
LOW VOLTAGE AIR CIRCUIT-BREAKERS EMAX E1.3-E2.3-E4.3-E6.3

SACE Emax 3

Operating instructions for the design engineer



Safety instructions, symbols and glossary	1	Ekip Aware - Connectivity.....	87
1 - Safety instructions.....	1	1 - Overview.....	87
2 - Glossary	1	2 - USB.....	88
Introduction	2	3 - BLE	89
1 - Contents.....	2	4 - NFC	91
2 - Safety.....	3	5 - Remote.....	92
3 - Regulations	4	6 - BLE MESH	93
4 - Environmental conditions	5	Ekip Aware - Standard Protections	96
5 - Selectivity between ABB SACE circuit-breakers	7	1 - Protections - Introduction.....	96
6 - Documents and Tools for the design engineer.....	8	2 - Standard Protections LI, LSI, LSIG	98
Management operations	9	3 - Standard additional protections and functions	110
1 - Transport and checking on receipt.....	9	4 - Zone Selectivity.....	117
2 - Unpacking and handling E1.3.....	12	5 - Logic selectivity.....	119
3 - Unpacking and handling E2.3-E4.3-E6.3	15	6 - Performance table of standard protections	121
4 - Description E1.3	18	7 - Curves of standard protections	123
5 - Description E2.3-E4.3-E6.3.....	26	8 - Standard Measurements	130
6 - Installation E1.3	35	9 - Datalogger	134
7 - Installation E2.3-E4.3-E6.3.....	43	10 - Main settings of Ekip Aware	136
8 - Technical characteristics.....	51	11 - Additional settings via remote	139
Overview of the protection release.....	52	12 - Test.....	142
1 - General characteristics	52	13 - Ekip Aware default parameters	145
2 - Overview of protections and functions.....	54	Measuring	146
3 - Accessories.....	56	1 - Measuring	146
4 - Operating features	57	2 - Main settings of the Measuring digital upgrade	149
Ekip Aware - Interface and menus	58	3 - Additional settings via remote.....	149
1 - Presentation of interface.....	58	Class 0,5 and Class 1 Power and Energy metering	150
2 - Navigation	62	1 - Class 0,5 and Class 1 Power and Energy metering	150
3 - Protections Menu.....	64	Datalogger Pro	153
4 - Measurements Menu.....	66	1 - Datalogger Pro.....	153
5 - Menù Diagnostic	68	Network Analyzer.....	157
6 - Menù Info.....	71	1 - Network Analyzer	157
7 - Test Menu	74	Power Controller	165
8 - Settings Menu	75	1 - Power Controller.....	165
9 - Changing parameters and commands.....	76	Adaptive Load Shedding.....	166
10 - PIN and security	78	1 - Adaptive Load Shedding.....	166
Cybersecurity guidelines	80	RC protection	167
1 - Disclaimer	80	1 - RC protection	167
2 - Emax 3 product versions	80	2 - RC Protection performance table	168
3 - Defense in Depth.....	81	3 - RC protection curve.....	169
4 - Secure operating environment	81	4 - RC Protection test	170
5 - Recommendations concerning product security hardening.....	82	5 - RC Protection default.....	170
6 - Security capabilities of the product - Common characteristics	83	L OFF Protection	171
7 - Communication available in Standard version.....	84	1 - L OFF Protection.....	171
8 - Secure communication with the IEC 62443 Version	84	Flexible Digital Rating Plug	171
9 - Vulnerability management.....	86	1 - Flexible Digital Rating Plug.....	171

Non Defeatable I Protection	171
1 - Non Defeatable I Protection function	171
Current Protections	172
1 - Current Protections	172
2 - Performance table of Current Protections	176
3 - Current Protections Curves	177
4 - Settings of Current Protections	178
5 - Current Protections test.....	178
6 - Default of Current Protections.....	178
Voltage Protections	179
1 - Voltage Protections	179
2 - Performance table of Voltage Protections	183
3 - Voltage Protection curves	184
4 - Voltage Protection settings.....	186
5 - Voltage Protection test.....	186
6 - Voltage Protection default.....	186
Advanced Voltage Protections	187
1 - Advanced Voltage Protections.....	187
2 - Performance table of Advanced Voltage Protections....	191
3 - Advanced Voltage protection curves	192
4 - Settings of Advanced Current Protections.....	194
5 - Advanced Voltage Protection test.....	194
6 - Advanced Voltage Protection default	194
Directional Current Protection	195
1 - Directional Current Protection	195
2 - Directional Current Protection performance table	198
3 - Directional Current Protection curves	199
4 - Directional Current Protection settings.....	200
5 - Directional Current Protection test.....	200
6 - Directional Current Protection default.....	200
Frequency Protections	201
1 - Frequency Protections	201
2 - Performance table of Frequency Protections	206
3 - Frequency protection curves.....	207
4 - Frequency protections settings	209
5 - Frequency Protections test.....	209
6 - Frequency protections default.....	209
Power Protections	210
1 - Power Protections.....	210
2 - Performance table of Power Protections	214
3 - Power protection curves.....	215
4 - Power Protection settings	218
5 - Power Protection test	218
6 - Default of Power Protections	218
Dual Setting Protections	219
1 - Protections	219
Triple Setting Protections	220
1 - Protections	220

CB Internal Temperature Control protection	222
1 - CB Internal Temperature Control protection	222
Predictive Maintenance on-premise	223
1 - Predictive Maintenance on-premise	223
Custom Logics	226
1 - Protections	226
Advanced MDGF	232
1 - Advanced MDGF.....	232
Accessories	234
1 - Overview.....	234
2 - Standard accessories	238
3 - Assembly and disassembly	240
4 - Wiring diagrams.....	242
Mechanical accessories	250
1 - Mechanical Protection accessories	250
2 - Mechanical safety accessories	252
3 - Mechanical Interlocks.....	258
4 - Lifting plates.....	259
Electrical accessories	260
1 - Electrical control accessories	260
2 - Smart electrical monitoring accessories	265
2 - Electrical signalling accessories	270
Internal electronic accessories	278
1 - Digital Rating Plug	278
2 - Ekip Busbars Supply	279
3 - Ekip Signalling 4K	280
4 - M-Sense Enabler	283
External electronic accessories	286
1 - Introduction.....	286
2 - Ekip Supply Lite	286
3 - Ekip Supply Evo Modbus TCP	287
4 - Ekip Com Modbus RTU	295
5 - Ekip Com Profibus DP	298
6 - Ekip Com Profinet.....	301
7 - Ekip Com EtherNet/IP™	304
8 - Ekip Com IEC 61850.....	307
9 - Ekip Signalling 2K.....	311
10 - Ekip RELT	314
11 - Ekip Synchrocheck.....	318
12 - Ekip Temperature 4T	324
13 - Ekip Arc-Flash 6F	327
Other electronic accessories	331
1 - Ekip Signalling 10K Link	331
2 - Ekip Signalling Modbus TCP	331
3 - Rc Toroid	332
4 - S.G.R. Toroid.....	332
5 - Sensor MDGF	332
6 - External neutral	333
7 - Ekip AUP	333

8 - Ekip RTC.....	333
9 - Trip Unit I/O terminals.....	334
10 - T-Sense Ambient e T-Sense Busbar.....	334
Commissioning and maintenance	336
1 - Commissioning.....	336
2 - Maintenance.....	342
3 - First level maintenance	344
4 - E2.3-E4.3-E6.3 second level maintenance	350
5 - Lubrication of jaw-type isolating contacts of withdrawable circuit-breaker.....	358
Alarms or failures.....	359
1 - Management of alarms and faults.....	359
2 - Faults, causes and remedies.....	359
3 - Programming errors.....	364
4 - Self-diagnosis.....	365
5 - Alarms displayed and suggestions	365
Service.....	368
1 - ABB Electrification Service.....	368

Safety instructions, symbols and glossary

Symbols used in this manual

Symbol	Meaning
	Warns of an electrical hazard. Failure to comply with the relevant safety instructions could cause physical injury or death of personnel.
	This symbol, together with the caption " DANGER ", refers to a hazardous situation. Failure to comply with the relevant safety instructions could cause physical injury or death of personnel, or damage to equipment.
	This symbol, together with the caption " WARNING ", refers to a potentially hazardous situation. Failure to comply with the relevant safety instructions could cause physical injury or death of personnel, or damage to equipment.
	This symbol, together with the caption " IMPORTANT ", refers to important information on correct use of the product.
	This symbol, together with the caption " NOTE " refers to helpful advice for the operator and useful or important information on correct use of the product. This symbol and its caption do not refer to a hazardous situation.

1 - Safety instructions

This manual contains all the information required for safe use of the product.

How to read the safety notices

Each notice in the manual indicates:

- The type of hazard present
- Its degree of risk
- The actions required to prevent it

Risk levels are classified according to severity:

Level	Meaning
 DANGER	Refers to a hazard with a high degree of risk which, if not avoided, will result in death or serious injury.
 WARNING	Refers to a hazard with a high degree of risk which, if not avoided, could result in death or serious injury.
 CAUTION	Refers to a hazard with a low degree of risk which, if not avoided, could result in minor or moderate injuries.
 IMPORTANT	Refers to information considered to be important, but not related to a hazard.

The safety notes in this manual are the result of risk analysis. The highest risk level determines which alert appears when multiple hazards are present. Safety notices relating to persons may also include warnings about possible damage to equipment.

2 - Glossary

Term	Description
SACE Emax 3	New series of ABB SACE air circuit-breakers and air switch-disconnectors
CB	Circuit-breaker
Protection release	Electronic unit connected to the CB and to all the main electronic actuators and accessories. It provides measuring, monitoring and protection functions for the CB in the case of faulty operating conditions. If an alarm occurs, it commands a TRIP
Mainboard	Electronic board of the CB to which the protection release and all the main accessories and electronic actuators connect
Ekip Aware	Protection release for SACE Emax 3 CBs, equipped with touchscreen display
Trip coil	Opening actuator inside the CB controlled directly by the protection release
TRIP	Conclusive action of a protection timing or test command which, except in special configurations provided for by the protection release, coincides with activation of the trip coil, which instantly opens the bars of each pole and interrupts the circulating current
Vaux	Auxiliary power supply
4P / 3P / 3P + N	CB configuration: four-pole (4P), three-pole (3P) and three-pole with external neutral (3P + N)
If	Fault current measured by the protection release, useful for calculating trip time t_t

Introduction

1 - Contents

Foreword SACE Emax 3 is the new series of up to 6300 A low voltage air circuit-breakers and air switch-disconnectors designed to control all low voltage electrical installations with the highest efficiency: from industrial systems, marine applications, conventional and renewable power generating systems to buildings, shopping malls, data centers and communication networks.

Overview This manual contains all the useful information for:

- Facilitating the choice of the product and of the features required.
- Rapid access to all the necessary information for proper design.
- Proper use of all the features available with the solid-state protection trip units.
- All the supporting documentation.
- Link to management software.

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

- skilled person, in the electrical field (IEV 195-04-01): person with relevant education, training, knowledge and experience to enable him or her to perceive risks and to avoid danger which electricity can create;
- instructed person, in the electrical field (IEV 195-04-02): person adequately advised or supervised by electrically skilled persons to enable him or her to perceive risks and to avoid danger which electricity can create.



WARNING! Improper installation, use and maintenance. Risk of serious injury to persons and damage to equipment. Operations which can be performed by persons trained on the subject of electricity and mechanical are specifically indicated in this manual. All the remaining operations described in this manual must be performed by skilled persons, in the field of electricity and mechanical. ABB declines all liability for damage to persons or property caused by failure to comply with the instructions in this document.

Specifications and supporting documents To ensure that the Emax 3 circuit-breaker is installed and configured in the best possible way, please read the information in this manual and in the technical documentation of the product, supplied with the circuit-breaker or available at [ABB LIBRARY](#).

Document	Description
1SDH002309A1002	Installation, operation and maintenance instructions for Sace EmaxE1.3 circuit-breakers and Trip units
1SDH002310A1002	Installation, operation and maintenance instructions for Sace Emax E2.3-E4.3-E6.3 circuit-breakers and Trip units
1SDH002311A1002	Manual for design engineers with full information about SACE Emax 3 Trip units and accessories
1SDC220100D0201	General catalog of SACE Emax 3 circuit-breakers
1SDM000056A1001	Circuit diagrams of SACE Emax 3 circuit-breakers

Design notes The information in this manual was written in Italian and then translated into other languages to conform to the laws and/or commercial requirements concerning the product.

2 - Safety

Warnings

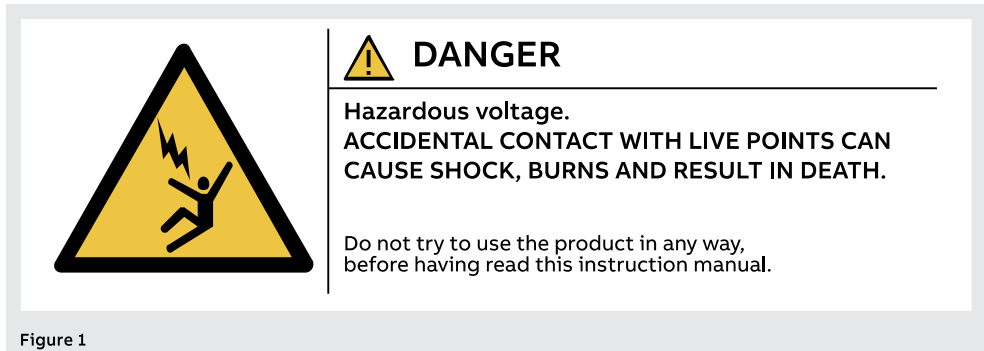


Figure 1

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 addressed to qualified personnel only and is not intended to replace an adequate training course or experience concerning the safety procedures of this device;
- for the products equipped with communication, the purchaser, the installer or the final customer is responsible for applying all the IT safety 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

3 - Regulations

Standards	The SACE Emax 3 circuit-breakers, the switch-disconnectors and their accessories comply with the following international standards: • IEC 60947-2 and IEC 60947-3 • EN 60947-2 • CEI EN 60947-2 They comply with the following EC directives: • "Low Voltage Directives" (LVD) nr. 2014/35/EC • "Electromagnetic Compatibility Directive" (EMC) nr. 2014/30/EU Devices equipped with BLE and NFC comply with international directives: • FCC part 15 • Radio Equipment Directive 2014/53/EU (RED)
------------------	--

4 - Environmental conditions

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

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

For the dimensions to be considered for installation, see the chapter 6 - Installation E1.3 on page 35 and chapter 7 - Installation E2.3-E4.3-E6.3 on page 43 where the references to the following information are given:

- 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 SACE Emax 3 is designed and made to operate in particularly difficult industrial conditions.

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 1: saline mist atmosphere
- IEC 60721-3-6 class from 6C1 to 6C3 (for presence of SO₂ and H₂S)
- IEC 60721-3-3 (ISO 9233) class from C1 to C3 (for presence of SO₂ and H₂S)



IMPORTANT: Circuit breaker is suitable for installation in environments with saline concentrations no higher than 10 mg/m³.

Dusty environments Dusty environments It is recommended to install the circuit breaker in suitably ventilated switchgear to minimize the effects of dust. Penetration by dust is minimized. In case of dusty environments (dust > 1 mg/m³) the frequency of maintenance needs to be increased.

See chapter 2 - Maintenance; second level maintenance procedures must be followed.

Vibrations The circuit-breaker, if correctly installed according to specifications [1SDH002309A1821](#) (E1.3) and [1SDH002310A1821](#) (E2.3-E4.3-E6.3), is insensitive to mechanical or electromagnetic vibrations that comply with 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
- Shipping Registers' specifications: RINA, BV, GL, ABS, LR, 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 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 3 circuit-breakers were developed and tested in an EMC environment in accordance with IEC 60947-2, Annex J and F, and according to standard IEC 60092-504, for marine installations.

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 trip unit, between -40 °C and +70 °C, -40 °F e +158 °F.
- Circuit-breaker in the original packaging, with Ekip Aware protection trip unit, between -25°C and + 70°C, -22°F e +158°F.



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

5 - Selectivity between ABB SACE circuit-breakers

Foreword Selectivity can be designed for ABB SACE circuit-breakers (among which SACE Emax 3).

There is selectivity in an installation when, in the event of an overload or short-circuit, it is possible to identify and isolate the point of overload or fault by opening only some circuit-breakers to guarantee service continuity to the installation.



IMPORTANT: selectivity is recommended in all installations with multiple switchgears or circuit-breakers connected, for example cascading or in a tree (with a main circuit-breaker on the supply side, and other circuit-breakers downstream to protect areas on the other side). Thus, only the circuit-breaker immediately upstream the overload or fault trips, and avoids opening of the circuit-breakers further upstream.

Types of selectivity With ABB SACE electronic releases, selectivity comprises:

- **Current-type selectivity.** Current selectivity takes place in the case of overcurrent. According to the principle, the current increases when the point of failure is near the supply source. Configure the protections of the releases nearer to the supply source and with higher current thresholds.
- **Time-type selectivity.** Time selectivity is actuated in the case of short-circuit. S protection normally trips. The release protection settings provide for different trip times. The circuit-breakers downstream open before those upstream.
- **Time-current selectivity.** Time-current selectivity is a combination of the previous two. The release protection settings increase the trip times and current thresholds as they get close to the supply source.
- **Energy selectivity.** Energy-based selectivity employs limiter circuit-breakers. Limiter circuit-breakers have very short trip times in the case of short-circuits to prevent the current from reaching its peak value. For example, all XT-Tmax series moulded-case circuit-breakers and some of the air circuit-breakers in the Emax 2 series are limiters.
- **Zone Selectivity** Zone selectivity is an evolution of time selectivity. The releases create a dialogue between the output and input block signals. For further details about Zone Selectivity with ABB SACE circuit-breakers, and especially SACE Emax 3, consult chapter "4 - Zone Selectivity" starting on page 117.

Further documents For each type of selectivity, the protections must be set so that only those circuit-breakers capable of isolating the overload or fault open, without the rest of the installation being de-energized.

6 - Documents and Tools for the design engineer

Supporting software Different software is available; the majority of which free of charge, to facilitate, optimize and extend the functions and configurations of SACE Emax 3 in your installation:

Ekip Connect 3

ABB software to interface with Ekip Aware and other low voltage devices ([LINK](#))

EPiC

ABB APP for interfacing with Ekip Aware, smartphone / tablet via Bluetooth or via USB-C cable ([LINK](#))

DOCweb

Web page for designing single-line diagrams of low and medium voltage electrical installations, choosing the operating and protection devices and checking and coordinating the protections ([LINK](#)) or ([LINK](#))

CURVESweb

Tool for designing, calibrating and printing the trip curves of the protection devices ([LINK](#)) or ([LINK](#))

SOC

Web application with official ABB data about coordinations between one or more devices such as Selectivity, Back-up and motor starting and monitoring ([LINK](#)) or ([LINK](#))

eConfigure Devices

Web application dedicated to choosing and configuring ABB products ([LINK](#))

Further documents Various documents available free of charge in the ABB libraries describe SACE Emax 3 and the functions it supports:

Brochure

([1SDC220100B0201](#))

Product Note

Ekip Aware communication ([1SDC220103L0201](#))

Embedded Arc flash protection ([1SDC220104L0201](#))

Sense accessories ([1SDC220105L0201](#))

Continuous thermal monitoring ([1SDC220106L0201](#))

Embedded Power and Energy monitoring ([1SDC220108L0201](#))

Datalogger and Datalogger Pro ([1SDC220109L0201](#))

White Papers

Arc flash hazards ([1SDC220112G0201](#))

Emax 2 to Emax 3 Product Replacement ([1SDC220117G0201](#))

Custom logic ([1SDC220119G0201](#))

Continuous thermal monitoring ([1SDC220124G0201](#))

Management operations

1 - Transport and checking on receipt

Introduction The SACE Emax 3 circuit-breakers, on account of their weight, require special attention during transport and handling.

They are distributed with following packages:

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



WARNING! Falling objects. Risk of serious injury to persons and damage to equipment. Comply with the following instructions during all stages of transportation:

- The movable part of the circuit-breaker must be removed from the switchgear and/or from the relative fixed part even if this latter is not installed in the switchgear.
- The circuit-breaker must be in the open position.
- The circuit-breaker must be protected and fastened in its original packing.
- The closing springs of the circuit-breaker must be completely discharged.

Weight of the circuit-breakers with packaging

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

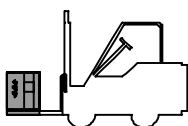
	Fixed			Moving part of withdrawable device			Fixed part of withdrawable device		
	III	IV	Fs	III	IV	Fs	III	IV	Fs
E1.3	16 Kg / 35 lbs	18 Kg / 39 lbs		20 Kg / 44 lbs	23 Kg / 51 lbs		23 Kg / 51 lbs	26 Kg / 57 lbs	
E2.3	46 Kg / 101 lbs	58 Kg / 128 lbs		53 Kg / 117 lbs	60 Kg / 132 lbs		41 Kg / 90 lbs	49 Kg / 108 lbs	
E4.3	63 Kg / 139 lbs	77 Kg / 170 lbs		67 Kg / 148 lbs	81 Kg / 179 lbs		57 Kg / 126 lbs	69 Kg / 152 lbs	
E6.3	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



IMPORTANT:

- weights are indicated with reference to the basic circuit-breakers including protection trip unit 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



DANGER! Falling objects. 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.



WARNING! Falling objects. Risk of serious injury to persons and damage to equipment. The qualified personnel tasked with handling and lifting work must use suitable 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.

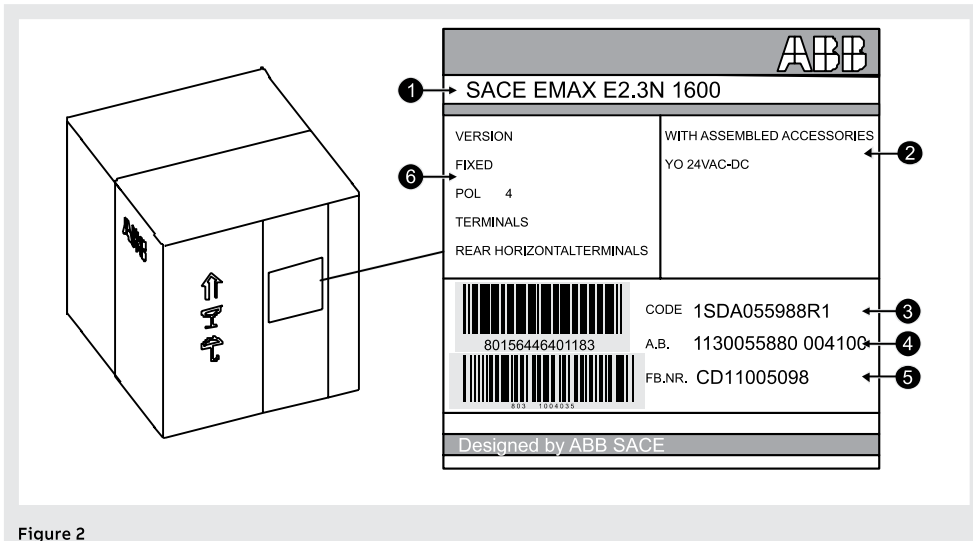


Figure 2

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

Inspection of packaging

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 12
- In the case of any inconsistencies, report them within five days of reception. See the paragraph "Damage and Discrepancy Report" in this chapter.

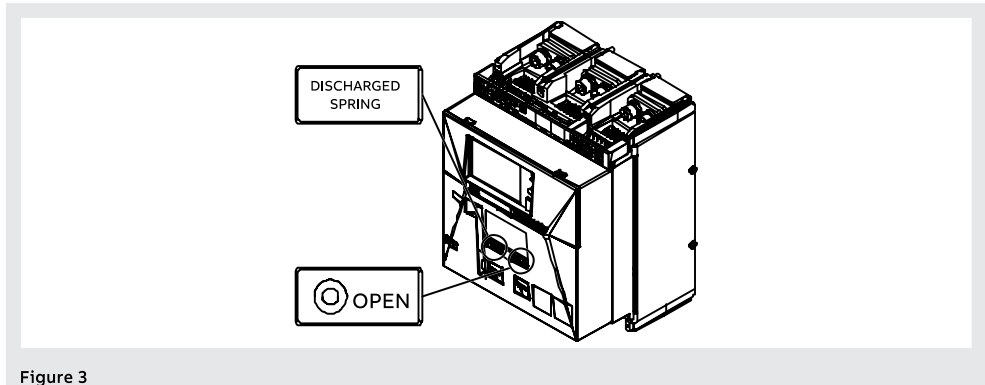
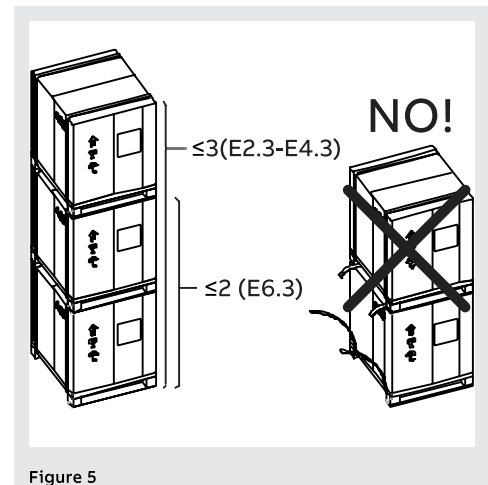
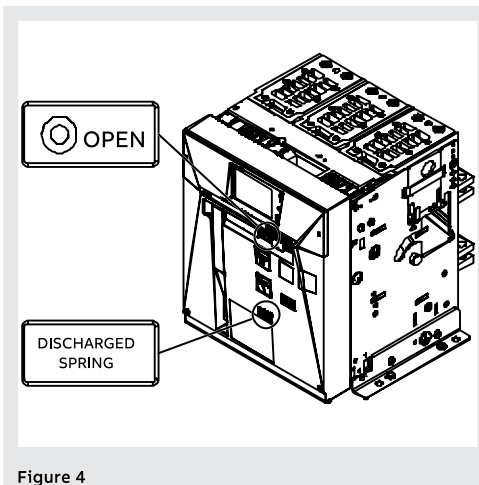
Damage and Discrepancy Report

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 discharged. See the paragraph Manual operations for opening and closing the circuit-breaker on page 20.
 - The circuit-breaker is protected and locked in its original packaging

E1.3**E2.3-E4.3-E6.3**

WARNING! Falling objects. Risk of serious injury to persons and damage to equipment. Up to three E2.3 and E4.3 circuit-breaker packages and up to two E6.3 circuit-breaker packages can be stacked. **DO NOT** stack packages that have been opened, tampered with or damaged. Such packages must be immediately separated and placed in a safe condition where they are unable to unbalance the stack.

2 - Unpacking and handling E1.3

Opening the packaging



NOTE: consult the instruction sheet in the pocket applied to the package in order to unpack in conditions of safety.

The following is the procedure for opening the packaging:

1. Cut the tape that seals the box. See Figure 6 and Figure 7.

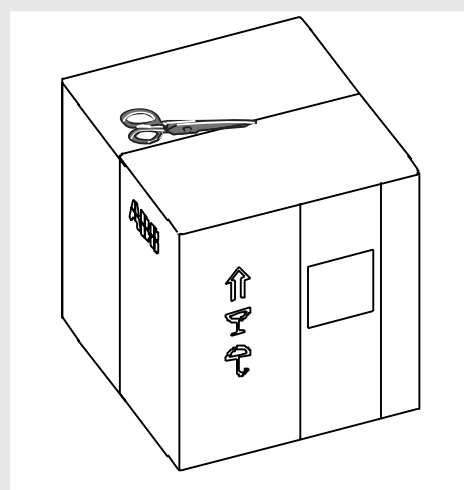


Figure 6

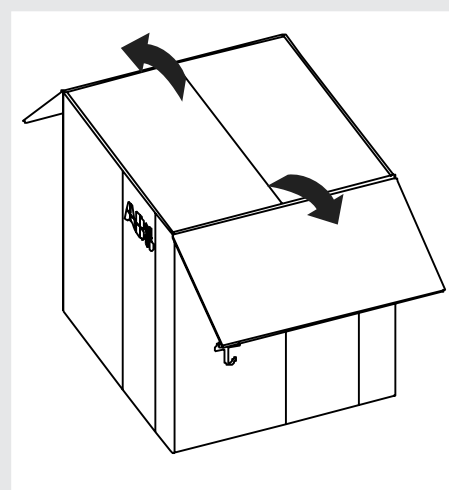


Figure 7

2. Open the upper part of the packing box and remove the upper containment protection. See Figure 8 and Figure 9.

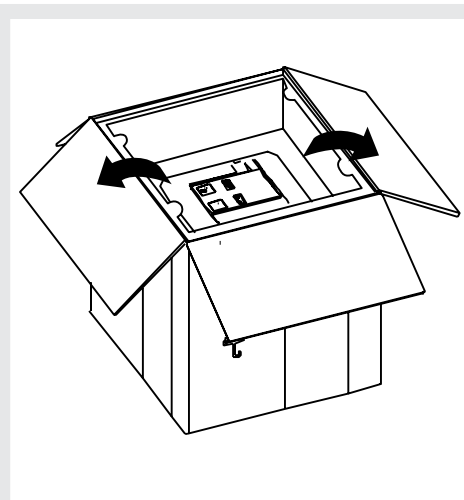


Figure 8

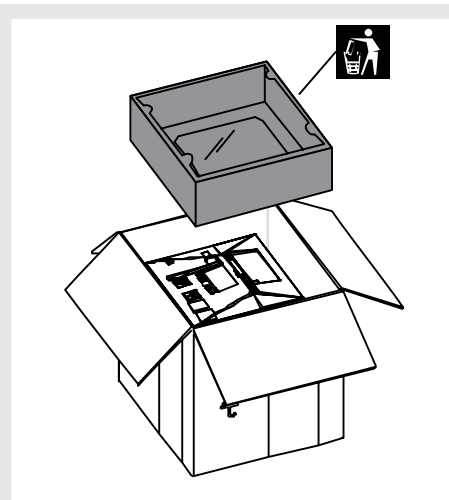


Figure 9

Continued on the next page

3. Remove the side containment protections from the packing box. See Figure 10.

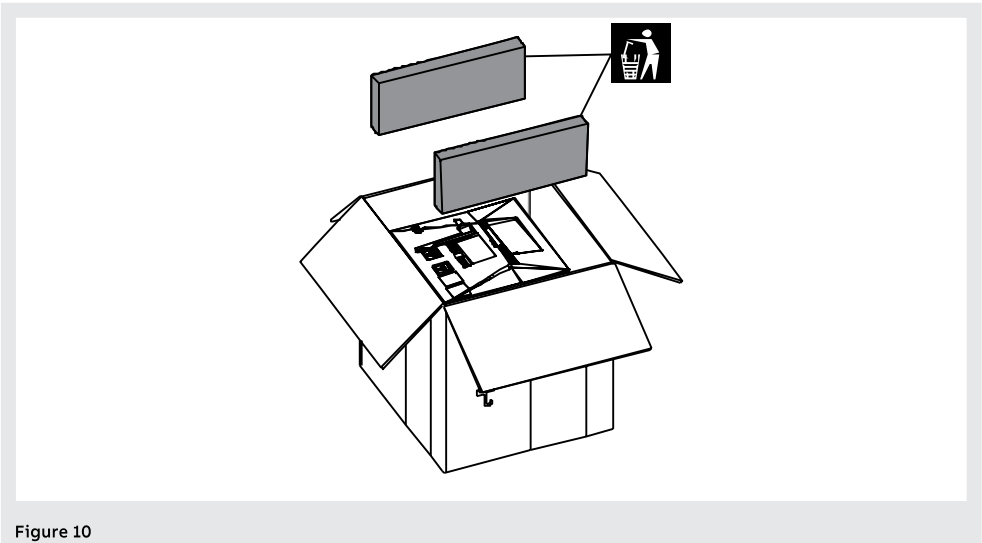


Figure 10

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	III	IV	III	IV
E1.3	14 Kg / 31 lbs	16 Kg / 35 lbs	18 Kg / 40 lbs	20 Kg / 44 lbs	20 Kg / 44 lbs	23 Kg / 51 lbs



IMPORTANT:

- 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



DANGER! Falling objects. 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.



WARNING! Falling objects. Risk of serious injury to persons and damage to equipment. The qualified personnel tasked with handling and lifting work must use suitable safety equipment.

Use the lifting plates to lift the movable part of the withdrawable version. See Figure 11.

Lift the fixed part from the base of the package with the aid of two hooks (not supplied). See Figure 12.

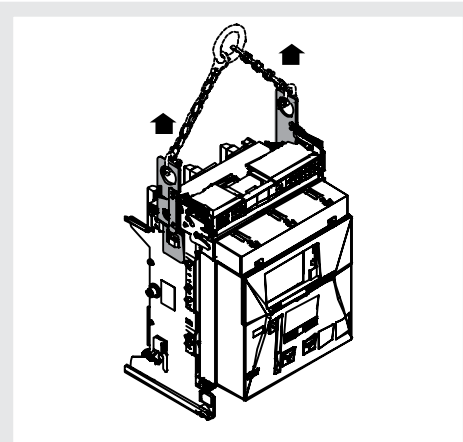


Figure 11

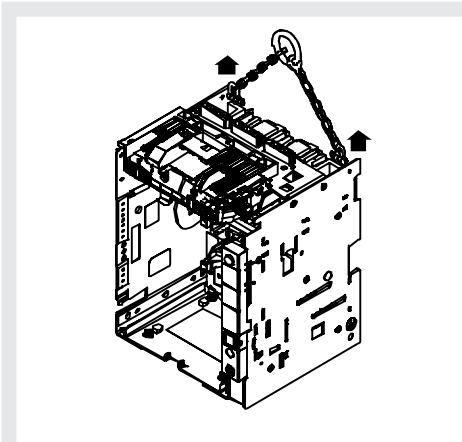


Figure 12



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

3 - Unpacking and handling E2.3-E4.3-E6.3

Opening the packaging



NOTE: consult the instruction sheet in the pocket applied to the package in order to unpack in conditions of safety.

The following is the procedure for opening the packaging:

1. Cut the bands that wrap the packing box. See Figure 13 and Figure 14.

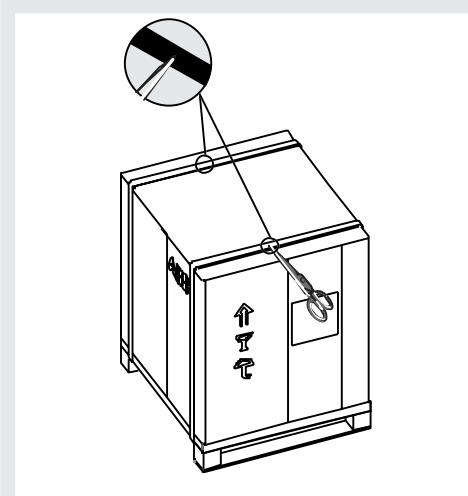


Figure 13



Figure 14

2. Open the upper part of the packing box. See Figure 15.
3. Remove the packing box by lifting it upwards. See Figure 16.

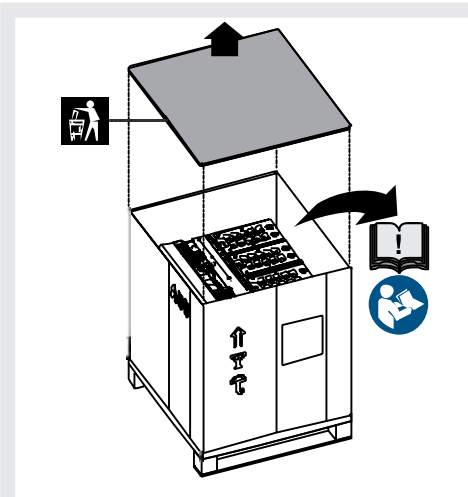


Figure 15

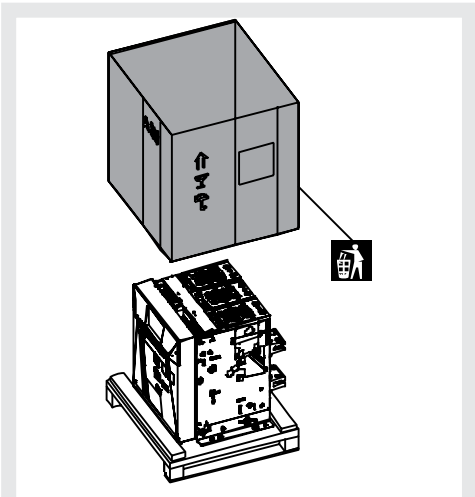


Figure 16

Continued on the next page

4. Take out the screws (see Figure 17 - Fixed circuit-breaker). Take out the screws and the mounting brackets (see Figure 18 - Moving part IEC, Figure 19 - Fixed part IEC).

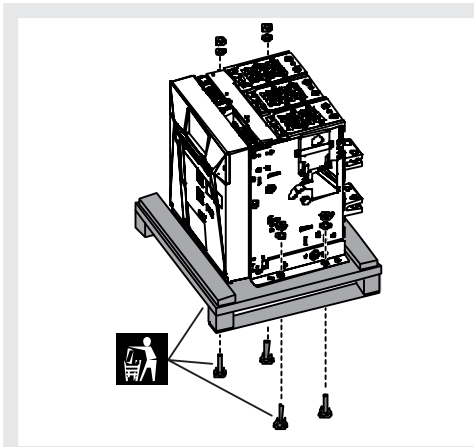


Figure 17 - Fixed circuit-breaker

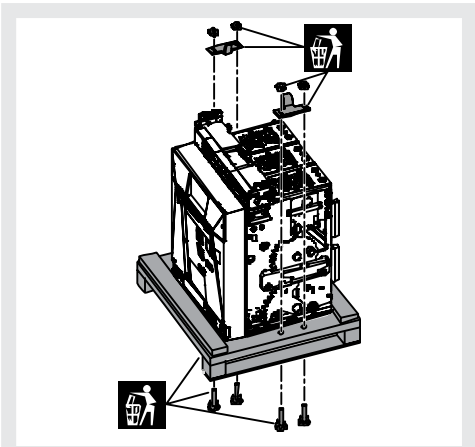


Figure 18 - Moving part IEC

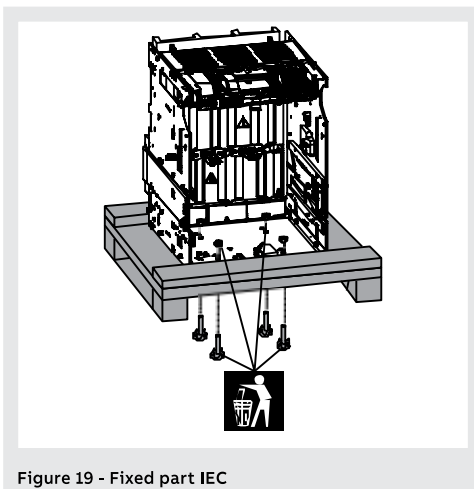


Figure 19 - Fixed part IEC

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
E2.3	41 Kg / 90 lbs	53 Kg / 117 lbs		48 Kg / 106 lbs	55 Kg / 121 lbs		36 Kg / 79 lbs	44 Kg / 97 lbs	
E4.3	56 Kg / 123 lbs	70 Kg / 154 lbs		60 Kg / 132 lbs	74 Kg / 163 lbs		50 Kg / 110 lbs	62 Kg / 137 lbs	
E6.3	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



IMPORTANT:

- 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



DANGER! Falling objects. 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.



WARNING! Falling objects. Risk of serious injury to persons and damage to equipment. The qualified personnel tasked with handling and lifting work must use suitable safety equipment.

To lift the fixed circuit-breaker or moving part of withdrawable device:

- Lift the circuit-breaker from the base of the package with the aid of the lifting plates. See Figure 20 and Figure 21.

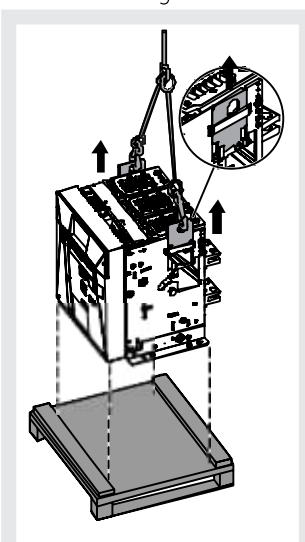


Figure 20

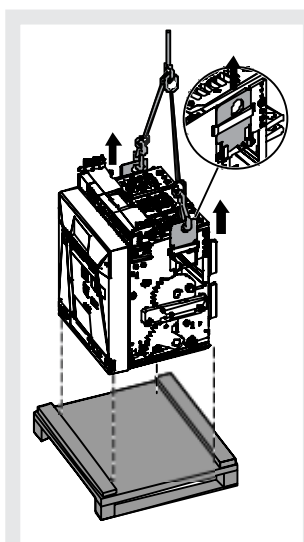


Figure 21

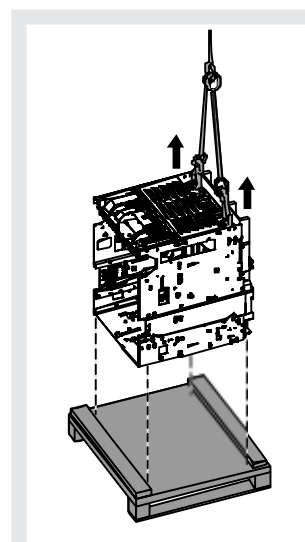


Figure 22

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 22.

4 - Description E1.3

Description of circuit-breaker Emax E1.3 circuit-breakers consist of a structure containing the poles, the operating mechanism and the auxiliary parts. Each pole, enclosed in a plastic box, consists of a breaking part and a current transformer. The circuit-breaker is available in two types:

- fixed version
- withdrawable

The circuit-breaker in fixed version (see Figure 23) has its own terminals for connection to the power circuit.

The withdrawable circuit breaker consists of a mobile part (see Figure 24) and of a fixed part (see Figure 25) 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.

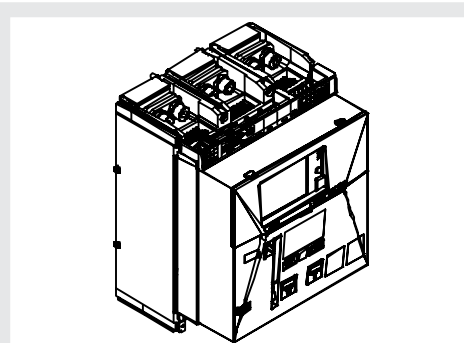


Figure 23

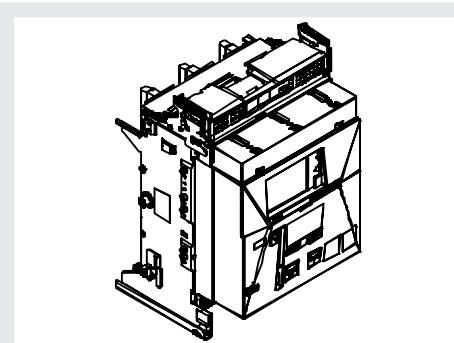


Figure 24

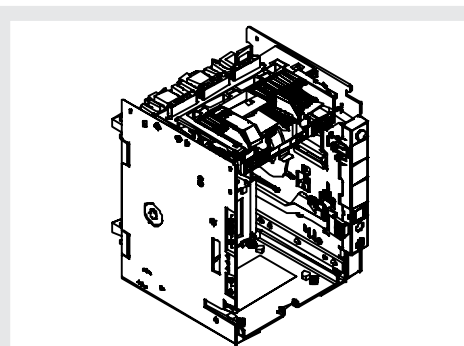


Figure 25

Description of the circuit-breaker front panel

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

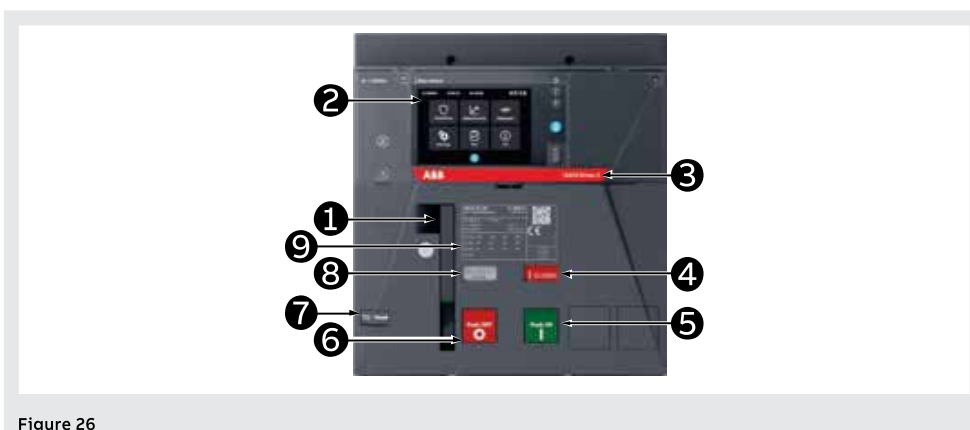


Figure 26

Pos.	Description
1	Lever for manually charging the closing springs
2	Ekip Aware protection trip unit
3	Name of the circuit-breaker
4	CB open (O) / closed (I) indicator
5	Closing pushbutton
6	Opening pushbutton
7	Mechanical signalling of tripped TU
8	Springs charged-discharged signalling device
9	Electrical data plate

Description of circuit-breaker rating plate

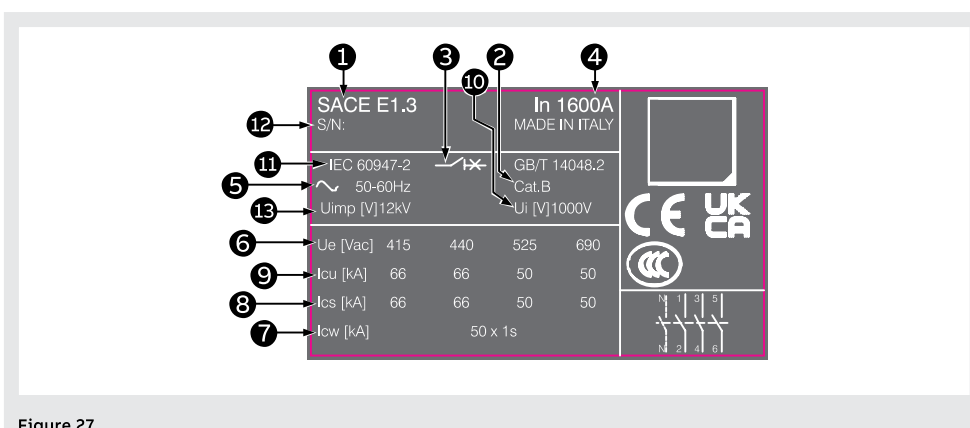


Figure 27

Pos.	Description
1	Type of circuit-breaker
2	Utilization category
3	Device type: Circuit-breaker or switch-disconnector
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

Manual operations for opening and closing the circuit-breaker

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

1. Make sure that the circuit-breaker is open. The "O - OPEN" opening/closing indicator must be activated. Check that the springs are discharged. The spring indicator must indicate "DISCHARGED SPRING - white colour", as illustrated in Figure 28.
2. Charge the springs. - Repeatedly pull lever [A] downward until the spring indicator [B] indicates "CHARGED SPRING - yellow colour", as illustrated in Figure 29.

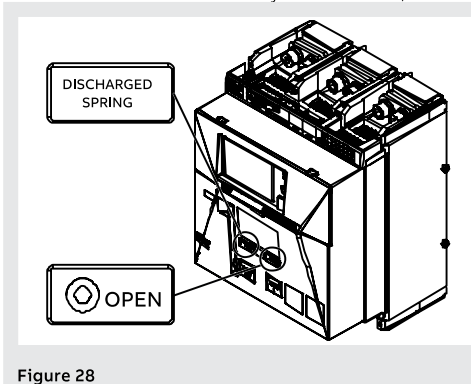


Figure 28

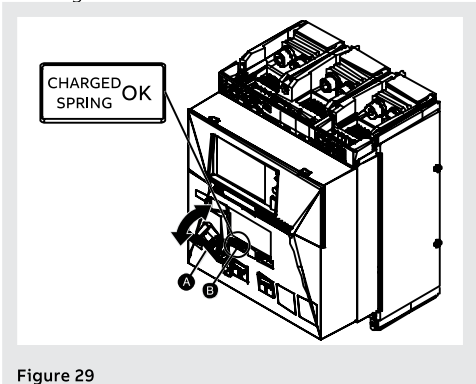


Figure 29

3. Make sure that the circuit-breaker is open. The "O - OPEN" opening/closing indicator must be activated. Check that the springs are charged. The spring indicator must indicate "CHARGED SPRING - yellow colour", as illustrated in Figure 30.
4. Closing - Press the closing pushbutton "I - Push ON" as indicated in Figure 31.

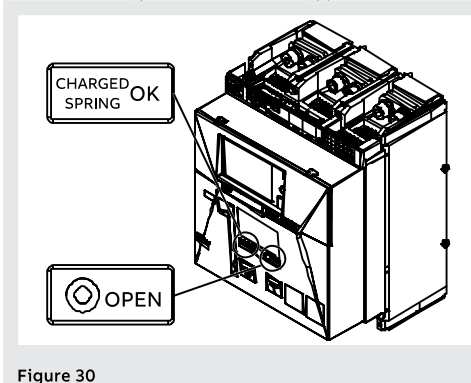


Figure 30

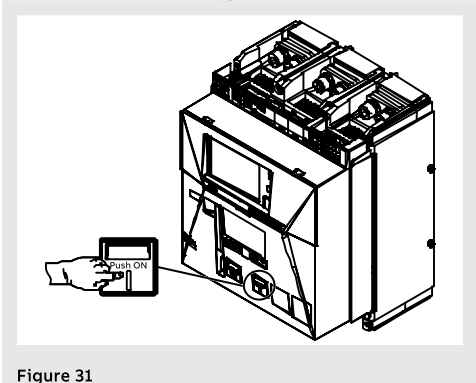


Figure 31

5. Make sure that the circuit-breaker is closed. The "I - CLOSED" opening/closing indicator must be activated. Check that the springs are discharged. The spring indicator must indicate "DISCHARGED SPRING - white colour", as illustrated in Figure 32.
6. Opening - Press the opening pushbutton "O - Push OFF" as indicated in Figure 33.

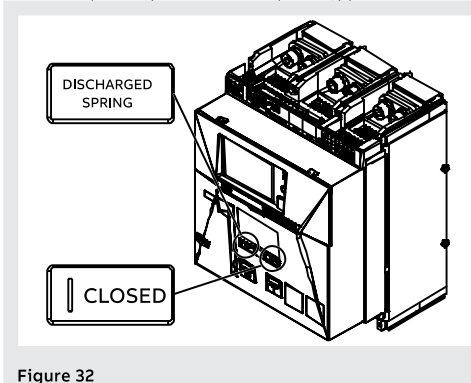


Figure 32

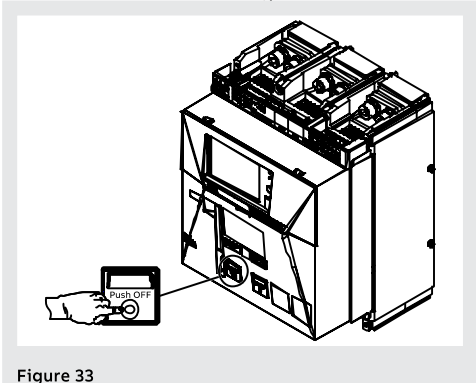


Figure 33

Continued on the next page

7. Make sure that the circuit-breaker is open. The “O - OPEN” opening/closing indicator must be activated. Check that the springs are discharged. The spring indicator must indicate “DISCHARGED SPRING - white colour”, as illustrated in Figure 34.

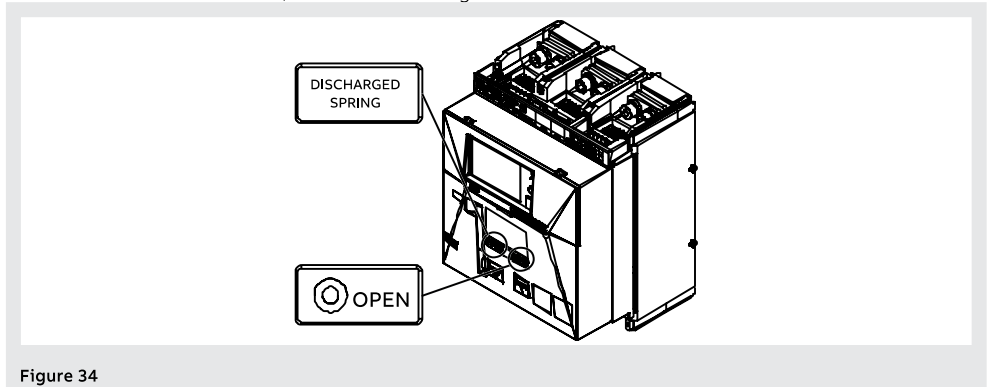


Figure 34

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

1. Circuit-breaker open with springs discharged (see Figure 35).
2. Circuit-breaker open with springs charged (see Figure 36).
3. Circuit-breaker closed with springs discharged (see Figure 37).
4. Circuit-breaker closed with springs charged (see Figure 38). This state occurs when, after closing, the springs are charged in the manual mode or automatically by the gear motor (if provider for).

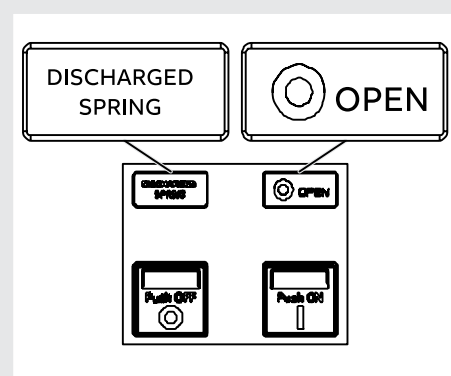


Figure 35

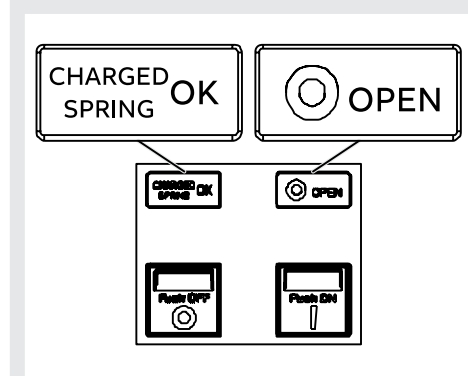


Figure 36

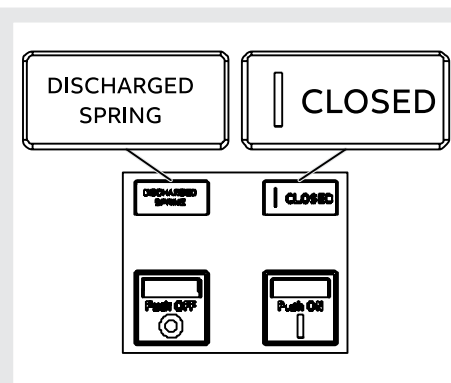


Figure 37

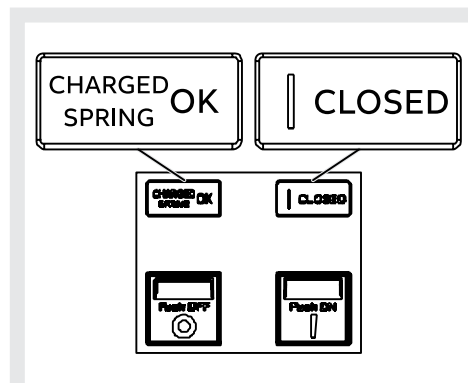


Figure 38

Circuit breaker racking-in/ racking-out operations

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



DANGER! Hazardous voltage. ACCIDENTAL CONTACT WITH LIVE PARTS CAN CAUSE SHOCKS, BURNS AND CAN EVEN BE FATAL.

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



WARNING! Hazardous surface. Risk of serious injury to persons. Before proceeding, remove all equipment used during the work and remove processing waste and materials used.

1. Turn plate through 90° before inserting the moving part.

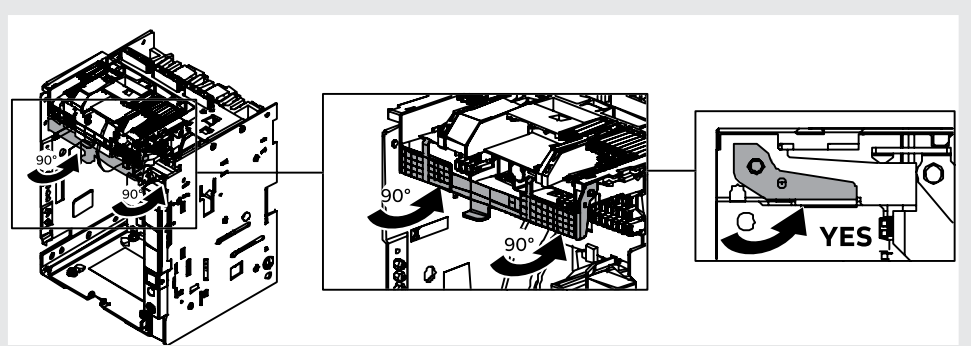


Figure 39

2. Make sure that signalling device on the fixed part indicates the **DISCONNECT** position. See Figure 40.

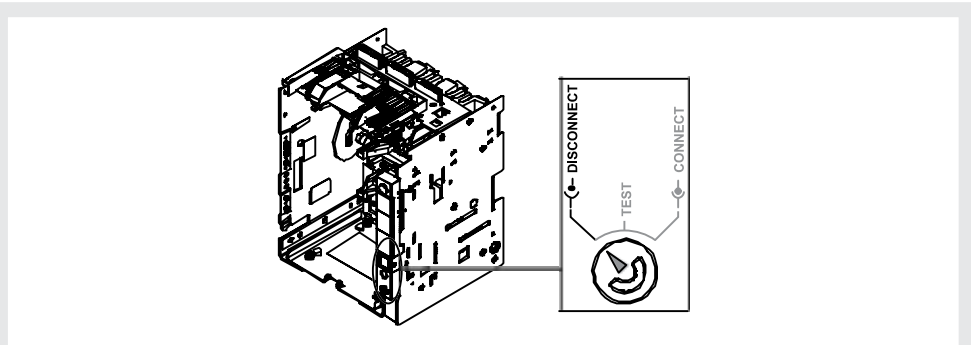


Figure 40

3. Position the moving part in the fixed part and push until it comes to a stop. See Figure 41 and Figure 42.

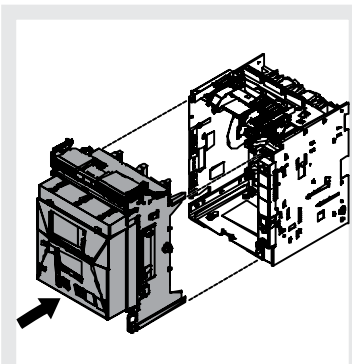


Figure 41

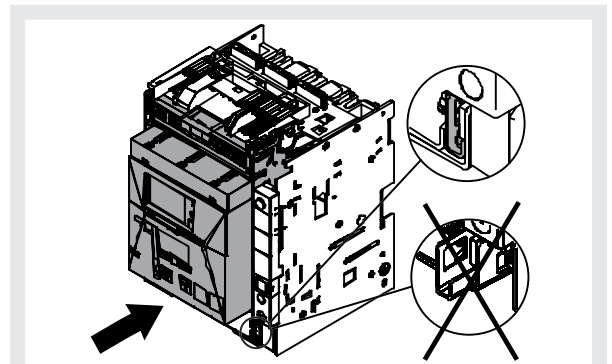


Figure 42

Continued on the next page

4. Extract the disconnection crank from its housing See Figure 43.
5. Press the lock pushbutton and fit the handle into the moving part. In this phase, the moving part will still be in the **DISCONNECT** position. See Figure 44.

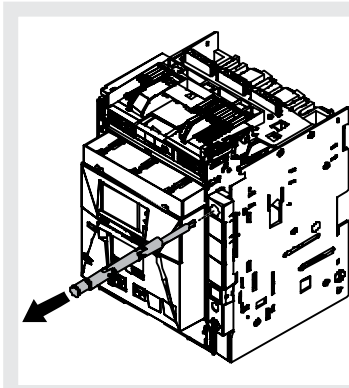


Figure 43

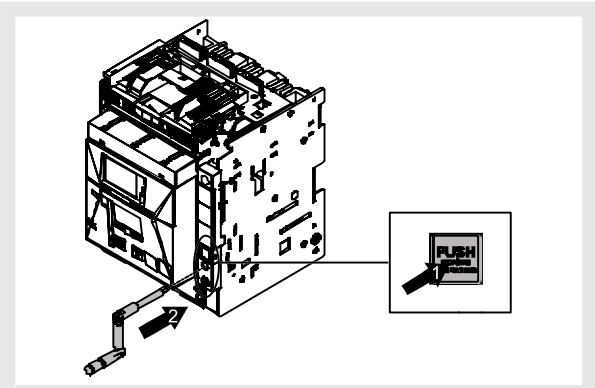


Figure 44

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

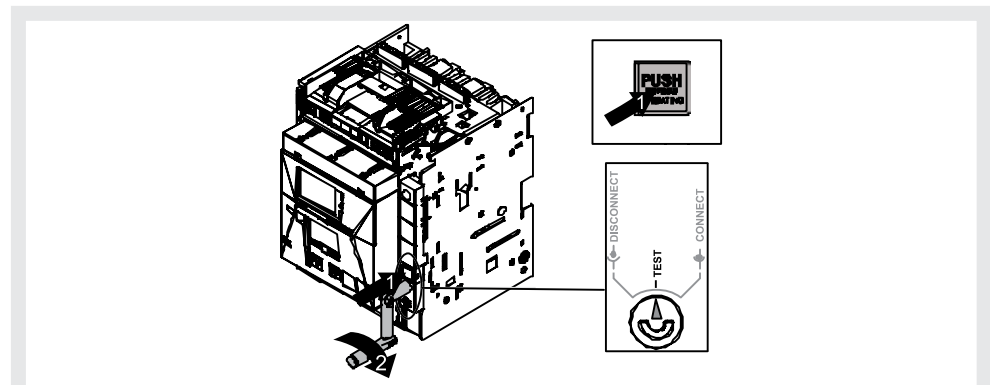


Figure 45

7. Press lock pushbutton and turn handle clockwise until pushbutton projects and signaling device indicates that circuit-breaker is in position **CONNECT**. See Figure 46.

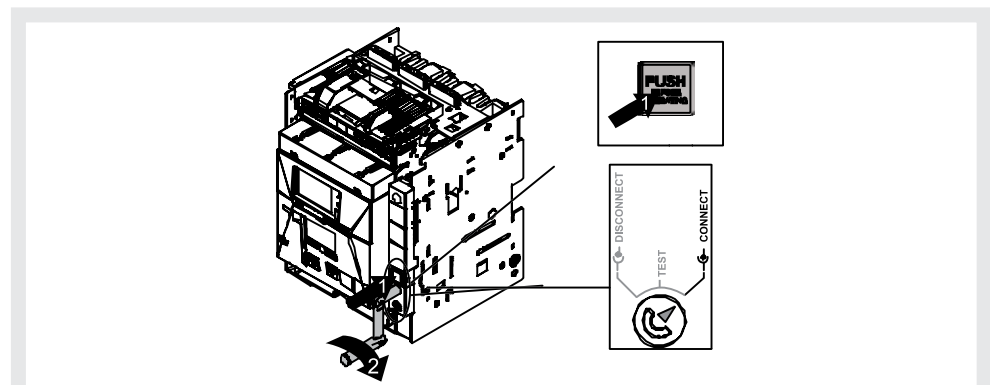


Figure 46

Continued on the next page

8. Extract the crank. See Figure 47.
9. Replace the crank in its housing See Figure 48.

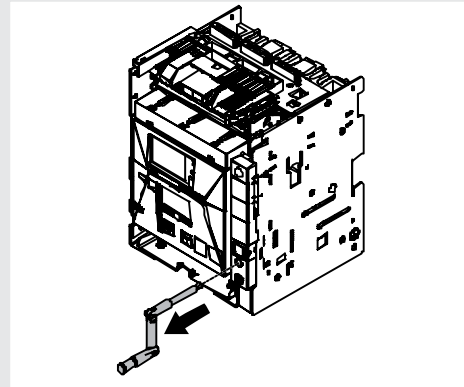


Figure 47

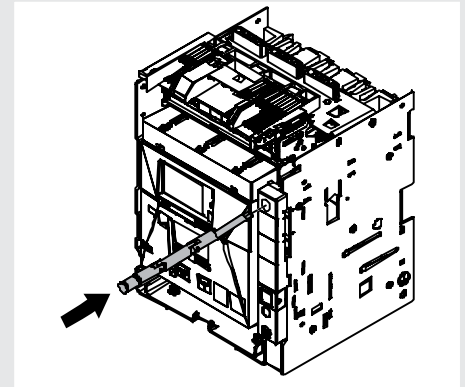


Figure 48

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

After extraction, in order to remove the moving part, unlock the safety lock. See Figure 49.



WARNING! Mobile parts. Risk of serious injury to persons and damage to equipment. 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.

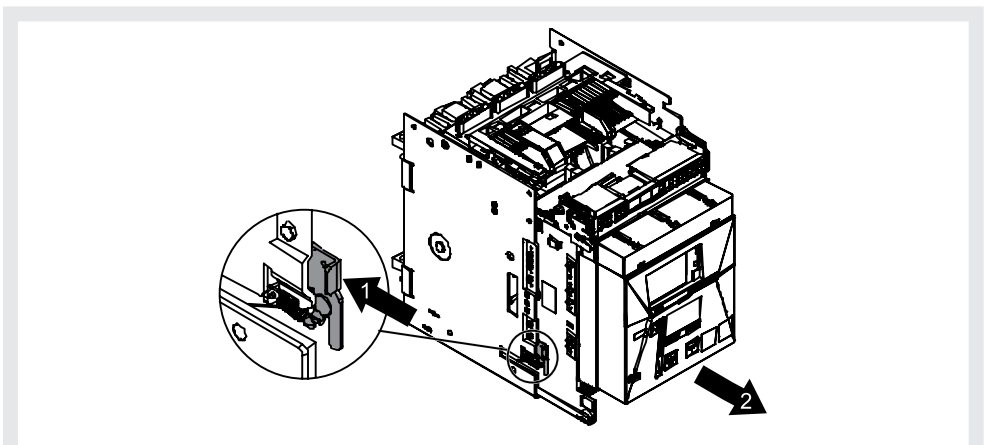
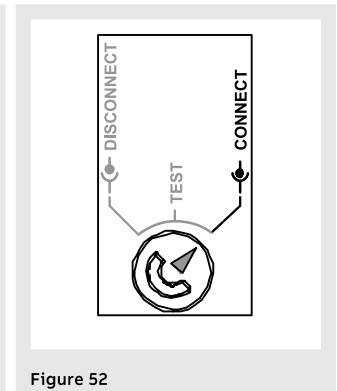
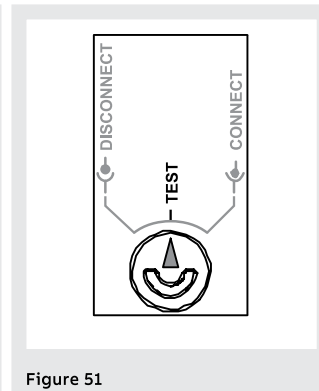
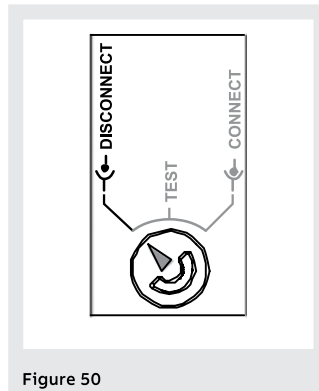


Figure 49

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 DISCONNECT position (see Figure 50)
- circuit-breaker in test position (see Figure 51)
- circuit-breaker in CONNECT position (see Figure 52)



5 - Description E2.3-E4.3-E6.3

Description of circuit-breaker The Emax E2.3-E4.3-E6.3 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 of its own phase.

The circuit-breaker is available in two types:

- fixed version
- withdrawable

The circuit-breaker in fixed version (see Figure 53) has its own terminals for connection to the power circuit.

The withdrawable circuit breaker consists of a mobile part (see Figure 54) and of a fixed part (see Figure 55) 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.

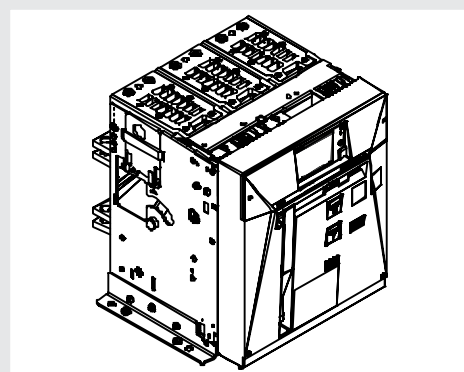


Figure 53

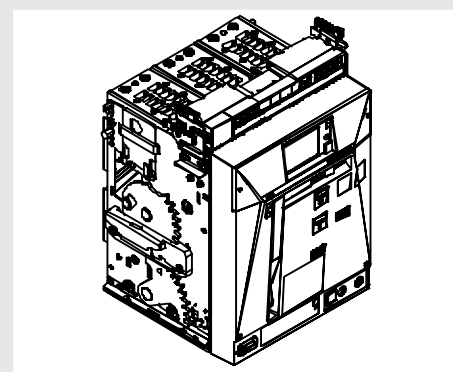


Figure 54

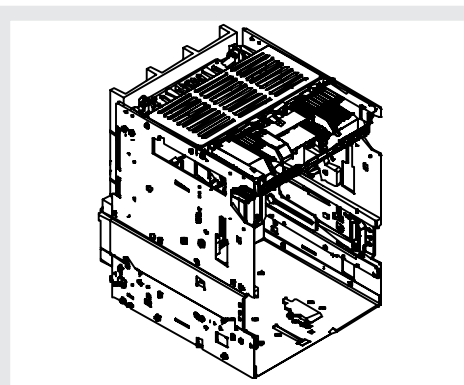


Figure 55

Description of the circuit-breaker front panel

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

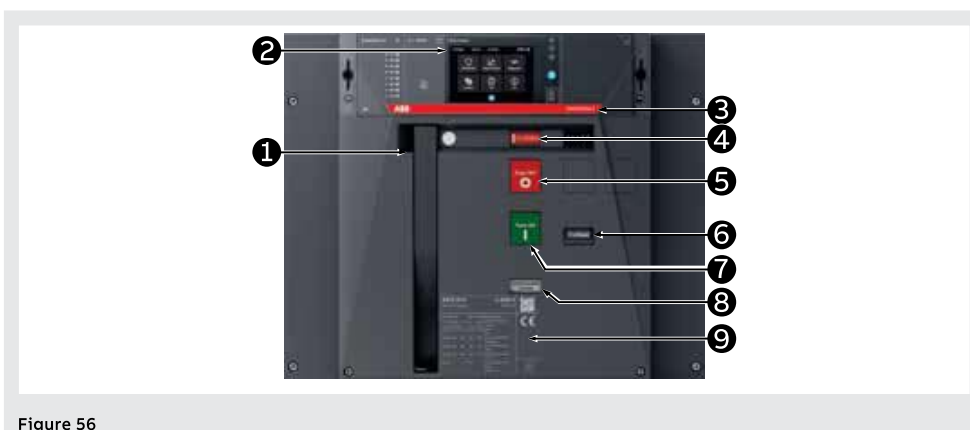


Figure 56

Pos.	Description
1	Lever for manually charging the closing springs
2	Ekip Aware protection trip unit
3	Name of the circuit-breaker
4	CB open (O) / closed (I) indicator
5	Opening pushbutton
6	Mechanical signalling of tripped TU
7	Closing pushbutton
8	Springs charged-discharged signalling device
9	Electrical data plate

Description of circuit-breaker rating plate

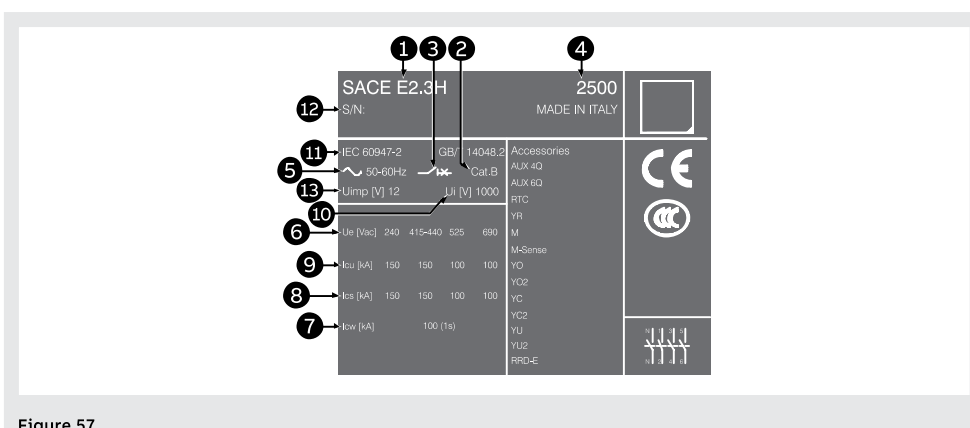


Figure 57

Pos.	Description
1	Type of circuit-breaker
2	Utilization category
3	Device type: Circuit-breaker or switch-disconnector
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

Manual operations for opening and closing the circuit-breaker

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

1. Make sure that the circuit-breaker is open. The “O - OPEN” open/closed indicator indicates opening. Check that the springs are discharged. The “DISCHARGED SPRING - white colour” spring indicator indicates that the springs are discharged, as illustrated in Figure 58.
2. Charge the springs by repeatedly pull lever [A] downward until the spring indicator [B] indicates “CHARGED SPRING - yellow colour”, as illustrated in Figure 59.

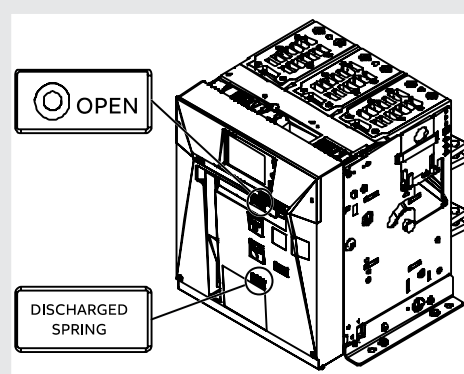


Figure 58

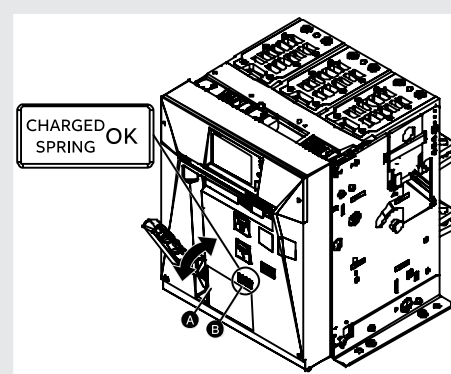


Figure 59

3. Make sure that the circuit-breaker is open. The “O - OPEN” open/closed indicator indicates opening. Check that the springs are charged. The “CHARGED SPRING - yellow colour” spring indicator indicates that the springs are charged, as illustrated in Figure 60.
4. Closing - Press the closing pushbutton “I - Push ON” as indicated in Figure 61.

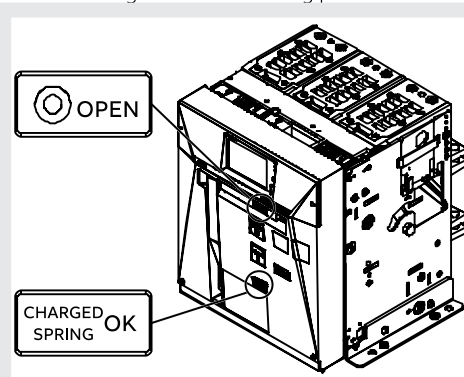


Figure 60

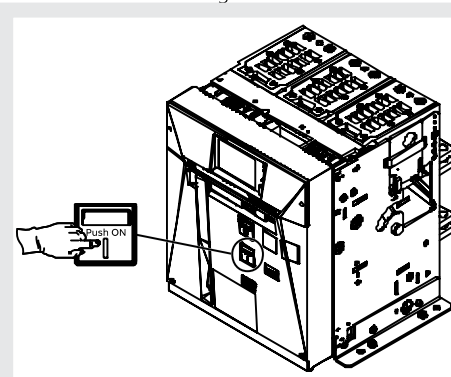


Figure 61

5. Make sure that the circuit-breaker is closed. The “O - CLOSED” open/closed indicator indicates closing. Check that the springs are discharged. The “DISCHARGED SPRING - white colour” spring indicator indicates that the springs are discharged, as illustrated in Figure 62.
6. Opening - Press the opening pushbutton “O - Push OFF” as indicated in Figure 63.

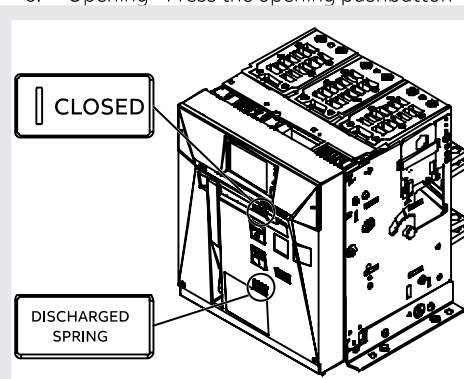


Figure 62

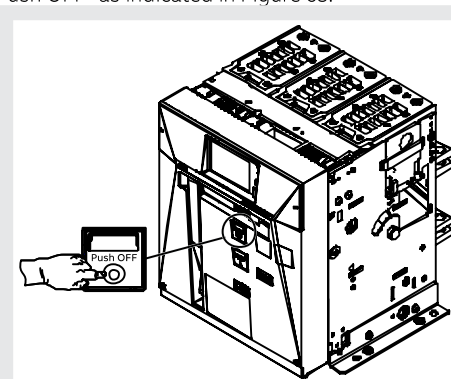


Figure 63

Continued on the next page

7. Make sure that the circuit-breaker is open. The “O - OPEN” open/closed indicator indicates opening. Check that the springs are discharged. The “DISCHARGED SPRING - white colour” spring indicator indicates that the springs are discharged, as illustrated in Figure 64.

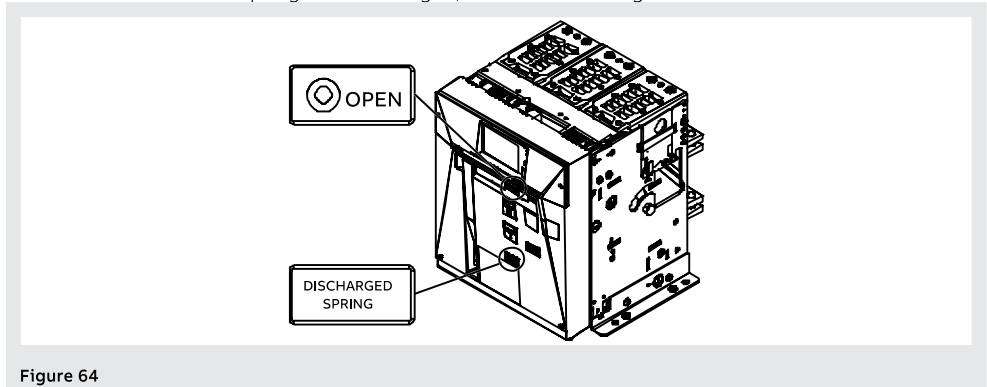


Figure 64

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

1. Circuit-breaker open with springs discharged (see Figure 65).
2. Circuit-breaker open with springs charged (see Figure 66).
3. Circuit-breaker closed with springs discharged (see Figure 67).
4. Circuit-breaker closed with springs charged and not ready to close (see Figure 68). This state occurs when after closing (see step 4 - Manual operations for opening and closing the circuit-breaker) the springs are recharged manually or automatically by the gearmotor (if provided).
5. Circuit-breaker open with springs charged and not ready to close (see Figure 69). This state occurs in the following cases:
 - The circuit-breaker is open due to tripping of protection trip units and the Reset signal has not been reset. To close the circuit-breaker press the TU Reset pushbutton on the front of the circuit-breaker.
 - The key lock or padlock is active in the open position.
 - The undervoltage coil is de-energized.
 - The opening coil is permanently energized.
 - The closing coil is permanently energized.
 - The pushbutton for enabling the insertion/extraction crank of a withdrawable circuit-breaker is pressed.

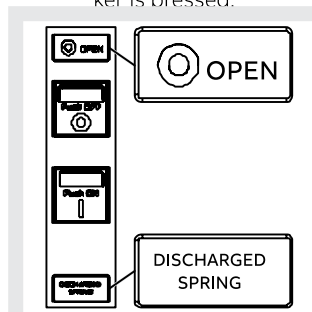


Figure 65

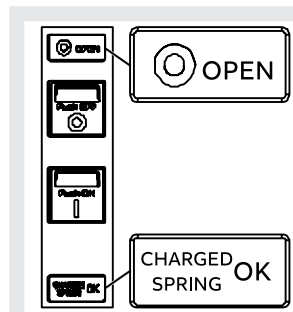


Figure 66

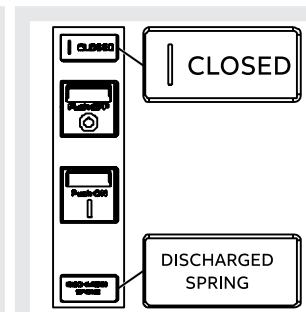


Figure 67

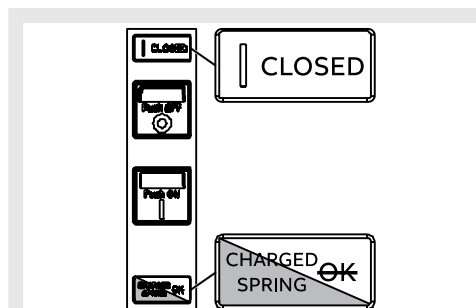


Figure 68

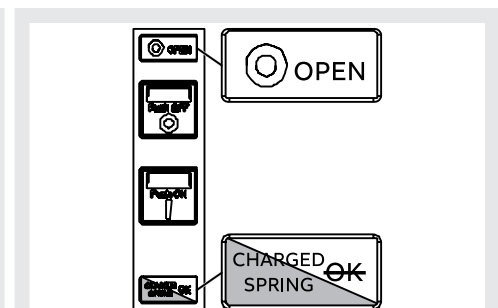


Figure 69

Circuit breaker racking-in/ racking-out operations

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



DANGER! Hazardous voltage. ACCIDENTAL CONTACT WITH LIVE PARTS CAN CAUSE SHOCKS, BURNS AND CAN EVEN BE FATAL.

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



WARNING! Hazardous surface. Risk of serious injury to persons. Before proceeding, remove all equipment used during the work and remove processing waste and materials used.

1. Turn the rating plate through 90° and withdraw the guideways by taking hold of the purpose-made levers.

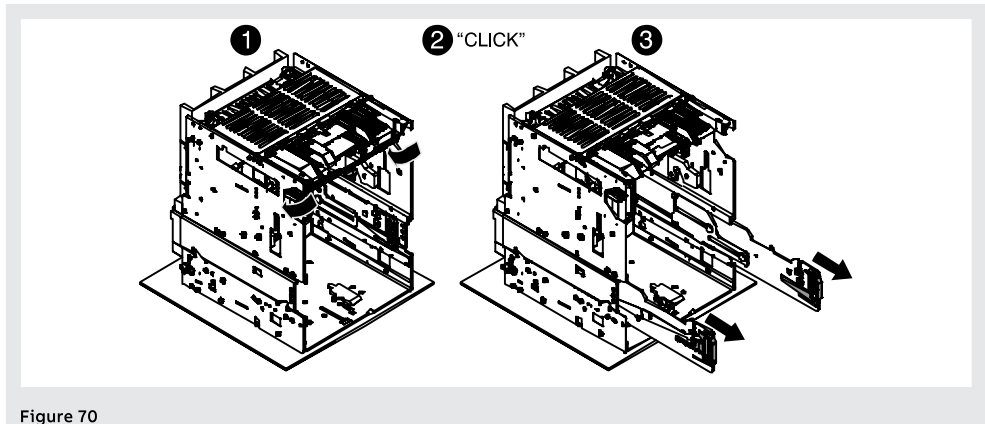


Figure 70

2. Lift the lifting plates and couple the movable part.
3. Place the movable part on the guideways of the fixed part, insert the slot in the side wall into the hook of the guideway of the fixed part.

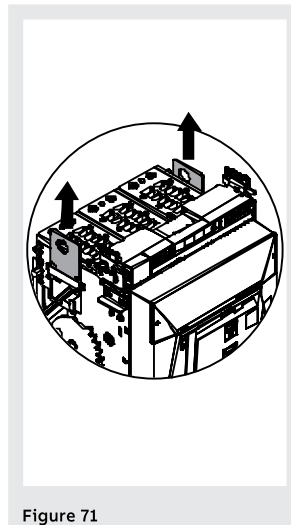


Figure 71

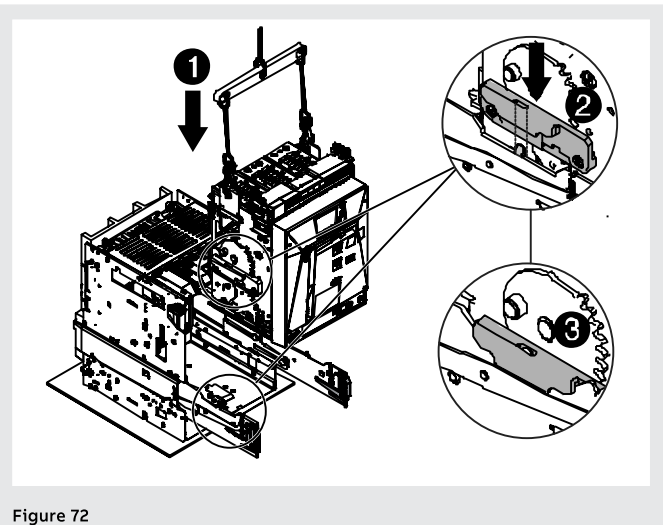


Figure 72

4. Release the movable part and lower the lifting plates.

Continued on the next page

5. Make sure that the signalling device indicates the **DISCONNECT** position. See Figure 73.

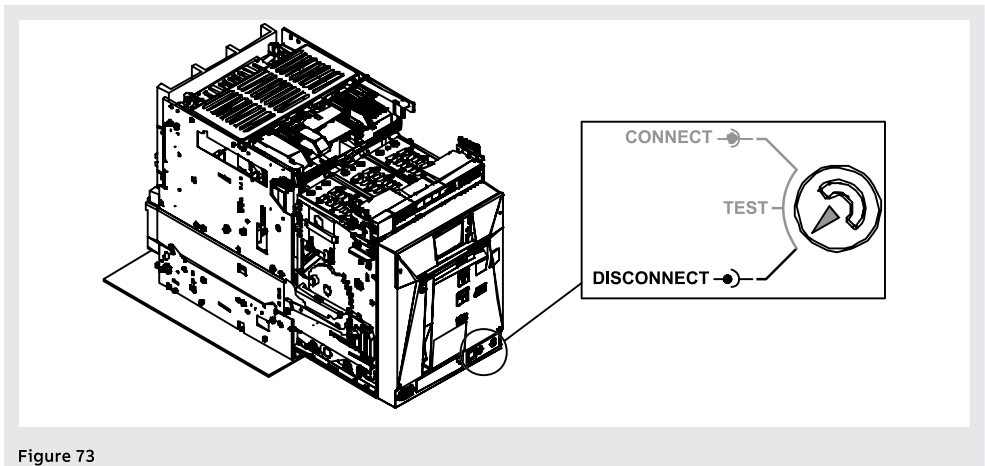


Figure 73

6. Grip the guide levers of the fixed part and push them until the moving part stops. See Figure 74.

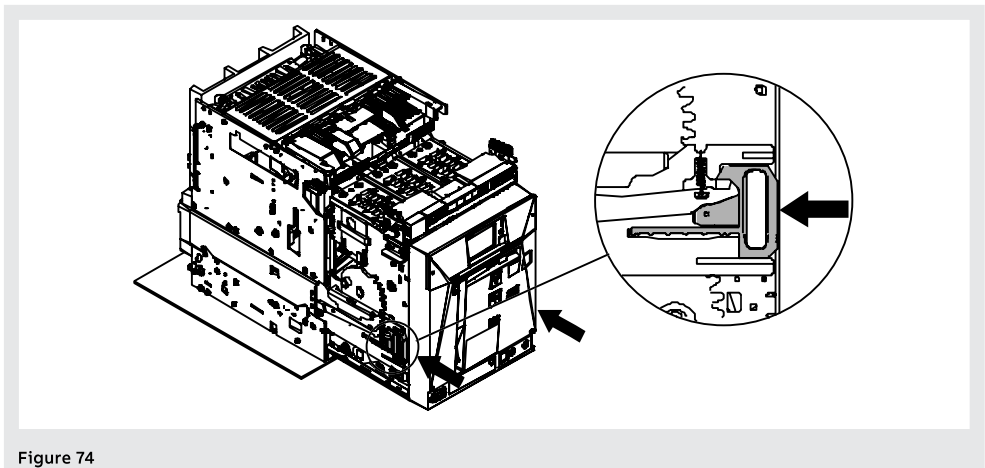


Figure 74

Continued on the next page