

Vmax

Installation and service instructions

12 ... 17.5 kV - 630 ... 1250 A - 16 ... 31.5 kA



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For your safety!

- Make sure that the installation room (spaces, divisions and ambient) is suitable for the electrical apparatus.
- Check that all the installation, putting into service and maintenance operations are carried out by qualified personnel with suitable knowledge of the apparatus.
- Make sure that the standard and legal prescriptions are complied with during installation, putting into service and maintenance, so that installations according to the rules of good working practice and safety in the work place are constructed.
- Strictly follow the information given in this instruction manual.
- Check that the rated performance of the apparatus is not exceeded during service.
- Check that the personnel operating the apparatus have this instruction manual to hand as well as the necessary information for correct intervention.
- Pay special attention to the danger notes indicated in the manual by the following symbol:



Responsible behaviour safeguards your own and others' safety!
For any requests, please contact the ABB Assistance Service.

I. Introduction

This publication contains the information needed to install medium voltage Vmax circuit breakers and put them into service.

For correct use of the product, please read it carefully.

Like all the apparatus we manufacture, the Vmax circuit breakers are designed for different installation configurations.

Furthermore, this apparatus allows further technical and construction modifications (at the customer's request) to adapt to special installation requirements.

Consequently, the information given below may sometimes not contain instructions concerning special configurations.

Apart from this manual, it is therefore always

necessary to consult the latest technical documentation (circuit and wiring diagrams, assembly and installation drawings, any protection coordination studies, etc.), especially regarding any variants requested in relation to the standardised configurations. Only use original spare parts for maintenance operations.

For further information, please also see the technical catalogue of the circuit breaker and the spare parts catalogue.



All the installation, putting into service, running and maintenance operations must be carried out by skilled personnel with in-depth knowledge of the apparatus.

II. Environmental protection programme

The Vmax circuit breakers are manufactured in accordance with the ISO 14000 Standards (Guidelines for environmental management).

The production processes are carried out in compliance with the Standards for environmental

protection in terms of reduction in energy consumption as well as in raw materials and production of waste materials. All this is thanks to the medium voltage apparatus manufacturing facility environmental management system.

III. Application of the X-ray emission Standards

One of the physical properties of vacuum insulation is the possibility of X-ray emission when the interrupter contacts are open.

The specific tests carried out at the PTB laboratories (Physikalisch-Technische Bundesanstalt, in Brunswick - Germany) show that local emission at a distance of 10 cm from the interrupter or pole surface, does not exceed 1 mSv/h.

It follows that:

- at the rated service voltage the use of vacuum interrupters is absolutely safe;
- application of the withstand voltage at industrial frequency, according to the IEC 62271-100 and VDE 0670 Standards, is safe;
- application of a voltage higher than the withstand voltage at industrial frequency or of a direct current test voltage in direct current, specified in the IEC and VDE Standards, cannot be used;
- limitation of the above-mentioned local phenomena, with interrupters with open contacts, depends on keeping the specified distance between the contacts.

This condition is intrinsically guaranteed by correct operation of the operating mechanism and by adjustments of the transmission system.

1. Packing and transport

The circuit breaker is shipped in special packing, in the open position and with the springs discharged. Each piece of apparatus is protected by a plastic cover to prevent any infiltration of water during the loading and unloading stages and to keep the dust off during storage.

2. Checking on receipt



Before carrying out any operation, always make sure that the operating mechanism springs are discharged and that the apparatus is in the open position.

On receipt, check the state of the apparatus, integrity of the packing and correspondence with the nameplate data (see fig. 1) with what is specified in the order confirmation and in the accompanying shipping note.

Also make sure that all the materials described in the shipping note are included in the supply.

Should any damage or irregularity be noted in the supply on unpacking, notify ABB (directly or through the agent or supplier) as soon as possible and in any case within five days of receipt.

The apparatus is only supplied with the accessories specified at the time of ordering and validated in the order confirmation sent by ABB.

The accompanying documents inserted in the shipping packing are:

- instruction manual (this document)
- test certification
- identification label
- copy of the shipping documents
- electric wiring diagram.

Other documents which are sent prior to shipment of the apparatus are:

- order confirmation
- original shipping advice note
- any drawings or documents referring to special configurations/conditions.

ABB	
Circuit breaker	IEC 62271-100
Vmax	CEI 17-1 ←
CLASSIFICATION	
SN	PR. YEAR
M MASS	... kV
Ur	
ELECTRICAL DIAGRAM	
FIG.	
OPERATING MECHANISM	
-MO1 V	
Made by ABB	

Caption

- A Circuit breaker rating plate.
 B Operating mechanism rating plate.
 1 Type of apparatus.
 2 Symbols of compliance with Standards.
 3 Serial number.
 4 Circuit breaker characteristics.
 5 Characteristics of the operating mechanism auxiliaries

Fig. 1

3. Storage

When a period of storage is foreseen, our work-shops can (on request) provide suitable packing for the specified storage conditions.

On receipt the apparatus must be carefully unpacked and checked as described in Checking on receipt (chap. 2).

If immediate installation is not possible, the packing must be replaced, using the original material supplied.

Insert hygroscopic packets inside the packing, with at least one standard packet per piece of apparatus. Should the original packing not be available and immediate installation is not possible, store in a covered, well-ventilated, dry, dust-free, non-corrosive ambient, away from any flammable materials and at a temperature between $-5\text{ }^{\circ}\text{C}$ and $+40\text{ }^{\circ}\text{C}$.

In any case, avoid any accidental impacts or positioning which stresses the structure of the apparatus.

4. Handling

Before carrying out any operations, always make sure that the operating mechanism springs are discharged and that the apparatus is in the open position. To lift and handle the circuit breaker, proceed as follows (fig. 2):

- use a special lifting tool (1) (not supplied) fitted with ropes with safety hooks (2);
- insert the hooks (2) in the special holes in the circuit breaker frame and lift;
- on completion of the operation (and in any case before putting into service) unhook the lifting tool.

During handling, take great care not to stress the insulating parts and the terminals of the circuit breaker.



The apparatus must not be handled by putting lifting devices directly under the apparatus itself. Should it be necessary to use this technique, put the circuit breaker onto a pallet or a sturdy supporting surface (see fig. 3).

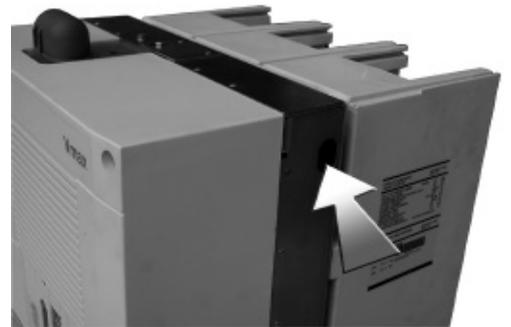


Fig. 2

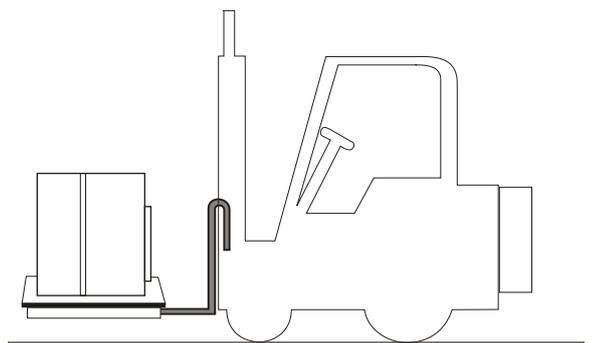


Fig. 3

5. Description

5.1. General

The Vmax series of circuit breakers are pieces of apparatus under vacuum for indoor installation; for the electrical performances, please refer to the corresponding technical catalogue code 1VCP000169. For special installation requirements, please contact ABB.

The following versions are available:

- fixed
- withdrawable for UniGear ZS1 type switchgear
- withdrawable for PowerCube modules
- withdrawable for UniSec switchgear.

5.2. Reference Standards

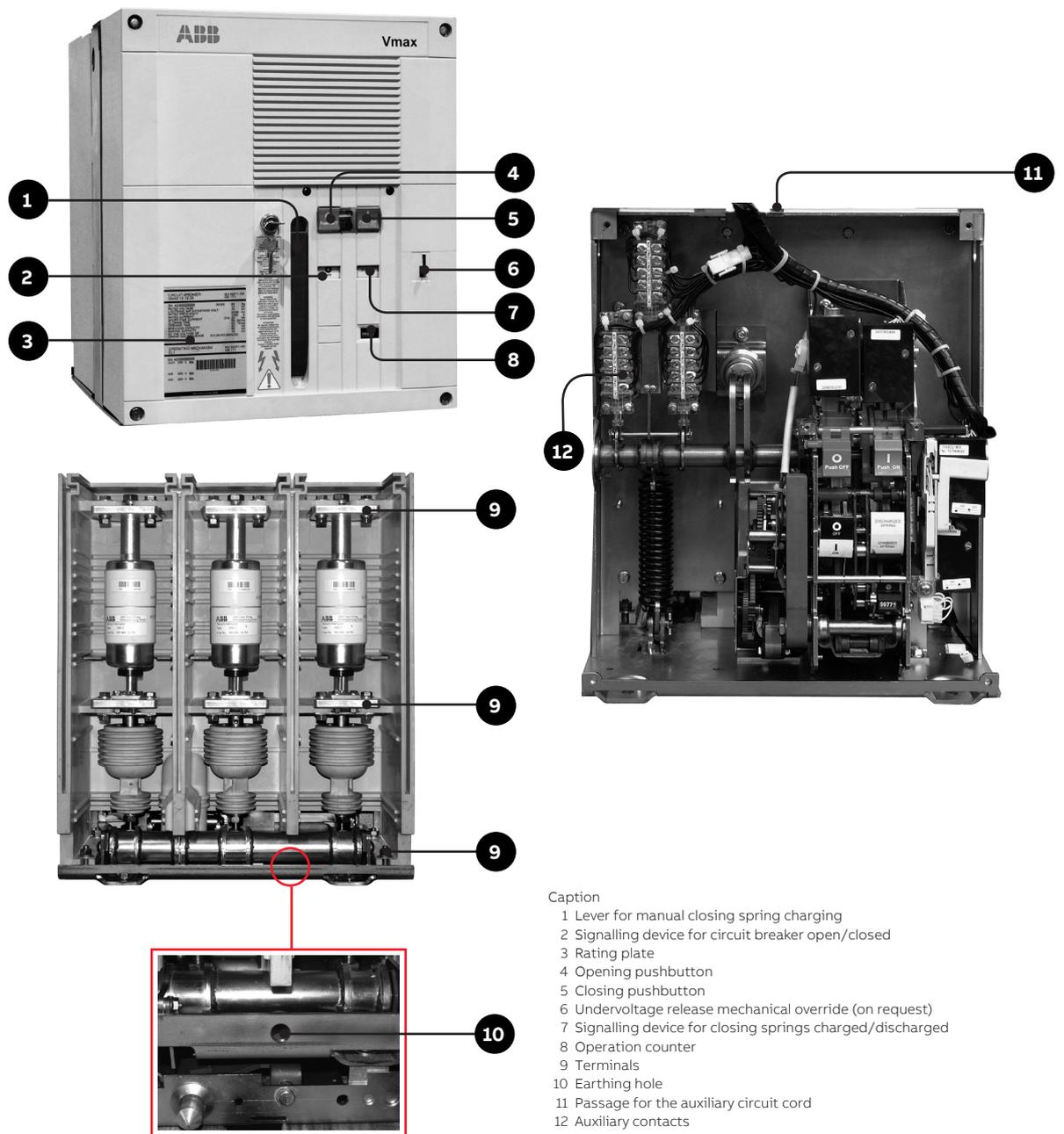
The Vmax circuit breakers conform to the IEC 62271-100, CEI 17-1 file 1375 Standards and those of major industrialised countries.

5.3. Fixed circuit breaker

The fixed circuit breaker (fig. 4) is the basic version complete with structure and front protection screen. The fixing holes are made in the lower part of the structure.

For the electrical connections of the circuit breaker auxiliary circuits, the proper terminal box is available. The earthing hole is placed in the rear part of the circuit breaker.

Note: there is a specific fixed version for UniGear switchgear with fixed CB called Vmax/F.



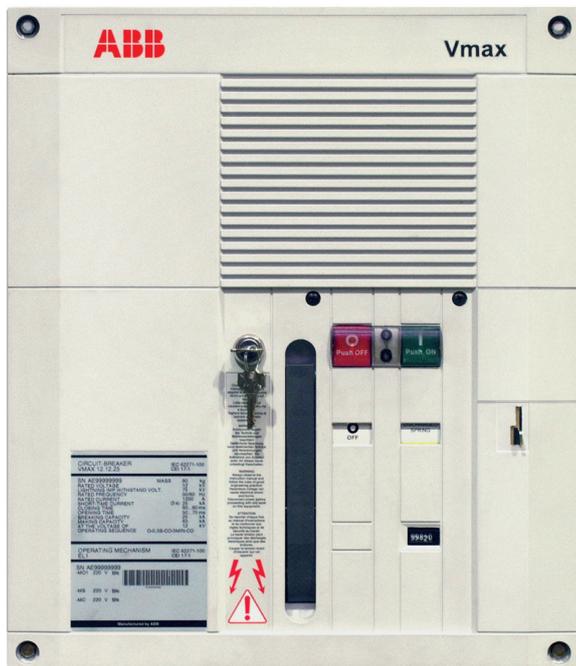
Caption

- 1 Lever for manual closing spring charging
- 2 Signalling device for circuit breaker open/closed
- 3 Rating plate
- 4 Opening pushbutton
- 5 Closing pushbutton
- 6 Undervoltage release mechanical override (on request)
- 7 Signalling device for closing springs charged/discharged
- 8 Operation counter
- 9 Terminals
- 10 Earthing hole
- 11 Passage for the auxiliary circuit cord
- 12 Auxiliary contacts

Fig. 4

5. Description

5.3.1. General characteristics of fixed circuit breakers



5.3.2. Standard fittings for fixed circuit breakers

The basic versions of the fixed circuit breakers are three-pole and fitted with:

- EL type manual operating mechanism
- mechanical signalling device for closing springs charged/discharged
- mechanical signalling device for circuit breaker open/closed
- closing pushbutton
- opening pushbutton
- operation counter
- set of ten circuit breaker open/closed auxiliary contacts

Note: application of the shunt opening release and/or additional shunt opening release foresees the use of one or two auxiliary make contacts (normally open), thereby reducing the number of auxiliary contacts available.

- lever for manual closing spring charging
- auxiliary circuit support terminal box.

Circuit breaker

Fixed version

Fixed version for ABB UniGear 500R panel

Standards	IEC 62271-100
	CEI EN62271-100 (file 7642)
	C37.54, C37.09, C37.04, C37.55
	UL Recognized Component Mark

Rated voltage	Ur [kV]
Rated insulation voltage	Us [kV]
Withstand voltage at 50 Hz	Ud (1 min) [kV]
Impulse withstand voltage	Up [kV]
Rated frequency	fr [Hz]
Rated normal current (40 °C)	Ir [A]

Rated breaking capacity (rated symmetrical short-circuit current)	Isc [kA]
---	----------

Rated-short time withstand current (3s)	Ik [kA]
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Making capacity	Ip [kA]
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Operation sequence	[O – 0.3 s – CO – 15 s – CO]
	[O – 0.3 s – CO – 3 min – CO]

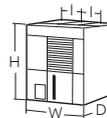
Opening time	[ms]
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Arc duration	[ms]
--------------	------

Total breaking time	[ms]
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Closing time	[ms]
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Maximum overall dimensions	H [mm/in]
	W [mm/in]
	D [mm/in]
	Pole center I [mm/in]



Weight	[kg/lb]
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Standardized table of dimensions	1VCD
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Operating temperature	[°C]
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Tropicalization	IEC: 60068-2-30, 60721-2-1
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Electromagnetic compatibility	IEC 62271-1
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(*) This version cannot be sold loose; this version can only be supplied for 2000 A; Vmax/FH version must be ordered together with ABB UniGear 500R switchgear.

(**) Up to 15 kV

Vmax 12		Vmax 17		Vmax/F 12 (*)			Vmax/F 17 (*)			Vmax 15
•		•		-			-			•
-		-		•			•			-
•		•		•			•			-
•		•		•			•			-
-		-		-			-			•
-		-		-			-			•
12		17.5		12			17.5			15
12		17.5		12			17.5			15
28		38		28			38			36 (at 60 Hz)
75		95		75			95			95
50-60		50-60		50-60			50-60			60
630	1250	630	1250	630	1250	2000	630	1250	2000 (**)	1200
16	16	16	16	-	-	-	-	-	-	-
20	20	20	20	-	-	-	-	-	-	-
25	25	25	25	25	25	25	25	25	25	25 (3 cycles)
31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5 (3 cycles)
16	16	16	16	-	-	-	-	-	-	-
20	20	20	20	-	-	-	-	-	-	-
25	25	25	25	25	25	25	25	25	25	25 (2s)
31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5 (2s)
40	40	40	40	-	-	-	-	-	-	-
50	50	50	50	-	-	-	-	-	-	-
63	63	63	63	63	63	63	63	63	63	65
80	80	80	80	80	80	80	80	80	80	82
•		•		•			•			-
-		-		-			-			•
33-60		33-60		33-60			33-60			27 ... 32.5
10-15		10-15		10-15			10-15			10-17.5
43-75		43-75		43-75			43-75			<50
30-60		30-60		30-60			30-60			45-80
496		534		543		543	543		543	534/21.02
416		416		416		416	416		416	416/16.38
421		456		461		562	461		562	456/17.95
133-155		133-155		133		133	133		133	133/5.24
77		77		77		80	77		80	77/169.40
003279		003279		003516		003558	003516		003558	003279
-5 ... +40		-5 ... +40		-5 ... +40			-5 ... +40			-30 ... +40
•		•		•			•			-
•		•		•			•			-

5. Description

5.4. Withdrawable circuit breaker

The withdrawable circuit breakers (see fig. 5) are available for UniGear type ZS1 switchgear, PowerCube modules and UniSec switchgear.

They consist of a truck on which the supporting structure of the circuit breaker is fixed.

The cord with the connector (14) (plug) for connection of the operating mechanism electrical accessories comes out of the connection (15).

The strikers for operating the contacts (racked-in/ isolated) placed in the switchgear are fixed in the top part of the circuit breaker.

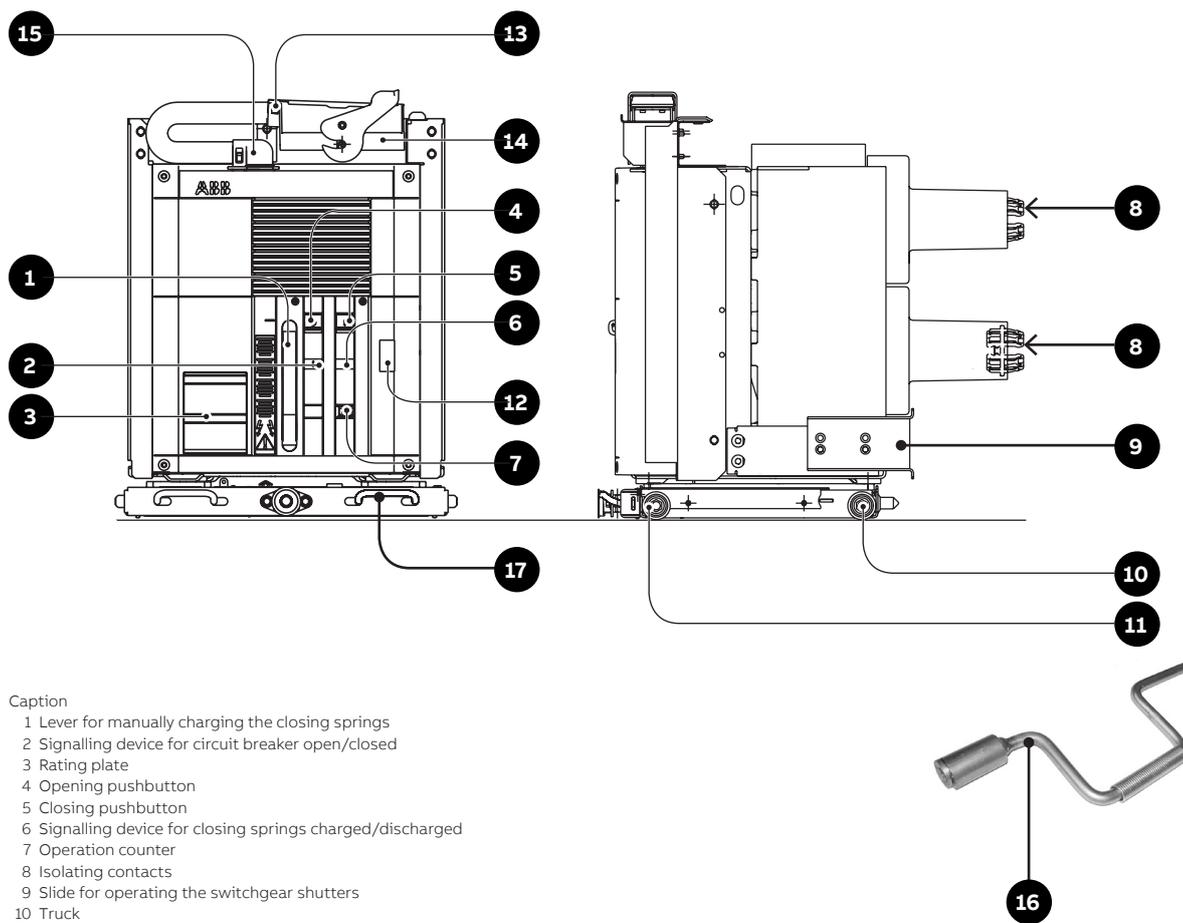
The slides (9) for operating the segregation shutters of the medium voltage contacts of the enclosure or of the switchgear are fixed on the sides of the circuit breaker.

On the front part of the circuit breaker truck, the crosspiece is mounted with the handles (17) for hooking up the circuit breaker for the racking-in/out operations by means of the special operating lever (16). The circuit breaker is completed with the isolating contacts (8).

The withdrawable circuit breaker is fitted with special locks on the front crosspiece, which allow hooking up into the corresponding couplings of the switchgear. The locks can only be activated by the handles with the truck fully resting against the crosspiece. The operating lever (16) must be fully inserted (also see par. 7.6.). A lock prevents the truck from advancing into the enclosure or fixed part when the earthing switch is closed. Another lock prevents racking-in and racking-out with the circuit breaker closed. With the truck in an intermediate position between isolated and racked-in, a further lock prevents circuit breaker closing (either mechanical or electrical).

A locking magnet is also mounted on the truck which, when de-energised, prevents the truck racking-in operation.

On request, an interlock is also available which prevents circuit breaker racking-in with the door open, and door opening with the circuit breaker closed.



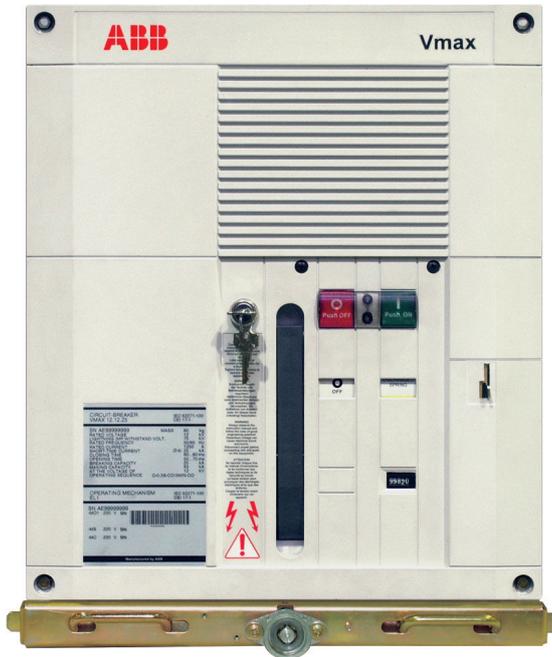
Caption

- 1 Lever for manually charging the closing springs
- 2 Signalling device for circuit breaker open/closed
- 3 Rating plate
- 4 Opening pushbutton
- 5 Closing pushbutton
- 6 Signalling device for closing springs charged/discharged
- 7 Operation counter
- 8 Isolating contacts
- 9 Slide for operating the switchgear shutters
- 10 Truck
- 11 Locks for hooking into the fixed part
- 12 Undervoltage release mechanical override (on request)
- 13 Strikers for activating the contacts placed in the enclosure
- 14 Connector (plug)
- 15 Cabling connection
- 16 Operating lever of circuit breaker racking-in/out.
- 17 Handles for activating the locks (11).

Fig. 5

5. Description

5.4.1. General characteristics of withdrawable circuit breakers (12 - 17.5 kV) for UniGear ZS1 type units 550 mm wide, for PowerCube PB1 modules 600 mm wide and for UniSecswitchgear



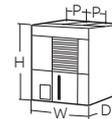
5.4.2. Standard fittings for withdrawable circuit breakers for UniGear ZS1 type switchgear 550 mm wide, for PowerCube modules 600 mm wide and for UniSec switchgear

The basic versions of the withdrawable circuit breakers are three-pole and fitted with:

- EL type manual operating mechanism
- mechanical signalling device for closing springs charged/discharged
- mechanical signalling device for circuit breaker open/closed
- closing and opening pushbutton
- operation counter
- set of ten auxiliary circuit breaker open/closed contacts
- lever for manually charging the closing springs
- isolating contacts
- cord with connector (plug only) for auxiliary circuits, with striker pin on request, which does not allow connection of the plug in the socket if the rated current of the circuit breaker is different from the rated current of the panel
- racking-in/out lever (the quantity must be defined according to the number of pieces of apparatus ordered)
- locking electromagnet in the truck (1).

(1) On request. This prevents racking-in of the circuit breaker in the panel with auxiliary circuits not connected (plug not inserted in the socket).

Circuit breaker	
Use in switchgear/enclosure	IEC 62271-100
Standards	CEI EN62271-100 (file 7642)
	C37.54 - C37.09 - C37.04 - C37.55
	UL Listed
Rated voltage	Ur [kV]
Rated insulation voltage	Us [kV]
Withstand voltage at 50 Hz	Ud (1 min) [kV]
Impulse withstand voltage	Up [kV]
Rated frequency	fr [Hz]
Rated normal current (40 °C)	Ir [A]
Rated breaking capacity (rated symmetrical short-circuit current)	Isc [kA]
Rated short-time withstand current (3s)	Ik [kA]
Making capacity	Ip [kA]
Operation sequence	[O - 0.3" - CO - 15" - CO]
	[O - 0.3" - CO - 3" - CO]
Opening time	[ms]
Arc duration	[ms]
Total breaking time	[ms]
Closing time	[ms]
Maximum overall dimensions	H [mm/in]
	W [mm/in]
	D [mm/in]
	Pole centre P [mm/in]
Weight	[kg/lb]
Standardized table of dimensions	1VCD
Operating temperature	[°C]
Tropicalization	IEC: 60068-2-30, 60721-2-1
Electromagnetic compatibility	IEC 62271-1



Vmax/L 12		Vmax/L 17		Vmax/W 12		Vmax/W 17		Vmax/W 15	Vmax/Sec 12		Vmax/Sec 17	
UniGear 550		UniGear 550		PowerCube		PowerCube		PowerCube	UniSec WBC/WBS		UniSec WBC/WBS	
•		•		•		•		-	•		•	
•		•		•		•		-	•		•	
-		-		-		-		•	-		-	
-		-		-		-		(on request)	-		-	
12		17.5		12		17.5		15	12		17,5	
12		17.5		12		17.5		15	12		17,5	
28		38		28		38		36 (at 60 Hz)	28		42	
75		95		75		95		95	75		95	
50-60		50-60		50-60		50-60		60	50-60		50-60	
630	1250	630	1250	630	1250	630	1250	1200	630	1250	630	1250
16	16	16	16	16	16	16	16	-	16	16	16	16
20	20	20	20	20	20	20	20	-	20	20	20	20
25	25	25	25	25	25	25	25	25 (3 cycles)	25	25	25	25
31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5 (3 cycles)	-	-	-	-
16	16	16	16	16	16	16	16	-	16	16	16	16
20	20	20	20	20	20	20	20	-	20	20	20	20
25	25	25	25	25	25	25	25	25 (2s)	25	25	25	25
31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5 (2s)	-	-	-	-
40	40	40	40	40	40	40	40	-	40	40	40	40
50	50	50	50	50	50	50	50	-	50	50	50	50
63	63	63	63	63	63	63	63	65	63	63	63	63
80	80	80	80	80	80	80	80	82	-	-	-	-
•		•		•		•		-	•	•	•	•
-		-		-		-		•	-	-	-	-
33 ... 60		33 ... 60		33 ... 60		33 ... 60		27 ... 32.5	33...60	33...60	33...60	33...60
10 ... 15		10 ... 15		10 ... 15		10 ... 15		10 ... 17.5	10...15	10...15	10...15	10...15
43 ... 75		43 ... 75		43 ... 75		43 ... 75		<50	43...75	43...75	43...75	43...75
30 ... 60		30 ... 60		30 ... 60		30 ... 60		45 ... 80	30...60	30...60	30...60	30...60
665	665	665	665	665	665	665	665	665/26.18	665	665	665	665
461	461	461	461	503	503	503	503	503/19.80	503	503	503	503
665	665	665	665	662	662	662	662	662/26.06	662	662	662	662
150	150	150	150	150	150	150	150	150/5.91	150	150	150	150
98	98	98	98	98	98	98	98	98/215.60	98	98	98	98
003334		003334		003280		003280		003280	003280	003280	003280	003280
-5 ... +40		-5 ... +40		-5 ... +40		-5 ... +40		-30 ... +40	-5...+40		-5...+40	
•		•		•		•		-	•		•	
•		•		•		•		-	•		•	

5. Description

5.5. Characteristics of the electrical accessories

Shunt opening release (-MBO1); Additional shunt opening release (-MBO2); Shunt closing release (-MBC)

Un: 24 - 30 - 48 - 60 - 110 - 125 - 220 - 250 V-	
Un: 24 - 48 - 60 - 110 - 120 ... 127 - 220 ... 240 V~ 50 Hz	
Un: 110 - 120 - 127 - 220 - 240 V~ 60 Hz	
Operating limits:	70 ... 110% Un
Inrush power (Ps):	DC 200 W; AC = 200 VA
Inrush time	approx 100 ms
Maintenance power (Pc):	DC = 5 W; AC = 5 VA
Opening time:	40 ... 60 ms
Closing time:	40 ... 80 ms
Insulation voltage:	2000 V 50 Hz (for 1 min)

Undervoltage release (-MBU)

Un: 24 - 30 - 48 - 60 - 110 - 125 - 220 - 250 V-	
Un: 24 - 48 - 60 - 110 - 120 - 127 - 220 ... 240 V~ 50 Hz	
Un: 110 - 120 ... 127 - 220 ... 240 V~ 60 Hz	
Operating limits:	
- circuit breaker opening:	35-70% Un
- circuit breaker closing:	85-110% Un
Inrush power (Ps):	DC 200 W; AC = 200 VA
Inrush time	approx 100 ms
Maintenance power (Pc)	DC = 5 W; AC = 5 VA
Opening time:	30 ms
Insulation voltage:	2000 V 50 Hz (for 1 min)

Electronic time delay device for undervoltage release (mounted outside the circuit breaker)

Un: 24 ... 30 - 48 - 60 - 110 ... 127 - 220 ... 250 V-	
Un: 48 - 60 - 110 ... 127 - 220 ... 240 V~ 50/60 Hz	
Adjustable opening time (release + time delay device):	0.5-1-1.5-2-3 s

Auxiliary contacts of the circuit breaker

Un:	24 ... 250 V AC-DC			
Rated current:	Ith ² = 10 A			
Insulation voltage:	2000 V 50 Hz (for 1 min)			
Electrical resistance:	3 mOhm			
Rated current and breaking capacity in category AC11 and DC11:				
Un	Cosφ	T	In	Icu
220 V ~	0.7	--	2.5 A	25 A
24 V -	--	15 ms	10 A	12 A
60 V -	--	15 ms	6 A	8 A
110 V -	--	15 ms	4 A	5 A
220 V -	--	15 ms	1 A	2 A

Note

Application of the shunt opening release and/or additional shunt opening release foresees the use of one or two auxiliary make contacts (normally open), thereby reducing the number of auxiliary contacts available.

Motor operator (-MAS)

Un: 24 ... 30 - 48 ... 60 - 110 ... 130 - 220 ... 250 V-	
Un: 100 ... 130 - 220 ... 250 V~ 50/60 Hz	
Operating limits:	85 ... 110% Un
Inrush power (Ps):	DC 600 W; AC = 600 VA
Rated power (Pn):	DC = 200 W; AC = 200 VA
Inrush time	0.2 s
Charging time:	4-5 s
Insulation voltage:	2000 V 50 Hz (for 1 min)

Locking magnet on the operating mechanism (-RLE1)

Un: 24 - 30 - 48 - 60 - 110 - 132 - 220 - 250 V-	
Un: 48 - 60 - 110 - 120 ... 127 - 220 ... 240 V~ 50/60 Hz	
Operating limits:	85 ... 110% Un
Inrush power (Ps):	DC 250 W; AC = 250 VA
Continuous power (Pc):	DC = 5 W; AC = 5 VA
Inrush time:	150 ms

Locking magnet on the truck (-RLE2)

Un: 24 - 30 - 48 - 60 - 110 - 125 - 127 - 132 - 220 - 240 V-	
Un: 24 - 30 - 48 - 60 - 110 - 125 - 127 - 220 - 230 ... 240 V~ 50/60 Hz	
Operating limits:	85 ... 110% Un
Inrush power (Ps):	DC 250 W; AC = 250 VA
Continuous power (Pc):	DC = 5 W; AC = 5 VA
Inrush time:	150 ms

Device for monitoring the functionality and continuity of the shunt opening/closing releases (Shunt Test Unit)

Un:	24 ... 250 V AC/DC
Maximum interrupted current:	6 A
Maximum interrupted voltage:	250 V AC

6. Instructions for operating the circuit breaker

6.1. Safety indications



Vmax circuit breakers guarantee a minimum IP2X degree of protection when installed in the following conditions:

- fixed circuit breaker, installed behind a protective metallic net
- withdrawable circuit breaker, installed in switchgear.

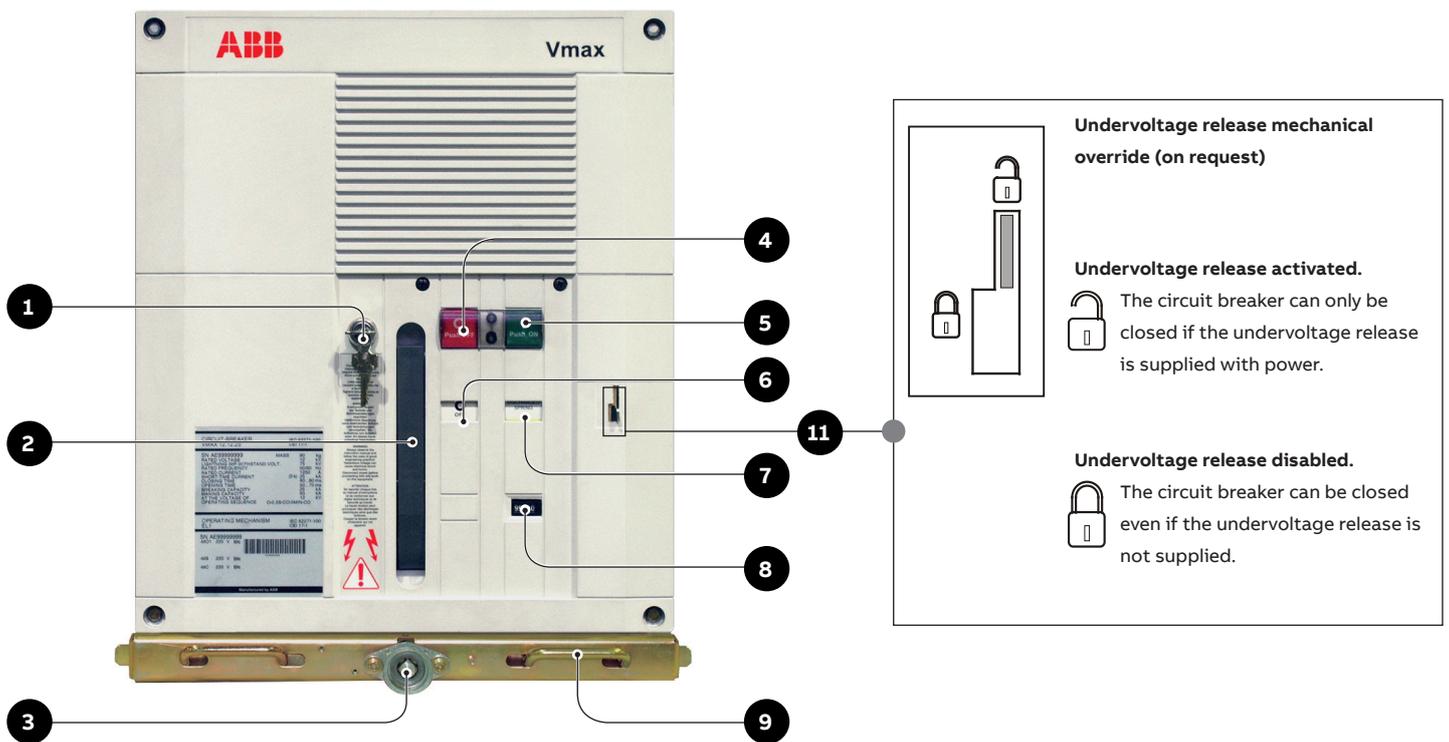
Under these conditions the operator is totally guaranteed against accidental contact with moving parts.

Should mechanical operations be carried out on the circuit breaker outside the switchgear, be very careful of the moving parts.

If the operations are prevented, do not force the mechanical interlocks and check that the operating sequence is correct.

Racking the circuit breaker in and out of the switchgear must be done gradually to avoid shocks which may deform the mechanical interlocks.

6.2. Operating and signalling parts



Caption

- 1 Key lock (if provided) (*)
 - 2 Lever for manually charging the closing springs.
 - 3 Coupling lever for racking-out operation (only for withdrawable circuit breakers).
 - 4 Opening pushbutton.
 - 5 Closing pushbutton.
 - 6 Signalling device for circuit breaker open/closed.
 - 7 Signalling device for closing springs charged/discharged.
 - 8 Operation counter.
 - 9 Handles for operating the truck locks (only for withdrawable circuit breakers).
 - 10 Operating lever for circuit breaker racking-in/out.
 - 11 Undervoltage release mechanical override (on request).
- (*) Warning! To activate the key lock: open the circuit breaker, keep the opening pushbutton depressed, then turn the key and remove it from the housing.

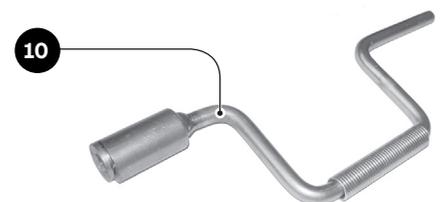


Fig. 6

6. Instructions for operating the circuit breaker

6.3. Circuit breaker closing and opening operations

Circuit breaker operation can be either manual or electrical (fig. 6 - fig. 7).

a) Manual spring charging operation

To manually charge the closing springs, it is necessary to repeatedly activate the charging lever (2) (maximum rotation angle of the lever: about 90°) until the yellow signalling device (7) appears which indicates completion of charging.

The maximum forces which can normally be applied to the lever are ≤ 150 N for the EL1 operating mechanism, ≤ 200 N for the EL2 operating mechanism and ≤ 250 N for the EL2S operating mechanism. For the type of operating mechanism, please refer to the rating plate in fig. 1.

b) Electrical spring charging operation

On request, the circuit breaker can be fitted with the following accessories for electrical operation:

- geared motor for automatic closing spring charging
- shunt closing release
- shunt opening release.

The geared motor automatically recharges the springs after each closing operation until the yellow signalling device (7) appears.

If the power is cut off during charging, the geared motor stops and automatically starts recharging the springs again when the power returns.

In any case, it is always possible to complete the recharging operation manually.

c) Circuit breaker closing

The operation can only be carried out with the closing springs completely charged. For manual closing, press the pushbutton (5). When there is a shunt closing release, the operation can also be carried out remotely by means of a special control circuit. Closing having taken place is indicated by the signalling device (6).

d) Circuit breaker opening

For manual opening, press the pushbutton (4). When there is a shunt opening release, the operation can also be carried out remotely by means of a special control circuit. Opening having taken place is indicated by the signalling device (6).

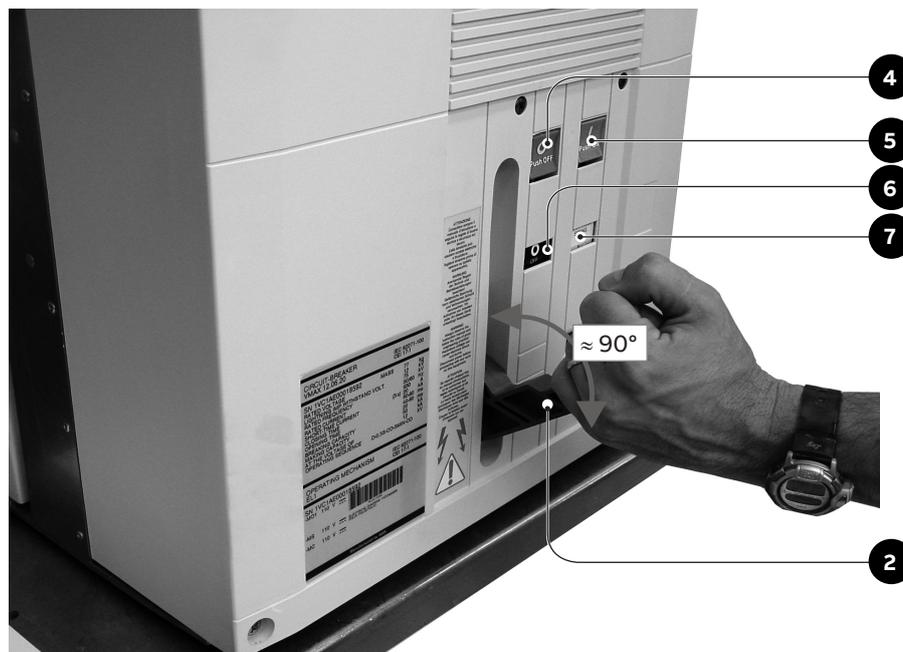


Fig. 7

7. Installation

7.1. General



Correct installation is of primary importance. The manufacturer's instructions must be carefully studied and followed. It is good practice to use gloves for handling the pieces during installation.

7.2. Installation and service conditions

The following Standards must be taken into particular consideration during installation and service:

- IEC60694/DIN VDE 0101
- VDE 0105: Electrical installation service
- DIN VDE 0141: Earthing systems for installations with rated voltage above 1 kV
- All the accident prevention regulations in force in the relative countries.

7.2.1. Normal conditions

Follow the recommendations in the IEC 60694 and 62271-100 Standards. In more detail:

Ambient temperature

Maximum	+ 40 °C
Average maximum over 24 hours	+ 35 °C
Minimum (according to class – 5), apparatus for indoor installation	– 5°

Humidity

The average value of the relative humidity, measured for a period longer than 24 hours, must not exceed 95%.

The average value of the pressure of the water vapour, measured for a period longer than 24 hours, must not exceed 2.2 kPa.

The average value of the relative humidity, measured for a period longer than 1 month, must not exceed 90%.

The average value of the pressure of the water vapour, measured for a period longer than 1 month, must not exceed 1.8 kPa.

Altitude

≤ 1000 m above sea level.

7.2.2. Special conditions

Installations over 1000 m a.s.l.

Possible within the limits permitted by reduction of the dielectric resistance of the air.

Increase in the ambient temperature

Reduction in the rated current.

Encourage heat dissipation with appropriate additional ventilation.

Climate

To avoid the risk of corrosion or other damage in areas:

- with a high level of humidity, and/or
- with rapid and large temperature variations, take appropriate steps (for example, by using suitable electric heaters) to prevent condensation phenomena.

For special installation requirements or other operating conditions, please contact ABB.



The areas involved by the passage of power conductors or conductors of auxiliary circuits must be protected against access of any animals which might cause damage or disservices.

7. Installation

7.2.3. Trip curves

The following graphs show the number of closing-opening cycles (No.) allowed, of the vacuum interrupters, according to the breaking capacity (Ia).

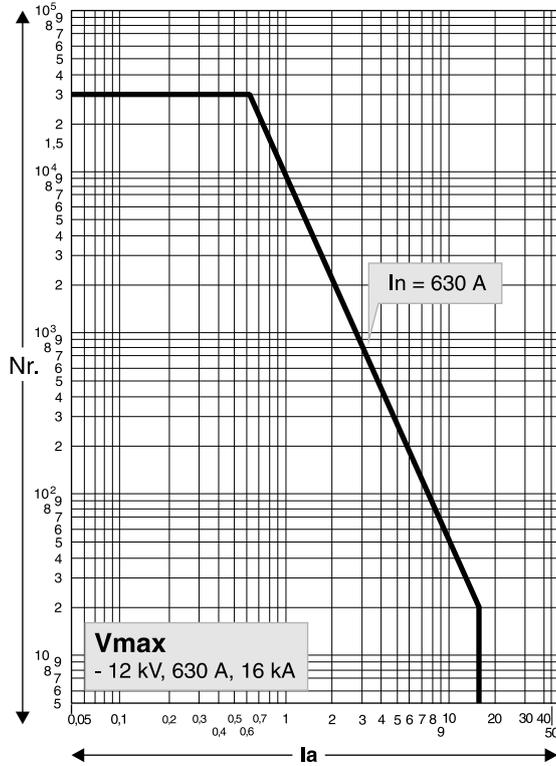


Fig. 8a

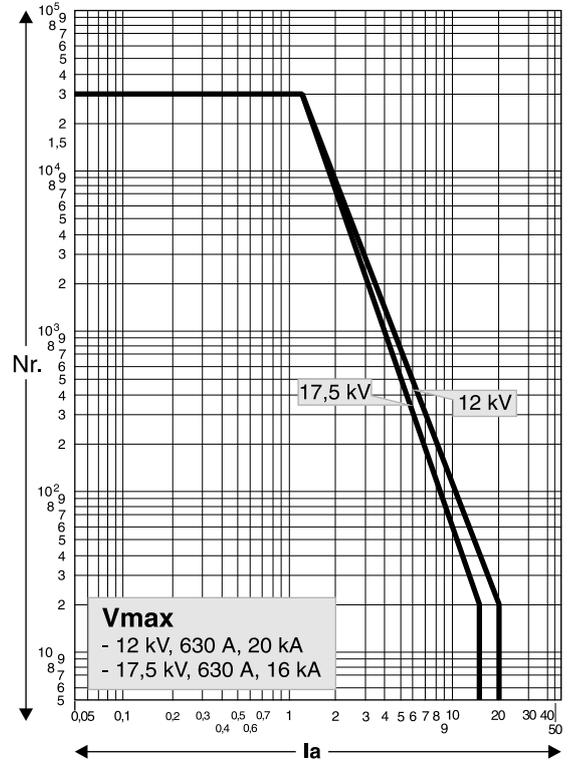


Fig. 8b

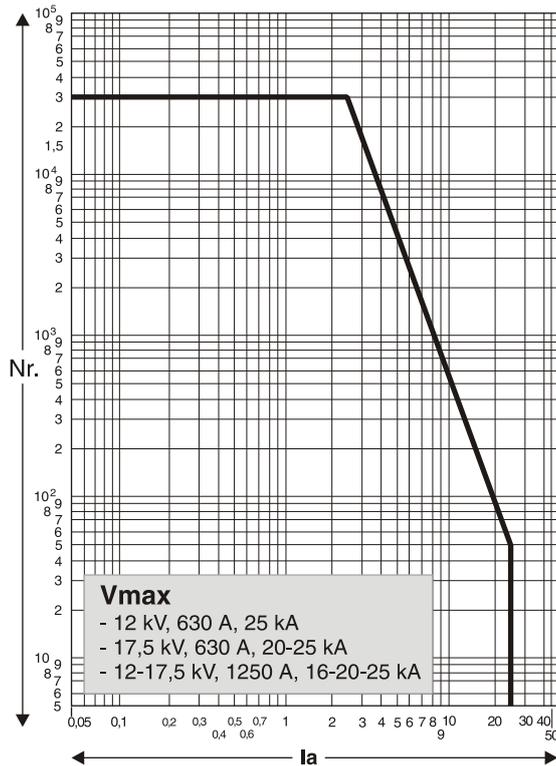


Fig. 8c

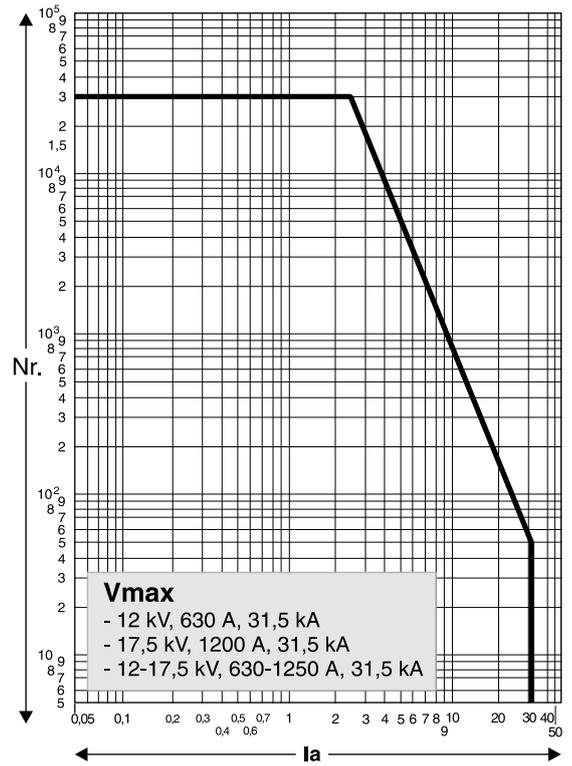


Fig. 8d

Caption
Nr. Number of closing-opening cycles allowed for the vacuum interrupters.
Ia Breaking capacity of the vacuum interrupters.

7.3. Preliminary operations

- Clean the insulating parts with clean dry cloths.
- Check that the top and bottom terminals are clean and free of any deformation caused by shocks received during transport or storage.

7.4. Installation of fixed circuit breakers

The circuit breaker can be fixed directly on the supporting plate or on a truck provided by the customer. The customer must guarantee a minimum degree of protection (IP2X) from the front towards live parts.

Note: the circuit breakers for UniGear switchgear with fixed CB are installed directly in the factory – the Customer is not required to carry out any activities.

7.5. Withdrawable circuit breakers with truck made by third parties

The Vmax circuit breakers installed on trucks made by the customer must be fitted with one or two additional auxiliary contacts (operated by the mechanical lock and by the circuit breaker release device) which are entrusted with the function of interrupting the shunt closing release circuit (-MBC). In this way it is certain that no electrical impulse can activate the shunt closing release with the circuit breaker in an intermediate position. The customer must also provide a lock to prevent circuit breaker traverse when it is in the closed position.

7.6. Withdrawable circuit breakers with ABB truck for UniGear ZS1 550 mm wide, and UniSec switchgear

The withdrawable circuit breakers are preset for use in UniGear type ZS1 switchgear 550 mm wide. For racking-in/racking-out of the switchgear, fully insert the lever (1) (fig. 9) in the appropriate seat (2) and work it clockwise for racking-in, and anti-clockwise for racking-out, until the limit switch positions are reached. Circuit breaker racking-in/-out must be carried out gradually to avoid shocks which might deform the mechanical interlocks and the limit switches.

The torque normally required to carry out racking-in and racking-out is < 25 Nm.

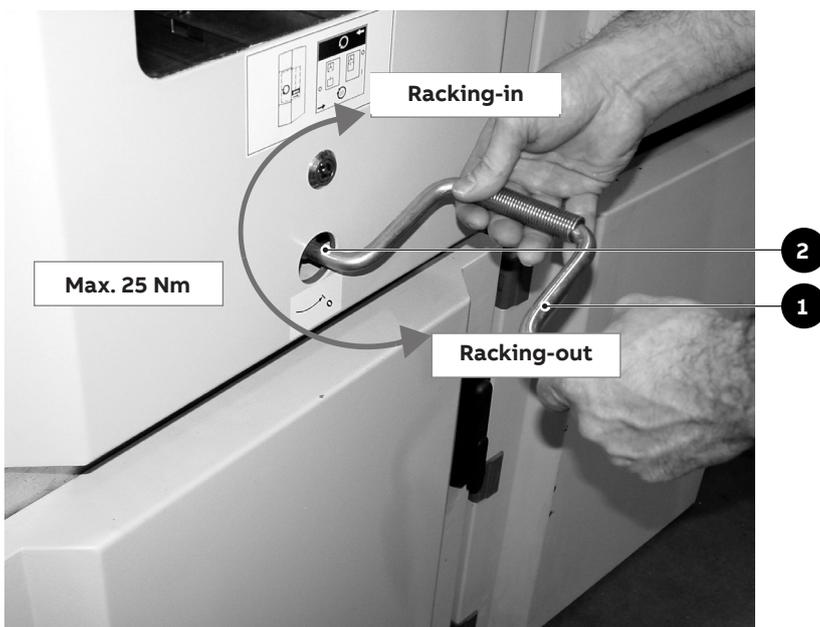
This value must not be exceeded. If operations are prevented or difficult, do not force them and check that the operating sequence is correct.

Note: about 20 rotations of the lever are required to complete the racking-in/out operation.

When the circuit breaker has reached the isolated for test/isolated position, it can be considered racked into the switchgear and, at the same time, earthed by means of the truck wheels.

630 A and 1250 A withdrawable circuit breakers are interchangeable dimensionally. Thanks to different coding of the auxiliary circuit plug, incorrect combinations between panels and circuit breakers are prevented.

For the circuit breaker installation operations, also refer to the technical documentation of the above-mentioned switchgear.



The racking-in/-out operations must always be carried out with the circuit breaker open.

7. Installation

7.7. Power circuit connections of fixed circuit breakers

7.7.1. General recommendations

- Select the cross-section of the conductors according to the service current and the short-circuit current of the installation.
- Prepare special supporting insulators, near the terminals of the fixed circuit breaker or of the enclosure, sized according to the electrodynamic forces deriving from the short-circuit current of the installation.

7.7.2. Assembly of the connections

- Check that the contact surfaces of the connections are flat, and are free of any burrs, traces of oxidation or deformation caused by drilling or impacts received.
- According to the conductor material and the surface treatment used, carry out the operations indicated in table T1 on the contact surface of the conductor

Assembly procedure

- Put the connections in contact with the circuit breaker terminals taking care to avoid mechanical stresses (traction / compression) on, for example, the conducting busbars on the terminals.
- Interpose a spring washer and a flat washer between the head of the bolt and the connection.
- It is advisable to use bolts according to DIN class 8.8 Standards, also referring to what is indicated in table T2.
- In the case of cable connections, strictly follow the manufacturer's instructions to make the terminals.

T1

Bare copper	Copper or silver-plated aluminium	Bare aluminium
<ul style="list-style-type: none"> • Clean with a fine file or emery cloth. • Tighten fully and cover the contact surfaces with 5RX Moly type grease. 	<ul style="list-style-type: none"> • Clean with a rough dry cloth. • Only in the case of obstinate traces of oxidation, clean with a very fine grain emery cloth taking care not to remove the surface layer. • If necessary, restore the surface treatment. 	<ul style="list-style-type: none"> • Clean with a metal brush or emery cloth. • Cover the contact surfaces again immediately with neutral grease. • Insert the copper-aluminium bimetal with surfaces shined (copper side in contact with the terminal; aluminium side in contact with the connection) between the aluminium connection and the copper terminal.

T2

Bolt	Recommended tightening torque (1)	
	Without lubricant	With lubricant (2)
M6	10.5 Nm	4.5 Nm
M8	26 Nm	10 Nm

(1) The nominal tightening torque is based on a friction coefficient of the thread of 0.14 (distributed value the thread is subjected to which, in some cases, is not negligible). The nominal tightening torque with lubricant is according to the DIN 43673 Standards.

(2) Oil or grease. The thread and contact surfaces of the lubricated heads. Take into account the deviations from the general Standards table (for example, for contact systems or terminals) as foreseen in the specific technical documentation. The thread and contact surfaces of the heads of bolts must be slightly oiled or greased, so as to obtain correct nominal tightening torque.

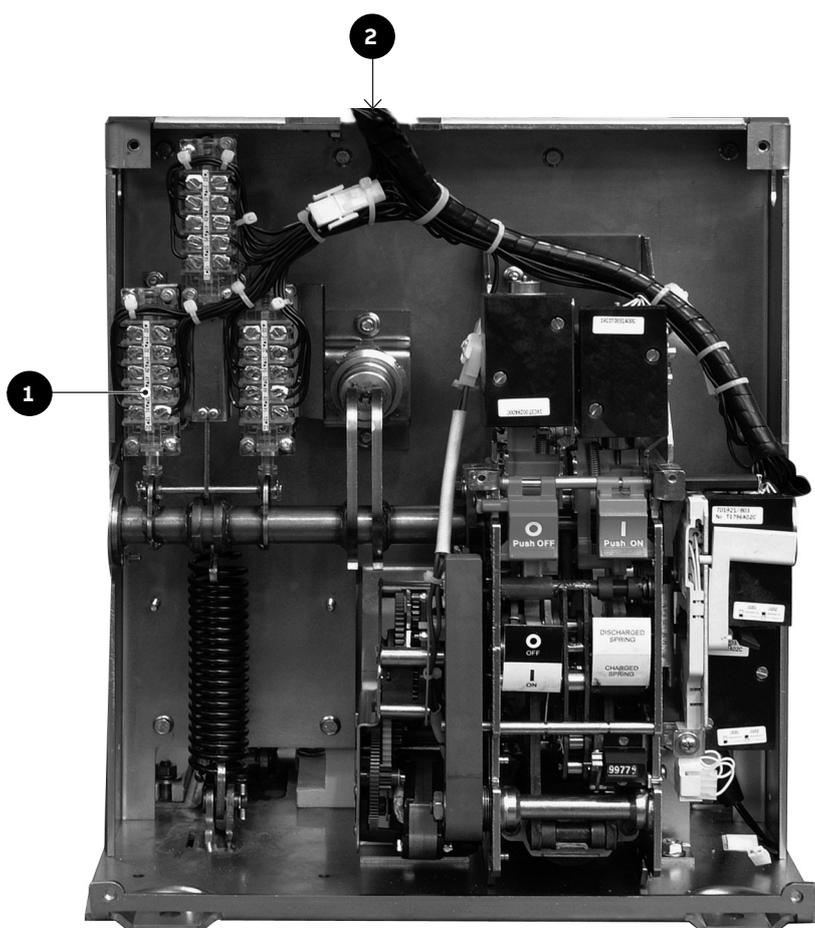


Fig. 10



Fig. 11

7.8. Earthing

For the fixed version circuit breaker, carry out earthing by means of the special screws marked with the relative symbol (see fig. 4).

Clean and degrease the area around the screw to a diameter of about 30 mm and, on completion of assembly, cover the joint again with Vaseline grease. Use a conductor (busbar or cord) with a cross-section conforming to the Standards in force.

7.9. Connection of the auxiliary circuits

Note: the minimum cross-section of the wires used for the auxiliary circuits must not be less than the one used for the internal cabling. Furthermore, they must be insulated for 3 kV test.

Please note that auxiliary circuits must be energized with 2 kV (maximum test voltage) as per standards indications.

7.9.1. Fixed circuit breaker

Connection of the circuit breaker auxiliary circuits must be made by means of the proper terminal box mounted inside the circuit breaker and the wires must pass through the connector (2). Outside the connector, the cables must pass through a suitable metal protective covering (pipe, wiring duct, etc.) and be earthed.

To prevent the cabling wires outside the circuit breaker (provided by the customer) from accidentally coming into contact with moving parts and therefore damaging the insulation, the wires should be positioned and fixed as shown in the figure.

Note: the circuit breakers for UniGear switchgear with fixed CB are installed directly in the factory – the Customer is not required to carry out any activities.



Before removing the operating mechanism cover to access the terminal box, check that the circuit breaker is open and the closing springs discharged.

7.9.2. Withdrawable circuit breakers

The auxiliary circuits of withdrawable circuit breakers are fully cabled in the factory as far as the connector (1 - fig. 11).

For the external connections, refer to the electric wiring diagram of the switchgear.

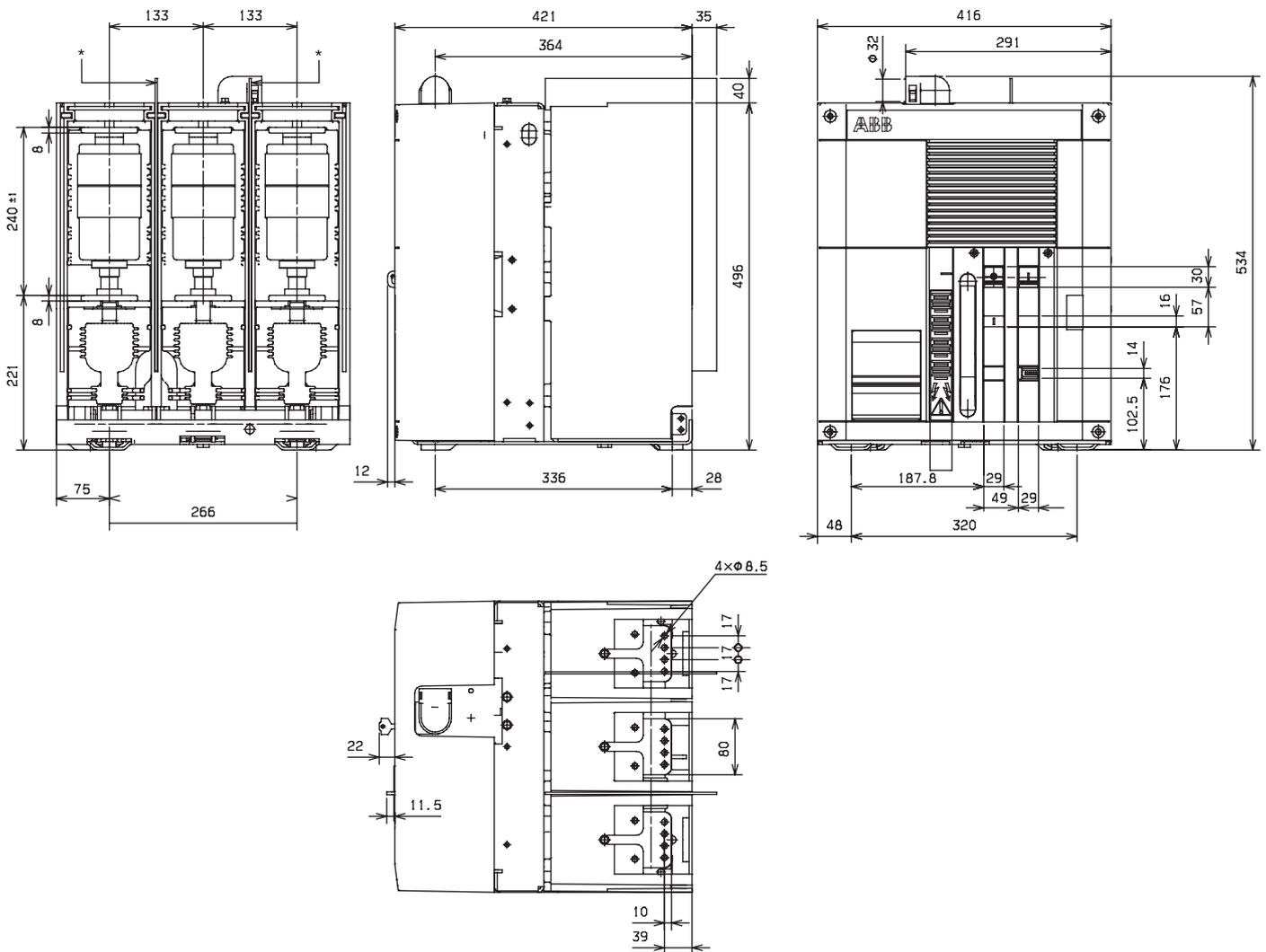
7. Installation

7.10. Overall dimensions

Vmax - Fixed circuit breakers

12-17.5 kV; 630-1250 A; 16-20-25-31.5 kA

TN 1VCD003279-V3198



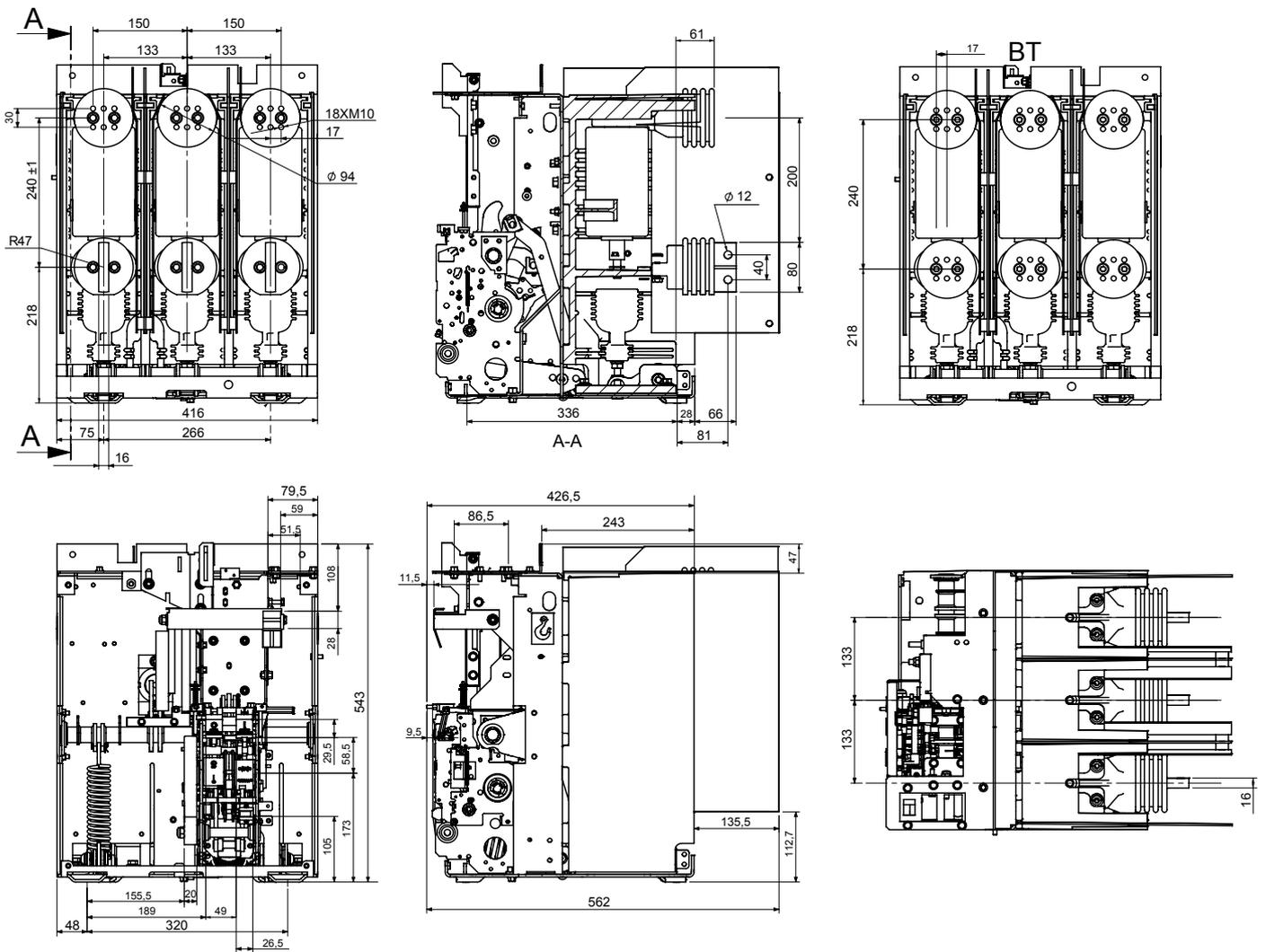
(*) Insulating shields for 17.5 kV

7. Installation

Vmax/F - Fixed circuit breakers for UniGear 500R

12-17.5 kV; 1600-2000 A; 25-31.5 kA

TN 1VCD003558-V2315

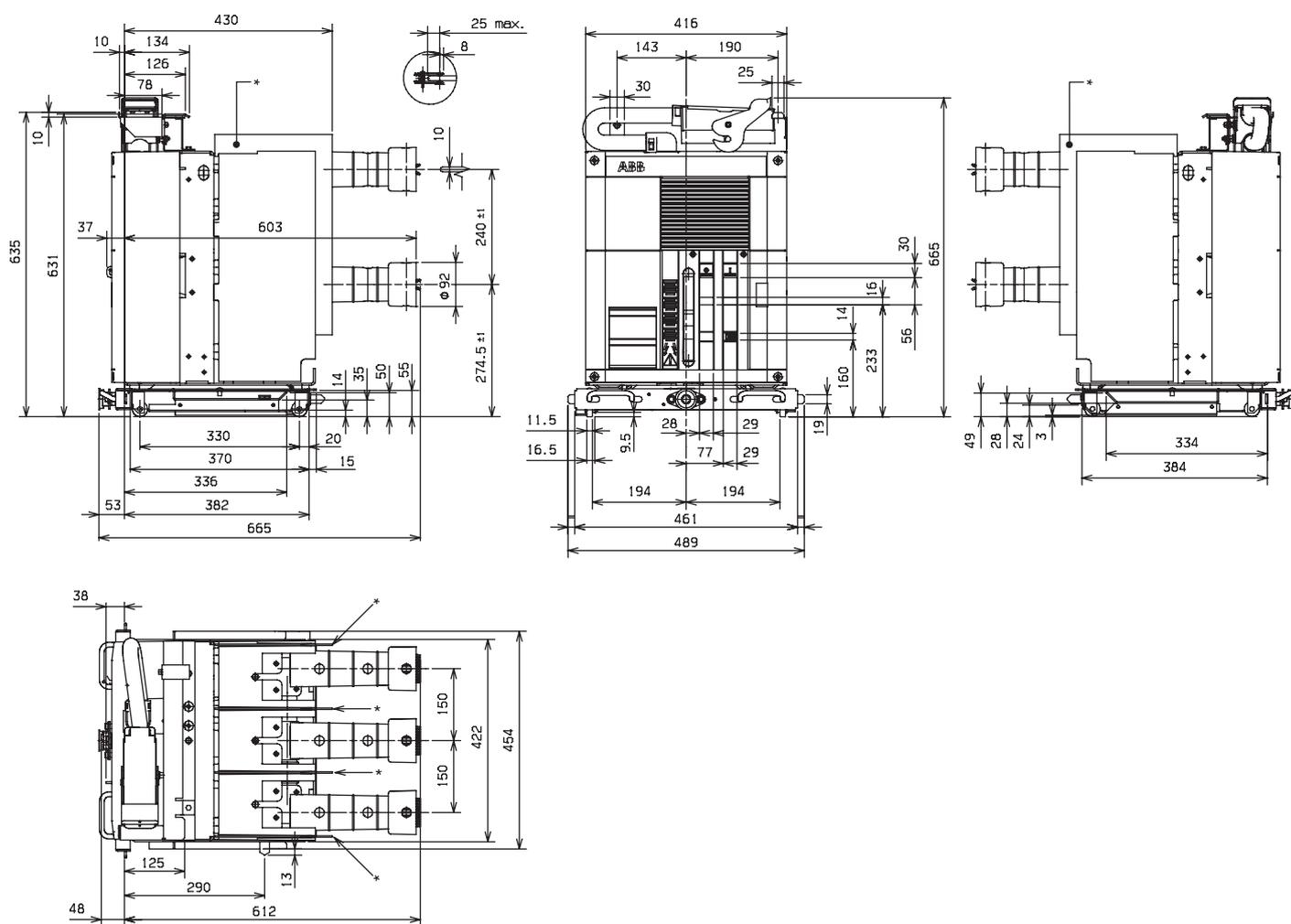


(*) Insulating shields for 17.5 kV

Vmax/L - Withdrawable circuit breakers for UniGear 550

12-17.5 kV; 630-1250 A; 16-20-25-31.5 kA

TN 1VCD003334-V2296



(*) Insulating shields for 17.5 kV

7. Installation

Vmax/W - Withdrawable circuit breakers for PowerCube modules

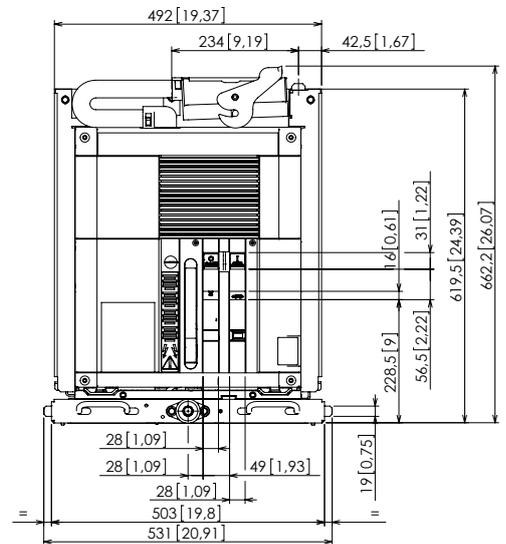
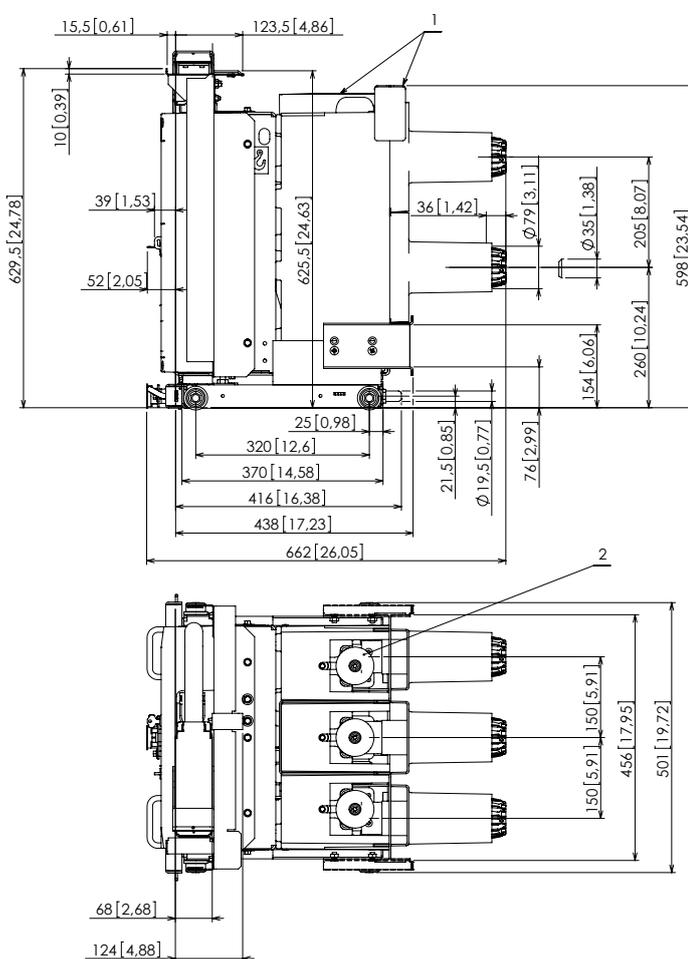
12-17.5 kV; 630-1250 A; 16-20-25-31.5 kA

TN 1VCD003280-V3519

Vmax/SEC - Withdrawable circuit breakers for UniSec switchgear

12-17.5 kV; 630-1250 A; 16-20-25 kA

TN 1VCD003280-V3519



(1) Insulating shields for 17.5 kV

(2) Electrical field distributor (for 17,5 kV)

Note: dimensions in brackets are in inches

8. Putting into service

8.1. General procedures



All the operations regarding putting into service must be carried out by ABB personnel or by suitably qualified customer personnel with in-depth knowledge of the apparatus and of the installation.

Should the operations be prevented, do not force the mechanical interlocks and check that the operating sequence is correct.

The operating forces which can be applied for racking-in withdrawable circuit breakers are indicated in paragraph 7.6.

Before putting the circuit breaker into service, carry out the following operations:

- check tightness of the power connections at the circuit breaker terminals;
- establish the setting of the primary electronic overcurrent release (if provided);
- check that the value of the power supply voltage of the auxiliary circuits is between 85% and 110% of the rated voltage of the electrical accessories;
- check that no foreign bodies, such as bits of packing, have got into the moving parts;
- check that there is a sufficient exchange of air in the installation place to avoid overtemperatures;
- also carry out the checks indicated in table T3.

T3

ITEM INSPECTED	PROCEDURE	POSITIVE CHECK	
1	Insulation resistance.		
	<p>Medium voltage circuit With a 2500 V megger, measure the insulation resistance between the phases and the exposed conductive part of the circuit</p> <p>Auxiliary circuits With a 500 V megger (if the apparatus installed allows this), measure the insulation resistance between the auxiliary circuits and the exposed conductive part.</p>	<p>The insulation resistance should be at least 50 Mohm and in any case constant over time.</p> <p>The insulation resistance should be a few Mohm and in any case constant over time.</p>	
2	Auxiliary circuits.	Check that the connections to the control circuit are correct: proceed at the relative power supply.	Operations and signals are normal.
3	Manual operating mechanism.	Carry out a few closing and opening operations (see cap. 6). N.B. Supply the undervoltage release and the locking magnet on the operating mechanism at the relative rated voltage (if provided).	The operations and the relative signals take place normally.
4	Motor operator (if provided).	Supply the spring charging geared motor at the relative rated voltage. Carry out a few closing and opening operations	The springs are charged normally. The signals are normal. With the springs charged, the geared motor stops.
		N.B. Supply the undervoltage release and the locking magnet on the operating mechanism at the relative rated voltage (if provided).	The geared motor recharges the springs after each closing operation.
5	Undervoltage release (if provided).	Supply the undervoltage release at the relative rated voltage and carry out the circuit breaker closing operation.	The circuit breaker closes normally. The signals are normal.
		Cut off power to the release.	The circuit breaker opens. The signalling changes over.
6	Shunt opening release and additional shunt opening release (if provided).	Close the circuit breaker and supply the shunt opening release at the relative rated voltage.	The circuit breaker opens normally. The signals are normal.
7	Shunt closing release (if provided).	Open the circuit breaker and supply the shunt closing release at the relative rated voltage.	The circuit breaker closes normally. The signals are normal.

8. Putting into service

T3

ITEM INSPECTED	PROCEDURE	POSITIVE CHECK
8	Key lock (if provided). Open the circuit breaker, keep the opening pushbutton depressed, then turn the key and remove it from the housing. Attempt the circuit breaker closing operation Put the key back in and turn it 90°. Carry out the closing operation.	Neither manual nor electrical closing takes place Both electrical and manual closing take place normally; in this position the key cannot be removed.
9	Auxiliary contacts in the operating mechanism. Insert the auxiliary contacts in suitable signalling circuits. Carry out a few closing and opening operations.	Signals take place normally.
10	Undervoltage override (if provided). With the circuit breaker open, springs charged, override not connected and undervoltage release not supplied with power, attempt circuit breaker closing.	Closing is not possible.
11	Locking electromagnet (-RLE1) (if provided). With the circuit breaker open, springs charged and locking electromagnet not supplied, attempt circuit breaker closing both manually and electrically.	Closing is not possible.
12	Locking electromagnet on the truck circuit breaker (-RLE2) (if provided). With the circuit breaker open, in the isolated for test position and the locking electromagnet not supplied, attempt circuit breaker racking-in. Supply the locking electromagnet and carry out the racking-in operation	Racking-in is not possible. Racking-in takes place correctly.
13	Auxiliary transmitted contacts for signalling circuit breaker racked-in, isolated (UniGear or UniSafe switchgear). With the circuit breaker racked into the enclosure, carry out a few traverse operations from the isolated for test position to the connected position. Take the circuit breaker to the racked-out position.	The signals due to the relative operations take place normally.

9. Maintenance

Maintenance operations are aimed at ensuring trouble-free operation of the apparatus for the longest possible time.

In accordance with what is specified in the IEC 61208 / DIN 31 051 Standards, the following operations must be carried out.

Inspection:	Determination of the actual conditions
Servicing:	Measures to be taken to maintain the specification conditions
Repairs:	Measures to be taken to restore the specification conditions.

9.1. General

Vacuum circuit breakers are characterised by simple, sturdy construction and long life.

The operating mechanism is maintenance-free for its whole operating life and only requires functional inspections (see par. 9.2.2.).

The vacuum interrupters are maintenance-free for their whole operating life.

Vacuum interruption does not produce harmful effects even when there are frequent trips at the rated and short-circuit current.

The servicing interventions and their aim depend on the environmental conditions, on the sequence of operations and on the trips under short-circuit.

Notes

For maintenance work, respect the following Regulations:

- the relative specifications indicated in the “Standards and Specifications” chapter;
- regulations for safety in the workplace indicated in the “Putting into service and operations” chapter;
- regulations and specifications of the country where the apparatus is installed.

The maintenance operations can only be carried out by trained personnel who respect all the safety regulations. Furthermore, it is recommended that ABB service personnel should be called in, at least to check the service performances and for repair work. During maintenance work, turn the power supply off and put the apparatus under safe conditions.



Before carrying out any operations, always make sure that the circuit breaker is open, with the springs discharged and that it is not supplied with power (medium voltage circuit and auxiliary circuits).

9.1.1. Operating life

Operating life expectancy of Vmax vacuum circuit breakers is as follows:

- vacuum interrupter: up to 30,000 operations according to the type (see par. 7.2.3. Trip curves);
- actuator: up to 10,000 operations, under normal operating conditions, according to the type of circuit breaker and with regular maintenance.

9.2. Inspections and functional tests

9.2.1. Interruption devices in general

- Carry out regular inspections to verify that the interruption devices are in good condition.
- Inspection at fixed intervals can be waived when the apparatus is permanently monitored by qualified personnel.
- Above all, the checks must include a visual inspection to find any contamination, traces of corrosion and electrical discharge phenomena.
- Carry out more frequent inspections when there are unusual operating conditions (including adverse climatic conditions) and in the case of environmental pollution (e.g. heavy contamination or an atmosphere with aggressive agents).
- Visual examination of the isolating contacts. Turning the system of contacts alternately is recommended, in order to keep the internal surface of the contact areas clean. The contact areas must be cleaned if there are signs of overheating (discoloured surface) (also see the “Repairs” paragraph).
- If any anomalous conditions are found, appropriate servicing measures must be taken (see the “Servicing” paragraph).

9. Maintenance

9.2.2. Stored energy operating mechanism

Carry out the functional test of the operating mechanism every 5,000 operations or every 4 years. Before doing the test, open the circuit breaker and carry out the following operations:

- for withdrawable circuit breakers, take the circuit breaker to the test position
- for fixed circuit breakers: cut off the voltage to the medium voltage circuit.

Note

Insulate the working area and make it safe, following the safety regulations specified in the IEC/DIN VDE Standards.

Functional test

- Make the circuit breaker safe by discharging the closing springs (close and open the circuit breaker by means of the closing and opening pushbuttons).
- With the circuit breaker in the test position, carry out a few opening and closing operations by means of the shunt opening and closing releases.
- The nuts and screws are tightened in the factory and correct tightening is marked with a coloured sign. Further tightening operations during the operating life of the circuit breaker are not foreseen. However, if it should be necessary to tighten the nuts or screws again following any trips, the values indicated in fig. 12 must be respected.

9.3. Servicing

9.3.1. Interruption devices in general

If the devices had to be cleaned during the inspections, according to what is specified in par. 9.2.1., use the following procedure:

- insulate the working area and make it safe, respecting the safety regulations specified in the IEC/DIN VDE Standards;

- general cleaning of surfaces:

- dry and eliminate any light deposits of dirt using a soft dry cloth;
- more resistant deposits of dirt can be removed using a slightly alkaline domestic cleanser;
- cleaning insulating surfaces and conductive parts:
 - light dirt: with Rivolta BWR 210 detergent;
 - resistant dirt: with cold 716 type detergent.

After cleaning, rinse thoroughly with clean water and dry carefully.

Note

Only use halogen-free detergents and never trichloroethane, trichloroethylene or carbon tetrachloride!

9.3.2. Actuator and transmission system

Servicing must be carried out after 15,000 operations both for the actuator (snap-on box) and for the shock absorber.

Note

Dismantling and replacement of the operating mechanism (snap-on box) can only be carried out by ABB personnel or by qualified and specially trained personnel, especially for the necessary adjustments.

Servicing details

- If provided, turn off the spring charging motor power supply and manually discharge the operating mechanism springs by closing and opening the circuit breaker.
- Replace parts subject to high climatic or mechanical stresses (contact an ABB service centre).

Note

These operations can only be carried out by ABB personnel or suitably qualified and specially trained personnel

9.3.3. Vacuum interrupters

The vacuum interrupters are maintenance-free up to the maximum number of electrical operations foreseen for the type of interrupter (see par. 7.2.3. Trip curves).

Checking screw tightening

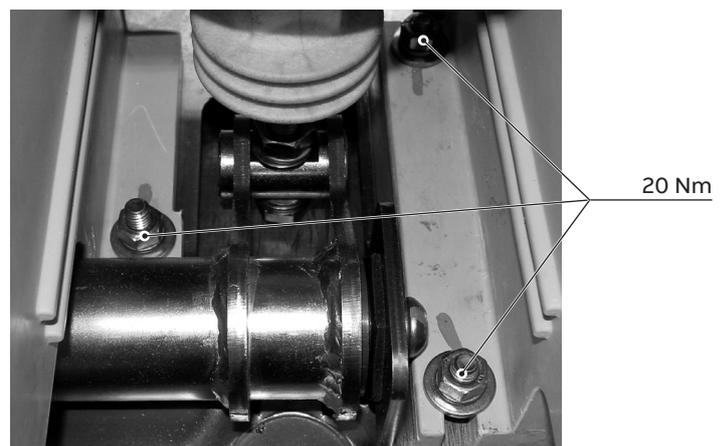


Fig. 12

The operating life of the vacuum interrupter is defined by the sum of the ultimate currents corresponding to the specific type of interrupter in accordance with what is indicated in the graphs of 7.2.3. Trip curves: when the sum of the ultimate currents is reached, the complete pole must be replaced.

Note

Dismantling and replacement of the interrupter assembly can only be carried out by ABB personnel or by qualified and specially trained personnel, especially for the necessary adjustments.

To carry out the interrupter test use the VIDAR vacuum tester, of the Electric GmbH, Bad Homburg v.d.H. company Programme.

To check vacuum tightness of the interrupter, the following test values must be set on the VIDAR tester:

Rated circuit breaker voltage	Rated circuit breaker voltage
12 kV	28 kV
17.5 kV	28 kV

The test must always be carried out with the circuit breaker open with the contacts at the nominal distance.

Procedure for testing the degree of vacuum of the interrupter:

- cut off the voltage in the working area and make it safe in accordance with the safety regulations specified in the IEC/DIN VDE Standards;
- open the circuit breaker;
- earth a terminal of each circuit breaker phase;
- connect the earth terminal of the VIDAR tester to the circuit breaker structure;
- connect the high voltage terminal of the VIDAR tester to the terminal not connected to earth of the interrupter (L1 phase) and carry out the test. Repeat the test for phases L2 and L3.

Note

The tester connection cables can produce an indication due to the capacitive effect. In this case the cables must not be removed.

9.3.4. Lubrication

- Visually inspect the lubrication conditions of the tulip isolating contacts, the sliding surfaces, etc. Lubricate if necessary.
- Check correct electrical and mechanical operation of the various devices, particularly with regard to the interlocks. Lubricate if necessary.

9.4. Repairs

Replacement of spare parts and accessories must only be carried out by ABB personnel or suitably qualified and specially trained personnel. Always work with the circuit breaker open and locked so that it cannot be closed again, with the work area insulated and made safe.

The operating mechanism springs must be discharged.

All power supply sources must be disconnected and made safe against any reclosing during removal and installation work.



Should maintenance be carried out by the customer's personnel, responsibility for the interventions remains with the customer. The replacement of parts not included in the "List of spare parts" (par. 10.1.) must only be carried out by ABB personnel.

In particular

- complete interrupter assembly with connections
- actuator and transmission system
- group of closing springs
- opening spring
- shock absorber.

10. Spare parts and accessories



All assembly operations of spare parts/ accessories must be carried out following the instructions enclosed with the spare parts, by ABB personnel or by suitably qualified customer personnel with in-depth knowledge of the apparatus (IEC 60694) and all the Standards aimed at carrying out these interventions in safe conditions. Should the maintenance be carried out by the customer's personnel, responsibility for the interventions remains with the customer. Before carrying out any operation, always make sure that the circuit breaker is open, the springs discharged and not supplied (medium voltage circuit and auxiliary circuits)

To order circuit breaker spare parts/accessories, refer to the ordering sales codes indicated in the technical catalogue and always state the following:

- type of circuit breaker
- rated voltage of the circuit breaker
- rated normal current of the circuit breaker
- breaking capacity of the circuit breaker
- serial number of the circuit breaker
- rated voltage of any electrical spare parts. .

For availability and to order spare parts, please contact our Service office.

10.1. List of spare parts

- Shunt opening release
- Additional shunt opening release
- Undervoltage release
- Time delay device for undervoltage release
- Mechanical override for undervoltage release
- Shunt closing release
- Spring charging geared motor with electrical signalling of springs charged
- Contact signalling geared motor protection circuit breaker open/closed
- Contact signalling closing springs charged/ discharged
- Circuit breaker auxiliary contacts
- Locking electromagnet on the operating mechanism
- Position contact of the withdrawable truck
- Contacts signalling racked-in/isolated
- Key lock in open position
- Isolation interlock with the door
- Protection for opening pushbutton
- Protection for closing pushbutton
- Locking electromagnet on the withdrawable truck
- Set of six tulip contacts
- Insulating partitions.

For more information please contact:



More product information:
abb.com/mediumvoltage
Your contact center:
abb.com/contactcenters
More service information:
abb.com/service

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