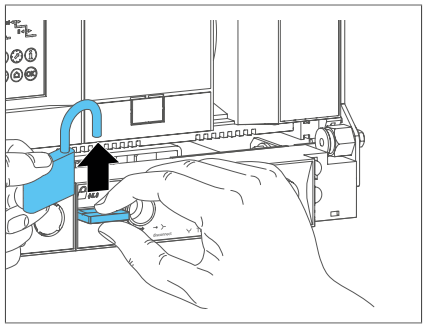
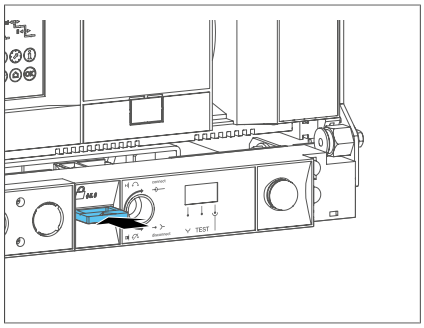
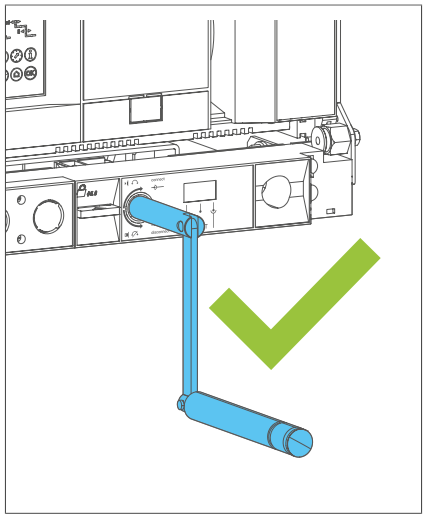


To activate the locking device:

	Action	Illustration
1	Check that the circuit breaker is in one of the 3 stable states (Connected, Test or Disconnected) and then that the racking handle is not already inserted into the racking-in/racking-out hole. Pull on the padlocking and position acknowledgement tab.	

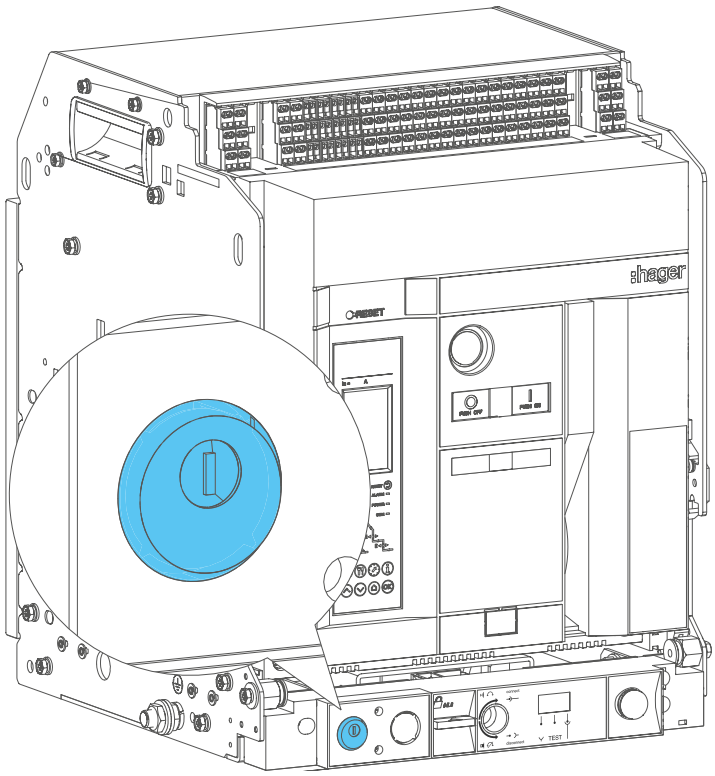
Information

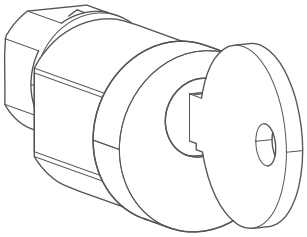
A special version of the circuit breaker is available for applications with locking in the drawout position only.

	Action	Illustration	
2	Position the padlock on the tab and close it.		
3	Check that it is not possible to insert the racking handle into the racking-in/racking-out hole. To unlock the device, pull on the padlock and position acknowledgement tab and remove the padlock.		
4	Check that the padlock and position acknowledgement tab returns to its initial position. Check that it is now possible to insert the racking handle into the racking-in/racking-out hole.		

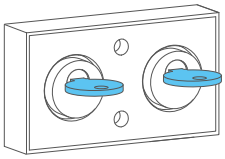
23.8 Locking the chassis using keylocks

This locking device locks the circuit breaker in the chassis and prevents the racking handle from being inserted.

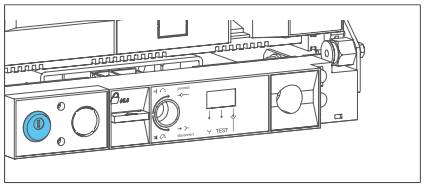
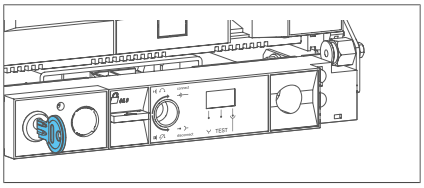


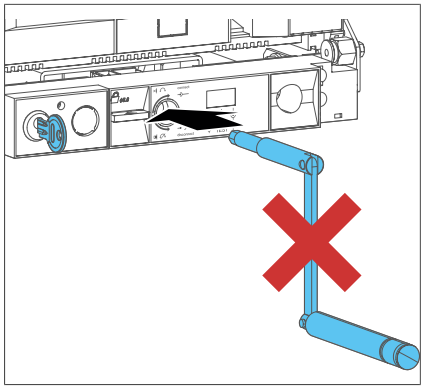


Up to 2 locks can be installed in the housing.



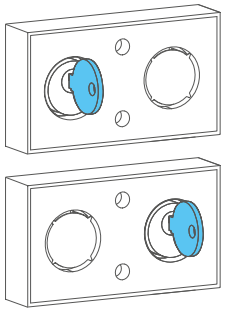
To activate or deactivate the locking device:

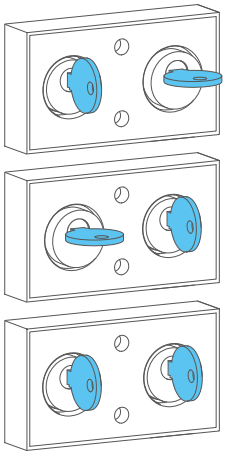
	Action	Illustration	
1	Check that the lock is in the vertical position. Or that the key is inserted in the position.		

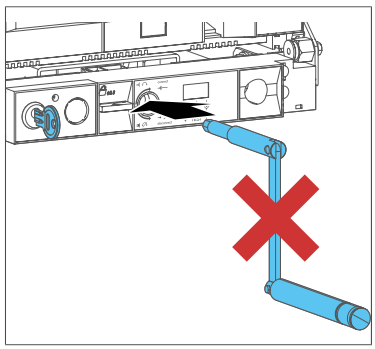
	Action	Illustration	
2	Check to ensure that it is not possible to insert the racking handle into the racking-in/racking-out hole.		

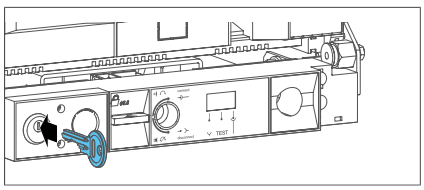
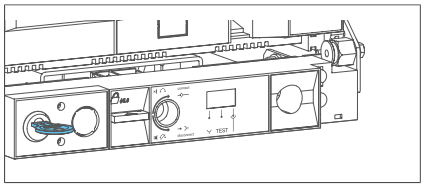
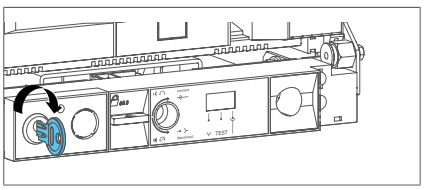
Information

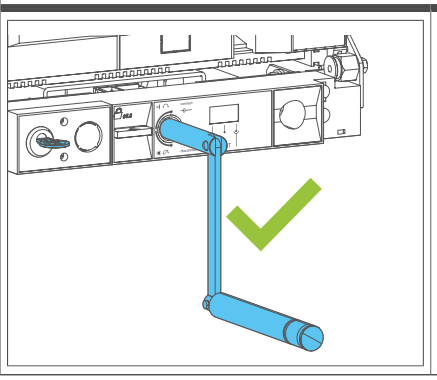
If one or 2 locks are installed, a single key in the vertical position prevents the introduction of the racking handle into the racking-in/racking-out hole.





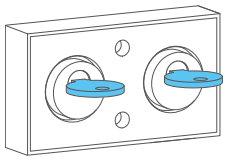


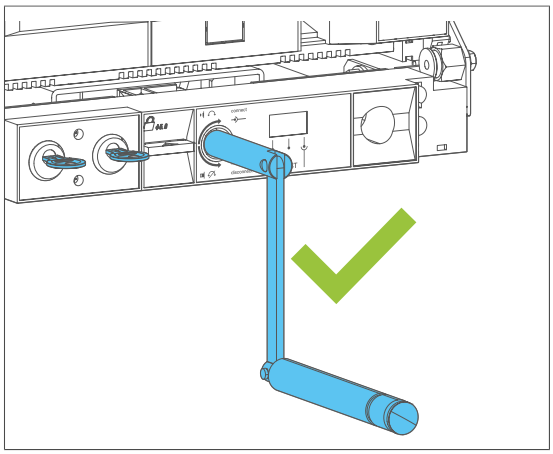
3	To unlock the device, insert the key into the lock. Turn the key of the locking device clockwise... to move it to the horizontal position.	 	

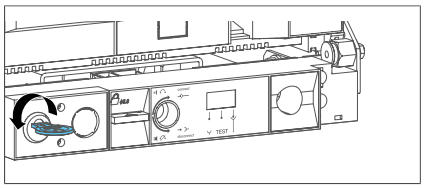
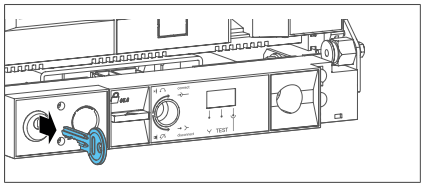
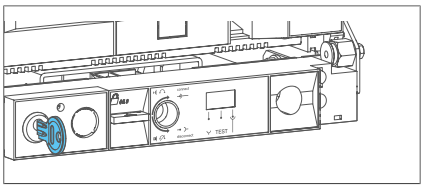
	Action	Illustration	
4	Check that it is now possible to insert the racking handle into the racking-in/racking-out hole.		

Information

If 2 locks are installed, both keys must be in the horizontal position to allow the introduction of the racking handle into the racking-in/racking-out hole.





5	Remove the racking handle from the racking-in/racking-out hole. The key remains locked in the lock. To remove it, turn the key counter-clockwise to the vertical position.	 	

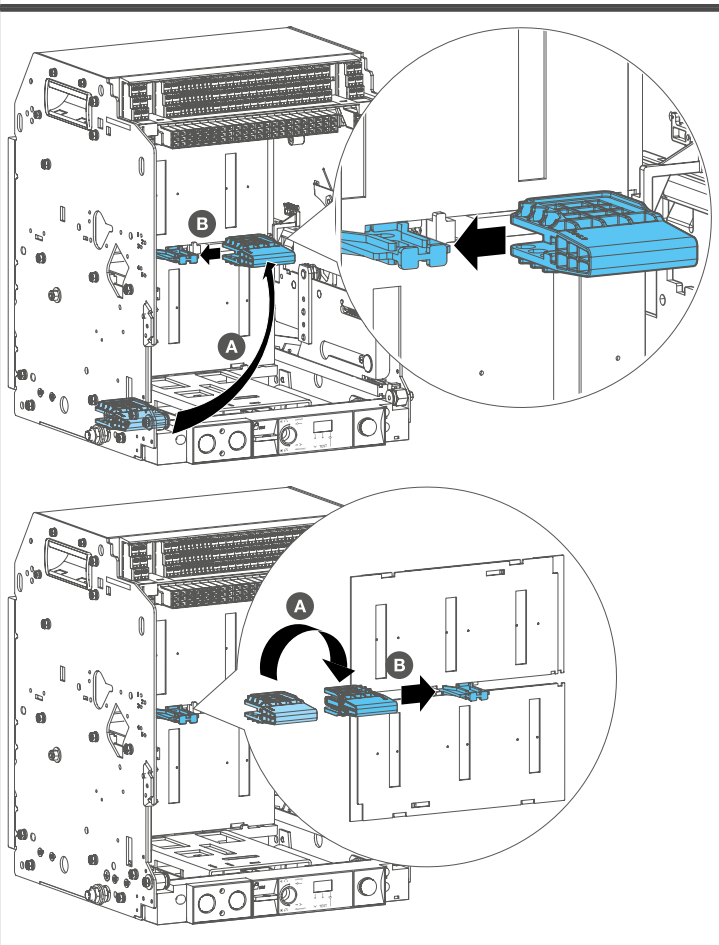
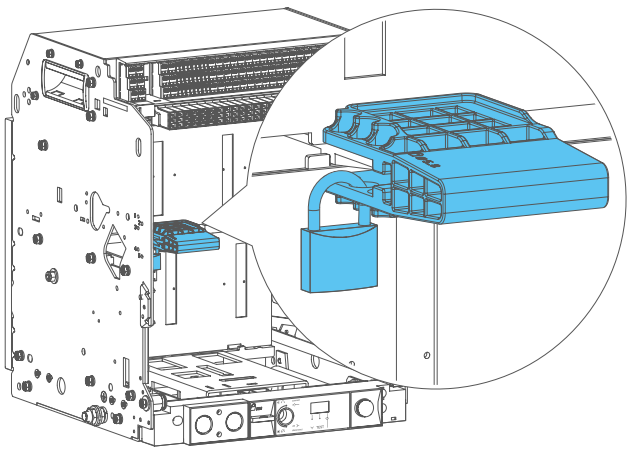
Information

Refer to instruction manual 6LE007877A to install this locking accessory.

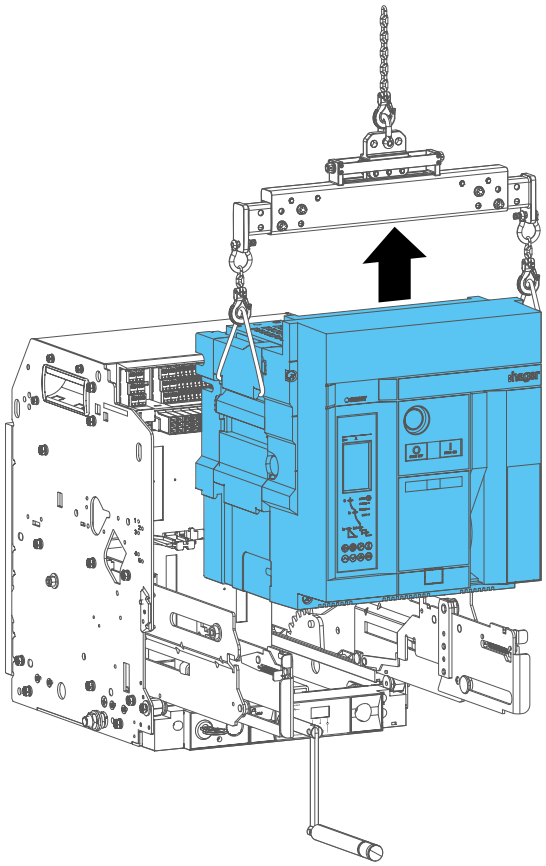
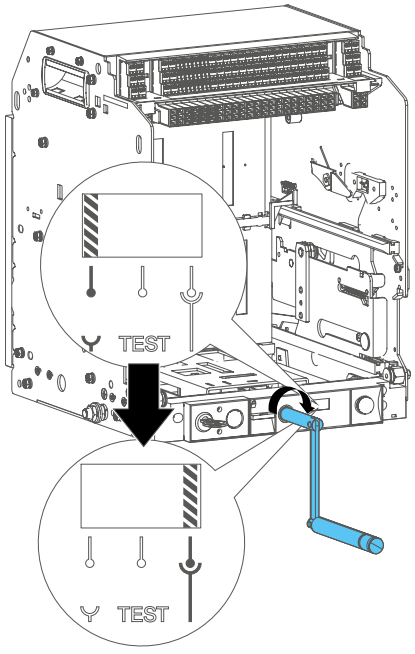
23.9 Locking of the insulating safety shutters

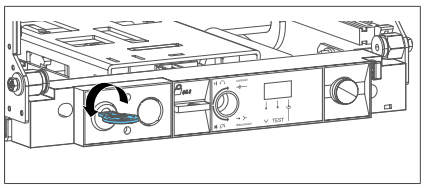
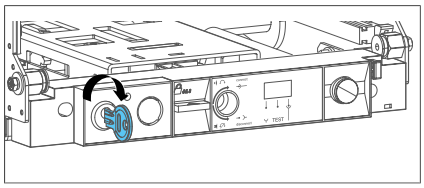
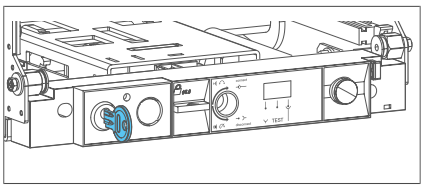
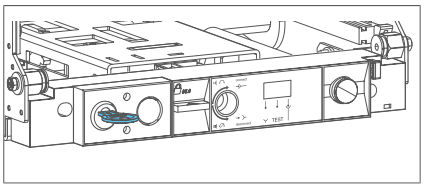
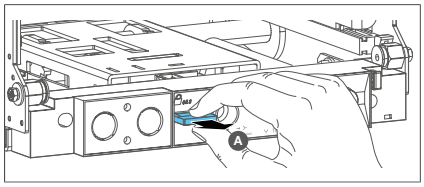
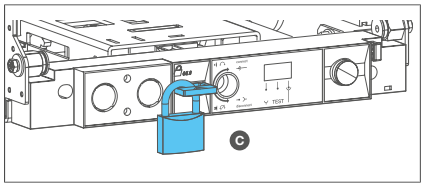
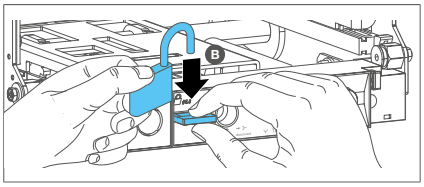
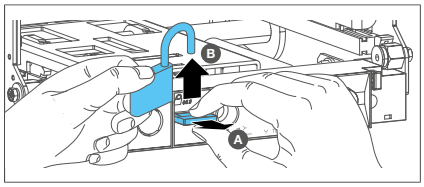
The safety isolating shutters hide the main circuit contacts in the chassis when the circuit breaker is in the disconnected or Test position. They prevent accidental access to the connections.
The top and bottom flaps can be locked to prevent opening or racking the circuit breaker into the Connected position

❶ Locking using the accessory in the chassis. This accessory is factory integrated with all versions of hws drawout circuit breakers.

	Action	Illustration
1	Remove the locking accessory from the chassis and place it on the insulating safety shutter. Note that the accessory can be inserted from 2 sides by turning it through 180°.	
2	Lock the shutter with a padlock. Up to three Ø5 to Ø8 mm padlocks can be installed.	

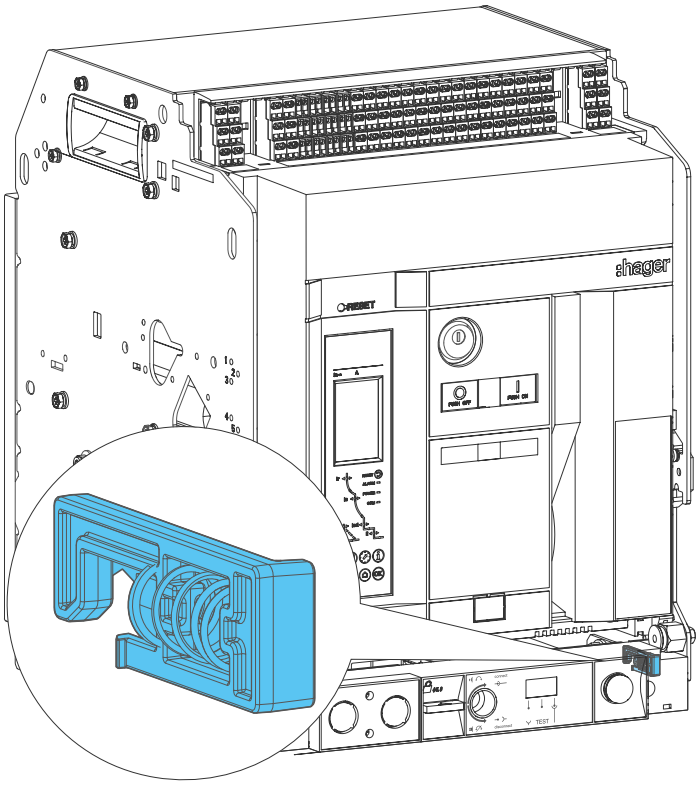
❷ Locking using the CL key locks or padlocking and position acknowledgement tab.

	Action	Illustration
1	Remove the circuit breaker from the chassis (see Chapter 10, Removing the drawout circuit breaker).	
2	Put the circuit breaker in the Connected position (see Chapter 9, Operation of the drawout circuit breaker in the chassis).	

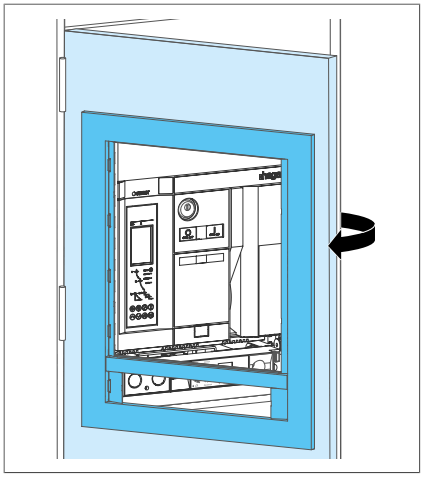
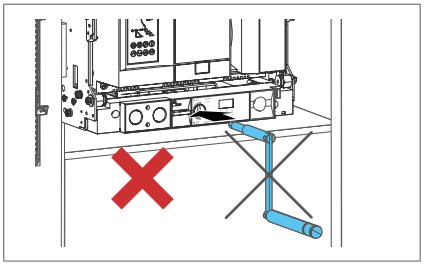
	Action	Illustration	
3	Remove and store the racking handle. Using the key lock, turn the locking device key anticlockwise... to move it to the vertical position. To unlock the safety shutters, turn the key clockwise to the horizontal position.	 	 
4	The insulating safety shutters can also be locked using the padlocking and position acknowledgement tab. a) Pull on the tab. b) position the padlock. c) Close it.	 	
5	To unlock the insulating safety shutters: a) Pull on the tab b) Remove the padlock.		

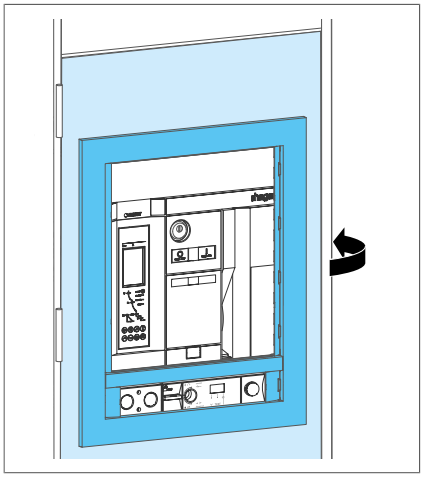
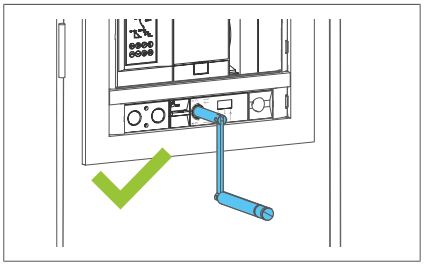
23.10 RI open door racking interlock

This locking device prevents the racking handle being inserted into the circuit breaker rack in/rack out mechanism when the door of the electrical cabinet is open.



To activate the locking device:

	Action	Illustration	
1	Open the electrical cabinet door. Check to ensure that it is not possible to insert the racking handle into the racking-in/racking-out hole.		

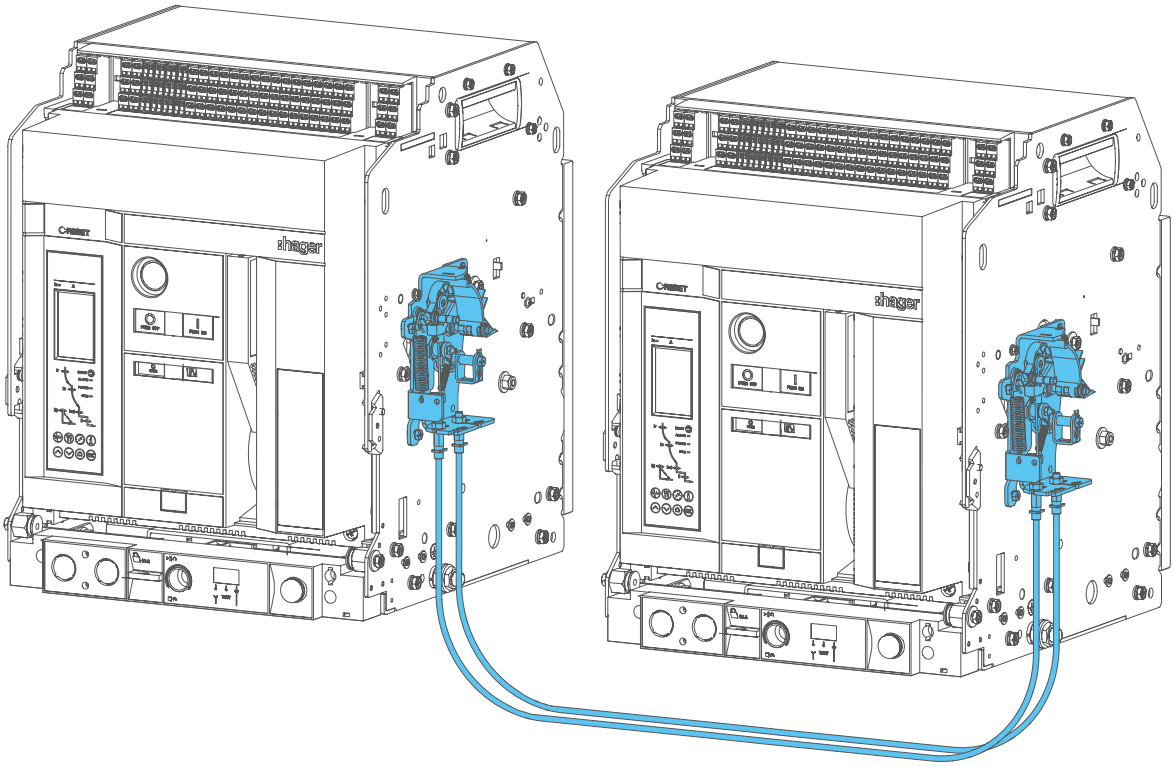
	Action	Illustration	
2	Close the electrical cabinet door. Check to ensure that it is now possible to insert the racking handle into the racking-in/racking-out hole.		

Information

Refer to instruction manual 6LE007874A to install this locking accessory.

23.11 Mechanical interlock

The mechanical interlocking kit is used to interlock 2 to 3 circuit breakers installed vertically or horizontally in the electrical cabinet.



In this way it prevents interlocked circuit breakers closing at the same time according to the types of application described below:

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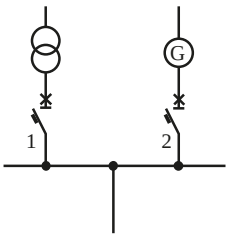
<tr><th>Diagram</th><th>Type</th><th>Locking logic</th><th>Description</th></tr>
<tr><td> 
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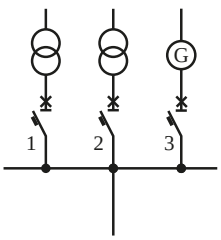
<tr><td>1</td><td>0</td></tr>
<tr><td>0</td><td>1</td></tr>
</table></td><td>Only one device out of two can be closed.</td></tr>
<tr><td> 
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<tr><td>0</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td></tr>
</table></td><td>Only one device out of three can be closed.</td></tr>
</table>

<table>
<tr><th>Diagram</th><th>Type</th><th>Locking logic</th><th>Description</th></tr>
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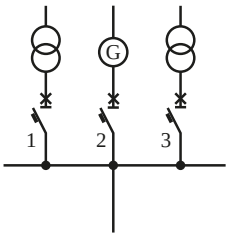
<td> 
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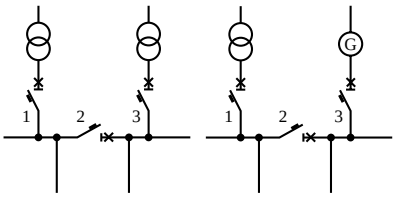
<tr><td>1</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td></tr>
</table>
</td>
<td>Allows two devices to be closed if the third is open.
The latter can only be closed if the other two are open.</td>
</tr>
<tr>
<td> 
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<tr><td>0</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>1</td></tr>
</table>
</td>
<td>Two devices out of three can be closed at the same time.</td>
</tr>
</table>

24 Glossary

ANSI
American National Standards Institute. Each electrical protection corresponds to an ANSI code.

ENCT
External neutral current sensor.

GF
Earth fault protection.

INST
Instantaneous Protection

LTD
Long Time Delay. Long time delay.

MCR
Making Current Release. Automatic instantaneous protection upon closure of the power contacts for short-circuit fault.

Breaking capacity
The value of the prospective current that a switching device is capable of breaking at a stated voltage under prescribed conditions of use and behaviour.
Reference is generally made to the rated ultimate short-circuit (Icu) breaking capacity and to the service short-circuit breaking capacity (Ics).

Ultimate short circuit breaking rating (ICU)
Expressed in kA, it indicates the maximum breaking capacity of the circuit breaker.
It is confirmed by a test sequence O - t - CO (according to IEC 60947-2) at ICU, followed by a test to prove that the circuit is properly isolated. This test ensures safety for the user.

PTA
Pre-Trip Alarm. Overload pre-alarm.

STD
Short Time Delay. Short time delay protection

ZSI
Zone Selective interlocking. Zone selectivity.

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