

Configuration of the inputs The inputs of the module can be configured separately in the Arc Flash 6F page:

- Input S1 and Input S2 for the modul 6F-1
- Input S3 and Input S4 for the modul 6F-2

The following table lists the configurable parameters for each input:

Parameter	Description	Default
Input AFS Enable	Enables/disables the input and relevant state and alarm controls	Disabled
Number of Sensors of AFS	Indicates the number of sensors connected to the input, can be set between 0 and 3	0

Configuration of protections The Arc Flash AF1 and AF2 protections can be enabled and configured in the configuration pages of the Other protections, parameters A B and C.

The next table lists the configuration parameters of the two Arc Flash protections.

Parameter	Description	Default
Status	Enables/disables the protection.	Disabled
Trip enable	Enables/disables transmission of the opening command of the circuit-breaker. If disabled, the alarm is managed as information only.	Disabled
Arc-Flash1 Ch1 Arc-Flash1 Ch2 Arc-Flash2 Ch1 Arc-Flash2 Ch2	One parameter for each channel/input. If enabled, pairs the protection channel and this trips if at least one of the paired channels detects an electric arc.	See note
BlockOnProgStatusA BlockOnProgStatusB BlockOnProgStatusC BlockOnProgStatusD	One parameter for each programmable state A B C and D. If enabled, deactivates the protection if the condition paired to the relevant programmable state is fulfilled.	---
Current enable	Enables/disables current monitoring. If enabled and when an electric arc is present, the protection is only activated if at least one phase current exceeds the "Current Threshold".	Enabled
Current Threshold	If an electric arc is present and the "Current enable" parameter is enabled, defines the threshold that at least one phase current must exceed in order to activate the protection. Setting range from 0.3 to 10 In, in 0.1 In steps.	2,00 In



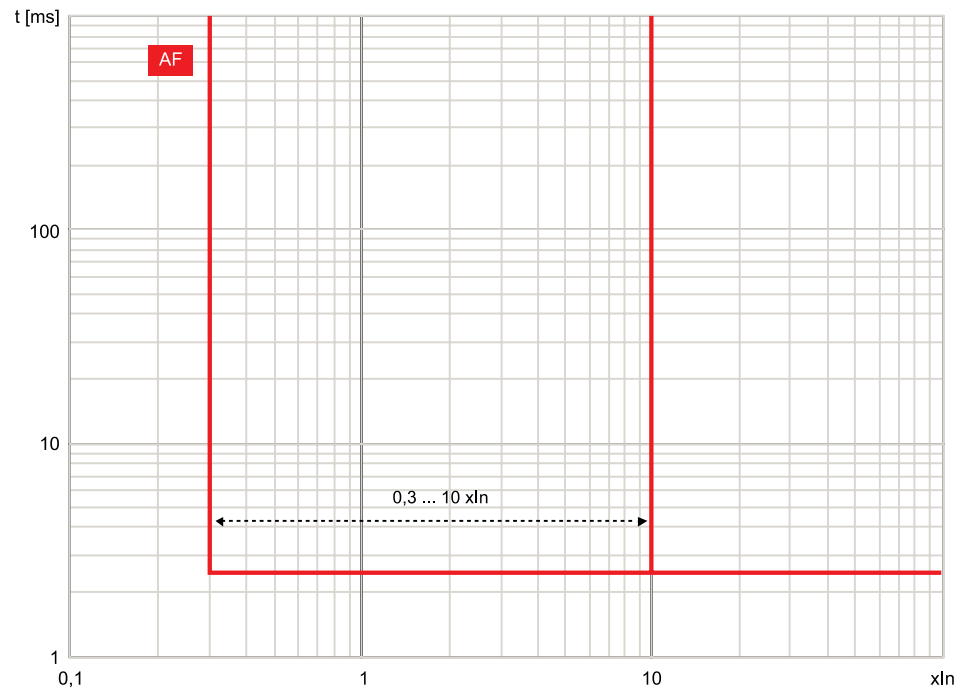
NOTE: Arc-Flash1 Ch1 and Ch2 are enabled by default for protection AF1. Arc-Flash1 Ch1 and Ch2 are enabled by default for protection AF2.

States and alarms The state of the inputs of the module and any Arc Flash configuration errors can be viewed in the Warnings/Alarms page:

- ArcFlash Connection Alarm warns of the absence of sensors connected to an enabled input
- ArcFlash Sensor Number Warning indicates that a number of sensors are connected to an enabled input differing from the one configured
- AF1 Configuration Error indicates that there is an error or inconsistency in the protection configuration
- AF2 Configuration Error indicates that there is an error or inconsistency in the protection configuration

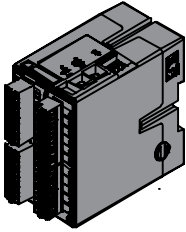
Additional information Besides the serial number and software version of the module, the state of the CRC (correctness of software installed in the module) and activated memory bank can be viewed via USB-C port, via BLE and via system bus.

Trip curve of the protections The maximum trip time with AF1 or AF2 protection, using either only light detection or light plus current (above the threshold set by the Current Threshold parameter), is 2.5 ms. For the total clearing time, please refer to white paper: Arc flash hazards ([1SDC220112G0201](#)).



Other electronic accessories

1 - Ekip Signalling 10K Link



Ekip Signalling 10K Link is an external accessory signaling module. It can be installed on a standard 35 mm DIN rail (DIN EN 50022 type TS 35x15 mm).

This module has:

- Ten programmable output contacts
- Ten or eleven programmable digital inputs
- One power led and twenty or twenty-one signaling leds (one for each input/output)

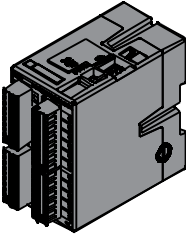
The module must be connected to a Link bus network.

Further details about *Ekip Signalling 10K Link* are available in ABB Library, especially in document [1SDH002524A1001](#).



IMPORTANT: make sure that you have read the recommendations concerning security and prevention from unauthorized access.

2 - Ekip Signalling Modbus TCP



Ekip Signalling Modbus TCP is an external accessory module. It can be installed on a standard 35 mm DIN rail (DIN EN 50022 type TS 35 x 15 mm).

Its function is to share on another Ethernet network with communication protocol.

The module has 11 digital inputs and 10 output contacts:

- The inputs allow the state of the devices and other information to be monitored
- The outputs allow the circuit-breakers to be operated.

Each input and output is associated with a state LED.

The module can operate in three modes:

Mode	Characteristics
CB Supervisor	The module can be associated with a single circuit-breaker, which can be selected from a list. Configuration of the inputs and output is pre-defined
Multi MCCB Supervisor	The module can be associated with up to five circuit-breakers. Configuration of the inputs and output is pre-defined. i NOTE: mode available with moulded case circuit-breakers
Free I/O	The inputs and outputs can be fully configured by the user

The module can be supplied by 110...240 V AC / DC or 24...48 V DC.

Further details about *Ekip Signalling Modbus TCP* are available in ABB Library, especially in document [1SDH001456R0002](#).

3 - Rc Toroid



Rc is an external residual current sensor which can be installed in Ekip Aware units equipped with Rc Protections packages.

Presence of the toroid must be enabled in the menu (*Settings-Configuration-External Toroid* = Toroid RC) when Ekip Aware is being programmed. When the sensor is enabled, the protection release automatically activates runtime verification of the connection.



IMPORTANT: The toroid can be selected as an alternative to that of S.G.R.; protections Gext, MDGF and Rc are alternatives to each other. Toroid RC can be selected if the Measuring digital upgrade is present (see page 146).

All parameters are also available via the remote connection systems.

Further details about the *Rc toroid* connection are available in ABB Library, especially in document [1SDH002310A1521](#).

4 - S.G.R. Toroid



S.G.R. or *Source Ground Return* is the external single-pole current sensor available for the LSIG version of Ekip Aware and in the other versions with optional Ground Protection packages

Presence of the toroid must be enabled in the menu (*Settings-Configuration-External Toroid* = Toroid SGR) when Ekip Aware is being programmed. Once the selector has been enabled, the parameter for selecting the Size appears in the menu and the protection release automatically activates runtime verification of the connection.



IMPORTANT: the toroid can be chosen as an alternative to the Rc one; protections Gext, MDGF and Rc are alternatives to each other

All parameters are also available via the remote connection systems.

Further details about the *S.G.R. toroid* connection are available in ABB Library, especially in document [1SDH002310A1507](#).

5 - Sensor MDGF

When in the LSIG version or equipped with the optional Ground Protection package, Ekip Aware can be connected to earth fault current protection systems in the MDGF configuration.

Presence of the sensor must be enabled in the menu (*Settings-Configuration-External Toroid* = Toroid MDGF) when Ekip Aware is being programmed. Once the selector has been enabled, the parameter for selecting the Size appears in the menu and the protection release automatically activates runtime verification of the connection.

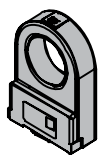


IMPORTANT: otherwise the sensor can be selected via Rc toroid and Gext; Gext, RC and MDGF protections are alternatives to each other

All parameters are also available via the remote connection systems.

Further details about MDGF sensor connection are available in ABB Library, specifically in document [1SDM000056A1001](#).

6 - External neutral



It is a current sensor for the neutral pole outside the circuit-breaker, available in several sizes (for each CB model, from E1.3 to E6.3) and versions (sensor closed or openable), which allows neutral protection to be created via connection to Ekip Aware.

It is intended for three-pole circuit-breakers only and is supplied on request.

Configuration

To activate the presence of the sensor, set the *Configuration* parameter in the *Settings - Configuration* menu as: 3P+N.

If the sensor is the openable version, after having activated the 3P+N configuration, the model installed must be indicated in the *Settings - Configuration* menu.



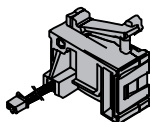
IMPORTANT: The user must also select the model when changing from the openable sensor version to the closed one. In this specific case, the user must select Sensors A/B.

The parameters are also available via the remote connection systems, for example, via Ekip Connect in the *Unit Configuration* page.

Further details about connection of the *External neutral* are available in ABB Library, specifically in documents

- [1SDH002310A1506](#) for circuit breakers E1.3 and E2.3
- [1SDH002310A1515](#) for circuit breakers E4.3 and E6.3

7 - Ekip AUP



The communication modules are always supplied with dedicated Ekip AUP auxiliary position contacts. In case of a withdrawable circuit-breaker, the Ekip AUP contacts give the signal of moving part racked-in/out from the fixed part.

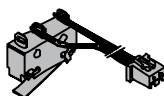
The assembly assures that the position signalling is given also with the moving part withdrawn.



IMPORTANT: if there are more than one communication modules, only one of these can be connected to the Ekip AUP contacts

Further details about assembly of the modules and the Ekip AUP contacts are available in ABB Library, particularly in document [1SDH002310A1811](#).

8 - Ekip RTC



The communication modules are always supplied with auxiliary contact Ekip RTC, which provides the protection release with the "circuit-breaker ready to receive a close command" signal.

Further details about assembly of the Ekip RTC contact are available in ABB Library, especially in document [1SDH002309A1614](#).

9 - Trip Unit I/O terminals



Trip Unit I/O terminals are required for withdrawable circuit-breakers so that the Trip Unit can be connected in the presence of external voltage sockets, toroid RC, toroid S.G.R., external neutral sensor and zone selectivity.

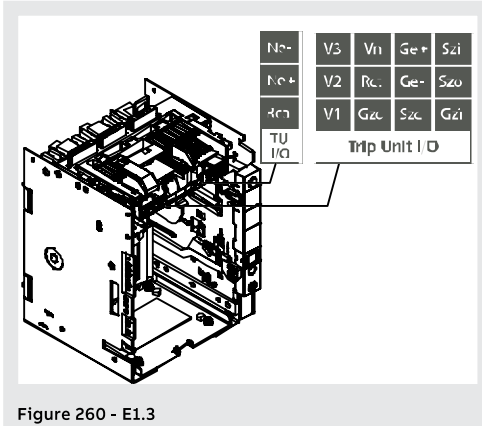


Figure 260 - E1.3

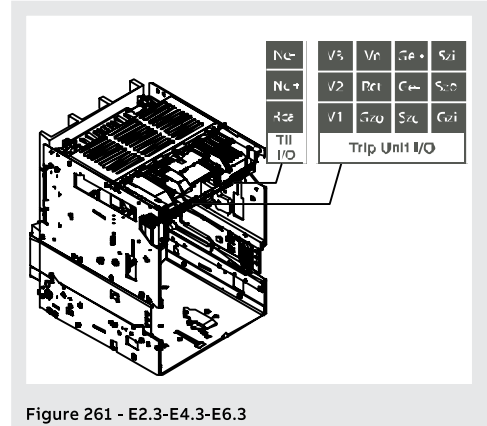
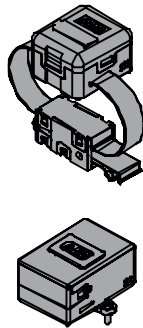


Figure 261 - E2.3-E4.3-E6.3

Details about assembly are available in ABB Library, especially in document [1SDH002310A1615](#).

10 - T-Sense Ambient e T-Sense Busbar



HAZARD! RISK OF ELECTRIC SHOCK! Make sure the busbars are not energized before working on the T-Sense Busbar accessories.



IMPORTANT: this device conforms to radio equipment directive 2014/53/EU (RED) and FCC regulation part 15. Operation is subject to the following conditions:

- it must not cause harmful interference
- it must accept any interference received, including interference that could cause an undesired operation

T-Sense Ambient and T-Sense Busbar are electronic accessories that can be installed in the switchboard for the purpose of measuring environmental information such as temperature and humidity. The data can be viewed via EPiC, Ekip Connect and Ekip Aware (temperature only).



NOTE: Reading data are not transmitted during configuration

Both accessories can connect via a BLE MESH network to Ekip Aware, which is able to receive information from up to 16 devices and, in turn, makes the information available in real time for monitoring and signalling purposes.



NOTE: prolonged inactivity may result in the accessory being disconnected from the network.



WARNING! the busbars must be disconnected from the power supply when the T-Sense Busbar accessories are configured. The modules must be energized via the USB-C port.

Continued on the next page



NOTE: press the button on the accessory to perform the configuration operations via EPiC. Once the button has been pressed you have 60 s to complete the configuration, after which the operation will be interrupted. Press the button again to resume the operation; the procedure will continue from the point at which it was interrupted. If the accessory fails to connect, move it closer to the CB.

The two T-Sense accessories differ in certain operating characteristics:

- T-Sense Ambient is an independent device supplied by an internal battery and can be installed in any part of the switchboard
- The T-Sense Busbar device uses the currents in the busbars of the switchgear to self-energize itself, with a minimum 40A. To enable the T-Sense Busbar device to function, the power supply connection strap must wrap around the busbar. The T-Sense Busbar device can be assembled on busbars measuring 5 mm X 50 mm up to 10 mm X 100 mm. One or more T-Sense Busbar devices can be installed per busbar



NOTE: Configuration of the alarm thresholds is described on page 326.

T-Sense accessories have a LED, which lights up in the following cases:

- one flash every 60 seconds to indicate that data is being sent
- one flash every 3 seconds during configuration

The accessories provide the following measurements:

Accessory	Quantity	Operating Ambient T range	Measurable T operating range	Accuracy
T-Sense Ambient	Temperature	-40 ... 70°C	-40 ... 70°C ⁽¹⁾	1 %
	Humidity	0 - 100 %	0 - 100 %	2 %
T-Sense Busbar	Temperature	-40 ... 70°C	-40 ... 120°C ⁽²⁾	1 %
	Humidity	0 - 100 %	0 - 100 %	2 %

(1) up to 90°C if the operating temperature is < 50°C

(2) up to 150°C for a limited time

A network configuration procedure is required to activate the connection between the accessories and Ekip Aware, as described on page 87.

Further details are available in ABB Library, especially in document [1SDH002310A1557](#).

Commissioning and maintenance

1 - Commissioning

Introduction The general check is necessary:

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

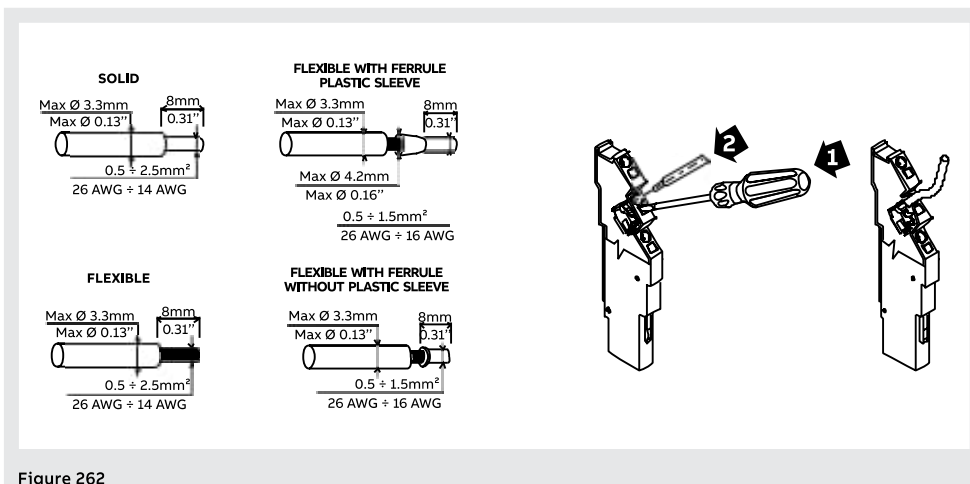


Dangerous voltage ACCIDENTAL CONTACT WITH LIVE POINTS CAN CAUSE SHOCK, BURNS AND RESULT IN DEATH. Check that the circuit-breaker with all switchgear apparatus are de-energized.

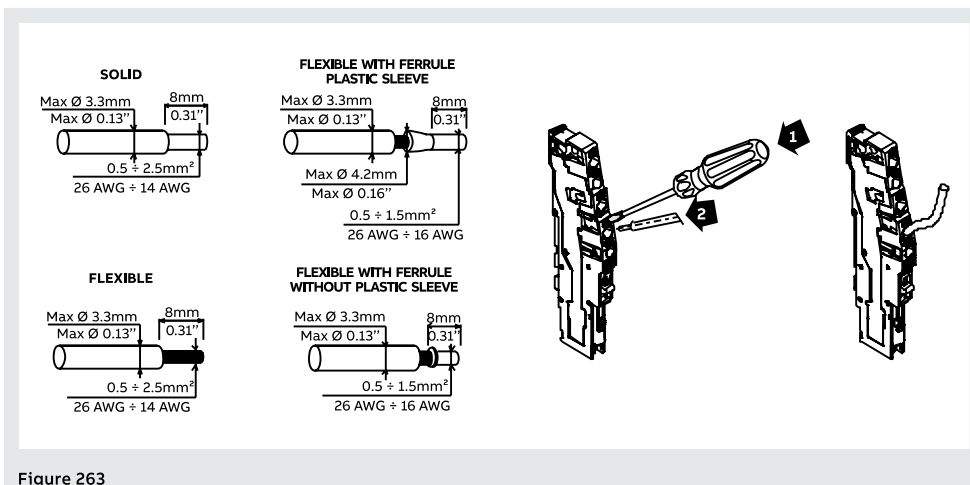


WARNING! The verifications involve procedures which must only be performed by persons skilled in the electrical field (IEV 195-04-01): person with sufficient training and experience to enable him or her to perceive risks and avoid the dangers potentially created by electricity) and mechanical.

Terminal wiring Indication of cable size for wiring terminals:



5-way terminal cabling Indication of cable size for wiring terminals:



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, clearances respected)
	4. The installation environmental conditions must be consistent with the "Environmental conditions" specifications on page
Connections	1. Power connections tightened to the terminals of the circuit-breaker
	2. Cables and busbars with adequate cross-section
	2. Busbars with adequate cross-section
	3. Correct ground connections
Operations	4. Maximum distances of separators respected
	Perform some opening and closing operations (See chapter "Description of the product - circuit-breaker opening/closing operations on page 20). The spring loading lever must move with regularly
Trip unit alarm	 IMPORTANT: in the presence of an undervoltage coil the circuit-breaker can be closed only after the trip unit is energized
	Energize the protection release by connecting to the USB-C port using a Power bank or a PC or a Smartphone and check on the display to make sure there are no alarms
State of circuit-breaker on Ekip Aware	With Ekip Aware, the circuit-breaker state must be read correctly (see table on page 359). Perform a circuit-breaker closing/opening operation and make sure that change of state is read correctly
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
Ekip Aware parameters	Access the protection release via the Ekip Connect or EPiC application to check and edit the parameters. Edit the protection parameters, the circuit-breaker configuration, the configuration of the external and internal accessories, the frequency, PIN code, date and language as required.



NOTE: for security reasons, ABB strongly advises you to change the PIN right from the first access and to keep it with care.

Check 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 to charge the springs at the relevant rated voltage.
	Result: The springs are charged correctly. The signals are normal. When the springs are charged the gearmotor stops.
	2. Perform some closing and opening operations.
	Result: The gearmotor recharges the springs after every closing operation.
Undervoltage coil and Sense undervoltage coil	 IMPORTANT: <i>If present, power the undervoltage coil in advance.</i>
	1. Power the undervoltage coil at the relevant rated voltage and perform the closing operation on the circuit-breaker.
	Result: The circuit-breaker closes correctly; the signals are normal.
	2. Turn off the voltage supply to the trip unit. The circuit-breaker opens.
	3. Energize the undervoltage coil with the rated voltage. Charge the springs and close the circuit-breaker to perform the circuit-breaker closing operating.
	4. For Sense undervoltage coil only, check for the presence of the coil in the protection release menu
	Result: The circuit-breaker closes; the signal switches over.
Opening coil	 IMPORTANT: If the undervoltage 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 due to a power failure. Otherwise, examine the circuit-breaker and the associated equipment to make sure that they are in a good condition.
	1. Close the circuit-breaker.
	2. Power the opening coil at the relevant rated voltage.
Closing coil	Result: The circuit-breaker opens correctly; the signals are normal.
	1. Open the circuit-breaker.
	2. Charge the springs manually or electrically.
Sense opening coil	3. Power the closing coil at its rated voltage.
	Result: The circuit-breaker closes correctly; the signals are normal.
	1. Power the protection trip unit with the Vaux auxiliary power supply.
Sense opening coil	2. Supply the contacts of the Sense coil at the relevant rated voltage.
	3. Close the circuit-breaker
	4. Connect the protection release to a PC or to the smartphone via USB-C connector.
	5. Access the protection release using the Ekip Connect or EPiC APPs and make sure that the Sense opening coil is activated and detected.
	6. Access the Sense coil page and select the "Open CB" command
	Result: The circuit-breaker opens correctly; the signals are normal.
	 IMPORTANT: <i>The test can be performed if the trip unit and the coils are energized.</i>

^(*) If present.

Continued on the next page

Accessories ^(*) to be checked	Procedure
Sense closing coil	1. Power the protection trip unit with the Vaux auxiliary power supply.
	2. Supply the contacts of the Sense coil at the relevant rated voltage.
	3. Charge the springs.
	4. Connect the protection release to a PC or to the smartphone via USB-C connector.
	5. Access the protection release using the Ekip Connect or EPiC APPs and make sure that the Sense closing coil is activated and detected.
	6. Access the Sense coil page and select the "Close CB" command
	Result: The circuit-breaker closes correctly; the signals are normal.
	 IMPORTANT: The test can be performed if the trip unit and the coils are energized.
Lock for circuit-breaker in open position (key or padlock)	1. Open the circuit-breaker
	2. Keep the opening pushbutton pressed
	3. Turn the key and remove it
	For padlocks:
	3.1 Turn lock selector switch to padlocks
	3.2 Insert a padlock of the required size
	3.3 Remove key from padlock
	4. Attempt the circuit-breaker closing operation. Result: Both manual and electrical closing is prevented.
Auxiliary open/closed 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. bring the circuit-breaker to the connected, isolated for test and disconnected position.
	Result: the signals due to the relative operations are normal.
Locking devices for connected/test/disconnected positions ^(**)	1. Perform operating tests.
	Result: the interlocks function correctly.
Interlocks between circuit breakers assembled side by side and stacked	1. Perform operating tests.
	Result: the interlocks function correctly.
Racking-in/out device ^(**)	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 proper installation. The supply voltage of the auxiliary accessories must be between 85% and 110% of the rated voltage for the auxiliary accessories.
External modules	1. For all modules with terminal box: check connection to <i>Ekip Supply</i> in mechanical seat of terminal box.
	2. Supply the protection release and make sure it powers up
	3. Check on menu or via Ekip Connect to make sure that the local bus on protection release is enabled
	4. Check that the Power LED on each module is on in the same way as the Power LED of Ekip Aware (steady or synchronous flash)
	5. Check on menu or via one of the Ekip Connect APPs or EPiC to make sure that all installed modules are present and that there are no alarms

^(*) If present.

^(**) Withdrawable versions only.

Continued on the next page

Accessories ^(*) to be checked	Procedure
Internal Sense moduls	1. Make sure that the protection release is on and that both Vaux and BLE are on
	2. Connect to the protection release via Ekip Connect or EPiC and check that all the Sense accessories provided for by the CB (Sense coils, M-Sense Enabler) are enabled and detected
	3. If they are not enabled, activate and check that they are detected and that there are no errors.
T-Sense Moduls	1. For all T-Sense modules, make sure that the following are on
	2. Make sure that the protection release is on and that both Vaux and BLE are on.
	3. Connect to the protection release via Ekip Connect or EPiC and either create the MESH network for connection to the T-Sense accessory or make sure that it is present.
	4. Make sure that all the required T-Sense accessories are present and detected
Single-pole sensor SGR or MDGF, residual current sensor Rc (if its presence is provided for by the Trip unit model / Rc package)	1. Make sure that the sensor is connected to the terminal box
	2. Supply the protection release and make sure it powers up
	3. Access the Info-Feature Collect menu and make sure that the protections with external sensors (Gext for sensor SGR, MDGF for sensor MDGF, Rc for sensor RC) are present
	4. Access the Settings-Configuration-Earth protection menu and configure the presence of sensor (SGR, MDGF or Rc)
	5. Select size for SGR and MDGF
	6. Check diagnosis bar to make sure there are no alarms
	7. Connect to Ekip Connect or EPiC and set the protection parameters
Zone selectivity	1. Check selectivity connections (between Ekip Aware and the other units) as shown in circuit diagrams
	2. Provide Ekip Aware with auxiliary power and make sure that CB status is: Open
	3. Check that the protection of the selectivity concerned has been enabled (example: S protection)
	4. Select the <i>Test - Zone Selectivity</i> menu and the submenu of the protection concerned; repeat points 5, 6, 7 and 8 for each protection activated
	 IMPORTANT: for selectivity D, consider submenu S for the Forward connections and G for the Backward connections
	Check Output:
	5. Select the <i>Force Output</i> command and check, on the unit connected to the Ekip Aware output, that the state of its <i>Input</i> = ON
	6. Select <i>Release Output</i> and check on the unit that <i>Input</i> = OFF
	Check Input:
	7. Select the <i>Force Output</i> command in the unit connected to the input of Ekip Aware; check on protection release: <i>Input</i> = ON
	8. Select <i>Release Output</i> and check on Trip unit: <i>Input</i> = OFF

^(*) If present.

Final check list Perform the operations described below after having completed the general inspection procedures and checked the accessories. Print this sheet and use it to make an inspection report in the "Checks" column.

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	Ekip Aware parameters	Adjust the protection release as required by the design data of the installation (at the installation designer's charge)	
4	Connecting the voltage	Connect the auxiliary voltage	
5	Closing the switchgear	Close the switchgear door	
6	Charging the springs	Charge the closing springs	
7	Undervoltage coil	Make sure that undervoltage coil is energized	
8	Opening and closing coils	Make sure that opening and closing coils are NOT energized	
9	Mechanical interlock of the circuit-breaker	If present, make sure that the mechanical interlock of the circuit-breaker is not active	
10	Locking devices	If present, make sure that the locking devices of the circuit-breaker are not active	
11	Status signals	Make sure that the signalling devices on the front of the circuit-breaker indicate: circuit-breaker open - springs discharged O - OPEN and white spring signalling device DISCHARGED SPRING	

2 - Maintenance

Safety standards Comply with the following mandatory recommendations during maintenance work.



Dangerous voltage ACCIDENTAL CONTACT WITH LIVE POINTS CAN CAUSE SHOCK, BURNS AND RESULT IN DEATH.



WARNING! Dangerous voltage and mechanical hazards. Risk of serious injury to persons and damage to equipment. Before proceeding with any maintenance operation, it is mandatory to:

- Set the circuit-breaker to the open position and make sure that the springs of the operating mechanism are discharged.
- If the circuit-breaker is the withdrawable type, withdraw it from the fixed part (see paragraph Circuit breaker racking-in/racking-out operations).
- 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 ground the terminals on both the supply side and load side.
- Use adequate personal protection equipment, ensure that the apparatus is in a safe condition and proceed in accordance with the Laws in force.

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

skilled person, in the electrical field (IEV 195-04-01): person with sufficient training and experience to enable him or her to perceive risks and avoid the dangers 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 The circuit-breakers SACE Emax 3, with or without opening or closing coils, can withstand the following operating cycles if regularly serviced. For further information see chapter on page .

circuit-breaker IEC 60947	Interrupted rated current I _u (40°C) [A]	Mechanical life with regular maintenance		Electrical life		
		No. of operations (x 1000)	Frequency of operations/hour	440 V No. of operations (x 1000)	690 V No. of operations (x 1000)	Frequency of operations/hour
E1.3	< / = 1000	20	60	8	8	30
	1250	20	60	8	6,5	30
	1600	20	60	8	6,5	30
	1250L	20	60	3	1	30
E2.3	< 1250	25	60	15	15	30
	1600	25	60	12	10	30
	2000	25	60	10	8	30
	2500	20	60	8	7	30
E4.3	< 2500	20	60	10	10	20
	2500	20	60	8	8	20
	3200	20	60	7	7	20
	4000	15	60	5	4	20
E6.3	4000	12	60	4	4	10
	5000	12	60	3	2	10
	6300	12	60	2	2	10

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Maintenance schedule

Proper maintenance of the equipment allows good electromechanical operation to be maintained over time.

The maintenance plan for SACE Emax 3 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.

Activity	Frequency in standard environments	Frequency in dusty environments (dust level measured > 1mg/m ³)
E1.3 maintenance	One year or 2000 operations or after tripping due to short circuit	6 months or 1000 operations or after tripping due to short circuit
E2.3-E4.3-E6.3 first level maintenance	One year or 20% of mechanical life or 20% of electrical life	6 months or 10% of mechanical life or 10% of electrical life
E2.3-E4.3-E6.3 second level maintenance	Three years or 50% of mechanical life or 50% of electrical life or after a trip due to short-circuit	18 months or 25% of mechanical life or 25% of electrical life or after a trip due to short-circuit
Lubrication of jaw-type isolating contacts of withdrawable circuit-breaker	100 racking-in and racking-out operations ⁽¹⁾ or three years	50 racking-in and racking-out operations ⁽¹⁾ or 18 months
Command replacement ⁽²⁾	10000 operations for E4.3 V; 6000 operations for E6.3V and E6.3X	

⁽¹⁾ Keep track of the number of racking in and out operations or make an estimate on the basis of the average number of racking out operations to ensure that the jaw-type isolating contacts are cleaned and lubricated correctly.

⁽²⁾ For command replacement, contact ABB.

Compliance with the following rules is also recommended:

- Circuit-breakers that are operated infrequently or that remain closed or open for long periods of time must also be subjected to programmed maintenance.
- All circuit-breakers provide the number of operations performed when the protection release is energized by auxiliary power supply. Ekip Aware releases provide this information on the display at any time.
- During the service, visually inspect the circuit-breaker from the outside to check for the presence of dust, dirt or damage.

3 - First level maintenance

The maintenance operations must be carried out in accordance with the maintenance plan indicated on page 343.

Preliminary operations



WARNING! Dangerous voltage and mechanical hazards. Risk of serious injury to persons and damage to equipment. Before proceeding with any maintenance operation, it is mandatory to:

- Set the circuit-breaker to the open position and make sure that the springs of the operating mechanism are discharged.
- If the circuit-breaker is the withdrawable type, withdraw it from the fixed part (see paragraph Circuit breaker racking-in/racking-out operations).
- 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 ground the terminals on both the supply side and load side.
- Use adequate personal protection equipment, ensure that the apparatus is in a safe condition and proceed in accordance with the Laws in force.

Inspections and general cleaning

Perform the following checks:

1. Make sure the circuit-breaker is clean. Use a clean, dry cloth to remove dust and traces of oil or excess grease. Use a mild detergent if necessary. If there is a thick build-up of dirt, use a thinner available in the ABB greasing kit or contact the service staff.
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. Use clean brushes and cloths to remove dust or dirt. Use a mild detergent if necessary. Use a thinner of the Chemma 18 type or equivalent if there is a thick built-up of dirt.
2. Make sure there is no trace of localized overheating on the terminals. Overheating alters the colour of parts in contact, which are usually a silvery white colour.
3. Check that the bolts used to fasten all the connections to the terminals are well tightened as indicated in the kit instructions of the terminals.

Disassembly operations for circuit breakers E1.3

To disassemble the parts of the circuit-breaker:

1. Remove the front cover (A) by removing the mounting screws (B and C).
2. With a four-pole circuit-breaker (Figure 264 - Four-pole fixed circuit-breaker), remove the lateral shield (D) by removing the fixing screws (E).
3. With circuit-breaker in the withdrawable version (Figure 265 - Three-pole withdrawable circuit-breaker), remove the protection (F) and the terminal-cover (G) by removing the screws (H)

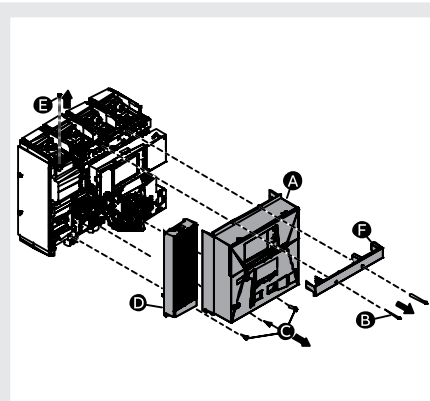


Figure 264 - Four-pole fixed circuit-breaker

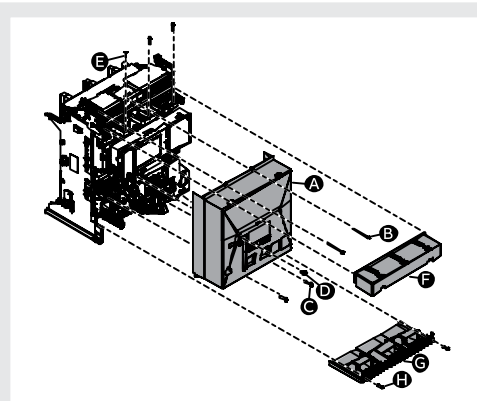


Figure 265 - Three-pole withdrawable circuit-breaker

4. Remove the gearmotor (I) by removing the screw (L).

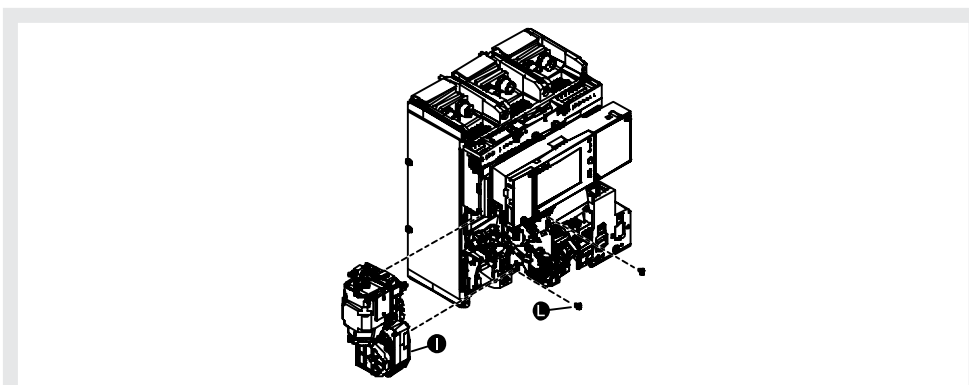


Figure 266 - Removing the gearmotor

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

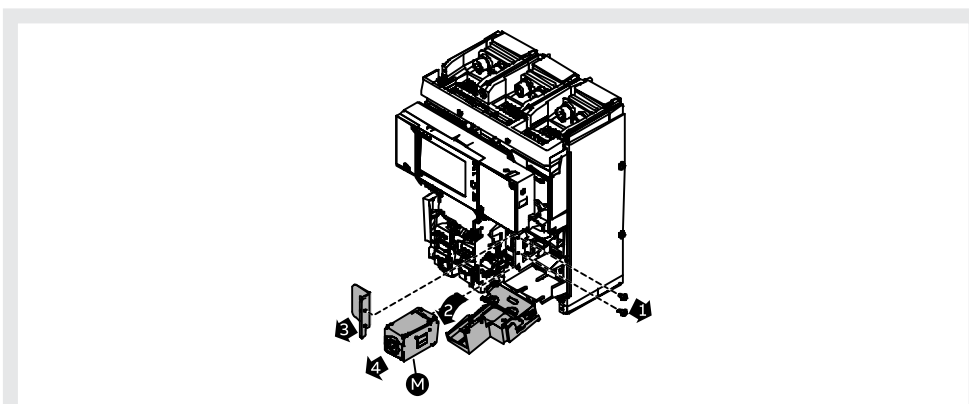


Figure 267 - Removing the undervoltage coil

Disassembly operations for circuit breakers E2.3-E4.3-E6.3

To disassemble the parts of the circuit-breaker:

1. Remove the transparent flange (A) of the trip unit, by turning the screws (B).
2. Remove the front cover of the circuit-breaker (C), by removing the mounting screws (D).

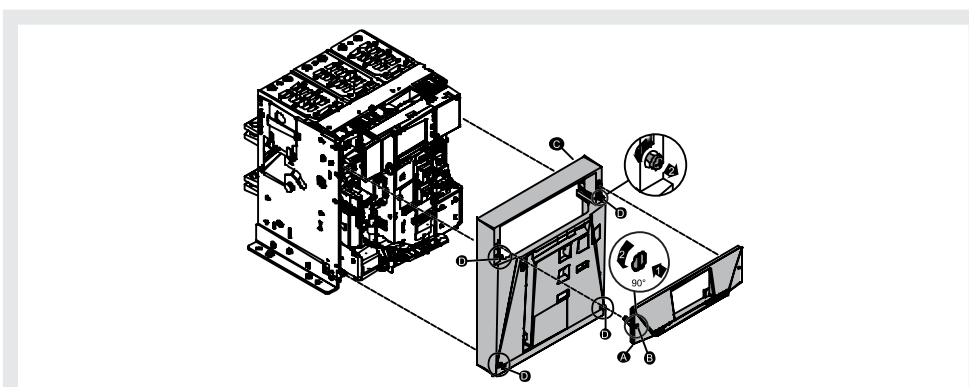


Figure 268 - Removing the flange and front cover

3. Remove the gearmotor (E) by removing the screw (F) and the connector. Before proceeding, consult document [1SDH002310A1609](#).

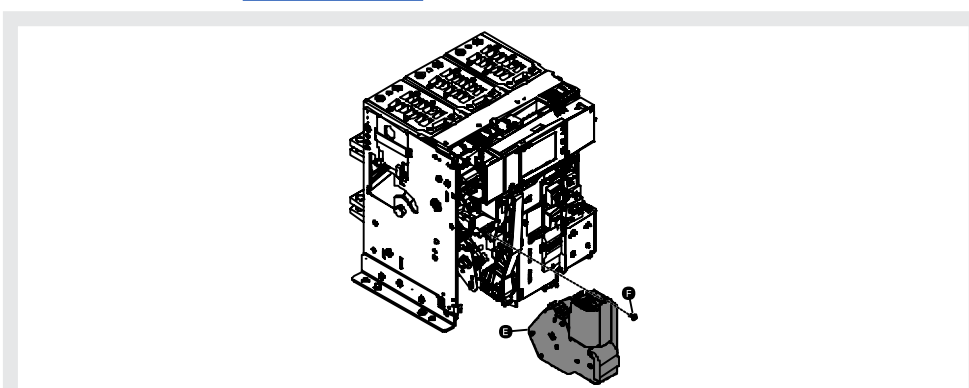


Figure 269 - Removing the gearmotor

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

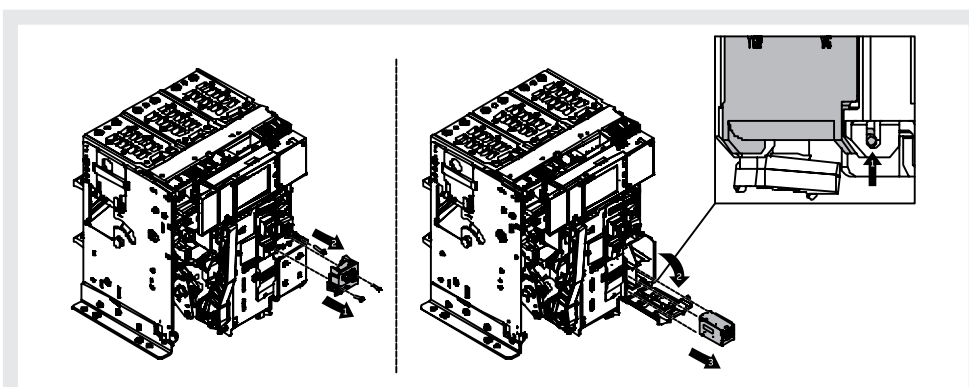


Figure 270 - Removing the undervoltage coil

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 Chemma 18 or equivalent.
2. Lubricate the closing shaft and closing latch in the indicated points, using the ABB greasing kit or Mobilgrease 28.
3. Make sure that the closing shaft is free to rotate.

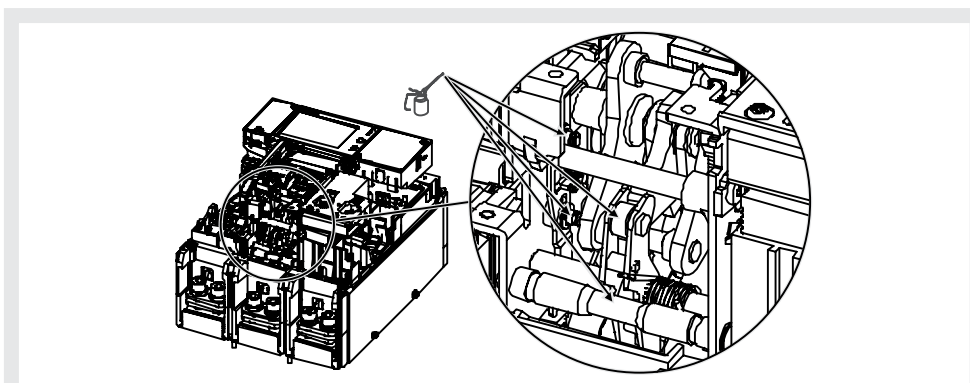


Figure 271 - Lubrication of the shafts and closing and opening latches

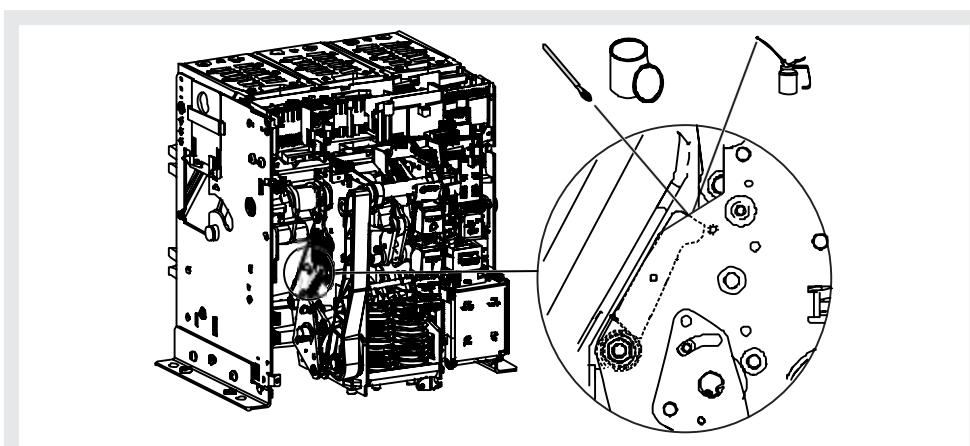


Figure 272 - Lubricating the shaft and closing hook

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.



IMPORTANT: it is advisable to replace the gear motor if it has performed more than 10000 spring charging operations or reached 50% of the declared mechanical life of the circuit-breaker.

Inspection of the protection trip unit

Check that the trip unit is in good condition:

1. Energize the protection release with Power bank, PC or Smartphone connected to the USB-C port.
2. Check the correct operation of the protection trip unit: tripping test with "Trip Test" and "Autotest".
3. Using Ekip Aware, check display and front LED to make sure there are no alarms. If alarms are present consult chapter Alarms or failures from page 359.
4. Make sure that all outgoing wiring (terminal box, terminal box modules, if present) is correctly connected
5. Check, via Ekip Aware, the percentage of wear of the circuit-breaker contacts and the state of health of the protection release and accessories. Check all the information in the Diagnostic menu, via display.
6. Having terminated, remove the supply connection made in step 1 from the protection 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. If necessary, reconnect the auxiliary power supply.
2. Put the movable part (breakers) in the test position (see indication TEST).
3. 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
4. Perform the operations in the following sequence:
 - Open - Springs discharged
 - Open - Springs charged
 - Closed - Springs discharged
 - Closed - Springs charged
5. Check that the following operate correctly:
 - accessories, if provided.
 - gearmotor, if provided.
 - undervoltage 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.

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

Perform maintenance periodically as indicated in the table below.

Activity	Frequency	Maintenance operations
Functionality	1 year or	See kit sheet
Check tightness	20% of mechanical life or	
Lubrication ^(*)	20% of electrical life	As shown in the figure
Cables	Three years or 50% of the mechanical life or 50% of the electrical life of the largest circuit-breaker involved in the interlock. After a trip due to a short-circuit.	Replacement is advisable

^(*) Use ABB greasing kit or grease of the Mobilgrease 28 type.

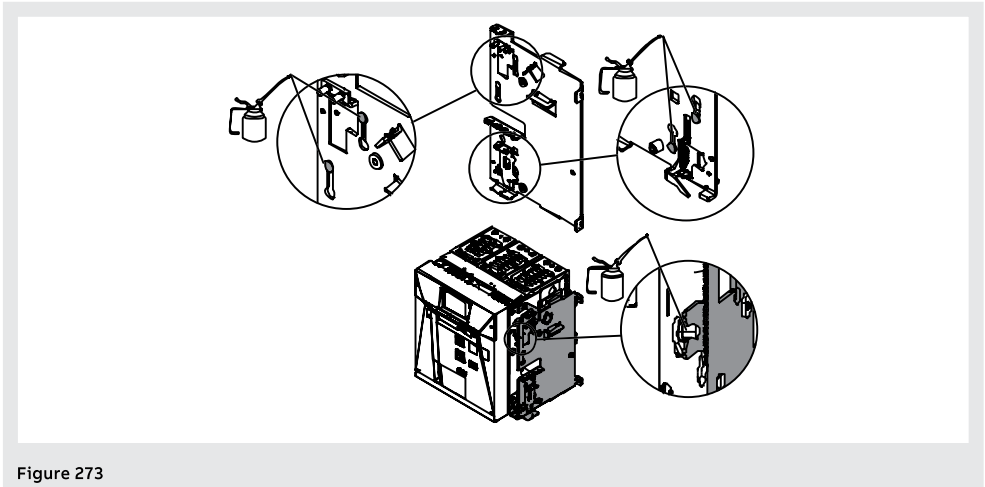


Figure 273

4 - E2.3-E4.3-E6.3 second level maintenance

The maintenance operations must be carried out in accordance with the maintenance plan indicated on page 343.

Preliminary operations



WARNING! Dangerous voltage and mechanical hazards. Risk of serious injury to persons and damage to equipment. Before proceeding with any maintenance operation, it is mandatory to:

- Set the circuit-breaker to the open position and make sure that the springs of the operating mechanism are discharged.
- If the circuit-breaker is the withdrawable type, withdraw it from the fixed part (see paragraph Circuit breaker racking-in/racking-out operations).
- 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 ground the terminals on both the supply side and load side.
- Use adequate personal protection equipment, ensure that the apparatus is in a safe condition and proceed in accordance with the Laws in force.

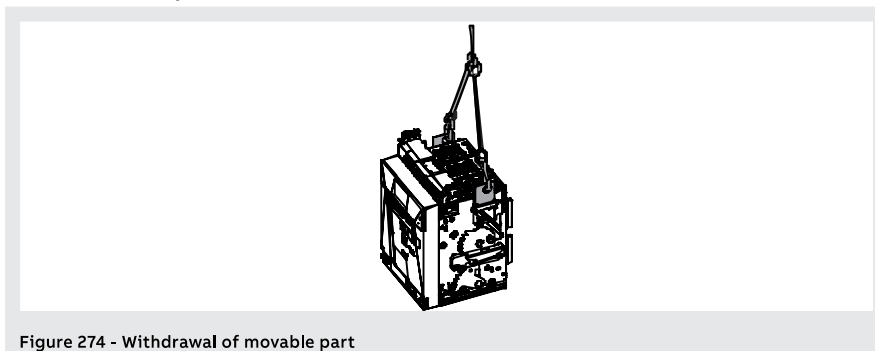


Figure 274 - Withdrawal of movable part

Inspections and general cleaning

Perform the following checks:

1. Make sure the circuit-breaker is clean. Use a clean, dry cloth to remove dust and traces of oil or excess grease. Use a mild detergent if necessary. If there is a thick build-up of dirt, use a thinner available in the ABB greasing kit or contact the service staff.
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 in 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. Check for loose screws of the fixed part of the framework (M8 - 25Nm).

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

Perform the following checks on the connections:

1. Use clean brushes and cloths to remove dust or dirt. Use a mild detergent if necessary. If there is a thick build-up of dirt, use a thinner available with ABB greasing kit or contact the service staff for assistance.
2. Make sure there is no trace of localized overheating on the terminals. Overheating alters the colour of parts in contact, which are usually a silvery white colour.
3. Check that the bolts used to fasten all the connections to the terminals are well tightened as indicated in the kit instructions of the terminals.

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

1. Remove the transparent flange (A) of the trip unit, by turning the screws (B).
2. Remove the front cover of the circuit-breaker (C), by removing the mounting screws (D).

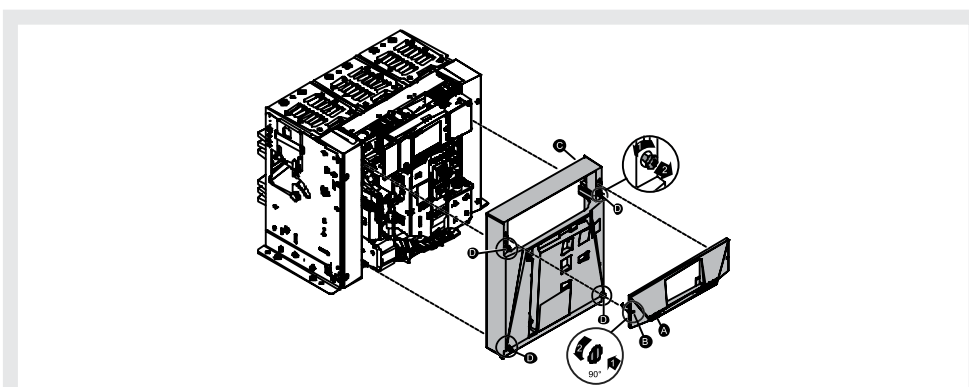


Figure 275 - Removing the flange and front cover

3. Remove one or both of the side guards (E) (if installed) by removing the front screws (F).
4. Remove the gearmotor (G) by removing the screw (H) and the connector. Before proceeding, consult document [1SDH002310A1609](#).

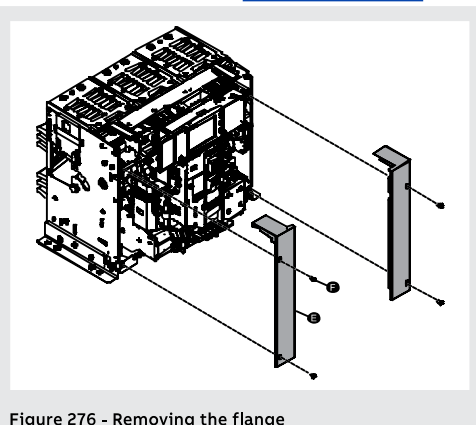


Figure 276 - Removing the flange

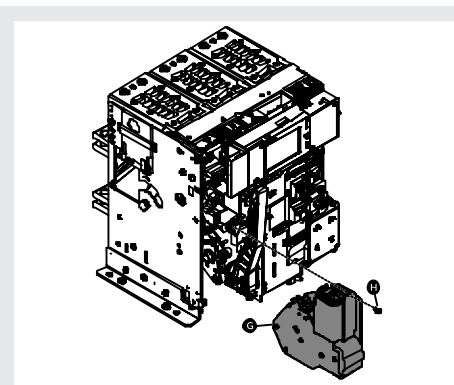


Figure 277 - Removing the gearmotor

5. If there is an undervoltage coil (I), remove it, and discharge the springs of the operating mechanism for closing and opening the circuit breaker.

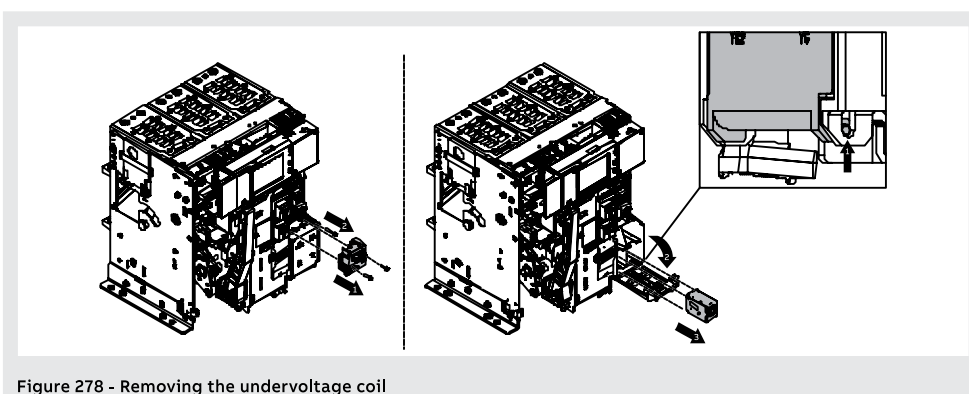


Figure 278 - Removing the undervoltage coil

Continued on the next page



WARNING! The verifications involve procedures which must only be performed by persons skilled in the electrical field (IEV 195-04-01): person with sufficient training and experience to enable him or her to perceive risks and avoid the dangers potentially created by electricity) and mechanical.

6. Disassemble the metal protection plate (N) by removing screw (O).

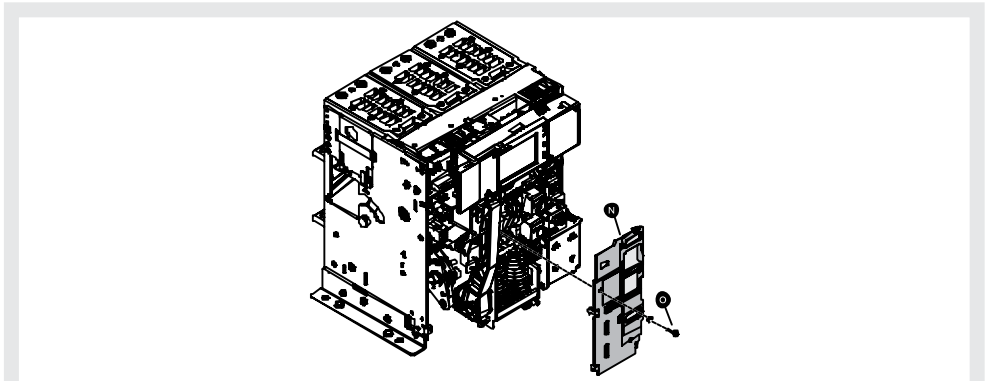


Figure 279 - Removing the protection plate

Before cleaning and lubrication of the operating mechanism, you must remove the protection trip unit. For information about removal, see the document [1SDH002310A1523](#), or request the intervention of a technician ABB.

Cleaning and lubrication of the operating mechanism

To clean and lubricate:

1. Clean the closing latch, the closing shaft, the opening latch and opening shaft in the points indicated in the illustrations. If there is a thick build-up of dirt, use a thinner available in the ABB greasing kit or contact the service staff for assistance.
2. Lubricate the closing latch, the closing shaft, the opening latch and opening shaft in the points indicated in the illustrations, using the ABB greasing kit or Mobilegrease 28.
3. Make sure that the opening and closing shafts are free to turn.

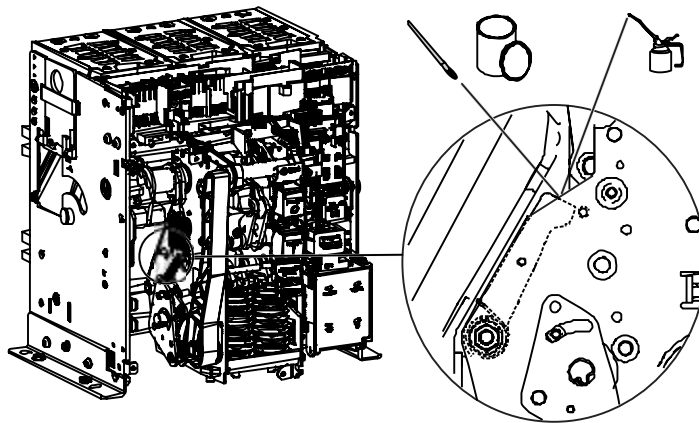


Figure 280 - Lubricating the shaft and closing hook

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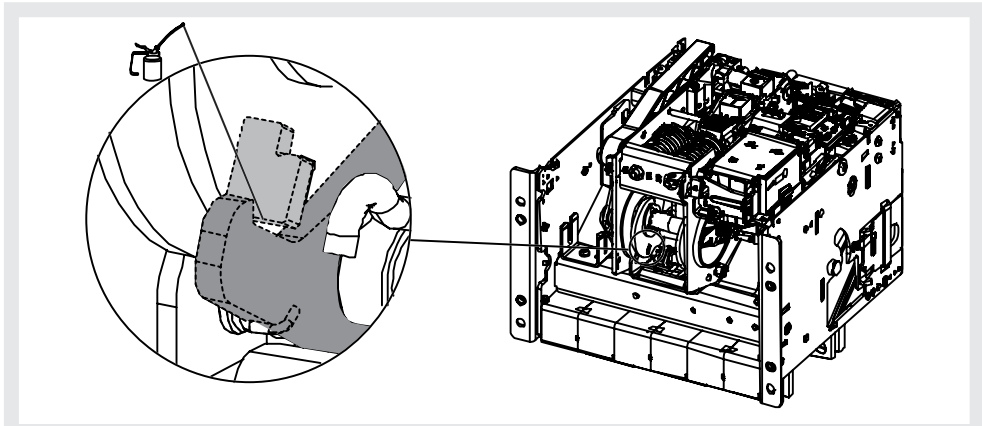


Figure 281 - Lubricating the closing hook

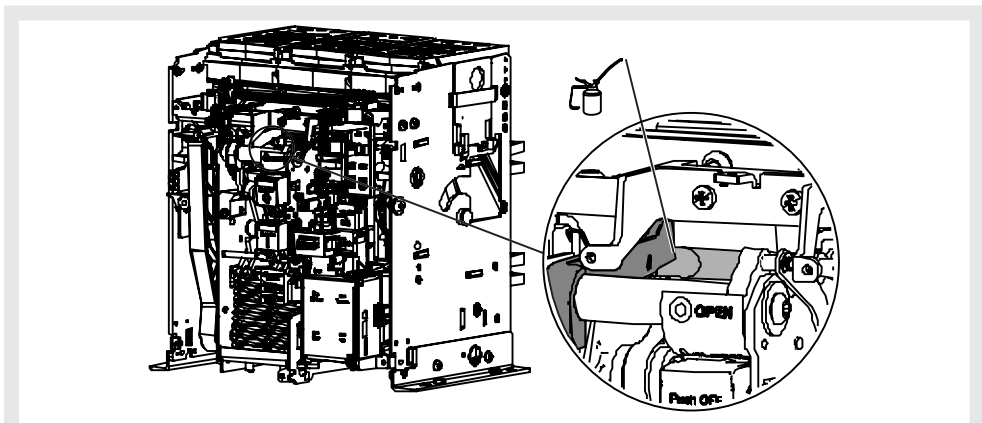


Figure 282 - Lubricating the shaft and opening hook

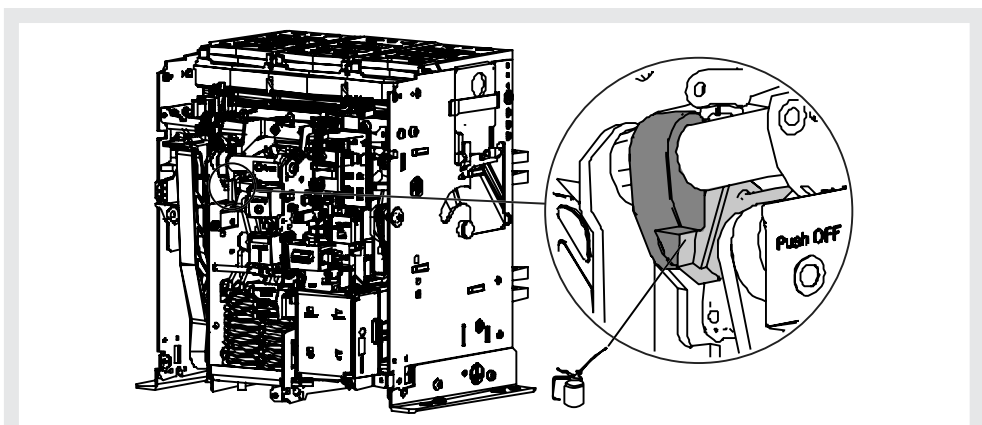


Figure 283 - Lubricating the opening hook

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