

DISTRIBUTION SOLUTIONS

Vmax

Medium voltage vacuum circuit breakers

IEC: ... 17.5 kV; ... 2000 A; ... 31.5 kA

ANSI: ... 15 kV; ... 1200 A; ... 31.5 kA



Vmax is the synthesis of renowned ABB technology in the design and construction of vacuum circuit breakers and excellence in production processes.

Vmax circuit breakers are ideal for electrical distribution applications with short-circuit levels up to 31.5 kA.

The simple, compact design results in greater flexibility for a wide range of applications.

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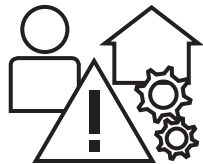
Vmax: its strengths, your benefits



**Affordable
range**



**Optimized
logistics**



**Safety and
protection**

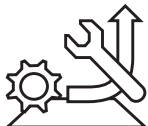


Productivity Maximizing your output



Services and training

- **Dedicated service training for installation and maintenance**
 - Have in-house trained personnel for installation and maintenance
- **Specialized ABB Service personnel for installation and maintenance**
 - Rely on ABB support for installation and maintenance
- **Field application support and analysis for special applications**
 - Rely on ABB technical support to choose the best solution for your specific application



Easy to install

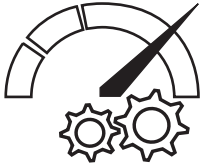
- **Withdrawable version available**
 - Quickly and easily rack the breaker in and out for maintenance
 - Receive the complete breaker solution ready for installation inside the panel



Speed up your projects

- **Breaker+cassette offering**
 - Reduce your engineering effort thanks to ABB's proven design

Vmax: its strengths, your benefits

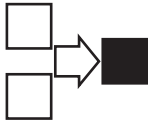


Reliability Protecting your assets



Safety and protection

- **Truck interlocking magnet: Avoid breaker rack-in inside a panel with a different rated current**
 - Eliminate the risk of installing the wrong breaker inside the panel
- **Avoid breaker rack-in without an auxiliary plug connected**
 - Eliminate the risk of installing the breaker without activating its protection functions



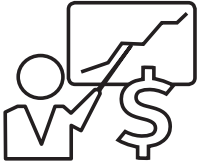
Optimum interface

- **Mechanically interchangeable with HD4 and VD4 in PowerBox**
 - Use the same panel design to host breakers with different technologies
- **Fixed execution with truck assembled ready for customization**
 - Design and assemble your own contact system that best fits your panel, with the interlocking system already mounted



Global availability

- **ABB by your side**
 - Count on a worldwide presence for any support you may need



Efficiency Optimizing your investments



Affordable Range

- **Optimized solution for low duty applications**
 - Design a competitive switchgear solution for low duty applications



Optimized logistics

- **Very compact and light breaker (phase distance 133 mm)**
 - Handle the breaker easily and reduce transportation burden

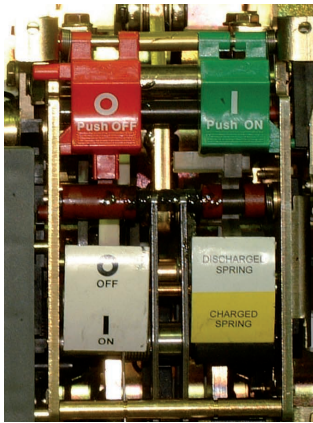


1. Description

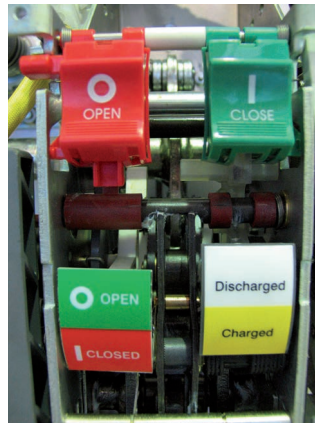


01

- Vacuum breaking technique
- Contacts in a vacuum protected against oxidation and contamination
- Operation under different climatic conditions
- Limited switching energy
- Stored energy operating mechanism with anti-pumping device supplied as standard
- Simple customization with a complete range of accessories
- Fixed and withdrawable version
- Compact dimensions
- Sealed-for-life vacuum interrupters
- Sturdiness and reliability
- 10,000 operations with regular maintenance
- Circuit breaker racking-in and racking-out with the door closed
- Incorrect and hazardous operations prevented thanks to special locks in the operating mechanism and in the truck



02



03

01 Vmax/L according to IEC STDs

02 Push-buttons and mechanical indicators for IEC versions

03 Push-buttons and mechanical indicators for ANSI versions

General information

The new Vmax circuit breakers are the synthesis of ABB's affirmed technology in designing and constructing vacuum interrupters and their excellence in design, engineering and production of circuit breakers.

The Vmax medium voltage circuit breakers consist of an insulating monobloc in which three vacuum interrupters are housed.

The monobloc and operating mechanism are fixed to a frame.

The vacuum interrupter houses the contacts and makes up the interrupting chamber.

Current breaking in vacuum

The vacuum circuit breaker does not require an interrupting and insulating medium. In fact, the interrupter does not contain ionizable material.

In any case, on separation of the contacts an electric arc is generated, made up exclusively of melted and vaporised contact material.

The electric arc only remains supported by the external energy until the current is cancelled by passing through natural zero.

At that instant, the rapid reduction in the load density carried and fast condensation of the metallic vapor, leads to extremely rapid recovery of the dielectric properties.

The vacuum interrupter therefore recovers the insulating capacity and the capacity to withstand the transient recovery voltage, definitively extinguishing the arc.

Since high dielectric strength can be reached in the vacuum, even with minimum distances, circuit breaking is also guaranteed when separation of the contacts takes place a few milliseconds before passage of the current through natural zero.

The special geometry of the contacts and the material used, together with the limited duration and low voltage of the arc guarantee minimum contact wear and long life. Furthermore, the vacuum prevents their oxidation and contamination.

EL type operating mechanism

The low speed of the contacts, together with the reduced run, and the mass contained, limit the energy required for the operation and therefore guarantee extremely limited wear of the system. This means the circuit breaker requires limited maintenance.

The Vmax circuit breakers use a mechanical operating mechanism, with stored energy and free release. These characteristics allow opening and closing operations independent of the operator. The mechanical operating mechanism is of simple concept and use and can be customized with a wide range of easily and rapidly installed accessories. This simplicity translates into greater reliability of the apparatus.

Structure

The operating mechanism, monobloc and interrupters are fixed to a metal frame which is also the support for the fixed version of the circuit breaker.

The compact structure ensures sturdiness and mechanical reliability.

Apart from the isolating contacts and the cord with plug for connection of the auxiliary circuits, the withdrawable version is completed with the truck for racking it into and out of the switchgear with the door closed.

Available versions

Vmax circuit-breakers are available in fixed and withdrawable versions with a front operating mechanism.

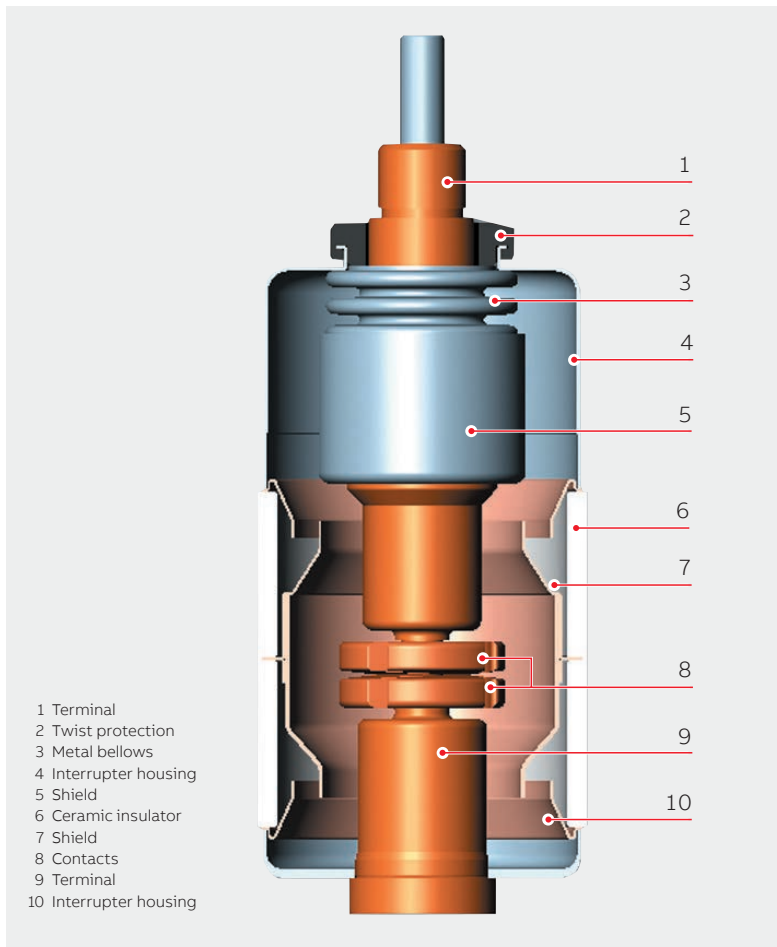
The withdrawable version is available for UniGear ZS1 switchgear with 550 mm width, for PowerCube modules with 600 mm width, and for UniSec WBC and WBS. A specific fixed version is available for UniGear 500R switchgear.

Note: all the above-mentioned switchgear only comply with IEC Standards.

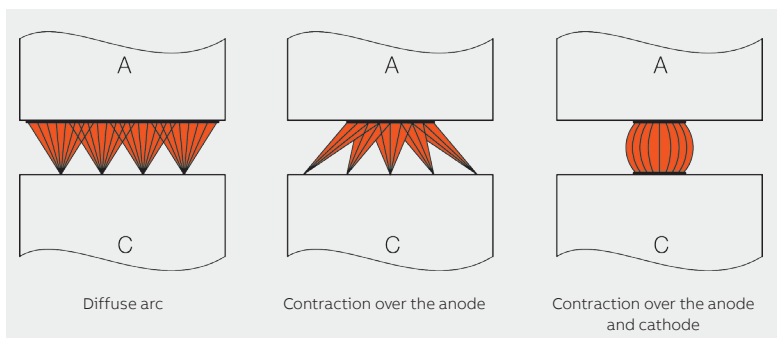
1. Description

Breaking principle of ABB interrupters

In a vacuum interrupter, the electric arc starts at the instant of separation of the contacts, is maintained until the next current through zero and can be influenced by the magnetic field.



Vacuum interrupter



Schematic diagram of the transition from a diffuse to a contracted arc in a vacuum interrupter.

Diffuse or contracted vacuum arcs

Following contact separation, single melting points form on the surface of the cathode, producing metal vapors which support the arc. The diffuse vacuum arc is characterized by expansion over the contact surface and by an even distribution of the thermal stress. At the rated current of the vacuum interrupter, the electric arc is always of the diffuse type. Contact erosion is very limited, and the number of interruptions very high.

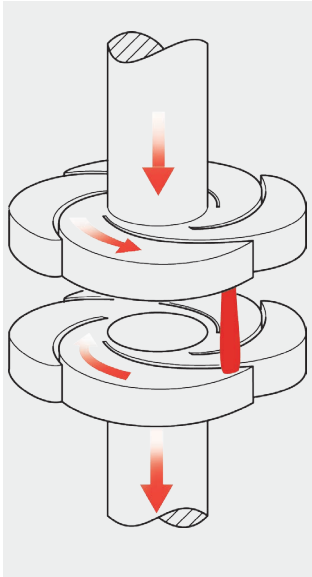
As the interrupted current value increases (above the rated value), the electric arc tends to be transformed from the diffuse into the contracted type, due to the Hall effect. Starting at the anode, the arc contracts and as the current rises further it tends to concentrate. In the area involved there is an increase in temperature with consequent thermal stress on the contact. To prevent overheating and erosion of the contacts, the arc is kept rotating. With arc rotation it becomes similar to a moving conductor which the current passes through.

Spiral geometry of ABB vacuum interrupter contacts

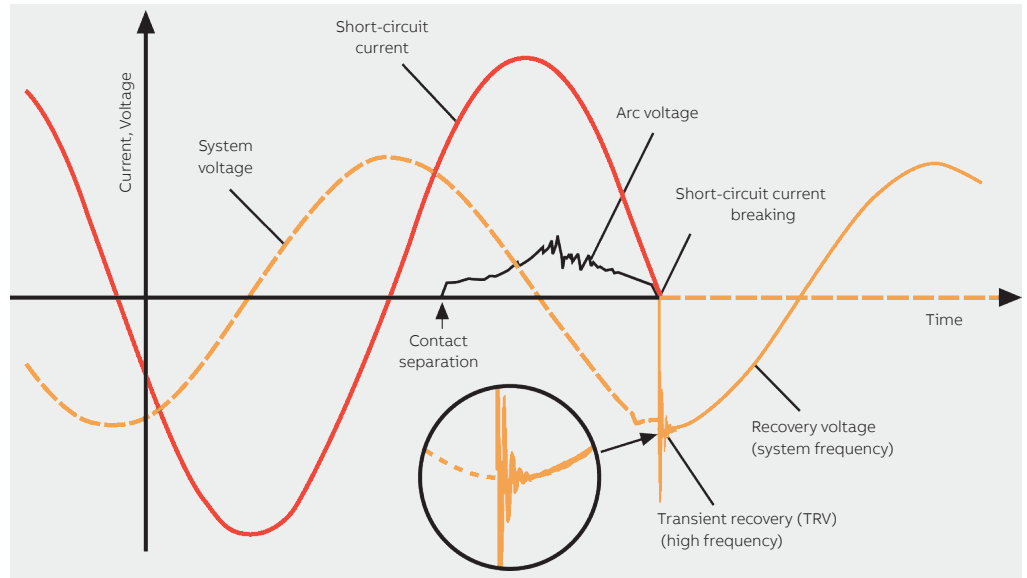
The special spiral geometry of the contacts generates a radial magnetic field in all areas of the arc column, concentrated over the circumferences of the contacts. An electromagnetic force is self-generated and acts tangentially, causing rapid arc rotation around the contact axis.

This means the arc is forced to rotate and to involve a wider surface than that of a fixed contracted arc. Apart from minimizing thermal stress on the contacts, all this makes contact erosion negligible and, above all, allows the breaking process to be controlled even with very high short-circuit currents.

ABB vacuum interrupters are zero-current interrupters and are free of any re-striking. Rapid reduction in the current charge and rapid condensation of the metal vapors simultaneously with the zero current, means maximum dielectric strength can be restored between the interrupter contacts within microseconds.



Radial magnetic field contact pattern with an arc rotating in a vacuum.



Development of current and voltage trends during a single-phase vacuum breaking process.

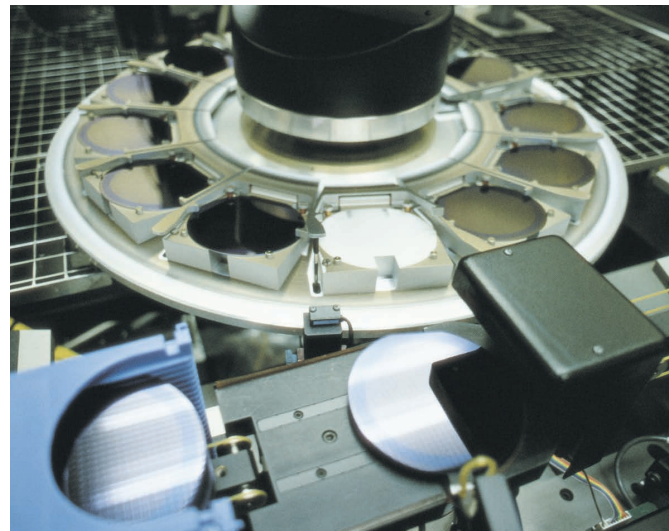
Fields of application

Vmax circuit breakers are used in electrical distribution to protect cables, distribution and transformer substations, motors, transformers, generators and capacitor banks.

Standards and approvals

Vmax circuit-breakers comply with the IEC 62271-100, ANSI/IEEE C37.54, C37.09, C37.04 and C37.55 standards and with those of major industrialized countries. Additionally, Vmax/L and Vmax/Sec are registered in the main naval registers and are therefore suitable for marine applications. The Vmax circuit breakers have undergone the tests indicated below and guarantee safety and reliability of apparatus in service in all installations.

- **Type tests:** heating, insulation withstand at power frequency, atmospheric impulse withstand insulation, short-time and peak withstand current, mechanical life, making capacity and breaking capacity.
- **Individual tests:** insulation of main circuits with voltage at power frequency, auxiliary and control circuit insulation, measurement of main circuit resistance, mechanical and electrical operation.



1. Description

Service safety

Thanks to the complete range of mechanical and electrical locks (available on request), safe distribution switchgear can be built with Vmax circuit breakers.

The locking devices have been studied to prevent incorrect operations and to carry out inspection of the installations, ensuring maximum operator safety. Key locks or padlock devices enable opening and closing operations and/or racking in and racking out.

The racking-out device with the door closed only allows the circuit breaker to be racked into or out of the switchgear with the door closed. Anti-racking-in locks prevent circuit breakers with different rated currents from being racked in, and the racking-in operation with the circuit breaker closed.

Accessories

The Vmax circuit breakers have a complete range of accessories to satisfy all installation requirements.

The operating mechanism has a standardized range of accessories and spare parts which are easy to identify and order. The accessories are installed conveniently from the front of the circuit breaker. Electrical connection is carried out with plug-socket connectors.

Use, maintenance and service of the apparatus are simple and require limited use of resources.



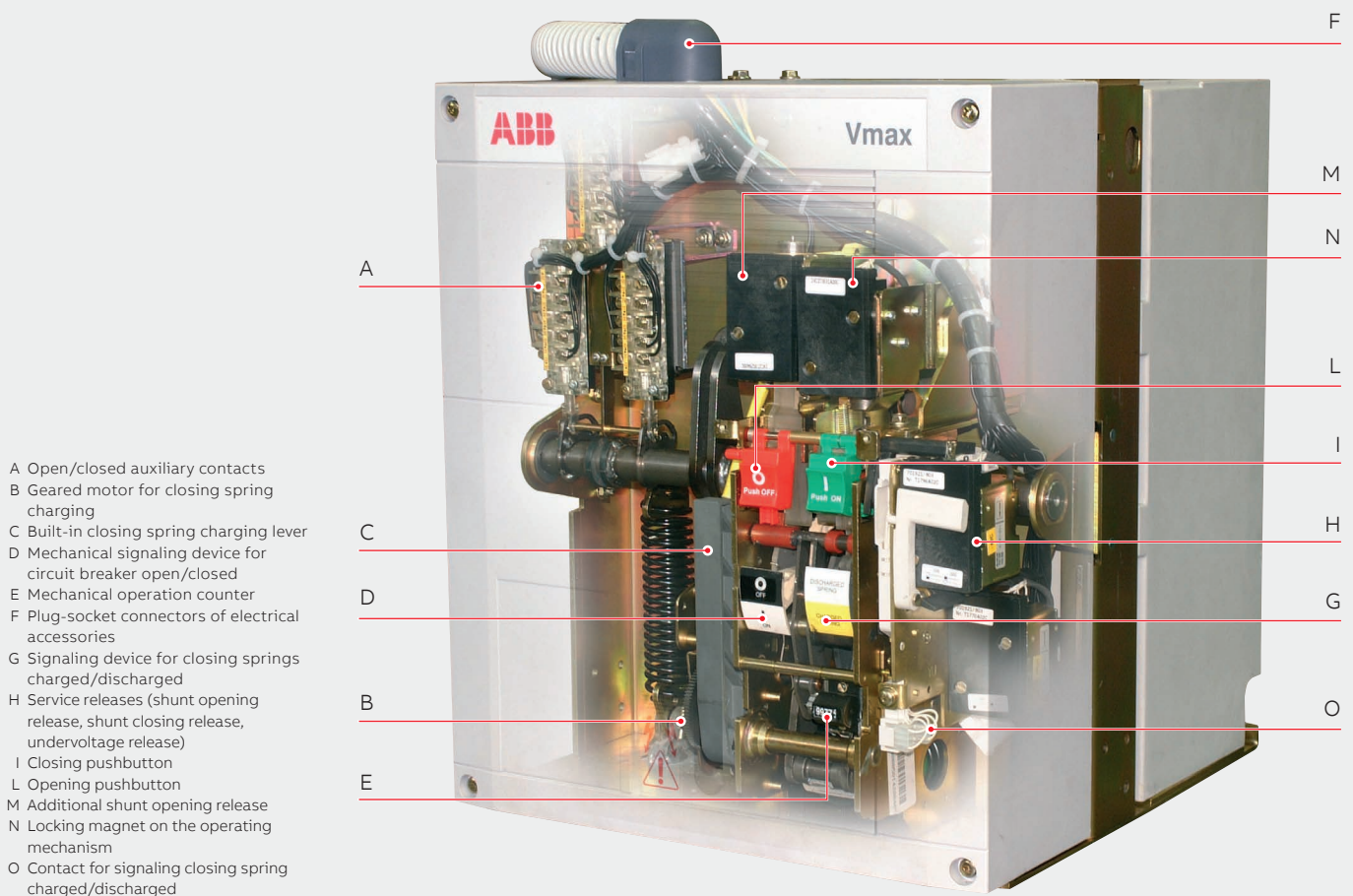
Operating mechanism

The operating mechanism of Vmax circuit breakers is of simple concept and use and can be customized with a wide range of easily and rapidly installed accessories. This simplicity translates into greater reliability of the apparatus. The operating mechanism is of the stored energy type with the anti-pumping device mounted as standard and it is fitted with suitable locks to prevent incorrect operations. Each operation sequence is only enabled if all the conditions ensuring it will be carried out correctly are respected.

The accessories are the same for all the types of Vmax circuit breakers. To facilitate assembly and replacement of accessories, assembly seats with special fixed references are provided.

- Highly reliable operating mechanisms thanks to a low number of components
- Extremely limited and simple maintenance
- The accessories are common to the whole range
- The electrical accessories can be easily and rapidly installed or replaced thanks to the wiring already prepared with its own plug-socket connectors
- Mechanical anti-pumping device is standard
- Built-in closing spring charging lever
- Key lock with circuit breaker open
- Protective cover over the opening and closing pushbuttons for operation using a special tool
- Padlock on the operating pushbuttons

Circuit breaker operating mechanism (pushbutton and mechanical indicators according to IEC STDs)



2. Additional Services

ABB Power Care

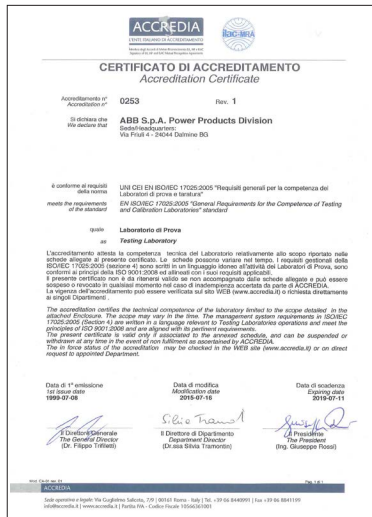
ABB Power Care allows you to better manage the electrification system, ensuring operational continuity and optimizing the financial resources available. Depending on the profile of each company, ABB can offer a wide range of assistance services, allowing customers to

choose those best suited to the needs of the installation. The ABB Power Care platform is based on an array of services that customers can select, according to their needs, when the service contract is activated. The services offered range from the possibility of dedicated access to a full range of support services for each type of equipment. All services are provided by qualified and certified ABB personnel.

The array of ABB Power Care packages consists of five areas and four levels of service, in which each area is geared to different customer needs and the degree of support offered by ABB increases in step with the levels.

ABB Power Care	Base level	Level 1	Level 2	Level 3		
Includes training and retraining of personnel. The purpose of the courses on products and applications is to provide all participants with the necessary knowledge and skills for ABB equipment, while the ongoing training services help maintenance managers to develop a strategy for the ongoing training of staff, tailored to their duties.	Services for skills development	List of training courses for products	Training courses for products	Training courses for applications	Ongoing training	
Provides rapid assistance in emergency situations. Dedicated access provides a direct line in the case of request for "call based" service, while technical support and emergency services ensure that the customer receives adequate support within defined times. The contract may also include the management of strategic spare parts in the installation.	Emergency maintenance services	Dedicated access	Technical support within defined times	Emergency response within defined times	Assessment and management of spare parts	
Allows the condition of the equipment to be ascertained and safety aspects to be monitored, as well as the definition of the measures necessary to contain risks. In this area, the ABB package includes periodic inspections or the installation of a monitoring system for the evaluation of the conditions of the equipment.	Services for diagnosis and assessment of conditions	Initial evaluation and documentation of the installed base	Assessment of the conditions and risk probability of the equipment (*)	Equipment monitoring	Remote monitoring of equipment	
Includes support services for the personnel of the installation so that they are able to carry out extraordinary operations without any problems by being able to browse the online product documentation, chat with ABB experts, or get dedicated online access to the ABB platform that hosts the files/documentation for the equipment of the installation.	Support for personnel of the installation	Report on the state of the life cycle of the installed base	Online manuals and instructions	Online support for personnel of the installation	File storage	
ABB offers technical advice and preventive maintenance operations to keep the equipment in good condition, while minimizing the risk of outage and serious failures of the electrical equipment.	Maintenance services in the installation	MV	Annual measurement of partial discharges	Maintenance of protection and control units	Maintenance of circuit breakers	Maintenance of switchgear
		LV	Periodic technical evaluation	Services for products	Advanced services for products	Advanced services for switchgear (*)

(*) These services are available for the installation/switchgear system.



Technical documentation

To go into technical and application aspects of Vmax circuit-breakers in depth, please ask for the following publications:

- UniGear ZS1 type switchgear code 1VCP000138
- REF542plus unit code 1VTA100001
- PowerCube code 1VCP000091
- UniSec code 1VFM200003
- PowerCare Service code 1VCP000486-1410

Quality Assurance System

This complies with the ISO 9001 Standards, certified by an independent external organization.

Test laboratory

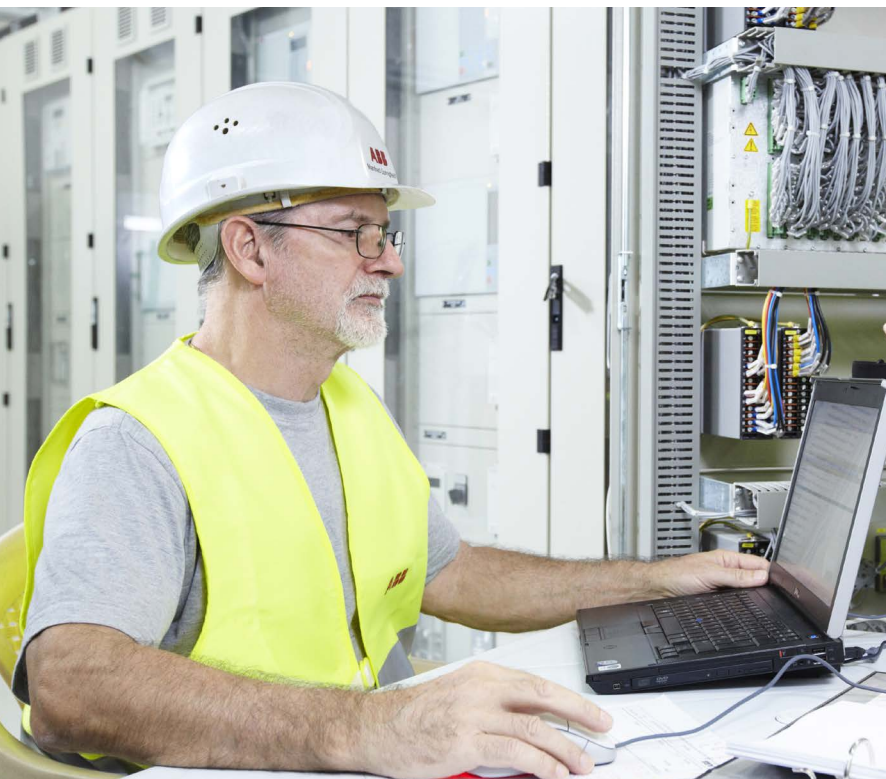
This complies with the UNI CEI EN ISO/IEC 17025 Standards, accredited by an independent external organization.

Environmental Management System

This complies with the ISO 14001 Standards, certified by an independent external organization.

Health and Safety Management System

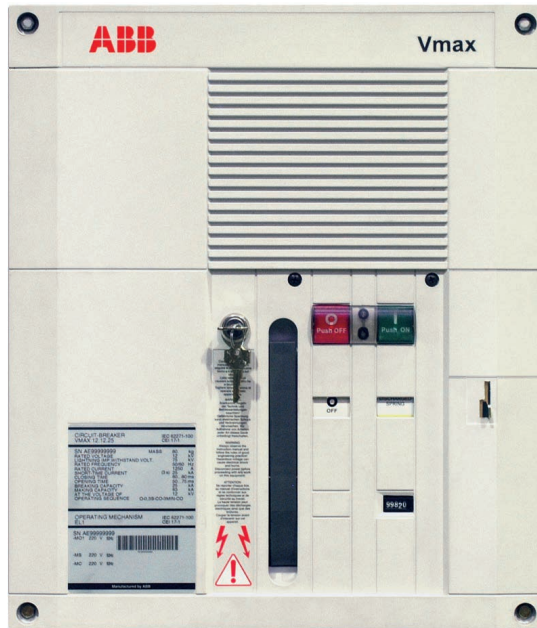
This complies with the OHSAS 18001 Standards, certified by an independent external organization.



3. Selection and ordering

General characteristics of fixed circuit breakers for:

- free-standing installation
- ABB UniGear 500R switchgear



Standard fittings for fixed circuit breaker series (1)

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

- EL type manual operating mechanism
- mechanical signaling device for closing springs charged/discharged
- mechanical signaling device for circuit breaker open/closed
- closing pushbutton
- opening pushbutton
- operation counter
- set of ten circuit breaker open/closed auxiliary contacts (2)
- lever for manually charging the closing springs
- auxiliary circuit support terminal board.

(1) Refer to the UniGear 500R catalogue for the standard equipment of the Vmax/F circuit breaker.

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

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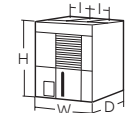
Operation sequence	[O – 0.3 s – CO – 15 s – CO]
	[O – 0.3 s – CO – 3 min – CO]

Opening time	[ms]
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Arc duration	[ms]
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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.

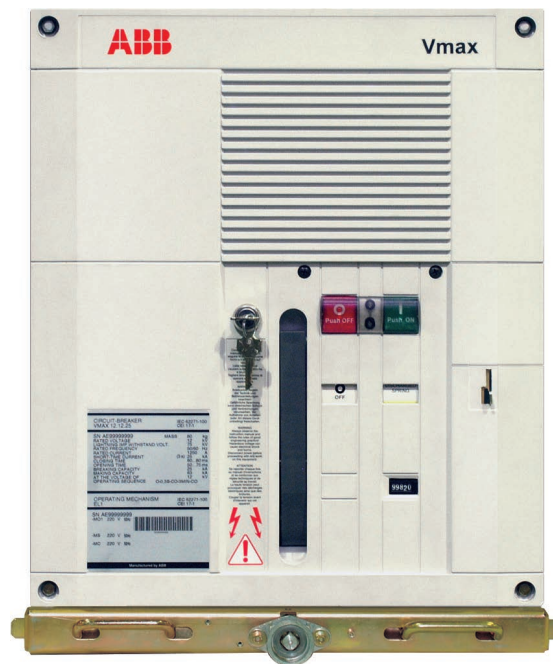
(**) Up to 15 kV

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
•		•		•			•			-
•		•		•			•			-

3. Selection and ordering

General characteristics of withdrawable circuit breakers for:

- UniGear switchgear (550 mm width)
- PowerCube PB1 modules (600 mm width)
- UniSec WBC and WBS



Standard fittings for withdrawable circuit breaker series

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

- EL type manual operating mechanism
- mechanical signaling device for closing springs charged/discharged
- mechanical signaling device for circuit breaker open/closed
- closing pushbutton
- opening pushbutton
- operation counter
- set of ten circuit breaker open/closed auxiliary contacts ⁽¹⁾
- lever for manually charging the closing springs
- isolating contacts
- cord with connector (plug only) for auxiliary circuits, with striker pin which does not allow the plug to be inserted into the socket if the rated current of the circuit breaker is different from the rated current of the panel

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

- racking-in/out lever (the quantity must be defined according to the number of pieces of apparatus ordered)
- locking electromagnet in the truck (-RLE2). This prevents the circuit breaker being racked into the panel with the auxiliary circuits disconnected (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) I_{sc} [kA]

Rated short-time
withstand current (3s) I_k [kA]

Making capacity I_p [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 I [mm/in]

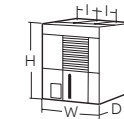
Weight [kg/lb]

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	
•		•		•		•		-	•		•	
•		•		•		•		-	•		•	

3. Selection and ordering

Optional accessories

The accessories identified with the same number are alternative to each other.

1 Shunt opening release (-MBO1)

Allows opening command of apparatus to be enabled by remote control.

This release is suitable for both instantaneous and permanent duty. However, an auxiliary contact -BGB1 de-energizes it after circuit breaker has opened. In the case of instantaneous service, the current impulse must last at least 100 ms.

This release can be controlled by the following devices: coil continuity control (CCC), opening circuit supervision (TCS)(*) or the ABB STU functionality control device (supplied on request).

Characteristics	
Un	24-30-48-60-110...132-220...250 V DC
Un	48-60-110...127-220...250 V AC 50-60 Hz
Operating limits	65 ... 120% Un
Inrush power (Ps)	60...100 W / VA
Continuous power consumption (Pc)	1.5 W
Electronics self-consumption (no coil supplied); value independent of voltage applied	1.5 mA
Opening time	33...60 ms
Insulation voltage	2000 V 50 Hz (for 1 min)

(*) The minimum current that the relay with TCS function (used for monitoring coil continuity) detects as a condition denoting that the trip circuit is operating correctly (specified for each relay in the relative manual), must be sensibly higher than the current consumption of the actual coil (~1.5 mA).

If this fails to occur, always add, in parallel to the TCS, a circuit able to absorb sufficient current to compensate the gap while preventing the total current in the TCS circuit from rising above the maximum threshold (Itcs < 10 mA for High Voltage coils - from 110V to 250V, and Itcs < 50 mA for Low Voltage coils from 24 V to 60 V).

A simple resistor can be sized for the purpose, depending on the parameters of the TCS and the auxiliary voltage range used. For further information, refer to the Guide for Smart Coil 1VCD601416.



2 Additional shunt opening release (-MBO2)

Similarly to shunt opening release -MBO1, this allows the opening command of the apparatus to be transmitted by remote control. It can be powered by the same circuit as main shunt opening release -MBO1 or by a circuit that is completely separate from release -MBO1.

This release is suitable for both instantaneous and permanent duty. However, an auxiliary contact -BGB1 de-energizes it after the circuit breaker has opened.

To guarantee the release action, the current impulse must last at least 100 ms.

Continuity functionality can be checked with a continuity control device (CCC), opening circuit supervision (TCS)(*) or the STU functionality control device (supplied on request).

-MBO2 has the same electrical and operating characteristics as release -MBO1.

3 Opening solenoid (-MO3)

The opening solenoid (-MO3) is a special release with demagnetisation to be combined with an overcurrent protection relay of the self-supplied type.

It is located in the operating mechanism (in the left side piece) and is not alternative to the additional shunt opening release (-MBO2).

It is not available for 40 and 50 kA circuit breakers.

Should the application of this accessory be required, specify the request at the time of order since subsequent application by the customer is not possible.

Note: for combination with the protection relays, please ask for the document: Data sheet 1VCD600854.

The opening solenoid (-MBO3) is available in two versions:

- For DC (release by discharging energy stored in protection relay against overcurrent of the self-supplied type)
- For AC (release by means of the energy supplied by an adder transformer on the secondaries of the protection current transformers) (the TA is at customer's charge)

(*) The minimum current that the relay with TCS function (used for monitoring coil continuity) detects as a condition denoting that the trip circuit is operating correctly (specified for each relay in the relative manual), must be sensibly higher than the current consumption of the actual coil (~1.5 mA).

If this fails to occur, always add, in parallel to the TCS, a circuit able to absorb sufficient current to compensate the gap while preventing the total current in the TCS circuit from rising above the maximum threshold (Itcs < 10 mA for high-voltage coils (from 110 V to 250 V), and Itcs < 50 mA for low-voltage coils (from 24 V to 60 V).

A simple resistor can be sized for the purpose, depending on the parameters of the TCS and the auxiliary voltage range used.

For further information, refer to the Guide for Smart Coil 1VCD601416.



3. Selection and ordering

4 Shunt closing release (-MC)

Allows closing command of apparatus to be transmitted by remote control.

This release is suitable for both instantaneous and permanent duty. An auxiliary contact that de-energizes it after the circuit breaker has closed is not envisaged.

The permanently supplied release provides the electrical anti-pumping function with both electrical opening and re-closing commands maintained. To guarantee the closing action, the current impulse must last at least 100 ms.

If there is the same supply voltage for shunt closing release -MBC and under-voltage release -MBU and the circuit breaker must close automatically when auxiliary voltage returns, there must be a delay of at least 50 ms between under-voltage release energizing and energizing of the shunt closing release to allow the closing operation to take place. Continuity functionality can be checked with a continuity control device (CCC), opening circuit supervision (TCS) or the STU functionality control device (supplied on request).

Characteristics	
Un	24-30-48-60-110...132-220...250 V DC
Un	48-60-110...127-220...250 V AC 50-60 Hz
Operating limits	65 ... 120% Un
Inrush power (Ps)	60...100 W / VA
Continuous power consumption (Pc)	1.5 W
Electronics self-consumption (no coil supplied; value independent of voltage applied)	1.5 mA
Opening time	33...60 ms
Insulation voltage	2000 V 50 Hz (for 1 min)



5 Electronic time-delay device (-KFT)

The electronic time delay device must be mounted externally to the circuit breaker. It allows release trip with established and adjustable times.

The use of the delayed undervoltage release is recommended in order to prevent trips when the power supply network of the release may be subject to cuts or voltage drops of short duration.

If it is not energized, circuit breaker closing is prevented.

The time-delay device must be combined with an undervoltage release with the same voltage as the delay device.

Characteristics of the time-delay device

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



3. Selection and ordering

6 Undervoltage release (-MBU)

The undervoltage release opens the circuit-breaker when there is a sensible reduction or lack of the voltage that powers it. The circuit-breaker can only close when the release is energized (the closing lock is obtained mechanically).

It can be used for remote release (by means of a pushbutton of the normally closed type), for locking on automatic closing/opening in the absence of voltage in the auxiliary circuits. Supplied by means of the secondary output of a voltage transformer, it provides locking upon automatic closing/opening in the absence of voltage in the Medium Voltage main circuit. If there is the same supply voltage for shunt closing release -MBC and under-voltage release -MBU and the circuit-breaker must close automatically when auxiliary voltage returns, there must be a delay of at least 50 ms between under-voltage release energizing and energizing of the shunt closing release to allow the closing operation to take place.

The undervoltage release is available in the following versions:

- A Undervoltage release (with supply shunted from a transformer on the supply side of the circuit-breaker or from an auxiliary power supply, regardless of the state in which the circuit-breaker is to be found).
- B Undervoltage release with -KFT electronic time-lag device (0.5 - 1 - 1.5 - 2 - 3 s) (with power supply as indicated for 5A); this device is supplied with a 0.5 s setting (the adjustments are described in the Circuit diagrams chapter)

Characteristics

Un	24-30-48-60-110...132-220...250 V DC
Un	48-60-110...127-220...250 V AC 50-60 Hz
Operating limits	- circuit-breaker opening: 35-70% Un
	- circuit-breaker closing: 85-110% Un
Inrush power (Ps)	150 W / VA
Continuous power consumption (Pc)	1.55 W
Electronics self-consumption (no coil supplied); value independent of voltage applied	1.5 mA
Insulation voltage	2000 V 50 Hz (for 1 min)



6a Undervoltage release mechanical override

The mechanical override of the undervoltage release is a mechanical device allowing deactivation of the undervoltage release functionality.

Should this accessory be required, specify the request at the time of ordering because subsequent application by the customer is not possible.

Deactivation of the undervoltage release takes place by means of a special two-position selector located on the front of the circuit breaker operating mechanism. The override remains in the selected position until the selector is moved manually from “undervoltage deactivated” to “undervoltage activated” (and vice versa). With the override set to “undervoltage deactivated” the circuit breaker behaves as if it were without the undervoltage release. This means it is possible to close the circuit breaker even without power supply to the release.

With the circuit breaker closed, if you move the selector to the “undervoltage activated” position, the following occurs:

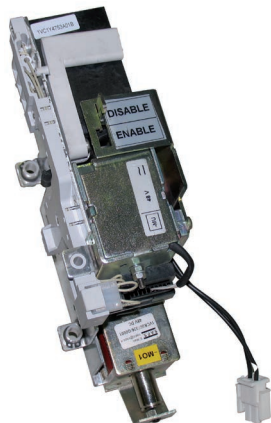
- the circuit breaker remains in the closed state if the undervoltage release is energized (supplied)
- the circuit breaker opens immediately if the undervoltage release is de-energized (not supplied).

The undervoltage circuit breaker override is particularly required when:

- the circuit breaker controls/protects a MV/LV transformer and the undervoltage release receives the power supply from the LV side and therefore only with the circuit breaker closed (without the undervoltage override it would never be possible to close the circuit breaker and therefore to supply the undervoltage release)
- should it be desired to carry out manual opening and closing operations of a circuit breaker fitted with undervoltage, in the withdrawn position and/or with auxiliary circuits not supplied.

The undervoltage mechanical override with manual resetting is always fitted with an auxiliary contact for electrical signaling of undervoltage release deactivated (-BB6).

Note: the mechanical override with manual resetting cannot be supplied on the Italian market for the delivery point of power to the user connected in medium voltage. The CEI 0-16 Standard does, in fact, prohibit permanent deactivation of the undervoltage release when it is used by the “General Protection” to control opening of the “General Device”.



3. Selection and ordering

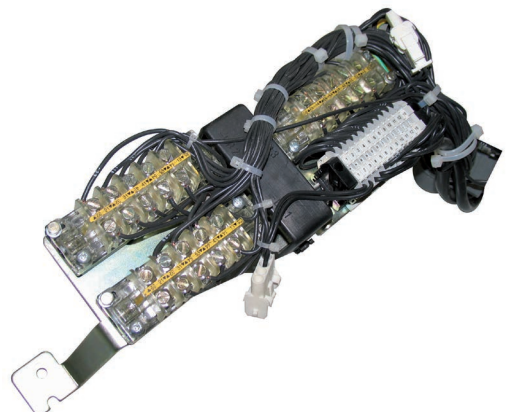
7 Circuit breaker auxiliary contacts (-BGB1; -BGB2; -BGB3)

It is possible to have electrical signaling of circuit breaker open/closed with a group of 15 auxiliary contacts as an alternative to the 10 provided as standard.

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

General characteristics	
Insulation voltage according to VDE 0110 standard. Group C	660 V AC 800 V DC
Rated voltage	24 V ... 660 V
Test voltage	2.2 kV
Rated overcurrent	10 A
Number of contacts	5
Contact run	6 mm ... 7 mm
Activation force	26 N
Resistance	3 mΩ
Storage temperature	-20 °C ... +120 °C
Operating temperature	-20 °C ... +70 °C
Contact overtemperature	20 K
Number of cycles	30,000
Unlimited breaking capacity if used with 10 A fuse in series	

Electrical characteristics			
Un		Rated current	Breaking capacity
220 V AC	Cosφ = 0.7	2.5 A	25 A
380 V AC	Cosφ = 0.7	1.5 A	15 A
500 V AC	Cosφ = 0.7	1.5 A	15 A
660 V AC	Cosφ = 0.7	1.2 A	12 A
Time constant			
24 V DC	1 ms	10 A	12 A
	15 ms	10 A	12 A
	50 ms	8 A	10 A
	200 ms	6 A	7.7 A
60 V DC	1 ms	8 A	10 A
	15 ms	6 A	8 A
	50 ms	5 A	6 A
	200 ms	4 A	5.4 A
110 V DC	1 ms	6 A	8 A
	15 ms	4 A	5 A
	50 ms	2 A	4.6 A
	200 ms	1 A	2.2 A
220 V DC	1 ms	1.5 A	2 A
	15 ms	1 A	1.4 A
	50 ms	0.75 A	1.2 A
	200 ms	0.5 A	1 A



8 Transient contact (-BGB4)

This contact closes momentarily (duration > 30 ms) on circuit breaker opening controlled remotely with a shunt opening release. The indication is not provided when opening is manual and local. In fact, a contact (-BGB11) is activated by the manual pushbutton and cuts off the transient contact closure (-BGB4). The transient contact is activated directly from the main operating shaft when the indication is provided only on actual opening of the main circuit breaker contacts.

9 Transmitted contacts in the truck (-BGT1; -BGT2)

Transmitted contacts of the withdrawable circuit breaker (installed in the circuit breaker truck). These contacts are either in addition or as an alternative to the position contacts (for signaling circuit breaker racked out) located in the unit. They also carry out the function of the position contact (-BGT3).



10 Position contact (-BGT3)

This is used, together with the locking magnet of the operating mechanism (-RLE1) to prevent remote closing during racking into the cubicle. It is supplied for Vmax/W and Vmax/L withdrawable circuit breakers. It is not supplied when the transmitted contacts in the truck are required (-BGT1; -BGT2).



3. Selection and ordering

11 Motor operator (-MAS)

This carries out automatic charging of the circuit breaker operating mechanism closing spring. After circuit breaker closing, the geared motor immediately recharges the closing springs. In the case of a power cut or during maintenance work, the closing spring can be charged manually in any case (by means of the special crank handle incorporated in the operating mechanism).

Characteristics		
Un	24...30 - 48...60 - 110...130 - 220...250 V-	
Un	100...130 - 220...250 V~ 50/60 Hz	
Operating limits	85 ... 110% Un	
Power on inrush (Ps)	≤ 40 kA	50 kA
	DC = 600 W; AC = 600 VA	DC = 900 W; AC = 900 VA
Rated power (Pn)	DC = 200 W; AC = 200 VA	DC = 350 W; AC = 350 VA
	Charging time	0,2 s
Charging time	6-7 s	6-7 s
Insulating voltage	2000 V 50 Hz (for 1 min)	2000 V 50 Hz (for 1 min)

12 Contact for signaling closing spring charged/discharged (-BGS2)

This consists of a microswitch which allows remote signaling of the state of the circuit breaker operating mechanism closing spring.

The contact is available in the following versions:

- contact open: signaling spring charged
- contact closed: signaling spring discharged.



Protections and locks

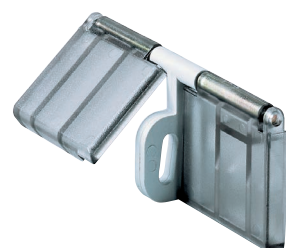
Various mechanical and electromechanical locking and protection devices are available.

13 Opening and closing pushbutton protection

The protection allows the opening and closing pushbuttons to be operated using a special tool only.

14 Opening and closing pushbutton padlock

The device allows the opening and closing pushbuttons to be locked using a maximum of three padlocks (not supplied): \varnothing 4 mm.



3. Selection and ordering

15 Key lock in open position

The lock is activated by a special circular lock. Different keys (for a single circuit breaker) are available, or the same keys (for several circuit breakers).

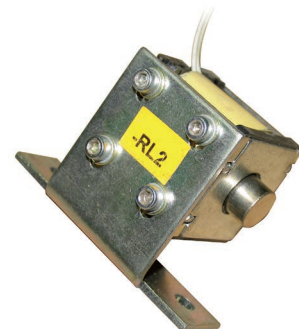
16 Locking magnet on the truck (-RLE2)

Accessory for the withdrawable version to prevent circuit breaker racking into the switchgear with the auxiliary circuit plug disconnected.

The plug makes the anti racking-in lock for different rated current (by means of special pins). This accessory is compulsory for Vmax/L in UniGear 550 switchgear and is optional for Vmax/W in the PowerCube enclosure.

Characteristics

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
Power on inrush (Ps):	DC 250 W; AC = 250 VA
Continuous power (Pc):	DC = 5 W; AC = 5 VA
Inrush duration:	150 ms



17 Locking magnet on the operating mechanism (-RLE1)

This allows activation of the operating mechanism when the lock is energized only.

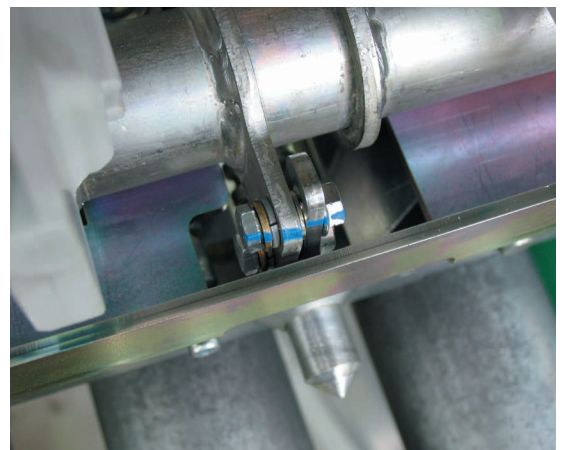
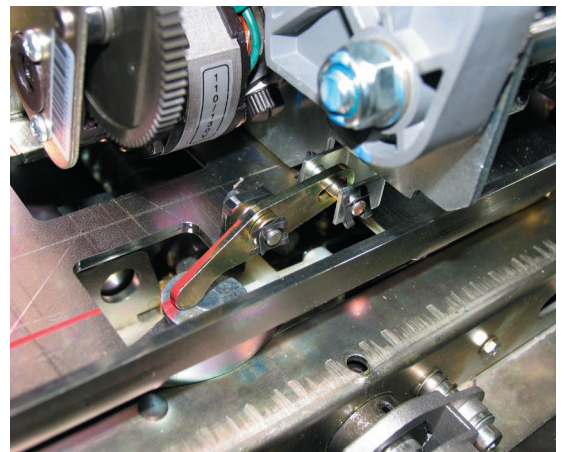
**18 Mechanical racking-in/racking-out interlock**

This device allows the racking-in and racking-out lock to be made for circuit breakers which have been converted into the withdrawable version using a fixed circuit breaker.

The lock consists of two devices which carry out the following functions respectively:

- lock on circuit breaker closing during racking in and racking out (installed in the front part of the circuit breaker)
- lock on racking in and racking out with the circuit breaker (installed in the rear part of the circuit breaker).

Compulsory device for Vmax/W and Vmax/L circuit breakers.



4. Specific product characteristics



Resistance to vibrations

The Vmax circuit breakers are unaffected by mechanically generated vibrations. Please contact us for the versions approved by the shipping registers.

Tropicalization

The Vmax circuit breakers are manufactured in compliance with the strictest regulations for use in hot-humid-saline climates.

All the most important metal components are treated against corrosive factors according to EN12500 Standards environmental class C and to ANSI/IEEE C37.20.2.

Galvanization is carried out in accordance with UNI ISO 2081 Standards, classification code Fe/ Zn 12, with a thickness of 12×10^{-6} m, protected by a conversion layer mainly consisting of chromates in compliance with the UNI ISO 4520 Standards. These construction characteristics mean that all the Vmax series of apparatus and their accessories comply to IEC/TS 62271-304 Standards environmental class 2.





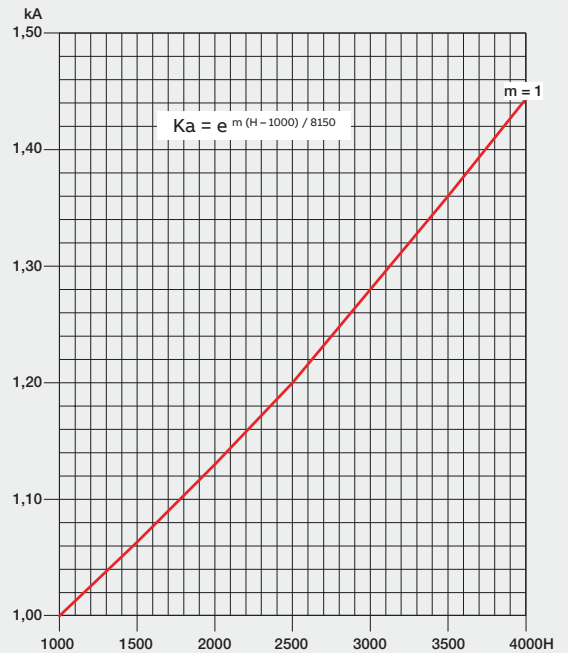
Altitude

The insulating property of air decreases as the altitude increases, therefore this phenomenon must be taken into account for external insulation of the apparatus (the internal insulation of the interrupters does not undergo any variations as it is guaranteed by the vacuum).

The phenomenon must always be taken into account during the design stage of the insulating components of apparatus to be installed over 1000 m / 3300 ft above sea level.

In this case an ACF (Altitude Correction Factor) must be considered, which can be taken from the graph following, built up on the basis of the indications in the IEC 62271-1 Standards or by Table 8 of ANSI/IEEE C37.20.2 1999. The following example is a clear interpretation of the indications given above according IEC Standards.

Graph for determining the Ka correction factor according to IEC 62271-1 standards.



Example

- Installation altitude: 2000 m
- Rated service voltage of 12 kV
- Industrial frequency withstand voltage: 28 kV rms
- Impulse withstand voltage: 75 kVp
- Ka factor, which can be taken from the graph = 1.13.

Considering the above parameters, the apparatus must withstand (on test at zero altitude, i.e. at sea level):

- power frequency withstand voltage: $28 \times 1.13 = 31.6$ kVrms
- impulse withstand voltage: $75 \times 1.13 = 84.7$ kVp.

From the above, it can be deduced that for installations at an altitude of 2000 m above sea level, with 12 kV service voltage, the apparatus must be provided with 17.5 kV rated voltage, characterized by insulation levels at industrial frequency of 38 kVrms with 95 kVp impulse withstand voltage.

H = altitude in meters;

m = value referred to power frequency and to the lightning impulse withstand and between phase voltages.

4. Specific product characteristics

Anti-pumping device

The EL operating mechanism of Vmax circuit breakers (in all versions) is fitted with a mechanical anti-pumping device which prevents re-closing due to either electrical or mechanical commands.

Should both the closing command and any one of the opening commands (local or remote) be active at the same time, there would be a continuous succession of opening and closing operations.

The anti-pumping device avoids this situation, ensuring that each closing operation is only followed by a single opening operation and that there is no closing operation after this.

To obtain a further closing operation, the closing command must be released and then re-launched. Furthermore, the anti-pumping device only allows circuit breaker closure if the following conditions are present at the same time:

- operating mechanism springs fully charged
- opening pushbutton and/or opening release (-MBO1/-MBO2) not enabled
- circuit breaker open.

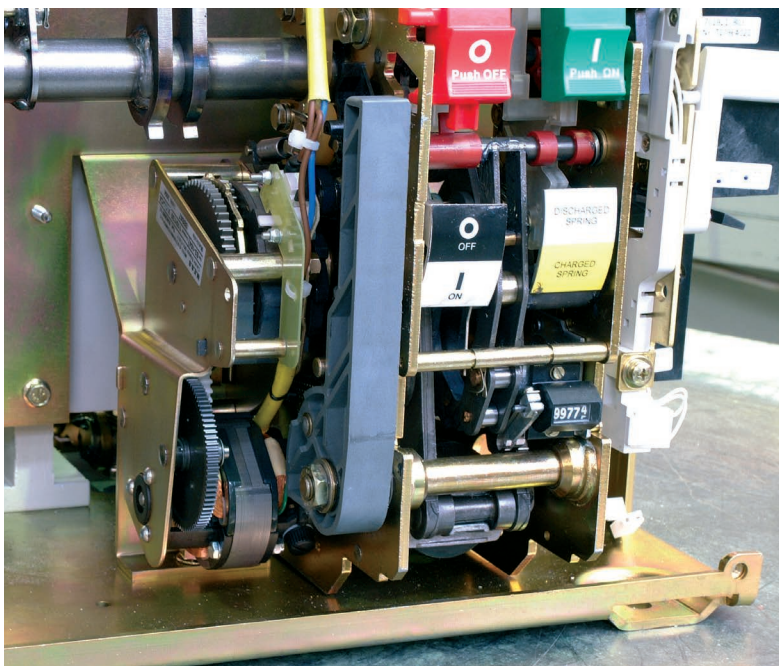
Environmental protection program

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.

Assessment of the environmental impact of the life cycle of the product, obtained by minimizing energy consumption and overall raw materials of the product, became a concrete matter during the design stage by means of targeted selection of the materials, processes and packing.

This is to allow maximum recycling at the end of the useful life cycle of the apparatus.



Spare parts ^(*)

- Shunt opening release
- Supplementary shunt opening release
- Undervoltage release
- Time delay device for undervoltage release
- Undervoltage release override
- Shunt closing release
- Spring charging geared motor with electrical signaling of springs charged
- Contact signaling closing springs charged/discharged
- Circuit breaker auxiliary contacts
- Locking electromagnet on the operating mechanism
- Position contact of the withdrawable truck
- Contacts signaling connected/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 isolating contacts

(*) Replacement with spare parts as well as maintenance operations must be carried-out by ABB personnel or by skilled and specially trained personnel with in-depth knowledge of the apparatus.

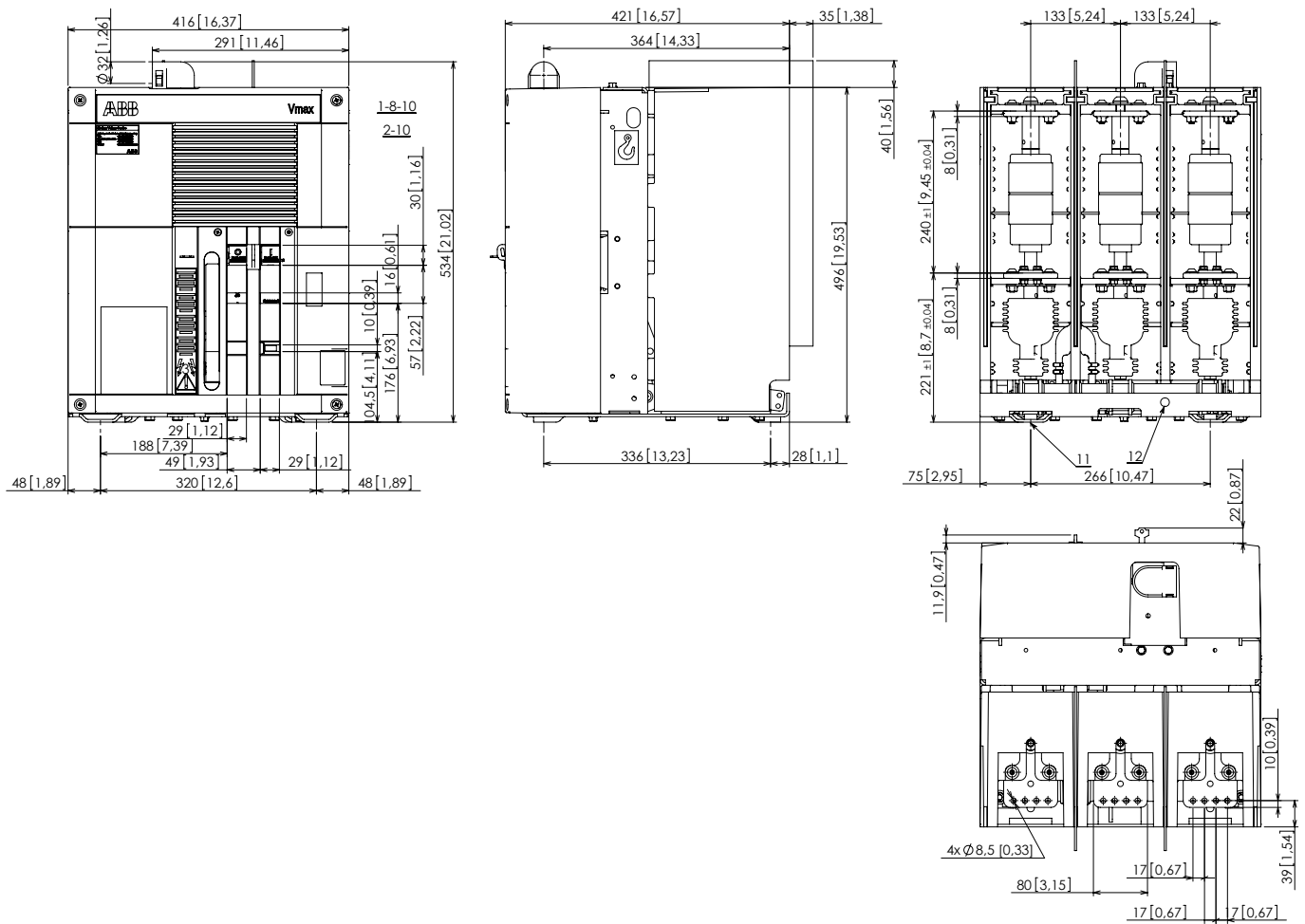
Ordering

For availability and to order spare parts, please contact our Service department, specifying the circuit breaker serial number.

5. Overall dimensions

Vmax - Fixed circuit breaker
 IEC: 12...17.5 kV - 630...1250 A - 16...31.5 kA
 ANSI: 15 kV - 1200 A - 25...31.5 kA

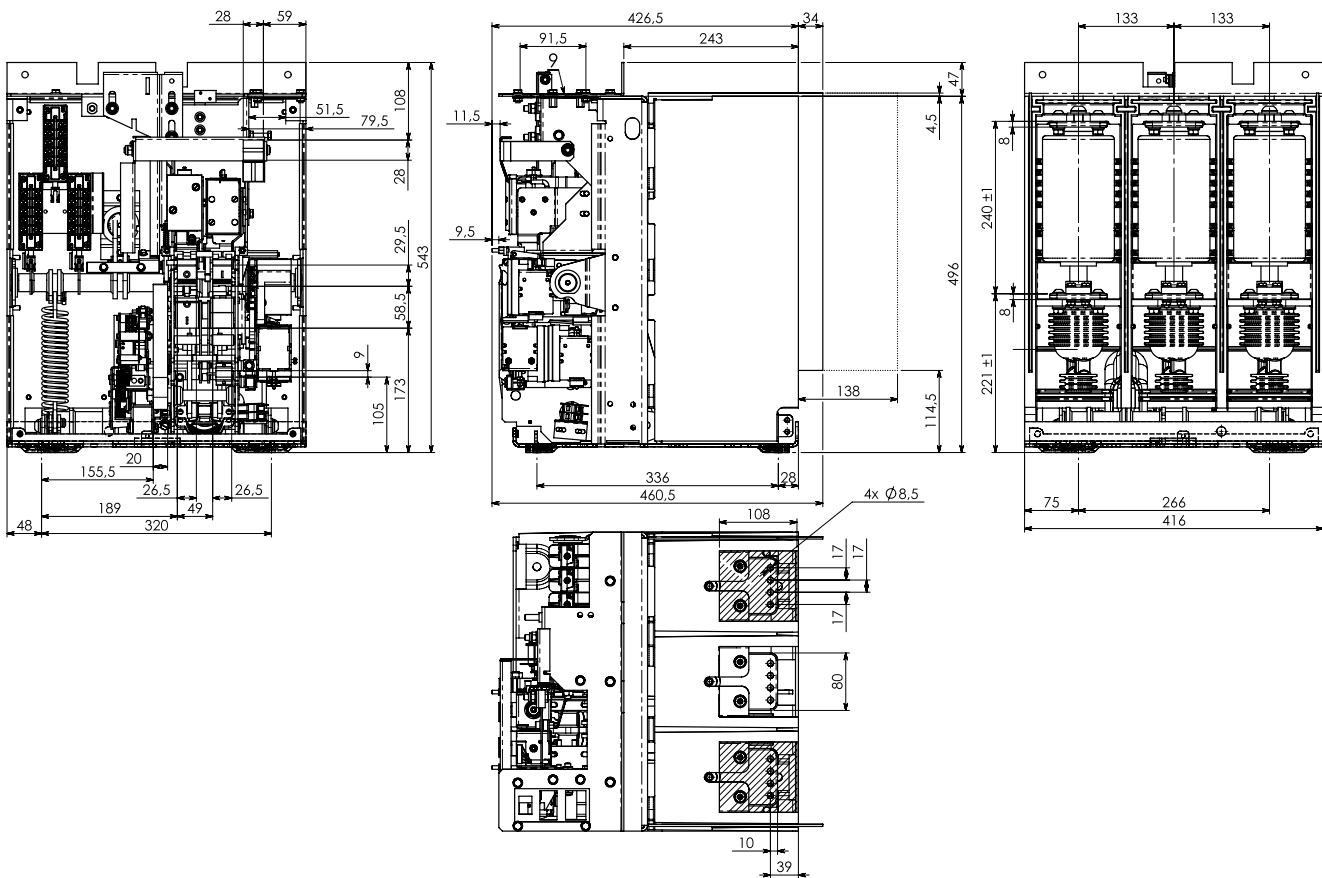
1VCD003279_V3198



Dimensions are in "mm" and in "inches".

Vmax/F - Fixed circuit breakers for UniGear 500R
IEC: 12...17.5 kV - 630 A - 25...31.5 kA

1VCD003516_E0771

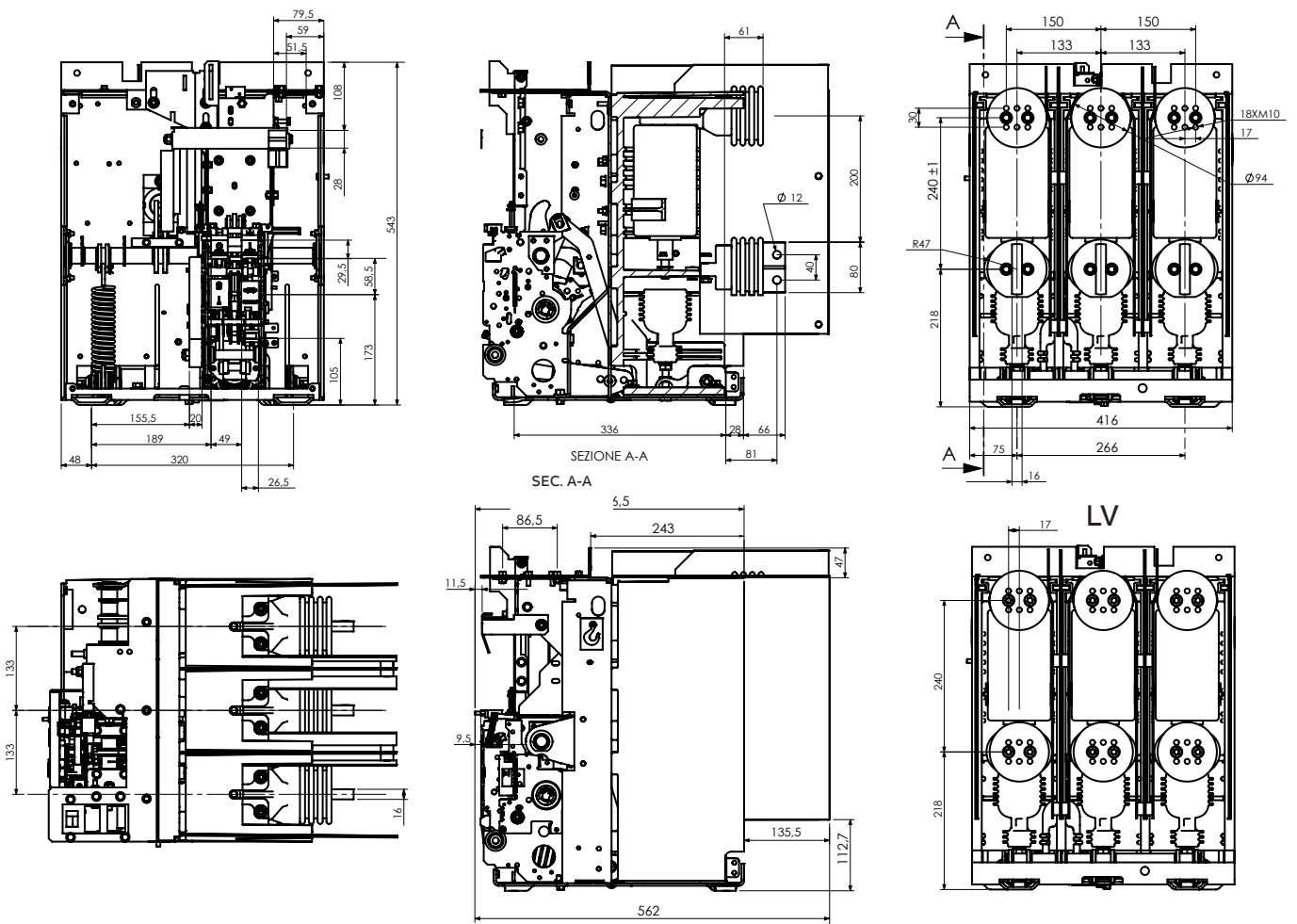


Dimensions are in "mm".

5. Overall dimensions

Vmax/FH - Fixed circuit breakers for UniGear 500R
 IEC: 12...15 kV - 2000 A - 25...31.5 kA

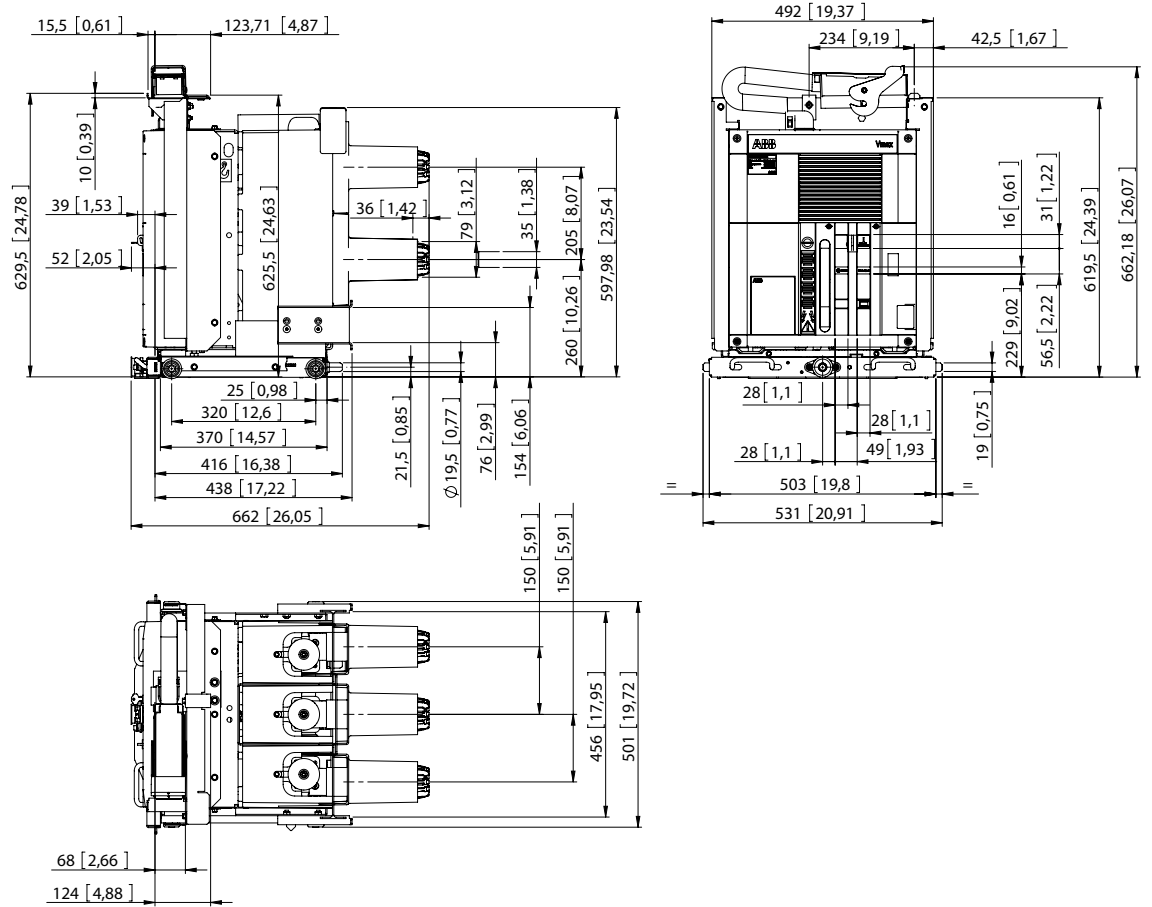
1VCD003558_V2315



Dimensions are in "mm".

Vmax/W - Withdrawable circuit breakers for PowerCube
 IEC: 12...17.5 kV - 630...1250 A - 16...31.5 kA
 ANSI: 15 kV - 1200 A - 25...31.5 kA

1VCD003280_V6158

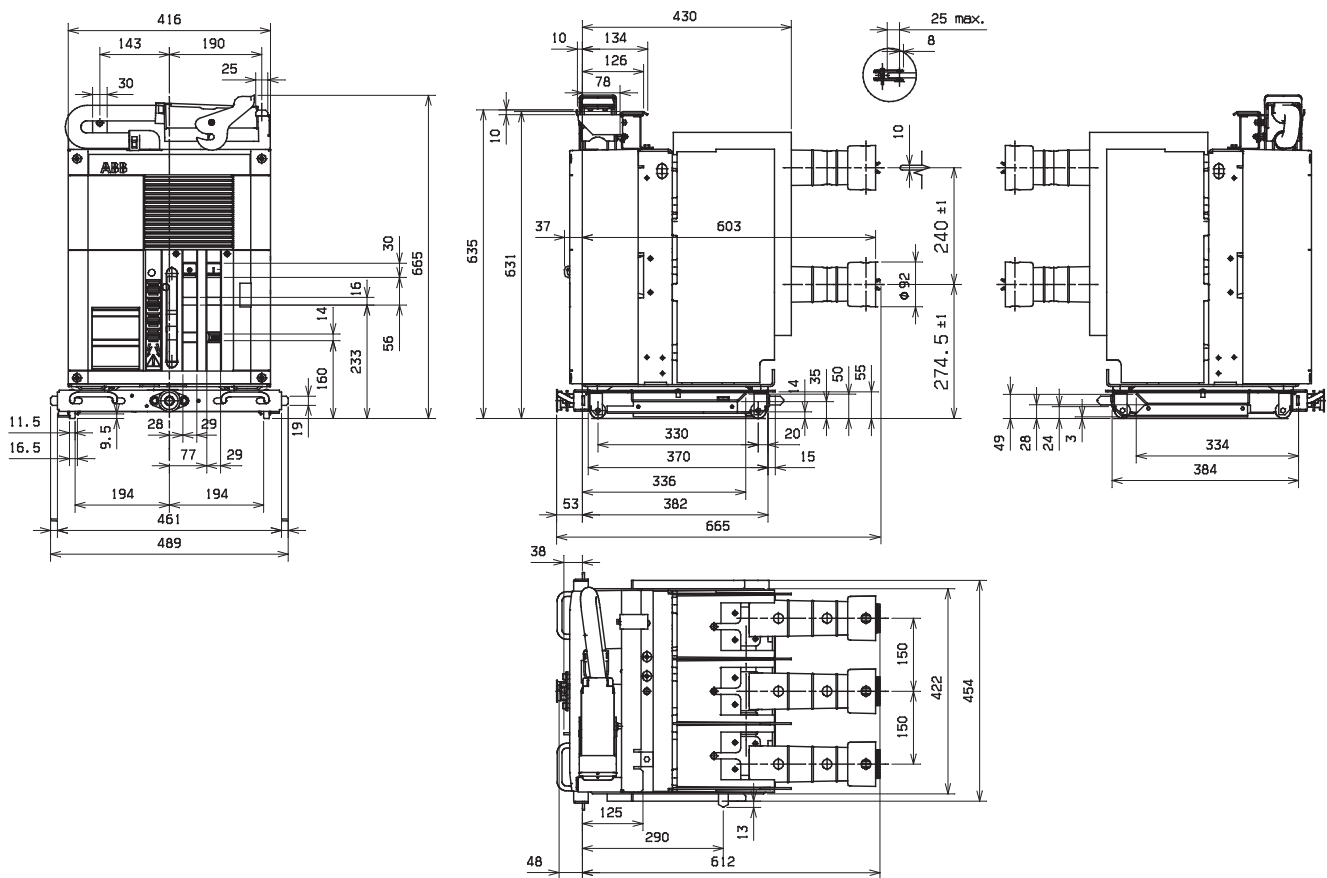


Dimensions are in "mm" and in "inches".

5. Overall dimensions

Vmax/L - Withdrawable circuit breakers
for UniGear 550 switchgear
IEC: 12...17.5 kV - 630...1250 A - 16...31.5 kA

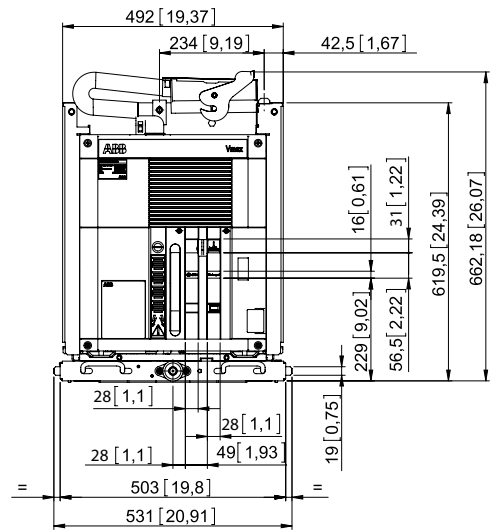
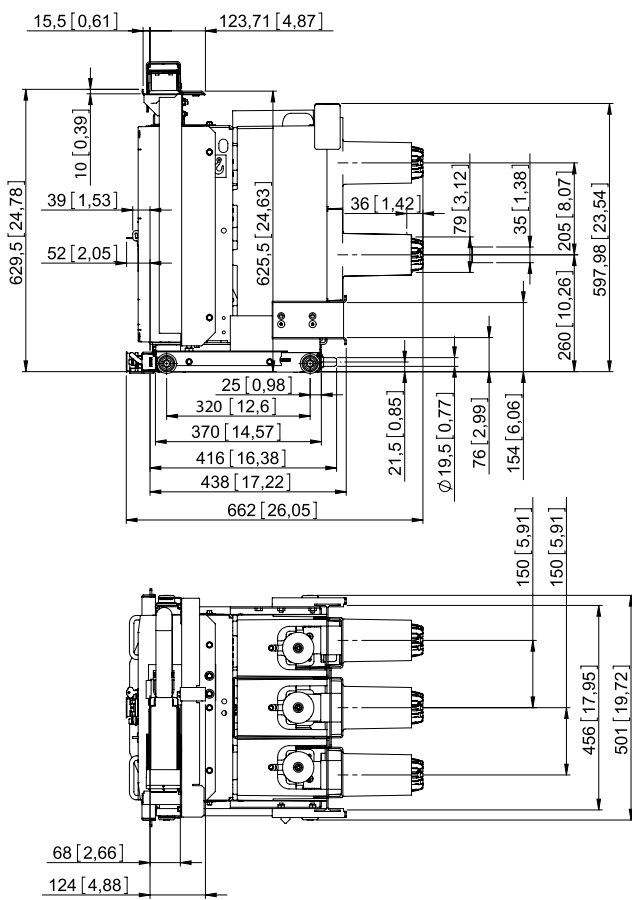
1VCD003334_V2296



Dimensions are in "mm" only.

Vmax/Sec - Withdrawable circuit breakers
for UniSec WBC and WBS switchgear
IEC: 12...17.5 kV - 630...1250 A - 16...25 kA

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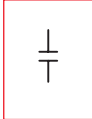



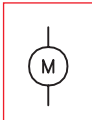
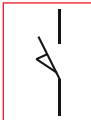
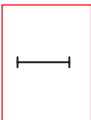
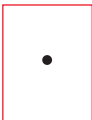


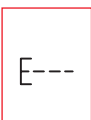
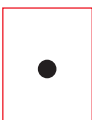
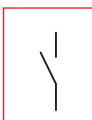
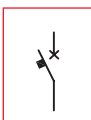
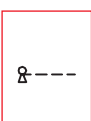
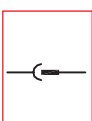
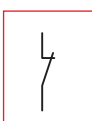
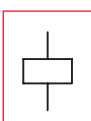

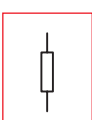
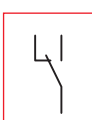
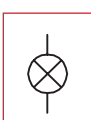
6. Electric circuit diagram

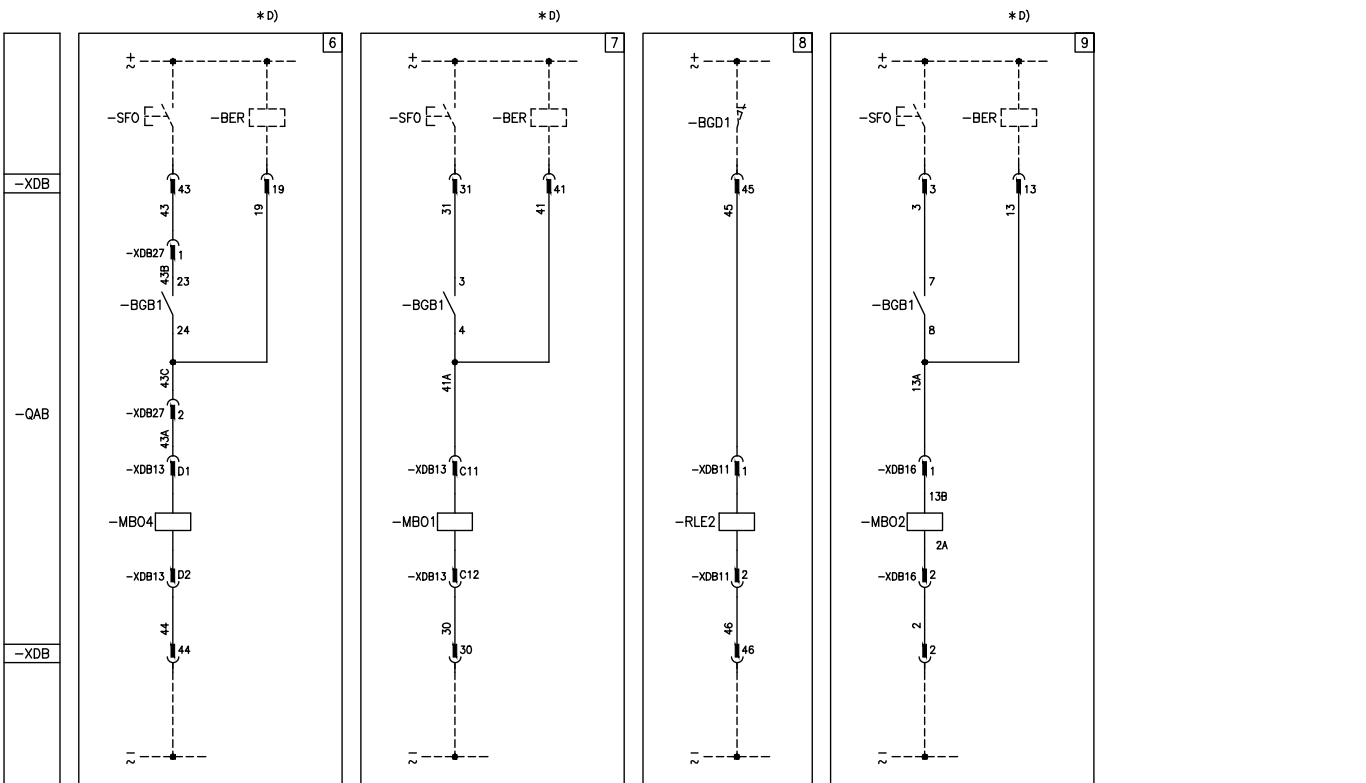
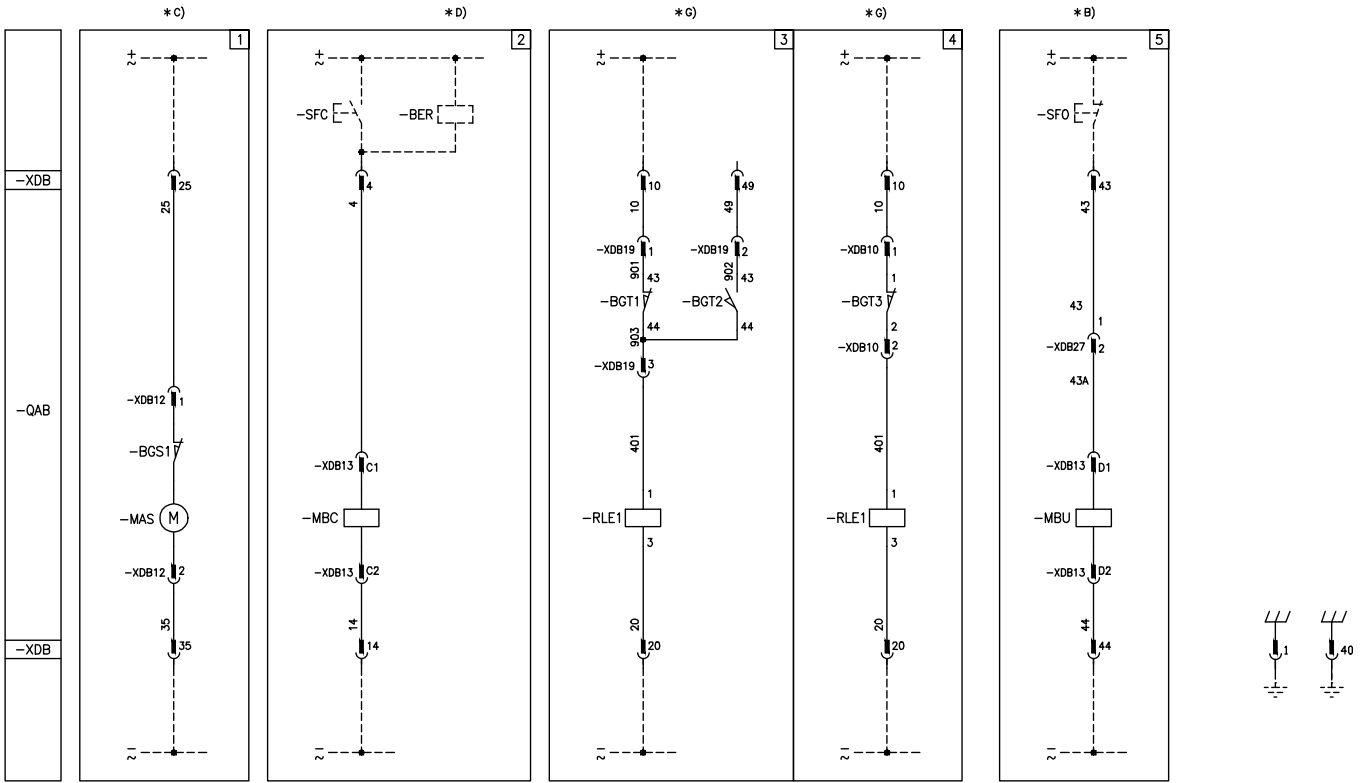
Circuit-diagram of Vmax circuit breaker in withdrawable version for PowerCube and UniGear 550, with EL operating mechanism.
For other circuit breakers, please consult us.

The diagram indicates the following conditions:

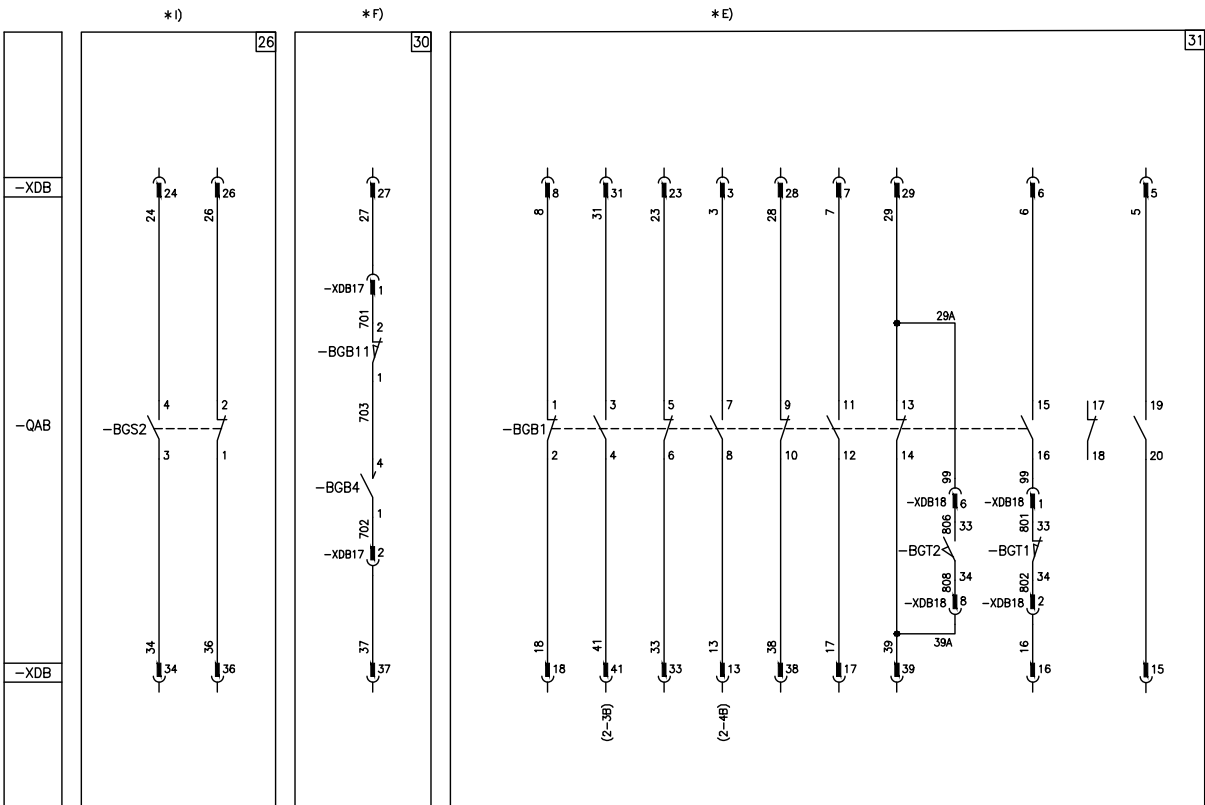
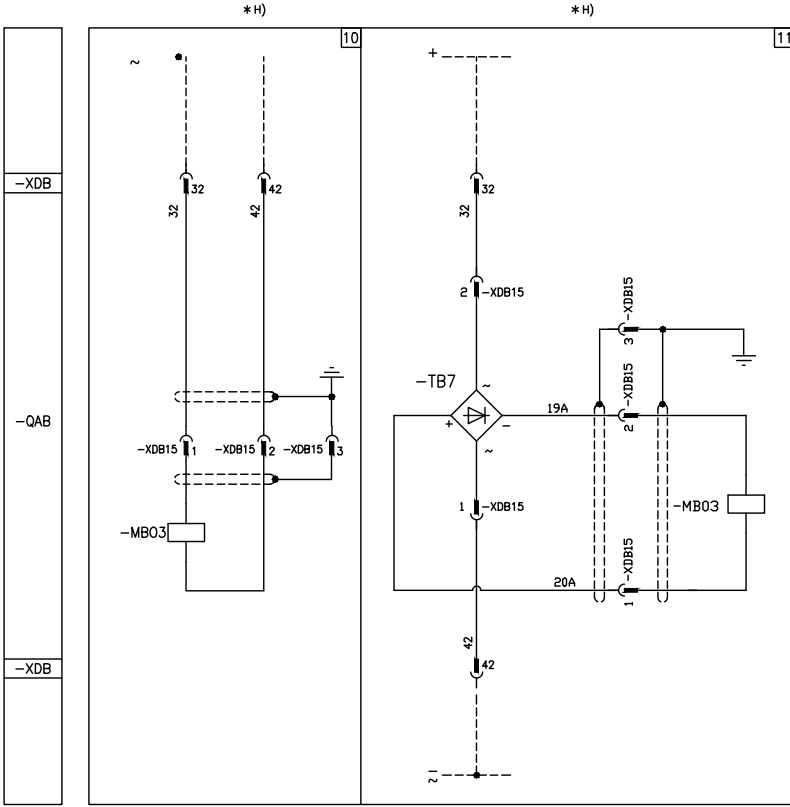
- circuit breaker off and connected
- circuits de-energized
- closing springs discharged

Graphical symbols for electrical diagrams (617 IEC Standards)

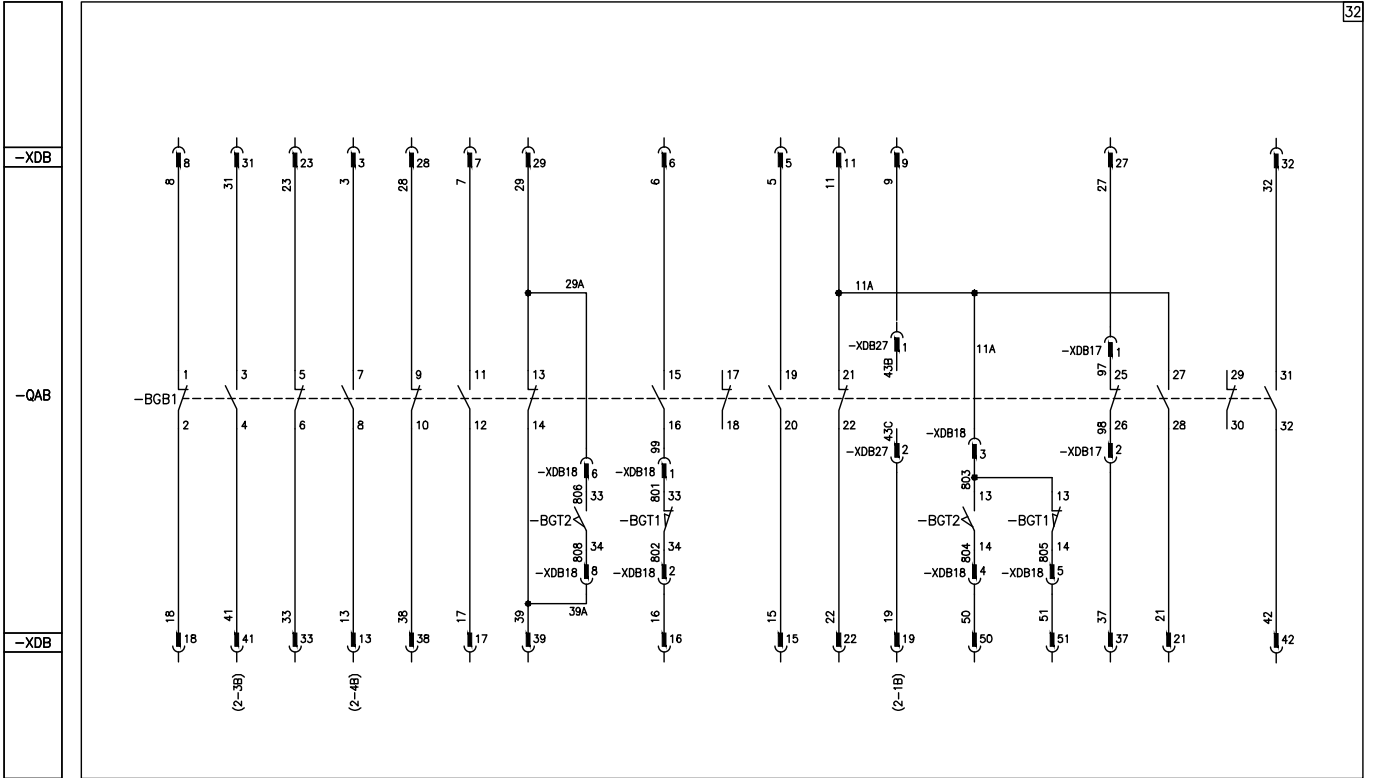
	Thermal effect		Frame		Capacitor (general symbol)		Passing make contact closing momentarily when its operating device is released
	Electromagnetic effect		Conductors in screened cable (two conductors shown)		Motor (general symbol)		Position switch (limit switch) make contact
	Delay		Connection of conductors		Rectifier in full wave connection (bridge)		Position switch (limit switch) brake contact
	Pushbutton control		Terminal or clamp		Make contact		Circuit breaker with automatic release
	Key control		Socket and plug (female and male)		Break contact		Operating device (general symbol)
	Earth (general symbol)		Resistor (general symbol)		Change-over break before make contact		Lamp (general symbol)



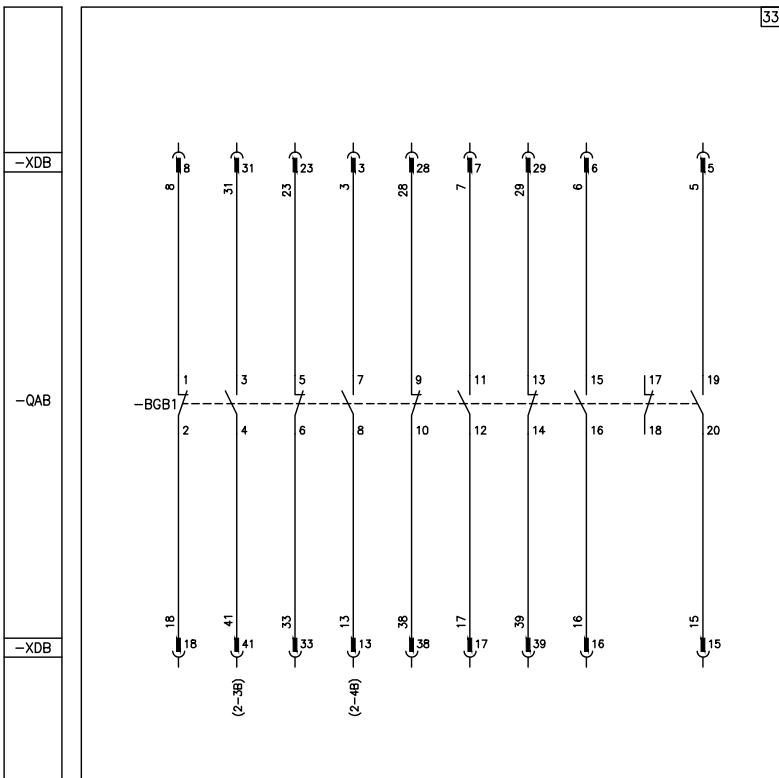
6. Electric circuit diagram



* E)

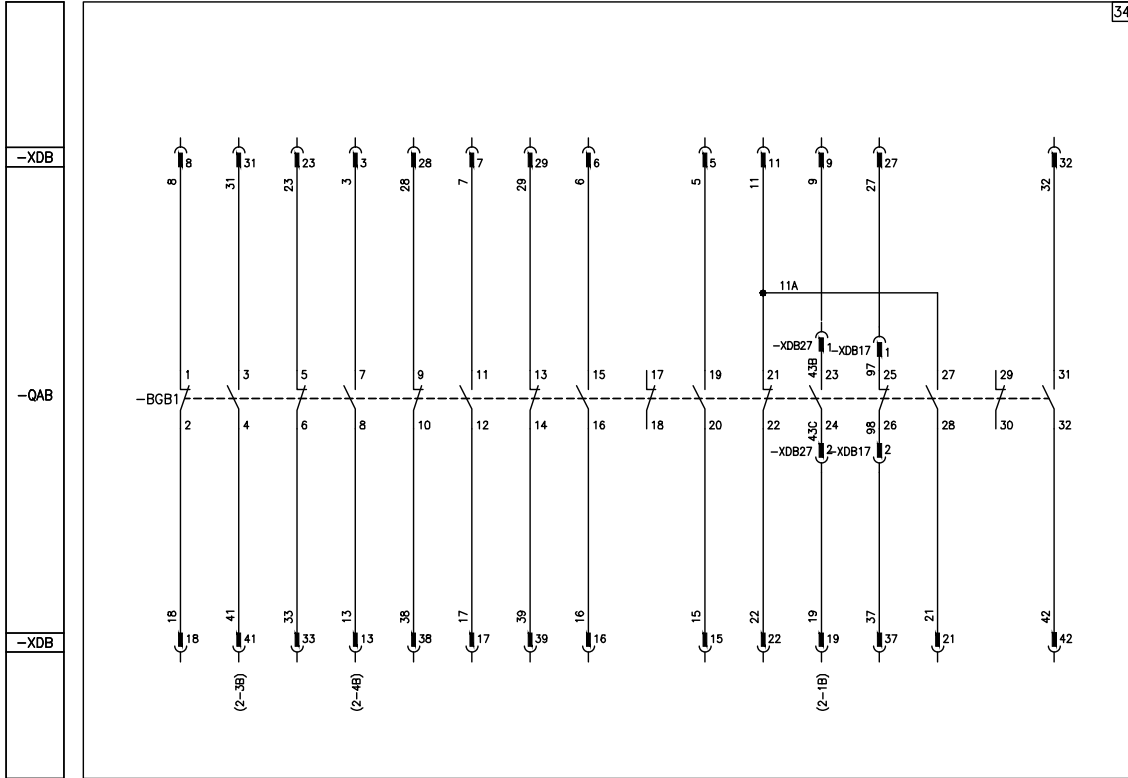


* E)

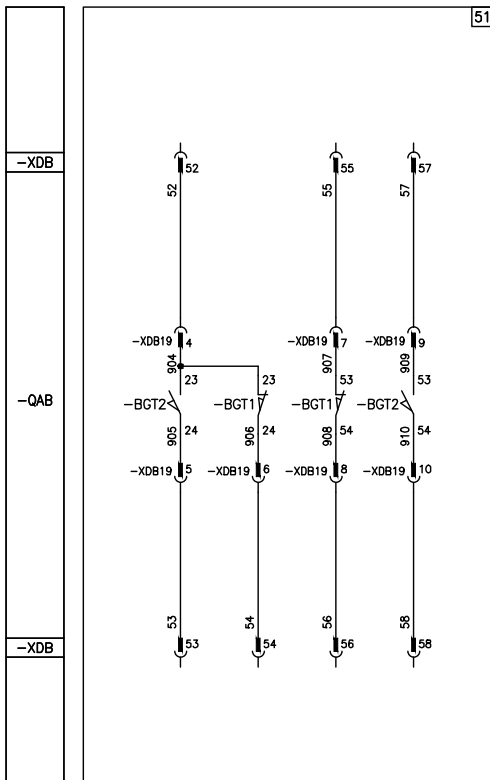


6. Electric circuit diagram

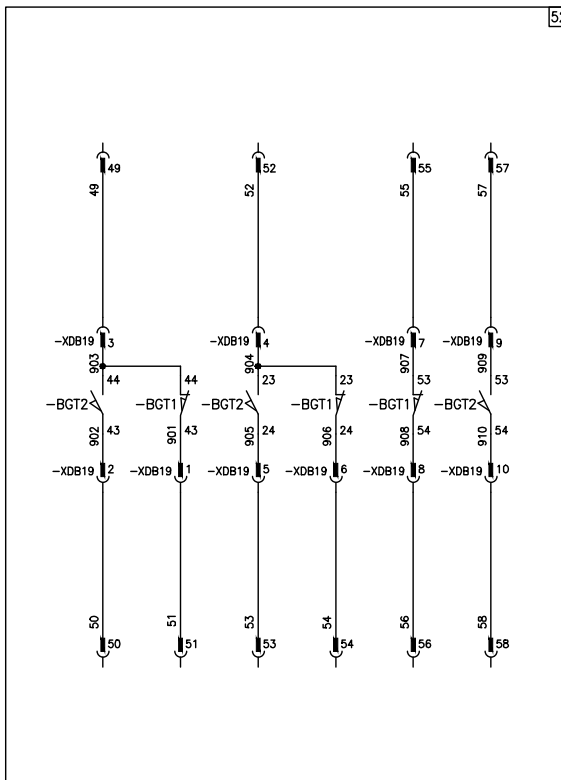
* E)



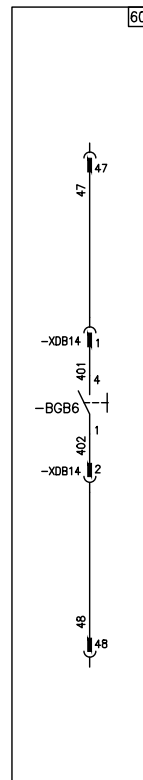
* F)



* F)



* F)



Represented operational state

The diagram indicates the following conditions:

- inserted circuit breaker in open position
- de-energized circuit
- discharged closing springs


Caption	
	= Reference number of diagram figure
*	= See note indicated by the letter
-BER	= SOR Test Unit device for the shunt opening release supervision and shunt closing coil continuity (see note D)
-BGB1	= Circuit breaker auxiliary contacts
-BGB4	= Passing auxiliary make contact closing momentarily when circuit -breaker opens
-BGB6	= Contact signaling undervoltage release deactivate
-BGB11	= Contact to break the -BGB4 signaling during the manual opening operation
-BGD1	= Position contact of the enclosure door
-BGS1	= Limit switch of the springs charging motor
-BGS2	= Limit switch signaling closing springs charged or discharged
-BGT1	= Contacts signaling circuit breaker in inserted position (see note F)
-BGT2	= Contacts signaling circuit breaker in isolated position (see note F)
-BGT3	= Circuit breaker position contact, it is open during the travel of the breaker
-MAS	= Motor for the closing charging springs (see note C)
-MBC	= Shunt closing release (see note D)
-MBO1	= First shunt opening release (see note D)
-MBO2	= Second shunt opening release (see note D)
-MBO3	= Opening solenoid for microprocessor-based release external to the circuit breaker
-MBO4	= Third shunt opening release (see note D)
-MBU	= Undervoltage release (see note B)
-Q4B	= Circuit breaker accessories
-RLE1	= Locking magnet. If de-energized, it prevents the circuit breaker from closing mechanically (it is possible to limit its consumption by connecting in series a delaying pushbutton enabling the operation).
-RLE2	= Locking magnet (on the truck). If de-energized, it prevents the circuit breaker from racking-in and racking-out mechanically (it is possible to limit its consumption by connecting in series a delaying pushbutton enabling the operation)
-SFC	= Pushbutton or contact for the circuit breaker closing
-SFO	= Pushbutton or contact for the circuit breaker opening
-TB7	= Rectifier for shunt opening release -MBO3
-XDB	= Terminal box for the circuit breaker circuits
-XDB10, ...,19	= Connectors of the accessories
-XDB27	= Connector of the accessories

Diagram figures description	
Fig. 1	= Spring charging-motor circuit (see note C)
Fig. 2	= Shunt closing release (antipumping is achieved mechanically)
Fig. 3	= Locking magnet. If de-energized, it prevents the circuit breaker from closing mechanically. (This figure must be given when is requested -RLE1 and fig. 31 or 32 is selected.) (It is possible to limit its consumption by connecting in series a delaying pushbutton enabling the operation.)
Fig. 4	= Locking magnet. If de-energized, it prevents the circuit breaker from closing mechanically. (This figure must be given when -RLE1 is requested and Figs. 33 or 34 are selected.) (It is possible to limit its consumption by connecting in series a delaying pushbutton enabling the operation.)
Fig. 5	= Instantaneous undervoltage release (see note B)
Fig. 6	= Third shunt opening release circuit with possibility of permanent supervision of coil continuity (see note D)
Fig. 7	= First shunt opening release circuit with possibility of permanent supervision of coil continuity (see note D)
Fig. 8	= Locking magnet (on the truck). If de-energized, it prevents the circuit breaker from racking-in and racking-out mechanically. (It is possible to limit its consumption by connecting in series a delaying pushbutton enabling the operation.)
Fig. 9	= Second shunt opening release circuit with possibility of permanent supervision of coil continuity (see note D)
Fig. 10	= Opening solenoid for microprocessor-based release external to the circuit breaker
Fig. 11	= Opening solenoid for microprocessor-based release external to the circuit breaker with AC supply
Fig. 26	= Contact signaling charged or discharged closing springs
Fig. 30	= Passing auxiliary make contact closing momentarily when circuit breaker opens
Fig. 31, ..., 34	= Circuit breaker available auxiliary contacts (see note E)
Fig. 51	= Contact signaling circuit breaker in inserted and isolated position located on circuit breaker's truck (obligatory when Figs. 31 or 32 are requested)
Fig. 52	= Contact signaling circuit breaker in inserted and isolated position located on circuit breaker's truck (on demand when Figs. 33 or 34 are requested)
Fig. 60	= Contact signaling undervoltage release deactivate.

6. Electric circuit diagram

Incompatibility		
The combination of circuits given in the figures below are not possible supplied on the same circuit breaker:		
3-4	3-33-34	4-31-32
5-6	10-11	31-32-33-34
31-32-52	33-34-51	51-52

Notes	
A)	The circuit breaker is delivered complete with the accessories listed in the order acknowledgement only. To draw up the order, examine the apparatus catalogue.
B)	The undervoltage release is available in the version suitable for circuit breaker supply-side feeding or for feeding from an independent source. Circuit breaker may be closed only if the undervoltage release is energized (lock on closing is achieved mechanically). If the same voltage is supplied for both closing and undervoltage releases and if automatic closing of the circuit breaker is required when the auxiliary voltage supply is restored, it is necessary to delay the energization of the closing release by 50 ms after the undervoltage release acceptance. Incompatible with -MBO4.
C)	Check the power supply available on the auxiliary circuit to verify if it is adequate to start several closing spring-charging motors simultaneously. To prevent excessive consumption, the closing springs must be charged manually before energizing the auxiliary circuit.
D)	The supervision circuit of the shunt opening release coil continuity must be used for this function only. It is possible to use the SOR Test Unit device to check the coil continuity. -MBO4 incompatible with -MBU -MBO4 not available for Vmax and VD4 50 kA
E)	When Fig. 6 is requested, contact -BGB1 (23-24) given in Fig. 32-34 is not available. When Fig. 7 is requested, contact -BGB1 (3-4) given in Fig. 31-32-33-34 is not available. When Fig. 9 is requested, contact -BGB1 (7-8) given in Fig. 31-32-33-34 is not available. When Fig. 10 or 11 are requested, contact -BGB1 (31-32) given in Fig. 32 and Fig. 34 is not available. When Fig. 30 is requested, contact -BGB1 (25-26) given in Fig. 32 and Fig. 34 is not available.
F)	Contacts signaling connected and isolated positions (-BGT1 and -BGT2) given in Fig. 51 or Fig. 52 are located on the truck's circuit breaker (moving part).
G)	Fig. 3 is given when Fig. 31 or Fig. 32 are requested. Fig. 4 is given when Fig. 33 or Fig. 34 are requested. (In this case -BGT3 is obligatory).
H)	Fig. 10 available only VD4 up to 31.5 kA and Vmax. Fig. 11 available only VD4 up to 31.5 kA
I)	Both limit switches signaling must be working at the same supply voltage.



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For more information please contact:



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