Installation and service instructions

Installation, service and maintenance instructions for the fixed part of withdrawable version circuit-breakers

1SDH000533R0002 L5838

Emax UL Listed

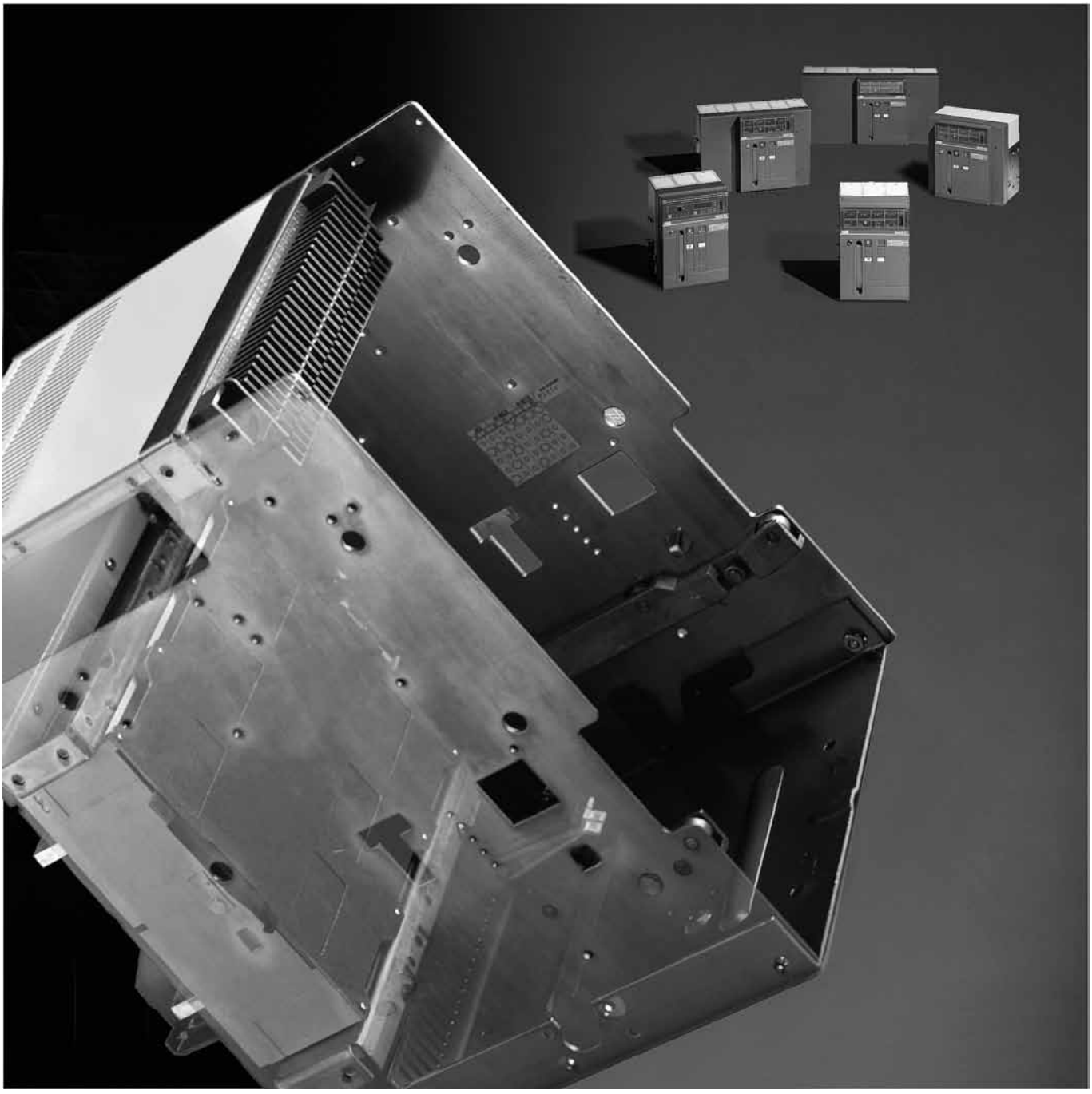

ABB SACE

Dwg.		Resp.Off.		Title **Installation, service and maintenance instructions for the fixed part of withdrawable version circuit-breakers**	Language **en**
App.		Take-over Off.			
Model	L2564 L5348	L5639 L5838		Apparatus **Emax UL**	Scale
ABB	**ABB SACE**			Doc. No. **1SDH000533R0002**	

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WARNING

HAZARDOUS VOLTAGE
CAN SHOCK, BURN
OR CAUSE DEATH.

Do not attempt to handle, install, use or service this product before reading instruction book

- **READ THIS MANUAL CAREFULLY BEFORE ATTEMPTING TO INSTALL, OPERATE OR SERVICE THIS CIRCUIT BREAKER.**
- **File these instructions with other instruction books, drawings and descriptive data of the circuit breaker. Keep this manual available for the installation, operation and maintenance about this equipment. Use of these instructions will facilitate proper maintenance of the equipment and prolong its useful life.**
- **Install the Emax circuit breaker within the design limitations as described in the Installation and service instructions shipped with the circuit breaker. These circuit breakers are designed to operate within the current and voltage limitations on the switch nameplate. Do not apply these switches to systems with current and/or voltages that exceed these limits.**
- **Follow your company's safety procedures.**
- **Do not remove covers, open doors or work on equipment unless power has been turned off and all circuits de-energized.**

WARNING

- **Detailed descriptions of standard repair procedures, safety principles and service operations are not included. It is important to note that this document contains warnings and cautions against certain specific service methods that could cause personal injury to service personnel, damage equipment, or render it unsafe. These warnings do not cover all conceivable ways in which service, whether or not recommended by ABB, might be performed, or the possible hazardous consequences of each conceivable way, nor could ABB investigate all such ways. Anyone using service procedures or tools, whether or not recommended by ABB, must satisfy himself thoroughly that neither personal safety, nor equipment safety, will be jeopardized by the service method or tools selected. Should further information be required or specific problems arise that are not sufficiently covered, refer the matter to an ABB service representative.**
- **This publication is written only for qualified persons and is not intended to be a substitute for adequate training and experience in the safety procedures for this device.**
- **The purchaser, installer or ultimate user is responsible for ensuring that warning signs are attached and all access doors and operating handles are securely locked when the gear is left unattended, even momentarily.**
- **All information contained in this manual is based on the latest product information available at the time of printing. We reserve the right to make changes at any time and without prior notice**

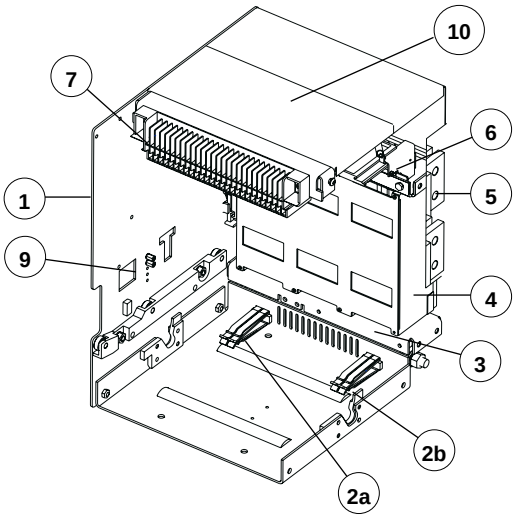
1. Description

1.1 General characteristics

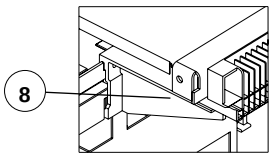
The SACE Emax series of circuit-breakers consists of a steel sheet structure which houses the operating mechanism, the poles and the auxiliary parts. Each pole, insulated from the others, contains the circuit-breaking parts and the current transformer of the corresponding phase.
The structure of the poles differs according to whether the circuit-breaker is selective or current-limiting.
The fixed version circuit-breaker has its own terminals for connection to the power circuit; in the withdrawable version the circuit-breaker comprises the moving part of the apparatus, which is completed with a fixed part fitted with the terminals for connection to the power circuit of the installation. The moving part and the fixed part are coupled by means of special contacts installed in the fixed part.

1.2 Fixed part construction characteristics

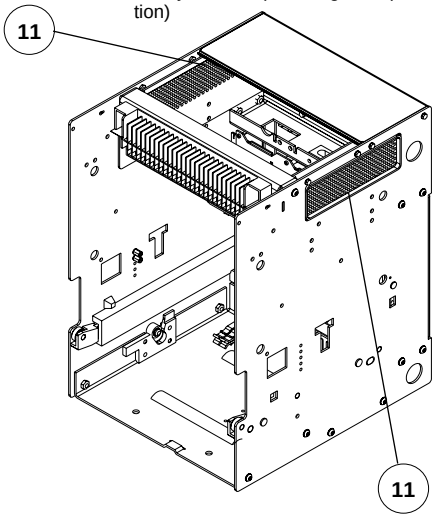
1 Steel sheet supporting structure
2 Earthing contacts (a: for all versions; b: for E4, E6)
3 Safety shutters (IP20 degree of protection)



LOW switching power



4 Insulating terminal support base
5 Terminals
6 Contacts for signalling connected/test isolated/ disconnected (on request)
7 Sliding contacts
8 Padlock for safety shutters (on request)
9 Anti-racking-in lock for circuit-breakers of different size
10 Casing
11 Insulation



HIGH switching power

		E1		E2				E3				E4					E6			
		B-A	N-A	B-A	N-A	S-A	H-A	N-A	S-A	H-A	V-A	S-A	H-A	V-A	L-A	H-A/f	H-A	V-A	L-A	V-A 600
LOW switching power	RH TERMINALS	-	-	OK	OK	-	-	OK	MAX 2500	-	-	OK	OK	-	-	OK	OK	-	-	-
	RV TERMINALS	-	-	OK	OK	-	-	OK	OK	-	-	OK	OK	-	-	OK	OK	-	-	-
	Mixed TERMINALS	-	-	OK	OK	-	-	OK	MAX 2500	-	-	OK	OK	-	-	OK	OK	-	-	-
HIGH switching power	RH TERMINALS	OK	OK	-	-	OK	OK	-	-	MAX 2500	MAX 2500	-	-	OK	OK	-	-	OK	OK	-
	RV TERMINALS	OK	OK	-	-	OK	OK	-	-	OK	OK	-	-	OK	OK	-	-	OK	OK	OK
	Mixed TERMINALS	OK	OK	-	-	OK	OK	-	-	MAX 2500	MAX 2500	-	-	OK	OK	-	-	OK	OK	-

Fig. 1

2. Checking on receipt

Examine the state of the material received and its consistency with the content of the order. Should any damage or errors be found on unpacking, which must be carried out carefully, make the relative notification within and not over 5 days from the receipt of the material. The notification must indicate the number of the shipping note.

3. Storage, lifting and weights

The fixed part is protected by an external wooden crate and is fixed by means of screws to the transport pallet or to the bottom of the packing case. If the fixed part will be stored in a warehouse even for a short time before being put into service, after checking it on receipt, it must be put back in its container and protected by waterproof material.

WARNING!
– **Store fixed part in a a dry, dust-free room free of aggressive chemical agents such as a storage room.**
– **Position the fixed part on a horizontal surface, not in direct contact with the floor, but on a suitable support surface (Fig. 2)**
– **The maximum number of stackable fixed parts is indicated in figure 3.**

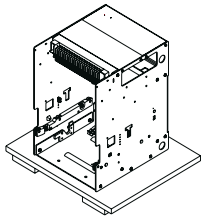


Fig. 2

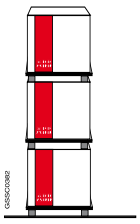


Fig. 3

With regard to lifting, follow the instructions: the fixed part must be placed on a sturdy supporting surface and lifted, preferably, by means of a special fork-lift truck. However, the use of ropes is allowed. In this case, the lifting ropes must be hooked up as shown in the figures.

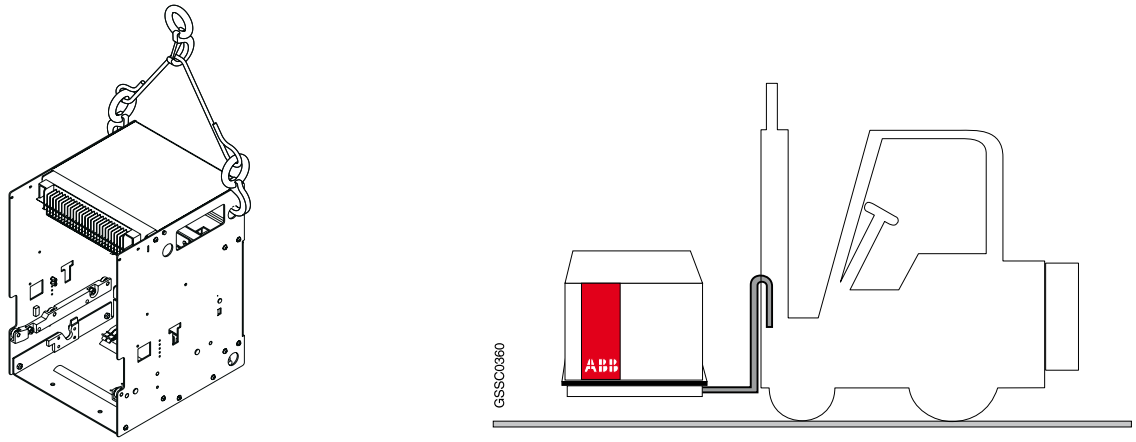


Fig. 4

Table of the fixed parts weights

Fixed part	3 poles withdrawable		4 poles withdrawable	
	Kg	Lbs	Kg	Lbs
E1	25	55	27	60
E2	30	66	33	73
E3	38	84	45	99
E4	53	117	58	128
E4/f	-	-	63	139
E6	73	162	80	176
E6/f	-	-	88	194
E6V-A 6000	185	408	-	-

Note
The above table refers to fixed parts with horizontal back terminals.

4. Installation

4.1 Installation room

Install the circuit-breaker in a dry, dust-free, non-corrosive room, and in such a way that it is not subject to shocks or vibrations; where this is not possible, install it inside a switchboard with a suitable degree of protection.
For the preparation of the installation room, please refer to the "Overall dimensions" chapter, which gives information on the following points:
– minimum installation volumes of the circuit-breakers and derived versions
– distances to be respected for circuit-breakers in compartments
– overall dimensions of the circuit-breakers
– fixing drillings
– compartment door drillings.

WARNING: The installation, commissioning and any ordinary and extraordinary maintenance of the circuit-breaker and accessories must be performed by skilled personnel, with a detailed knowledge of the equipment.

WARNING ELECTRICAL SHOCK HAZARD:
Disconnect and lock and tag out all electrical power feeds to avoid any potential shock hazard when you are assembling, installing maintaining or removing the circuit breaker from service. Some operations must be performed when the circuit-breaker is energized. In this case, reasonable care and compliance with all safe working practices is required.

4.2 Installation of the fixed part of the withdrawable circuit-breaker

4.2.1 Preparation of the fixed part

Assembly of the anti-racking-in lock

Before installing the fixed part, it is necessary to check the presence of the anti-racking-in lock for circuit-breakers with different electrical characteristics from those of the fixed part; if the anti-racking-in lock has been supplied separately, proceed to assemble it as follows:

– On the self-adhesive plate (4), find the assembly position of the stop bolts in relation to the circuit-breaker which has to be housed in the fixed part
– Insert the two hexagonal-head screws (1) in the holes found in the previous item as shown in the figure
– Fix the two screws with the washers (2) and the hexagonal stops (3).

Make sure that the anti-racking-in lock corresponding to the one installed on the fixed part is present on the circuit-breaker (moving part).

Example for E1B 08 according to the nameplate diagram

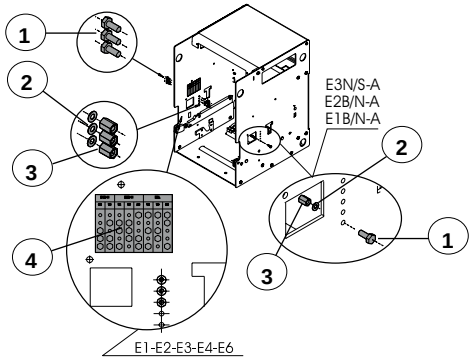


Fig. 5

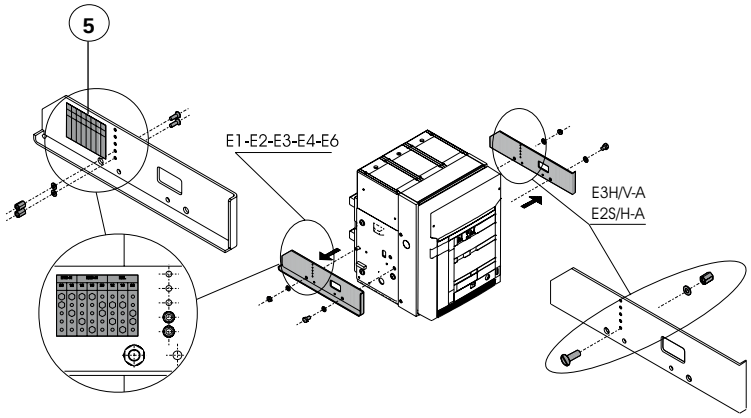
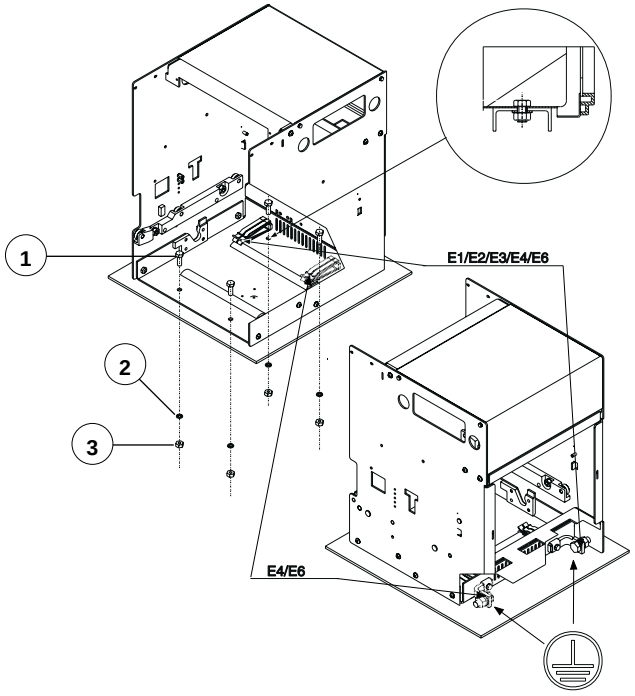


Fig. 6

4.2.2 Installation of the fixed part

Attach the fixed part by means of the screws (1), washers (2) and nuts (3) (M8x 16), supplied by ABB SACE. If other screws are used, make sure that the head of the screws does not extend more than 5.5 mm (0.22 inches) from the base of the fixed part.



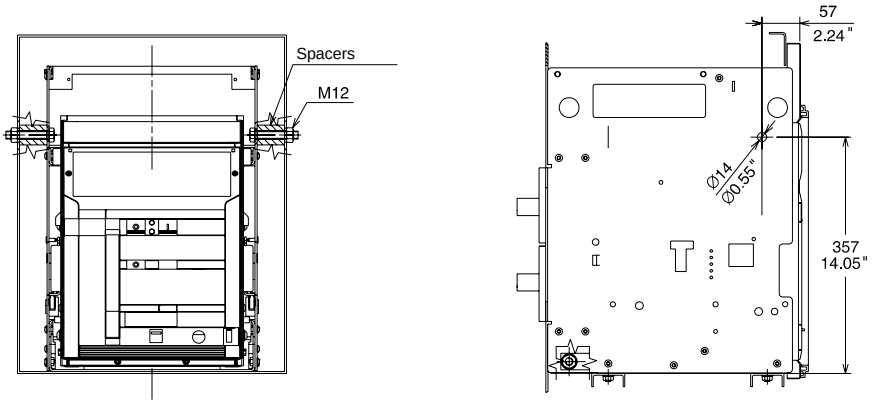
Notes
(*) For the E1-E2-E3 fixed parts, there are four fixing points, whereas there are six for E4-E6.

Fig. 7

4.2.3 Installation of the fixed part on board a ship

Regarding the fixing points of the SACE Emax withdrawable version air circuit-breakers, for applications on board a ship, additional fixing on the sides of the fixed part itself is recommended (the M12 screws and the spacers are not provided in the supply).

E1 - E2 - E3



E4 - E6

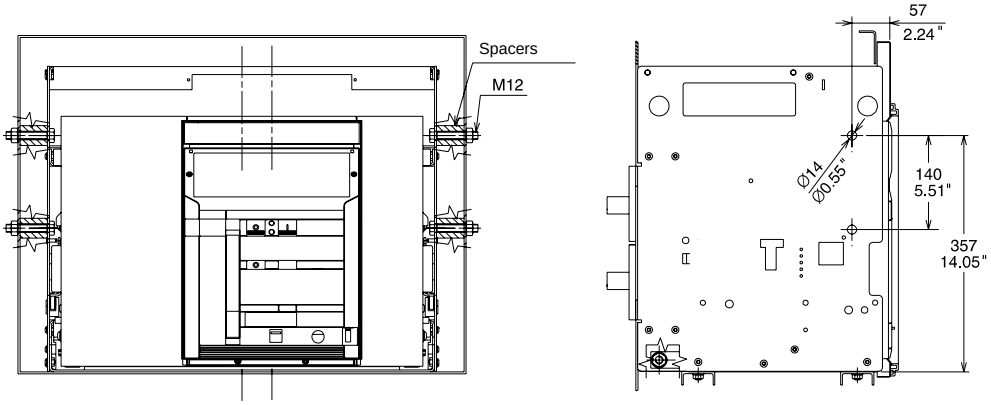


Fig. 8

4.3 Installation of the flange on the compartment door (Fig. 9)

– Make the compartment door drillings specified in the "Overall dimensions" paragraph.
– Attach the flange (1) on the front of the compartment door, fixing it from the inside by means of the self-tapping screws (2).

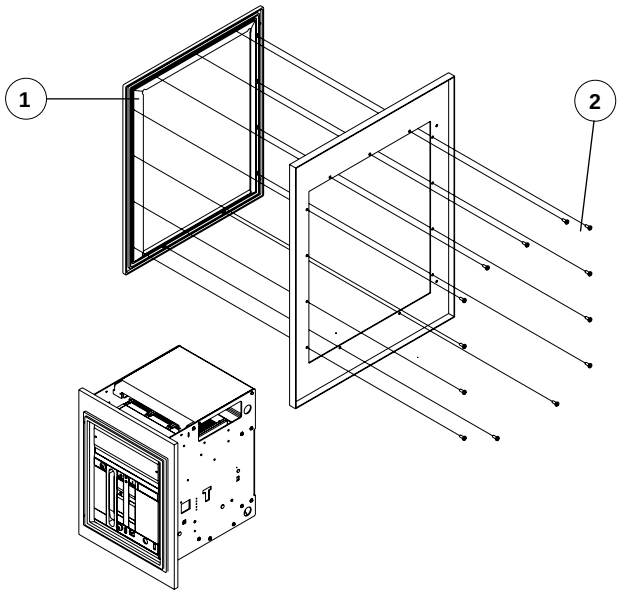
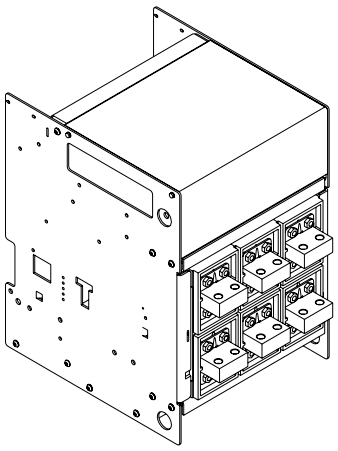


Fig. 9

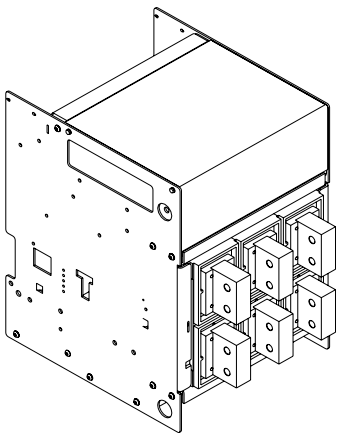
5. Electrical connections

5.1 Connections to the power circuit

5.1.1 Shapes of the terminals



Horizontal rear terminals



Vertical rear terminals

Note
The drawings are provided to show the type of terminal in graphic form. The exact shape of the terminals is given in the "Overall dimensions" chapter.

Fig. 10

5.1.2 Examples of positioning the connection busbars according to the types of terminal

The connection busbars enable the connection between the terminals of the circuit-breakers and the busbars of the switchgear. Their sizing must be carefully studied by the switchgear designer.
Some examples of possible constructions in relation to the shape and size of the circuit-breaker terminals are given in this paragraph. The various types of terminals are of constant dimensions for each size of circuit-breaker: it is normally advisable to exploit the whole contact surface of the terminal, so the width of the connection busbars should be the same as that of the terminal. Different connection capacities can be obtained by adjusting the thickness and number of busbars in parallel. In some cases, reductions in the width of the connection in relation to that of the terminal are allowable as shown in the following examples.

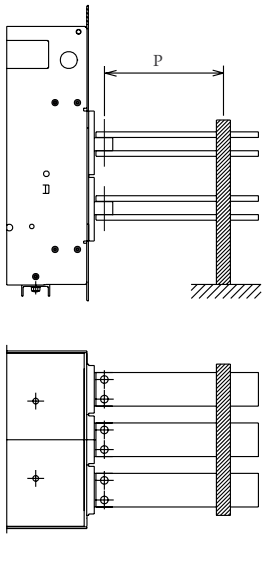
Possible length of connection busbars				
Connection busbars				
	Nominal current	**Number**	**Dimensions mm/inches**	**Dimensions mm/inches**
E1	800 A	1	76.2/3"	6.35/0.26"
E1	1200 A	2	50.8/2"	6.35/0.26"
E2	1200 A	2	50.8/2"	6.35/0.26"
E2	1600 A	2	76.2/3"	6.35/0.26"
E3	1200 A	2	50.8/2"	6.35/0.26"
E3	1600 A	2	76.2/3"	6.35/0.26"
E3	2000 A	2	101.6/4"	6.35/0.26"
E3	2500 A	3	101.6/4"	6.35/0.26"
E4	3200 A	5	76.2/3"	6.35/0.26"
E4	3600 A	6	76.2/3"	6.35/0.26"
E4/f	3200 A	5	76.2/3"	6.35/0.26"
E4/f	3600 A	6	76.2/3"	6.35/0.26"
E6	4000 A	7	76.2/3"	6.35/0.26"
E6	5000 A	7	101.6/4"	6.35/0.26"
E6V-A 6000	6000 A	8	127/5”	6.35/0.26"

Fig. 11

Positioning the first anchoring baffle of the busbars according to the short-circuit current

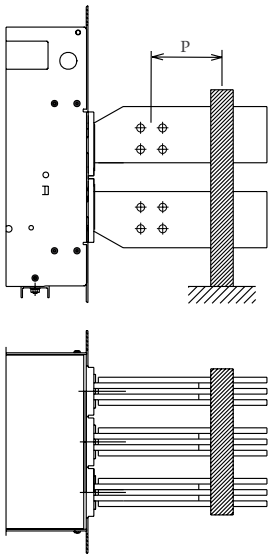
Anchoring to the switchgear

HORIZONTAL TERMINALS



P	E1-E2	E3-E4-E6
mm/ inch	250/9.84"	150/5.91"

VERTICAL TERMINALS



P	E1-E2	E3-E4-E6
mm/ inch	250/9.84"	250/9.84"

Fig. 12

5.1.3 Assembly procedure for the connection busbars

Inspect the contact surfaces of the busbar connections very carefully: they must be very clean with no burrs, dents or traces of rust. Such traces must be eliminated using a fine file or an emery cloth to prevent localized increases in temperature. Upon completion, remove any residue with a cloth soaked in a suitable solvent. When copper connections are used, it is advisable to tin-plate the contact surfaces.
When aluminium connections are used, the contact surfaces must be tinned.
The connections must not exert any strain on the terminals in any direction.
Always insert a large diameter flat washer and a spring washer between them (to spread the tightening pressure over a greater area).
Make the contact between connection and terminal and tighten the fixing screws completely.
Always use two wrenches (so as not to strain the insulating parts excessively), applying the tightening torque indicated in Fig. 11. Check tightness after 24 hours.

M12/ ½" high-strength screws
Tightening torque of the main terminals: 70 Nm / 620 Lbft

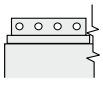
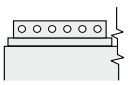
Fixed part terminals		No. screws for phase	No. screws for neutral
	E1/E2	2	2
	E3	3	3
	E4	4	2
	E4/f	4	4
	E6	6	3
	E6/f	6	6

Fig. 13

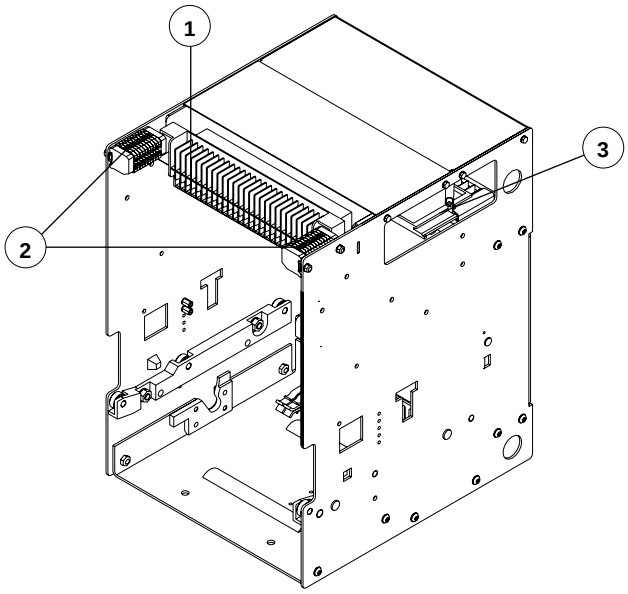
5.2 Earthing

The fixed part of the withdrawable circuit-breaker has one or two terminals on the rear, marked with the special symbol, for connection to earth (Fig. 9). Each terminal is complete with a bolt for fixing the connection.
A conductor with a cross-section conforming to current standards must be used for the connection. Before assembling the connection, clean and degrease the area around the screw. After the assembly tighten the bolt with a torque of 70 Nm/ 620 Lbft.

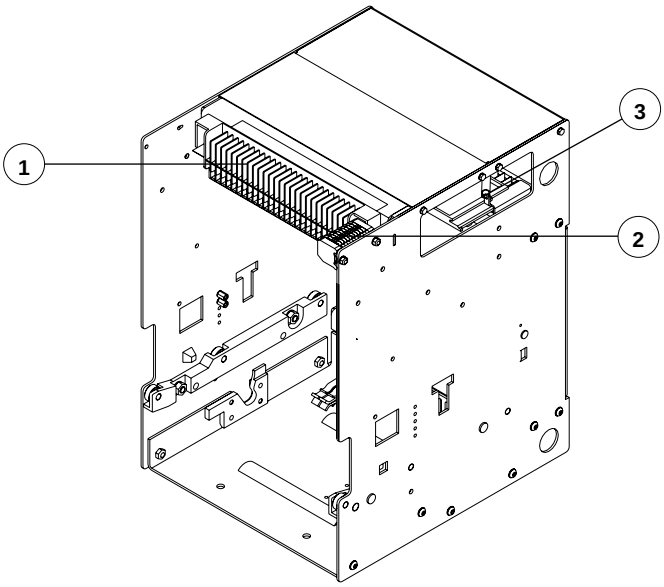
5.3 Wiring the circuit-breaker auxiliary circuits

5.3.1 Withdrawable circuit-breaker

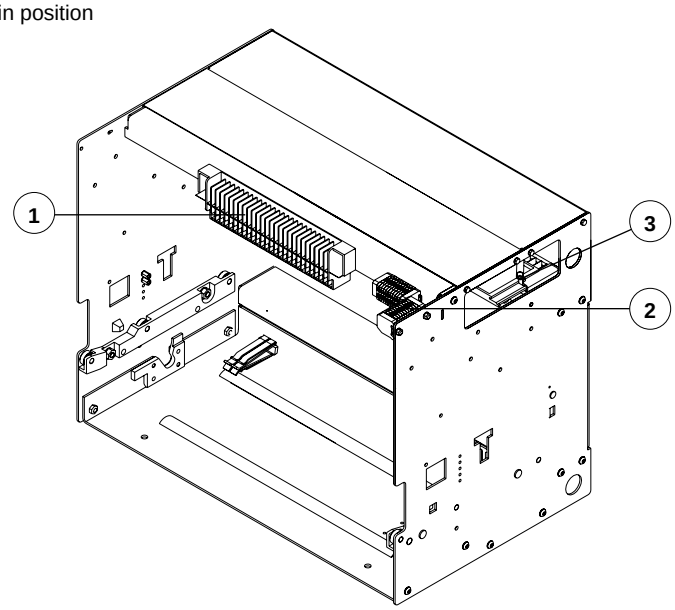
For connection of the moving part to the auxiliary circuits, a connection with sliding contacts is available on the fixed part (see figure), identified by code X on the electrical circuit diagram.
The terminals of the fixed connector are immediately accessible when the compartment door is open.
Furthermore, a terminal box identified by code XF is available for connecting the position contacts of the moving part in relation to the fixed part.
The connector and terminal box have screw terminals.



E1 - E2 - E3
10 contacts in position



E1 - E2 - E3
5 contacts in position



E4 - E6
10 contacts in position

Legend
1) Sliding contacts(X)
2) Terminal box for position contacts (XF)
3) Position contacts

Fig. 14

6. Fixed part accessories

6.1 Electrical accessories

6.1.1 Auxiliary contacts

Auxiliary contacts installed on the circuit-breaker are available enable an indication of the circuit-breaker's status.

Characteristics

Un	In max	T
125 V DC	0.3 A	10 ms
250 V DC	0.15 A	10 ms

Un	In max	cosφ
250 V AC	5 A	0.3

Electrical signalling for circuit-breaker connected/test isolated/disconnected (Fig. 14)

In addition to mechanical signalling of the position of the circuit-breaker, it is possible to have electrical signalling by means of 5 or 10 auxiliary contacts which are installed on the fixed part.
Only available for circuit-breakers in withdrawable versions for installing on the fixed part.
The auxiliary contacts can have the following configuration:

– 5 contacts; group consisting of 2 connected signalling contacts, 2 disconnected signalling contacts and 1 test position signalling contact (main contacts isolated, but sliding contacts connected)
– 10 contacts; group consisting of 4 connected signalling contacts, 4 disconnected signalling contacts and 2 test position signalling contacts (main contacts isolated, but sliding contacts connected).

Reference figures in the electrical circuit diagrams:

S75I (31-32) - S75T (31-32) - S75E (31-32)

6.2 Mechanical accessories

6.2.1 Accessory for shutter padlocks (Fig.15)

They enable the shutters to be padlocked (installed on the fixed part) in the closed position.
Only available for circuit-breakers in withdrawable versions for installing on the fixed part.

6.2.2 Mechanical lock on compartment door

This prevents the compartment door from being opened when the circuit-breaker is closed (connected in the case of withdrawable circuit-breakers) and prevents circuit-breaker closing with the compartment door open.

6.2.3 Lock in open position with Kirk lock (internal or on front door)

This makes it possible to lock the circuit breaker in the open position using a Kirk key lock (not supplied).
For use on fixed circuit breakers, the accessory must be ordered together with the interlock plate for fixed circuit breakers.

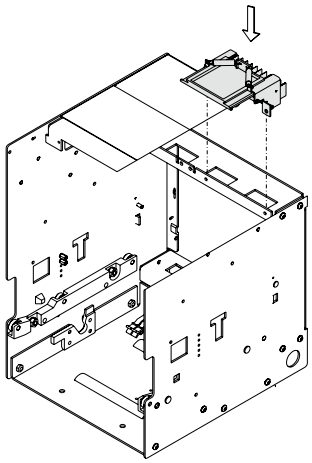


Fig. 14

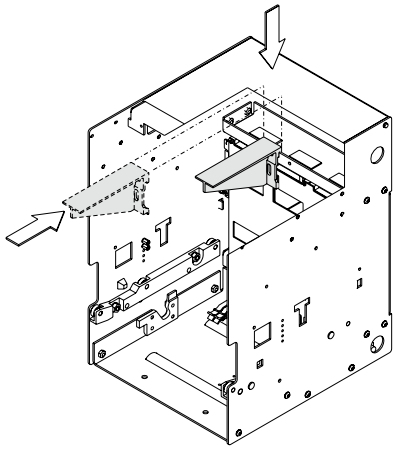


Fig. 15

6.2.4 Mechanical interlock

This mechanism makes the mechanical interlock between two or three circuit-breakers (even of different sizes and in any fixed/withdrawable version) by means of a flexible cable. The electrical circuit diagram for the electrical changeover by means of a relay (to be provided by the customer) is supplied with the mechanical interlock. The circuit-breakers can be installed vertically or horizontally. Four types of interlocks are available:

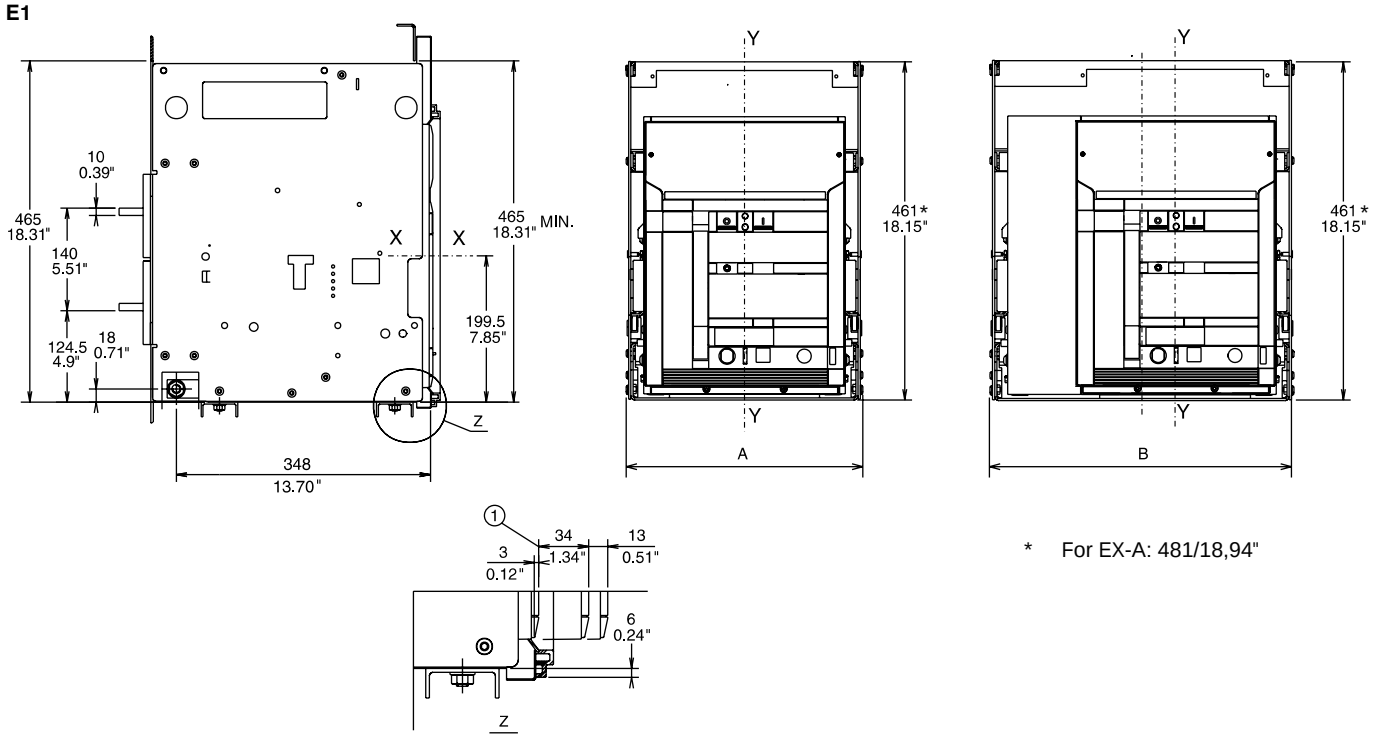
type A:	between 2 circuit-breakers (power supply + emergency)
type B:	between 3 circuit-breakers (2 power supplies + emergency)
type C:	between 3 circuit-breakers (2 power supplies + bus-tie)
type D:	between 3 circuit-breakers (3 power supplies / a single closed circuit-breaker)

7. Overall dimensions

Withdrawable circuit breaker

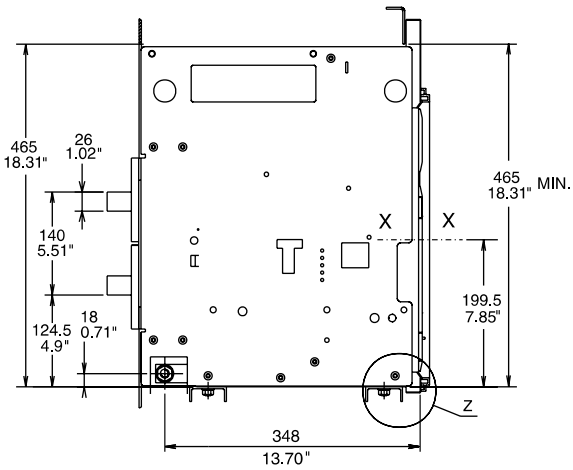
Basic version with horizontal rear terminals

E1



* For EX-A: 481/18,94"

E2-E3-E4-E6



	A 3 Poles	B 4 Poles
E1-A	324/12.76"	414/16.3"
E2-A	324/12.76"	414/16.3"
E3-A	432/17.01'	558/21.97"
E4-A	594/23.39"	684/26.93"
E4/f-A		774/30.47"
E6-A	810/31.89"	936/36.85"
E6/f-A		1061/41.81"

Legend

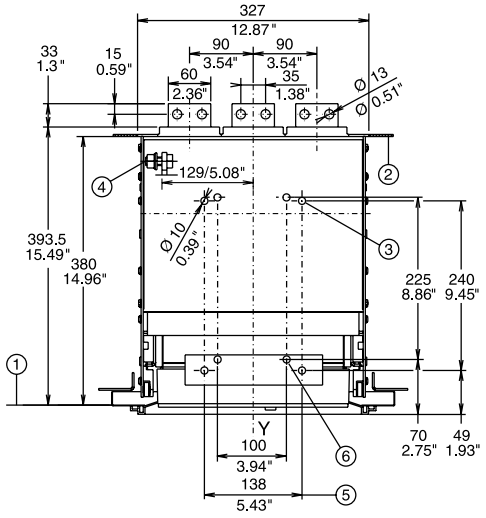
① Run from connected for a TEST to isolated

Fig. 17

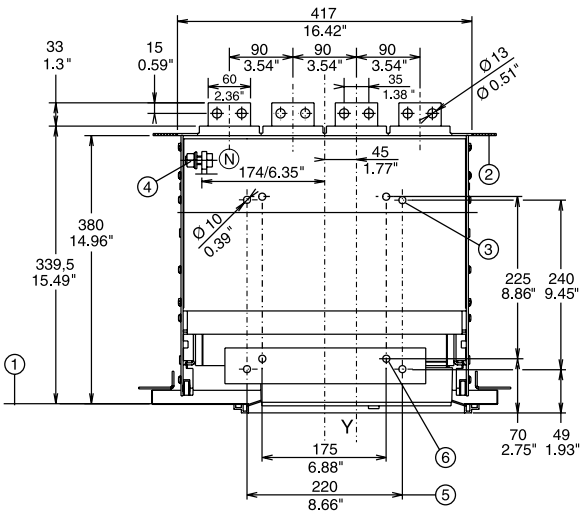
Withdrawable circuit breaker

Basic version with horizontal rear terminals

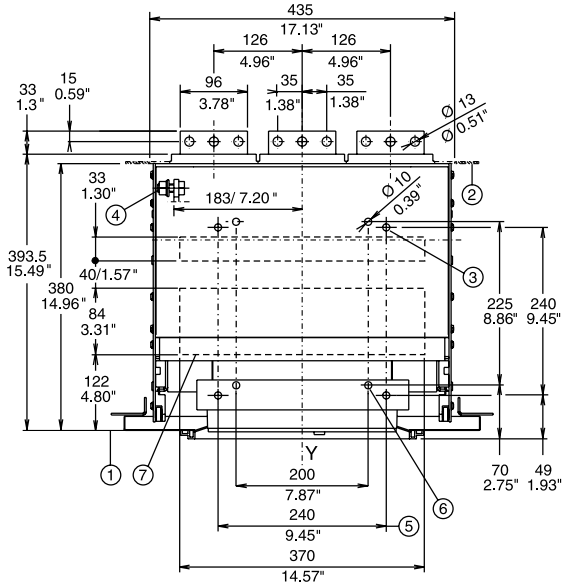
E1 3 poles / **E2** 3 poles



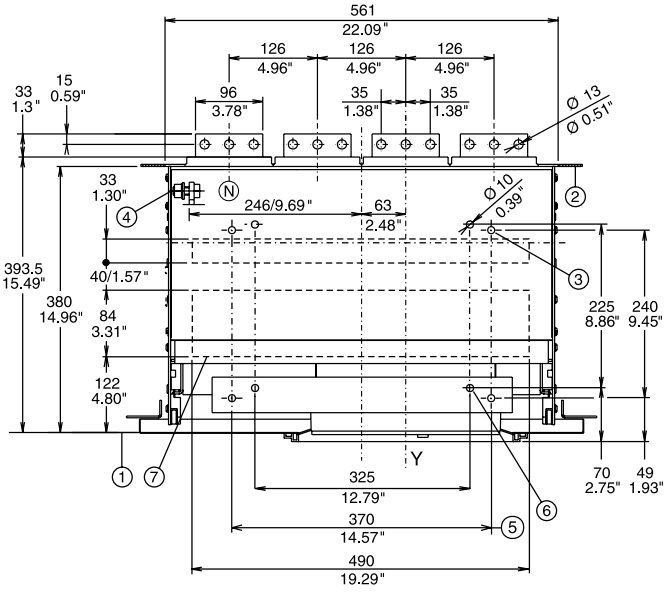
E1 4 poles / **E2** 4 poles



E3 3 poles



E3 4 poles



Legend

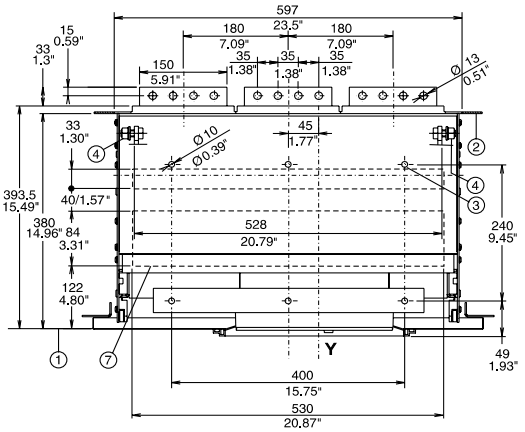
1. *Inside edge of compartment door*
2. Segregation (where foreseen)
3. M8 mounting holes for circuit breaker (included in the supply)
4. No. 1 M12 screw for earthing (included in the supply)
5. No. 4 fixed part mounting holes (standard)
6. Alternative drilling with 25 mm / 0.98 inch. pitch for fixing fixed part
7. Ventilation drilling on the switchboard

Fig. 18

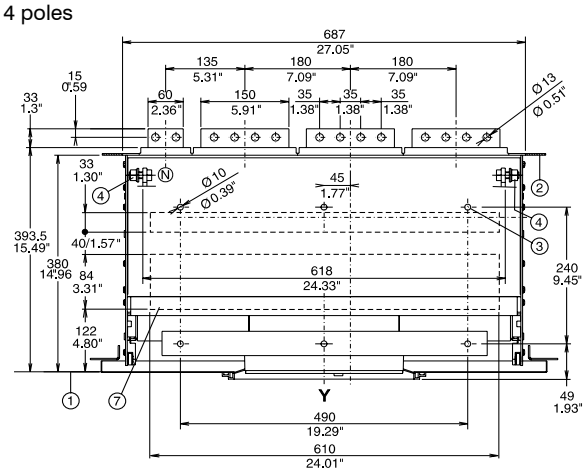
Withdrawable circuit breaker

Basic version with horizontal rear terminals

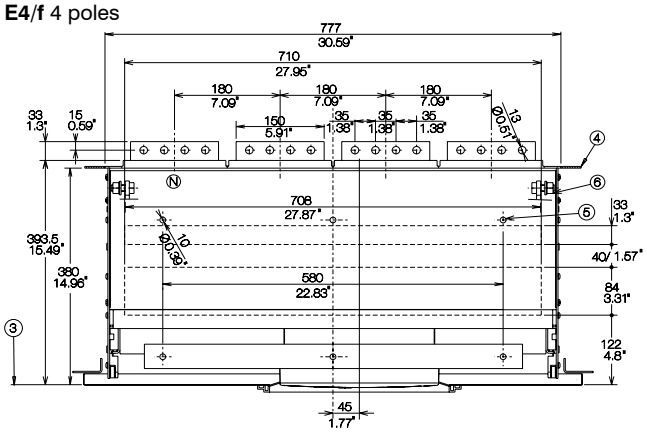
E4 3 poles



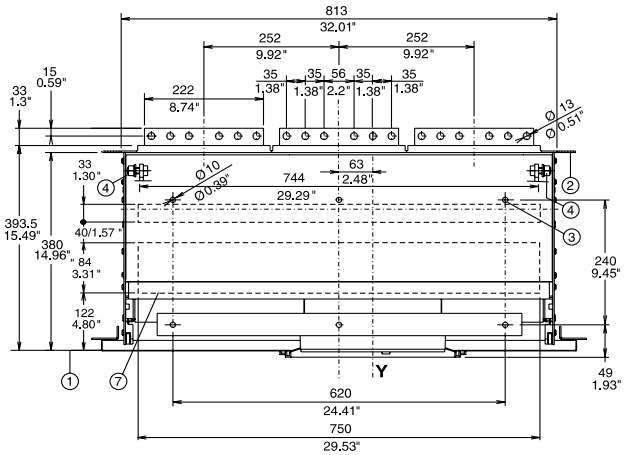
E4 4 poles



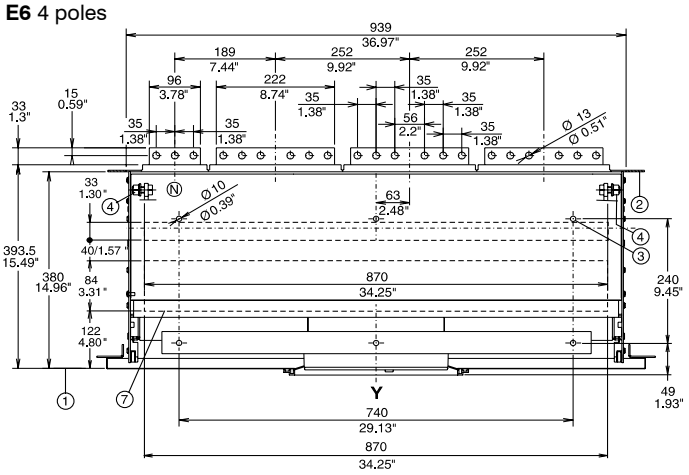
E4/f 4 poles



E6 3 poles



E6 4 poles



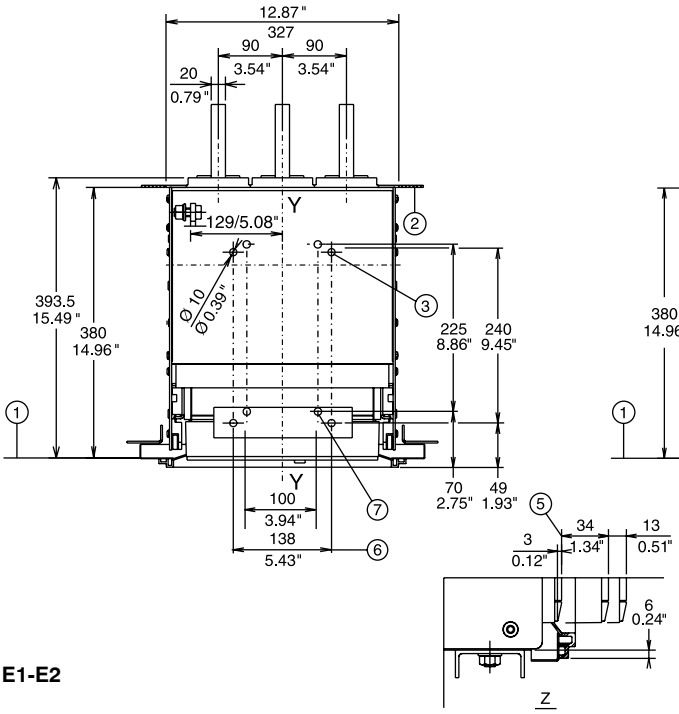
Legend

1. Inside edge of compartment door
2. Segregation (where foreseen)
3. M8 mounting holes for circuit breaker (included in the supply)
4. No. 1 M12 screw for earthing (included in the supply)
7. Ventilation drilling on the switchboard

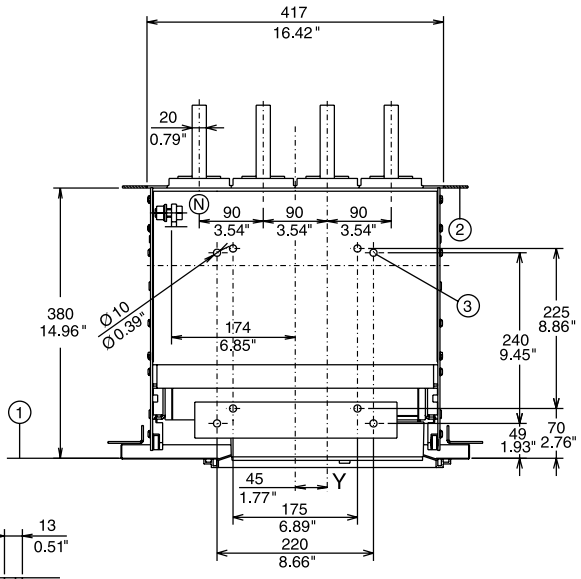
Fig. 19

Version with vertical rear terminals

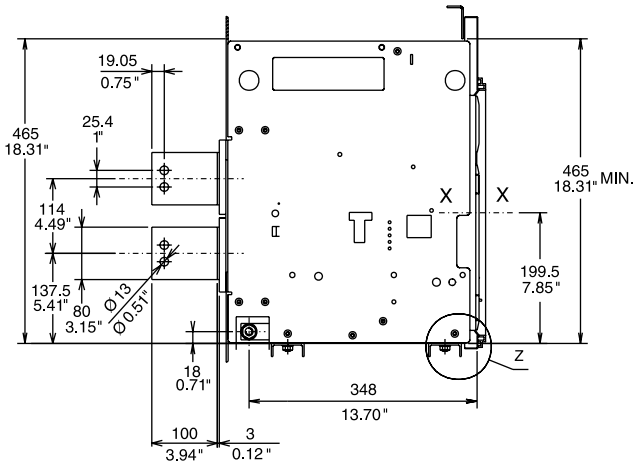
E1 3 poles / **E2** 3 poles



E1 4 poles / **E2** 4 poles



E1-E2



Legend

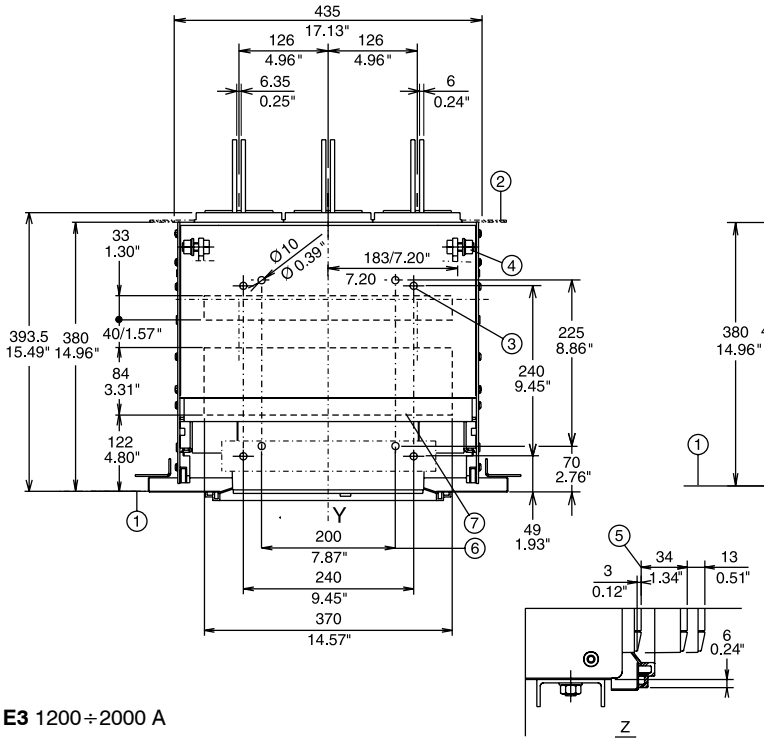
1. Inside edge of compartment door
2. Segregation (where foreseen)
3. M8 mounting holes for circuit breaker (included in the supply)
5. Run from connected for a TEST to isolated
6. No. 4 fixed part mounting holes (standard)
7. Alternative drilling with 25 mm / 0.98 inch. pitch for fixing fixed part

Fig. 20

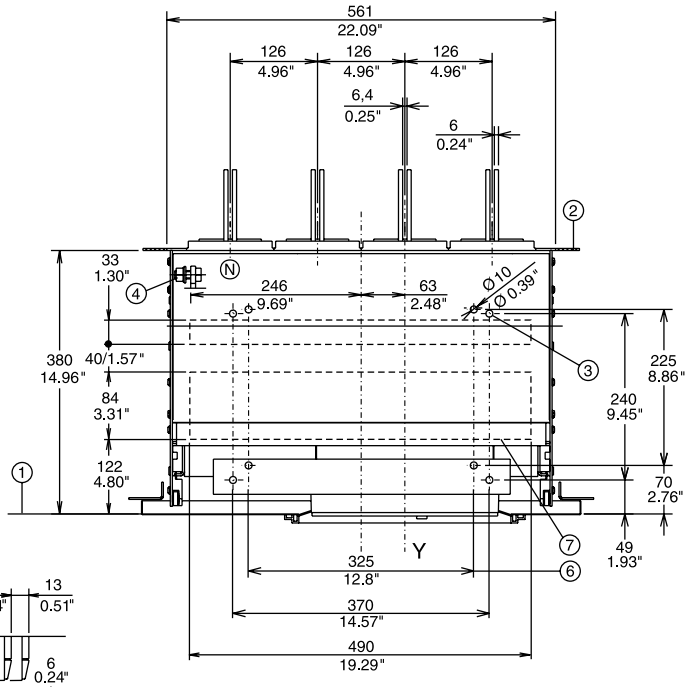
Withdrawable circuit breaker

Version with vertical rear terminals

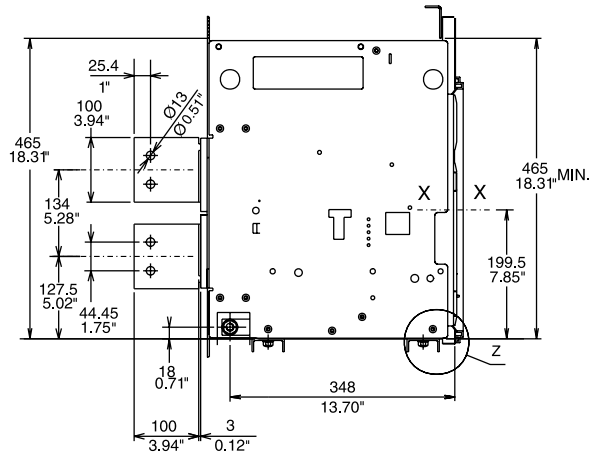
E3 3 poles 1200÷2000 A



E3 4 poles 1200÷2000 A



E3 1200÷2000 A



Legend

(1) *Inside edge of compartment door*

(2) Segregation (where foreseen)

(3) M8 mounting holes for circuit breaker (included in the supply)

(4) No. 2 M12 screws for earthing (included in the supply)

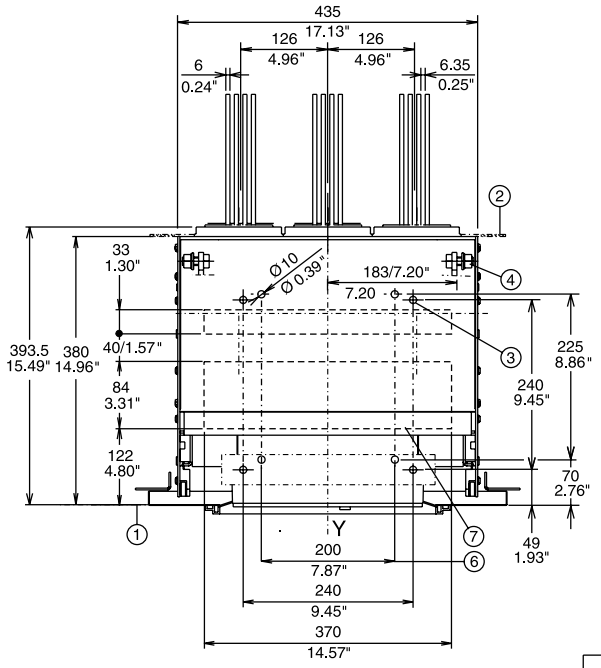
(5) Run from connected for a TEST to isolated

(6) Alternative drilling with 25 mm / 0.98 inch. pitch for fixing fixed part

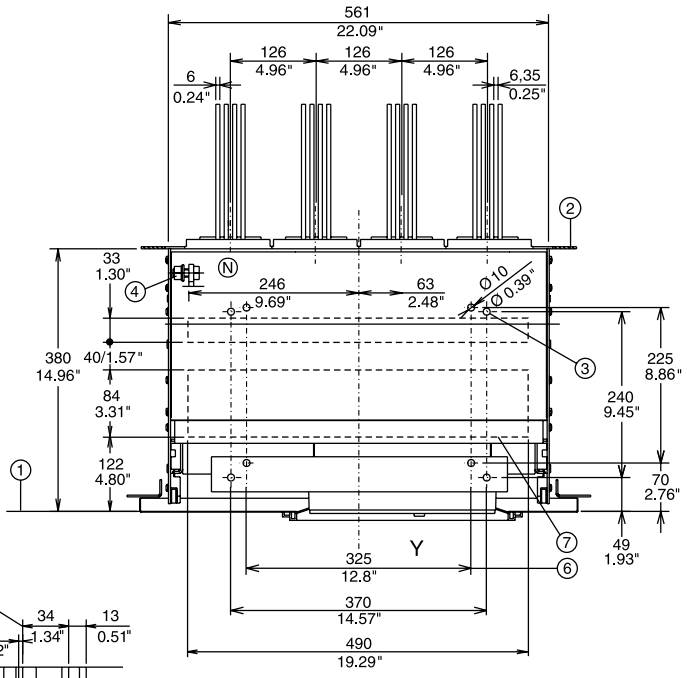
(7) Ventilation drilling on the switchboard

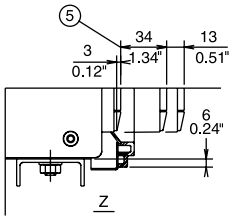
Fig. 21

E3 3 poles 2500 A

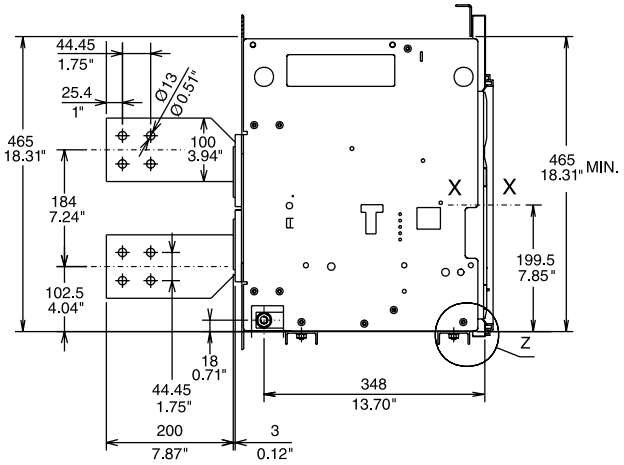


E3 4 poles 2500 A





E3 2500 A



Legend

(1) *Inside edge of compartment door*

(2) Segregation (where foreseen)

(3) M8 mounting holes for circuit breaker (included in the supply)

(4) No. 2 M12 screws for earthing (included in the supply)

(5) Run from connected for a TEST to isolated

(6) Alternative drilling with 25 mm / 0.98 inch. pitch for fixing fixed part

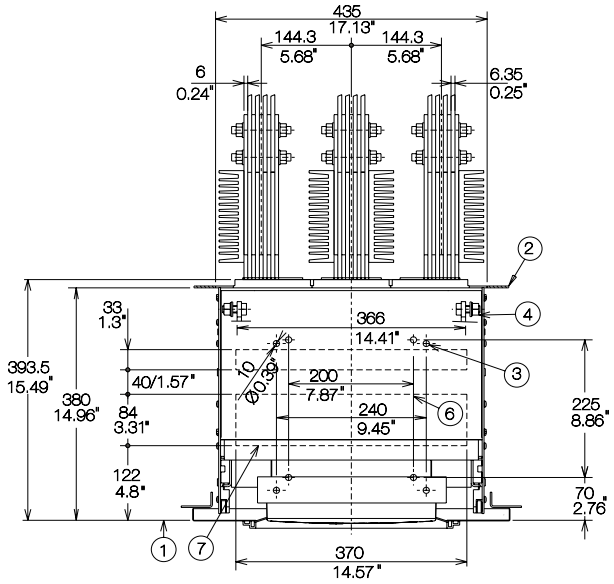
(7) Ventilation drilling on the switchboard

Fig. 22

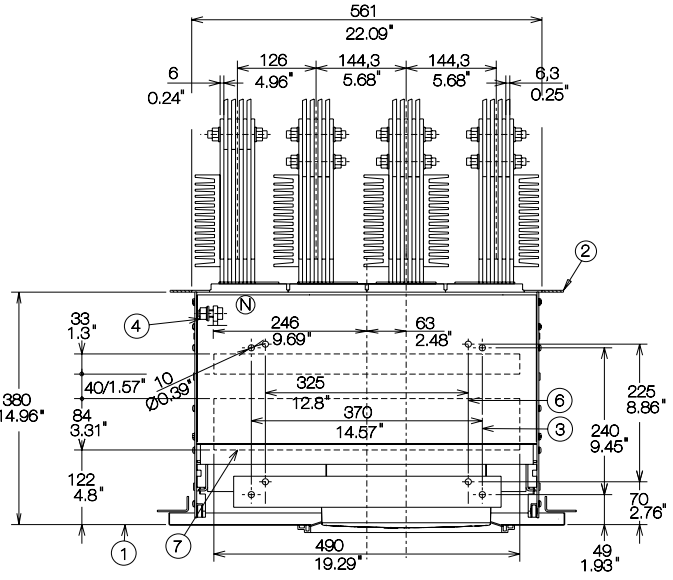
Withdrawable circuit breaker

Version with vertical rear terminals

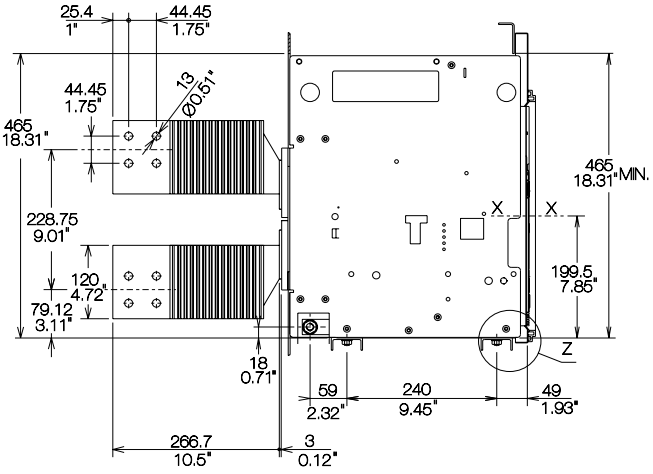
E3 3 poles 3200 A

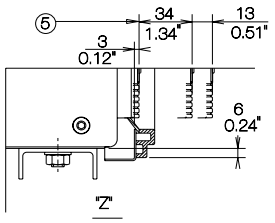


E3 4 poles 3200 A



E3 3200 A





Legend

① Inside edge of compartment door

② Segregation (where foreseen)

③ M8 mounting holes for circuit breaker (included in the supply)

④ No. 2 M12 screws for earthing (included in the supply)

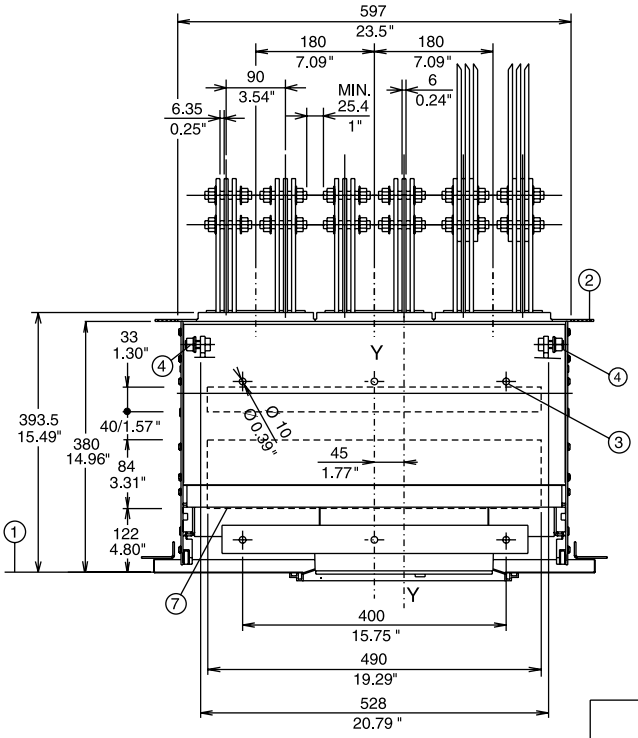
⑤ Run from connected for a TEST to isolated

⑥ Alternative drilling with 25 mm / *0.98 inch.* pitch for fixing fixed part

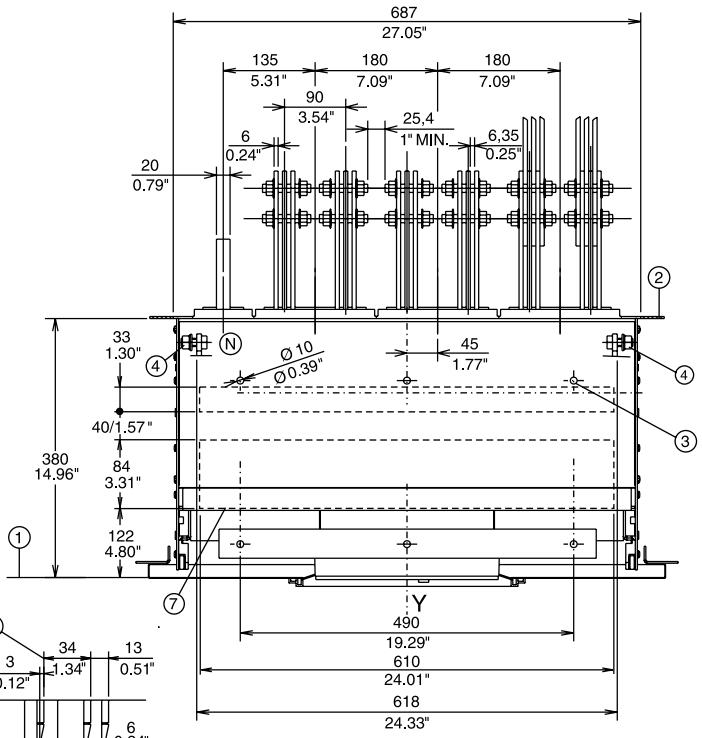
⑦ Ventilation drilling on the switchboard

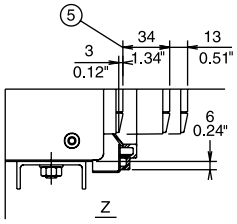
Fig. 23

E4 3 poles

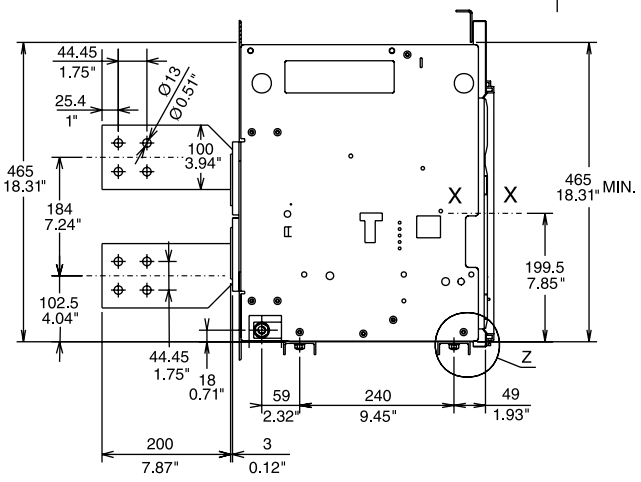


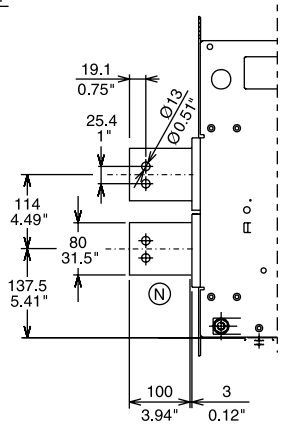
E4 4 poles





E4



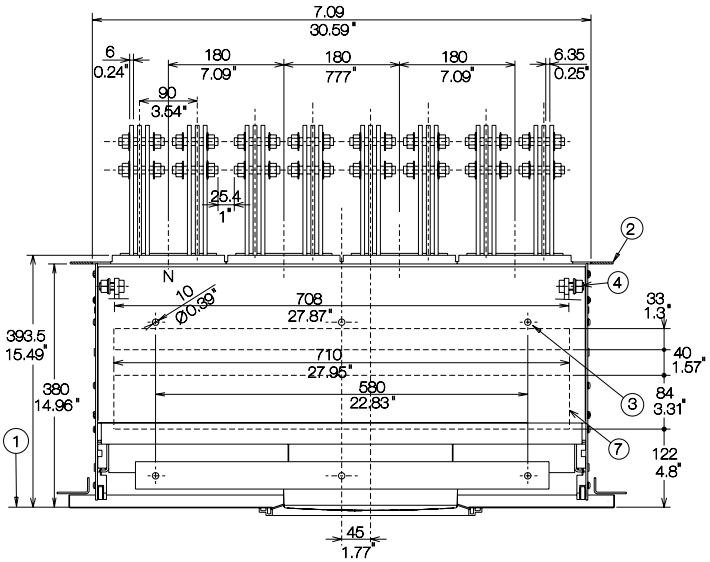


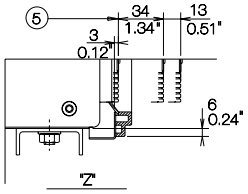
Legend

1. *Inside edge of compartment door*
2. Segregation (where foreseen)
3. M8 mounting holes for circuit breaker (included in the supply)
4. No. 2 M12 screws for earthing (included in the supply)
5. Run from connected for a TEST to isolated
7. Ventilation drilling on the switchboard

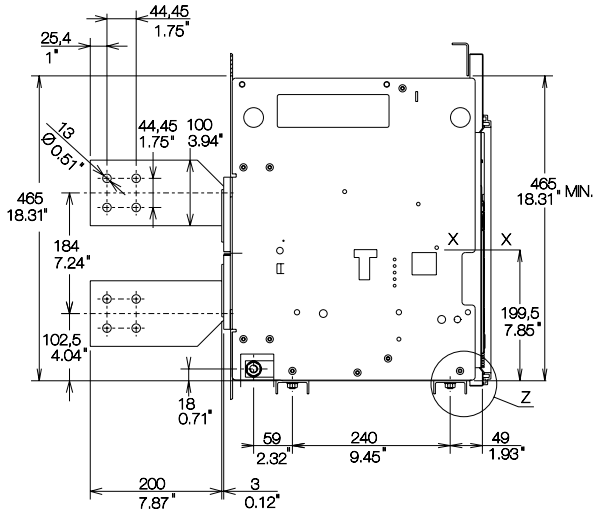
Fig. 24

E4/f 4 poles





E4



Legend

(1) *Inside edge of compartment door*

(2) *Segregation (where foreseen)*

(3) *M8 mounting holes for circuit breaker (included in the supply)*

(4) *No. 2 M12 screws for earthing (included in the supply)*

(5) *Run from connected for a TEST to isolated*

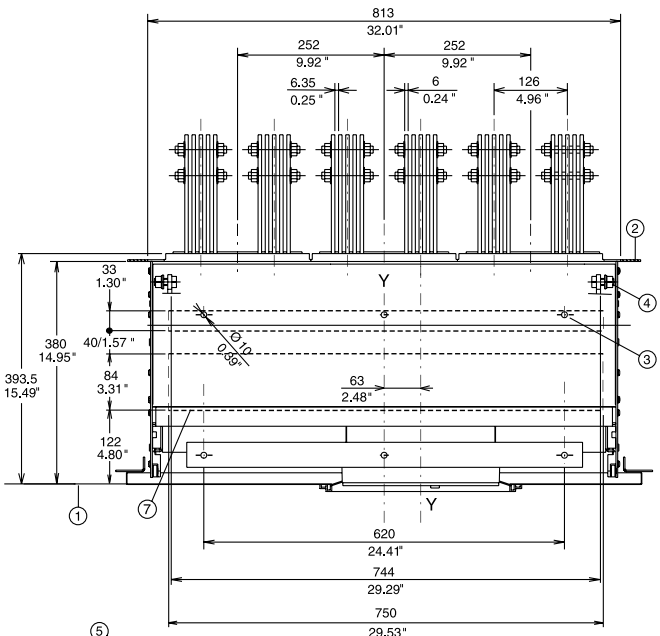
(7) *Ventilation drilling on the switchboard*

Fig. 25

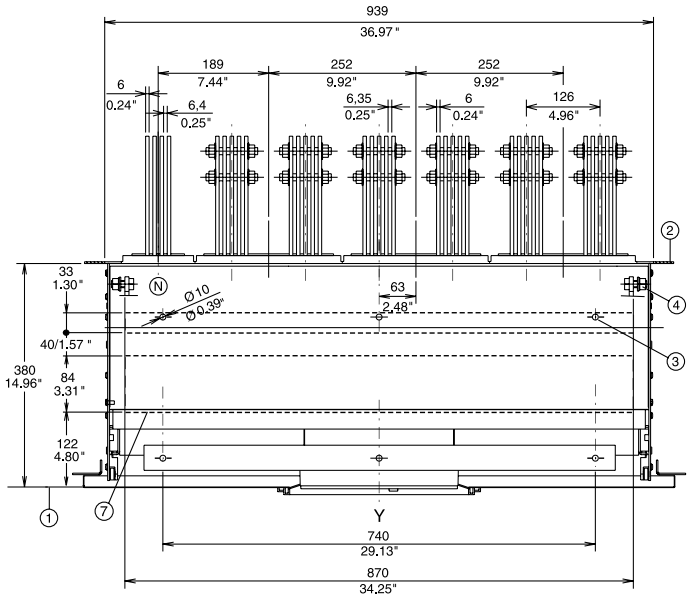
Withdrawable circuit breaker

Version with vertical rear terminals

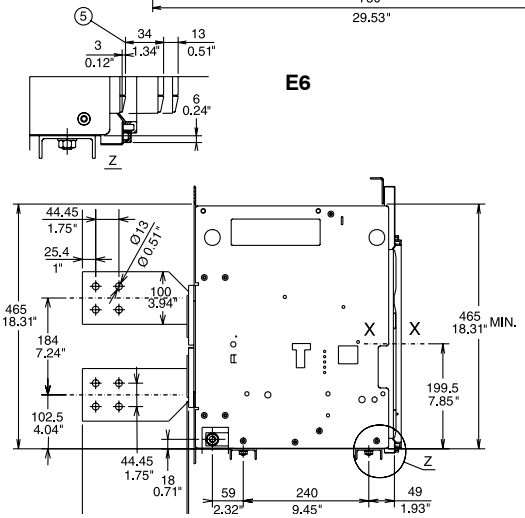
E6 3 poles



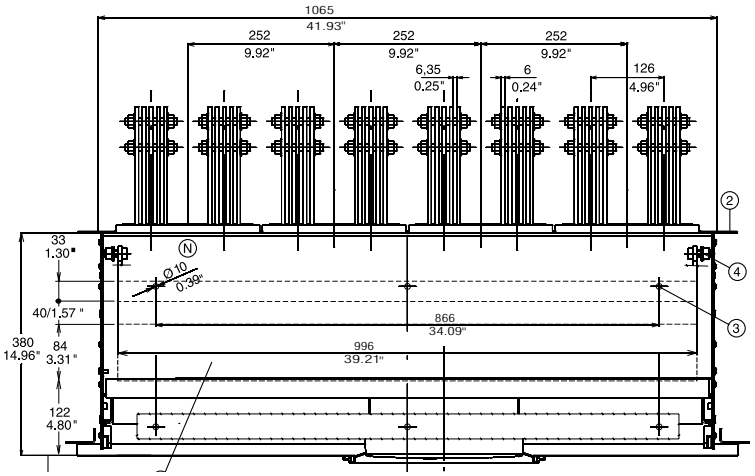
E6 4 poles



E6



E6/f 4 poles



Legend

1 Inside edge of compartment door

2 Segregation (where foreseen)

3 M8 mounting holes for circuit breaker (included in the supply)

4 No. 2 M12 screws for earthing (included in the supply)

5 Run from connected for a TEST to isolated

7 Ventilation drilling on the switchboard

Fig. 26

Withdrawable circuit breaker

Version with vertical rear terminals

Legend

① *Inside edge of compartment door*

② *Segregation (where foreseen)*

③ *M8 mounting holes for circuit breaker (included in the supply)*

④ *No. 2 M12 screws for earthing (included in the supply)*

⑤ *Run from connected for a TEST to isolated*

⑦ *Ventilation drilling on the switchboard*

E6V-A 6000 3 poles

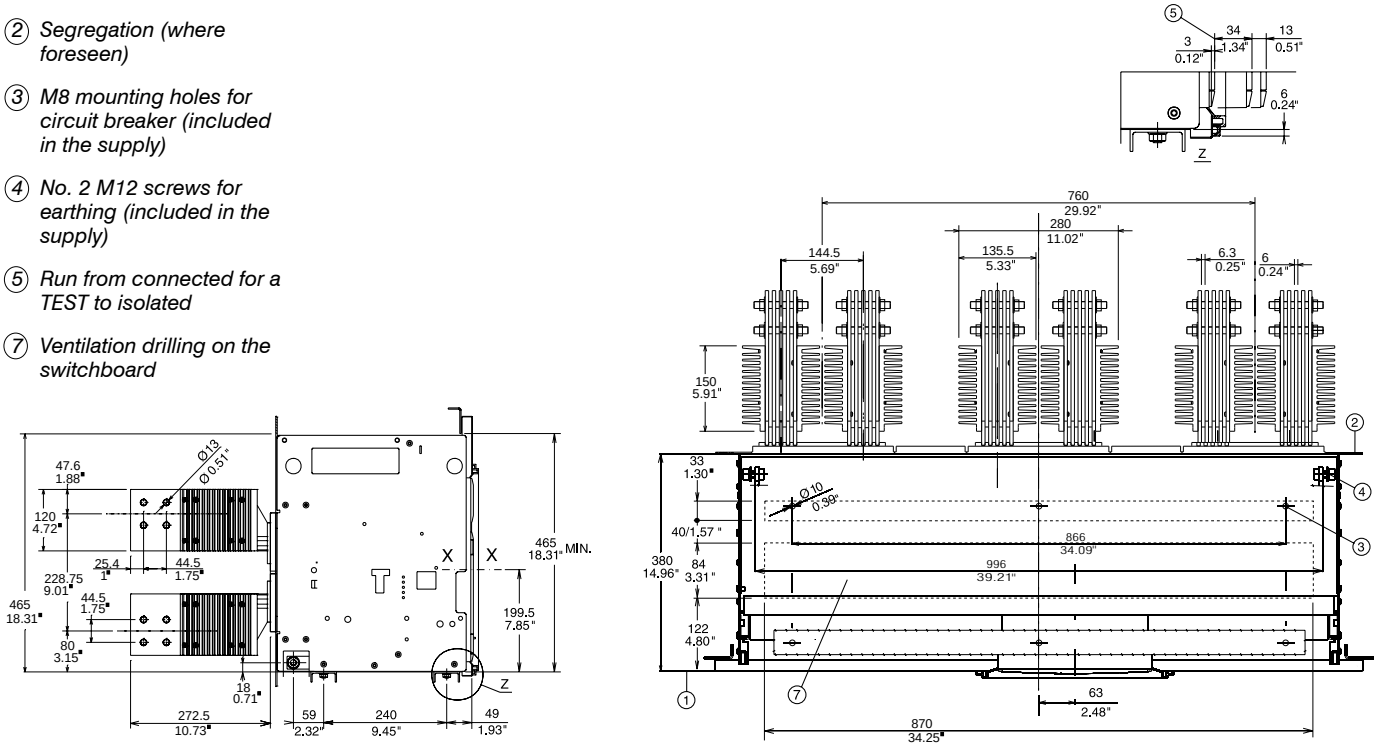
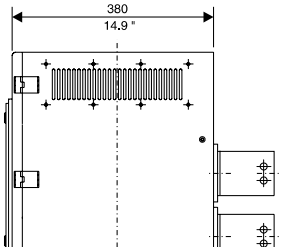


Figure 27.

Compartment dimensions

** Suitable to operate at 100% RATING in a minimun cubicle space (see the table), with a ventilation of 48 (12x4) sq. in. side botton and side top.

Check cubicle drawing.



	A 3 Poles	A 4 Poles	B
E1-A	400/15.7"	490/19.3"	500/19.7"
E2-A	400/15.7"	490/19.3"	500/19.7"
E3 N-S-A	500/19.7"	630/24.8"	500/19.7"
E3 H-V-A	500/19.7"	630/24.8"	850/33,5"
E4 S-H-A	700/25.7"	790/30.1"	500/19.7"
E4/f-A	-	880/34.6"	500/19.7"
E4 V-L-A	700/25.7"	790/30.1"	850/33,5"
E6 H-A	1000/39.3"	1130/44.5"	500/19.7"
E6/f H-A	-	1260/49,7"	850/33,5"
E6 H-A	1000/39.3"	1130/44.5"	500/19.7"
E6 V-L-X-A	1000/39.4"	1130/44.5"	500/19,7"

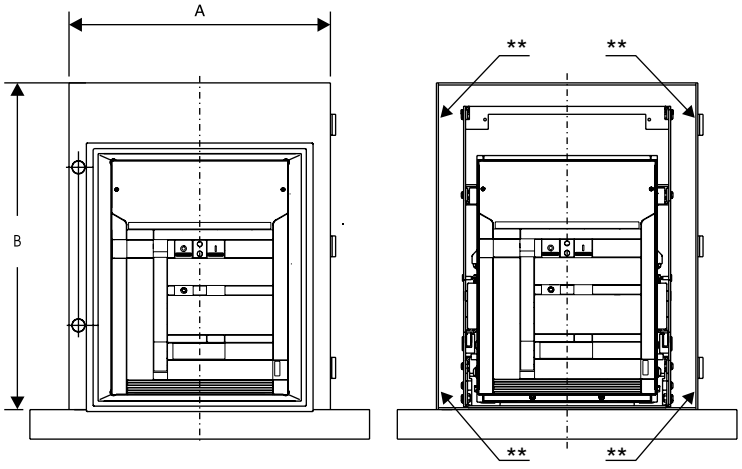
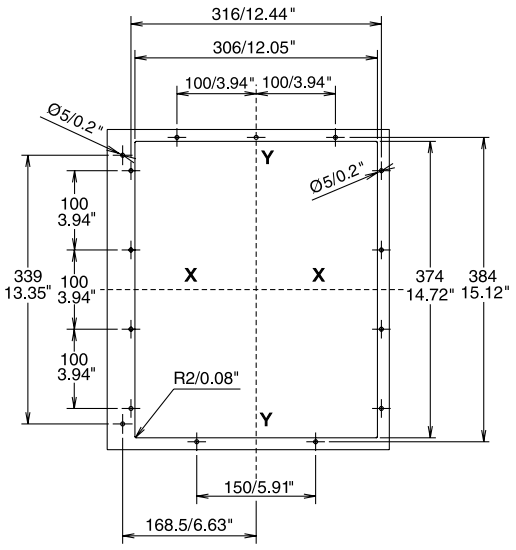


Fig. 28

Drilling of compartment door

Tightening torque for fastening screws 20 Nm - 177 Lb in.
Tightening torque for main terminals 70 Nm - 620 Lb in.
Tightening torque of the earthing screw 70 Nm - 620 Lb in.



	High resistance M12 screw Quantity per terminal	
	PHASE	NEUTRAL
E1-E2	2	2
E3	3	3
E4	4	2
E4/f	4	4
E6	6	3
E6/f	6	6

Fig. 29

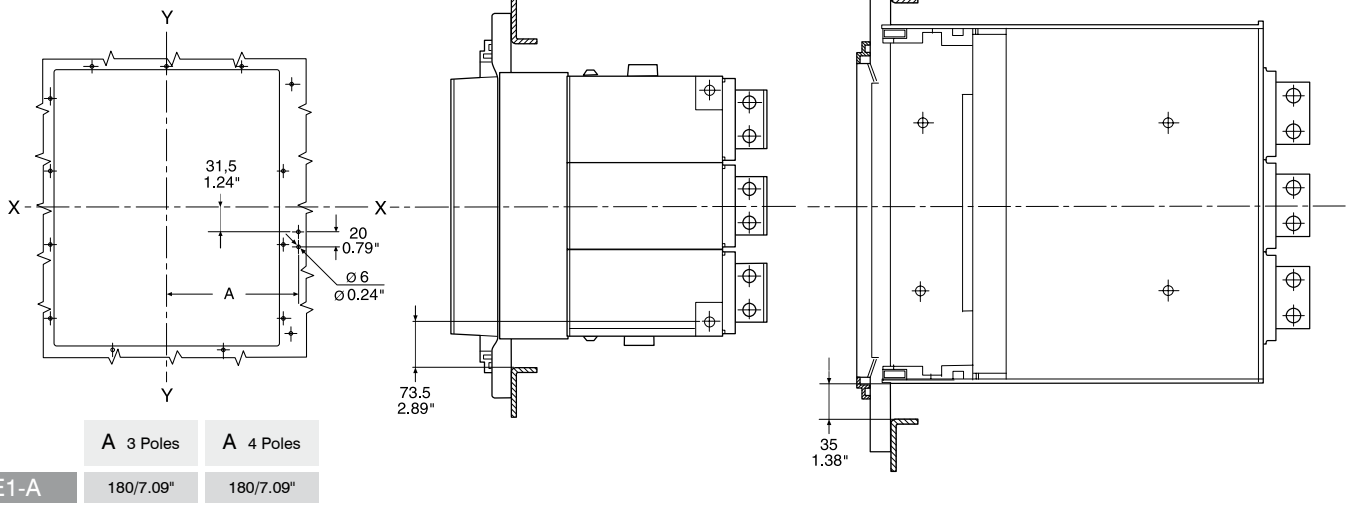
Compartment door mechanical lock

Drilling of compartment door

Minimum distance between circuit breaker and switchboard wall

Fixed version

Withdrawable version



	A 3 Poles	A 4 Poles
E1-A	180/7.09"	180/7.09"
E2-A	180/7.09"	180/7.09"
E3-A	234/9.21"	234/9.21"
E4-A	270/10.63"	360/14.17"
E4/f-A		360/14.17"
E6-A	360/14.17"	486/19.13"
E6/f-A		486/19.13"

Fig. 30

8. Electrical circuit diagrams

WARNING:
Before installing the circuit-breaker, carefully read note F on the circuit diagrams.

8.1. Operating state shown

The diagram is shown under the following conditions:
- withdrawable circuit breaker, open and racked-in
- circuits de-energized
- releases not tripped
- motor operating mechanism with springs discharged.

8.2. Versions

The diagram shows a withdrawable circuit breaker but is also valid for fixed circuit breakers.

Fixed version
The control circuits are included between the XV terminals (the X connector is not supplied).

The applications indicated in figures 31, 32 cannot be supplied with this version.

Withdrawable version
The control circuits are included between the poles of the X connector (the XV terminal box is not supplied).

Version without overcurrent releases
The applications indicated in figures 13, 14, 41, 42, 43, 44, 45, 46, 47, 48, 62 cannot be supplied with this version.

Version with electronic release PR121/P
The applications indicated in figures 42, 43, 44, 45, 46, 47, 48 cannot be supplied with this version.

Version with electronic release PR122/P
The applications indicated in figure 41 cannot be supplied with this version.

Version with electronic release PR123/P
The applications indicated in figure 41 cannot be supplied with this version.

8.3. Caption

Captions

☐	= Number of figure for the diagram
*	= See the note indicated by the letter
A1	= Circuit breaker applications
A3	= Applications located on the fixed part of the circuit breaker (only provided with withdrawable circuit breakers)
A4	= Indicative apparatus and connections for control and signaling, outside the circuit breaker
A13	= PR021/K signaling unit (outside the circuit breaker)
AY	= SACE SOR TEST UNIT control/monitoring unit (see note R)
D	= Electronic time-delay device of the undervoltage release, outside the circuit breaker
F1	= Delayed-trip fuse
K51	= PR121/P, PR122/P, PR123/P type electronic release with the following protection functions: - L against overload with inverse long delay trip - adjustment I1 - S against short circuit with inverse short or independent delay trip - adjustment I2 - I against short circuit with instantaneous trip - adjustment I3 - G against ground fault with inverse short delay trip - adjustment I4
K51/1...8	= PR021/K signaling unit contacts
K51/GZin	= (DBin) Zone selectivity: input for protection G (only provided with Vaux and PR122/P or PR123/P releases) or “backward” input for protection D (only provided with Vaux and PR123/P release)
K51/GZout	= (DBout) Zone selectivity: output for protection G (only provided with Vaux and PR122/P or PR123/P releases) or “backward” output for protection D (only provided with Vaux and PR123/P release)
K51/IN1	= Programmable digital polarised input (only provided with Vaux. and PR122/P or PR123/P releases with PR120/K signal module) at 24 Vdc (K9 ⊕, K7 O)
K51/P1...P4	= Programmable digital signal (only provided with Vaux. and PR122/P or PR123/P releases with PR120/K signal module)
K51/SZin	= (DFin) Zone selectivity: input for protection S or “forward” input for protection D (only provided with Vaux. and PR122/P or PR123/P releases)
K51/SZout	= (DFout) Zone selectivity: output for protection S or “forward” output for protection D (only provided with Vaux. and PR122/P or PR123/P releases)
K51/YC	= Closing control from PR122/P or PR123/P electronic release with PR120/D-M communication module
K51/YO	= Opening control from PR122/P or PR123/P electronic release with PR120/D-M communication module
M	= Motor for closing spring charging
Q	= Circuit breaker

Q/1...27 = Circuit breaker auxiliary contacts
S33M/1...3 = Limit contacts of spring charging motor
S43 = Changeover switch for setting remote/local control
S51 = Contact for electric signal indicating circuit breaker opened by overcurrent release. The circuit breaker can only be closed again after the reset button is pressed or after the electric reset coil YR has been powered (if present).
S75E/1.4 = Contacts for electric signal indicating circuit breaker in open position (only for withdrawable version circuit breakers)
S75I/1..5 = Contacts for electric signal indicating circuit breaker racked-in (only for withdrawable version circuit breakers)
S75T/1..4 = Contact for electric signal indicating circuit breaker in test position (only for withdrawable version circuit breakers)
CS = Button or contact to close the circuit breaker
SO = Button or contact to open the circuit breaker
SO1 = Button or contact to open the circuit breaker with delayed trip
SO2 = Button or contact to open the circuit breaker with instantaneous trip
SR = Button or contact to reset the circuit breaker
TI/L1 = Current transformer located on phase L1
TI/L2 = Current transformer located on phase L2
TI/L3 = Current transformer located on phase L3
Vaux = Auxiliary power voltage (see note F)
UI/L1 = Current sensor (Rogowski coil) located on phase L1
UI/L2 = Current sensor (Rogowski coil) located on phase L2
UI/L3 = Current sensor (Rogowski coil) located on phase L3
UI/N = Current sensor (Rogowski coil) located on the neutral
UI/0 = Current sensor (Rogowski coil) located on the conductor connecting the MV/LV transformer star center to the ground (see note G)
W1 = System Bus: serial interface with the control system. Modbus RTU on EIA RS485 interface (see note E)
W2 = Internal Bus: serial interface with the accessories of the PR121/P, PR122/P and PR123/P trip unit.
X = Delivery connector for auxiliary circuits of withdrawable circuit breaker
X1...X7 = Connectors for the circuit breaker applications
XF = Delivery terminal box for position contacts of the withdrawable circuit breaker (located on the fixed part of the circuit breaker)
XK1 = Connector for the power circuits of the PR121/P, PR122/P and PR123/P releases
XK2 - XK3 = Connector for the auxiliary power circuits of the PR121/P, PR122/P and PR123/P releases
XK5 = Connectors for the PR120/V module
XO = Connector for the YO1 release
XV = Delivery terminal box for auxiliary circuits of fixed version circuit breaker
YC = Shunt closing release
YO = Shunt opening release
YO1 = Overcurrent shunt opening release (trip coil)
YO2 = Second shunt opening release (see note Q)
YR = Coil for electric circuit breaker reset
YU = Undervoltage release (see notes B and Q)
XK4 = Connector for open/close signal
XK5 = Voltage connector for PR120/V
XK6 = Connector for PR120/K
XK7 = Connector for “charged spring” and “racked in/racked out” for PR120/D-M

Description of figures

Fig. 1 = Closing spring charging motor circuit.
Fig. 2 = Shunt closing release circuit.
Fig. 4 = Shunt opening release.
Fig. 6 = Instantaneous undervoltage release (see notes B and Q).
Fig. 7 = Undervoltage release with electronic time-delay device, outside the circuit breaker (see notes B and Q).
Fig. 8 = Second shunt opening release (see note Q)
Fig. 11 = Contact for electrical signaling of springs charged.
Fig. 12 = Contact for electrical signaling of undervoltage release energized (see notes B and S).
Fig. 13 = Contact for electrical signaling that the circuit breaker is open because the overcurrent release has tripped. The circuit breaker can only be closed after the reset pushbutton has been pressed.
Fig. 14 = Contact for electrical signaling that the circuit breaker is open because the overcurrent release and electric reset coil have tripped. The circuit breaker can only be closed after the reset pushbutton has been pressed or after the coil has been powered.
Fig. 21 = First pack of auxiliary contacts for circuit breaker.
Fig. 22 = Second pack of auxiliary contacts for circuit breaker (see note V).
Fig. 23 = Third pack of additional auxiliary contacts outside the circuit breaker.
Fig. 31 = First pack of contacts for electrical signaling that the circuit breaker is in the racked-in, test or racked-out position.
Fig. 32 = Second pack of contacts for electrical signaling that the circuit breaker is in the racked-in, test or rackedout position.

Fig. 41 = Auxiliary circuits for the PR121/P release (see note F).
Fig. 42 = Auxiliary circuits for the PR122/P and PR123/P release (see notes F, N and V).
Fig. 43 = Circuits for measurement module PR120/V for PR122/P and PR123/P releases connected internally to the three-pole or four-pole circuit breaker (optional for PR122/P release; see note U).
Fig. 44 = Circuits for measurement module PR120/V for PR122/P and PR123/P releases connected externally to the circuit breaker (optional for PR122/P release; see notes O and U).
Fig. 45 = Circuits for communication module PR120/D-M for PR122/P and PR123/P releases (optional; see note E).
Fig. 46 = Circuits for signal module PR120/K for PR122/P and PR123/P releases - connection 1 (optional; see note V).
Fig. 47 = Circuits for signal module PR120/K for PR122/P and PR123/P releases - connection 2 (optional; see note V).
Fig. 48 = Circuits for measurement module PR120/V for PR122/P and PR123/P releases connected internally to the three-pole circuit breaker with external neutral (optional for PR122/P release; see note U).
Fig. 61= SACE SOR TEST UNIT control/monitoring unit (see note R).
Fig. 62= PR021/K signaling unit (available with all releases)

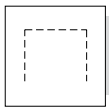
Incompatibilities

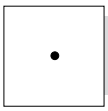
The circuits shown in the following figures cannot be powered on the same circuit breaker at the same time:
6 - 7 - 8
13 - 14
22 - 46 - 47
43 - 44 - 48

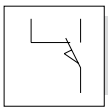
Notes

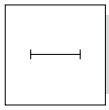
A) The circuit breaker is only fitted with the applications specified in the ABB order confirmation. To make out the order, please consult the apparatus catalogue.
B) The undervoltage release is provided for power supply branched on the supply side of the circuit breaker or from an independent source: circuit breaker closing is only allowed with the release energized (the lock on closing is made mechanically).
In the case where there is the same power supply for the closing and undervoltage releases and automatic circuit breaker closing is required, on return of the auxiliary voltage, a 30 millisecond delay must be introduced between the instant of consent of the undervoltage release and powering of the closing coil. This can be carried out by means of a circuit outside the circuit breaker including a permanent closing contact, the contact indicated in Figure 12 and a time-delay relay.
E) For connecting the EIA RS485 serial line, see “Technical Application Papers – QT 9” communication via BUS with the ABB switches.
F) The Vaux. auxiliary voltage allows activation of all the functions of the PR121/P, PR122/P and PR123/P releases.
Since the Vaux must be isolated from the ground, “galvanically separated converters” compliant with IEC 60950 (UL 1950) or equivalent must be used to guarantee a shared current or a runaway current (see IEC 478/1, CEI 22/3) of not more than 3.5mA, IEC 60364-41 and CEI 64-8.
G) Protection against ground fault is available with the PR122/P and PR123/P releases by means of a current sensor located on the conductor which connects the MV/LV transformer star center to ground.
The connection between terminals 1 and 2 (or 3) of the UI/O current transformer and poles T7 and T8 of the X (or XV) connector must be made using a shielded and corded two-pole cable (e.g. BELDEN 3105A/3106A) not longer than 15 m. The shield must be grounded on the circuit breaker side and on the current sensor side
N) With PR122/P and PR123/P releases, connection with the zone selectivity inputs and outputs must be made using a shielded and corded two-pole cable (e.g. BELDEN 3105A/3106A) not longer than 300m. The shield must be grounded on the selectivity input side.
P) With PR122/P - PR123/P releases with communication module PR120/D-M, coils YO and YC can be operated directly by contacts K51/YO and K51/YC with maximum voltages of 110-120 VDC and 240-250 VAC.
Q) The second shunt opening release must be installed as an alternative to the undervoltage release.
R) Operation of the SACE SOR TEST UNIT + shunt opening release (YO) system is guaranteed starting from 75% of the Vaux of the shunt opening release itself.
When the YO power supply contact is closing (short circuit of terminals 4 and 5), the SACE SOR TEST UNIT cannot determine the state of the opening coil. For this reason:
- If the opening coil has a continuous power supply, the TEST FAILED and ALARM signals will be activated
- If the control of the opening coil is carried out impulsively, the TEST FAILED signal may be activated at the same moment. In this case, the TEST FAILED signal should only be considered an actual alarm signal if it remains on for longer than 20s.
S) Also available in the normally closed contact version
U) The measurement module PR120/V is always supplied with relay PR123/P.
V) If fig. 22 (second pack of auxiliary contacts for circuit breaker) is present simultaneously with relay PR122/P (or PR123/P), the contacts for the selectivity zone in fig. 42 (K51/Zin, K51/Zout, K51/Gzin and K51/Gzout) are not wired. Moreover, the signal module PR120/K in figures 46 and 47 cannot be supplied.
Z) Short-circuit T5 and T6 if the external neutral current sensor (UI/N)is not connected.

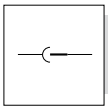
Graphic signs for circuit diagrams (IEC 60617 and CEI 3-14...3-26 Standards)


Shield
(may be drawn
in any shape)

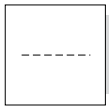

Terminal

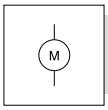

Change-over position contact with momentary circuit breaking (limit contact)


Time delay

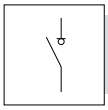

Plug and socket
(male and female)

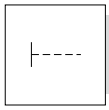

Power isolator with automatic breaking action

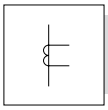

Mechanical or electrical connection

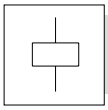


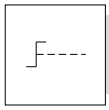
Motor
(general symbol)

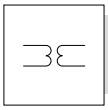

Switch-disconnector

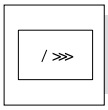

Manual mechanical control (general case)


Current transformer

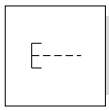

Control coil
(general symbol)

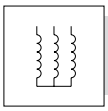

Rotating control

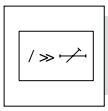

Voltage transformer



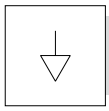
Instantaneous overcurrent relay

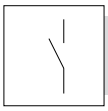

Pushbutton control

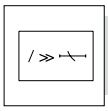

Winding of three-phase transformer, Star connection



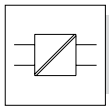
Overcurrent relay with adjustable short time-delay trip

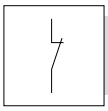

Equipotentiality

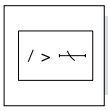

Make contact



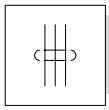
Overcurrent relay with inverse short time-delay tripa tempo breve inverso

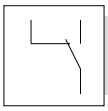

Galvanically separated converter


Break contact with automatic circuit breaking



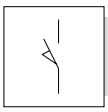
Overcurrent relay with inverse long time-delay trip

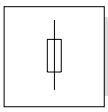

Shielded cable conductors (i.e., 3 conductors shown)

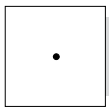

Change-over contact

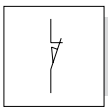
Earth fault overcurrent relay with inverse short time delay

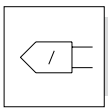

Conductors or stranded cables (i.e., 3 conductors shown)


Make position contact (limit contact)


Fuse (general symbol)


Connection of conductors

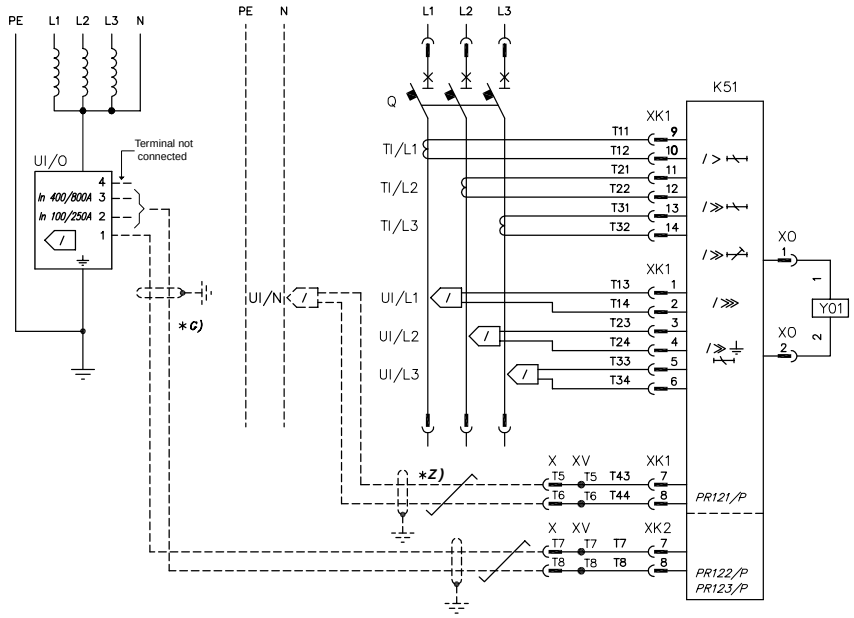

Break position contact (limit contact)



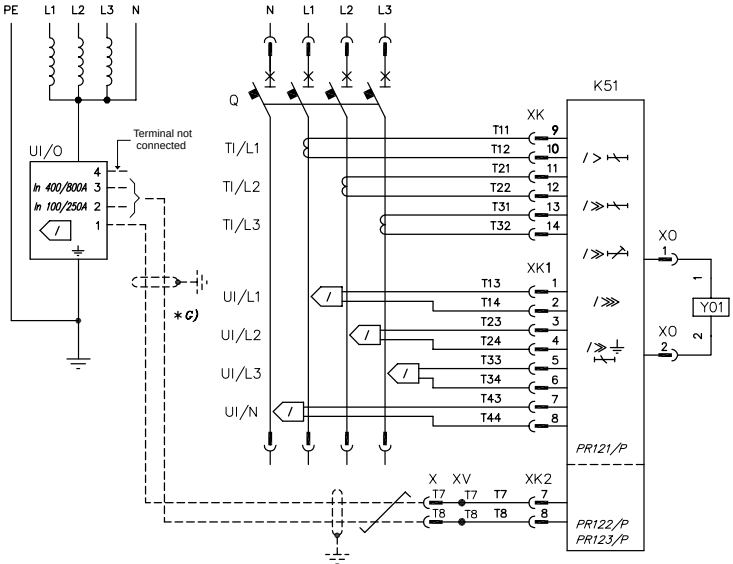
Current sensor

Circuit diagrams – operating status

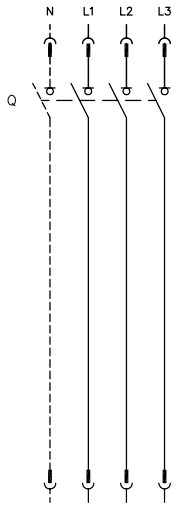
Three-pole circuit breaker with electronic release PR121/P, PR122/P or PR123/P



Four-pole circuit breaker with electronic release PR121/P, PR122/P, PR123/P.

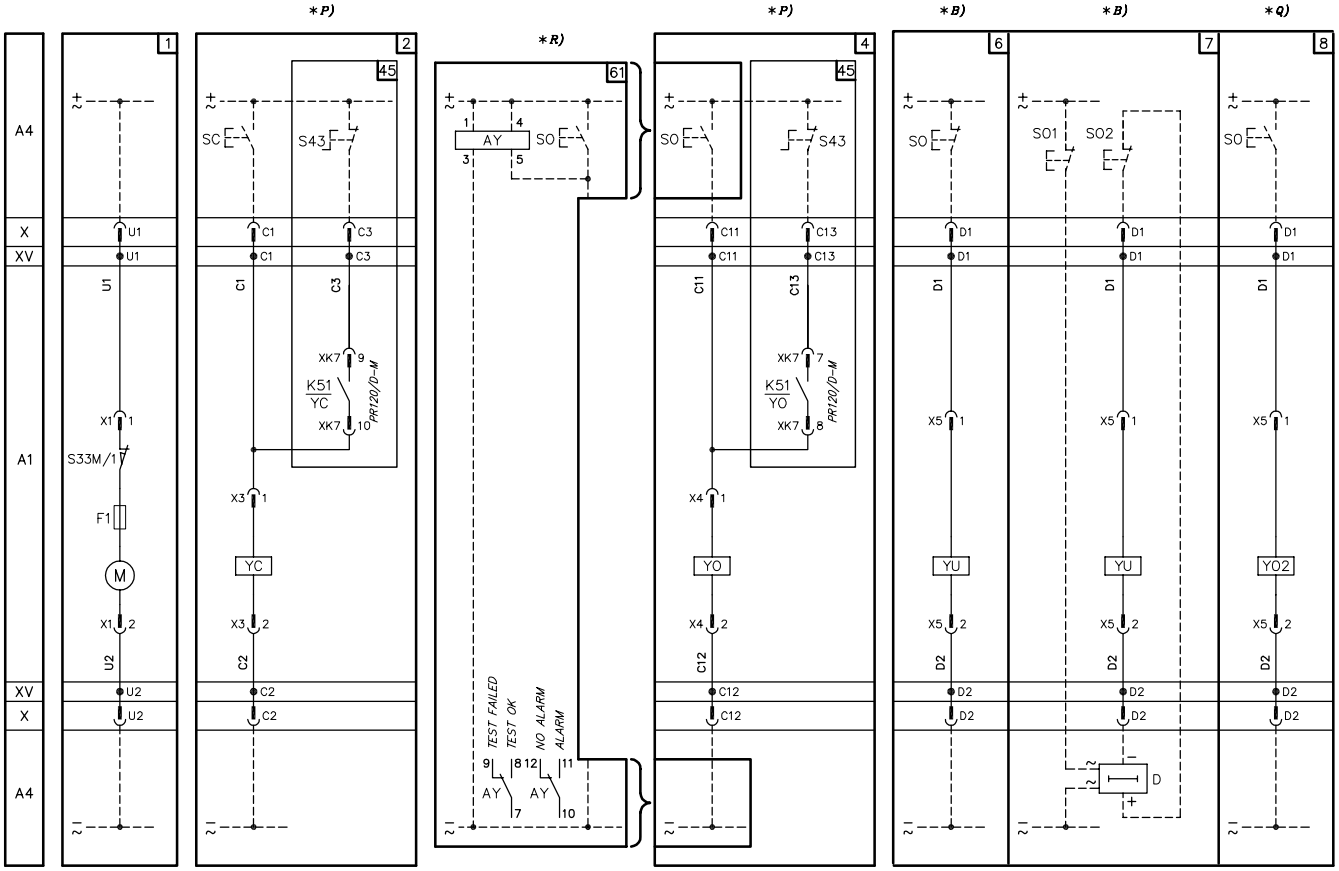


Three-pole or four-pole switch-disconnector

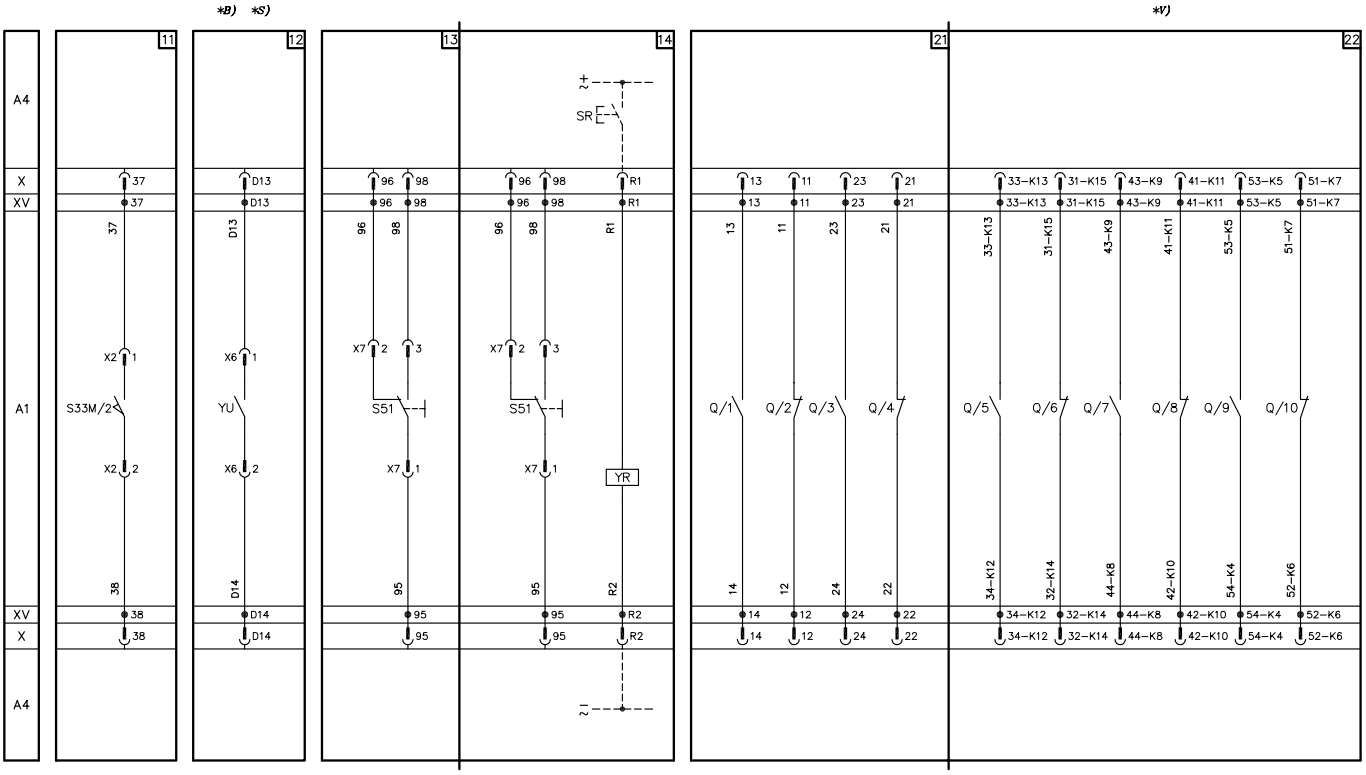


Model	L2564	L5639		Apparatus	**Emax UL**	Scale
	L5348	L5838				
				Doc. N°	**1SDH000533R0002**	Page N° **27/34**

Motor operating mechanism, opening, closing and undervoltage releases

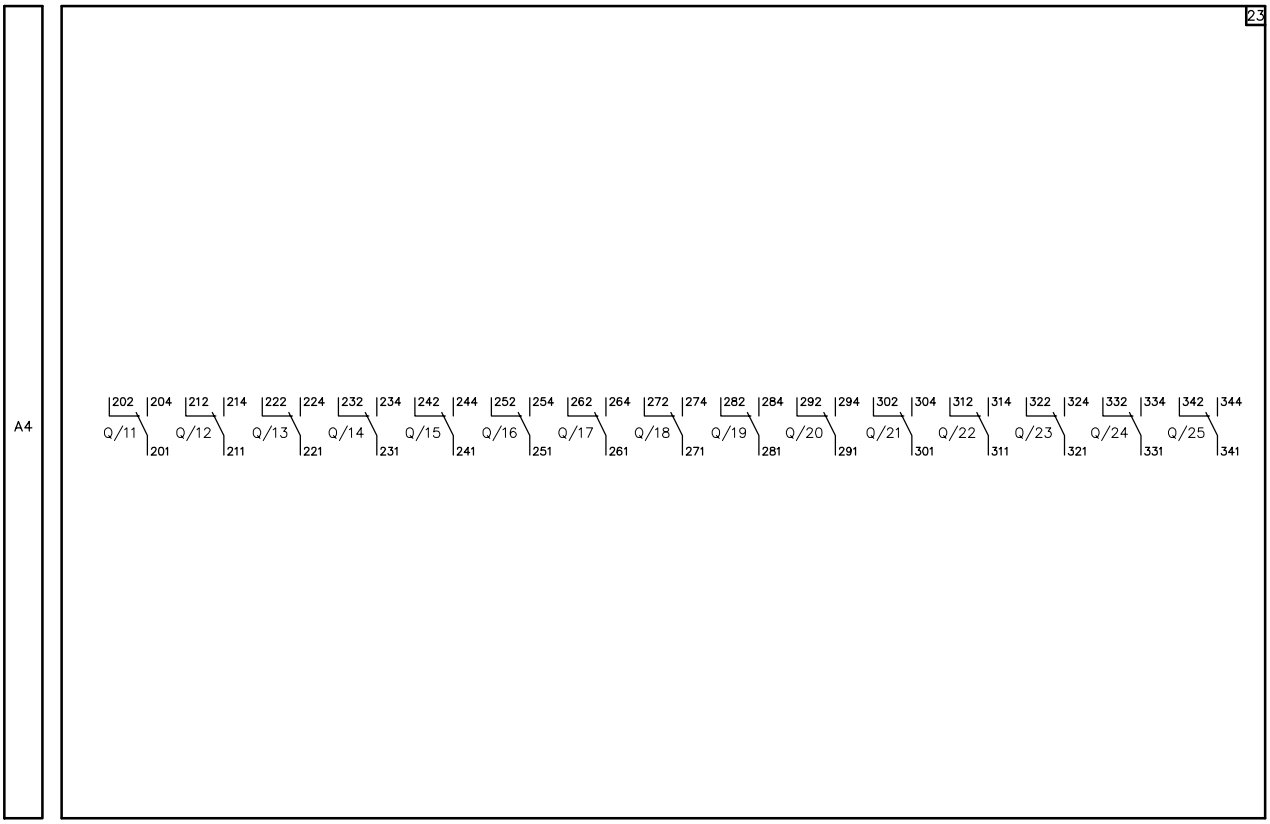


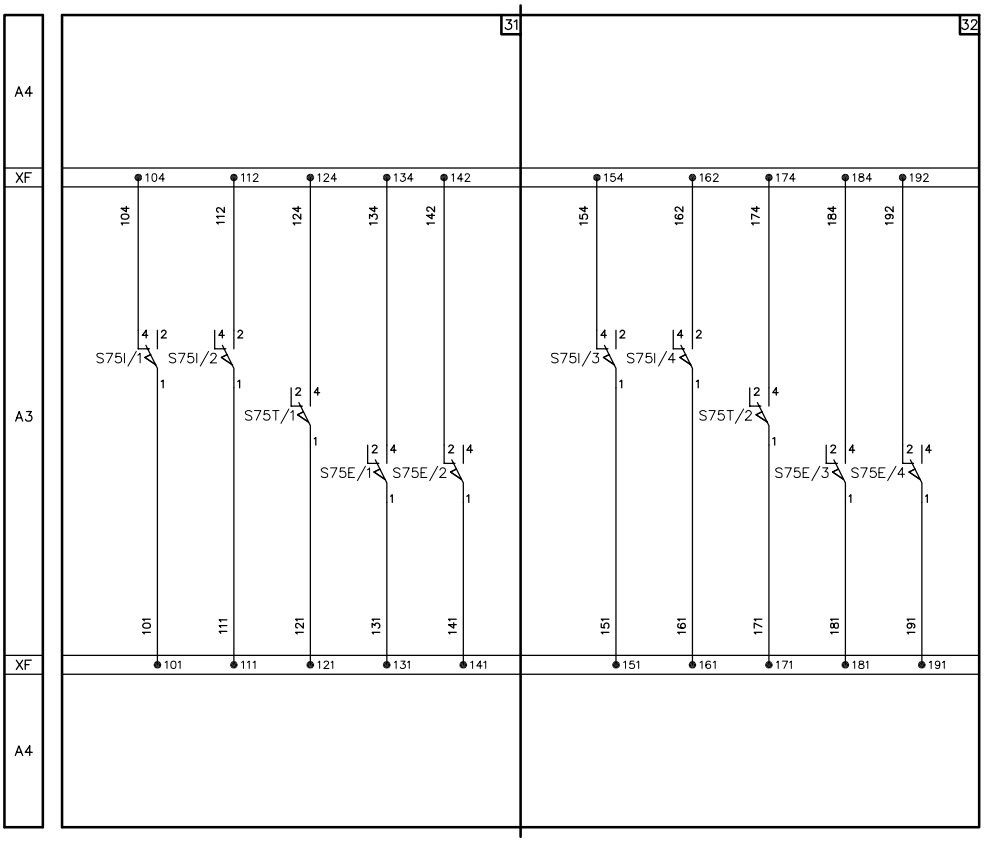
Signaling contacts



Model	L2564	L5639		Apparatus	**Emax UL**	Scale
	L5348	L5838				
				Doc. N°	**1SDH000533R0002**	Page N° **28/34**

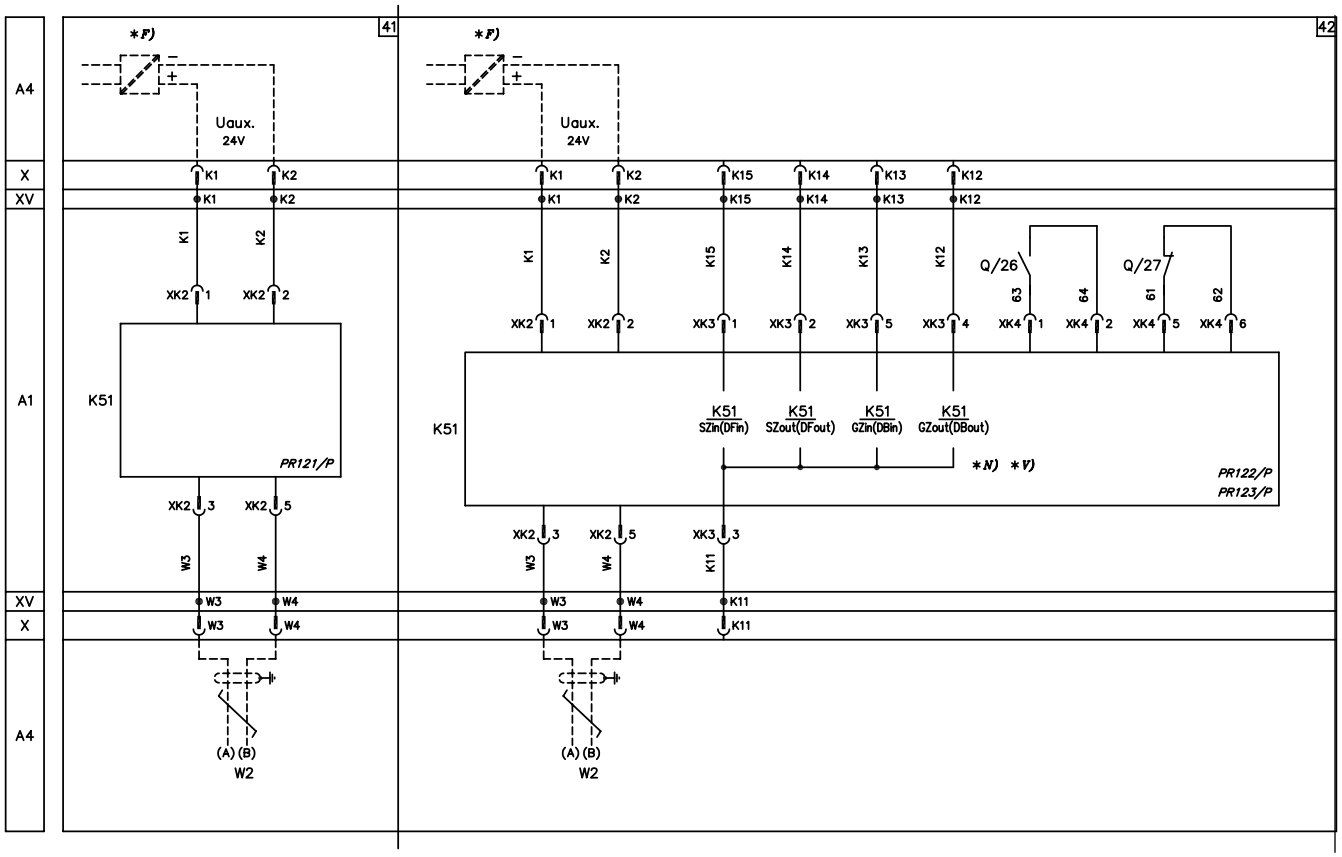
Signaling contacts



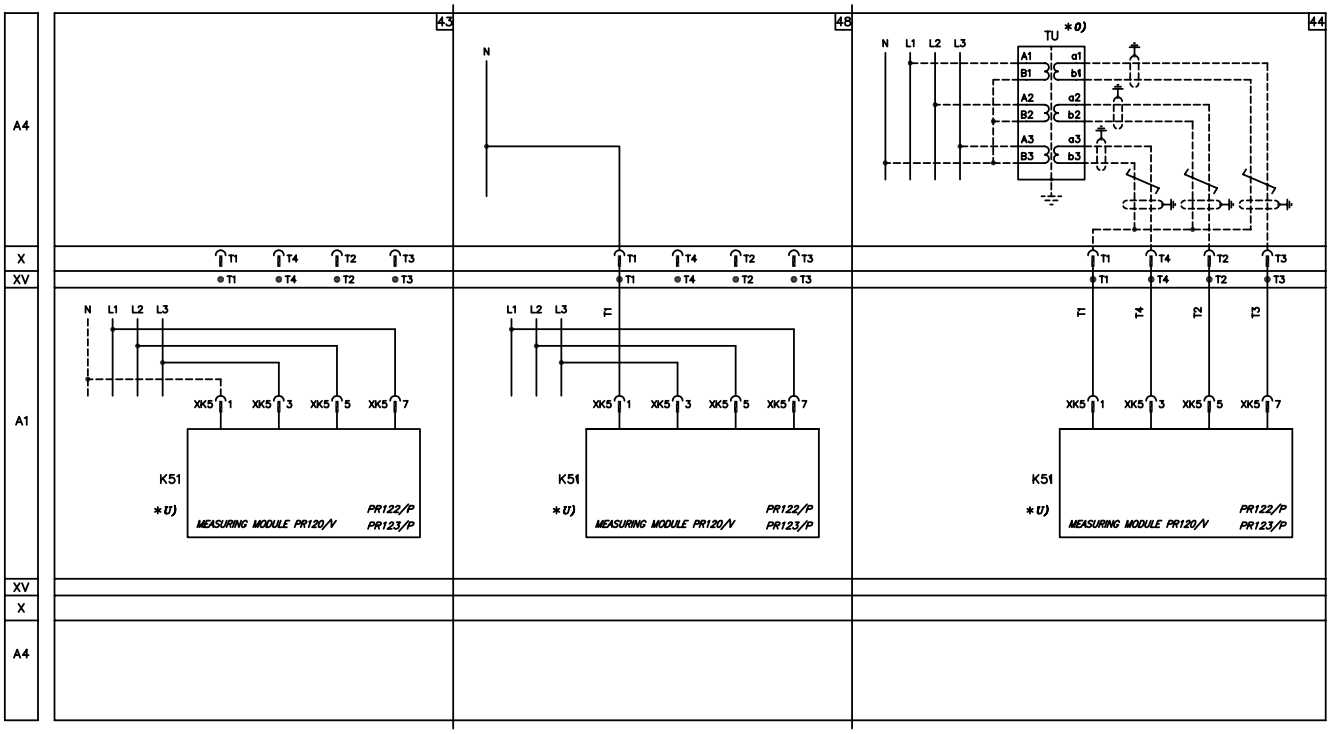


Model	L2564	L5639		Apparatus	**Emax UL**	Scale
	L5348	L5838				
				Doc. N°	**1SDH000533R0002**	Page N° **29/34**

Auxiliary circuits for PR121/P, PR122/P and PR123/P releases

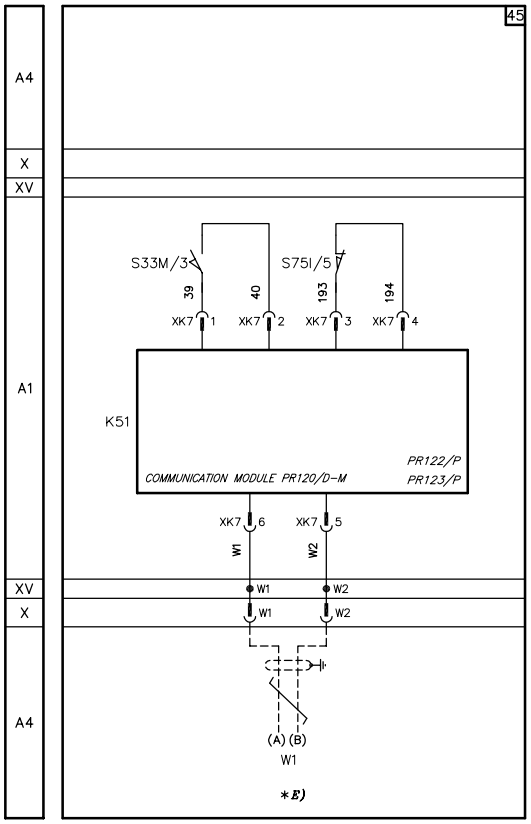


Measurement module PR120/V

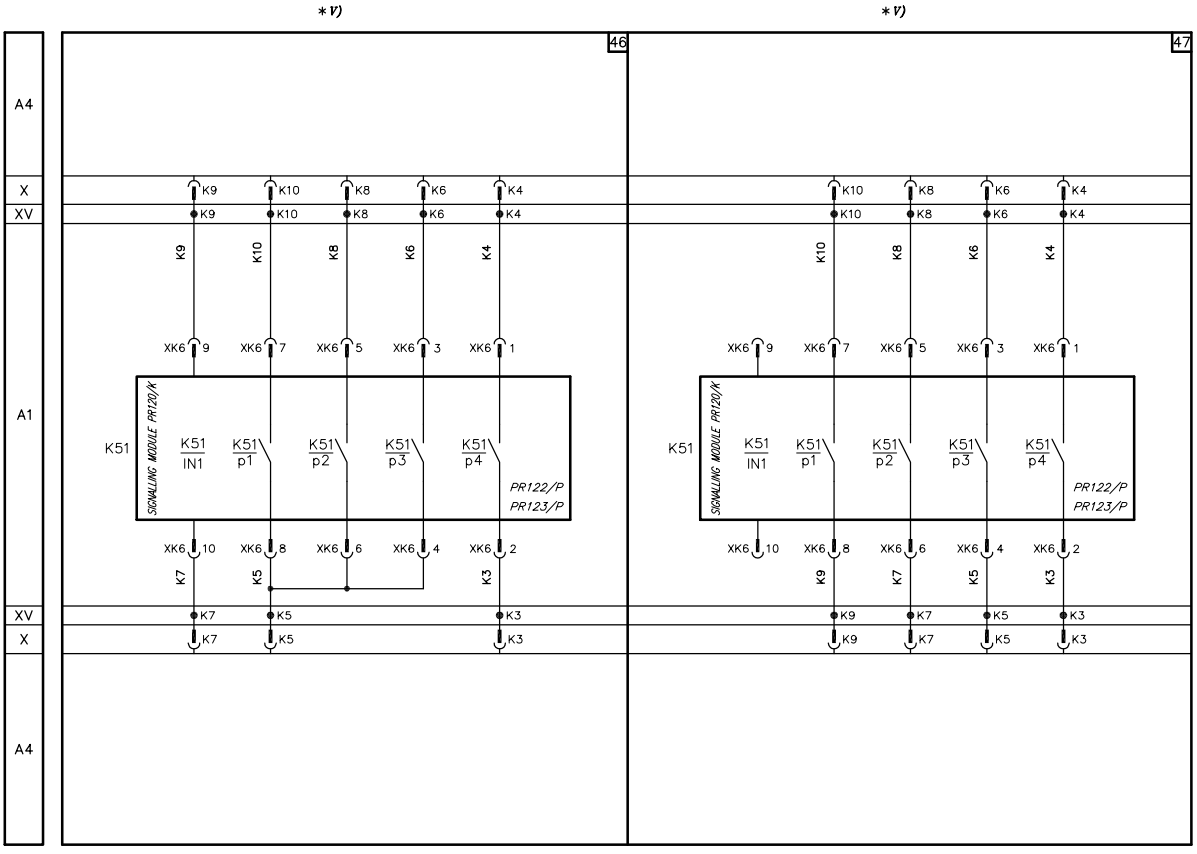


Model	L2564	L5639		Apparatus	**Emax UL**	Scale
	L5348	L5838				
				Doc. N°	**1SDH000533R0002**	Page N° **30/34**

Communication module PR120/D-M

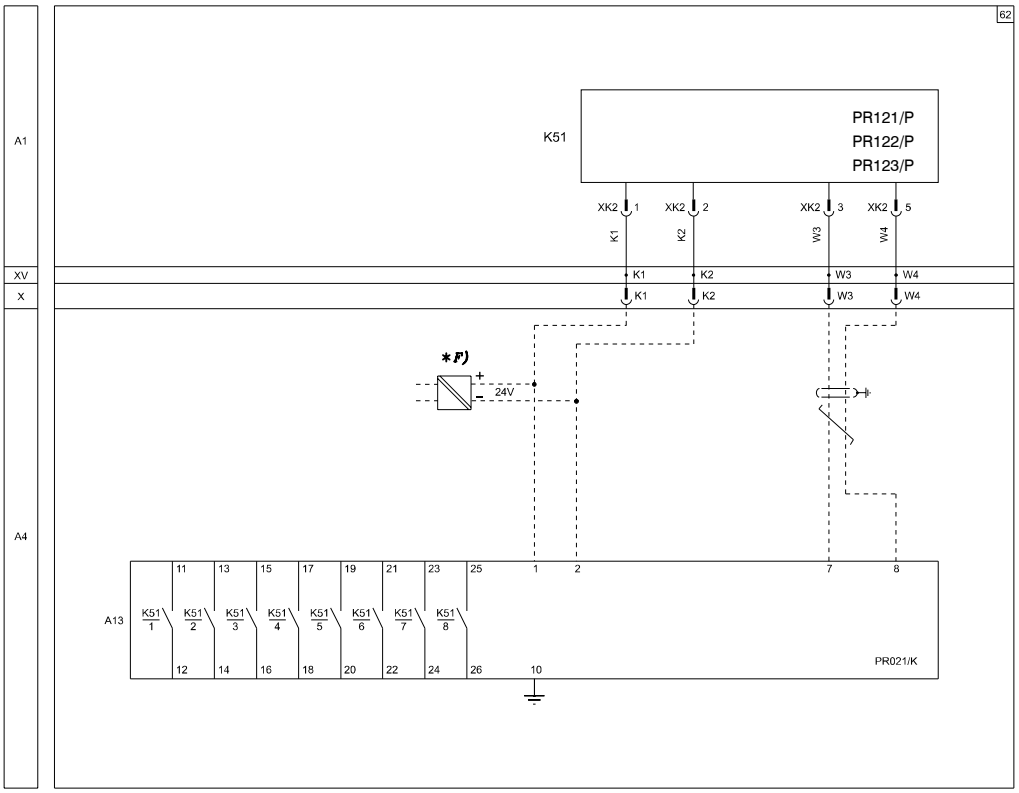


Signaling module PR120/K



Model	L2564	L5639		Apparatus	Emax UL	Scale
	L5348	L5838				
				Doc. N°	1SDH000533R0002	Page N° 31/34

Signaling unit PR021/K

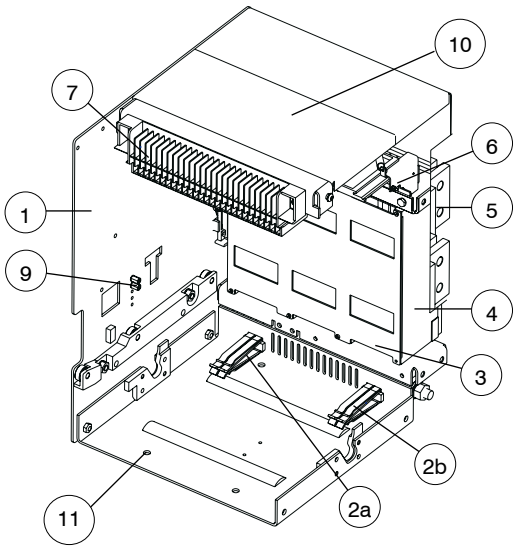


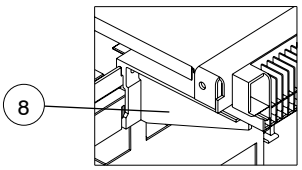
Model	L2564	L5639		Apparatus	**Emax UL**	Scale
	L5348	L5838				
				Doc. N°	**1SDH000533R0002**	Page N° **32/34**

9. Annex for Emax VF circuit breakers

The Emax UL fixed parts can be used with Emax VF circuit breaker for high frequency applications and Emax VF switch disconnectors.
In this cases the information present in the previous chapters are integrated with the following prescriptions.

9.1 Fixed part construction characteristics





1 Steel sheet supporting structure
2 Earthing contacts (a: for all versions; b: for E4,E6)
3 Safety shutters (IP20 degree of protection)
4 Insulating terminal support base
5 Terminals
6 Contacts for signalling connected/test isolated/disconnected (on request)
7 Sliding contacts
8 Padlock for safety shutters (on request)
9 Anti-racking-in lock for circuit-breakers of different size
10 Casing
11 Fixing holes (qty 4 for E2, E3, 6 for E4, E6)

Fig. 30

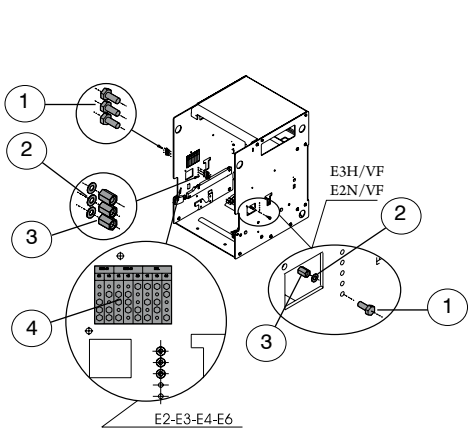
		E2N/VF	E3H/VF	E4H/VF	E6H/VF
III Poles Only	RH TERMINALS	max 1600A	max 2500A	max 3600A	max 5000A
	RV TERMINALS	max 1600A	max 2500A	max 3600A	max 5000A
	Mixed TERMINALS	max 1600A	max 2500A	max 3600A	max 5000A

9.2 Installation of the fixed part of the withdrawable circuit-breaker

Assembly of the anti-racking-in lock
Before installing the fixed part, it is necessary to check the presence of the anti-racking-in lock for circuit-breakers with different electrical characteristics from those of the fixed part. If the anti-racking-in lock has been supplied separately, proceed to assemble it as follows:
- On the self-adhesive plate (4), find the assembly position of the stop bolts in relation to the circuit-breaker which has to be housed in the fixed part
- Insert the two hexagon-head screws (1) into the holes found in the previous item as shown in the figure
- Fix the two screws with the washers (2) and the hexagonal stops (3).

Make sure that the anti-racking-in lock corresponding to the one installed on the fixed part is present on the circuit-breaker (moving part).
- Anti-racking-in plate on the moving part (5).

Example for E2N-VF according to the nameplate diagram:



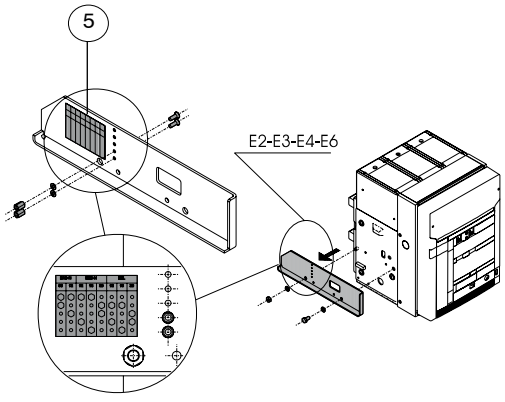
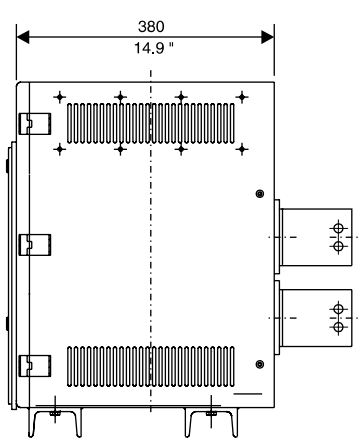
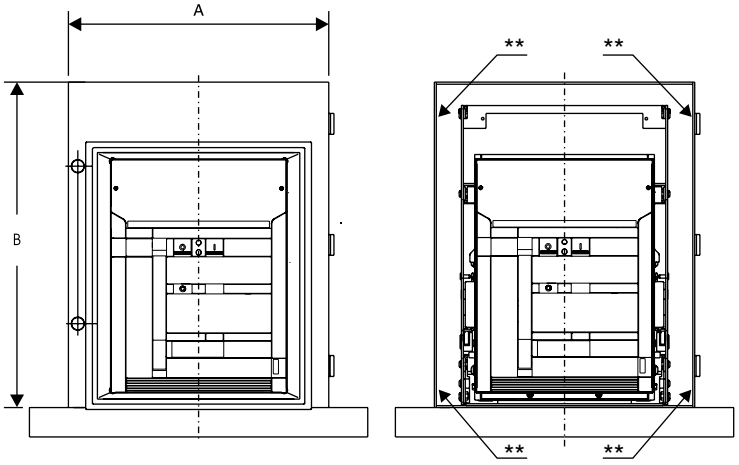


Fig. 31

9.3 Overall dimensions: compartment dimensions





	A 3 Poles	B
E2/VF	400/15.7"	500/19.7"
E3/VF	500/19.7"	500/19.7"
E4/VF	700/25.7"	500/19.7"
E6/VF	1000/39.3"	500/19.7"

** Suitable to operate at 100% RATING in a minimun cubicle space (see the table), with a ventilation of 48 (12x4) sq. in. side botton and side top.

Check cubicle drawing.

Fig. 32

9.4 Electrical circuit diagrams

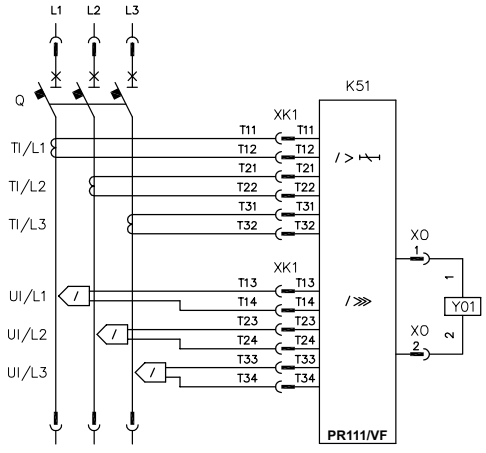
Version with PR111/VF

The applications indicated in figures 41, 42, 43, 44, 45, 46, 47, 48, 62 at paragraph 8 cannot be supplied in this version.

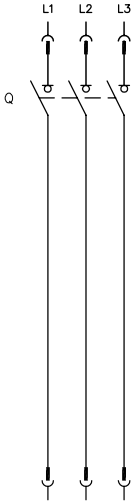
Hereinafter the specific circuit diagram for PR111/VF that replaces the corresponding figure of the circuit diagram Emax UL indicated at par.8

K51= PR111/VF type electronic release with the following protection functions:
- L against overload with inverse long delay trip - adjustment I1
- I against short circuit with instantaneous trip - adjustment I3

Three-pole circuit breaker with electronic release PR111/VF



Three-pole switch-disconnector



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Due to possible developments of standards as well as of materials, the characteristics and dimensions specified in the present catalogue may only be considered binding after confirmation by ABB SACE.

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