

SACE Emax 2

Emax low voltage air circuit-breakers E2.2-E4.2-E6.2

Installation, operation and maintenance instructions for
the installer and the user



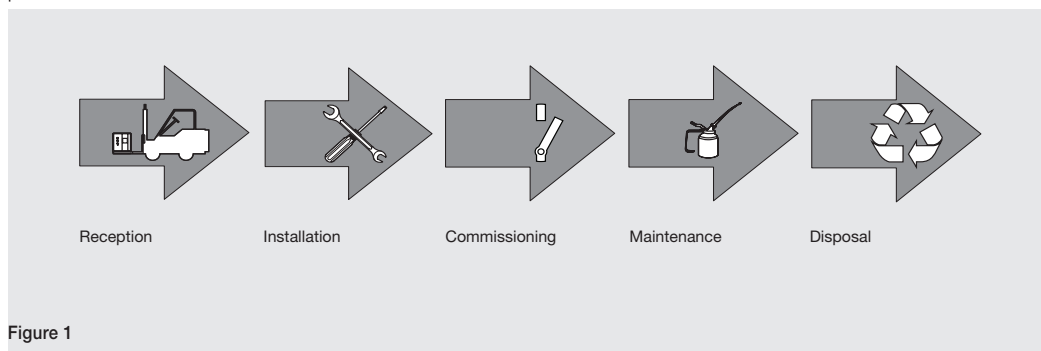
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Emax E2.2-E4.2-E6.2 circuit-breakers

1 - Contents

Organization of this handbook This manual contains instructions on the operations to be performed on EMAX circuit-breakers E2.2-E4.2-E6.2 throughout their life cycle, from reception to installation, and from commissioning to subsequent maintenance during operation, with particular attention to the environment at the end of the life cycle of the product.



Intended readership This manual refers to two user profiles, as defined by standard IEC 60050:

- Expert person, in the electrical area (IEV 195-04-01): Person with sufficient training and experience to allow him/her to perceive the risks and to avoid the hazards potentially created by electricity.
- Instructed person, in the electrical area (IEV 195-04-02): person adequately informed or supervised by electrotechnical personnel to allow them to perceive the risks and to avoid the hazards potentially created by electricity.



NOTE: This manual specifically indicates what operations can be performed by people trained in the field of electricity. All the remaining operations described in the handbook must be performed by expert persons, in the electrical area. ABB declines all liability for damage to persons or property caused by failure to comply with the instructions in this document.

Instructions



HAZARD! RISK OF ELECTRIC SHOCK! Unplug or disconnect any power supply, to avoid any potential risk of shock during assembly, installation, maintenance or removal of the circuit-breaker from the service.



WARNING! Some operations must be performed when the circuit-breaker is energized. In this case it is necessary to comply with all safety regulations.

Warnings

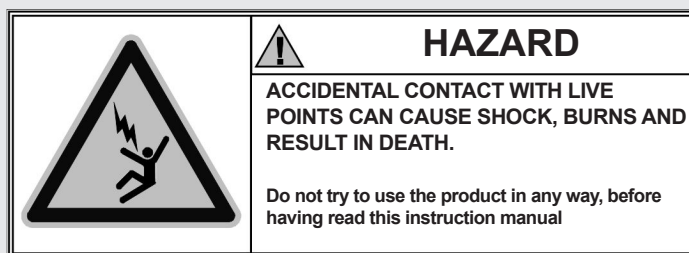


Figure 2

The following warnings must be respected:

- **READ THE INSTRUCTIONS CAREFULLY BEFORE TRYING TO INSTALL, OPERATE OR REPAIR THE CIRCUIT BREAKER.**
- Store these instructions along with other documents for instruction, maintenance and installation, drawings and descriptive notes on the circuit-breaker.
- Keep these documents available during the installation, operation and maintenance of the appliance. The use of these instructions facilitates proper maintenance.
- Install the circuit-breaker within the limits of the project described in the instruction manual shipped with the unit. These circuit-breakers are designed to operate with values of voltage and current within the limits of plate ratings. Do not install this equipment in systems operating at nominal values exceeding these limits.
- Follow the safety procedures indicated by Your Company.
- Do not open any covers or doors, do not work on devices before removing power from all circuits, and after making sure of that with a measuring instrument.

**WARNING!**

- detailed descriptions of standard procedures for installation, use, maintenance and principles for safe operation are not included. It is important to note that this document contains safety and precaution instructions, against certain methods (of installation, use and maintenance) that could cause harm to personnel, damage devices, or make them unsafe.
- these warnings and alarms do not include all conceivable ways to make installation, use and maintenance recommended by ABB or not, that may be made, or possible consequences and complications of each conceivable way, nor shall ABB investigate all those ways.
- anyone using maintenance procedures or devices, recommended by ABB or not, must check thoroughly that neither personal safety nor the safety devices are endangered by mode of installation, use, maintenance or the instruments used. For more information, questions or specific problems contact your nearest ABB representative.
- This manual is written for qualified personnel only and is not intended as a substitute for a proper course, or experience about safety procedures for this device.
- for the products equipped with communication, the purchaser, the installer or the final customer is responsible for applying all the IT security measures necessary in order to prevent risks deriving from connection to communication networks; such risks include, among other things, the use of the product by unauthorized persons, alteration of its normal functionality, accessing and modifying the information.
- the purchaser, installer or end user is responsible for ensuring that notices and safety signs are posted and that all access points and switching devices are locked securely when the switchgear is left unattended, even momentarily.
- all the information contained in this document reflects the latest product information available at the time of printing. We reserve the right to edit the document at any time and without notice

Standards The Emax 2 circuit-breakers and their accessories comply with the following international standards:

- IEC 60947
- EN 60947
- CEI EN 60947
- IEC 61000
- UL 1066

They comply with the following EC directives:

- "Low Voltage Directives" (LVD) no.. 2006/95/EC
- "Electromagnetic Compatibility Directive" (EMC) no. 2004/108/EC

The Emax 2 circuit-breakers also feature a range certified according to these standards:

- Russian - GOST (Russia Certificate of Conformity)
 - Chinese - China CCC (China Compulsory Certification)
-

2 - Transport and checking on receipt

Introduction The Emax 2 circuit-breakers, on account of their weight, require special attention during transport and handling.

They are distributed with following packages:

- single package for fixed circuit-breaker
- two packages for withdrawable circuit-breakers (one package for the fixed part and one for the mobile part).

The following notes regard transport, handling and storage.

Weight of the circuit-breakers with packaging

The following table specifies the weights of the circuit-breakers with packaging:

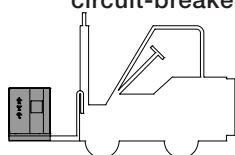
	Fixed			Moving part of withdrawable device			Fixed part of withdrawable device		
	III	IV	Fs	III	IV	Fs	III	IV	Fs
E2.2	46 Kg / 101 lbs	58 Kg / 128 lbs		53 Kg / 117 lbs	60 Kg / 132 lbs		41 Kg / 90 lbs	49 Kg / 108 lbs	
E4.2	63 Kg / 139 lbs	77 Kg / 170 lbs		67 Kg / 148 lbs	81 Kg / 179 lbs		57 Kg / 126 lbs	69 Kg / 152 lbs	
E6.2	118 Kg / 260 lbs	134 Kg / 295 lbs	151 Kg / 333 lbs	129 Kg / 258 lbs	143 Kg / 315 lbs	159 Kg / 350 lbs	96 Kg / 212 lbs	109 Kg / 240 lbs	123 Kg / 271 lbs
E2.2-A	50 Kg / 110 lbs	63 Kg / 139 lbs		59 Kg / 130 lbs	68 Kg / 150 lbs		39 Kg / 86 lbs	46 Kg / 101 lbs	
E4.2-A	66 Kg / 154 lbs	81 Kg / 179 lbs		75 Kg / 165 lbs	91 Kg / 201 lbs		52 Kg / 115 lbs	63 Kg / 139 lbs	
E6.2-A	126 Kg / 278 lbs	143 Kg / 315 lbs	159 Kg / 351 lbs	147 Kg / 324 lbs	163 Kg / 359 lbs	180 Kg / 397 lbs	88 Kg / 194 lbs	100 Kg / 220 lbs	110 Kg / 243 lbs



NOTE:

- weights are indicated with reference to the basic circuit-breakers including protection release and its sensors, without terminals and without accessories.
- the weights of the fixed part of withdrawable circuit-breakers refer to the version with horizontal rear terminals.

Transport of the packaged circuit-breaker



WARNING! Improper lifting can result in death, serious injury to persons and damage to the equipment. Never lift a circuit-breaker and / or a fixed part above other people.



IMPORTANT: The trained personnel in charge of handling and lifting must use appropriate safety equipment.

Identification of packaging Examine the state of the packaging and check that:

- The data on the packaging plate match the data of the order.
- The box is intact and perfectly closed.

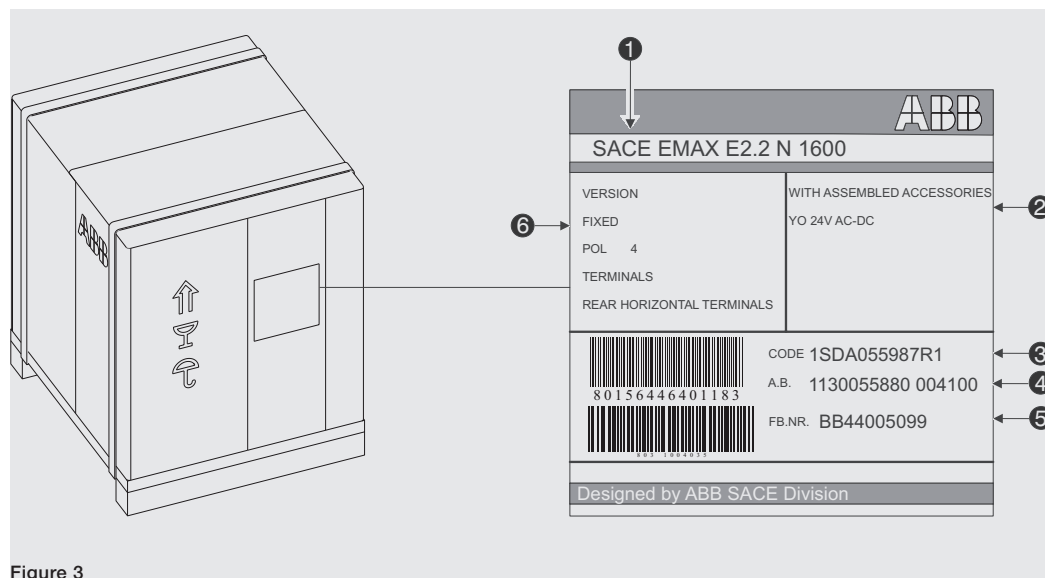


Figure 3

Pos.	Description
1	Short description of the circuit-breaker
2	Description of accessories
3	Commercial code
4	Confirmation number and location
5	Circuit-breaker serial number
6	Features of the circuit-breaker

Packaging checks Examine the state of the material received and verify that:

- The circuit-breaker or the fixed part are consistent with the order.
- The circuit-breaker or the fixed part are completely intact.

**IMPORTANT:**

- If the material is to be stored, check it beforehand. For opening the packaging, follow the procedures outlined in the section "Unpacking and handling - opening the packages" on page 10
- In the case of any inconsistencies, report them within five days of reception. See the paragraph "Damage and Discrepancy Report" in this chapter.

Damage and Discrepancy Report If there is any damage to the packaging upon receipt and / or inconsistencies between order and product identification label or product please contact ABB. Damage to the packaging must be reported no later than seven days from receipt of the material.



NOTE: The notification must indicate the Packing List number.

Storage method Place the packaging (circuit-breakers and / or fixed parts) on a horizontal plane, not in contact with the floor. If the circuit-breaker has been removed and reinserted in the package ensure, prior to storage that:

- The circuit-breaker is in the open position and the springs are unloaded. See the chapter "Description - circuit-breaker opening/closing operations" on page 16
- The circuit-breaker is protected and locked in its original packaging



WARNING! overlay up to three packages with circuit-breakers E2.2 and E4.2 and up to two packages with circuit-breakers E6.2. If the packaging has been opened, you can stack the circuit-breakers on the condition that the package is re-wrapped as original.

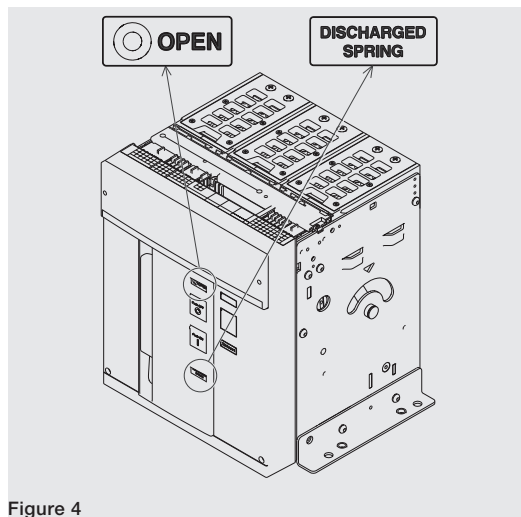


Figure 4

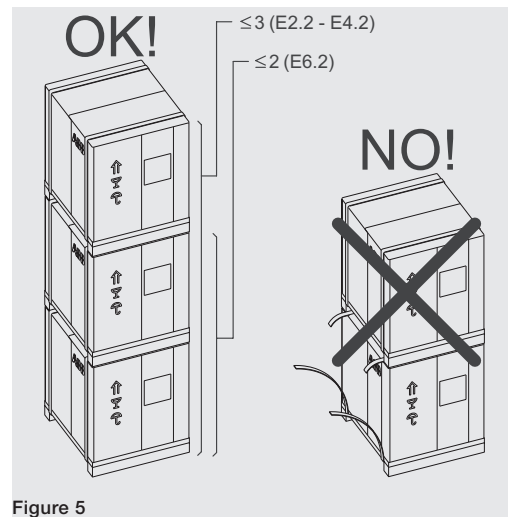


Figure 5

3 - Unpacking and handling

Opening the packaging



NOTE: to unpack the circuit-breaker safely refer to the instruction sheet in the zipped packaging pouch.

The following is the procedure for opening the packaging:

1. Cut the bands that wrap the packing box. See Figure 6 e Figure 7.

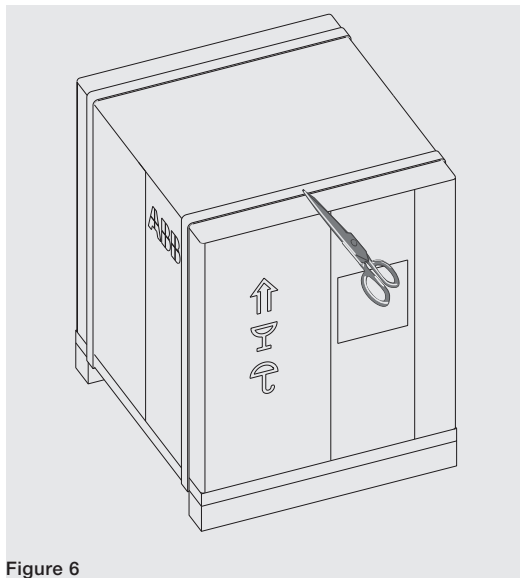


Figure 6

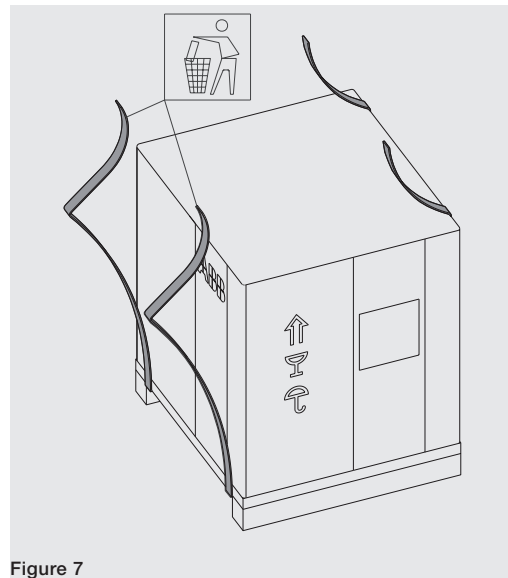


Figure 7

2. Open the upper part of the packing box. See Figure 8.
3. Remove the packing box by lifting it upwards. See Figure 9.

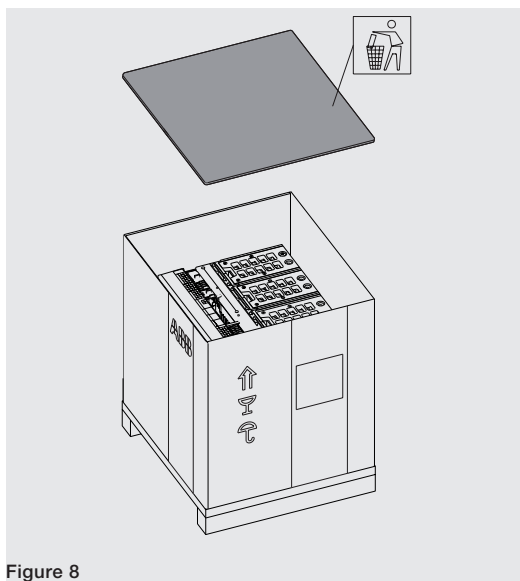


Figure 8

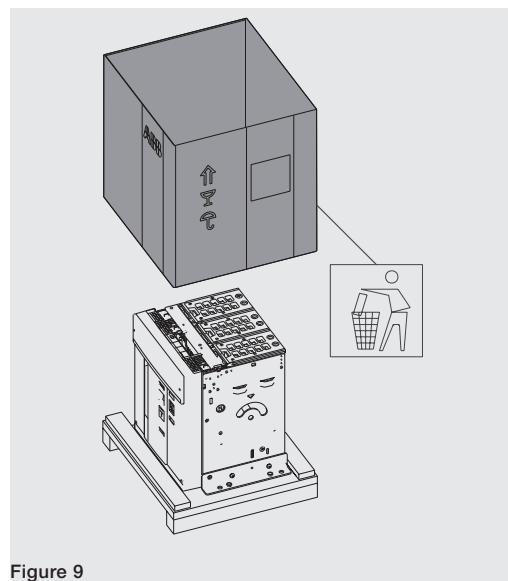


Figure 9

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4. Disassembly the screws (See Figure 10 Fixed circuit-breaker). Disassembly the screws and the mounting brackets (See Figure 11 Moving part IEC, Figure 12 Moving part UL, Figure 13 Fixed part IEC and Figure 14 Fixed part UL).

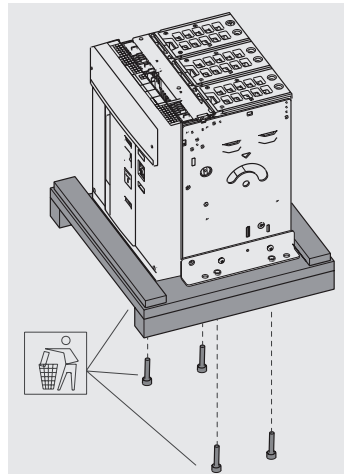


Figure 10 Fixed circuit-breaker

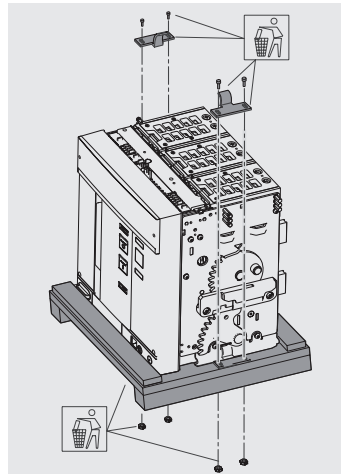


Figure 11 Moving part IEC

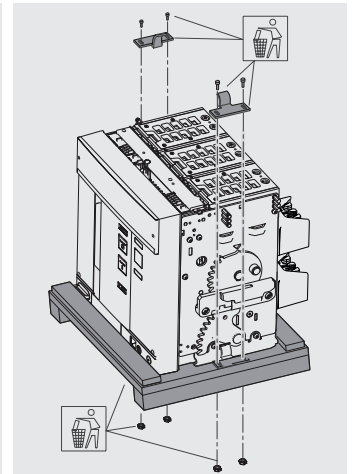


Figure 12 Moving part UL

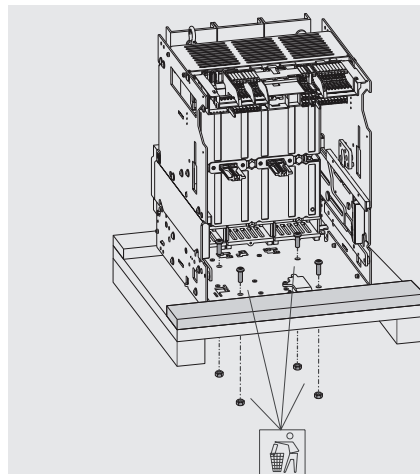


Figure 13 Fixed part IEC

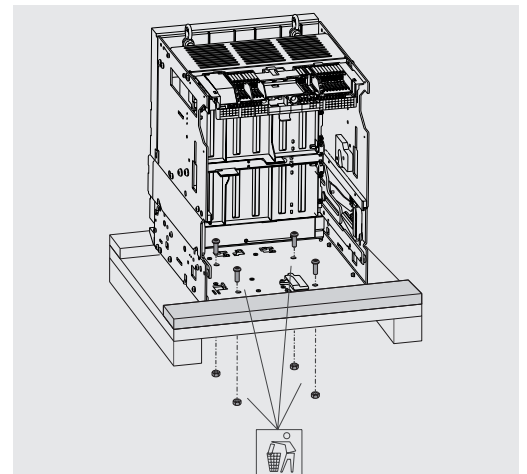


Figure 14 Fixed part UL

Disposal of packing materials For disposal of the packaging materials see the chapter " 6 - Decommissioning and treatment at end of life " on page 113.

Weight of circuit-breakers without packaging

The following table specifies the weights of the circuit-breakers without packaging:

	Fixed			Moving part of withdrawable device			Fixed part of withdrawable device		
	III	IV	Fs	III	IV	Fs	III	IV	Fs
E2.2	41 Kg / 90 lbs	53 Kg / 117 lbs		48 Kg / 106 lbs	55 Kg / 121 lbs		36 Kg / 79 lbs	44 Kg / 97 lbs	
E4.2	56 Kg / 123 lbs	70 Kg / 154 lbs		60 Kg / 132 lbs	74 Kg / 163 lbs		50 Kg / 110 lbs	62 Kg / 137 lbs	
E6.2	109 Kg / 240 lbs	125 Kg / 276 lbs	140 Kg / 309 lbs	120 Kg / 265 lbs	134 Kg / 295 lbs	148 Kg / 326 lbs	87 Kg / 192 lbs	100 Kg / 220 lbs	112 Kg / 247 lbs
E2.2-A	45 Kg / 99 lbs	58 Kg / 128 lbs		54 Kg / 119 lbs	63 Kg / 139 lbs		34 Kg / 75 lbs	41 Kg / 90 lbs	
E4.2-A	59 Kg / 130 lbs	74 Kg / 163 lbs		68 Kg / 150 lbs	84 Kg / 185 lbs		45 Kg / 99 lbs	56 Kg / 123 lbs	
E6.2-A	115 Kg / 254 lbs	132 Kg / 291 lbs	148 Kg / 326 lbs	136 Kg / 300 lbs	152 Kg / 335 lbs	169 Kg / 373 lbs	77 Kg / 170 lbs	89 Kg / 196 lbs	99 Kg / 218 lbs



NOTE:

- the weights indicated in the table refer to the basic circuit-breakers including relays and its sensors, without terminals and without accessories.
- the weights of the withdrawable circuit-breakers refer to the weight of the fixed part in a version with horizontal rear terminals.

Lift the fixed circuit breaker or the moving part of a withdrawable circuit-breaker



WARNING! Improper lifting can result in death, serious injury to persons and damage to the equipment. Never lift a circuit-breaker and / or a fixed part above other people.



IMPORTANT: The trained personnel in charge of handling and lifting must use appropriate safety equipment.

To lift the circuit-breaker:

- Raise the circuit-breaker from the base of the packaging with the aid of the lifting plates supplied with the circuit-breaker. See Figure 15 and Figure 16.

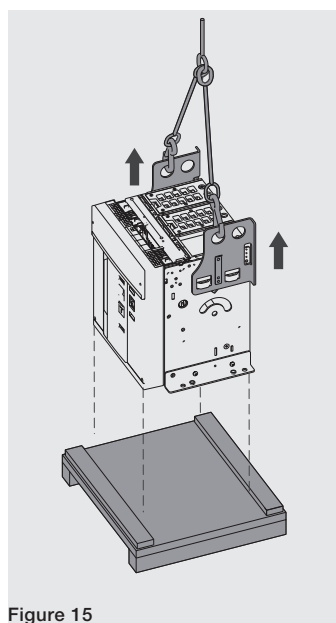


Figure 15

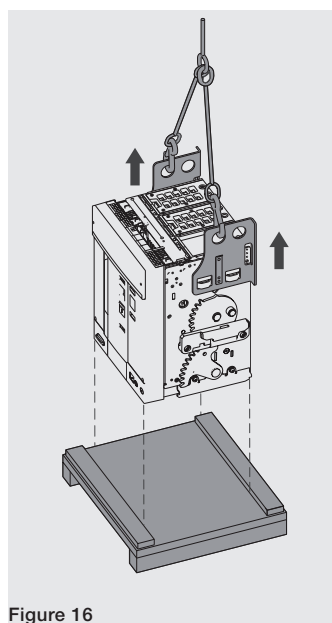


Figure 16

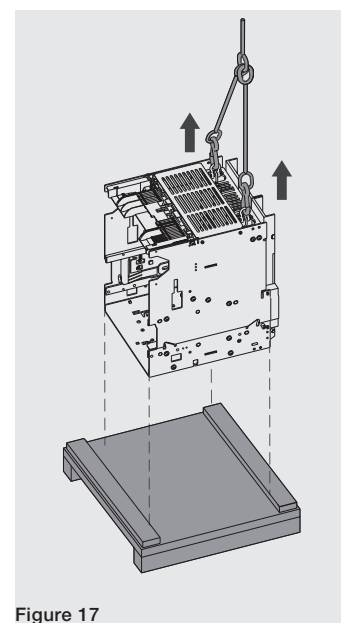


Figure 17

To raise the fixed part of the circuit-breaker

- Raise the fixed part from the base of the packaging with the aid of the two hooks supplied with the fixed part. See Figure 17.



IMPORTANT: keep the lifting plates for the circuit breaker, the lifting hooks of the fixed part and the manual of the circuit-breaker until disposal.

4 - Description

Description of circuit-breaker The Emax E2.2, E4.2 and E6.2 circuit-breakers consist of a steel structure in which the operating mechanism, the poles and the auxiliary parts are located.

Each pole, isolated from the others, contains the breaking parts and the current transformer in its phase.

The structure of the poles differs between selective circuit-breaker or limiter.

The circuit-breaker is available in two types:

- fixed version
- withdrawable

The circuit-breaker in fixed version (see Figure 18) has its own terminals for connection to the power circuit.

The withdrawable circuit breaker consists of a mobile part (see Figure 19) and of a fixed part (see Figure 20 for IEC and Figure 21 for UL) for connection through its own terminals to the power circuit.

The coupling between the mobile part and the fixed part is via disconnection contacts mounted on the fixed part.

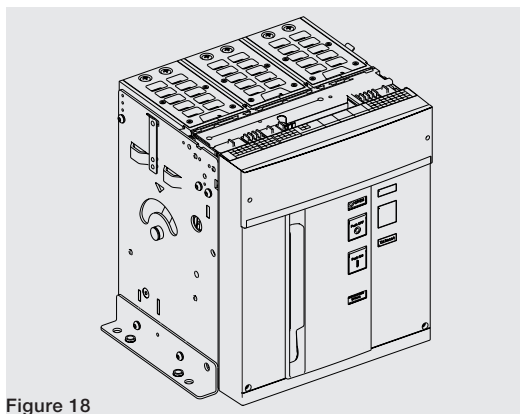


Figure 18

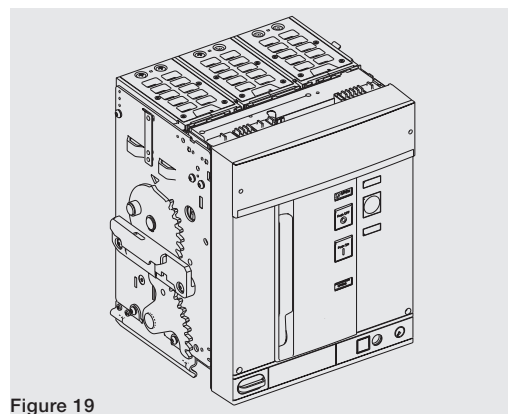


Figure 19

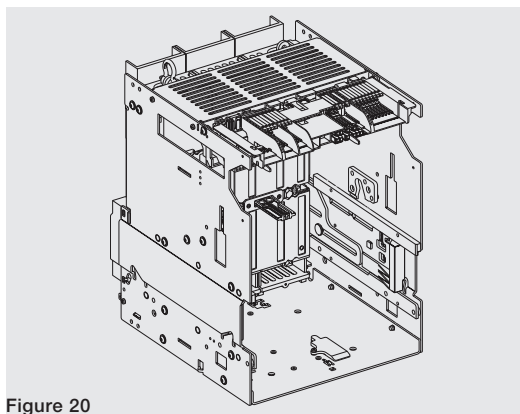


Figure 20

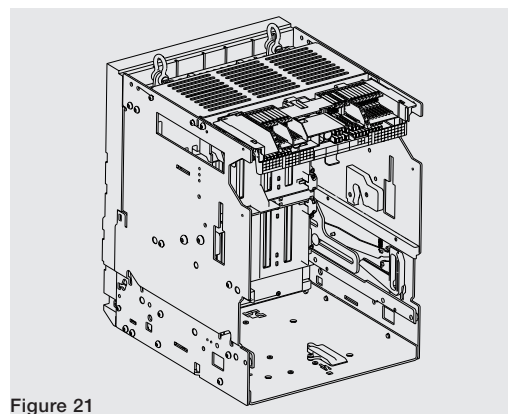


Figure 21

Description of the circuit-breaker front panel

The following are the main components of the circuit-breaker:

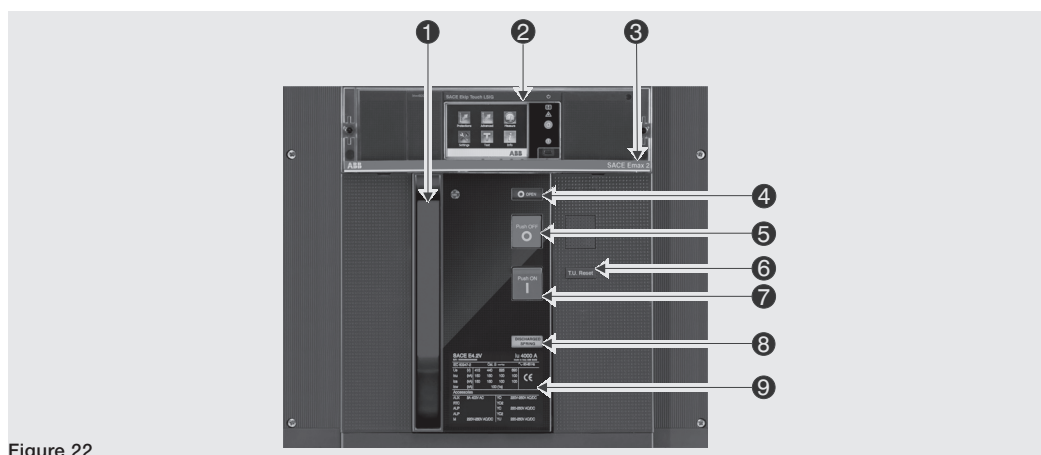


Figure 22

Pos.	Description
1	Lever for manually loading the closing springs
2	SACE Ekip protection release
3	Name of the circuit-breaker
4	Open-closed signalling device
5	Opening pushbutton
6	Release tripping mechanical signal
7	Closing pushbutton
8	Springs loaded-unloaded signalling device
9	Electrical specifications plate

Description of specifications plate IEC

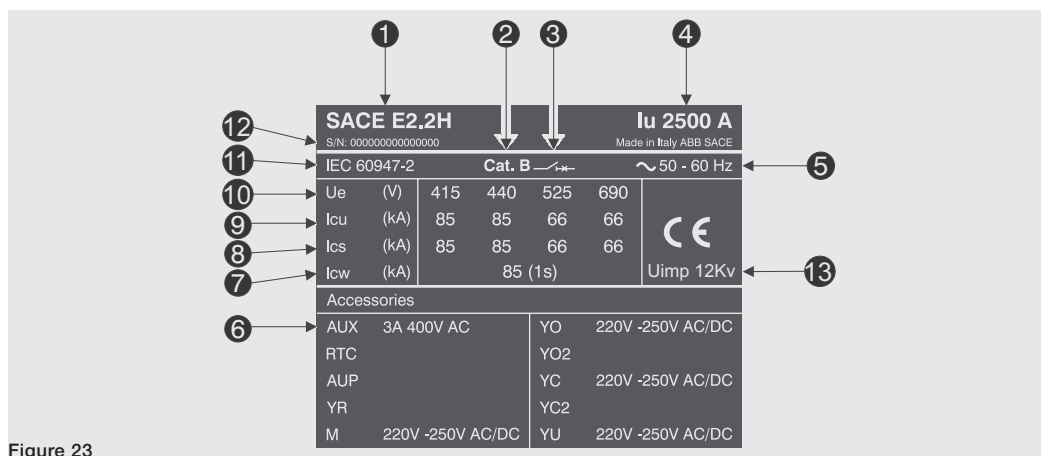


Figure 23

Pos.	Description
1	Type of circuit-breaker
2	Utilization category
3	Device type: Circuit-breaker or disconnecter
4	Rated current
5	Rated operating frequency
6	Rated voltage of accessories
7	Admissible rated short-time current
8	Rated duty short-circuit breaking capacity
9	Rated ultimate short-circuit breaking capacity
10	Rated service voltage
11	Standards
12	Circuit-breaker serial number
13	Impulse voltage

Continued on the next page

Description of specifications
plate UL

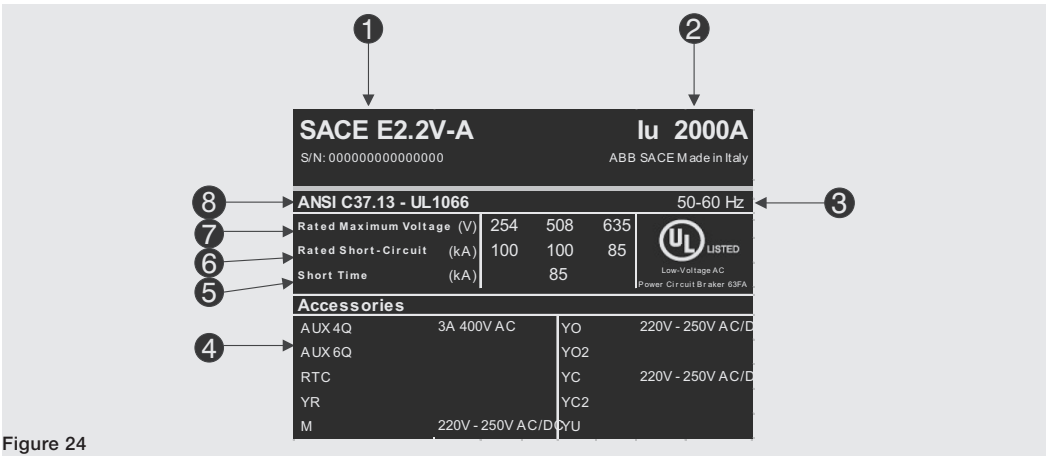


Figure 24

Pos.	Description
1	Type of circuit-breaker
2	Rated current
3	Rated operating frequency
4	Rated voltage of accessories
5	Rated short-circuit breaking capacity
6	Rated service voltage
7	Standards
8	Circuit-breaker serial number

Manual operations for opening and closing the circuit-breaker

The following is the sequence of steps for closing and opening the circuit-breaker:

1. Check that the circuit-breaker is open (open / closed indicator "O - OPEN"), and check that the springs are unloaded (spring signalling device "white - DISCHARGED SPRING") as indicated in Figure 25.
2. Loading the springs - Pull the lever [A] downwards several times until the springs loaded signalling device [B] is "yellow - CHARGED SPRING" as indicated in Figure 26.

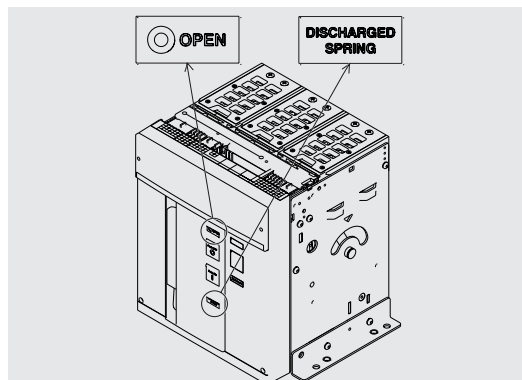


Figure 25

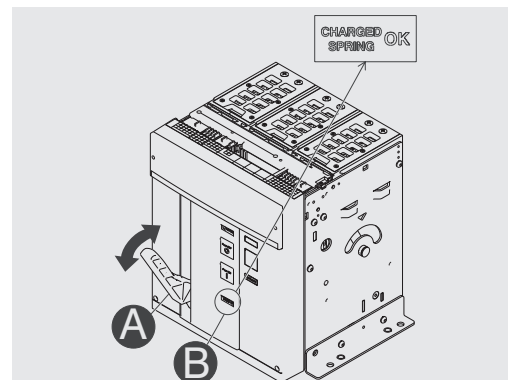


Figure 26

3. Check that the circuit-breaker is open (open/closed signalling device "O - OPEN"), and check that the springs are loaded (springs signalling device "yellow - CHARGED SPRING") as indicated in Figure 27.
4. Closing - Press the closing push-button "I - Push ON" as indicated in Figure 28.

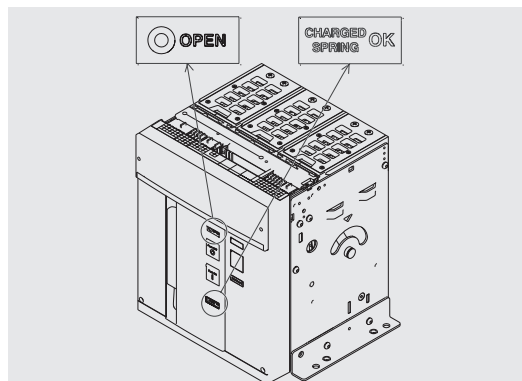


Figure 27

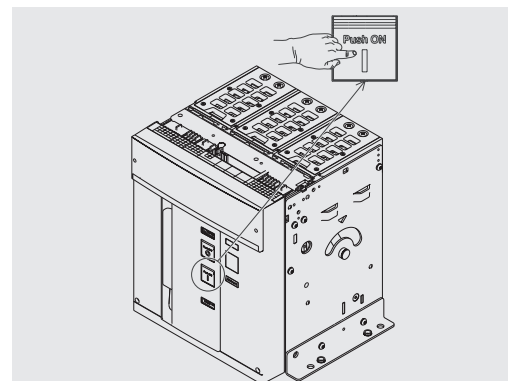


Figure 28

5. Check that the circuit-breaker is closed (open/closed indicator "I - CLOSED"), and check that the springs are discharged (spring signalling device "white - DISCHARGED SPRING") as indicated in Figure 29.
6. Opening - Press the opening push-button "O - Push OFF" as indicated in Figure 30.

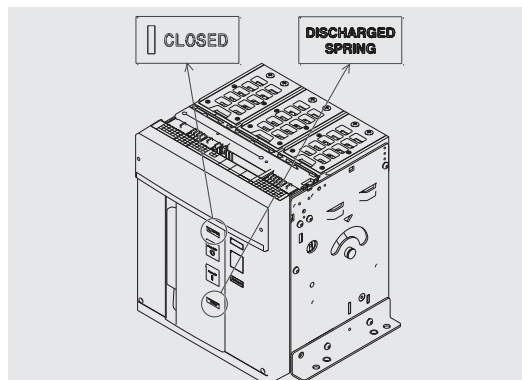


Figure 29

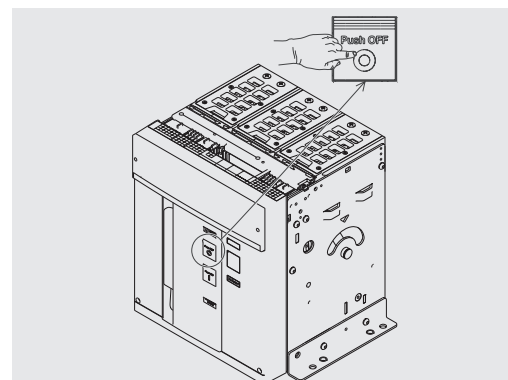
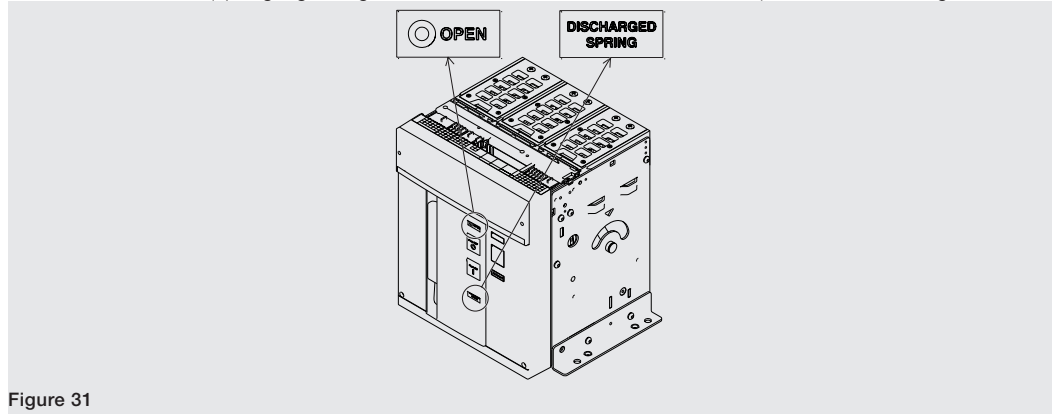


Figure 30

Continued on the next page

7. Check that the circuit-breaker is open (open / closed indicator "O - OPEN"), and check that the springs are unloaded (spring signalling device "white - DISCHARGED SPRING") as indicated in Figure 31.



Mechanical status indicators The following are the possible states in which you can find the circuit-breaker during its use:

1. Circuit-breaker open with springs discharged (see Figure 32).
2. Circuit-breaker open with springs loaded (see Figure 33).
3. Circuit-breaker closed with springs discharged (see Figure 34).
4. Circuit-breaker closed with springs charged and not ready to close (see Figure 35). This state occurs when after closing (see step 4 - Manual operations for opening and closing the circuit-breaker) the springs are reloaded manually or automatically by the gearmotor (if provided).
5. Circuit-breaker open with springs charged and not ready to close (see Figure 36). This state occurs in the following cases:
 - The circuit-breaker is open due to tripping of protection releases and the Reset signal has not been reset. To close the circuit-breaker press the TU Reset button on the front of the circuit-breaker.
 - The key lock or padlock is active in the open position.
 - The under-voltage coil is de-energized
 - The opening coil is permanently energized.
 - The closing coil is permanently energized.
 - The button for enabling the insertion/extraction crank of a withdrawable circuit-breaker is pressed.

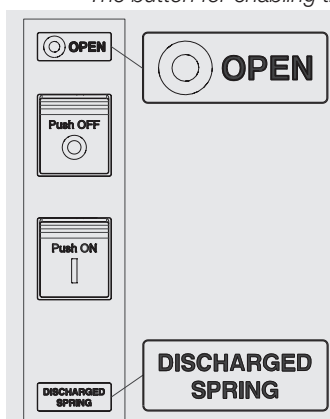


Figure 32

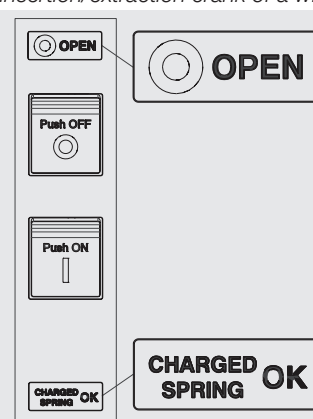


Figure 33

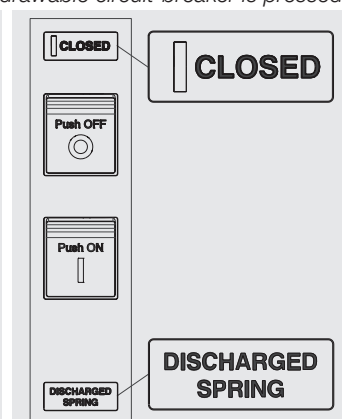


Figure 34

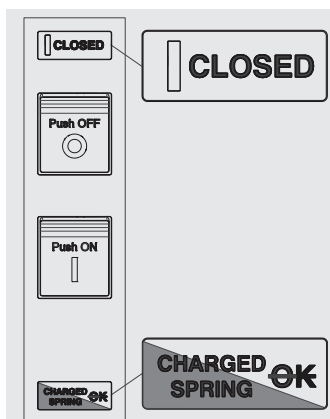


Figure 35

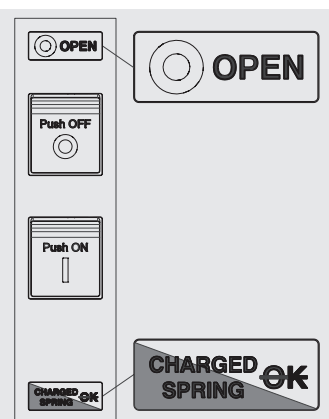


Figure 36

Circuit breaker racking-in/ racking-out operations

The following is the procedure for the insertion of the moving part in the fixed part:



WARNING!

- Make sure the circuit-breaker is disconnected from all sources of energy.
- Switch the circuit-breaker to the open position with springs unloaded.



WARNING! Before proceeding, remove all equipment used during the work and remove processing waste and materials used.

1. Position the lifting plates on the mobile part making sure that the tongue of the plates is latched properly. See Figure 37.

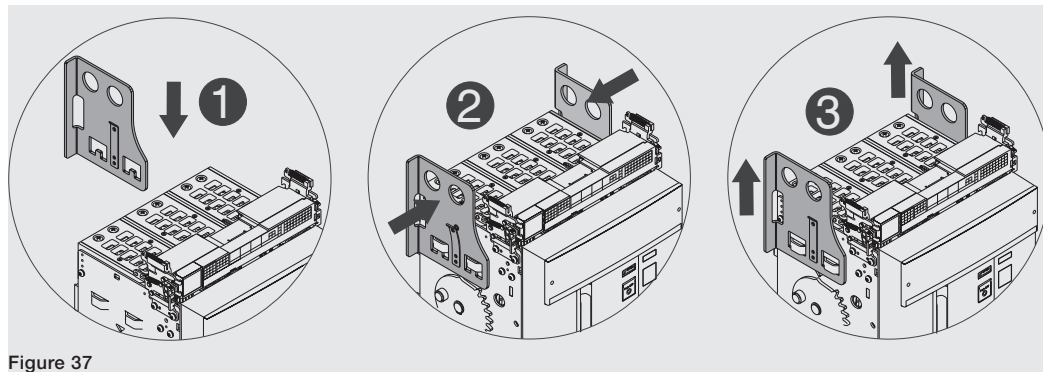


Figure 37

2. Extract the guides of the fixed part using the appropriate levers. See Figure 38.
3. Position the moving part over the guides of the fixed part. Latch by inserting the hollow part of the side in the latch of the guide of the fixed part See Figure 39.

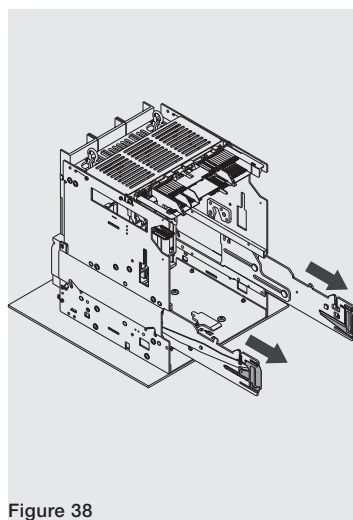


Figure 38

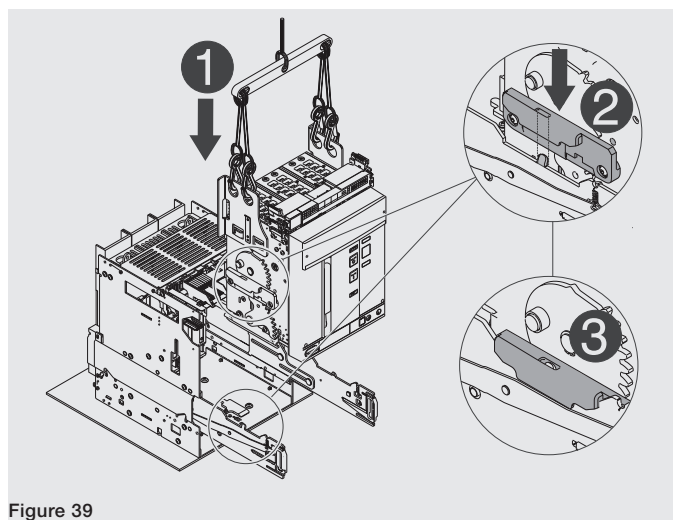


Figure 39

4. Unlatch the tongue and remove lifting plates from the moving part. See Figure 40.

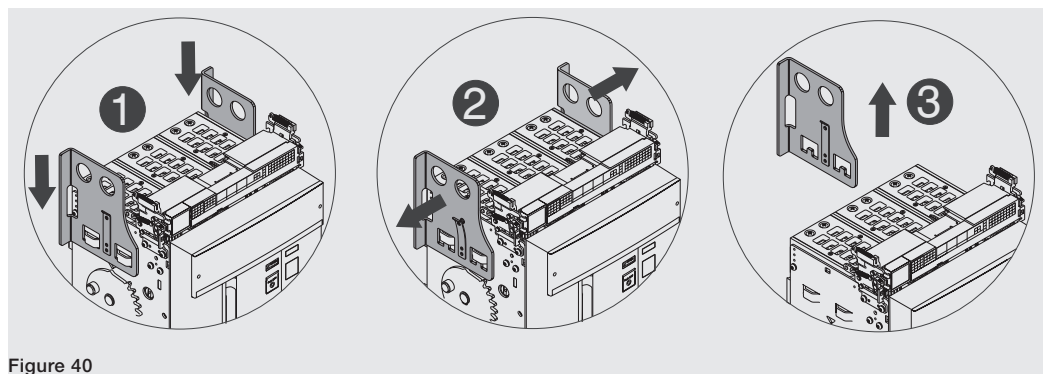


Figure 40

Continued on the next page

5. Make sure that signalling device indicates the **DISCONNECT** position. See Figure 41.

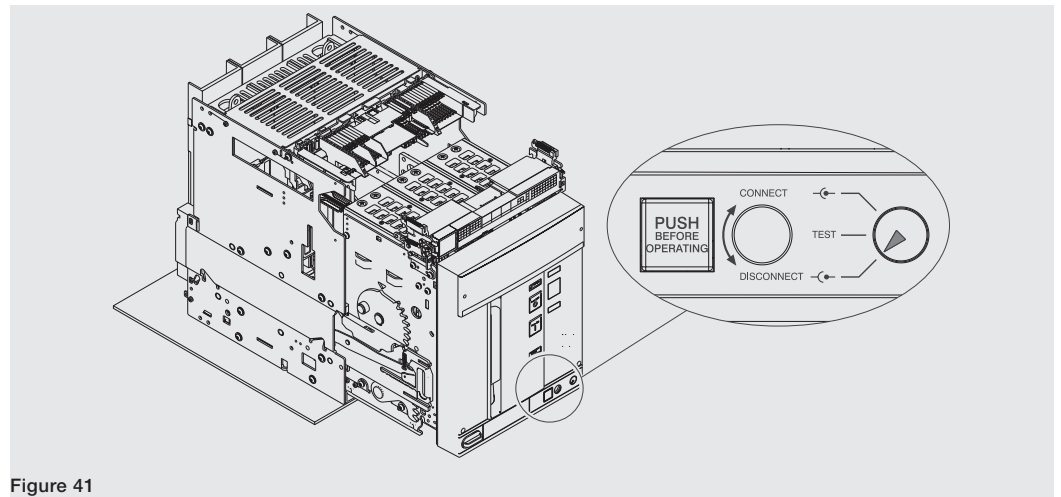


Figure 41

6. Grip the guide levers of the fixed part and push them until the moving part stops. See Figure 42.

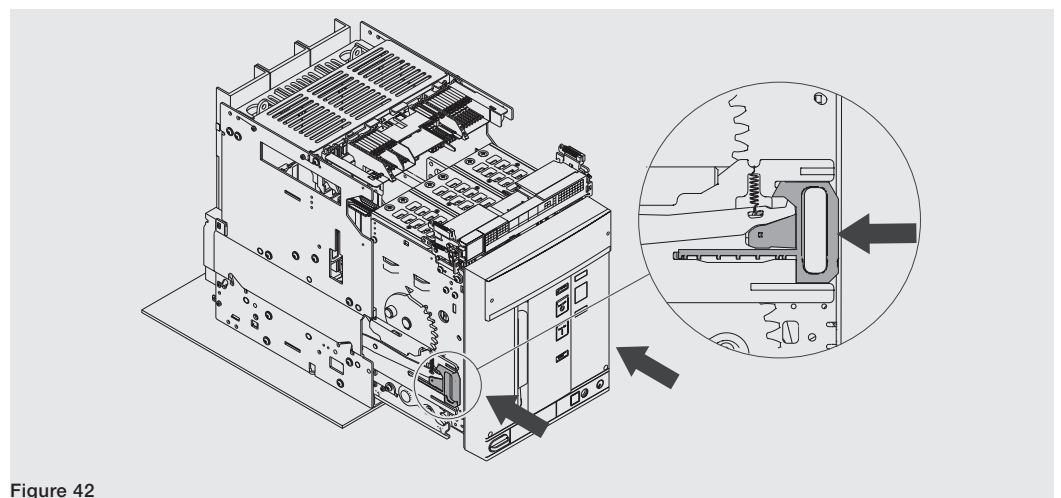


Figure 42

7. Extract the disconnection crank from its housing See Figure 43.
8. Press the lock push-button and insert the crank in the moving part. In this phase the moving part is still in **DISCONNECT** position. See Figure 44.

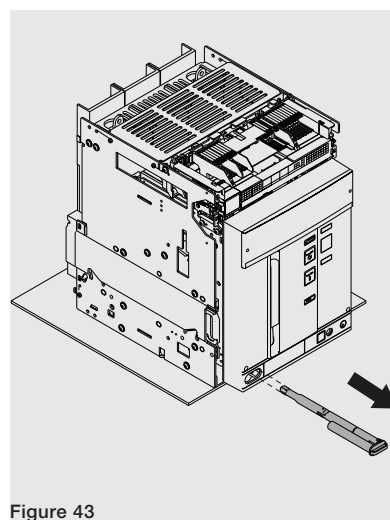


Figure 43

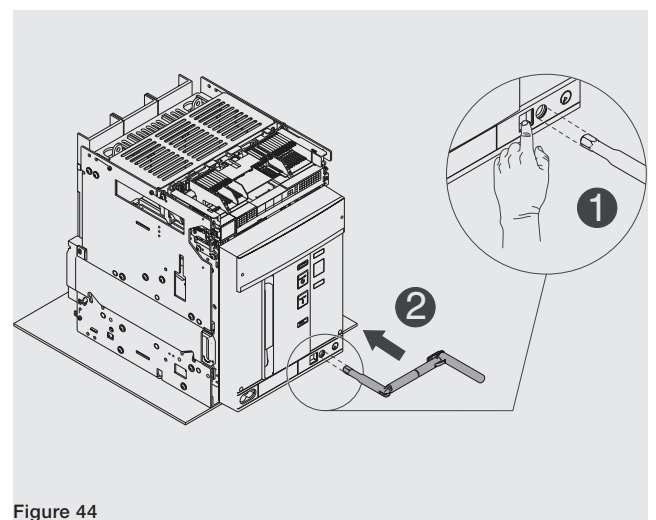


Figure 44

Continued on the next page

9. Turn the crank clockwise until the pushbutton comes out and the indicator shows that the circuit-breaker is in **TEST** position. See Figure 45.

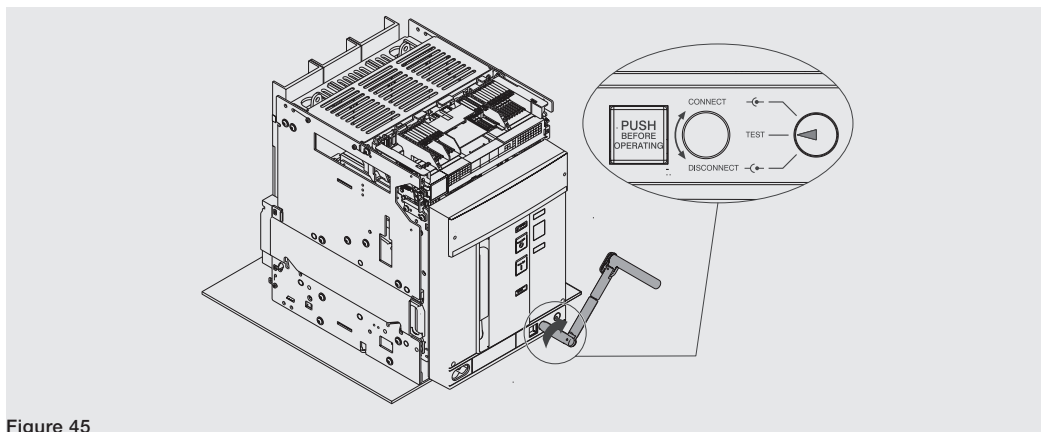


Figure 45

10. Press the lock button and rotate the crank clockwise until the pushbutton comes out and the indicator shows that the circuit-breaker is in **CONNECT** position. See Figure 46.

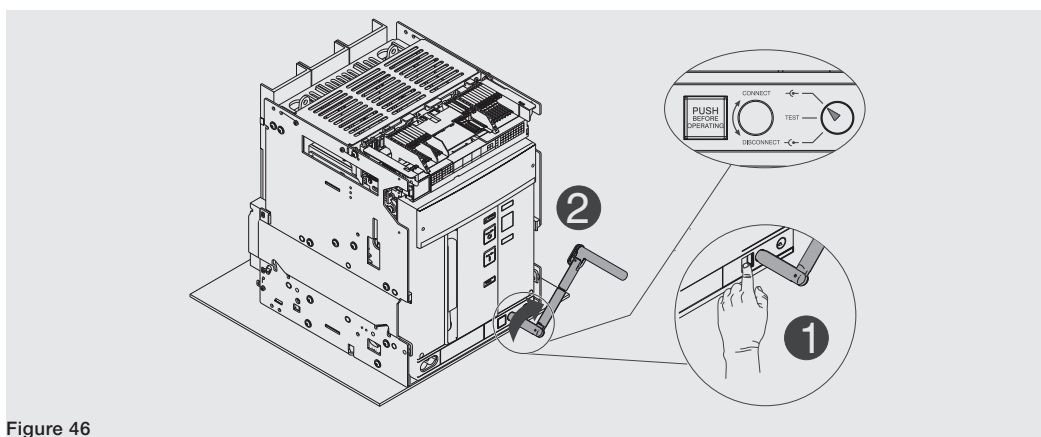


Figure 46

11. Extract the crank. See Figure 47.
12. Replace the crank in its housing See Figure 48.

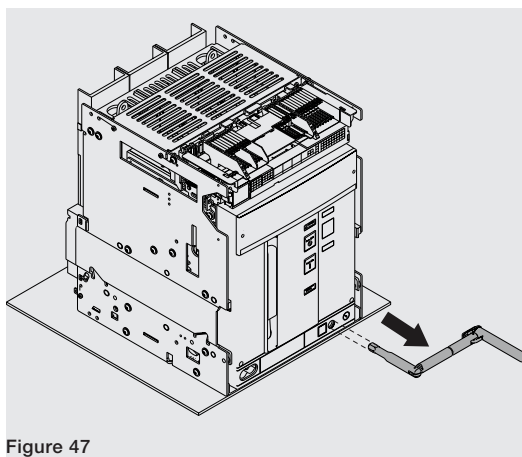


Figure 47

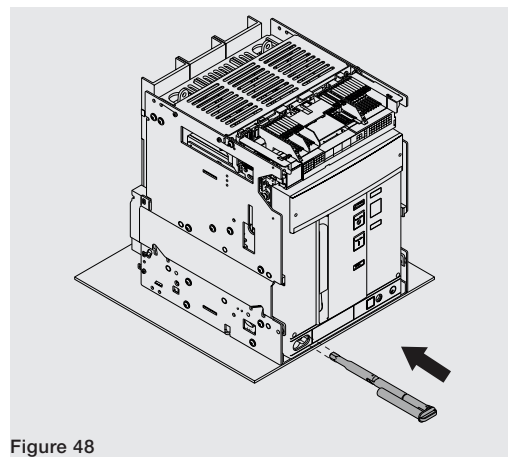


Figure 48



WARNING! The inserted circuit-breaker must be opened in order to be able to reach the test position. Discharge the springs before removing the circuit-breaker from the fixed part. On the UL version, the fail safe prevents the removal of the circuit-breaker from the fixed part with springs loaded. For further information see chapter "2 - Mechanical safety accessories" on page 86.

Continued on the next page

To extract the moving part from the fixed part, perform the same steps indicated for insertion in reverse order.

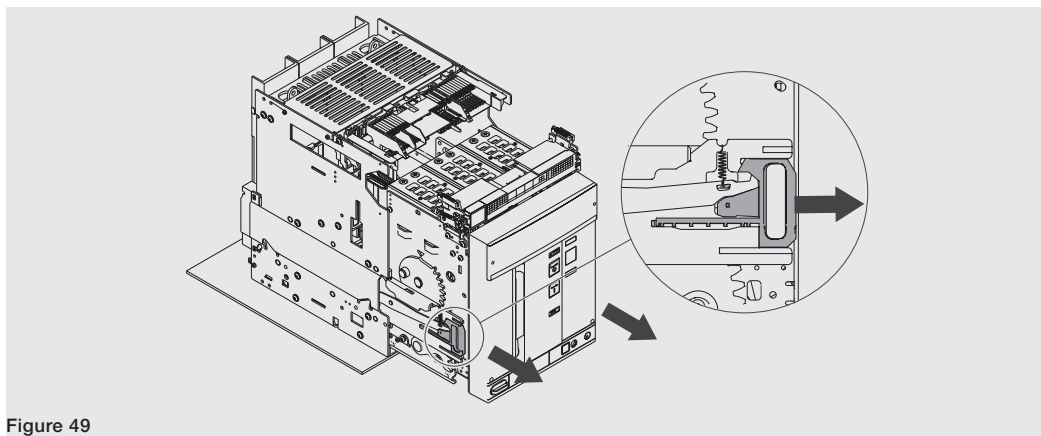


Figure 49

Always use both levers of the guides on the fixed part when racking out the circuit-breaker. See Figure 49.

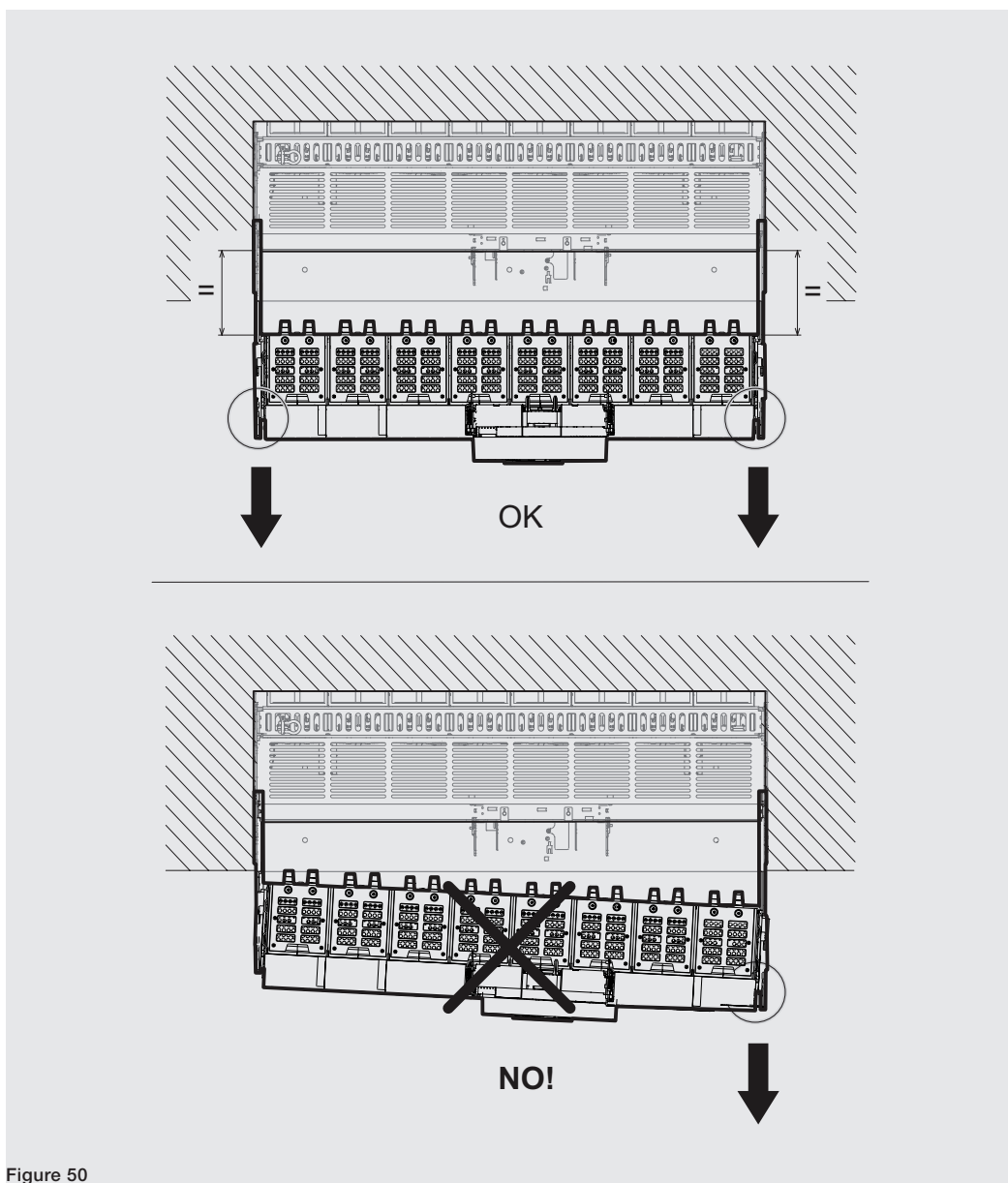


Figure 50



WARNING! When withdrawing the moving part, make sure that both guides on the fixed part travel to the same extent, thereby keeping the moving part parallel to the fixed part. See Figure 50.

Mechanical position indicators The following are the possible positions where you can find the mobile part of a withdrawable circuit-breaker during its use:

- circuit breaker in racked-out position (see Figure 51)
- circuit-breaker in the test position (see Figure 52)
- circuit-breaker in connected position (see Figure 53)

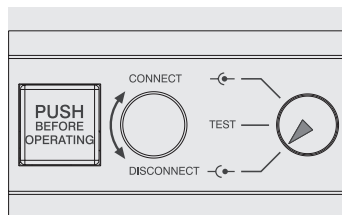


Figure 51

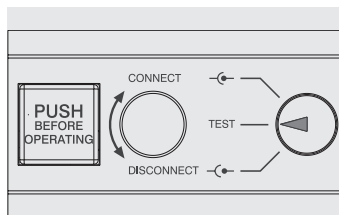


Figure 52

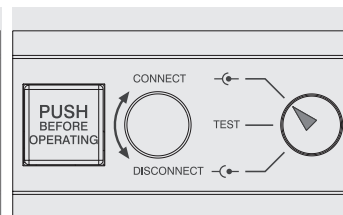


Figure 53

5 - Environmental conditions

Installation environment Install the circuit-breaker in a dry environment, without dust or corrosive acids, and so that is not subject to shock or vibration.

If this is not possible, mount the circuit-breaker in a framework protecting it adequately.

For the dimensions to be considered for installation, see the chapter "6 - Installation" on page 26 where the references for following information can be found:

- minimum installation volumes of the circuit-breakers and derived versions in a cell
- overall dimensions of the circuit-breakers and the fixed parts
- drilling of mounting holes
- drilling of the cell door

Temperatures of the installation environment The mechanical and electrical characteristics are guaranteed between -25 ° C and +70 ° C, -13 ° F e +158 ° F.

Particular weather conditions The circuit breaker is designed to operate in particularly difficult industrial environments.

It was tested according to:

- IEC 60068-2-1: endurance at low temperatures
- IEC 60068-2-2: hot dry climate
- IEC 60068-2-30: hot humid climate
- IEC 60068-2-52 severity 2: saline mist atmosphere
- IEC 60947 (pollution level ≤ 3)
- IEC60721-3-6 class 6C3
- IEC60721-3-2 class 3C2



NOTE: the circuit-breaker is suitable for installation in environments with saline concentrations no higher than 10 mg/m³.

Dusty environments It is recommended to install the circuit breaker in suitably ventilated switchgear where penetration by dust is minimized.

If the environments are dusty (dust > 1 mg/m³) it is required to always follow the second level maintenance procedures.

Vibration The circuit-breaker is insensitive to mechanical or electromagnetic vibrations that meet the following standards:

- IEC 60068-2-6 a) From 1 to 13 Hz with movement equal to 1 mm - 0,04 in b) From 13 to 100 Hz with constant acceleration equal to 0,7 g - 0,025 lbs
- Naval specifications: RINA, BV, GL, ABS, LRs, DNV

Altitude The circuit breaker maintains its rated operating characteristics up to 2000 m above sea level.

Once this altitude is passed, you need to consider reduction of dielectric strength and reduced cooling capacity of the air.

The following are the corrections expressed as a percentage to be applied to the parameters according to altitude:

Altitude	2000 m / 6600 ft	3000 m / 9900 ft	4000 m / 13200 ft	5000 m / 16500 ft
Rated service voltage (V) U _e	100%	88%	78%	68%
Rated current (A) at 40°C	100%	98%	93%	90%

Electromagnetic compatibility The use of specific devices in industrial installations may cause electromagnetic interference in the electrical system.

The SACE Emax 2 circuit-breakers were developed and tested in an EMC environment in accordance with IEC 60947-2, Annex J and F.

Storage Environment Store the circuit breaker in a dry, dust-free environment free of harsh chemicals.

The storage ambient temperature must be:

- Circuit-breaker in the original packaging, without protection release or Ekip Dip release, between -40 ° C and +85 ° C, -40 ° F e +185 ° F.
- Circuit-breaker in the original packaging, with Ekip Touch protection release, between -30 ° C and + 85 ° C, -22 ° F e +185 ° F.



NOTE: *the storage conditions may differ from the usage conditions.*

6 - Installation

Warnings and precautions before the installation

The following warnings and precautions must be respected before installing the circuit-breaker in the switchgear



WARNING!

- Disconnect the power from the circuit-breaker (power circuit and auxiliary circuits)
- Make sure the circuit-breaker is disconnected from all sources of energy
- Switch the circuit-breaker to the open position with springs unloaded



NOTE: The trained personnel in charge of handling and lifting must use appropriate safety equipment.

Mounting of the fixed circuit-breaker

Fix the circuit-breaker to a horizontal surface using 4 x M10 screws. See Figure 54.

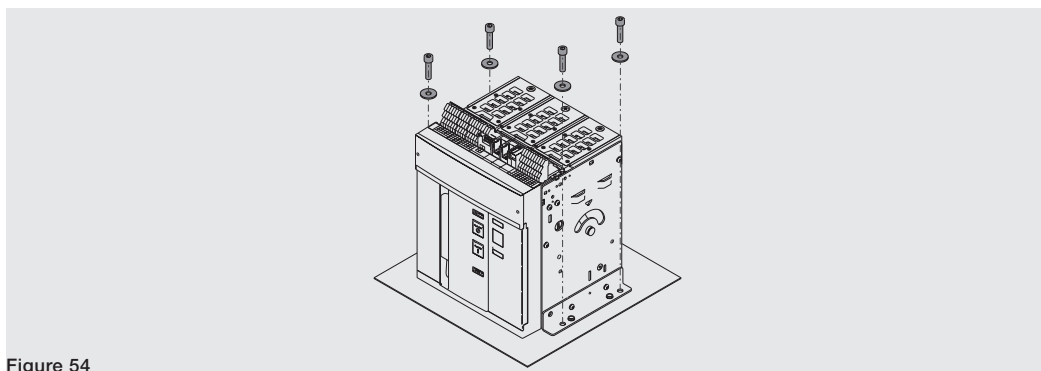


Figure 54



WARNING! E 2.2, E4.2 and E 6.2 circuit breakers can only be installed in a vertical position

Mounting anti-racking locks

Before installing the fixed part, it is necessary to fit the lock that prevents the insertion of circuit-breakers with different electrical characteristics from the fixed part. See Figure 55.

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0701](#).

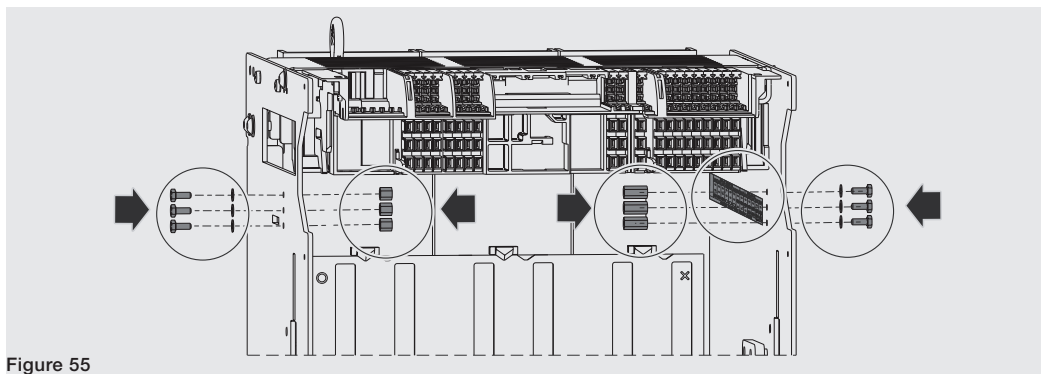


Figure 55

Mounting the fixed part of the withdrawable circuit-breaker.

Fix the fixed part to a horizontal surface using four M8 x 25 screws for E2.2 and E4.2 fixed parts, and using six M8 x 25 screws for E6.2 fixed parts. The screws are supplied by ABB. See Figure 56. Tighten the screws with tightening torque = 21 Nm - 186 lb.in.

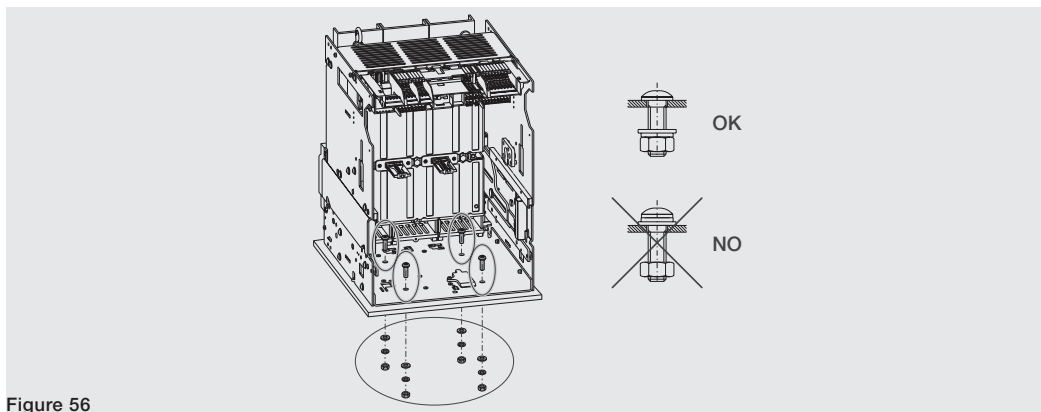


Figure 56



WARNING! E 2.2, E4.2 and E 6.2 circuit breakers can only be installed in a vertical position

Types of terminal

Emax 2 circuit-breakers can be equipped with different combinations of terminals for the upper and lower part.

The following are the different types of terminal:

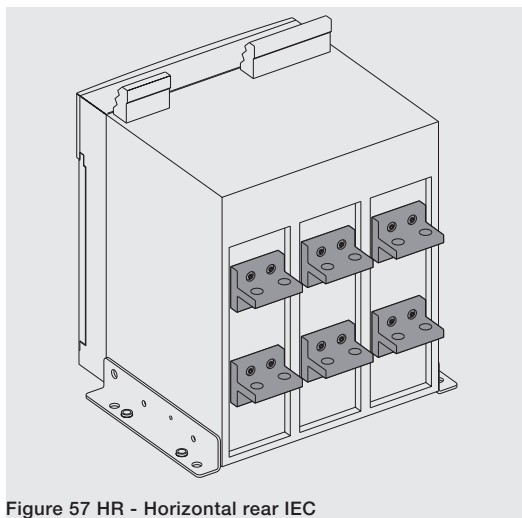


Figure 57 HR - Horizontal rear IEC

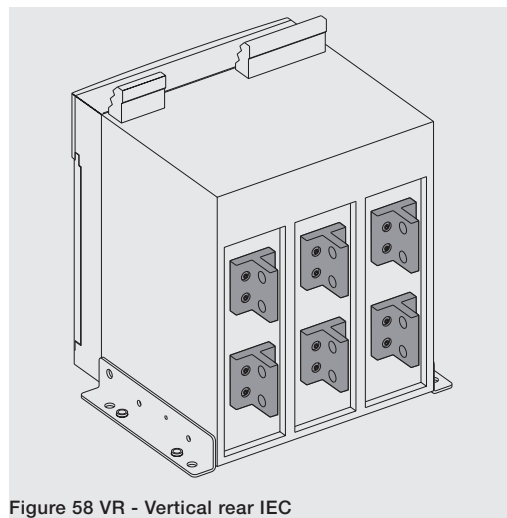


Figure 58 VR - Vertical rear IEC

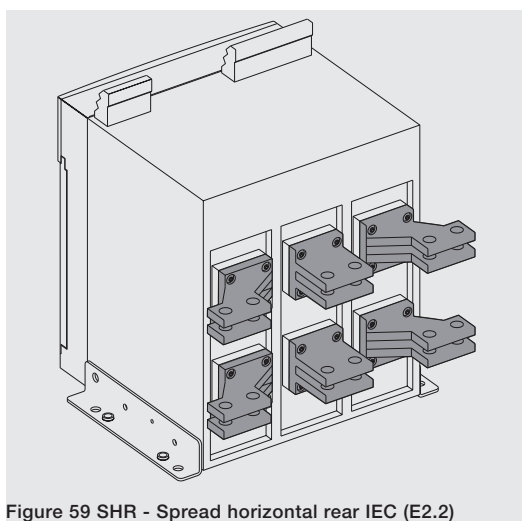


Figure 59 SHR - Spread horizontal rear IEC (E2.2)

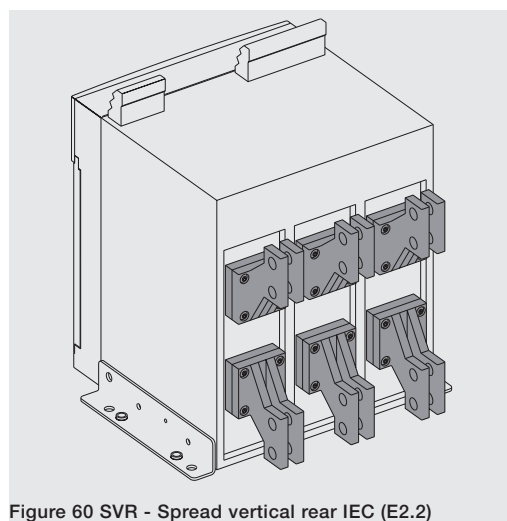


Figure 60 SVR - Spread vertical rear IEC (E2.2)

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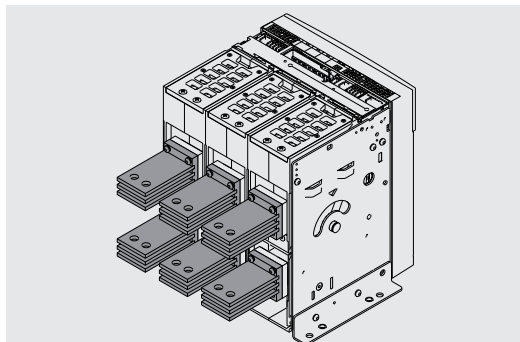


Figure 61 HR - Horizontal rear UL

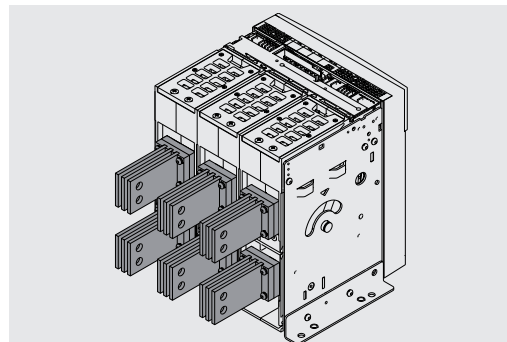


Figure 62 VR - Vertical rear UL

Reversal of the position of the vertical/horizontal terminals

If the circuit-breaker is supplied equipped with terminals of the horizontal/vertical rear type, it is possible at any time to switch from horizontal to vertical and vice versa, except for E4.2 UL 3200A versions. (see Figure 63 IEC and Figure 64 IEC). Lock the screws with the following tightening torques:

- E2.2 - M6 screws - Tightening torque 8.6 Nm - 70,8 lb.in
- E4.2 and E6.2 - M8 screws - Tightening torque 20 Nm - 177 lb.in

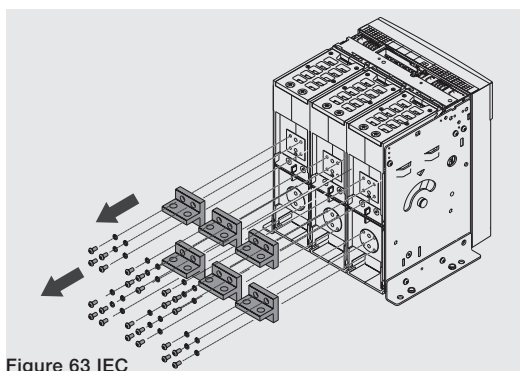


Figure 63 IEC

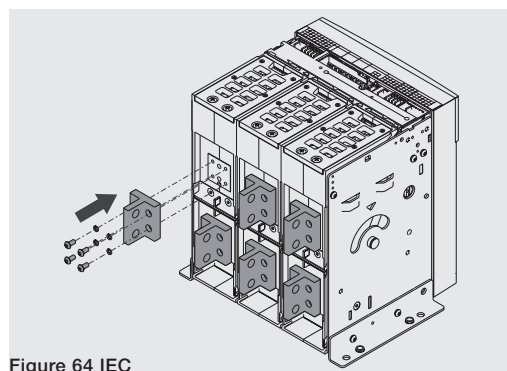


Figure 64 IEC

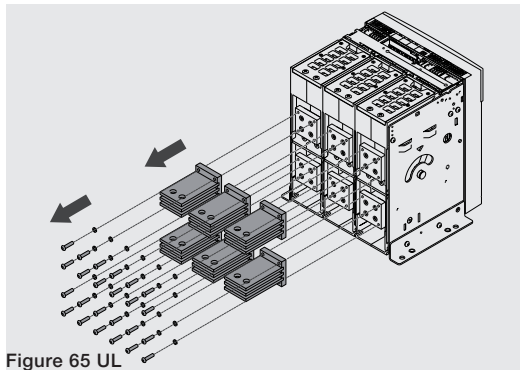


Figure 65 UL

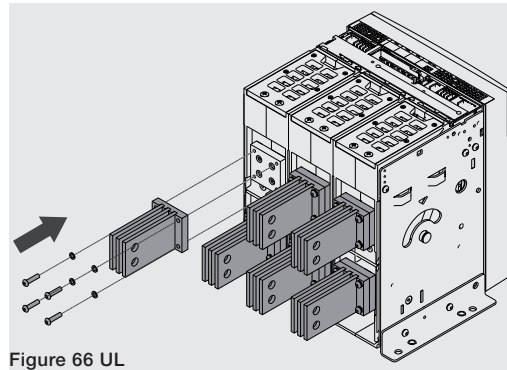


Figure 66 UL

Insulation clearances Information on insulation clearances is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the Emax 2 catalogue [1SDC200023D0201](#).

The following drawing is also available in .dxf format: [1SDH001301R0001](#) - Cubicle E1.2-E2.2-E4.2-E6.2

Phase separators Phase separators are available on request. Alternatively, it is possible to position the insulation barriers to segregate live parts. The Phase separators are mandatory if, between two phases, the minimum distance between the mounting screws of the circuit-breaker terminals with the connection bars is less than 14 mm - 0,55".

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0810](#).

Connection to the power circuit The connection of a circuit-breaker to the power circuit is performed using the connection busbars of the electric switchgear fixed to the terminals of the circuit-breaker. The sizing of the busbars is specified by the designer of the electrical switchgear.

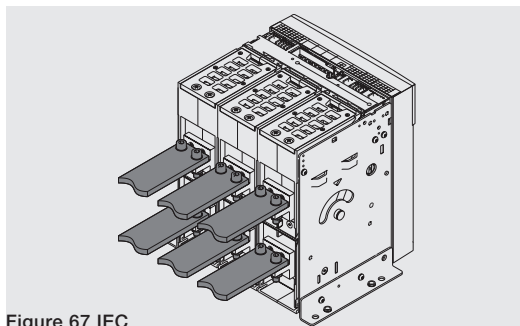


Figure 67 IEC

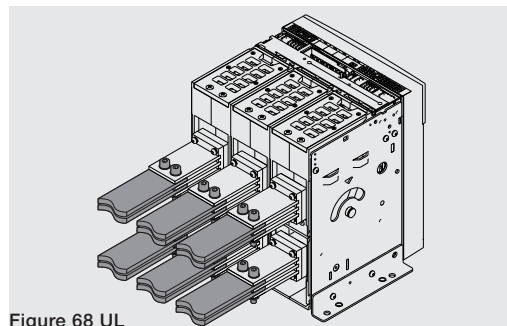


Figure 68 UL



IMPORTANT: it is possible to obtain different capacities for the connections by altering the thickness and number of busbars in parallel.

The following tables provide some examples of the quantity and the sizes of the connections that can be used for each type of circuit-breaker:

circuit-breaker IEC 60947	Iu (A)	Dimension of busbars (mm)	Horizontal terminals	Vertical terminals
E2.2	800	1x50x10	yes	yes
	1000	2x50x5	yes	yes
	1250	2x50x10	yes	yes
	1600	2x60x10	yes	-
		1x100x10	-	yes
	2000	3x60x10	yes	-
		2x80x10	-	yes
		3x60x10 ⁽¹⁾	yes	-
		2x80x10 ⁽¹⁾	-	yes
	2500	3x60x10	yes	-
		4x100x5	-	yes
		3x60x10 ⁽¹⁾	yes	-
		4x100x5 ⁽¹⁾	-	yes
E4.2	2000	2x80x10	yes	yes
	2500	2x100x10	yes	yes
	3200	3x100x10	yes	yes
	4000	4x100x10	yes	yes
E6.2	4000	4x100x10	yes	yes
	5000	5x100x10	yes	yes
	6300	7x100x10	yes	yes

⁽¹⁾ values for spread terminals

circuit-breaker UL 1066	Iu (A)	Dimension of busbars (inches)	Horizontal terminals	Vertical terminals
E2.2-A	1600	3x1/4x2	-	yes
		4x1/4x2	yes	-
		3x1/4x2.5	yes	-
		2x1/4x3	-	yes
	2000	4x1/4x2	-	yes
		4x1/4x2.5	yes	-
E4.2-A	2000	4x1/4x2	-	yes
		4x1/4x2.5	yes	-
	2500	3x1/4x4	-	yes
		4x1/4x4	yes	-
	3200	4x1/4x4	-	yes
E6.2-A	4000	4x1/4x5	yes	yes
	5000	6x1/4x5	-	yes
		8x1/4x5	yes	-

**IMPORTANT: Before proceeding with the connection between terminals and connection busbars:**

- make sure that contact surfaces of the busbars are free of burrs, dents, traces of rusting, dust or traces of grease.
- make sure, if aluminium busbars are used, than these are tin plated in the contact areas.
- make sure that the busbars do not exert forces in any direction on the terminal.
- for tightening use M10 screws with resistance class 8.8 equipped with spring washers and lock them with a torque of 45 Nm - 400 lb in.



NOTE: the information on the performance of the circuit-breakers in the switchgear in the various configurations is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the Emax 2 catalogue [1SDC200023D0201](#) IEC and [1SDC200023D0201](#) UL

Dimensions Information on the overall dimensions is available on the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the Emax 2 IEC catalogue [1SDC200023D0201](#) and the Emax 2 UL catalogue [1SDC200039D0201](#).

The following drawings are also available in .dxf format:

- [1SDH001000R0100](#) - E2.2 III-IV Fixed HR VR IEC
- [1SDH001000R0101](#) - E2.2 III-IV Fixed F IEC-UL
- [1SDH001000R0102](#) - E2.2 III-IV Withdrawable HR-VR IEC
- [1SDH001000R0103](#) - E2.2 III-IV Withdrawable F IEC
- [1SDH001000R0104](#) - E2.2 III-IV Fixed SHR IEC
- [1SDH001000R0105](#) - E2.2 III-IV Withdrawable SHR IEC
- [1SDH001000R0106](#) - E2.2 III-IV Fixed SVR IEC
- [1SDH001000R0107](#) - E2.2 III-IV Withdrawable SVR IEC
- [1SDH001001R0100](#) - E4.2 III-IV Fixed HR VR IEC
- [1SDH001001R0101](#) - E4.2 III-IV Fixed F IEC
- [1SDH001001R0102](#) - E4.2 III-IV Withdrawable HR-VR IEC
- [1SDH001001R0103](#) - E4.2 III-IV Withdrawable F IEC
- [1SDH001060R0100](#) - E6.2 III-IV Fixed HR IEC
- [1SDH001060R0101](#) - E6.2 III-IV Fixed VR IEC
- [1SDH001060R0102](#) - E6.2 IV FS Fixed HR-VR IEC
- [1SDH001060R0104](#) - E6.2 III-IV Fixed F IEC
- [1SDH001060R0105](#) - E6.2 III-IV Withdrawable HR IEC
- [1SDH001060R0106](#) - E6.2 III-IV Withdrawable VR IEC
- [1SDH001060R0107](#) - E6.2 IV FS Withdrawable HR-VR IEC
- [1SDH001060R0108](#) - E6.2 III-IV Withdrawable F IEC
- [1SDH001000R0120](#) - E2.2-E4.2-E6.2 Fixed Withdrawable Flange IEC-UL
- [1SDH001000R0121](#) - E2.2-E4.2-E6.2 Fixed internal mounting IEC-UL
- [1SDH001000R0300](#) - E2.2 III-IV Fixed H-V UL
- [1SDH001000R0302](#) - E2.2 III-IV Withdrawable H-V UL
- [1SDH001000R0303](#) - E2.2 III-IV Withdrawable F UL
- [1SDH001001R0300](#) - E4.2 III-IV Fixed H-V UL
- [1SDH001001R0302](#) - E4.2 III-IV Withdrawable H-V UL
- [1SDH001001R0303](#) - E4.2 III-IV Withdrawable F UL
- [1SDH001001R0304](#) - E4.2 III-IV Fixed H-V UL
- [1SDH001001R0305](#) - E4.2 III-IV Withdrawable H-V UL
- [1SDH001060R0300](#) - E6.2 III-IV Fixed H UL
- [1SDH001060R0301](#) - E6.2 III-IV Fixed V UL
- [1SDH001060R0302](#) - E6.2 IV FS Fixed H-V UL
- [1SDH001060R0305](#) - E6.2 III-IV Withdrawable H UL
- [1SDH001060R0306](#) - E6.2 III-IV Withdrawable V UL
- [1SDH001060R0307](#) - E6.2 IV FS Withdrawable H-V UL
- [1SDH001060R0308](#) - E6.2 III-IV FS Withdrawable F UL
- [1SDH001060R0309](#) - E6.2 III-IV Fixed V UL
- [1SDH001060R0310](#) - E6.2 IV FS Fixed V UL
- [1SDH001060R0311](#) - E6.2 III-IV Withdrawable V UL
- [1SDH001060R0312](#) - E6.2 IV FS Withdrawable V UL

Positioning anchor plates The diagram below indicates the distance for positioning the first anchor plate according to the type of circuit-breaker type and the peak current:

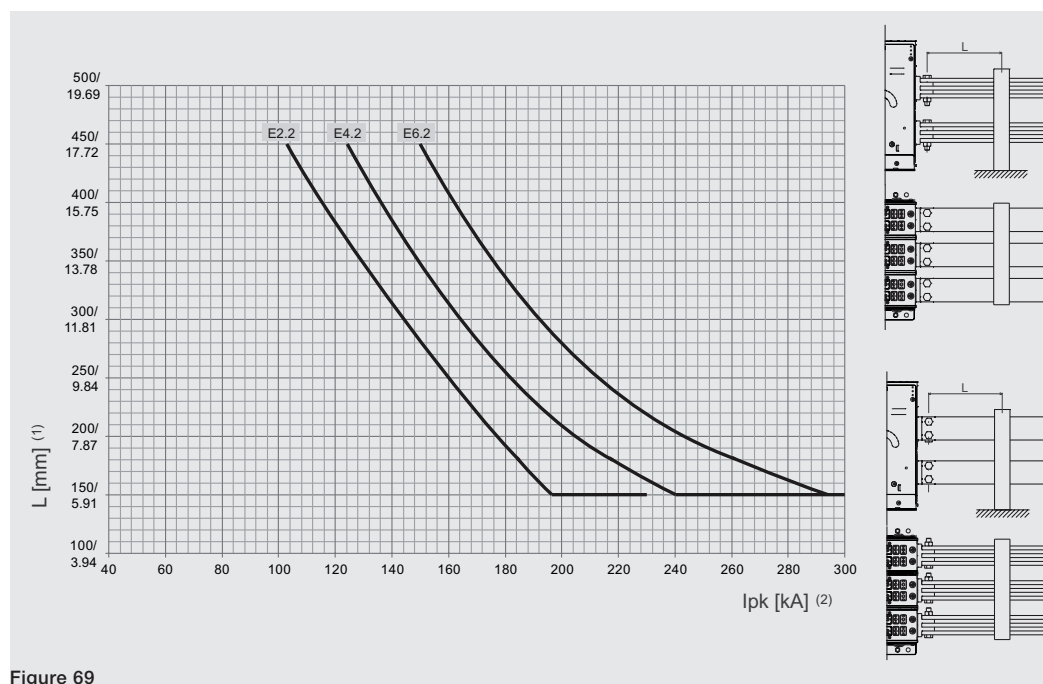


Figure 69

(1): distance of the first anchor plate from the circuit-breaker terminals

(2): peak current

Earthing The circuit-breaker in fixed version and the fixed part of withdrawable circuit-breaker are equipped with a screw for the earth connection.

The connection must be implemented by means of a conductor of suitable cross-section according to the IEC 61439-1 standard.

Clean and degrease the area around the screw before making the connection.

After assembly of the conductor, lock the screw with a torque of 2 Nm - 17,7 lb in.

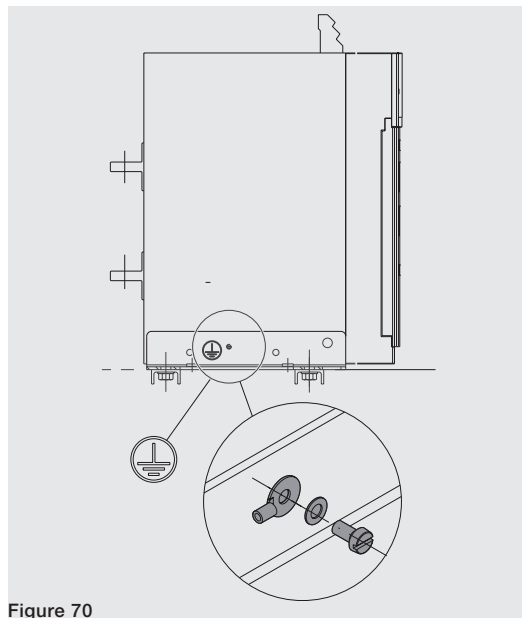


Figure 70

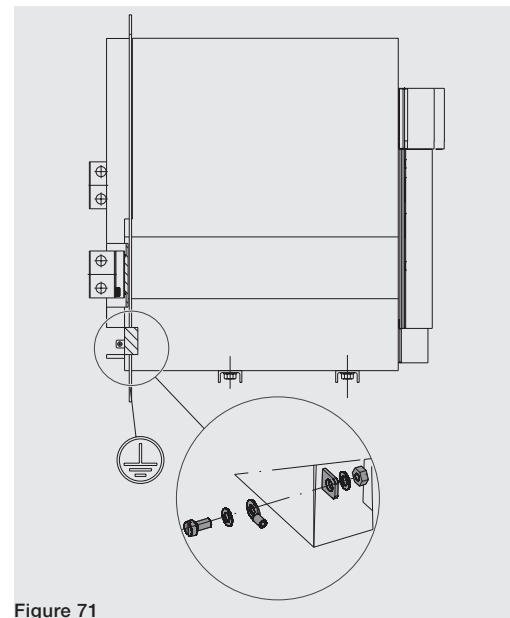


Figure 71

Introduction to Ekip protection releases

1 - Presentation

Families and functionality Emax 2 can be configured with five different types of protection release, distinguished by type of interface and functionality. One release has a dip-switch interface (Ekip Dip) while the others are equipped with a display touchscreen (Ekip Touch).

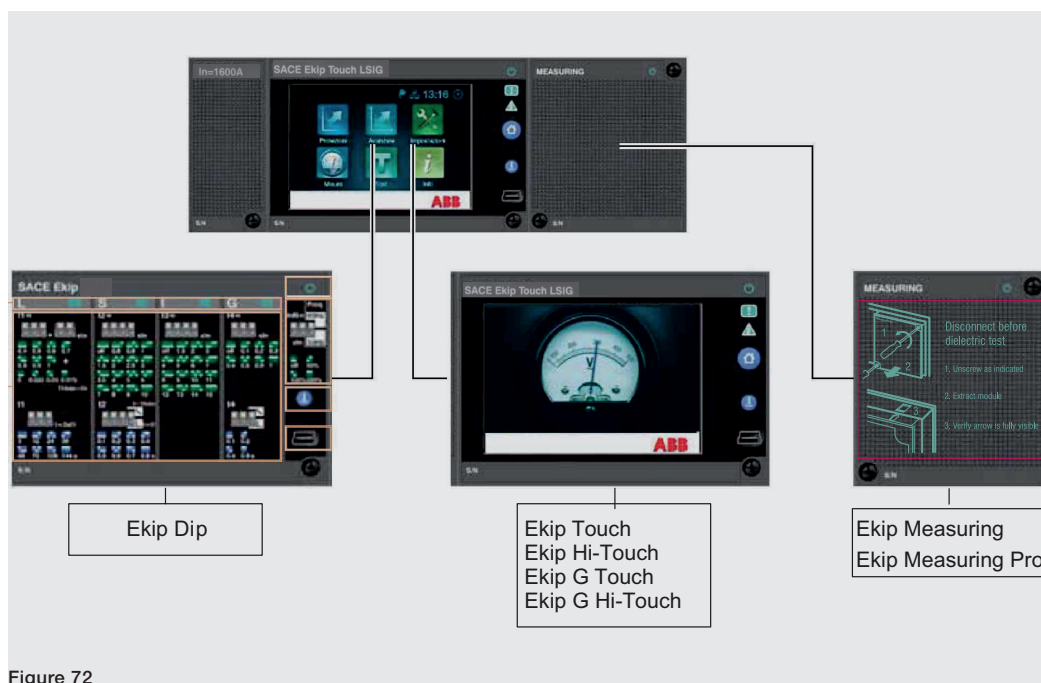


Figure 72

All versions of the releases include protection and measurement functions referring to the primary installation currents.

The Ekip Touch version can be equipped with the Ekip Measuring module to extend measurement functions or (with the Ekip Measuring Pro module) protection and measurement functions, to voltages, powers and energies.



NOTE: the Ekip Hi-Touch, Ekip G Touch and Ekip G Hi-Touch versions have the Ekip Measuring Pro module mounted as standard.

Ekip Dip is described starting from page 35

Information on Ekip Touch is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular in the manual [1SDH001316R0002](#).



```

graph LR
    subgraph Dip
        Dip[Dip]
    end
    subgraph Touch
        Touch[Touch]
        Touch --- M_Touch[M. Touch]
        Touch --- M_Measuring[M. Measuring]
        Touch --- M_HiTouch[M. Hi-Touch]
    end
    subgraph Generators
        subgraph G_Touch [G Touch]
            G_Touch --- M_Touch_G[M. Touch]
            G_Touch --- M_Measuring_G[M. Measuring]
        end
        subgraph G_HiTouch [G Hi-Touch]
            G_HiTouch --- M_Touch_GH[M. Touch]
            G_HiTouch --- M_Measuring_GH[M. Measuring]
            G_HiTouch --- M_HiTouch_GH[M. Hi-Touch]
        end
    end

```

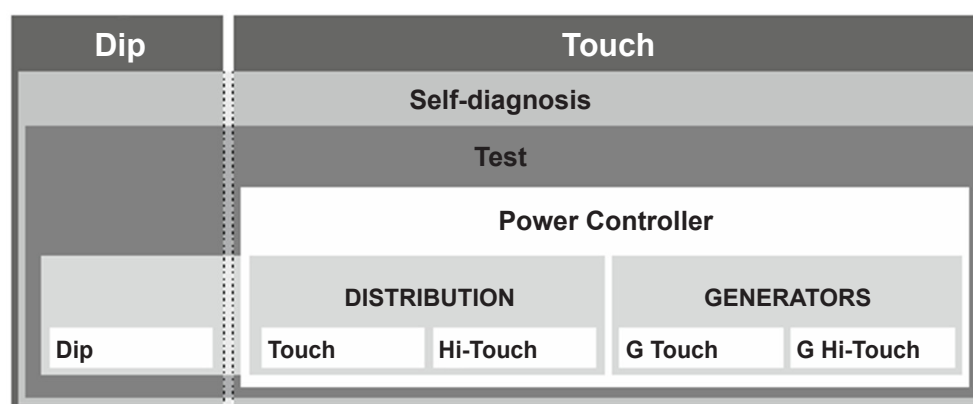
The DIP measurements are available starting from page 45.

Integrated functions: Self-diagnosis, Test and Power Controller

All the protection releases for Emax 2 integrate:

- Self-diagnosis: continuous monitoring of the state of the internal and external connections, with signalling of any faults that may occur.
- Test: checking of the protections and the other functionalities.

In addition, releases of the Ekip Touch series can be supplied equipped with Power Controller to regulate the energy demand.



The self-diagnosis and test functions for Ekip DIP are available starting from page 46.

Accessorizing modules

The Emax 2 circuit-breakers and Ekip releases can be accessorized as indicated in the combination tables on page 53.

Various types of modules are available, differing in functionality and the position in which they are mounted on the circuit-breaker.

The modules available for the terminal box of the circuit-breaker are:

Name	Description	Page
Ekip Supply	Power supply module.	62
Link	Communication module	64

The modules external to the circuit-breaker are:

Name	Description	Page
Ekip Signalling 10K	Signalling module.	71

The supervision, configuration and reporting functions are, in addition, guaranteed by further modules for temporary power supply and communication (test modules):

Name	Description	Page
Ekip TT	Power supply and test module	70
Ekip T&P	Power supply, communication and test module	69
Ekip Programming	Power supply, communication and programming module.	69
Ekip Bluetooth	Power supply and communication module	69

Ekip Dip protection release

1 - Operator interface

Introduction The operator interface of the Ekip Dip protection release allows you to:

- Set the parameters relating to the available protections.
- View the status of the release and alarms.
- Connect to the frontal connector to communicate and perform the opening test.

Components of the interface The Ekip Dip operator interface appears as follows:

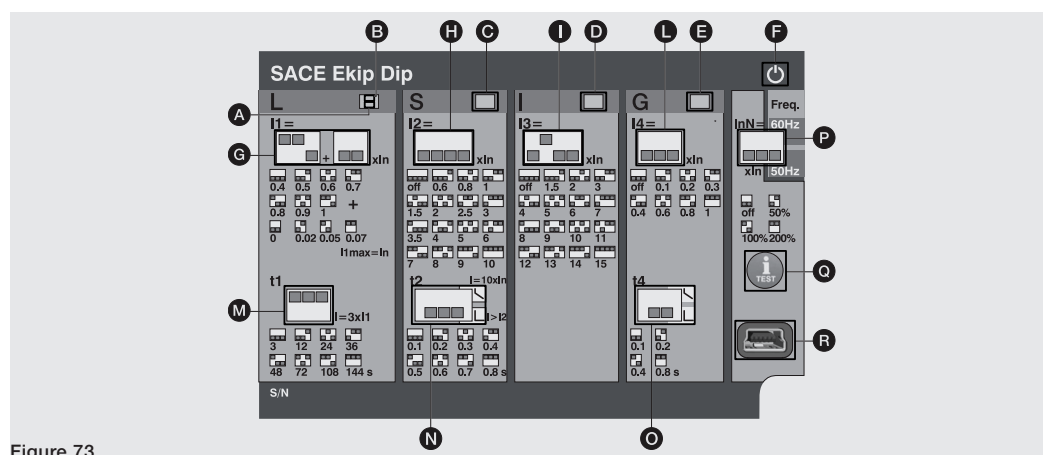


Figure 73

The following table provides a description of the components of the interface:

Position	Type	Description
A	LED	Protection LED L (alarm and trip)
B		Protection LED L (prealarm)
C		Protection LED S (alarm and trip)
D		Protection LED I (trip)
E		Protection LED G (alarm and trip)
F		Power LED (release powered and on)
G	Protections: thresholds	Protection L dip-switch (threshold I1)
H		Protection S dip-switch (threshold I2)
I		Protection I dip-switch (threshold I3)
L		Protection G dip-switch (threshold I4)
M	Protections: times	Protection L dip-switch (time t1)
N		Protection S dip-switch (time t2 and type of curve)
Or		Protection G dip-switch (time t4 and type of curve)
P	Settings	Neutral and frequency dip-switch
Q	Test	Test pushbutton
R		Test connector



IMPORTANT: the figure above refers to a an Ekip DIP, LSIG version. In the case of Ekip Dip LI or LSI versions, LEDs and dip-switches related only to the protections present are available.

LED The LEDs are useful on Ekip Dip in order to distinguish and identify various types of information on the protection release, the circuit-breaker and state of the line currents.

Operational conditions

The operation of the LED is determined by the power supply conditions of the release:

- With the release energized (by current sensors or by auxiliary power supply or by Ekip TT or by Ekip T&P or by Ekip Bluetooth) the LEDs are operational for all the signals.
- With the release de-energized, the LEDs are limited to the signalling of the last switch-off or trip event (combined with the check via iTest, described below).



NOTE: *with the release off, the operation of the LEDs is guaranteed if the internal battery of the release is working properly.*

About

The LEDs combined with the protections provide various information, with different combinations of lighting and blinking.



NOTE: *all the combinations related to protection LED signals are described in chapter Self-diagnosis and signalling , on page 47.*

The power led provides information about the power status of the protection release:

- LED on (default configuration) fixed or blinking, signals release energized.
- LED off signals release de-energized.



NOTE: *with Ekip T&P and Ekip Bluetooth modules and Ekip Connect software, it is possible to configure how the power led functions (LED fixed or blinking).*

Protections: thresholds The thresholds of all the protections can be modified with various dip-switches, as specified on the serigraph of the interface.

The values of the protections make reference to the current I_n , a nominal value of the release defined by the Rating Plug.



IMPORTANT:

- **Modification of the thresholds must be performed in the absence of protection alarms.**
- **Modifications carried out in alarm conditions are accepted by the release when resting condition is restored (absence of protection alarms).**

Protections: times The times and the curves of the protections can be modified with various dip-switches, as specified on the serigraph of the interface.



IMPORTANT:

- **Modification of the times must be performed in the absence of protection alarms.**
- **Modifications carried out in alarm conditions are accepted by the release when resting condition is restored (absence of protection alarms).**

Settings Two further settings are available:

- **Neutral** allows activation and adjustment of the protections on the neutral pole.
- **Frequency** allows the selection of the installation frequency.

iTest pushbutton The iTest push-button is useful for three operations:

- Perform tests (circuit-breaker opening test and led test).
- Reset the signal for intervention of the protection as a result of a trip.
- With the release off, check the information relating to the switch-off or tripping event.



NOTE: *pressing iTest with the release off, for approximately 4 seconds switches on:*

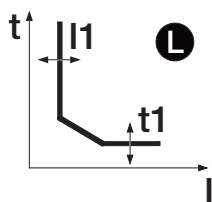
- The power led, if the release is off due to an energy drop (primary current less than the minimum level of operation, removal of auxiliary power supply with air circuit-breaker, etc...).
- The protection tripped LED if the release is off due to a protection trip.

Test connector The test connector allows the connection of Ekip TT, Ekip T&P and Ekip Bluetooth modules, in order to perform the following operations:

- Temporary energizing of the release to check the status, and perform the trip test (option possible with all the front interface modules).
 - Analysis, supervision and setting of additional parameters through external communication test units (Ekip T&P, Ekip Bluetooth).
-

2 - Protections

L Protection The protection L protects against overloads

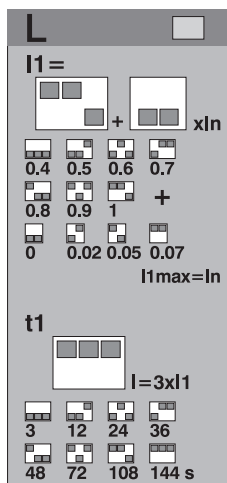


NOTE: the protection is available and active for all the versions of the release.

When the activation threshold is exceeded, the protection trips in a time that decreases as the current read increases.

Parameters

All the parameters that can be modified by the user affect the response curve, and related tripping times.

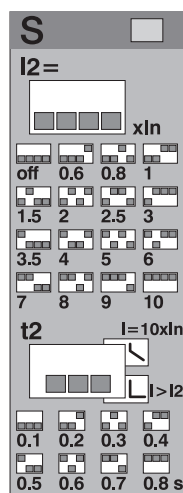
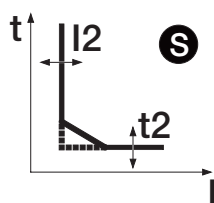


Parameter	Description
Threshold I1	The value I1 contributes in calculating the tripping time, and also defines the current value that, if exceeded, activates the protection (in reference to the curve, it is the part parallel to the ordinate). IMPORTANT: • The protection is activated and starts timing for currents between 1.05 and 1.2 of the threshold I1 set ⁽¹⁾. • The delay is interrupted if the current drops below the activation threshold.
Time t1	The value t1 contributes in calculating the tripping time (in reference to the curve, T1 affects the entire curve shifting it as a whole along the vertical axis). IMPORTANT: The protection limits the tripping time to 1 second in two cases: • if according to the calculation the time is less than 1 second. • If the fault current is greater than 12 In.

⁽¹⁾ Example (with I1 set to 400 A): the protection is activated for currents read between 420 A and 480 A.

With the modules Ekip T&P or Ekip Bluetooth and with the Ekip Connect software, it is possible to activate the function **Thermal Memory**, and adjust the threshold of **Prealarm**. See page 43.

Protection S The protection S protects against the selective short circuit.



NOTE: the protection is available for LSI and LSIG versions of the release.

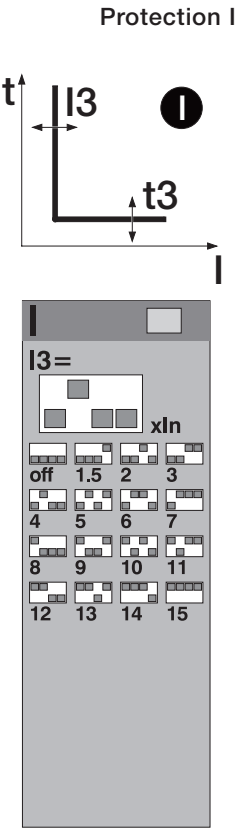
When the activation threshold is exceeded, the protection trips within a fixed or dynamic time (the time decreases as the current read increases).

Parameters

All the parameters that can be modified by the user affect the response curve, and related tripping times.

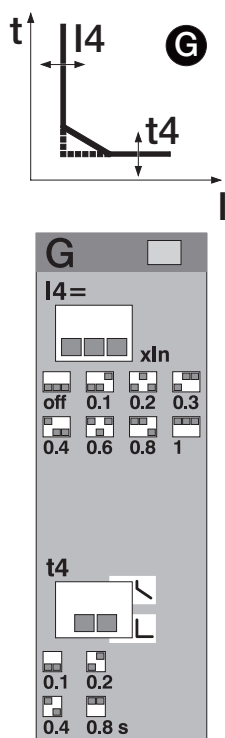
Parameter	Description
Enable	By setting the threshold dip-switches to the Off position, the protection is disabled.
Type of curve	Determines the dynamic of the curve and the tripping time, fixed or dynamic according to the selection: NOTE: calculation of the tripping time of the inverse time curve is based on a mathematical expression. The details provided in the table on page 44.
Threshold I2	It defines the current value that if exceeded activates the protection (in reference to the curve, it is the part parallel to the ordinate). IMPORTANT: - The I2 threshold set must be higher than the I1 threshold. An incorrect configuration returns an alarm signal. - The delay is interrupted if the current drops below the activation threshold.
Time t2	The selected function determines the contribution of t2: - Fixed time: t2 is the delay time between exceeding the I2 threshold and sending the opening command. - Dynamic time: t2 contributes in calculating the tripping time (in reference to the curve, t2 affects the entire curve, shifting it as a whole along the vertical axis). IMPORTANT: - The minimum tripping time of the protection is t2. If, according to the calculation, the tripping time is less, it is automatically limited to t2. - For all the UL versions, the maximum time allowed by the release is 0.4 s. If a higher value is set, the release signals the error and forces the parameter to 0.4 s.

With the modules Ekip T&P or Ekip Bluetooth and with the Ekip Connect software, it is possible to activate the function **Thermal Memory**. See page 43.



The protection I protects against instantaneous short circuit. When the activation threshold is exceeded, the protection trips within a fixed non-adjustable time.	
Parameters The user can set the intervention threshold.	
Parameter	Description
Enable	By setting the threshold dip-switches to the Off position, the protection is disabled.
Threshold I3	It defines the current value that if exceeded activates the protection (in reference to the curve, it is the part parallel to the ordinate).
! IMPORTANT: The I3 threshold set must be higher than the I2 threshold. An incorrect configuration returns an alarm signal.	

Protection G The protection G protects against an earth fault.



NOTE: the protection is available for the LSIG version of the release.

When the activation threshold is exceeded, the protection trips within a fixed or dynamic time (the time decreases as the current read increases).

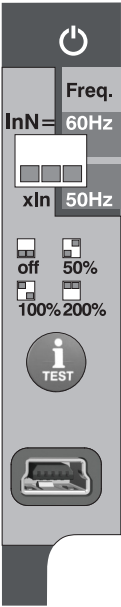
Parameters

All the parameters that can be modified by the user affect the response curve, and related tripping times.

Parameter	Description
Enable	By setting the dip-switches of the threshold in one of the available combinations other than Off, the protection is enabled. If enabled, the protection is inhibited automatically by the release in two conditions: - Disconnection of one or more current sensors. - Current measured on one of the phases is higher than a maximum value. ! IMPORTANT: the maximum current value that deactivates protection G varies according to the threshold set: 8 In (with $I4 \geq 0.8 I_n$) 6 In (with $0.5 I_n \leq I4 < 0.8 I_n$) 4 In (with $0.2 I_n \leq I4 < 0.5 I_n$) 2 In (with $I4 < 0.2 I_n$)
Type of curve	Determines the dynamic of the curve and the tripping time, fixed or dynamic according to the selection: i NOTE: calculation of the tripping time of the inverse time curve is based on a mathematical expression. The details are provided in the table on page 44.
Threshold I4	It defines the current value that if exceeded activates the protection (in reference to the curve, it is the part parallel to the ordinate). ! IMPORTANT: - The delay is interrupted if the current drops below the tripping threshold. - For all the UL versions the maximum threshold allowed by the release is 1200 A. If a higher value is set, the release signals the error and forces the parameter to 1200 A.
Time t3	The selected function determines the contribution of t4: - Fixed time: t4 is the delay time between the exceeding of the I4 threshold and the sending of the opening command. - Dynamic time: t4 contributes in calculating the tripping time (in reference to the curve, t4 affects the entire curve, shifting it as a whole along the vertical axis). ! IMPORTANT: - The minimum tripping time of the protection is t4. If, according to the calculation, the tripping time is less, it is automatically limited to t4. - For all the UL versions, the maximum time allowed by the release is 0.4s. If a higher value is set, the release signals the error and forces the parameter to 0.4 s.

Neutral and frequency

Adjusting the neutral setting serves to characterize the protections L, S and I on the Neutral pole with a control factor different to the other phases.



NOTE: use the adjustment of the neutral setting only with four-pole or three-pole circuit-breakers with external neutral: with three-pole circuit-breakers and neutral protection active, the release signals the absence of the current sensor.

The adjustment of the frequency is used in order to set the installation frequency (between 50 and 60 Hz).

Neutral parameters

The user can activate the protection and set the percentage for calculation of the protection thresholds.

Parameter	Description
Enable	By setting the threshold dip-switches to the Off position, the protection on the Neutral is disabled.
Threshold InN	Represented as a percentage; it defines the multiplication factor of the neutral current, for calculating the intervention threshold of the protections: • 50%: lowest tripping threshold (in reference to the curves of the protections, the neutral current is considered double the real one). • 100%: tripping threshold equal to the other phases. • 200%: highest tripping threshold (in reference to the curves of the protections, the neutral current is considered double the real one).

Limitations

The adjustment of the Neutral threshold to value of 200 % must be performed considering the following formula: $(I1 * InN) \leq Iu$.

I1 indicates the threshold of protection L in Amperes (example: 600 A), InN is the neutral threshold expressed as a multiplication factor (example: 1.5), Iu indicates the size of the circuit-breaker (example: 1000 A).

Additional protections The Ekip T&P and Ekip Bluetooth modules, and the Ekip Connect software, allow you to set some protections not available via dip-switch:

- Thermal Memory.
- Protection T.
- Prealarm threshold.
- Hardware Trip.

Thermal Memory

This function, available for protections L and S, reduces the tripping time of the protection based on the time elapsed between multiple trips caused by heating of the cables.



IMPORTANT: for the protection S the function can be activated if the selected curve is time-dependent.

Protection T

The protection T protects the circuit-breaker against abnormal temperatures recorded by the protection release.

The protection T is always active; via Ekip Connect it is possible to enable tripping, which takes place for temperatures $t < -25\text{ °C}$ or $t > 85\text{ °C}$.

Prealarm L

The prealarm L notifies that the current measured is close to the activation threshold of the protection L.

The prealarm threshold is expressed as a percentage value of the I_1 threshold, and is adjustable between 40% and 90% (default value).

Example: with $I_1 = 0.6 I_n$ and prealarm threshold = 50%, the prealarm is activated for currents greater than $0.3 I_n$

The prealarm state is activated for currents higher than the threshold set, and is deactivated for:

- Current less than the prealarm threshold.
- Current greater than the activation threshold of protection L.

Hardware Trip

The Hardware Trip protection protects against internal disconnections of the circuit-breaker. Via Ekip Connect it is possible to enable the trip command, which is sent if one or more of the following events is detected:

- Current sensors disconnected (internal or external if enabled).
- Rating Plug disconnected.
- Trip Coil disconnected.
- Internal problems with the protection release.



IMPORTANT: the protection trips if the error conditions persist more than 1 second.

Summary table of protections

ABB	ANSI ⁽⁵⁾	Threshold ⁽¹⁾	Threshold tolerance ⁽³⁾	Time ⁽¹⁾	Calculation formula t_t ⁽²⁾	Example calculation t_t ⁽²⁾	Tolerance t_t ⁽³⁾
L	49	$I1 = 0.4 \dots 1 \text{ In}$	activation for I_f in the range $(1.05 \dots 1.2) \times I1$	$t1 = 3 \dots 144 \text{ s}$	$t_t = (9 t1) / (I_f / I1)^2$	$t_t = 6.75 \text{ s}$ with: $I1 = 0.4 \text{ In}$; $t1 = 3 \text{ s}$; $I_f = 0.8 \text{ In}$	$\pm 10 \%$ with $I_f \leq 6 \text{ In}$ $\pm 20 \%$ with $I_f > 6 \text{ In}$
S ($t = k$)	50 TD	$I2 = 0.6 \dots 10 \text{ In}$	$\pm 7 \%$ with $I2 \leq 6 \text{ In}$ $\pm 10 \%$ with $I2 > 6 \text{ In}$	$t2 = 0.1 \dots 0.8 \text{ s}$	$t_t = t2$	-	The better of the two values: $\pm 10 \%$ or $\pm 40 \text{ ms}$
S ($t = k / I^2$)	51	$I2 = 0.6 \dots 10 \text{ In}$	$\pm 7 \%$ with $I2 \leq 6 \text{ In}$ $\pm 10 \%$ with $I2 > 6 \text{ In}$	$t2 = 0.1 \dots 0.8 \text{ s}$	$t_t = (100 t2) / (I_f)^2$	$t_t = 5 \text{ s}$ con: $I2 = 1 \text{ In}$; $t2 = 0.8 \text{ s}$; $I_f = 4 \text{ In}$	$\pm 15 \%$ with $I_f \leq 6 \text{ In}$ $\pm 20 \%$ with $I_f > 6 \text{ In}$
I	50	$I3 = 1.5 \dots 15 \text{ In}$	$\pm 10 \%$	Not adjustable	$t_t \leq 30 \text{ ms}$	-	-
G ($t = k$)	50N TD	$I4^{(4)} = 0.1 \dots 1 \text{ In}$	$\pm 7 \%$	$t4 = 0.1 \dots 0.8 \text{ s}$	$t_t = t4$	-	The better of the two values: $\pm 10 \%$ or $\pm 40 \text{ ms}$
G ($t = k / I^2$)	51N	$I4^{(4)} = 0.1 \dots 1 \text{ In}$	$\pm 7 \%$	$t4 = 0.1 \dots 0.8 \text{ s}$	$t_t = 2 / (I_f / I4)^2$	$t_t = 0.32 \text{ s}$ with: $I4 = 0.8 \text{ In}$; $t4 = 0.2 \text{ s}$; $I_f = 2 \text{ In}$	$\pm 15 \%$
Iinst	-	Defined by ABB	-	Instantaneous	-	-	-

⁽¹⁾ See the screen-print for the available combinations.

⁽²⁾ The calculation of t_t is valid for values of I_f that have exceeded the activation threshold of the protection.

⁽³⁾ Tolerances valid with release energized in service conditions or with the auxiliary; tripping time $\geq 100 \text{ ms}$, temperature and currents within operating limits. If the conditions are not guaranteed, the tolerances in the table shown below apply.

⁽⁴⁾ In the presence of an auxiliary power supply all the thresholds are active. If the auxiliary power supply is not present, the minimum threshold is automatically limited to the higher value between 100 A and 0.3 In

⁽⁵⁾ ANSI / IEEE C37-2 encoding.

Key

- ($t=k$) - Fixed time curve.
- ($t=k/I^2$) - Dynamic time curve.
- t_t - Tripping time.
- I_f - Primary fault current.

Tolerances in particular cases

If the conditions defined in point ⁽³⁾ of the above table are not guaranteed, the following tolerances apply:

Protection	Tolerance threshold	Tolerance t_t
L	Activation for I_f in the range $(1.05 \dots 1.2) \times I1$	$\pm 20 \%$
S	$\pm 10 \%$	$\pm 20 \%$
I	$\pm 15 \%$	$\leq 60 \text{ ms}$
G	$\pm 15 \%$	$\pm 20 \%$

3 - Measurements

Introduction Measurements The Ekip DIP release records various items of information, useful for analysis and consultation:

- Instantaneous measurements of phase currents.
- Measurement of the maximum and minimum currents recorded with an adjustable interval.
- Trip Log.
- List of events, changes of state and alarms recorded by the release
- Contact wear value.
- Number of mechanical and electrical operations.



NOTE: all the information is available with Ekip T&P and Ekip Bluetooth modules and with the Ekip Connect software. The Instantaneous measurements are also available with the Ekip Multimeter switchgear unit.

Instantaneous currents The following table summarises the measurements of the instantaneous currents:

Type of Measurement	Range	Standard operation range	Accuracy
Phase currents (I1, I2, I3, INe)	0.3...16 In	0.2...1.2 In	1 %



NOTE: the precisions specified in the table refer to the range of normal operation

Maximum and minimum currents The release is able to record the maximum and minimum current, measured inside an interval that can be programmed by the user.

Every measurement recorded is accompanied by the following information:

- Recording interval.
- Phase and value of maximum and minimum current measured.
- Date and time of the recording (referring to the internal clock).



NOTE: in the case of the minimum current, if the value drops below the 0.03 In threshold, it will be recorded and represented by the symbol “...” in the measurement field.

Trips The release is able to record the last 30 openings of the circuit-breaker caused by protection trips.

The trips include useful information relating to each trip:

- The protection that caused the trip.
- The progressive number of the opening.
- The date and time of the opening (referring to the internal clock).
- The measurements associated to the trip protection.

Contact wear Contact wear indicates the state of deterioration of the main contacts of the circuit-breaker.

The value is expressed as a percentage, and is 0 % in the case of no wear, and 100 % in the case of total wear.

It is calculated automatically by the release at every opening for protection or, in the presence of an auxiliary power supply, also at every manual opening of the circuit-breaker.

Number of operations In the presence of auxiliary power, the release records a series information relating to openings of the circuit-breaker:

- Number of manual operations.
- Total number of operations (manual + trips).

4 - Test

Presentation The Ekip TT, Ekip T&P and Ekip Bluetooth modules connected to the Ekip Dip release allow you to perform various tests:

- Release LED test
- Check on the presence of the internal battery.
- Circuit-breaker opening test (trip test).
- Protection test

LED test The LED test can be performed directly on Ekip Dip:

Phase	Operation
1	Connect a module to the front test connector of frontal test.
2	Press the iTest push-button for at least 6 seconds, but less than 9 seconds.
3	When the protection LEDs light up, release the iTest push-button.
4	Check the following switch-on sequence: • S, I, G LEDs on fixed. • Led prealarm L and alarm L that alternate three times. • All the protection LEDs off

Battery test The battery check is integrated in the LED test procedure, except for the battery error signal:

- If the battery is absent or not working, after iTest is pressed the error is signalled by five flashes of the prealarm led L.
- If the battery is present and working, the LED test proceeds as in the normal procedure.

Protection test In order to perform the protection test, follow the instructions below:

Phase	Operation
1	Make sure that the circuit-breaker is closed and that there are no primary currents.
2	Connect Ekip T&P or Ekip Bluetooth to the front test connector.
3	Start the communication with Ekip Connect.
4	Open the Information page and select the Test command, which opens the protection test page.
5	Set up the test as required and verify that the release functions properly.

Further information on Ekip Connect is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the manual [1SDH000891R0002](#).

Opening test The opening test can be performed directly on the release or from Ekip Connect.

To perform the release test:

Phase	Operation
1	Make sure that the circuit-breaker is closed and that there are no primary currents.
2	Connect a module to the front test connector of frontal test.
3	Press the iTest push-button for at least 9 seconds.
4	Check that the circuit-breaker opens and that the TU Reset button comes out

To perform the test from Ekip Connect:

Phase	Operation
1	Make sure that the circuit-breaker is closed and that there are no primary currents.
2	Connect Ekip T&P or Ekip Bluetooth to the front test connector.
3	Start the communication with Ekip Connect.
4	Select the trip test command.
5	Check that the circuit-breaker opens and that the TU Reset button comes out

Further information on Ekip Connect is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the manual [1SDH000891R0002](#).

5 - List of alarms and signals

LED view The Ekip Dip release continuously monitors its own operating status and that of all the devices to which it is connected. All the signals are available with the front LEDs.

The protection LEDs provide information with various combinations of lighting and flashing, while the Power LED, as described on page 36, indicates the power status of the release.

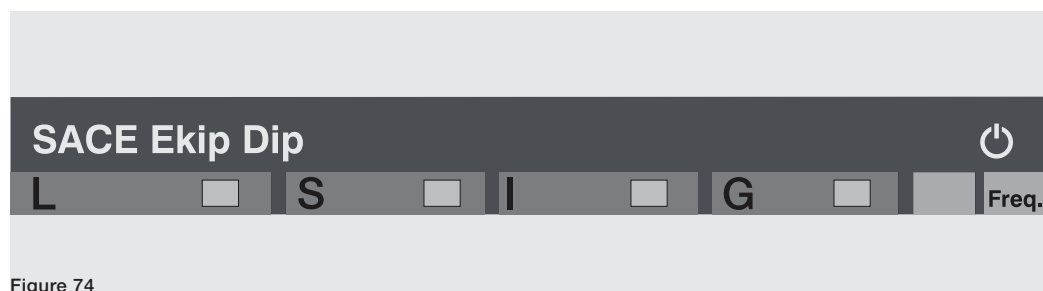


Figure 74



NOTE: the number of leds present depends on the version of the release (LI, LSI, LSIG).

Summary table of LED signals

The following table summarises the signals available with the protection LEDs and the operations to be carried out in response to alarms or fault conditions signalled.

Type of Information	Slow flashing (0.5Hz)			Fast flashing (2 Hz)				On and fixed			2 flashes every 2 s		3 flashes every 3 s	4 flashes every 4 s	HELP
	All R	G	All R+G	All R	R (single)	G	All R+G	All R	R (single)	G	All R	G	G	G	
Internal configuration error			x				x	x							A
Trip coil disconnected or trip command failed				x											B
Current sensors disconnected	x														B
Rating Plug error											X				B+E
Protection delay					x										C
Temperature alarm ⁽¹⁾					x										C
Prealarm L										x					C
Trip ⁽²⁾									x						C
Hardware Trip ⁽³⁾									x	x					B
Installation error						x									E
Parameters error												x			D
Circuit-breaker state not defined or in error		x													B
Error on Local Bus														x	F
Maintenance alarm													x		F
Software incompatibility								x		x					G
Low battery (during self-test) ⁽⁴⁾						x									H

⁽¹⁾ The temperature alarm is signalled by lighting of the protection L and I red LEDs.

⁽²⁾ The last trip can also be displayed with release off, by pressing the iTest key.

⁽³⁾ The Hardware Trip is signalled by lighting of the prealarm L yellow led and the protection I red led.

⁽⁴⁾ Five flashes when self-test is started up

Key to LED colours

The above table lists the colors of the LEDs, to be interpreted as follows:

- R = red LED (alarm led L, S, I, G).
- G = yellow LED (prealarm led L).



NOTE: for further details refer to the table listing the components of the interface, available on page 35.

Continued on the next page

HELP

Some led signals indicate connection errors or operational errors that require corrective or maintenance operations. The following are the suggestions for checking referring to the preceding LED table:

HELP note	Operation
A	Contact ABB.
B	Check the connections between release and accessories (Rating Plug, trip coil, sensors, etc).
C	Normal operation/signalling provided by the release.
D	Error in setting of the dip-switches. Check and correct the following conditions: • All the dip-switches of L are in the ON position • $I_1 > I_2$ or $I_2 > I_3$. • $I_u < (2 * I_n * I_1)$ in the case where $I_n = 200\%$. • $I_4 <$ the highest between 100 A and $0.3 I_n$, in the absence of auxiliary power supply. • $t_2 > 0,4s$ (in the case of circuit breaker UL) • $t_4 > 0,4s$ (in the case of circuit breaker UL) • $I_4 > 1200 A$ (in the case of UL circuit-breaker)
E	Carry out installation.
F	Connect via Ekip Connect in order to set the Local Bus or to confirm maintenance.
G	Contact ABB to restore software compatibility between Ekip Dip and Mainboard.
H	Replace the battery.

6 - Additional Ekip Dip functions

The Ekip T&P and Ekip Bluetooth modules, and the Ekip Connect software, allow you to set some functions and parameters not available via dip-switch:

- Maintenance.
- Local Bus.
- Date and time.

Maintenance The Maintenance function allows signalling to the user, via LED, that:

- 1 year has passed since the last maintenance.
- Contact wear has increased by more than 10% compared with the value at the last maintenance.

Via Ekip Connect there are two selections available:

- Activation: it allows to the maintenance function to be activated.
- Reset: it allows confirmation of maintenance on the release; the current date and contact wear values are recorded, and the signal is reset.

The reference date is that of the internal clock, and the elapsed time is calculated both with the release on and off (provided that the internal battery is working).



NOTE: manual modification of the date can cause variations in the calculation of the time elapsed, and therefore the date of the next maintenance.



NOTE: the maintenance signal due to increased contact wear is active for values higher than 20 %.

Local Bus In order to activate communication on the Local Bus with the Ekip Link, Ekip Multimeter or Ekip Signalling 10K modules, the Local Bus parameter must be enabled.



NOTE: communication with the modules is active if the auxiliary power supply is present.

Date and time. The Ekip Dip release has a user-adjustable internal clock.

Setting the date can be useful for some functions such as the recording of trips and minimum and maximum currents, and maintenance.

The clock is active if the internal battery of the release is working.

7 - Operating features

Primary operating currents The Ekip Dip release can be powered directly by the internal current sensors, with clearly defined primary currents.

The operating conditions for proper operation are listed below:

Parameter	Operating limits
Minimum three-phase turn-on current	> 80 A (E1.2-E2.2-E4.2) > 160 A (E6.2)
Rated frequency	50 / 60 Hz $\pm$ 10 %
Harmonic distortion	Conforming to 60947-2

Auxiliary power supply The Ekip Dip release can be connected to an external auxiliary power source, useful for activating some functions such as communication on the Local Bus or recording of manual operations.

The auxiliary power can be supplied by the modules of the Ekip Supply range (for further functional details, see page 62), or with direct connection to a terminal box.

The direct connection must be made guaranteeing the operating following conditions:

Parameter	Operating limits
Voltage	24 V DC galvanically isolated
Tolerance	$\pm$ 10 %
Maximum ripple	$\pm$ 5 %
Maximum inrush current @ 24 V	10 A per 5 ms
Maximum rated power @ 24 V	4 W
Connection cable	Insulated with a two-pole shielded cable (Belden 3105A type or equivalent)



IMPORTANT:

- With a direct connection, the power must be galvanically isolated and must ensure the insulation characteristics retrieved from IEC 60950 (UL 1950) or equivalent standards that ensure a common mode current, or leakage current, (see IEC 478/1, CEI 22/3) no greater than 3.5 mA.
- The Ekip Supply modules do not require galvanic insulation.

8 - Default parameters

Ekip DIP default parameters The Ekip Dip releases are supplied with the following default parameters, some adjustable with the front dip-switch (protections, Frequency, Neutral), other via front bus.

Protection/Parameter	Value
L	1 In; 144 s
S ⁽¹⁾	Off; 0.1 s
I	4 In
G ⁽¹⁾	Off; 0.1 s
Frequency	50 Hz (IEC) / 60 Hz (UL)
Neutral	Off (for circuit breakers three-pole). 50 % (for four-pole circuit-breaker)
Hardware Trip	Disabled
Measurement interval	5 minutes
Local Bus	Disabled
Alive LED	Disabled (Power LED on fixed)

⁽¹⁾ Protection S available with LSI and LSIG versions of the release. Protection G available with LSIG version.

Accessories

1 - Preliminary considerations

Introduction All the circuit-breakers have a series of electrical and mechanical accessories that can be applied according to the circuit-breaker type, and a series of electronic accessories that can be applied according to the type of Ekip release with which the circuit-breaker is equipped.

Accessory combination tables The following table shows the possible combinations of the electrical and mechanical accessories:

Type of accessory	Accessory	Circuit-breakers	Disconnectors	Derived versions		
				CS	MV	MTP
Electrical signalling	AUX 4Q	S	R	-	-	-
	AUX 6Q	R	R	-	-	-
	AUX 15Q	R	R	-	-	-
	Ekip AUP (*)	R	R	R	R	R
	Ekip RTC	R	R	-	-	-
	S51	S	-	-	-	-
	S33 M/2	R	R	-	-	-
Electrical control	YO-YC	R	R	-	-	-
	YO2-YC2	R	R	-	-	-
	YU	R	R	-	-	-
	M	R	R	-	-	-
	YR	R	-	-	-	-
Safety mechanical	KLC and PLC	R	R	-	-	-
	KLP and PLP (*)	R	R	-	-	R
	SL (*)	S	S	-	-	S
	SLE (*)	R	R	-	-	-
	DLR (*)	R	R	-	-	R
	DLP (*)	R	R	-	-	R
	DLC	R	R	-	-	R
	Anti-racking-in lock	S	S	-	-	S
	MOC	R	R	-	-	R
Protection mechanical	PBC	R	R	-	-	R
	IP54	R	R	-	-	R
Interlocks	MI	R	R	-	-	R

S: Standard. R: on request. (*): only for withdrawable version.

Continued on the next page

The following table shows the possible combinations of the electronic accessories:

Type of accessory	Accessory	Release				
		Ekip Dip	Ekip Touch	Ekip Hi-Touch	Ekip G Touch	Ekip G Hi-Touch
Power supply	Ekip Supply	R	R	R	R	R
Connectivity	Ekip Com	-	R	R	R	R
	Ekip Com Redundant	-	R	R	R	R
	Ekip Com Actuator	R	R	R	R	R
	Ekip Link	R	R	R	R	R
	Ekip Bluetooth	R	R	R	R	R
Signal	Ekip Signalling 2K	-	R	R	R	R
	Ekip Signalling 4K	-	R	R	R	R
	Ekip Signalling 10K	-	R	R	R	R
Measurement and Protection	Ekip Measuring	-	R	-	-	-
	Ekip Measuring Pro	-	R	S	S	S
	Ekip Synchrocheck	-	R	R	R	R
	Ekip Fan	R	R	R	R	R
	Rating Plug	R	R	R	R	R
	Toroid S.G.R.	-	R	R	R	R
	Rc Toroid	-	R	R	R	R
	External neutral sensor	R	R	R	R	R
Display and Supervision	Ekip Multimeter	R	R	R	R	R
	Ekip Control Panel	R	R	R	R	R
Testing and Programming	Ekip TT	R	S	S	S	S
	Ekip T&P	R	R	R	R	R
	Ekip Programming	R	R	R	R	R

S: Standard. R: on request.

Circuit-breaker dismantling operations

To dismantle the accessories, the following parts must be removed from the circuit-breaker:

- Transparent flange (A) of the release, by turning the screws (B).
- Escutcheon plate of the circuit-breaker (C), by removing the mounting screws (D).

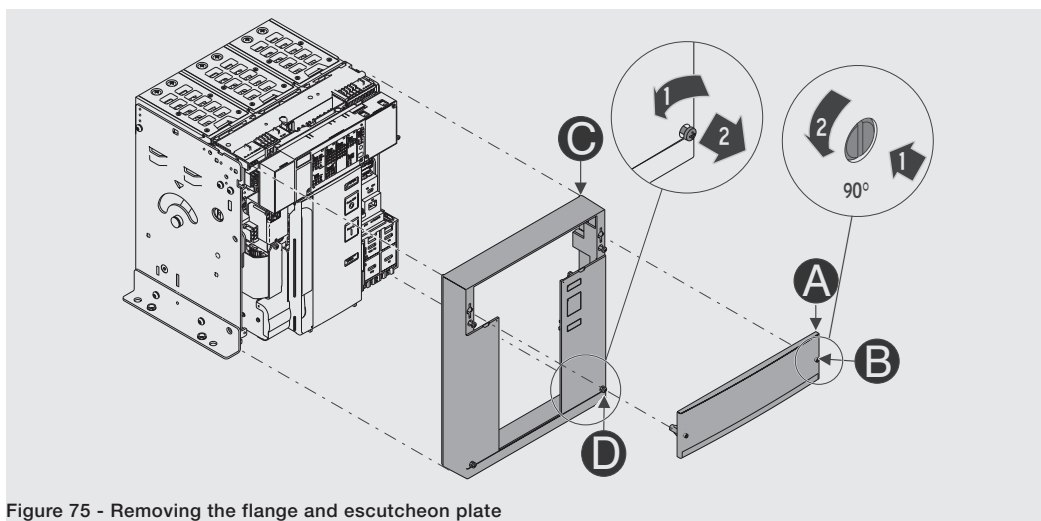


Figure 75 - Removing the flange and escutcheon plate

After reassembling the accessories, the parts previously disassembled must be reassembled as indicated:

- Escutcheon plate of the circuit-breaker (C), by screwing in the mounting screws (D). Tighten with tightening torque 1.1 Nm - 9,74 lb in.
- Transparent flange (A) of the release, by turning the screws (B).

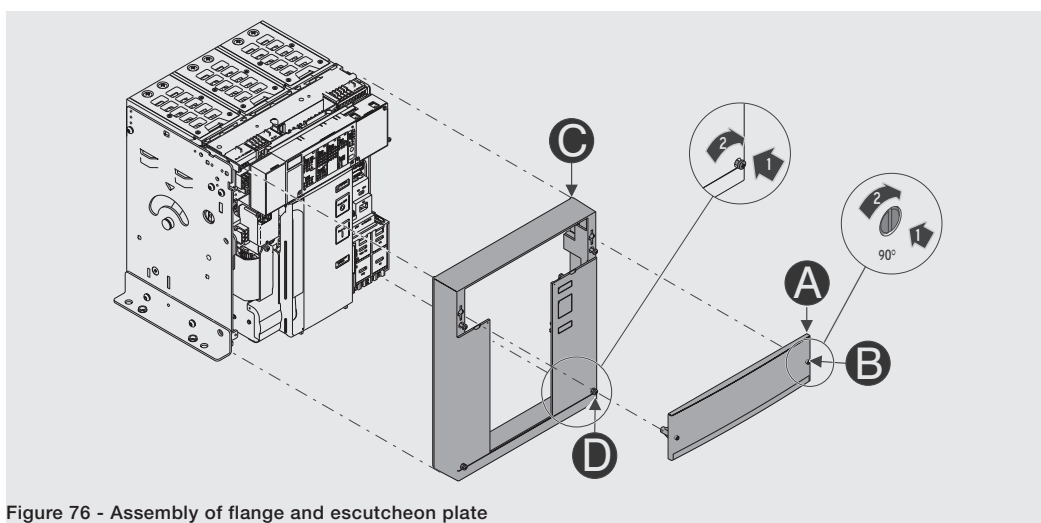


Figure 76 - Assembly of flange and escutcheon plate

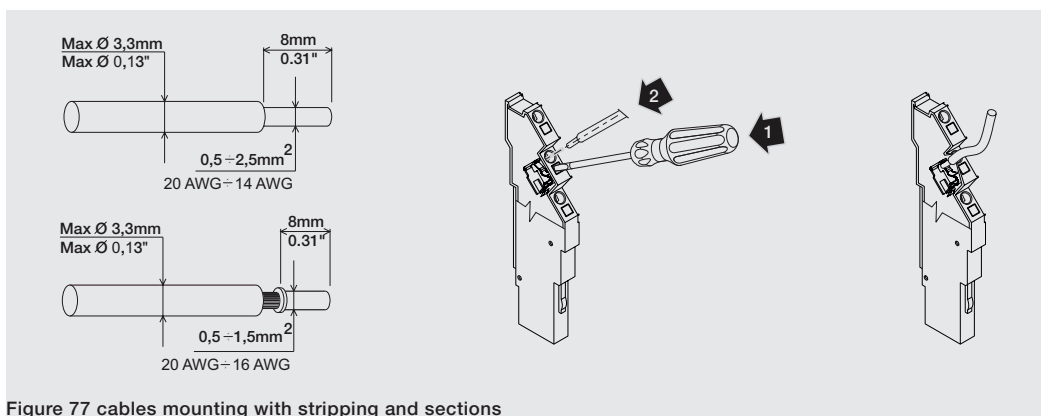


Figure 77 cables mounting with stripping and sections

2 - Wiring diagrams

General wiring diagrams The following is the wiring diagram of the circuit-breaker:

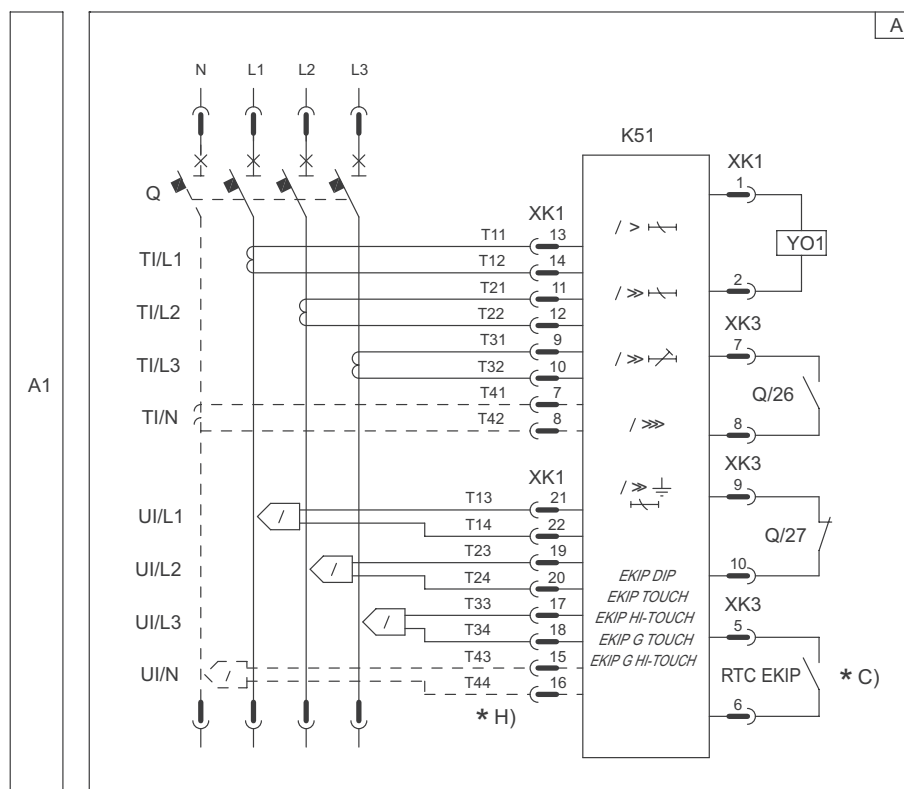


Diagram A - General diagram of the circuit-breaker



NOTE: The diagram is shown in the following conditions:

- Circuit-breaker in withdrawable version (also valid for fixed version), open and connected.
- Circuits de-energized.
- Releases not tripped.
- Motor operator with springs unloaded.

The following is the wiring diagram of the switch-disconnector:

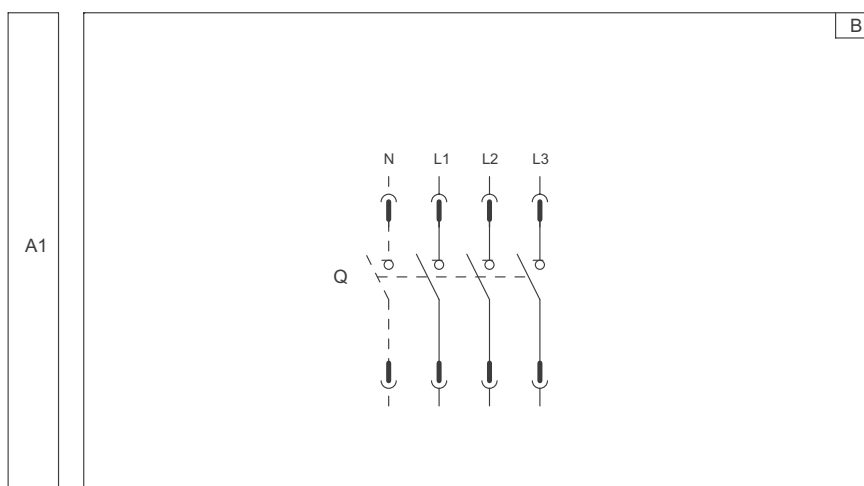


Diagram B - General diagram switch-disconnector

Continued on the next page

The wiring diagram of the circuit breaker is illustrated without any indication of the auxiliary power supply of the Ekip release. If the circuit-breaker is accessorized with the Ekip Supply module, for information see the page 62.

If the circuit-breaker is not accessorized with the Ekip Supply module, for the connection of the auxiliary power supply of the Ekip release see the direct power supply diagram shown below:

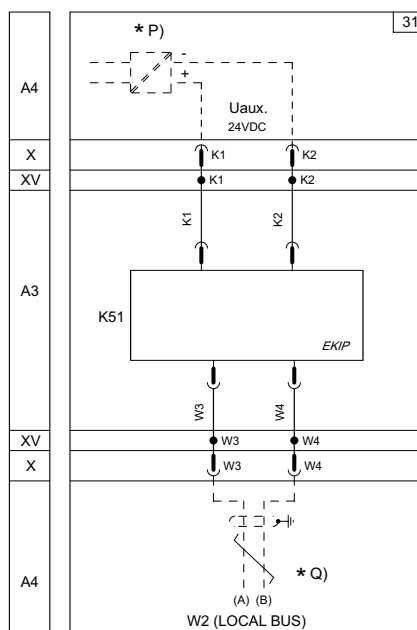


Diagram 31 - Direct auxiliary power supply

Circuit-breaker terminal box The circuit-breaker is equipped with a terminal box for the wiring of the accessories that varies according to the type of circuit-breaker:

- Terminal box for circuit-breaker in fixed version.
- Terminal box for circuit-breaker in withdrawable version.

The differences between the two terminal boxes are shown in Figure 78 :

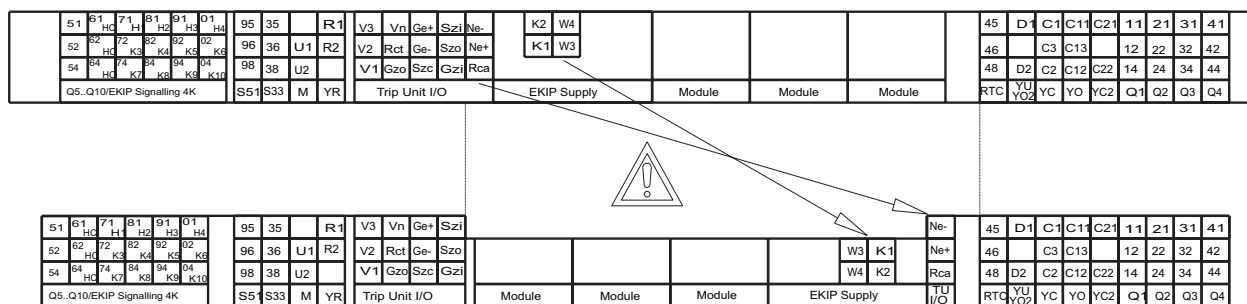


Figure 78

On page 58, the representation of the terminal box for a circuit-breaker in fixed version is shown.



NOTE: for the details of the wiring diagram of each individual accessory, please refer to the specific pages that describe the accessory in question.

Continued on the next page

11



The following is a key to the symbols used in the wiring diagrams:

Symbol	Description
*	See the note indicated by the letter
A1	Applications applied to the moving part of the circuit-breaker
A3	Applications applied to the fixed part of the circuit-breaker
A4	Indicative equipment and connections for operating and signalling, external to the circuit-breaker
BUS1	Serial interface with the external bus
D	Electronic time-delay device of the under-voltage coil YU, external to the circuit-breaker
F1	Time-delayed trip fuse
GZi(DBi)	Input for Zone Selectivity for protection G or input in "inverse" direction for protection D
GZo(DBo)	Output for Zone Selectivity for protection G or output in "inverse" direction for protection D
I O1...32	Programmable digital inputs of the Ekip protection release
K51	Overcurrent protection solid-state release
K51 / COM	Communication module
K51 / FAN	Fan power supply module
K51 / MEAS	Measurement module
K51 / SIGN	Signalling module
K51 / SUPPLY	Optional auxiliary power supply module (24-48Vdc and 110-220Vac / dc)
K51 / SYNC	Synchronization module
K51 / YC	Closing command via Ekip protection release
K51 / YO	Opening command via Ekip protection release
M	Motor for loading the closing springs
M2	Fan motor
O 01...32	Programmable signalling contacts of the Ekip protection release
O SC	Contact of the Ekip protection release for synchronism control
Q	Circuit breaker
Q / 1...Q / 27	Auxiliary contacts of the circuit-breaker
Rc	Rc sensor
RT1...RT3	Temperature sensors
RTC EKIP	Auxiliary contact ready to close the circuit-breaker
RTC	Contact for signalling circuit-breaker ready to close
S33M / 1...2	Spring loading motor limit contacts
S43	Switch for setting remote/local control
S51	Opening signalling contact
S75E / 1...4	Contacts for signalling circuit-breaker in disconnected position (only with withdrawable circuit-breakers)
S75I / 1...5	Contacts for signalling circuit-breaker in connected position (only with withdrawable circuit-breakers)
S75T / 1...2	Contacts for signalling circuit-breaker in test position (only with withdrawable circuit-breakers)
SC	Push-button or contact for closing the circuit-breaker
SO	Push-button or contact for immediate opening of the circuit-breaker
SO1	Push-button or contact for opening the circuit-breaker with time-delayed trip

Continued on the next page

SR	Push-button or contact for electrical reset of the break contact S51
SZi(DFi)	Input for Zone Selectivity for protection S or input in "inverse" direction for protection S
SZo(DFo)	Output for Zone Selectivity for protection S or output in "direct" direction for protection D
TI / L1	Current transformer, phase L1
TI / L2	Current transformer, phase L2
TI / L3	Current transformer, phase L3
TI / N	Current transformer on the neutral
TU1...TU2	Isolation voltage transformer (external to the circuit-breaker)
Uaux	Auxiliary power supply voltage
UI / L1	Current sensor, phase L1
UI / L2	Current sensor, phase L2
UI / L3	Current sensor, phase L3
UI / N	Current sensor on the neutral
UI / O	SGR sensor
W2	Serial interface with the internal bus (Local Bus)
W9...W13	RJ45 connector for communication modules
W9R...W11R	RJ45 connector for redundant communication modules
X	Delivery connector for the auxiliary circuits of the circuit-breaker in withdrawable version
XB1...XB7	Connectors for the circuit-breaker applications
XF	Delivery terminal box for the position contacts of the circuit-breaker in withdrawable version
XF1...XF2	Contact of the Ekip protection release for activation of the fans
XK1...XK3	Connectors for the auxiliary circuits of the Ekip protection release
XK7	Connector for the auxiliary circuits of the communication modules
XV	Delivery terminal box for the auxiliary circuits of the circuit-breaker in fixed version
YC	Closing coil
YC2	Second closing coil
YO	Opening coil
YO1	Opening coil for overcurrent
YO2	Second opening coil
YR	Coil for electrical reset of the break contact S51
YU	Under-voltage coil

The following is a key to the notes used in the wiring diagrams:

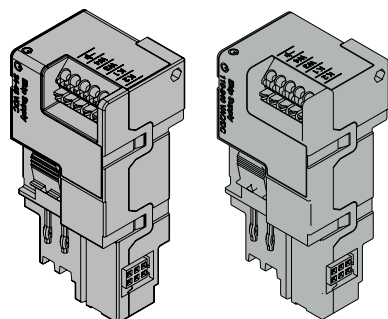
Note	Description
A)	The auxiliary power supply for the Ekip release is obligatory
C)	Always supplied with the Ekip Com module.
D)	Always supplied with the motor for loading the closing springs (diagram 13)
E)	Voltage transformer, mandatory in the case of external outlet sockets. External outlet sockets, mandatory for systems with rated voltage greater than 690V.
F)	The connections between the residual-current protection RC sensor and the poles of connector X (or XV) of the circuit-breaker must be implemented with a screened two-pole cable with paired braided conductors (BELDEN 9696 paired type or equivalent), with length no greater than 10m. The screen must be earthed on the circuit-breaker side.
G)	With all the electronic protection releases equipped with a display interface with LSIG protections, protection against earth faults (SGR) is available through a current sensor positioned on the star centre of the MV/LV transformer. The connection between terminals 1 and 2 of the UI/O current transformer and the Ge+ and Ge- poles of connector X (or XV) must be implemented with two-pole shielded stranded cable (BELDEN 9841 type or equivalent) no more than 15 m in length.

Continued on the next page

Note	Description
H)	The connection must be implemented with the 2m - 6 ft supplied cable. With three-pole circuit-breakers Ne+ and Ne- poles of connector X (or XV) must be short-circuited if the external neutral is not present.
I)	Mandatory if any Ekip module is present.
J)	Only for withdrawable circuit breakers as an alternative to diagrams 31-32-33.  NOTE: <i>Ekip Fan 24VDC occupies the space of the Ekip Supply and of a Module slot in the terminal box.</i>
K)	Only for withdrawable circuit breakers as an alternative to the diagrams 31-32-33.  NOTE: <i>Ekip Fan 220VAC occupies the space of the Ekip Supply and two Module slots in the terminal box.</i>
L)	In the presence of diagram 32, up to three applications can be provided between diagrams 41... 58 taken only once. In addition, it is possible to duplicate an Ekip Com module that may be selected choosing between diagrams 61...66.
M)	In the presence of diagram 33, up to three applications can be provided between diagrams 41... 58 taken only once. It is possible to duplicate the selected Ekip Com module choosing between diagrams 61...66.
N)	In the presence of diagram 34, only one application among diagrams 41... 58 can be provided.
O)	In the presence of multiple Ekip Com modules with circuit-breakers in withdrawable version, the contact S75I/5 must be connected only once on a single module.
P)	The auxiliary voltage Uaux allows all the functions of the Ekip electronic protection releases to be activated "Galvanically separated converters" conforming to standard IEC 60950 (UL 1950) or the equivalent standards, able to guarantee current in the common mode or leakage current (see IEC 478/1, CEI 22/3) that is no more than 3.5 mA (IEC 60364-41 and CEI 64-8) must be used since the Uaux must be isolated from the earth.
Q)	The maximum length of the cable for the local bus is 15 metres - 49 ft.

Electronic accessories

1 - Ekip Supply modules



Description The Ekip Supply is a power supply accessory module.

There are two types, depending on the input voltages to be supplied:

- Ekip Supply 24-48Vdc.
- Ekip Supply 110-240Vac/dc.

Compatibility The modules can be installed in the presence of releases of Ekip Dip, Ekip Touch, Ekip Hi-Touch, Ekip G Touch, and Ekip G Hi-Touch releases.

Electrical characteristics The following table lists the electrical characteristics:

Module	Power supply voltages	Frequency	Power input
Ekip Supply 24-48Vdc.	21.5...53 V DC	-	Maximum 10W
Ekip Supply 110-240Vac/dc	105...265 V AC/DC	45...66 Hz	Maximum 10 VA / W

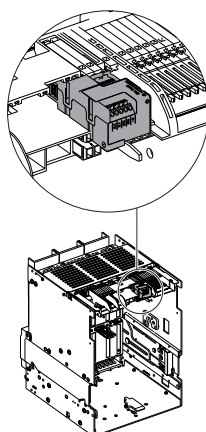
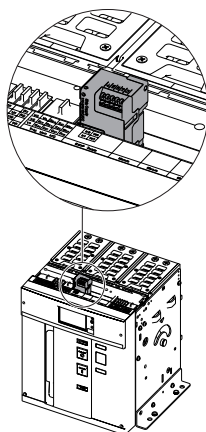
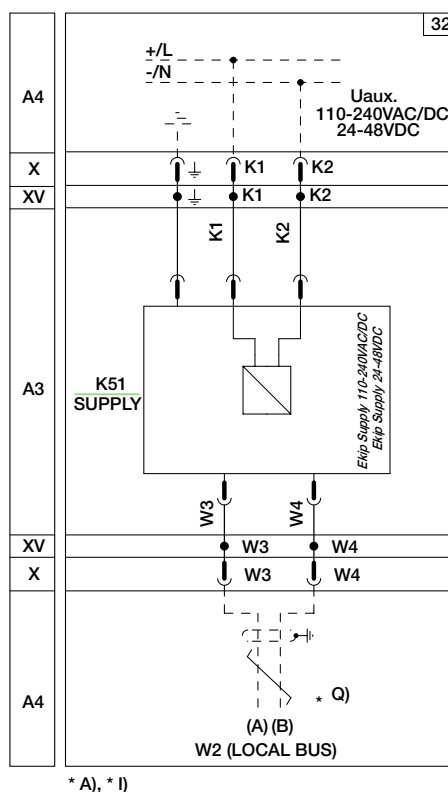
Connections

The modules must be mounted on the terminal box of the circuit-breaker or of the fixed part of the withdrawable circuit-breaker, in the first free slot.

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular in the kit sheet **1SDH001000R0511**.

An example with an E2.2 circuit-breaker in fixed and withdrawable versions is provided to the side.

The following is a view of the terminal box of E2.2-E4.2-E6.2 circuit-breakers, and the wiring diagram:

[illegible]

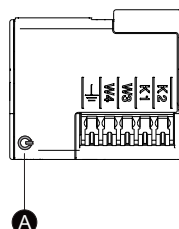
Diagrams 32

For external wiring, AWG 22-16 cables with a maximum external diameter of 1.4 mm must be used.

Further information is available on page 59, or on the site <http://www.abb.com/abblibrary/DownloadCenter/>, where the wiring diagram is available **1SDM000091R0001**.

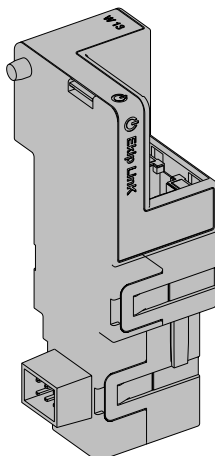
Signallings

The following table illustrates the possible signals, and their meaning:



Pos.	Description
A	Power LED, green. The possible states are: • Off: power supply absent. • On fixed: power supply present.

2 - Ekip Link module



Description Ekip Link is a communication accessory module that integrates the circuit-breaker in an internal Ethernet network with an ABB proprietary protocol.

The network to which the module is to be connected must be dedicated and comprising only Ekip Link and Ethernet switches that declare support for level L2 multicast on the datasheet. In this case the Ethernet switches do not require any configuration. If, instead, the network also includes routers, multicast must be enabled and configured on all VLAN interfaces with level L3.



IMPORTANT: the module can be connected only to internal Ethernet networks with one or more switchboards, to which releases or ABB Emax 2 accessories are connected. It is the installer's responsibility to ensure that all the necessary safety measures are adopted for all the connected devices (for example, the necessary access authorisations, and so on). The module cannot be connected to other Ethernet networks (for example, with the purpose of monitoring the system, or the office), or to the Internet.

The module is necessary if you wish to implement these functions:

- Power Controller.
- Zone Selectivity.
- Programmable Logic.

For these functions, the releases of the system that are involved must be equipped with an Ekip Link, and for each of these the IP addresses of the Ekip Link modules of the other releases must be inserted.

Each Ekip Link can be interfaced with a maximum of 15 releases (actors), including at most 12 for the Zone Selectivity function.

Only with Ekip Dip releases, the module can also be used with a function similar to that one of the Ekip Com Modbus TCP module, but with possibility to communicate only with an ABB master (for example: Ekip Connect or Ekip Control Panel).



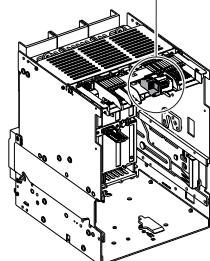
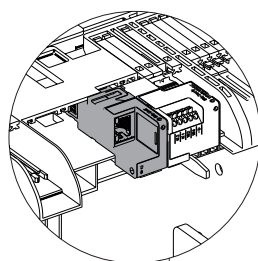
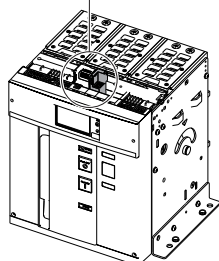
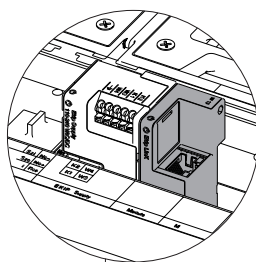
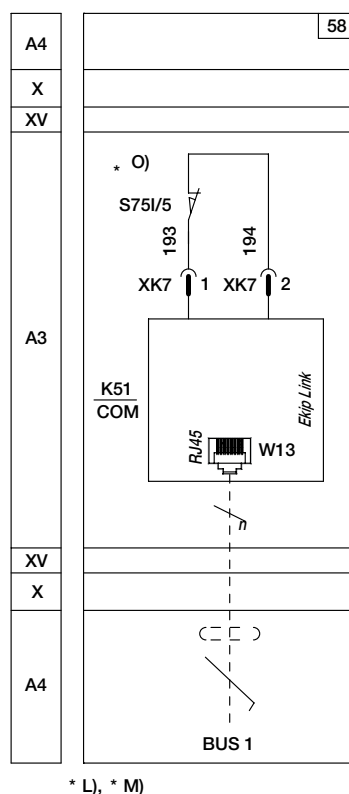
IMPORTANT: only one Ekip Link can be installed on each circuit-breaker.

The modules are always supplied with Ekip AUP and Ekip RTC contacts (see the chapter "4 - Other accessories" on page 68).

Compatibility and power supply The module can be installed in the presence of Ekip Dip, Touch, Hi-Touch, G Touch, and G Hi-Touch releases, and requires the presence of an Ekip Supply module in the first slot of the circuit-breaker terminal box.

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular in the kit sheet **1SDH001000R0514**.

The following is a view of the terminal box of E2.2-E4.2-E6.2 circuit-breakers, and the wiring diagram:

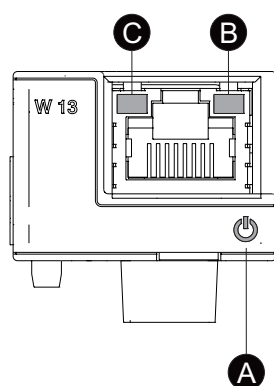
[illegible]

For the communication bus, a cable of type Cat.6 S/FTP must be used (Cat.6 with S/FTP double shielding). If the circuit-breaker is the withdrawable type, it is recommended to use cables fitted with a RJ45 socket with output at 90°.

Further information is available on page 59, or on the site <http://www.abb.com/abblibrary/DownloadCenter/>, where the wiring diagram is available **1SDM000091R0001**.

Signalings

The following table illustrates the possible signals, and their meaning:



Pos.	Description
A	Power LED, green. The possible states are: • Off: power supply absent. • On fixed: power supply and communication with the release present (with a release with the Alive LED option disabled). • On, with one flash per second (synchronized with that of the green LED on the release): power supply and communication with release present (with a release with the Alive LED option enabled). • On, with two quick flashes per second (not synchronized with those of the green LED on the release): power supply present, and communication with release absent (for example: because Local Bus disabled).
B	Link LED, green. The possible states are: • Off: connection error (signal absent). • On fixed: correct connection.
C	Activity LED, yellow. The possible states are: • Off: no activity on the line. • On, fixed or flashing: activity present on the line (in reception and/or transmission). When it is on, it may be fixed or flashing (communication is active in both cases).

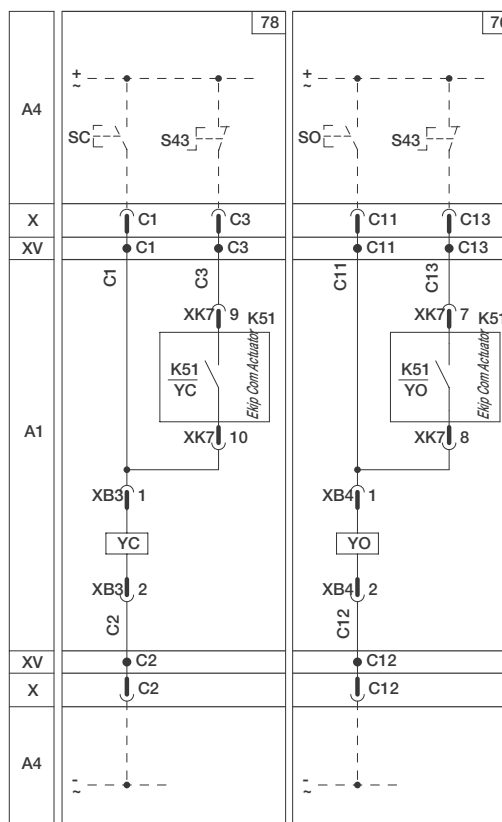
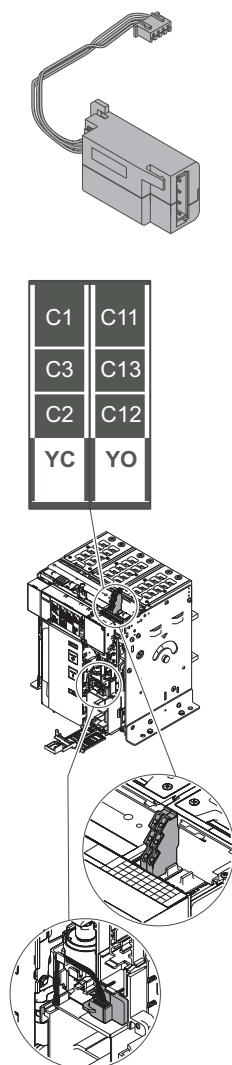
3 - Ekip Com Actuator module

Description Ekip Com Actuator is an accessory module that allows the SACE Emax 2 circuit-breakers to be opened and closed remotely.

Connections Ekip Com Actuator is installed on the front of the circuit-breaker in the accessories area.

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular in the kit sheet [1SDH001000R0501](#).

Wiring diagrams are provided below for the module:



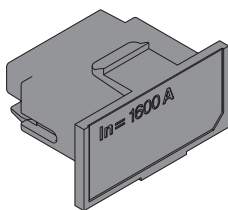
Diagrams 78 - 76

Further information is available on page 59, or on the site <http://www.abb.com/abblibrary/DownloadCenter/>, where the wiring diagram is available [1SDM000091R0001](#).

Compatibility Ekip Com Actuator module is supplied on request and is compatible with all Ekip releases if there is an Ekip Com or Ekip Link module present.

4 - Other accessories

Rating Plug



The Rating Plug defines the rated current I_n , necessary in order to set the current protections on the release, where these refer to I_n .

It is supplied with all Ekip releases, mounted on a front connector dedicated and accessible to the user, and can be replaced with release off and circuit breaker open.



IMPORTANT: the replacement of the Rating Plug with release on or circuit breaker closed may cause malfunction of the release, or unwanted opening of the switch.



NOTE: a trip unit can be equipped with any Rating Plug with a rated current of up to I_u , i.e. the rated uninterrupted current of the circuit-breaker (indicate on the rating plate of the circuit-breaker).

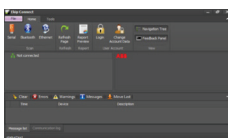
The release continuously checks for the presence of the Rating Plug, signalling its absence or any errors in assembly or installation.

Once mounted, when the release is energized, its installation is requested.

On the Touch, Hi-Touch, G Touch and G Hi-Touch releases to activate the residual current protection, it is necessary to mount a Rating Plug Rc. They are also available Rating Plug L = OFF, which allow you to cancel the protection L.

Further information on mounting the Rating Plug is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular in the kit sheet [1SDH001000R0510](#).

Ekip Connect software



Ekip Connect is the free software for communication and testing of ABB low voltage circuit-breakers equipped with compatible releases, in particular Ekip releases.

It must be installed on PCs equipped with the Microsoft Windows® operating system by downloading it from the site <http://www.abb.com/abblibrary/DownloadCenter/>.

With its communication function, it allows you to:

- Monitor the state of the circuit-breakers connected and record information.
- Execute the operation, reset, signalling commands, etc...
- Configure the protection releases with customized parameters.
- Configure the electronic accessories, connected to the release via Local Bus.
- Download information from releases equipped with Datalogger.
- Create communication reports.
- Reset configurations.

With test function, and Ekip T&P module (see page 69), it allows you to:

- Simulate fault conditions by performing manual or automatic tests.
- Perform trip tests.
- Create test reports.

Further information on the Ekip Connect application is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular in the manual [1SDH000891R0002](#).

Ekip Bluetooth module

The Ekip Bluetooth allows connection via Bluetooth between the Ekip releases, and a support (PC, tablet, or smart phone) with the Ekip Connect software installed (see the previous paragraph).



IMPORTANT: the Ekip Bluetooth module can also be connected to the releases when in service.



NOTE: Ekip Bluetooth only powers the release. Therefore, in order to set and to display information on any electronic accessories connected to the terminal box, these must be powered with an Ekip Supply module (see page 62).

It draws its power from a rechargeable lithium-polymer battery supplied with the unit. It is connected directly to the front test connector of the release, and allows a release without auxiliary voltage to be powered.

It is switched on by pressing the power button on the side, and is equipped with two LEDs:

- The first lit in green with the device on and the battery charge, red with the device turned on and low battery.
- The second flashing blue with active Bluetooth communication.



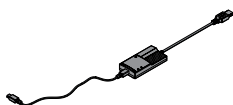
NOTE: the red flashing LED indicates that battery is completely drained, an error condition, or malfunction of the module.

The battery charging is performed by connecting the module to the USB ports of a PC with the supplied cable. Connection to a PC automatically switches the module on, and charging in progress is indicated by the flashing green LED, with increasing frequency as the level of charging rises. Completion of charging is indicated by the green LED on (fixed).



NOTE: during recharging, the module must be kept energized.

Further information on Ekip Bluetooth is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular in the kit sheet [1SDH001000R0518](#), and in the Ekip Connect software manual [1SDH000891R0002](#).

Ekip T&P module

The Ekip T&P module is part of the Ekip T&P programming and test kit for Ekip releases, and allows you to:

- In the absence of auxiliary voltage, to supply the release.
- With Ekip Connect software (see page 68), access the information and the pages for programming the release, and to activate the test pages.



IMPORTANT: Ekip T&P can also be connected to the releases when in service. In the case of connection to releases in service, it is not possible to perform a trip test.

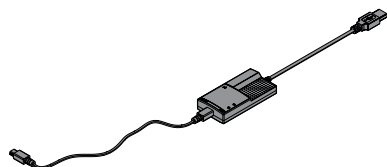


NOTE: Ekip T&P only powers the release. Therefore, in order to set and to display information on any electronic accessories connected to the terminal box, these must be powered with an Ekip Supply module (see page 62).

It draws its power from the PC, and connects one side directly to the test connector at the front of the release, and on the other to the USB ports of the PC with the cable supplied.

It turns on after connecting to the PC, and is equipped with two LEDs, a green one indicating that the module is on, and a yellow one indicating active communication.

Module Ekip Programming



Ekip Programming allows you to:

- In the absence of auxiliary voltage, to supply the release.
- With Ekip Connect software (see page 68), access the information and pages for programming the release.



IMPORTANT: Ekip Programming can be connected the releases also when they are in service.



NOTE: *Ekip Programming only powers the release. Therefore, to set and display the information for any electronic accessories connected to the terminal box, those accessories must be powered with an Ekip Supply module (see page 62).*

It draws its power from the PC, and connects one side directly to the test connector at the front of the release, and on the other to the USB ports of the PC with the cable supplied.

It turns on after connecting to the PC, and is equipped with two LEDs, a green one indicating that the module is on, and a yellow one indicating active communication.

Ekip TT module



Ekip TT is supplied as standard with Ekip Dip releases not mounted on a circuit-breaker, and with Touch, Hi-Touch, G Touch, and G Hi-Touch releases, and allows the following:

- Check that the opening mechanism of the circuit-breaker functions properly by commanding an opening by means of the test procedure.
- In the absence of auxiliary voltage and where the circuit breaker is open due to a protection tripping, power the release so that you can see which protection tripped either on the display or through the lighting of the corresponding LEDs.
- In the absence of auxiliary voltage, power the Ekip Touch, Hi-Touch, G Touch, and G Hi-Touch releases in order to set the protections.



IMPORTANT: Ekip TT can also be connected to the releases when in service. In the case of connection to releases in service, it is not possible to perform a trip test.



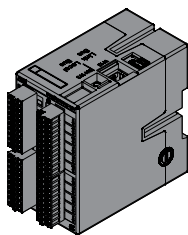
NOTE: *the Ekip TT only powers the release. Therefore, in order to set and to display information on any electronic accessories connected to the terminal box, these must be powered with an Ekip Supply module (see page 62).*

Draws its power from three AA alkaline batteries 1.5V, connects to the test connector at the front of the trip unit with the supplied cable, and is turned on by setting the side switch to ON.

It includes a led that is green when the device is energized and the batteries are charged, and red when the batteries are drained and need to be replaced.

Further information on Ekip TT is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular in the kit sheet [1SDH001000R0519](#), and in the Ekip Connect software manual [1SDH000891R0002](#).

Ekip Signalling 10K modules



The Ekip Signalling 10K is an external signalling accessory module that can be installed on a DIN rail.

It can be installed in the presence of Ekip Dip, Touch, Hi-Touch, G Touch, and G Hi-Touch releases. It must be powered independently from the releases to which it is connected, and can be powered in AC at nominal 110...240 V AC, or in DC at nominal 24...48 V DC.



IMPORTANT: AC and DC power supplies cannot be present at the same time.

On the front it has:

- 10 contacts for output signals.
- 10 or 11 digital inputs.
- A power LED, and 20 or 21 signalling LEDs (one for each output/input).

It can communicate with the outside in two alternative modes:

- Via Local Bus, with a single release equipped with an Ekip Supply module (see page 62).
- Via Link Bus, with a maximum of four releases, each equipped with an Ekip Link module (see page 64).



IMPORTANT: the module can be connected only to internal Ethernet networks with one or more switchboards, to which releases or ABB Emax 2 accessories are connected. It is the installer's responsibility to ensure that all the necessary safety measures are adopted for all the connected devices (for example, the necessary access authorisations, and so on). The module cannot be connected to other Ethernet networks (for example, with the purpose of monitoring the system, or the office), or to the Internet.

With communication via Local Bus, unless the release is disconnected, the closing/opening of the contacts of the module is commanded by the release, and the information on the state of the inputs is transmitted by the module to the release. In particular, the trip unit can be programmed so that:

- The closing/opening of a contact corresponds to a desired event or combination of events detected by the trip unit.
- The activation of an input corresponds to an action by the trip unit.

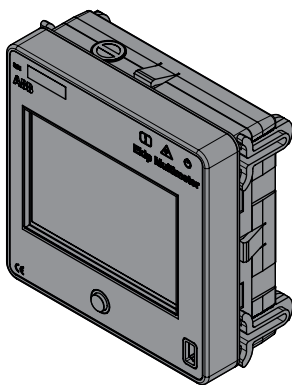
With multiple 10-K modules connected via Local Bus to the same trip unit, these can be at most three, and must be configured differently as a 10K-1 a 10K-2 and a 10K-3.

With communication via Link Bus:

- The module is connected to a network on which the releases equipped with an Ekip Link module share data packets containing information on their state.
- The IP Addresses of the releases to which you wish to connect it must be inserted on the module, and each contact can be programmed so as to be closed/opened in correspondence to an event or combination of events regarding a connected release.
- If the module receives a packet sent by a trip unit connected, the module reads the contents of the packet, and initiates any programmed action.

Further information on Ekip Signalling 10K is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular in the manual [1SDH001318R0002](#).

Ekip Multimeter module



The Ekip Multimeter is a remote viewing unit on the front of the switchgear and is equipped with a touchscreen display.

It can be installed in the presence of Ekip Dip, Touch, Hi-Touch, G Touch and G Hi-Touch releases, with which it communicates via Local Bus. It must be powered independently from the release to which it is connected, and can be powered in AC at nominal 110... 240 V AC, or DC at nominal 24...48 V DC.



IMPORTANT: AC and DC power supplies cannot be present at the same time.

The Ekip Multimeter is a remote viewing unit on the front of the switchgear and is equipped with a touchscreen display.

It can be installed in the presence of Ekip Dip, Touch, Hi-Touch, G Touch and G Hi-Touch releases, with which it communicates via Local Bus. It must be powered independently from the release to which it is connected, and can be powered in AC at nominal 110... 240 V AC, or DC at nominal 24...48 V DC.

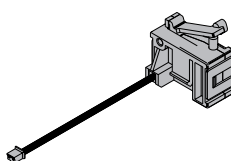
One release can communicate with a maximum of four Ekip Multimeters. On the other hand, the module can be connected to only one release.

In addition, the module makes an auxiliary voltage of 24 V DC available, which can be used to power the release. If the release is powered through Ekip Multimeter, the power supply must be applied directly on the terminal box of the circuit-breaker: in fact the Ekip Multimeter is sized in order to supply only the release, and therefore it is not able to supply sufficient power to supply an Ekip Supply module and any other electronic accessories connected to the terminal box.

In the case of connection to an Ekip Touch, Hi-Touch, G-Touch, and G Hi-Touch release, as well as displaying the measurements, the module also allows you to set parameters and the protection thresholds.

Further information on Ekip Multimeter is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular in the kit sheet [1SDH001000R0520](#).

Contacts Ekip AUP



The communication modules are always supplied with dedicated Ekip AUP auxiliary position contacts, which in the case of a withdrawable circuit-breaker supply the inserted/extracted signal of the moving part from the fixed part.

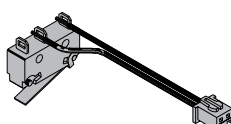
The assembly assures that the position signalling is also maintained with the moving part withdrawn.



IMPORTANT: in the presence of multiple communication modules, only one of these can be connected to the Ekip AUP contacts.

Further information on assembling Ekip AUP modules and contacts is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular in the kit sheet [1SDH001000R0603](#).

Ekip RTC contact



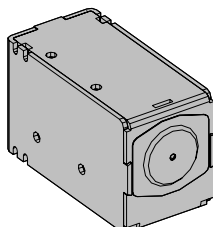
The communication modules are always supplied with an Ekip RTC auxiliary contact, which supplies the release with the signal indicating that the circuit-breaker ready to receive a close command.

Further information on the assembly of the Ekip RTC contact is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular in the kit sheet [1SDH001000R0604](#).

Electrical accessories

1 - Electrical control accessories

YO-YC-YO2-YC2: Opening and closing coil



The opening coils, YO and YO2, and the closing coils, YC and YC2, allow the circuit-breaker to be controlled remotely.

The opening of the circuit-breaker is always possible with the circuit-breaker closed, while closing is possible with the circuit-breaker open and the closing springs loaded.

The opening and closing coils can operate in two different modes:

- instantaneous service (the minimum duration of the command impulse must be 100ms).
- service with permanent power supply.



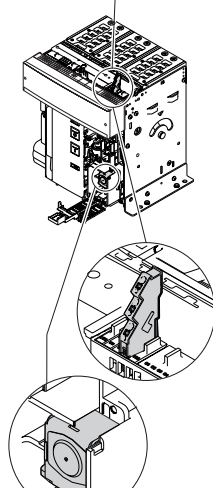
NOTE: the second opening coil YO2 is alternative to the under-voltage coil YU.



IMPORTANT:

- In the case of permanent power supply, if the closing coil trips it is necessary, after opening, to momentarily de-energize the coil in order to be able to re-use it for the subsequent closing.
- If instead the opening coil trips, it is necessary, after having de-energized it, to wait at least 100 ms before operating the closing coil.

D1	C1	C11	C21
	C3	C13	
D2	C2	C12	C22
YU YO2	YC	YO	YC2



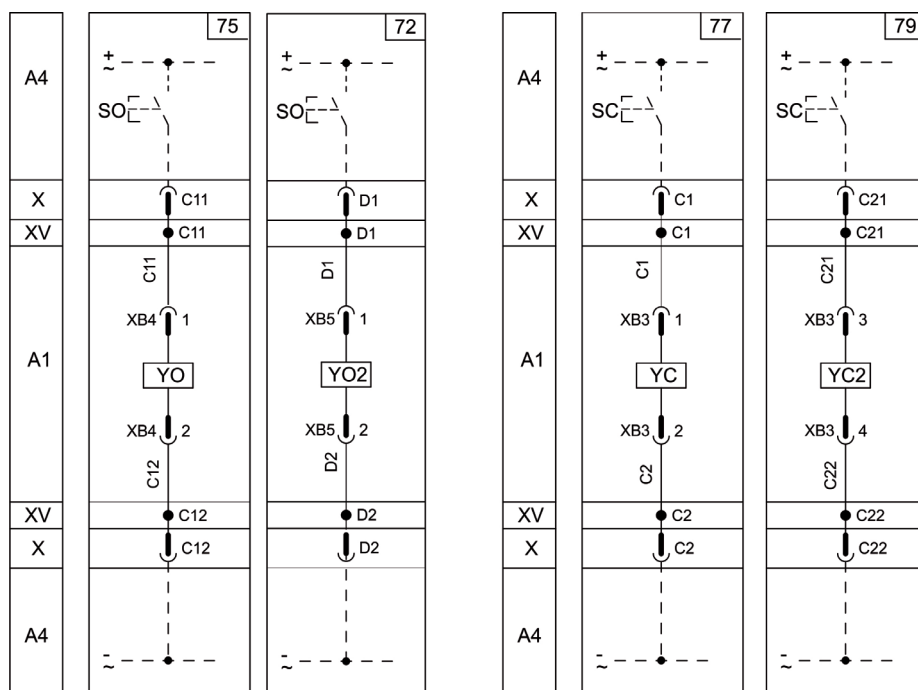
Available voltages and characteristics

The tables listing the available voltages and the electrical characteristics are provided below:

Available voltages (Un)	General characteristics	YO-YO2	YC-YC2
24 V AC/DC	Operating limits	70...110 %Un	85...110 %Un
30 V AC/DC	Inrush power (Ps)	AC = 300 VA DC = 300 W	
48 V AC/DC	Continuous power (Pc)	AC = 3,5 VA DC = 3,5 W	
60 V AC/DC	Opening time	35 ms	-
110...120 V AC/DC	Closing time	-	50 ms
220...240 V AC/DC			
240...250 V AC/DC			
277 V AC/DC			
380...400 V AC			
415...440 V AC			
480...500 V AC			
500...550 V AC			

YO-YC-YO2-YC2: Connections

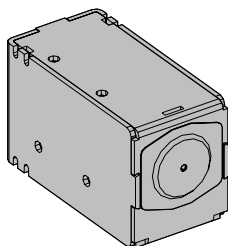
Further information is available on page 59, or on the site <http://www.abb.com/abblibrary/DownloadCenter/>, where the wiring diagram is available [1SDM000091R0001](#).



Diagrams 75 - 72 - 77 - 79

Information on assembly is available at the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the sheets kit:

- [1SDH001000R0502](#) for YO and YO2 coils
- [1SDH001000R0503](#) for YC and YC2 coils

YU: under-voltage coil

The under-voltage coil YU controls the value of the voltage in the circuit to which it is connected.

The coil opens the circuit-breaker when:

- the power supply voltage of the coil drops to a value in the range 35... 70 %Un

The under-voltage coil YU can in addition be used for the following purposes:

- Release the circuit-breaker remotely using push-buttons of the normally closed type.
- Activate the lock when the circuit-breaker is closed (the closing of the circuit-breaker is allowed only with the under-voltage coil energized).

**IMPORTANT:**

- The under-voltage coil YU is incompatible with the presence of the Fail Safe device (UL circuit-breakers).
- The under-voltage coil YU is a emergency release. For service operations use the opening coil.

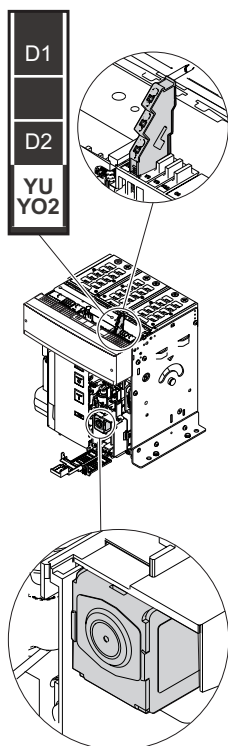


NOTE: the power supply of the coil must drawn on the supply side of the circuit-breaker or from an independent source.

If the under-voltage coil trips, it is necessary, after having reset it, to wait at least 100 ms before operating the closing coil.

The tables listing the available voltages and the electrical characteristics are provided below:

Available voltages (Un)	General characteristics	YU
24 V AC/DC	Operating limits	35...70 %Un
30 V AC/DC	Inrush power (Ps)	300 VA/W
48 V AC/DC	Continuous power (Pc)	3,5 VA/W
60 V AC/DC	Opening time	50 ms
110...120 V AC/DC		
220...240 V AC/DC		
240...250 V AC/DC		
277 V AC/DC		
380...400 V AC		
415...440 V AC		
480...500 V AC		

**YU: Connections**

Further information is available on page 59, or on the site <http://www.abb.com/abblibrary/DownloadCenter/>, where the wiring diagram is available [1SDM000091R0001](#).

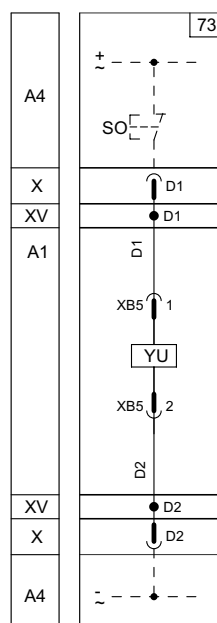
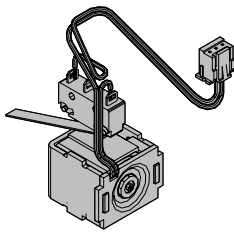


Diagram 73

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0504](#).

YR: remote resetting coil



The remote resetting coil deactivates the lock at the closing of the circuit-breaker, generated by the opening of the circuit-breaker caused by tripping of the Ekip protection release.

The tables listing the available voltages and the electrical characteristics are provided below:

Available voltages (Un)		General characteristics	
24 V AC/DC		Operating limits	90...110 %Un
110 V AC/DC			
220 V AC/DC			

YR: Connections

Further information is available on page 59, or on the site <http://www.abb.com/abblibrary/DownloadCenter/>, where the wiring diagram is available [1SDM000091R0001](#).

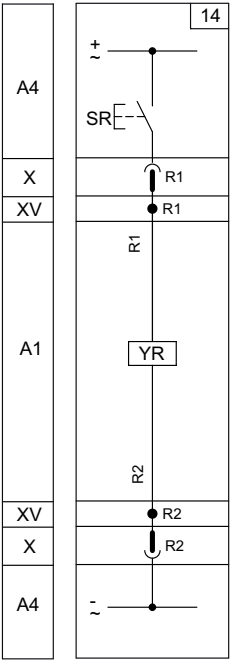
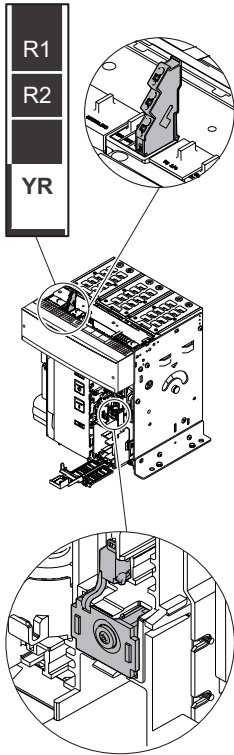
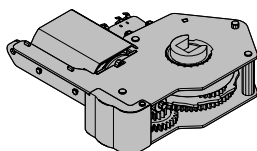


Diagram 14

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0606](#).

M: motor The motor automatically recharges the closing springs of the circuit-breaker when these are discharged.



The motor is equipped with a limit contact S33 M/1 that interrupts the power supply of the motor after loading of the springs is completed.

The motor is equipped with a limit contact S33 M/2 that signals the state of the loaded springs. For information on the S33 M/2 limit contact refer to the dedicated paragraph "S33 M/2: springs loaded signalling contact" in this chapter.



NOTE: The closing springs can in any case be loaded manually through the appropriate front control lever.

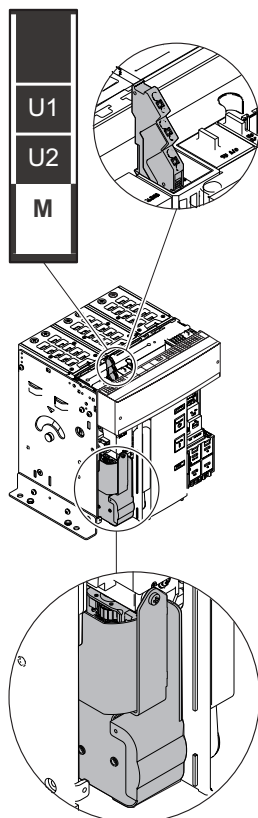
The tables listing the available voltages and the electrical characteristics are provided below:

Available voltages (Un)

24V...30V AC/DC
48V...60V AC/DC
100V...130V AC/DC
220V...250V AC/DC
277V AC/DC
380V...400V AC
440V...480V AC

General characteristics

Operating limits	85...110 %Un
Inrush power (Ps)	500 VA/W
Continuous power (Pc)	100 VA/W
Charging time	Min 5 s, max 10 s



M: Connections

Further information is available on page 59, or on the site <http://www.abb.com/abblibrary/DownloadCenter/>, where the wiring diagram is available [1SDM000091R0001](#).

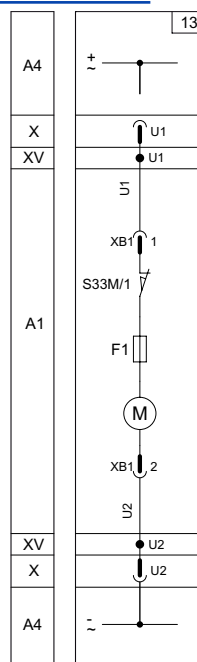
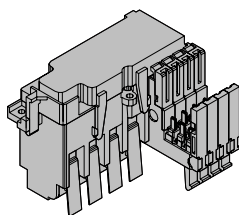


Diagram 13

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0609](#).

2 - Electrical signalling accessories

Aux 4Q: auxiliary open-closed contacts



The AUX 4Q contacts signal the open/closed state of the circuit-breaker.

These are "switched" contacts and are available in three types:

- four standard contacts
- four digital signals (low power)
- two standard contacts (Q1-Q2) + two digital signals (Q3-Q4)



NOTE: The standard AUX 4Q contacts are always included in the circuit-breakers

The following table provides information on the electrical characteristics:

11	21	31	41
12	22	32	42
13	23	33	43
Q1	Q2	Q3	Q4

Characteristics			Standard	Digital signals
Breaking capacity	DC	24V	-	0.1 A
		125V	0.5A @ 0ms / 0.3A @ 10ms	-
		250V	0.3A @ 0ms / 0.15A @ 10ms	-
	AC	250V	3A cos φ 0,3	-
			5A cos φ 0,7	-
			5A cos φ 1	-
		400V	3A cos φ 1	-
			2A cos φ 0,7	-
			1A cos φ 0,3	-
Minimum load			50mA @ 24V	1mA @ 5V

AUX 4Q: Connections

Further information is available on page 59, or on the site <http://www.abb.com/abblibrary/DownloadCenter/>, where the wiring diagram is available [1SDM000091R0001](#).

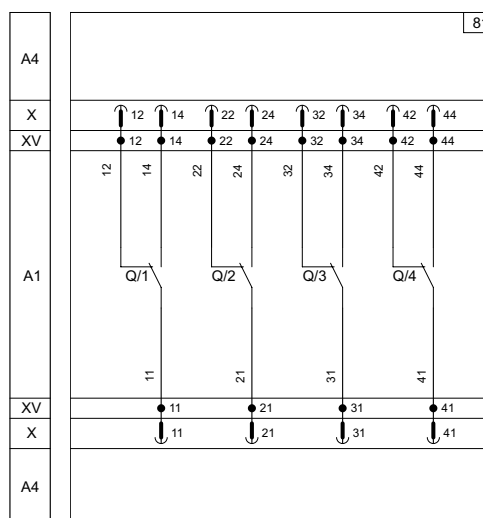
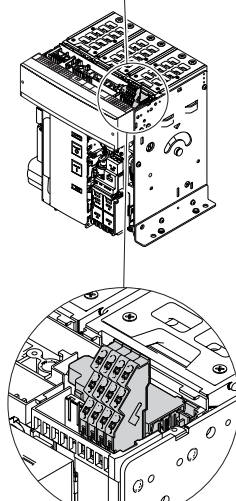
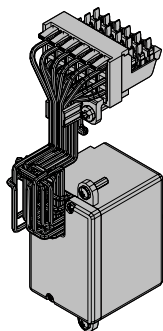


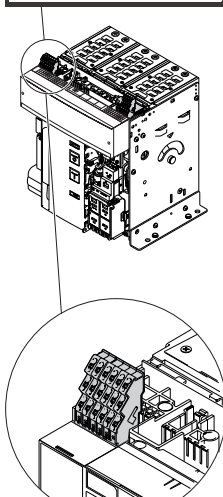
Diagram 81

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0613](#).

Aux 6Q: Additional open/closed auxiliary contacts



51	61	71	81	91	01
52	62	72	82	92	02
54	64	74	84	94	04
55	65	75	85	95	05
56	66	76	86	96	06
57	67	77	87	97	07
58	68	78	88	98	08
59	69	79	89	99	09
50	60	70	80	90	00
53	63	73	83	93	03
54	64	74	84	94	04
55	65	75	85	95	05
56	66	76	86	96	06
57	67	77	87	97	07
58	68	78	88	98	08
59	69	79	89	99	09
50	60	70	80	90	00



The additional AUX 6Q contacts signal the open/closed state of the circuit-breaker.

These are "switched" contacts and are available in three types:

- six standard contacts
- six digital signals (low power)
- three standard contacts (Q1-Q2-Q3) + three digital signals (Q4-Q5-Q6)



NOTE: it is possible to order the AUX 6Q contacts only if the circuit-breaker is not equipped with a protection release with the Ekip Signalling 4K module.

The following table provides information on the electrical characteristics:

Characteristics			Standard	Digital signals
Breaking capacity	DC	24V	-	0.1 A
		125V	0.5A @ 0ms / 0.3A @ 10ms	-
		250V	0.3A @ 0ms / 0.15A @ 10ms	-
	AC	250V	3A cos φ 0,3	-
			5A cos φ 0,7	-
			5A cos φ 1	-
		400V	3A cos φ 1	-
			2A cos φ 0,7	-
			1A cos φ 0,3	-
Minimum load			50mA @ 24V	1mA @ 5V

AUX 6Q: Connections

Further information is available on page 59, or on the site <http://www.abb.com/abblibrary/DownloadCenter/>, where the wiring diagram is available [1SDM000091R0001](#).

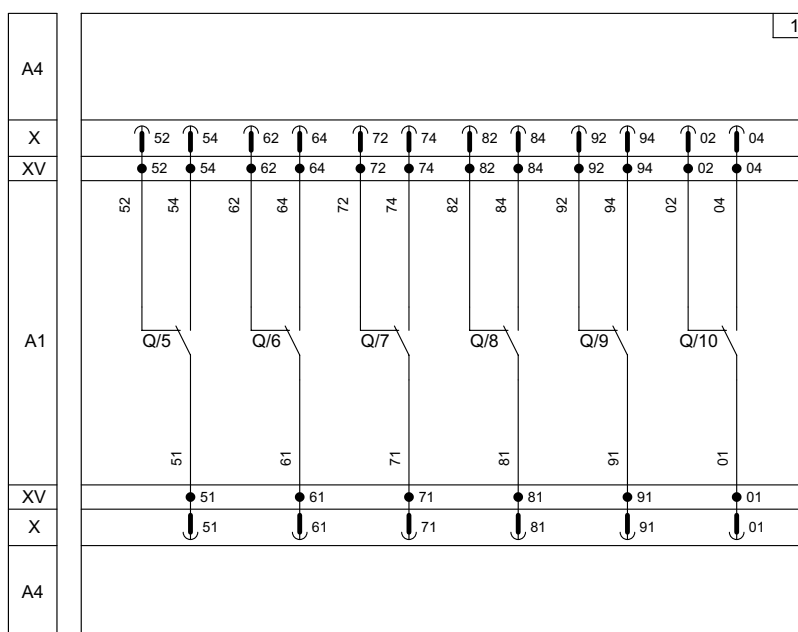
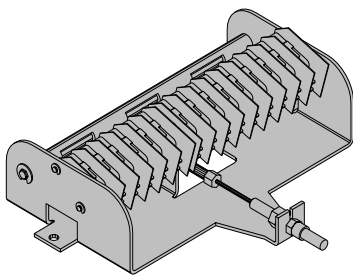


Diagram 1

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0601](#).

Aux 15Q: External additional open/closed auxiliary contacts



The external additional AUX 15Q contacts signal the open/closed state of the circuit-breaker.

These are "switched" contacts and are available in two types:

- 15 standard contacts
- 15 digital signals (low power)

The following table provides information on the electrical characteristics:

Characteristics			Standard	Digital signals
Breaking capacity	DC	24V	-	0.1 A
		125V	0.5A @ 0ms / 0.3A @ 10ms	-
		250V	0.3A @ 0ms / 0.15A @ 10ms	-
	AC	250V	3A cos φ 0,3	-
			5A cos φ 0,7	-
			5A cos φ 1	-
		400V	3A cos φ 1	-
			2A cos φ 0,7	-
			1A cos φ 0,3	-
Minimum load			50mA @ 24V	1mA @ 5V

AUX 15Q external: Connections

Further information is available on page 59, or on the site <http://www.abb.com/abblibrary/DownloadCenter/>, where the wiring diagram is available [1SDM000091R0001](#).

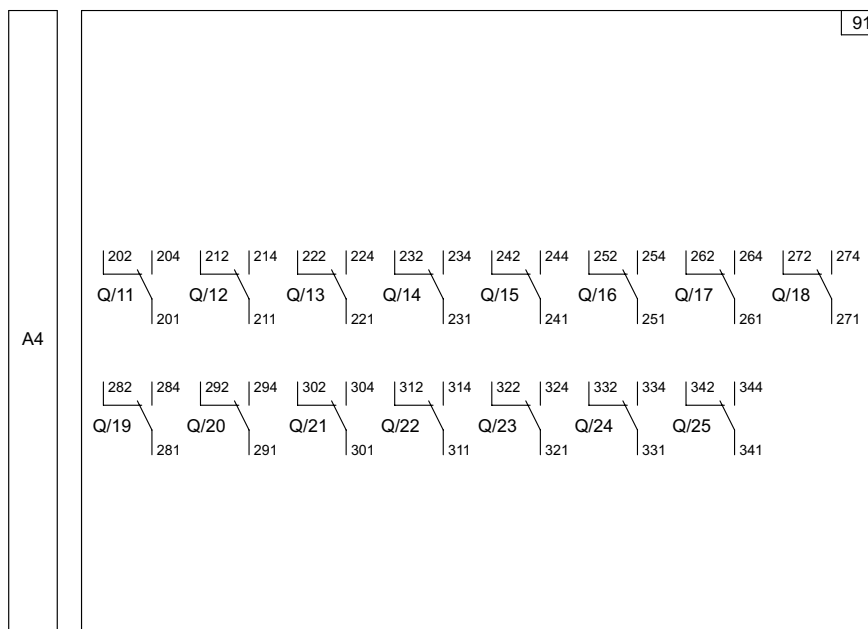
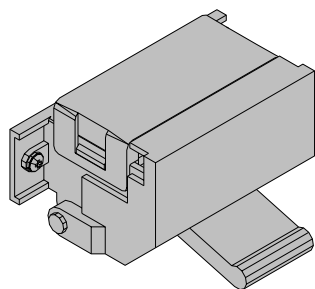


Diagram 91

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0607](#).

AUP: auxiliary position contacts The AUP contacts are intended for circuit-breakers in withdrawable version.



They electrically signal the position of a moving part (inserted/test/withdrawn) in relation to the fixed part in which they are inserted.

These are "switching" contacts and are available, up to a maximum of 10 contacts per circuit-breaker, in the following configurations:

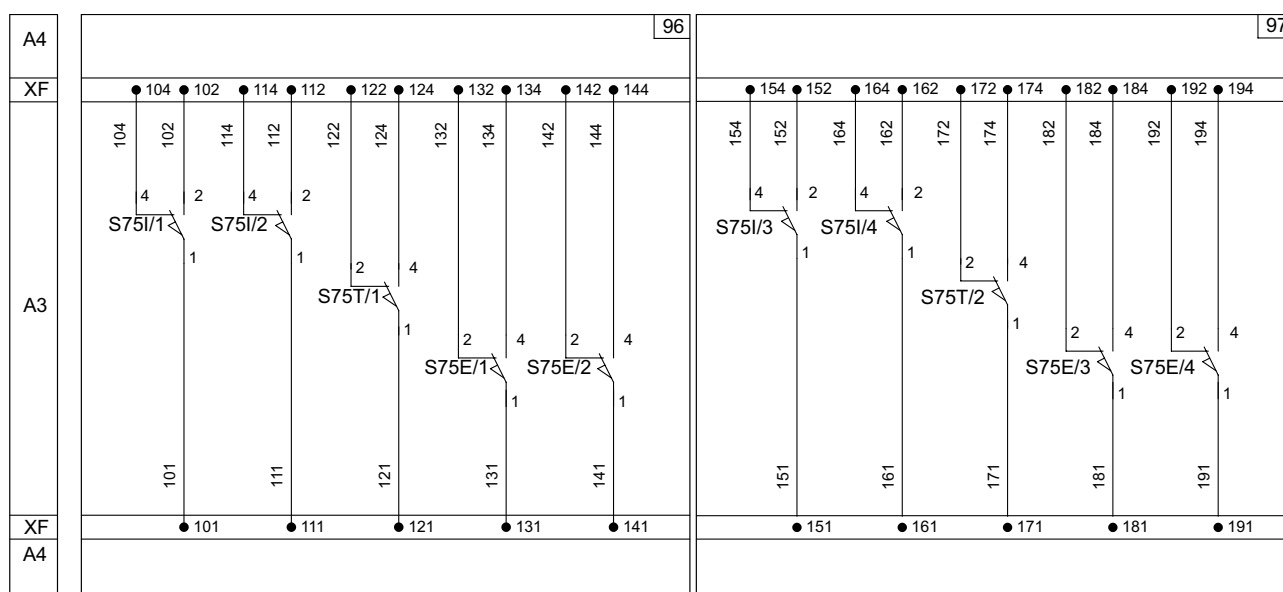
- five standard contacts
- five digital signals
- five additional standard contacts
- five additional digital signals

The following table provides information on the electrical characteristics:

Characteristics			Standard	Digital signals
Breaking capacity	DC	24V	-	0.1 A
		125V	0.5A @ 0ms / 0.3A @ 10ms	-
		250V	0.3A @ 0ms / 0.15A @ 10ms	-
	AC	250V	3A cos φ 0,3	-
			5A cos φ 0,7	-
			5A cos φ 1	-
		400V	3A cos φ 1	-
			2A cos φ 0,7	-
			1A cos φ 0,3	-
Minimum load			50mA @ 24V	1mA @ 5V

AUP: Connections

Further information is available on page 59, or on the site <http://www.abb.com/abblibrary/DownloadCenter/>, where the wiring diagram is available [1SDM000091R0001](#).



Diagrams 96 - 97

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0603](#) for IEC and [1SDH001400R0603](#) for UL.

RTC: ready to close signalling contact

The RTC contact indicates that the circuit-breaker is ready to receive a close command.

The conditions necessary to allow the closing of the circuit-breaker are:

- circuit-breaker open
- springs loaded
- absence of an opening command or a lock in opening

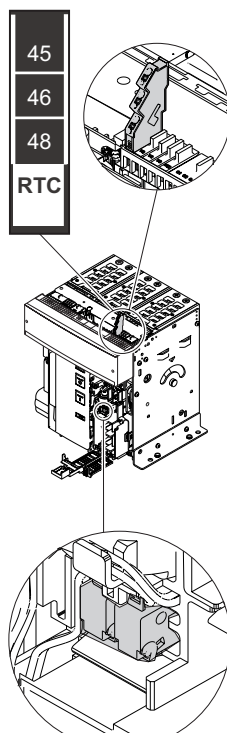


NOTE: if the circuit-breaker is opened due to the tripping of the Ekip protection release, in order to allow closing, the Reset signal of the circuit-breaker must have been reset (press the TU Reset key on the front panel).

The RTC contact is of the “switched” type and is available in a standard version or in the versions for digital signals.

The following table provides information on the electrical characteristics:

Characteristics			Standard	Digital signals
Breaking capacity	DC	24V	-	0.1 A
		125V	0.3A @ 0ms	-
			0.15A @ 10ms	-
		250V	0.3A @ 0ms	-
	0.15A @ 10ms		-	
	AC	125V - 250V	1A cos φ 0,3	-
			2A cos φ 0,7	-
3A cos φ 1			-	
Minimum load			50mA @ 24V	1mA @ 5V

**RTC: Connections**

Further information is available on page 59, or on the site <http://www.abb.com/abblibrary/DownloadCenter/>, where the wiring diagram is available [1SDM000091R0001](#).

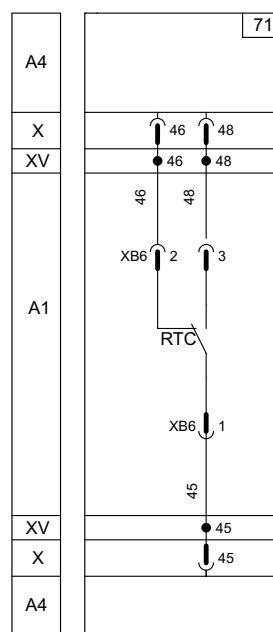
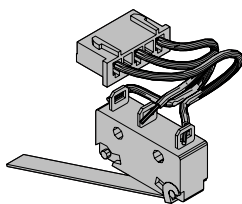


Diagram 71

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0604](#).

S51: release tripping signalling contact

The S51 contact signals the opening of the circuit-breaker due to tripping of the Ekip protection release.

It is available in two different types:

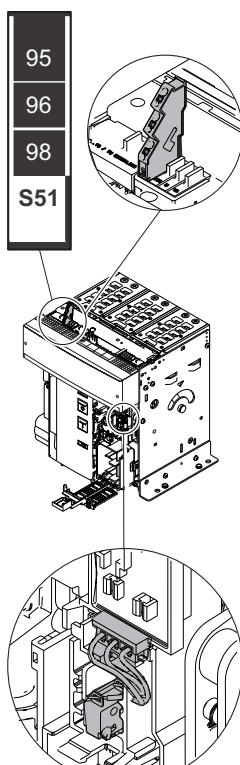
- standard contact
- contact for digital signals



NOTE: The standard S51 contact is always included in automatic circuit-breakers, and is associated with the TU Reset mechanical signalling.

The following table provides information on the electrical characteristics:

Characteristics			Standard	Digital signals
Breaking capacity	DC	24V	-	0.1 A
		125V	0.3A @ 0ms	-
			0.15A @ 10ms	-
		250V	0.3A @ 0ms	-
	0.15A @ 10ms		-	
	AC	125V - 250V	1,5A cos φ 0,3	-
			3A cos φ 0,7	-
5A cos φ 1			-	
Minimum load			100mA @ 24V	1mA @ 5V

**S51: Connections**

Further information is available on page 59, or on the site <http://www.abb.com/abblibrary/DownloadCenter/>, where the wiring diagram is available [1SDM000091R0001](#).

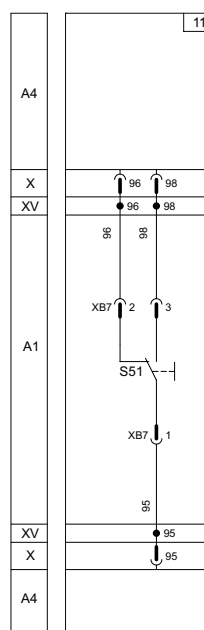


Diagram 11

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0605](#).

S33 M/2: springs loaded signalling contact

The S33 M/2 contact signals the current state of the closing springs of the circuit-breaker control (loaded or discharged).

It is available in two types:

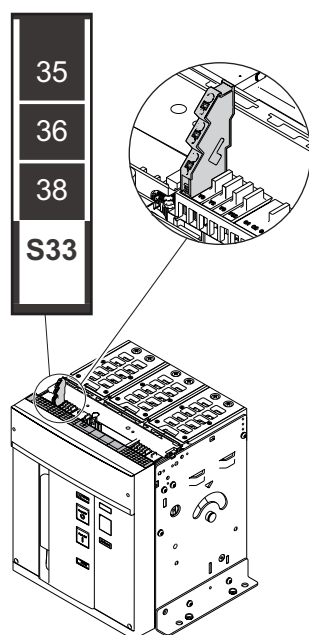
- standard contact
- contact for digital signals



NOTE: the S33_M/2 contact is always included in the gearmotor for automatic loading of the springs in the standard version. The version for digital signals must be requested with the order for the motor.

The following table provides information on the electrical characteristics:

Characteristics			Standard	Digital signals
Breaking capacity	DC	24V	-	0.1 A
		125V	0.5A @ 0ms / 0.3A @ 10ms	-
		250V	0.3A @ 0ms / 0.15A @ 10ms	-
	AC	250V	3A cos φ 0,3	-
			5A cos φ 0,7	-
			5A cos φ 1	-
		400V	3A cos φ 1	-
			2A cos φ 0,7	-
1A cos φ 0,3			-	
Minimum load			50mA @ 24V	1mA @ 5V



S33/M2: Connections

Further information is available on page 59, or on the site <http://www.abb.com/abblibrary/DownloadCenter/>, where the wiring diagram is available [1SDM000091R0001](#).

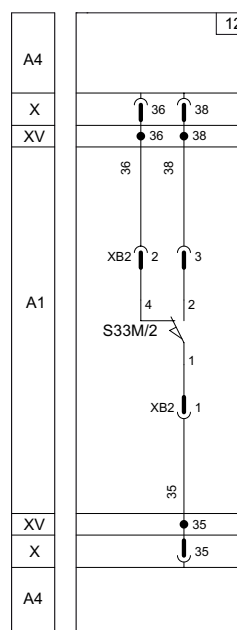


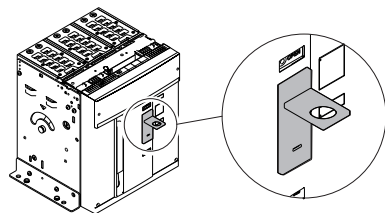
Diagram 12

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0609](#).

Mechanical accessories

1 - Mechanical Protection accessories

PBC: opening and closing push-button protection



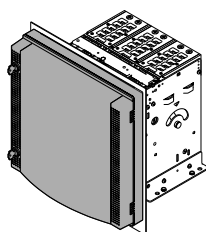
The push-button protection inhibits the use of the opening and closing push-buttons.

It is available in two types:

- Protection that simultaneously inhibits the use of both push-buttons. The use of the push-buttons is only allowed with the aid of an appropriate key.
- Padlockable protection that inhibits the use of one or both push-buttons with the aid of a padlock.

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0715](#).

IP54 protection



The IP54 protection completely protects the front of the circuit-breaker, to achieve Protection class IP54.

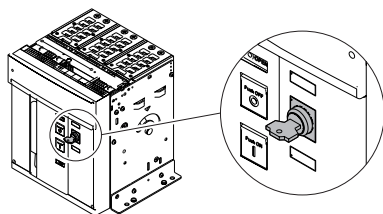
It is always equipped with two locks for closing, available in two types:

- lock with different key code numbers (for an individual circuit-breaker)
- lock with the same key code number (for more than one circuit-breaker)

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0714](#).

2 - Mechanical safety accessories

KLC: open position key lock



The KLC lock locks the circuit-breaker in the open position.

It can also be used during maintenance activities on the circuit-breaker after removal of the guard accessory.

The KLC lock is available with two types of locking:

- lock with different key code numbers (for an individual circuit-breaker).
- lock with the same key code number (for more than one circuit-breaker). The maximum number of key code numbers available is five.

If set up appropriately, the KLC-A lock can work with four other types of locks:

- Ronis
- Profalux
- Kirk
- Castell

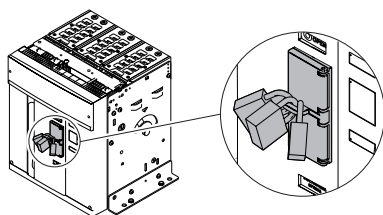


NOTE: the supply of Ronis - Profalux - Kirk - Castell locks is at customer's expense.

Information on assembly is available at the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the sheets kit:

- [1SDH001000R0702](#) for key locks with lock supplied by ABB;
- [1SDH001000R0703](#) for the key locks with pre-engineering for Ronis - Profalux - Kirk locks;
- [1SDH001000R0718](#) for the key locks with pre-engineering for Castell locks;

PLC: padlock



The PLC padlock locks the circuit-breaker in the open position.

It is available in two types:

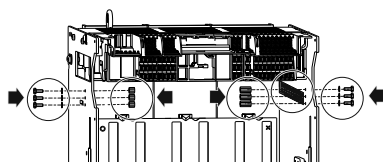
- lock usable with a maximum number of three padlocks with a diameter of 4 mm - 0,16"
- lock usable with a maximum number of two padlocks with a diameter of 8 mm - 0,32"
- lock for a padlock with a diameter of 7 mm - 0,28" or for a latch chain



NOTE: The padlocks are at the expense of the customer.

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0706](#).

Anti-racking-in lock

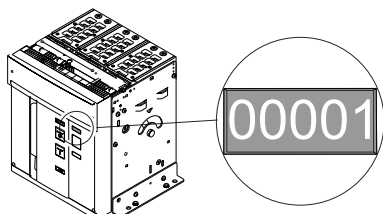


The anti-racking-in lock allows the moving part of the circuit-breaker to be inserted only into the corresponding fixed part.

It is intended for all withdrawable circuit breakers.

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0701](#).

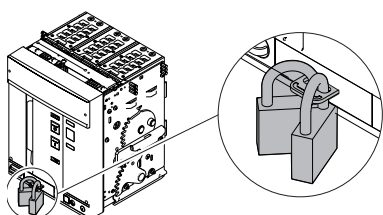
MOC: Operation counter



The mechanical operation counter displays the number of mechanical operations performed by the circuit-breaker.

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0710](#).

PLP: padlock in connected/test/disconnected positions



The PLP lock locks the moving part of a withdrawable circuit-breaker in the fixed part, in one of the following positions:

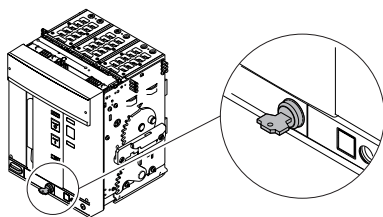
- connected
- test
- withdrawn

Only one type is available that allows you to mount up to three padlocks with a diameter of 8 mm.



NOTE: the PLP lock can also be supplied in the presence of a KLP lock

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0707](#).

KLP: key lock for connected/test/disconnected positions

The KLP lock for connected/test/disconnected position locks the moving part of a withdrawable circuit-breaker in the fixed part, in one of the following positions:

- connected
- test
- withdrawn



NOTE: it is possible to lock the moving part in the disconnected position only by using the additional accessory KLP lock.

The KLP lock for connected/test/disconnected positions is available with two types of lock:

- lock with different key code numbers (for an individual circuit-breaker).
- lock with the same key code number (for more than one circuit-breaker). The maximum number of key code numbers available is five.

Through an appropriate setup, the KLP lock for connected/test/disconnected positions can work with three other types of lock:

- Ronis
- Profalux
- Kirk
- Castell

The maximum number of locks that can be installed per circuit-breaker is the two, for all types of lock.



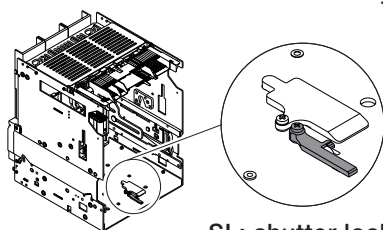
NOTE: the supply of Ronis - Profalux - Kirk locks is at customer's expense.



NOTE: the KLP lock can also be supplied in the presence of a PLP lock

Information on assembly is available at the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the sheets kit:

- [1SDH001000R0704](#) for key locks with lock supplied by ABB;
- [1SDH001000R0726](#) for key locks with lock supplied by ABB;
- [1SDH001000R0705](#) for the key locks with pre-engineering for Ronis - Profalux - Kirk locks;
- [1SDH001000R0719](#) for the key locks with pre-engineering for Castell locks;

KLP lock additional accessory

This additional accessory limits the locking function to the disconnected position only.

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0727](#).

SL: shutter lock

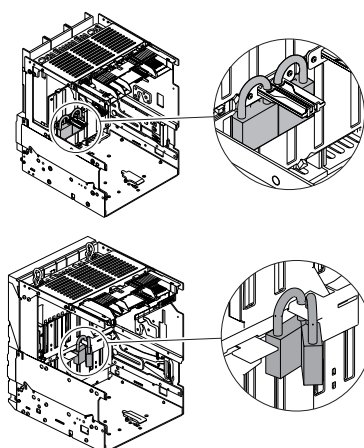
The SL shutter lock locks the shutters of the fixed part.

It is possible to lock the upper and lower shutters independently.

This is an accessory available on all the fixed parts and can work with the aid of padlocks with diameters of 4 mm - 0,16", 6 mm - 0,24", 8 mm - 0,32", with a maximum of four padlocks per fixed part (two for the upper shutters and two for the lower shutters).



NOTE: The padlocks are at the expense of the customer.



SLE: external shutter lock

The SLE lock locks the shutters from the outside of the fixed part with the aid of a 4 mm, 6 mm or 8 mm padlock.



NOTE: The padlocks are at the expense of the customer.

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0724](#).

DLC: Door opening lock with the circuit-breaker in closed position

The DLC prevents the following operations from being carried out:

- opening the switchgear door with the circuit-breaker closed if the circuit-breaker is in fixed version
- opening the switchgear door with the circuit-breaker closed and in connected position if the circuit-breaker is in fixed version
- closing of the circuit-breaker when the switchgear door is open

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0712](#).

DLP: door opening lock with the circuit-breaker in connected/test position

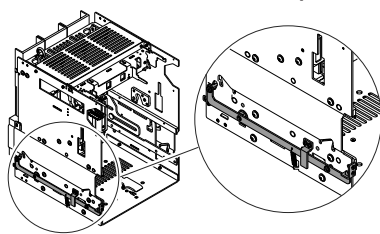
The DLP lock prevents the switchgear door from being opened when the moving part of the circuit-breaker is in the connected or test position.

It can be installed alternatively on the right side or the left side of the fixed part.



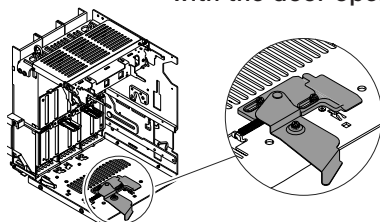
NOTE: The DLP lock is used as an alternative to the mechanical interlock.

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0709](#).

**DLR: lock on racking-in/racking-out of the moving part with the door open**

The DLR lock prevents the moving part from being racked in/out of the fixed part when the switchgear door is open.

It is available on request on all fixed parts.



Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0709](#).

Fail safe

The fail safe is a device that prevents the removal of the mobile part of a withdrawable circuit-breaker from the fixed part if the springs are loaded.

It is always supplied with UL circuit-breakers.

**IMPORTANT:**

- The fail safe device makes under-voltage coil YU unavailable.
- It is, however, possible not to install the fail safe device, in which case the under-voltage coil YU must be used.

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001400R0821](#).

3 - Mechanical Interlocks

Mechanical interlocks determine the opening/closing logic between two or three circuit-breakers.

Four types of interlocks are available, usable in both fixed and withdrawable versions.

Mechanical interlock of type A - Two Circuit-breakers

1	2
O	O
I	O
O	I

The Type A interlock is applicable to two circuit-breakers (normal power supply + emergency power supply). It allows you never to have two circuit-breakers in the closed position at the same time.

Information on assembly is available at the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the sheets kit:

- [1SDH001000R0720](#) for interlock between E2.2-E4.2-E6.2 circuit-breakers
- [1SDH000999R0721](#) for interlock between an E1.2 circuit-breaker and E2.2-E4.2-E6.2 circuit-breaker

Mechanical interlock of type B - Three Circuit-breakers

1	2	3
O	O	O
I	O	O
O	O	I
I	O	I
O	I	O

The Type B interlock is applicable to three circuit-breakers (two normal power supplies + emergency power supply).

It only allows the closing of the two circuit-breakers of the normal power supply if the circuit-breaker of the emergency power supply is open. The circuit-breaker of the emergency power supply can be closed only if the others two are open.

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0721](#).

Mechanical interlock of type C - Three Circuit-breakers

1	2	3
O	O	O
I	O	O
O	I	O
O	O	I
O	I	I
I	I	O
I	O	I

The Type C interlock is applicable to three circuit-breakers (two normal power supplies + a bus tie).

It allows the simultaneous closing of one or two circuit-breakers, resulting in two possible types of power supply of the half busbars:

- power supply from a single transformer (bus tie closed)
- power supply from both transformers (bus tie open)

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0722](#).

Mechanical interlock of type D - Three Circuit-breakers

1	2	3
O	O	O
I	O	O
O	I	O
O	O	I

The Type D interlock is applicable to three circuit-breakers (three power supplies on the same bar that must not operate in parallel)

It allows only one of the three circuit-breakers to be closed.

Information on the assembly is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0723](#).

Putting into service and maintenance

1 - Putting into service

Introduction The general check is necessary:

- when put into service for the first time
- after prolonged inactivity of the circuit-breaker



HAZARD! RISK OF ELECTRIC SHOCK! Test the circuit-breaker with all switchgear apparatus de-energized.



IMPORTANT: The checks involve carrying out procedures that can be performed only by Expert Persons in the electrical area (IEV 195-04-01: Person with sufficient training and experience to allow him/her to perceive the risks and to avoid the hazards potentially created by electricity).

General checks Before putting it into service for the first time or after a prolonged period of inactivity, some checks must be carried out on the circuit-breaker and the environment in which it is installed:

Points to be checked	Checks
Switchgear	1. Sufficient change of air to avoid overtemperatures
	2. Clean location, free of all installation refuse (e.g.: cables, tools, metal splinters)
	3. Circuit-breaker mounted correctly (tightening torques, air distances respected)
	4. The installation environmental conditions must be consistent with the "Environmental conditions" specifications on page 24
Connections	1. Power connections tightened to the terminals of the circuit-breaker
	2. Busbars with adequate cross-section
	3. Maximum distances of separators respected
	4. Maximum distances of separators respected
Operations	Perform some opening and closing operations (See chapter "Description of the product - circuit-breaker opening/closing operations on page 16). The spring loading lever must move with regularly
	 WARNING! in the presence of an under-voltage coil the circuit-breaker can be closed only after the release is energized
Alarms release	Connect the protection device Ekip TT to the release and verify that there are no alarms present
State of the circuit-breaker with Ekip DIP release	With the Ekip Dip release, the status of the circuit-breaker must not be in error (see the table on page 48). Perform a closing/opening operation on the circuit-breaker and verify the absence of alarms (see the table on page 48).
State of the circuit-breaker with Ekip Touch release	With the Ekip Touch release, the state circuit-breaker must be read correctly (see the table on page 48). Perform a closing/opening operation on the circuit-breaker and verify correct reading of the change of state.
Trip Test	With circuit-breaker closed and in conditions of rest (without circulating currents), carry out a Trip test, and verify the opening of the circuit-breaker

Procedures for checking the accessories

The following procedures for checking the accessories are to be performed before they are put into service:

Accessories ^(*) to be checked	Procedure
Gearmotor	1. Power the gearmotor for loading the springs at the relevant rated voltage. Result: The springs are loaded correctly. The signals are normal. When the springs are loaded the gearmotor stops.
	2. Perform some closing and opening operations. Result: The gearmotor reloads the springs after every closing operation.
	 NOTE! <i>If present, power the under-voltage coil in advance.</i>
Under-voltage coil	1. Power the under-voltage coil at the relevant rated voltage and perform the closing operation on the circuit-breaker. Result: The circuit-breaker closes correctly; the signalings are normal.
	2. Turn off the voltage supply to the release. The circuit-breaker opens.
	3. Power the under-voltage coil at the relevant rated voltage and perform the closing operation on the circuit-breaker. Result: The circuit-breaker closes; the signal changes over.
	 WARNING! <i>If the under-voltage coil has been tripped by a power failure, the circuit-breaker can be closed only after the coil has been energized electrically. Make sure that the coil has effectively been tripped by a power failure. Otherwise, examine the circuit-breaker and associated device to make sure that they are in a good condition.</i>
Opening coil	1. Close the circuit-breaker.
	2. Power the opening coil at the relevant rated voltage. Result: The circuit-breaker opens correctly; the signals are normal.
Closing coil	1. Open the circuit-breaker.
	2. Load the springs manually or electrically.
	3. Power the closing coil at its rated voltage. Result: The circuit-breaker closes correctly; the signals are normal.
Opening coil with Ekip Com Actuator	1. Power the protection release with the Vaux auxiliary power supply.
	2. Power the Ekip Com Actuator contacts.
	3. Close the circuit-breaker
	4. Select “open CB” from the Ekip Touch menu Result: The circuit-breaker opens correctly; the signals are normal.
	 NOTE! <i>The test can be performed if the release and the coils are energized.</i>

(*) if present.

(**) only withdrawable versions.

Continued on the next page

Accessories ^(*) to be checked	Procedure
Closing coil with Ekip Com Actuator	1. Power the protection release with the Vaux auxiliary power supply. 2. Power the Ekip Com Actuator contacts. 3. Load the springs. 4. Select "close CB" from the Ekip Touch menu Result: The circuit-breaker closes correctly; the signals are normal.  NOTE! The test can be performed if the protection release and the coils are energized.
Lock for circuit-breaker in open position (key or padlock)	1. Open the circuit-breaker 2. Keep the opening push-button pressed 3. Turn the key and remove it 4. Attempt the circuit-breaker closing operation. Result: Both manual and electrical closing are prevented.
Auxiliary contacts of the circuit-breaker	1. Connect the auxiliary contacts to appropriate signalling circuits or to the multimeter. 2. perform some closing and opening operations on the circuit-breaker. Result: signalling occurs normally.
Circuit-breaker connected, isolated for test, disconnected auxiliary contacts	1. Connect the auxiliary contacts to appropriate signalling circuits. 2. next bring the circuit-breaker to the connected, isolated for test and disconnected position. Result: the signals due to the relative operations are normal.
Interlocking devices of the circuit-breaker connected and extracted ^(**)	1. Perform operating tests. Result: the locks function correctly.
Interlock devices between circuit breakers assembled side by side and stacked	1. Perform operating tests. Result: the locks function correctly.
Device insertion and extraction ^(**)	1. Perform a few racking-in and racking-out operations. Result: in the rack-in operation the circuit-breaker is connected correctly. There is no particular resistance during the first turns of the handle.
Auxiliary accessories and auxiliary voltage	Verify the installation The value of the power supply auxiliary voltage of the auxiliary accessories must be between 85% and 110% of the rated voltage for the auxiliary accessories.
Modules	1. Power the protection release Result: Verify that Power LED is lit up on each accessory present. Make sure that the Local Bus communication line is activated on the protection release.
External connections	1. In the case of Neutral external sensors, single-pole or differential, to set the model and protection parameters appropriately. Result: No alarm present on the protection release.  WARNING! During this phase the circuit-breaker must be open and withdrawn (if withdrawable).

(*) if present.

(**) only withdrawable versions.

Final check list After completing the procedures for general checks and checks on the accessories, perform the following operations. Print this sheet in order to annotate in the column **Check** the check that was carried out.

Operation		Description	Check
1	Circuit-breaker OFF	Open the circuit-breaker	
2	Circuit-breaker connected	Switch the circuit-breaker in withdrawable version to the connected position and reposition the crank in its seat	
3	Release Parameters	Adjust the protection release in accordance with the design specifications of the installation (drawn up by design engineer of the installation). If necessary, power the protection release with an Ekip TT unit	
4	Removal of the Ekip TT	If present, remove the Ekip TT unit	
5	Connecting the voltage	Connect the auxiliary voltage	
6	Closing the switchgear	Close the switchgear door	
7	Loading the springs	Load the closing springs	
8	Under-voltage coil	Make sure that under-voltage coil is energized	
9	Opening and closing coils	Make sure that opening and closing coils are NOT energized	
10	Mechanical interlock of the circuit-breaker	If present, make sure that mechanical interlock of the circuit-breaker is not active	
11	Interlocking devices	If present, make sure that interlocking devices of the circuit-breaker are not active	
12	Status signals	Check that the signalling devices on the front of the circuit-breaker represent: circuit-breaker open - springs unloaded O - OPEN and springs signaller white DISCHARGED SPRING	

2 - Identification of alarms or failures

Introduction The protection release is able to identify some faults and to signal them through LEDs or the display; you need to identify the cause and eliminate it before re-closing the circuit-breaker, both locally and remotely.



WARNING! identification of the faults must be managed only by Expert Persons in the electrical area (IEV 195-04-01: Person with sufficient training and experience to allow him/her to perceive the risks and to avoid the hazards potentially created by electricity). Indeed, it may be necessary to perform insulation and dielectric tests on part or all of the installation.

Some failures involve partial operation of the circuit-breaker. Consult the paragraphs "Faults, causes and remedies" on page 95 and "Faults signalled on the display" on page 98 where the possible causes of the main faults are listed.

Further information on the Ekip Touch release and on the accessories mentioned in this chapter and which are not covered in this manual are available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, with the Ekip Touch manual [1SDH001316R0002](#).

Faults, causes and remedies The following is a list of possible fault situations, their possible causes and suggestions for resolving them.



NOTE: Before consulting the table, check the error messages on the display. If the suggestions indicated fail to resolve the problem, contact the ABB Assistance Service supplying, if possible supplying the report produced by the Ekip Connect software.

Faults	Possible causes	Suggestions
The circuit-breaker doesn't close when the closing push-button is pressed	The trip signal of the protection release has not been reset	Press the TU mechanical reset push-button or operate the electrical reset remotely.
	The open-position key lock or pad-lock is activated	Unlock the lock in open position using the relevant key
	The circuit-breaker is in an intermediate position between inserted and test or between test and extracted	Complete the connection operation
	The under-voltage coil is not energized	Check the power supply circuit and the power supply voltage
	The opening coil is permanently energized	Correct condition of operation.
	The release pushbutton is pressed (withdrawable version)	Rotate the crank to complete or the plug-in or unplugging operation initiated
The circuit-breaker doesn't close when the closing coil is powered	The trip signal of the protection release has not been reset	Press the TU Reset button
	The power supply voltage of the auxiliary circuits is too low	Measure the voltage: it should not be lower than 70% of the rated voltage of the coil
	The power supply voltage is different to that indicated on the rating plate	Check the voltage on the rating plate
	The cables of the coil are not inserted correctly in the terminals	Make sure there is continuity between cable and terminal and if necessary reconnect the cables of the coil to the terminals
	The connections in the power supply circuit are wrong	Check the connections using the relevant wiring diagram
	The closing coil is damaged	Replace the coil
	The operating mechanism is locked	Perform the closing operation manually; if the fault persists contact ABB
	The open position key lock is activated	Unlock the lock in open position using the relevant key
	The circuit-breaker is in an intermediate position between connected and test or the release push-button is pressed (withdrawable version)	Complete the connection operation
	The under-voltage coil is not energized	Make sure that under-voltage coil is energized properly
	The opening coil is permanently energized	Correct condition of operation. If necessary, disconnect the power from the opening coil
	The racking out crank handle is inserted (withdrawable version)	Remove the crank
The circuit-breaker doesn't open when the opening push-button is pressed	The operating mechanism is locked	Contact ABB

Continued on the next page

Faults	Possible causes	Suggestions
The circuit-breaker doesn't open when the opening coil is powered	The operating mechanism is locked	Contact ABB
	The power supply voltage of the auxiliary circuits is too low	Measure the voltage: it should not be lower than 85 % of the rated voltage of the coil
	The power supply voltage is different to that indicated on the rating plate	Use the correct voltage
	The cables of the coil are not inserted correctly in the terminals	Make sure there is continuity between cable and terminal and if necessary reconnect the cables of the coil to the terminals
	The connections of the power supply circuit are wrong	Check the connections using the relevant wiring diagram
	The opening coil is damaged	Replace the coil
The circuit-breaker doesn't open due to the command of the under-voltage coil trips	The operating mechanism is locked	Perform the opening operation manually; if the fault persists contact ABB
It is not possible to load the closing springs by means of the manual loading lever	The operating mechanism is locked	Contact ABB
It is not possible to load the closing springs by means of the gearmotor	The cables of the gearmotor are not inserted correctly in the terminals	Make sure there is continuity between cable and terminal and if necessary reconnect the cables of the gearmotor to the terminals
	The connections of the power supply circuit are wrong	Check the connections using the relevant wiring diagram
	The circuit-breaker is in disconnected position	Switch the circuit-breaker to the test or connected position
	The gearmotor protection internal fuse has tripped	Replace the fuse
	The gearmotor is damaged	Replace the gearmotor
It is not possible to press the button in order to insert the racking out crank handle	The circuit-breaker is closed	Press the opening push-button in order to allow the insertion of the crank with the circuit-breaker open
It is not possible to insert the moving part in the fixed part	The racking-in/racking-out operation is not performed correctly	See chapters "Circuit breaker racking-in/racking-out operations" on pages 19
	The moving part is incompatible with the fixed part	Check the compatibility between the moving part and the fixed part
It is not possible to lock the circuit-breaker in the open position	The opening push-button is not being pressed	Press the opening push-button and activate the lock
	The lock in open position is defective	Contact ABB
It is not possible to perform the trip test	The opening solenoid is not inserted correctly	Check the connection of the opening solenoid and check the messages on the display
	The trip signal of the protection release has not been reset	Press the reset push-button
	The busbar current is greater than zero	Correct condition of operation.

Continued on the next page

Faults	Possible causes	Suggestions
It is not possible to remove the circuit-breaker from extracted to removed	Fail Safe lock active	Discharge the closing springs of the command
Tripping times shorter than expected	Selected threshold too low	Correct the threshold
	Wrong curve selected	Correct the curve
	Thermal memory enabled	Disable it if it is not necessary
	Incorrect neutral selection	Correct the neutral selection
	Zone Selectivity enabled	Disable it if it is not necessary
Tripping times longer than expected	Threshold too high	Correct the threshold
	Curve too high	Correct the curve
	Wrong curve selected	Correct the curve type
	Incorrect neutral selection	Correct the neutral selection
Rapid trip with I3 = Off	Inst trip	Correct operating condition with short circuit at high current
High earth current, but no trip occurs	Incorrect selection of the sensor	Set internal or external sensor
	Function G inhibited with $I > 4I_n$	Correct condition of operation.
Display off (if present)	No auxiliary power supply and the current and/or voltage is less than minimum value	Correct condition of operation.
	Temperature outside range	Correct condition of operation.
The display is not backlit (if present)	Current and/or voltages below the display switch-on limit	Correct condition of operation.
Incorrect current reading	Current below the minimum threshold that can be displayed	Correct condition of operation.
Incorrect voltage, power and $\cos \varphi$ reading	Incorrect connection between isolation transformer and Ekip Measuring	Check the connections between the isolation transformer and Ekip Measuring
	Voltage parameter setting error	Set the correct parameters
The expected trip does not occur	Trip excluded	Correct condition of operation. Enable trip if necessary
No activation of the Unbalance protection U	Values outside range	Correct condition of operation.
Opening data not displayed	No auxiliary power supply and/or battery low	Correct condition of operation.
The password is not requested	The password was disabled or already inserted recently	Corrected condition of operation, reset the password with a value other than "0000"

Faults signalled on the display The following is a list of faults that can be detected from the display and the suggestions for resolving them:

Signal	Suggestions
No Com on Local Bus warning	Local bus enabled bus but no module present: check connection to terminal box modules (example: Ekip Supply, Com, Contact, ecc...)
Trip coil disconnected	Check the connection of the opening solenoid
Contact Wear PreAlarm/Alarm	Make sure that the contacts/poles are in good condition.
L1/L2/L3/Ne sensor disconnected	Check the connection of the current sensor
Gext sensor Disconnected	Check the connection of the current sensor
Rating Plug Error	Check the Rating Plug connection on the front of the protection release.
Internal Error	Contact ABB
Invalid Date	Set the date
CB Status Error	Check the circuit-breaker status signal contacts
Rating Plug Installation Warning	Install Rating Plug, and in the case of faults check its connection
Switchboard Actors Communication Error	Check the configuration and connection of the Ekip Link modules
Battery Low	Change the battery on the release ⁽¹⁾
Voltage module Installation warning	Install the module
Voltage Module Error	Error reading the module parameters. Contact ABB
Software Not Compatible	Software versions between Mainboard and Ekip Touch are not compatible with each other: editing of all parameters is inhibited on the display. Protections L, I and Iinst are activated and operative with the parameters entered in the previous protection release. Please consult ABB if compatibility needs to be restored.

⁽¹⁾ Further information is available from the web site <http://www.abb.com/abblibrary/DownloadCenter/>, where the procedure is available [1SDH001000R0509](#).

Consult the individual chapters describing the modules for fault finding and resolving with regard to Ekip Com modules.

3 - Maintenance

Safety standards The following are the warnings to be respected during the maintenance operations



HAZARD! RISK OF ELECTRIC SHOCK! Risk of electric shock or accident.



WARNING! before proceeding with any maintenance operation, it is obligatory to:

- **Open the circuit-breaker and make sure that the springs of the operating mechanism are unloaded.**
- **In the case of a withdrawable circuit-breaker, extract the circuit-breaker from the fixed part (see the indication DISCONNECTED)**
- **If work must be performed on fixed circuit-breakers or on fixed parts, disconnect the power supply to the power circuit and auxiliary circuits and visibly earth the terminals on both the supply side and load side.**
- **Set the equipment to safe conditions as established by the standards and laws in force.**

Expert personnel The maintenance operations must be carried out by Expert Personnel:

an expert person in the electrical area (IEV 195-04-01: Person with sufficient training and experience to allow him/her to perceive the risks and to avoid the hazards potentially created by electricity.

ABB declines all liability for damage to persons or property caused by failure to comply with the instructions in this document.

Circuit-breaker life Emax 2 circuit-breakers, with or without opening or closing coils, can withstand the following operating cycles if regularly serviced⁽¹⁾.

circuit-breaker IEC 60947	Interrupted rated current I _u (40°C) [A]	Mechanical life with regular maintenance		Electrical life		
				440V AC	690V AC	Frequency of Operations/hour
E2.2	< 1250	25	60	15	15	30
	1600	25	60	12	10	30
	2000	25	60	10	8	30
	2500	20	60	8	7	30
E4.2	< 2000	20	60	10	10	20
	2500	20	60	8	8	20
	3200	20	60	7	7	20
	4000	15	60	5	4	20
	3200	15	60	2	2	20
E6.2	4000	12	60	4	4	10
	5000	12	60	3	2	10
	6300	12	60	2	2	10

Circuit-breaker life

circuit-breaker UL 1066	Interrupted rated current	Mechanical life with regular maintenance		Electrical life		
	I _u (40°C) [A]	No. operations (x 1000)	Frequency of Operations/hour	480V AC No. operations (x 1000)	600V AC No. operations (x 1000)	Frequency of Operations/hour
E2.2-A	< 1250	25	60	15	15	30
	1600	25	60	12	10	30
	2000	25	60	10	8	30
E4.2-A	< 2000	20	60	10	10	20
	2500	20	60	8	8	20
	3200	20	60	7	7	20
E6.2-A	4000	12	60	4	4	10
	5000	12	60	3	2	10

⁽¹⁾See chapter 5 - Environmental conditions on page 24 .

Maintenance schedule Proper maintenance of the equipment allows good electromechanical operation to be maintained over time. The maintenance plan for SACE Emax 2 circuit-breakers specifies two periodic levels of maintenance for the different types of site conditions.

The following is a table of maintenance frequency with the periodic intervals and the routine maintenance operations.

Type of maintenance	Frequency of maintenance in standard environments ⁽¹⁾	Frequency of maintenance in dusty environments (dust level measured > 1mg/m ³)
First Level	One year or 20% of mechanical life or 20% of electrical life	6 months or 10% of mechanical life or 10% of electrical life
Second Level	Three years or 50% of mechanical life or 50% of electrical life or after a trip under short-circuit	18 months or 25% of mechanical life or 25% of electrical life or after a trip under short-circuit

⁽¹⁾See chapter 5 - Environmental conditions on page 24 .

Compliance with the following rules is also recommended:

- Even circuit-breakers that are operated infrequently or that remain closed or open for long periods of time must be subjected to programmed maintenance.
- All the circuit-breakers provide information on the number of operations performed in the presence of auxiliary power supply of the Trip Unit. With Ekip Dip releases, the information can be obtained with the aid of Ekip T&P and a PC on which the Ekip Connect software is installed. With Ekip Touch releases, the information is available at any time on the appropriate display. With Ekip Dip releases, installation of the mechanical operation counter is recommended (supplied on request).
- During the service, visually inspect the circuit-breaker from the outside to check for the presence of dust, dirt or damage.

4 - First level maintenance

First level maintenance should be carried out in accordance with the maintenance schedule shown on page 99.

Preliminary operations

The following are the operations to be carried out:

1. Open the circuit-breaker and make sure that the springs of the operating mechanism are unloaded.
2. In the case of a withdrawable circuit-breaker, extract the circuit-breaker from the fixed part (see the indication DISCONNECT)



WARNING! if work must be performed on fixed circuit-breakers or on fixed parts, disconnect the power supply to the power circuit and auxiliary circuits and visibly earth the terminals on both the supply side and load side.

Inspections and general cleaning

Perform the following checks:

1. Check the cleanliness of the circuit-breaker, removing any dust or oily traces or excess grease using a clean, dry rag (possibly using mild detergent. Use a cleaning product such as Henkel 273471 or Chemma 18 or equivalent if there is a heavy coating of dirt).
2. Check that the rating plates with the technical specifications of the apparatus are present.
3. Clean the rating plates with clean, dry rags.
4. Make sure that there are no foreign bodies in the circuit-breaker compartment.

Circuit-breaker connections and connections between circuit-breaker and switchboard

Perform the following checks on the connections:

1. With dry paint-brushes and rags remove dust or soil, if present (use a non- aggressive detergent if necessary. Use a cleaning product such as Henkel 273471 or Chemma 18 or equivalent if there is a heavy coating of dirt).
2. Make sure there are no traces of overheating on the terminals. Overheating is detected by a different coloration of the parts in contact; the contact parts are usually silvery white in colour.
3. Check the tightness of fastening bolts for all connections to the terminals



WARNING! if work must be performed on fixed circuit-breakers or on fixed parts, disconnect the power supply to the power circuit and auxiliary circuits and visibly earth the terminals on both the supply side and load side.

Disassembly operations

To disassemble the parts of the circuit-breaker:

1. Remove the transparent flange (A) of the release, by turning the screws (B).
2. Remove the escutcheon plate of the circuit-breaker (C), by removing the mounting screws (D).

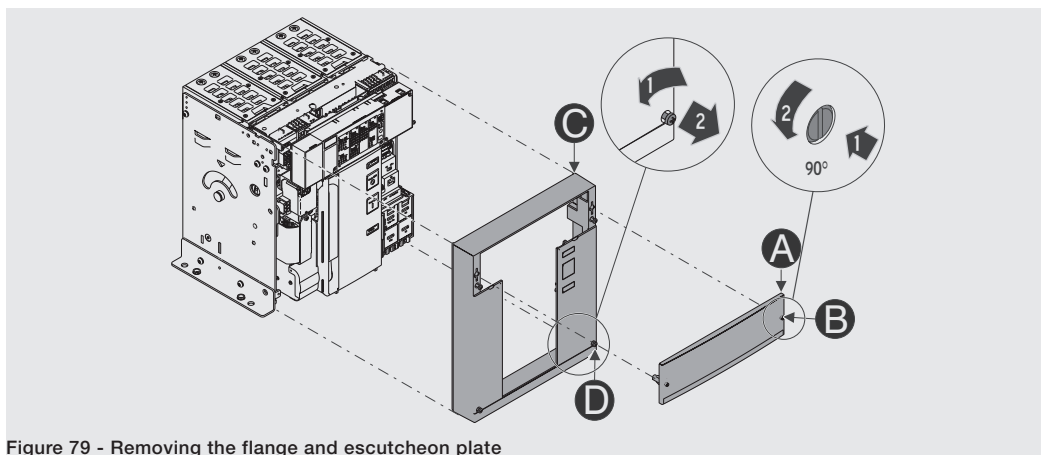


Figure 79 - Removing the flange and escutcheon plate

3. Remove the gearmotor (E) by removing the screw (F) and the connector.

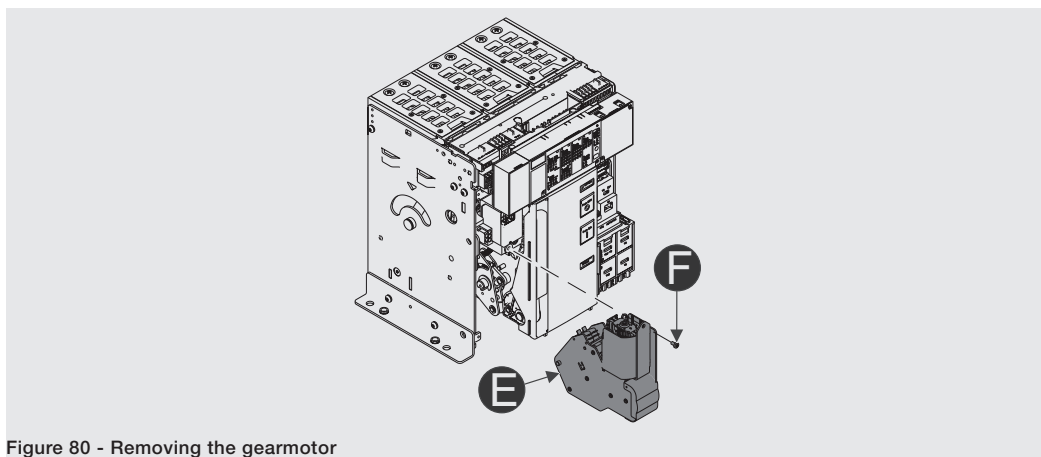


Figure 80 - Removing the gearmotor

4. If there is a minimum voltage coil (G), remove it, and discharge the springs of the operating mechanism for closing and opening the circuit breaker.

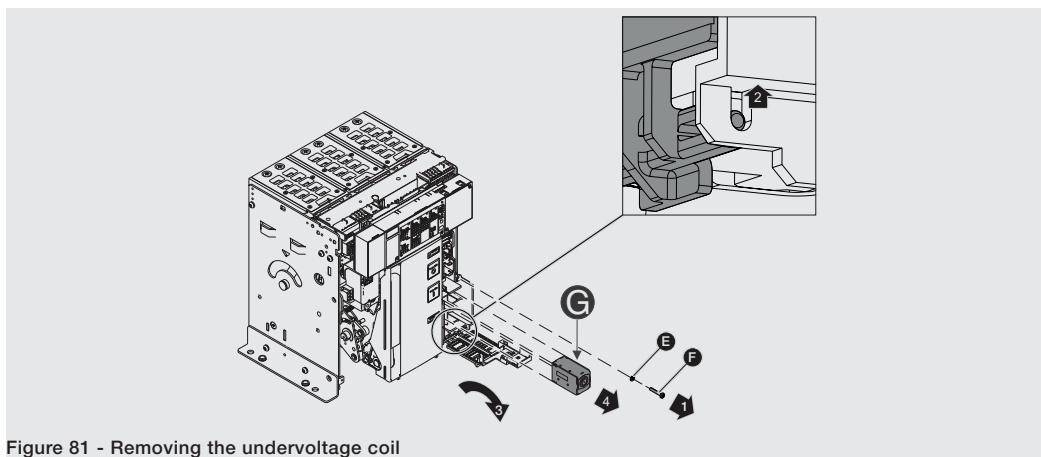


Figure 81 - Removing the undervoltage coil

Cleaning and lubrication of the operating mechanism

To clean and lubricate:

1. Clean the closing shaft and closing hook at the point indicated. In the case of excessive deposits you can use a laminate thinner such as Henkel 273471 or Chemma 18 or equivalent.
2. Lubricate, in the points indicated, the closing shaft and closing hook with grease Mobilgrease 28 (EXXON MOBIL).
3. Make sure that the closing shaft is free to rotate.

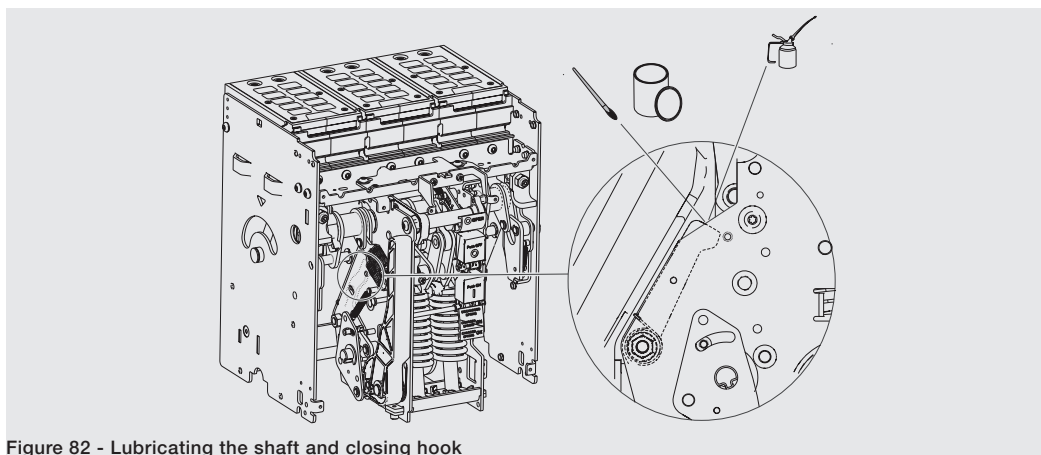


Figure 82 - Lubricating the shaft and closing hook

Inspection of electrical and mechanical accessories

Check the accessories:

1. Check that the accessories are securely fixed to the circuit-breaker.
2. Check that the accessories are connected correctly to the circuit-breaker.
3. Make sure that the coils (YU-YO-YC), if present, are in good condition (no excessive wear and tear, overheating, rupture).
4. Make sure that the mechanical operation counter functions correctly (if present) by operating the circuit-breaker.
5. Check the wear on the brushes of the gearmotor and if necessary replace them.



NOTE: you are recommended to change the gearmotor if it has performed more than 10000 spring loading operations.

Inspection of the protection release

Check that the release is in good condition:

1. Power the protection release with an Ekip TT battery unit.
2. Check the correct operation of the protection release: tripping test with "Trip Test" and "Self-test".
3. With an Ekip Dip release, verify the absence of alarms via the front LEDs.
4. With an Ekip Touch release, verify the absence of alarms via the display and the front LEDs.
5. Make sure that the cables are correctly connected to the release modules and to the release itself (if applicable).
6. On an Ekip Touch release check the percentage of wear on the contacts of the circuit-breaker.
7. Finally, remove the Ekip TT battery unit.

Test with Ekip Connect

Test the release:

1. Connect the Ekip Bluetooth or Ekip T & P unit to the release.
2. Connect the computer where the program is installed by means of a Bluetooth or USB connection.
3. After connecting the computer and release, check that there are no alarm signals by the release. Otherwise, refer to the paragraph " 2 - Identification of alarms or failures" on page 94.
4. In the absence of alarms you can proceed to the trip test and self test (depending on the type of release). For future checks it is recommended to insert the current date in the area called "Information". These data will be stored within the release itself.
5. Remove the Ekip Bluetooth or Ekip T & P unit from the release.

Final checks Reassemble and check the circuit-breaker:

1. Reassemble all the parts by performing all the operations indicated in the paragraph "Disassembly Operations" in reverse order and, if necessary, reconnect the auxiliary power supply.
2. Put the movable part (breakers) in the test position (see indication TEST).
3. Using the various auxiliaries perform the following operations 10 times:
 - *Opening (in both local and remote modes, if applicable)*
 - *Closing (in both local and remote modes, if applicable)*
 - *Tripping via Trip Test from the protection release.*
4. Perform the operations in the following sequence:
 - *Open - Springs unloaded*
 - *Open - Springs loaded*
 - *Closed - Springs unloaded*
 - *Closed - Springs loaded*
5. Check that the following operate correctly:
 - *accessories, if provided.*
 - *gearmotor, if provided.*
 - *under-voltage coil, if provided.*
 - *opening coil, if provided.*
 - *closing coil, if provided.*
 - *auxiliary contacts of the circuit-breaker, if provided.*
 - *lock for circuit-breaker in open position (key or padlock), if provided*

Interlock check Check that the vertical or horizontal interlocking devices (if provided) are installed and that they operate correctly.



WARNING! the interlocks cannot be tested in the Test or Disconnected positions.

5 - Second level maintenance

The second level of maintenance must be performed in accordance with the maintenance schedule shown on page 99.

Preliminary operations The following are the operations to be carried out:

1. Open the circuit-breaker and make sure that the springs of the operating mechanism are unloaded.
2. In the case of a withdrawable circuit-breaker work with it withdrawn from the fixed part. For removal of the fixed part see paragraph "Circuit breaker racking-in/racking-out operations" on page 19 .

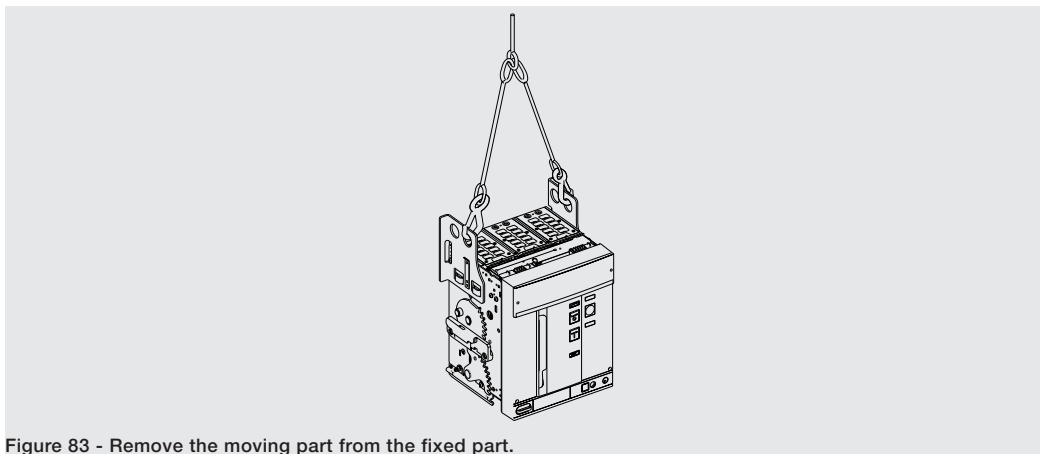


Figure 83 - Remove the moving part from the fixed part.



WARNING! if work must be performed on fixed circuit-breakers or on fixed parts, disconnect the power supply to the power circuit and auxiliary circuits and visibly earth the terminals on both the supply side and load side.

Inspections and general cleaning Perform the following checks:

1. Check the cleanliness of the circuit-breaker, removing any dust or oily traces or excess grease using a clean, dry rag (possibly using mild detergent. Use a cleaning product such as Henkel 273471 or Chemma 18 or equivalent if there is a heavy coating of dirt).
2. Check that the rating plates with the technical specifications of the apparatus are present.
3. Clean the rating plates with clean, dry rags.
4. If the circuit-breaker is the withdrawable version, remove all traces of dust, mould, condensation and oxidation inside the fixed part.
5. Make sure that there are no traces of overheating or cracks, which could impair the insulating parts of the circuit-breaker
6. Check the integrity of the separation pliers (for withdrawable circuit-breaker).
7. The jaw contacts must be silvery in colour with no traces of erosion or discoloration.
8. Make sure that there are no foreign bodies in the circuit-breaker compartment.
9. Make sure that the screws that fasten the fixed part to the switchgear are well tightened (M8 - 25Nm - 221,27 lb in)

Circuit-breaker connections and connections between circuit-breaker and switchboard

Perform the following checks on the connections:

1. With dry paint-brushes and rags remove dust or soil, if present (use a non-aggressive detergent if necessary. Use a cleaning product such as Henkel 273471 or Chemma 18 or equivalent if there is a heavy coating of dirt).
2. Make sure there are no traces of overheating on the terminals. Overheating is detected by a different coloration of the parts in contact; the contact parts are usually silvery white in colour.
3. Make sure that the bolts of the terminal connections are well tightened.



WARNING! if work must be performed on fixed circuit-breakers or on fixed parts, disconnect the power supply to the power circuit and auxiliary circuits and visibly earth the terminals on both the supply side and load side.

Disassembly operations To disassemble the parts of the circuit-breaker:

1. Remove the transparent flange (A) of the release, by turning the screws (B).
2. Remove the escutcheon plate of the circuit-breaker (C), by removing the mounting screws (D).

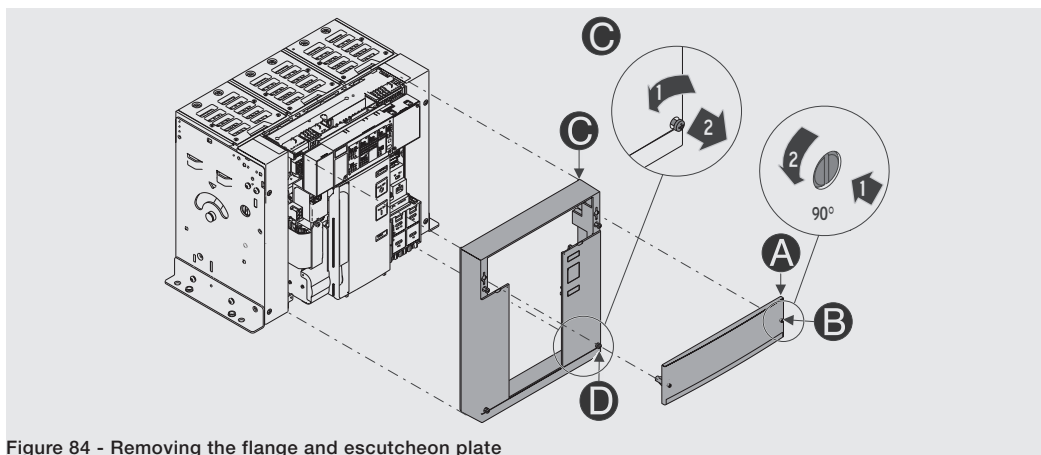


Figure 84 - Removing the flange and escutcheon plate

3. Remove one or both of the side guards (I) (if installed) by removing the front screws (L).
4. Remove the gearmotor (E) by removing the screw (F) and the connector.

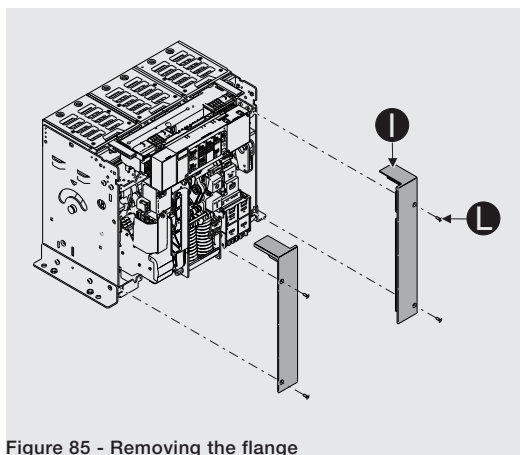


Figure 85 - Removing the flange

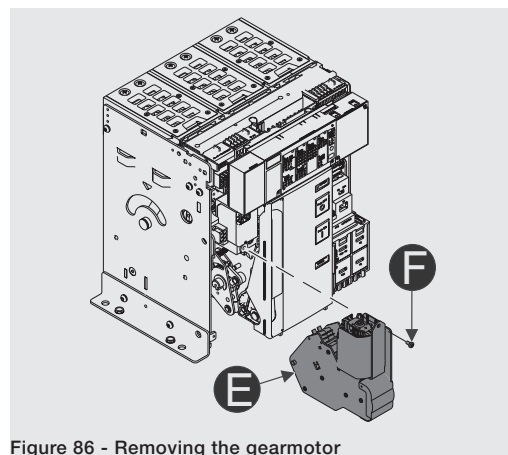


Figure 86 - Removing the gearmotor

5. If there is a minimum voltage coil (G), remove it, and discharge the springs of the operating mechanism for closing and opening the circuit breaker.

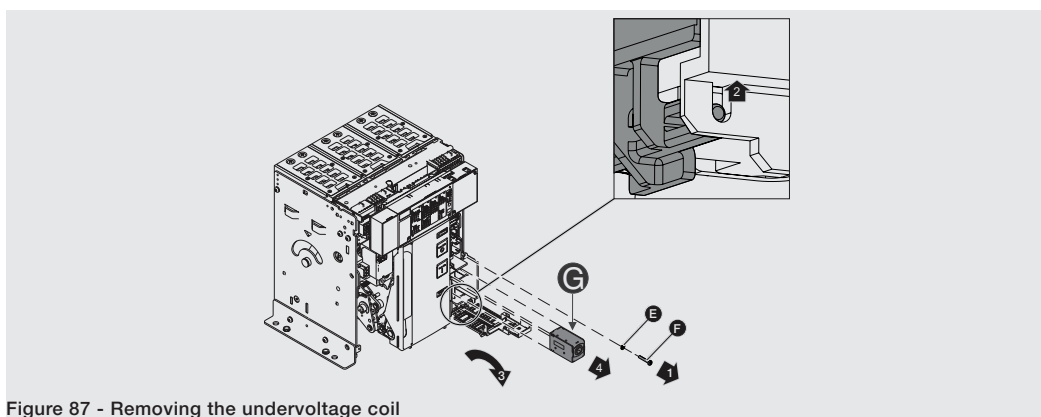


Figure 87 - Removing the undervoltage coil

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6. Remove the escutcheon plate of the circuit-breaker (e) by removing the screws (f) and the protection plate (g) by removing the screw (h).

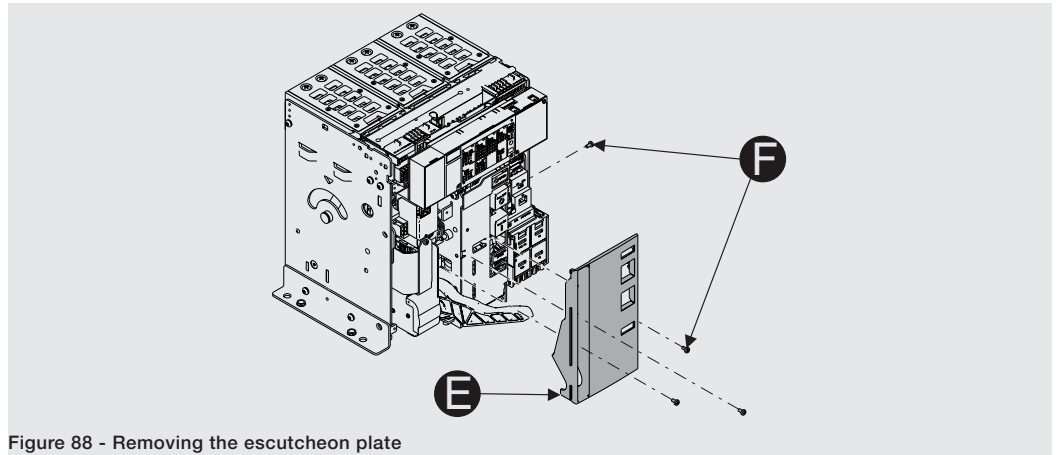


Figure 88 - Removing the escutcheon plate

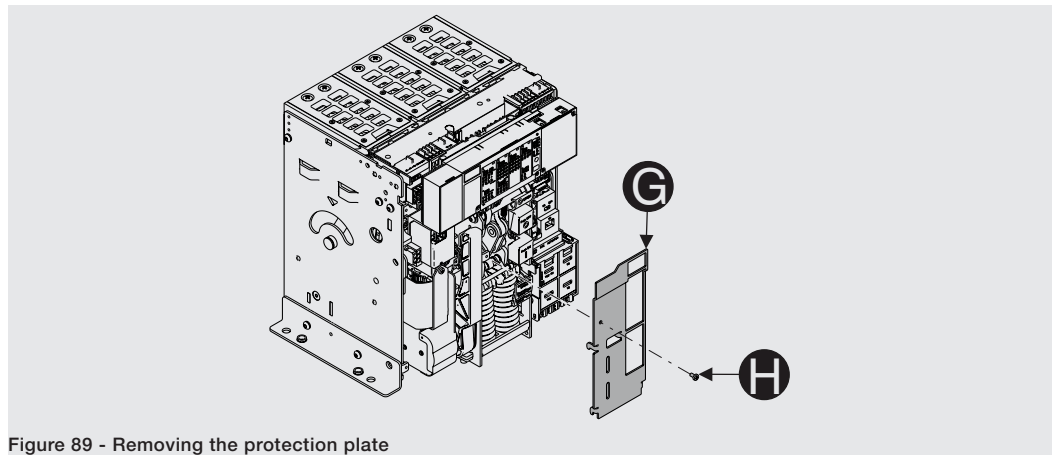


Figure 89 - Removing the protection plate

Before cleaning and lubrication of the operating mechanism, you must remove the protection release. For information about removal, see the document [1SDH001000R0523](#), or request the intervention of a technician ABB.

Cleaning and lubrication of the operating mechanism

To clean and lubricate:

1. Clean the closing hook, the closing shaft, opening hook and opening shaft in the points indicated by the illustrations. In the case of excessive deposits you can use a thinner laminate of the type Henkel 273471 or Chemma 18 or equivalent.
2. Lubricate closing hook, the closing shaft, opening hook and opening shaft in the points indicated by the illustrations with Mobilgrease 28 grease (EXXON MOBIL).
3. Make sure that the opening and closing shafts are free to turn.

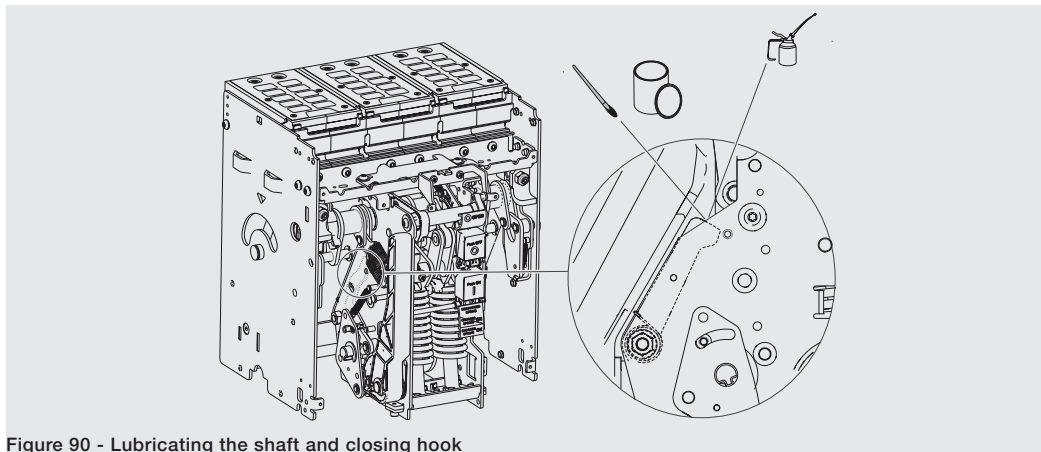


Figure 90 - Lubricating the shaft and closing hook

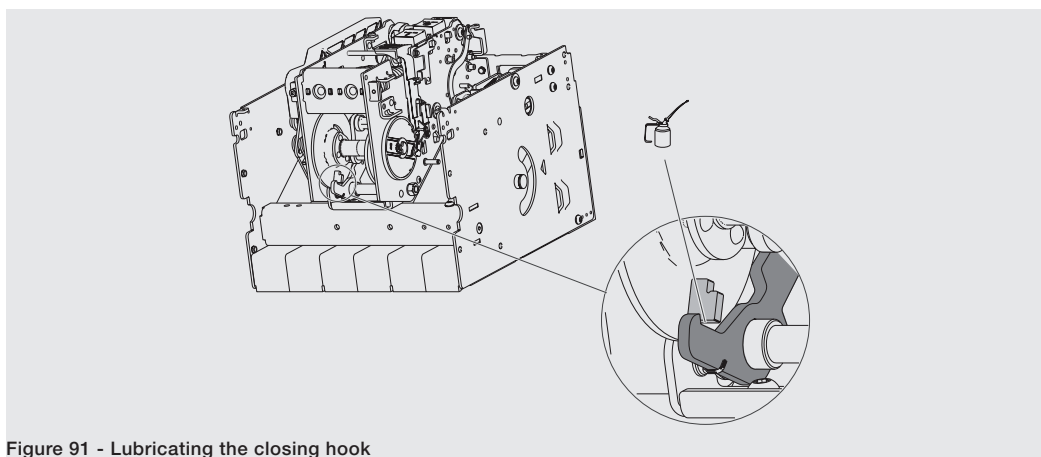


Figure 91 - Lubricating the closing hook

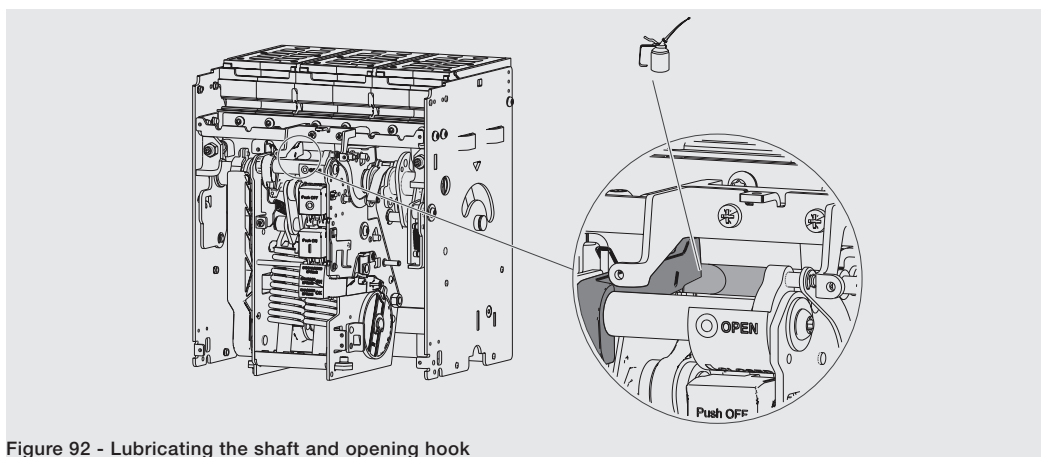


Figure 92 - Lubricating the shaft and opening hook

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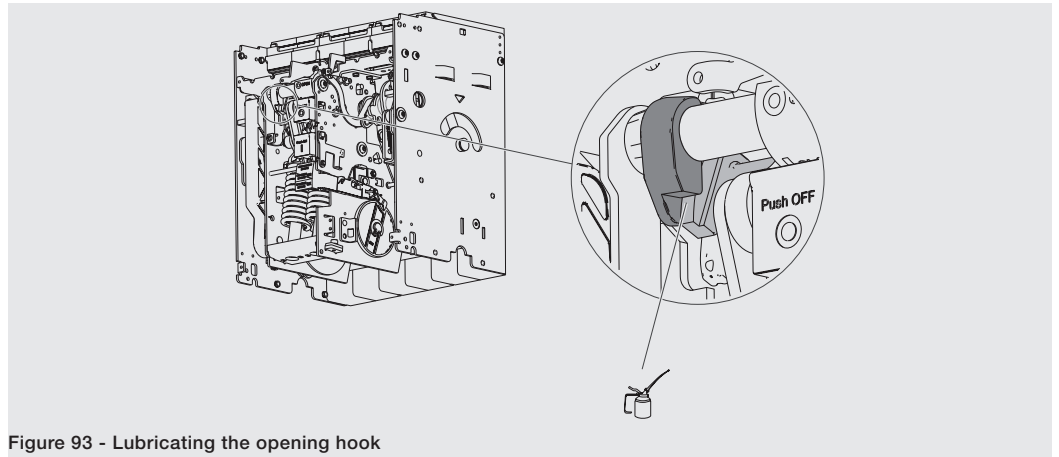


Figure 93 - Lubricating the opening hook

- In the case of deformed or rusty springs, rings missing or severe wear of the operating device, contact ABB Sace.

Inspection of electrical and mechanical accessories

Check the accessories:

1. Check that the accessories are securely fixed to the circuit-breaker.
2. Check that the accessories are connected correctly to the circuit-breaker.
3. Make sure that the coils (YU-YO-YC) are in good condition (no excessive wear and tear, overheating, rupture).
4. Make sure that the mechanical operation counter functions correctly (if present) by operating the circuit-breaker.
5. Check the wear on the brushes of the gearmotor and if necessary replace them.



NOTE: You are recommended to change the gearmotor if it has performed more than 10000 spring loading operations.

Check for wear on the contacts With the circuit-breaker open and springs discharged:

1. Remove the arc chutes

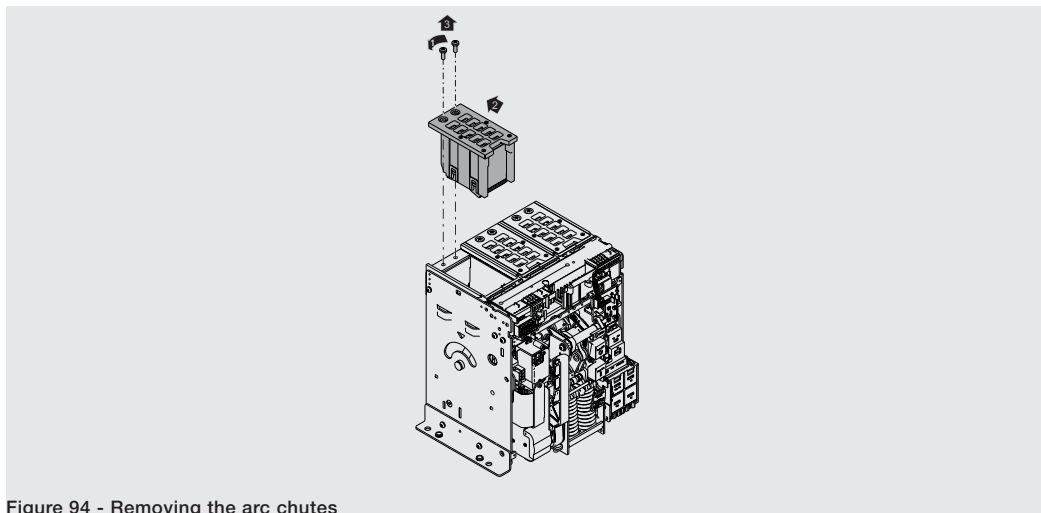


Figure 94 - Removing the arc chutes

2. Check the condition of the arc-breaking chutes: the base of the chute must be undamaged and the plates must be neither corroded nor indented.
3. Remove the dust with compressed air, then clean off all traces of fumes and slag with a brush.
4. Make sure that the contacts are in good condition.
5. Visually check to make sure that the main and arc-breaking plates are in place.
6. Check for tarnishing or beading. If such defects are discovered, ask for assistance from a qualified ABB Technician (*).
7. Check the arc-breaking gaps (distance A).

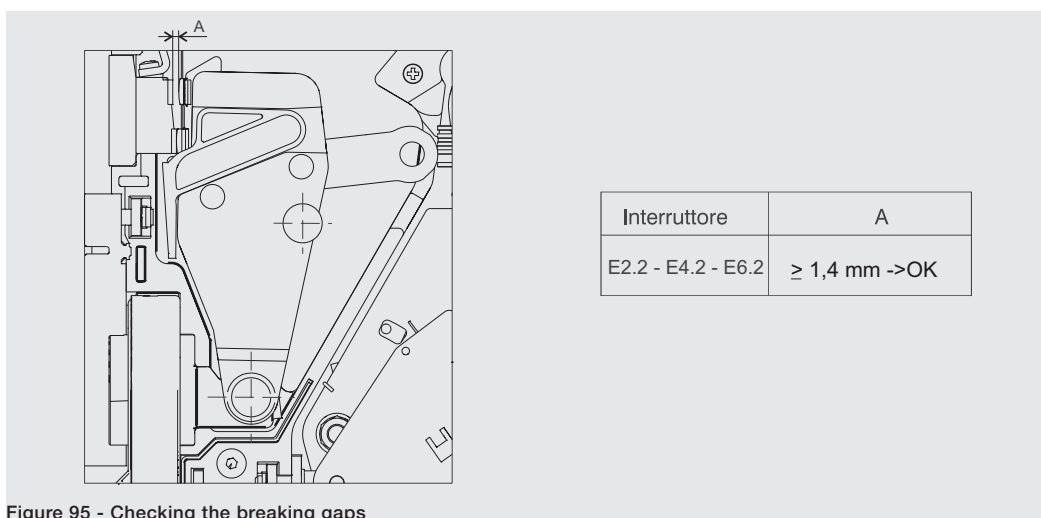


Figure 95 - Checking the breaking gaps

8. Close the circuit-breaker and check dimension A. Contact ABB Sace (*) if dimension A is incorrect. If dimension A is correct, open the circuit-breaker again and re-assemble the arc chutes.



NOTE: (*) After approval from the customer, ABB can proceed with replacement of the worn parts.

Inspection of the protection release

Check that the release is in good condition:

1. Power the protection release with an Ekip TT battery unit.
2. Check the correct operation of the protection release: tripping test with "Trip Test" and "Self-test".
3. With an Ekip Dip release, verify the absence of alarms via the front LEDs.
4. With an Ekip Touch release, verify the absence of alarms via the display and the front LEDs.
5. Make sure that the cables are correctly connected to the release modules and to the release itself (if applicable).
6. On an Ekip Touch release check the percentage of wear on the contacts of the circuit-breaker.
7. Finally, remove the Ekip TT battery unit.

Test with Ekip Connect

Test the release:

1. Connect the Ekip Bluetooth or Ekip T & P unit to the release.
2. Connect the computer where the program is installed by means of a Bluetooth or USB connection.
3. After connecting the computer and release, check that there are no alarm signals by the release. Otherwise, refer to the paragraph "2 - Identification of alarms or failures" on page 94.
4. In the absence of alarms you can proceed to the trip test and self test (depending on the type of release). For future checks it is recommended to insert the current date in the area called "Information". These data will be stored within the release itself.
5. Remove the Ekip Bluetooth or Ekip T & P unit from the release.

Final checks

Reassemble and check the circuit-breaker:

1. Reassemble all the parts by performing all the operations indicated in the paragraph "Disassembly Operations" in reverse order and, if necessary, reconnect the auxiliary power supply.
2. Put the movable part (breakers) in the test position (see indication TEST).
3. Using the various auxiliaries perform the following operations 10 times:
 - *Opening (in both local and remote modes, if applicable)*
 - *Closing (in both local and remote modes, if applicable)*
 - *Tripping via Trip Test from the protection release.*
4. Perform the operations in the following sequence:
 - *Open - Springs unloaded*
 - *Open - Springs loaded*
 - *Closed - Springs unloaded*
 - *Closed - Springs loaded*
5. Check that the following operate correctly:
 - *accessories, if provided.*
 - *gearmotor, if provided.*
 - *under-voltage coil, if provided.*
 - *opening coil, if provided.*
 - *closing coil, if provided.*
 - *auxiliary contacts of the circuit-breaker, if provided.*
 - *lock for circuit-breaker in open position (key or padlock), if provided*

Interlock check

Check that the vertical or horizontal interlocking devices (if provided) are installed and that they operate correctly.



WARNING! the interlocks cannot be tested in the Test or Disconnected positions.

6 - Decommissioning and treatment at end of life

Safety standards During the early stages of the process of decommissioning and end of life treatment of Emax 2 circuit-breakers, observe the following safety rules:

- the closing springs, even if unloaded, must never to be taken apart
- for handling and lifting of the circuit-breakers refer to the section "Unpacking and handling" on page 10 .



HAZARD! RISK OF ELECTRIC SHOCK! Unplug or disconnect any power supply, to avoid any potential risk of shock during removal of the circuit-breaker from the service.



WARNING! After dismantling the switchgear, the circuit-breaker must be stored in the open position with the closing springs unloaded and with the front escutcheon plate mounted.

Qualified personnel The operations for decommissioning Emax circuit-breakers involve performing procedures that can be performed by Trained Persons, in the electrical area (IEV 195-04-02): person adequately informed or supervised by electrotechnical personnel to allow them to perceive the risks and to avoid the hazards potentially created by electricity.

End of life treatment for circuit-breaker materials The materials used in the production of Emax 2 circuit-breakers are recyclable and should be treated separately as shown in the following table:

TYPE	MATERIAL
A	Plastic parts ⁽¹⁾
B	Metal parts
C	Printed circuits
D	Current sensors, cables, motors, electrical windings

⁽¹⁾ All the components of significant dimensions bear a mark specifying the type of material.



NOTE: refer to the national legislation in force at the time of decommissioning of the product, in the case where it specifies end of life treatment procedures different to those indicated.

Disposal of packing materials The materials used for the packaging of Emax 2 circuit-breakers are recyclable and should be treated separately as shown in the following table:

TYPE	MATERIAL
A	Plastic parts
B	Cardboard parts
C	Wooden parts
D	Metal parts



NOTE: refer to the national legislation in force at the time of decommissioning of the product, in the case where it specifies end of life treatment procedures different to those indicated.

