

DISTRIBUTION SOLUTIONS

VM1

Medium voltage vacuum circuit breakers
with magnetic drive

12...24 kV - 630...4000 A - 16...50 kA



VM1 is a Medium Voltage circuit breakers with magnetic actuator for primary distribution for control and protection of cables, overhead lines, substations, motors, transformers, generators, etc. in plants such as: chemical industries, steelworks, automobile industries, airports, large buildings and shopping malls. The magnetic drive activate the moving contacts of the interrupters and integrates all the functions of a traditional drive.

Table of contents

004–007	VM1: its strengths, your benefits
008–015	Description
016–041	Selection and ordering
042–045	Specific product characteristics
046–057	Overall dimensions
058–065	Electric circuit diagram

VM1: its strengths, your benefits



**Continuous
operation**



**Global
availability**



**Reliable in
extreme
conditions**



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 for choosing the best solution fitting your specific application



Continuous operation

- Breaker suitable for frequent operation
 - Rely on a solution that maintains high its reliability also in case of frequent C-O operations



Easy to install

- Withdrawable version available
 - Perform fast and easy rack-in/out of the breaker for maintenance
 - Receive the complete breaker solution ready for installation inside the panel



Speed up your projects

- Breaker+cassette offering
 - Receive the advanced breaker+cassette offering based on ABB proven design
- Technical cooperation agreements
 - Reduce you development time for new panel design

Reliability

Protecting your assets



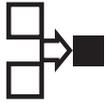
Safety and Protection

- Motorized truck for remote rack-in/out of the breaker
 - Put the breaker in service or in test position safely without the need of having personnel in front of the panel
- Magnetic interlock for truck:
 - Prevents circuit-breaker from being installed in switchgear with different rated current values and without having connected the auxiliary circuits



Reliable in extreme conditions

- By replacing poles every 30,000 ops, mechanical life can be extended to 100,000 C-O ops (50,000 for high duty breakers)
 - Very few mechanical parts in the kinematic chain reduces maintenance work and costs to the minimum while ensuring sturdy design and high reliability even when C-O operations are frequent
- Vacuum interrupters embedded in poles
 - Main components of circuit-breaker fully protected against knocks, dust and moisture



Optimum interface

- Standard product family up to 24 kV, 4000 A
 - Simplified range of accessories and interface common to entire product family
- Mechanical interchangeability of VD4 and HD4
 - Same switchgear configuration used to house circuit-breakers with either breaking technology



Global availability

- You can count on ABB
 - Our global presence means you can rely on us for any type of support you may require



Efficiency

Optimizing your investments



Affordable range

- Technical cooperation agreement
 - Rely on ABB technical support for new panel development based on ABB proven design



Optimized logistics

- Thermoplastic poles reduce circuit-breaker weight
 - Handle the breaker easily and reduce transportation burden

Description

General

The VM1 circuit breakers use vacuum interrupters embedded in the poles. The embedded interrupters are particularly sturdy and protect the interrupters against shocks, accumulation of dust, and humidity. Each interrupter houses the contacts and makes up the interrupting chamber. Actuation of the interrupter contacts is carried out by a single magnetic actuator controlled by position sensors and by an electronic module. The energy required for operation is provided by capacitors which ensure an adequate store of energy. The electronic control circuit can be supplied in two versions: the "basic" one and the one with the "full options" which are characterised by:

- high electromagnetic immunity
- self-diagnosis of the capacitor load and the continuity of the coils: controller watchdog with signalling of faults
- wide range of the auxiliary power supply in direct and alternating current
- low consumption for maintaining the capacitor load
- determination of the circuit breaker state by means of proximity sensors
- monitoring of all the interruption functions.

Thanks to the use of the embedded interrupters and the magnetic drive, the VM1 circuit breakers guarantee:

- sturdiness
- reliability
- long life
- limited maintenance.

Magnetic drive technology

The magnetic drive used in the VM1 circuit breakers generates the run required to activate the moving contacts of the interrupters and integrates all the functions of a traditional drive. The magnetic drive is a bistable system where the end-of-run positions of the moving armature are reached by means of magnetic fields generated by two coils (one for closing and one for opening). The moving armature is kept in position by permanent magnets.

The circuit breaker operations are obtained by energising the opening or closing coil respectively. The magnetic field generated by each coil attracts the moving armature and thereby moves it from one to the other of the permanent magnet latching points. According to the circuit breaker performances, one or two capacitors are provided in the control circuit which store the energy required for operation for a time limit of two minutes, even when there is a drop in the auxiliary voltage.

In case of emergency, the circuit breaker can be opened in any case by means of a special lever acting directly on the moving armature of the drive. Compared with a traditional drive, the magnetic actuator has few moving parts and drastically reduced wear even after a high number of closing and opening cycles.

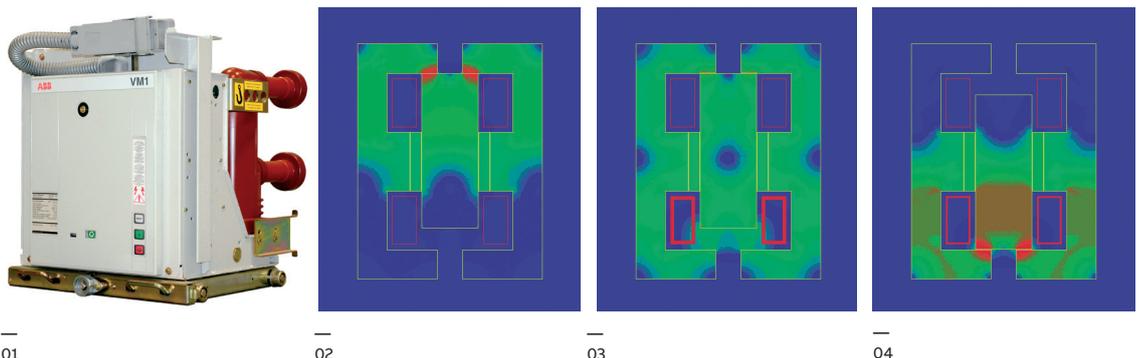
These characteristics make it practically maintenance-free.

01 VM1

02 Magnetic latching in end-of-run position.

03 Magnetic latching and magnetic field action of a coil.

04 Moving armature in opposing position to end-of-run magnetic latching.

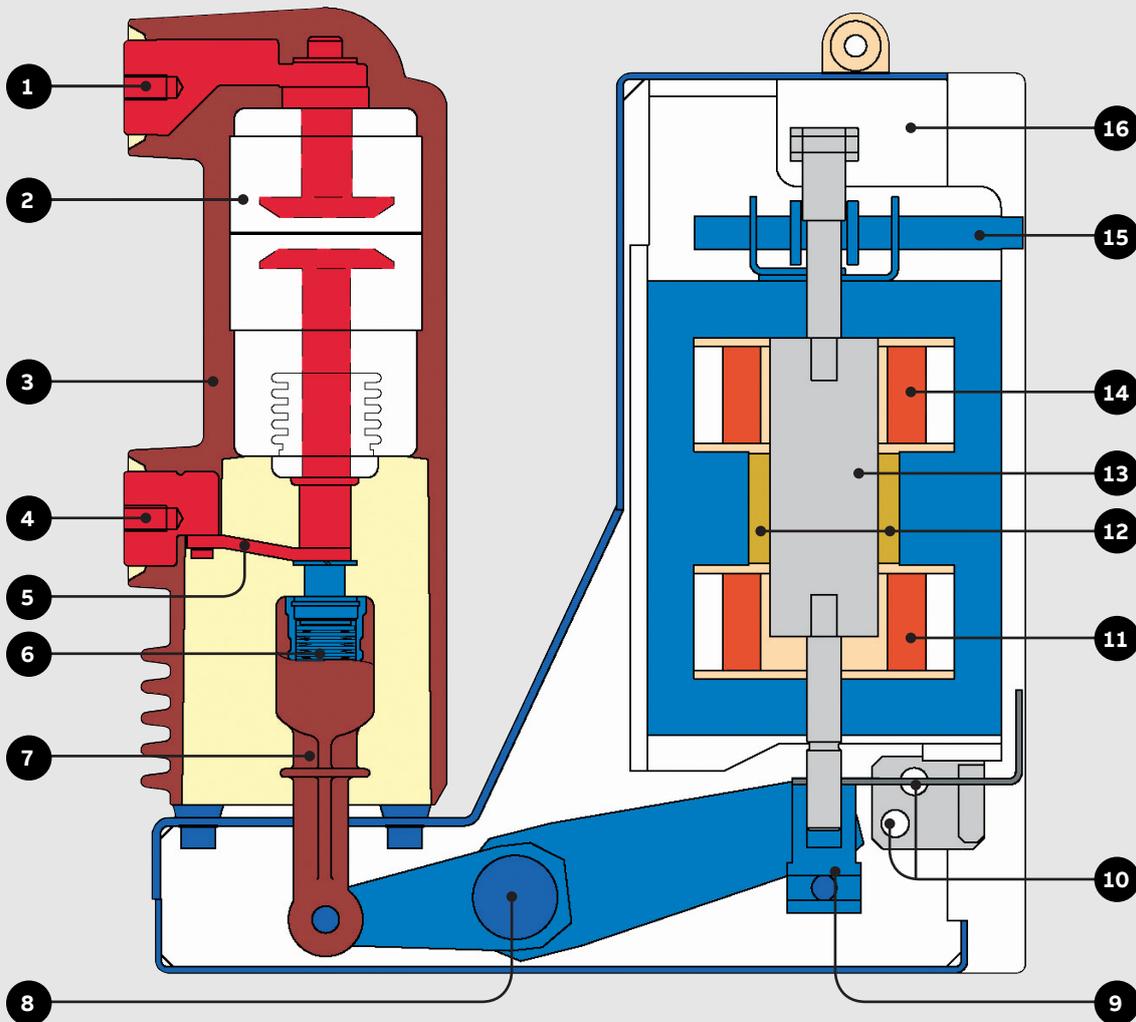


Structure

The magnetic actuator and the poles 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.

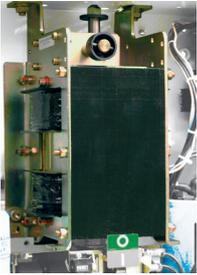
Apart from the isolating contacts and the cord with plug for connection of the auxiliary circuits, the withdrawable version is completed with the truck for racking it into and out of the switchgear or enclosure with the door closed.



- 1 Top terminal
- 2 Vacuum interrupter
- 3 Pole in resin
- 4 Bottom terminal
- 5 Flexible connection
- 6 Shock-absorber spring
- 7 Insulating tie-rod
- 8 Lever shaft

- 9 Run regulator
- 10 Position sensors
- 11 Closing coil
- 12 Permanent magnets
- 13 Moving armature
- 14 Opening coil
- 15 Manual emergency opening device
- 16 Supporting structure

Description



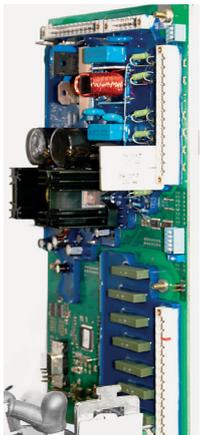
Magnetic actuator

This consists of a laminar pack, a permanent magnet, two coils and a moving armature. The moving element is attracted by the magnetic field generated by one of the windings and, by means of special kinematics, allows the contacts of the interrupters to be operated on opening and closing.



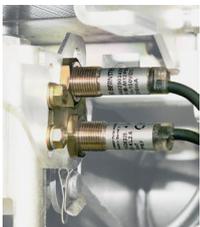
Capacitor

The capacitor (or capacitors according to the performances required) has the function of storing the energy required for a complete cycle: opening - closing - opening. When there is no auxiliary power supply, the capacitor is able to maintain the circuit operational for about 30 s.



Electronic module

The electronic module controls all the circuit breaker functions and can receive and send appropriate control and operating signals. It is available as standard in the basic version and, on request, in the version with the full options.



Sensors

The sensors have the function of determining the exact mechanical position of the circuit breaker (open or closed). The signal is sent to the electronic control module.

Control circuit power supply

The energy for circuit breaker operation is supplied by the capacitors which are kept charged by a feeder which also supply of the electronic circuit.

This guarantees correct operation even if the auxiliary power supply does not reach the rated value.

Thanks to the use of low consumption capacitors, the feeder consumption is about 10 watt with the circuit breaker closed or open.

After each operation the feeder consumes about 100 watt for a few seconds to restore the charging level of the capacitors.

The charging condition of the capacitors is constantly monitored by the electronic module which also sees to the functions of opening, closing, signalling, etc.

Two feeders are available:

- type 1: 24...48 V AC / 24...60 V DC
- type 2: 100...240 V AC / 110...250 V DC.

- Vacuum interrupting technique
- Vacuum interrupter protected against shocks, dust and humidity
- Contacts protected against oxidation and contamination
- Operation under different climatic conditions
- Perfect compatibility with the VD4 series
- Possibility of use in all types of plant
- Magnetic actuator
- Limited number of components
- Inductive position sensors
- Control of the state of the circuit breaker
- Control of continuity of the coils
- Control of capacitor charge
- Watchdog function
- Sealed-for-life poles

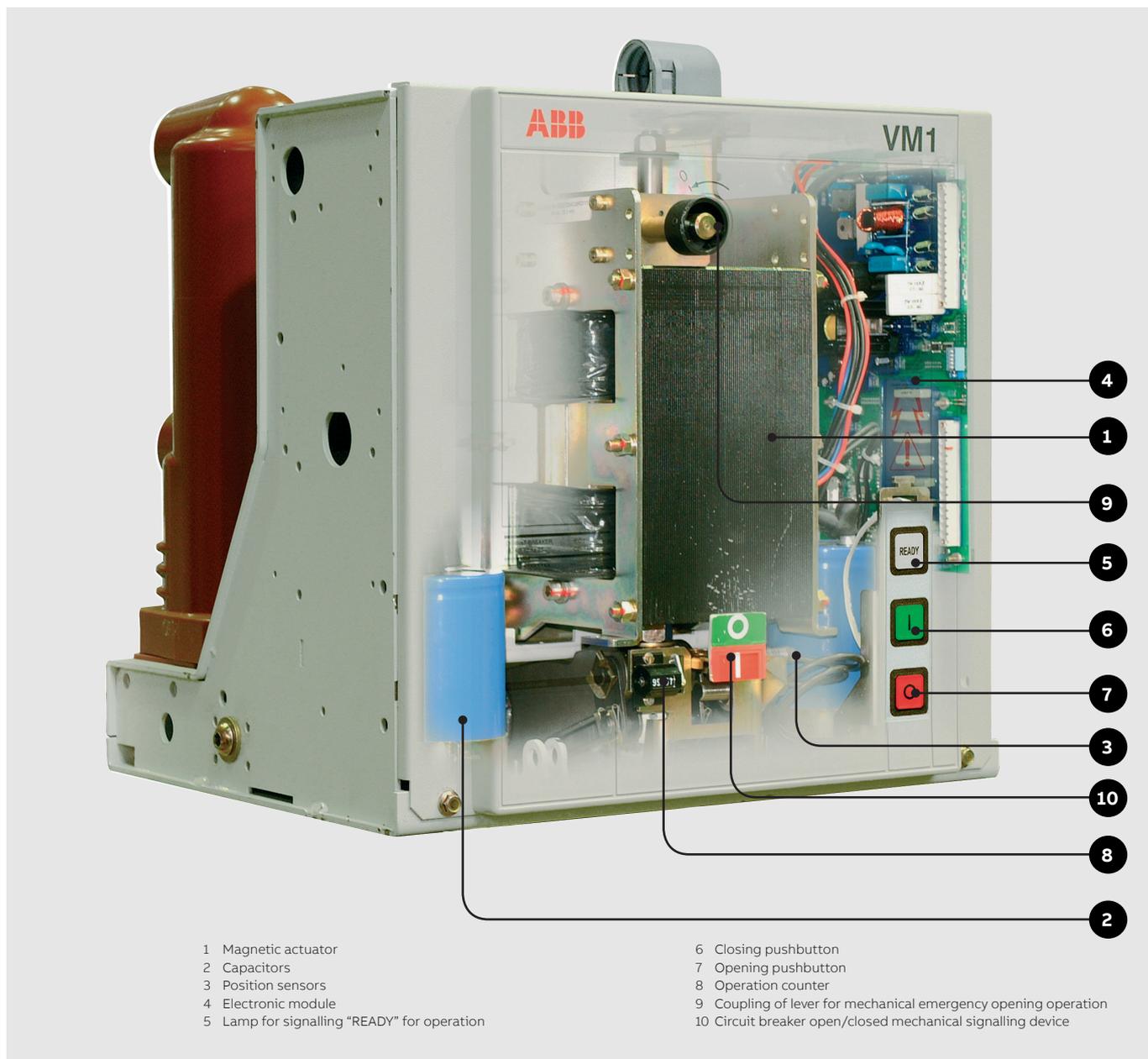
- High reliability and sturdiness
- Long electrical and mechanical life
- Limited maintenance
- Complete range of accessories
- Fixed and withdrawable version
- Circuit breaker racking-out and racking-in with the door closed
- Incorrect and hazardous operations prevented by special locks in the operating mechanism and in the truck
- High electromagnetic and environmental compatibility
- Emergency mechanical opening operation

Version VM1-T for use in substations

Circuit breaker VM1-T is a special version for use in medium voltage distribution substations. Just like circuit breaker VM1 from which it is derived, VM1-T is available in the fixed and withdrawable versions and allows extremely fast operating speeds to be obtained.

Circuit breaker VM1-T features:

- a magnetic actuator
- smart control of the coil current
- a device for storing the energy required for a complete switching cycle.



- 1 Magnetic actuator
- 2 Capacitors
- 3 Position sensors
- 4 Electronic module
- 5 Lamp for signalling "READY" for operation

- 6 Closing pushbutton
- 7 Opening pushbutton
- 8 Operation counter
- 9 Coupling of lever for mechanical emergency opening operation
- 10 Circuit breaker open/closed mechanical signalling device

Description

Vacuum current quenching

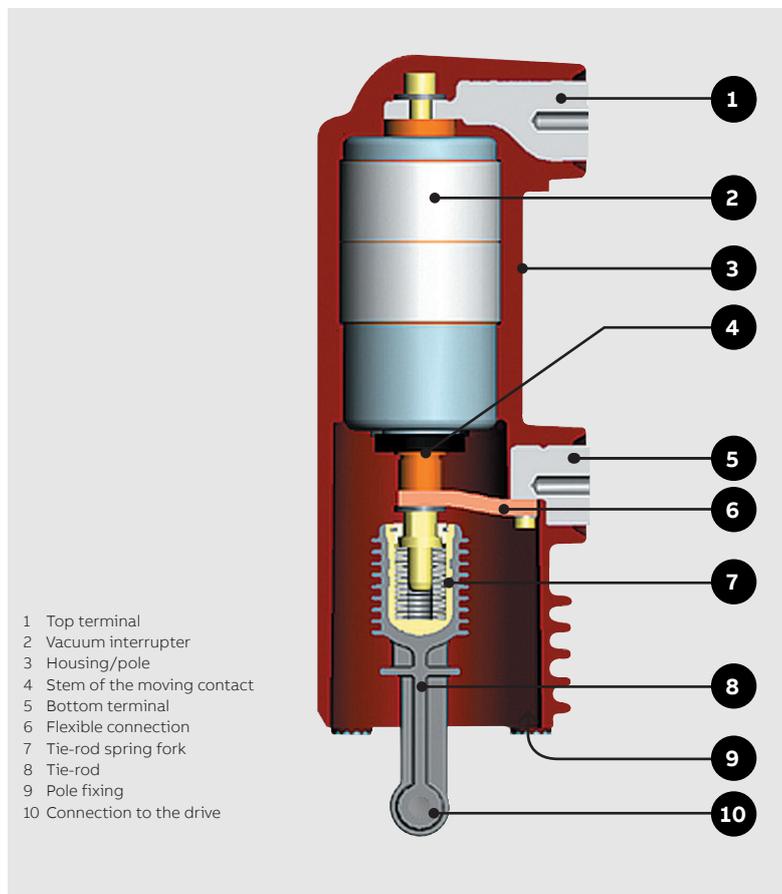
The vacuum circuit breaker does not require an interrupting and insulating medium. In fact, the interrupter does not contain ionisable material. In any case, on separation of the contacts an electric arc is generated made up exclusively of melted and vaporised contact material. The electric arc remains 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 rapid condensation of the metallic vapour, 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, interruption of the circuit 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.



Vacuum interrupter embedded in poles.

Characteristics of the interrupter

- Vacuum quenching technique
- Contacts protected against oxidation and contamination
- Vacuum interrupter embedded in the pole
- Interrupter protected against shocks, dust and humidity
- Operation under different climatic conditions
- Limited operating energy
- Compact dimensions
- Sealed-for-life vacuum interrupters
- Sturdiness and reliability
- Maintenance-free
- High environmental compatibility

Quenching principle of ABB interrupters

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

Vacuum arcs – diffuse or contracted

Following contact separation, single melting points form on the surface of the cathode. This causes formation of metal vapours which support the arc itself.

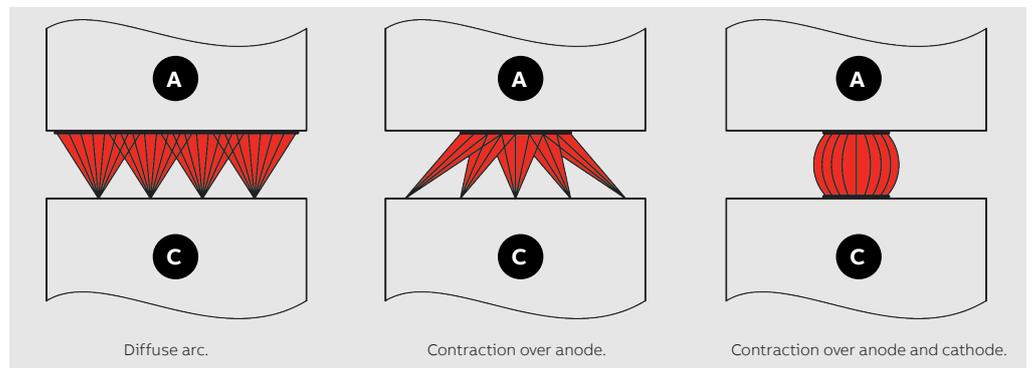
The diffuse vacuum arc is characterised by expansion over the surface of the contact itself and by evenly distributed thermal stress.

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 current interruptions very high.

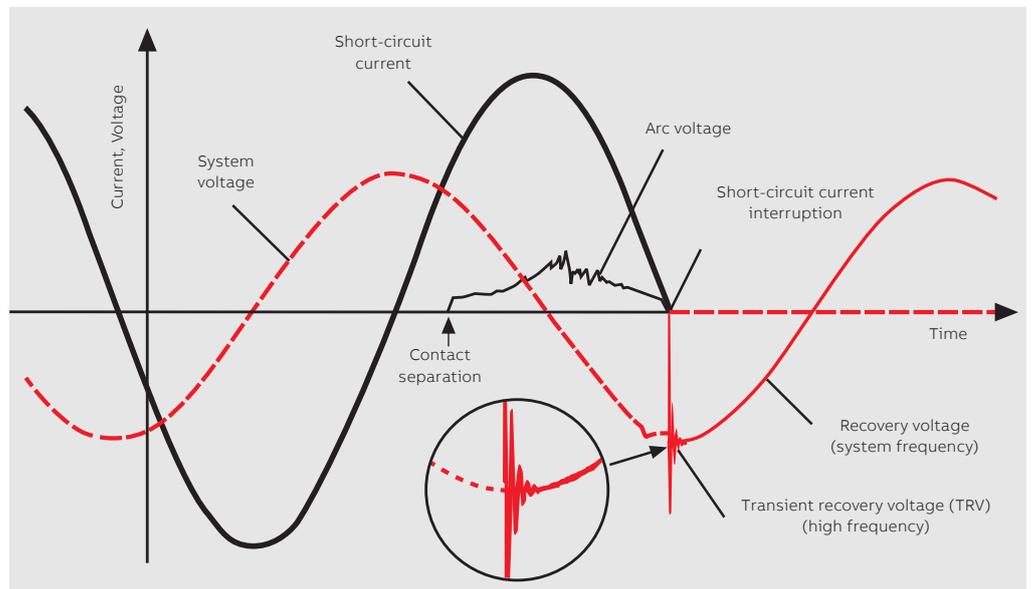
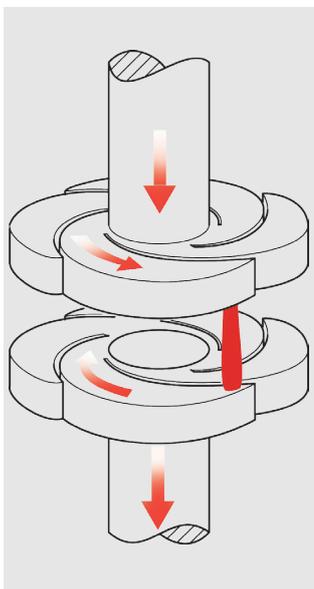
As the interrupted current value increases (above the rated value), the electric arc tends to be transformed from the diffuse into the contracted type, due to the Hall effect.

Starting at the anode, the arc contracts and as the current rises it tends to concentrate. Near 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.



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



Description

The spiral geometry of ABB vacuum interrupter contacts

The special geometry of the spiral contacts generates a radial magnetic field in all areas of the arc column, concentrated over the contact circumferences.

An electromagnetic force is self-generated which 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 minimising thermal stress on the contacts, all this makes contact erosion negligible and, above all, allows the interruption process to be controlled even with very high short-circuits. ABB vacuum interrupters are zero-current interrupters and are free of any re-striking.

Rapid reduction in the current density and rapid condensation of the metal vapours simultaneously with the moment of zero current means maximum dielectric strength can be restored between the interrupter contacts within a few thousandths of a second.

Accessories

The VM1 circuit breakers have a complete range of accessories to satisfy all installation requirements.

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

Versions available

VM1 circuit breakers are available in the fixed and withdrawable version with front operating mechanism.

The withdrawable version is available for UniGear switchgear and PowerCube modules.

The VM1 circuit breakers are interchangeable size-wise with the VD4 series, which use the same vacuum interrupters embedded in the poles.

Fields of application

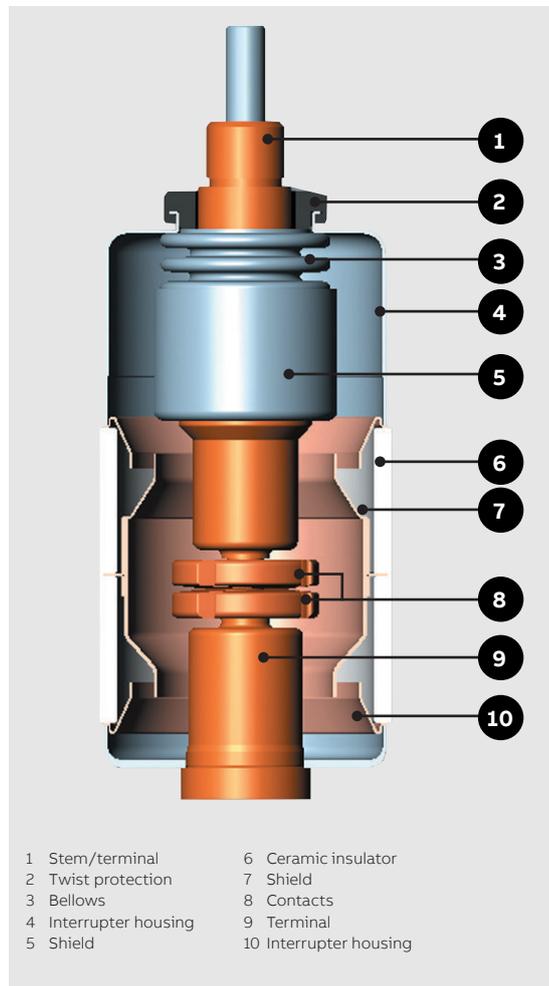
VM1 circuit breakers are characterised by great versatility of use.

They are used in primary power distribution for control and protection of cables, overhead lines, transformer and distribution substations, motors, transformers, generators, capacitor banks, etc. in plants such as: chemical industries, steelworks, automobile industries, airports, large buildings and shopping malls.

Standards and approvals

The VM1 circuit breakers comply with the IEC 62271-100, CEI 17-1 file 1375 Standards and with those of the major industrialised countries. The VM1 circuit breakers have undergone the tests indicated below and guarantee the safety and reliability of the apparatus in service in any installation.

- Type: heating, withstand insulation at power frequency, withstand insulation at lightning impulse, short-time and peak withstand current, mechanical life, short-circuit current making and breaking capacity, and no-load cable interruption.



Vacuum interrupter.

- Individual tests: insulation of the main circuits with voltage at power frequency, auxiliary and control circuit insulation, measurement of the main circuit resistance, mechanical and electrical operation.

Service safety

Thanks to the complete range of mechanical and electrical software (available on request), it is possible to construct safe distribution switchgear with the VM1 circuit breakers. The locking devices have been studied to prevent incorrect operations and for inspection of the installations guaranteeing maximum operator safety.



Technical documentation

To go into technical and application aspects of the VM1 circuit breakers in depth, please ask us for the following publications:

- PowerCube modules Code 1VCP000091
- UniGear switchgear Code 1VCP000138
- REF542plus unit Code 1VTA100001

Quality System

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

Test Laboratory

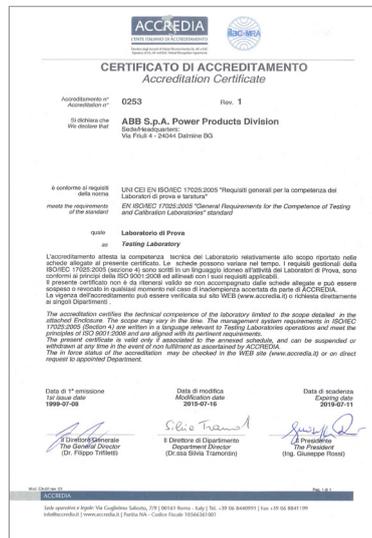
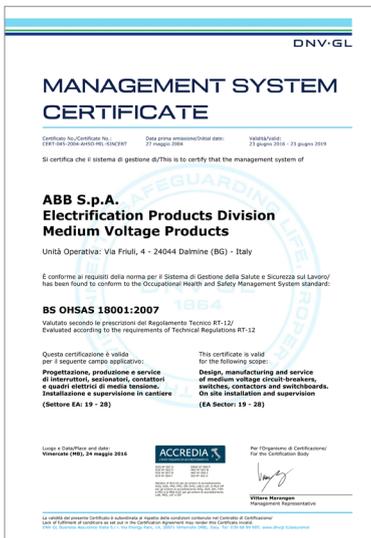
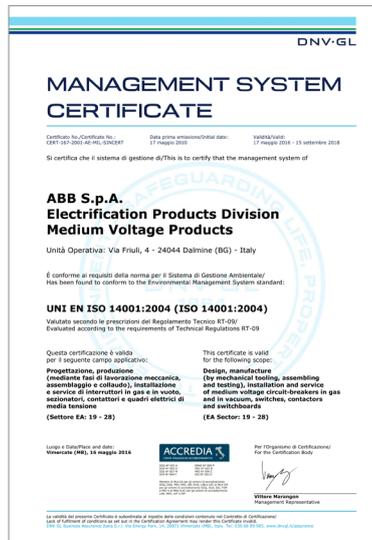
This complies with the UNI CEI EN ISO/IEC 17025 Standards, accredited by an independent external organization.

Environmental Management System

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

Health and Safety Management System

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

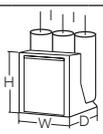


Selection and ordering

Fixed circuit breakers



General characteristics of VM1 fixed circuit breakers
(12 - 17,5 - 24 kV)

Circuit breaker	VM1 12 ⁽¹⁾													
Standards	IEC 62271-100 •													
	CEI 17-1 (File 1375) •													
Rated voltage	Ur [kV] 12													
Rated insulation voltage	Us [kV] 12													
Withstand voltage at 50 Hz	Ud (1 min) [kV] 28													
Impulse withstand voltage	Up [kV] 75													
Rated frequency	fr [Hz] 50-60													
Rated normal current (40 °C)	Ir [A]	630	630	1250	1250	1600	1600	2000	2000	2500	2500	3150	4000 ⁽²⁾	
		16	16	16	16	-	-	-	-	-	-	-	-	
		20	20	20	20	20	20	20	20	20	20	-	-	
		25	25	25	25	25	25	25	25	25	25	25	25	
		31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	
		-	-	-	40	40	40	40	40	40	40	40	40	40
Rated breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	-	-	-	40	40	40	40	40	40	40	40	40	
		-	-	-	50	50	50	50	50	50	50	50	50	
		16	16	16	16	-	-	-	-	-	-	-	-	
		20	20	20	20	20	20	20	20	20	20	-	-	
		25	25	25	25	25	25	25	25	25	25	25	25	
		31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	
Rated short-time withstand current (3 s)	Ik [kA]	-	-	-	40	40	40	40	40	40	40	40	40	
		-	-	-	50	50	50	50	50	50	50	50	50	
		40	40	40	40	-	-	-	-	-	-	-	-	
		50	50	50	50	50	50	50	50	50	50	-	-	
		63	63	63	63	63	63	63	63	63	63	63	63	
		80	80	80	80	80	80	80	80	80	80	80	80	
Making capacity	Ip [kA]	-	-	-	100	100	100	100	100	100	100	100		
		-	-	-	125	125	125	125	125	125	125	125		
		40	40	40	40	-	-	-	-	-	-	-	-	
		50	50	50	50	50	50	50	50	50	50	-	-	
Operation sequence	[O-3min-CO-3min-CO] •													
Opening time	[ms] 35...50													
Arc time	[ms] < 15													
Total interruption time	[ms] < 60													
Closing time	[ms] 45...60													
Mechanical operations (cycles)	Actuator ... 100.000													
	Interrupters ... 30.000													
Electrical operations (cycles)	Rated current ... 30.000													
	Under short-circuit ... 50													
Maximum overall dimensions		H [mm] 460-600												
		W [mm] 428												
		D [mm] 450-750												
		Pole centre distance l [mm] 150 210 150 210 210 275 210 275 275 210 275 275												
Weight	[kg] 94-245													
Standardised table of dimensions	1VCD 000001 000002 000001 000002 000003 000004 000003 000004 000004 - - -													
	(>31.5kA or >2500A) GCEM 700206													
Operating temperature	[°C] - 5 ... + 40													
Tropicalisation	IEC: 60068-2-30; 60721-2-1 •													
Electromagnetic compatibility	IEC: 62271-1 •													

(1) The circuit breakers up to 17,5 kV - 1250 A - 31,5 kA, are made with polyamide poles.

(2) 4000A guaranteed with forced ventilation

VM1 17 ⁽³⁾											VM1 24							
•											•							
•											•							
17.5											24							
17.5											24							
38											50							
95											125							
50-60											50-60							
630	630	1250	1250	1600	1600	2000	2000	2500	2500	3150	630	630	1250	1250	1600	2000	2500	
16	16	16	16	-	-	-	-	-	-	-	16	16	16	16	16	16	16	-
20	20	20	20	20	20	20	20	20	-	-	20	20	20	20	20	20	20	-
25	25	25	25	25	25	25	25	25	-	25	25	25	25	25	25	25	25	25
31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	-	31.5	-	-	-	-	-	-	-	-
-	-	-	40	40	40	40	40	40	40	40	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	16	16	16	-	-	-	-	-	-	-	16	16	16	16	16	16	16	-
20	20	20	20	20	20	20	20	20	-	-	20	20	20	20	20	20	20	-
25	25	25	25	25	25	25	25	25	-	25	25	25	25	25	25	25	25	25
31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	-	31.5	-	-	-	-	-	-	-	-
-	-	-	40	40	40	40	40	40	40	40	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	40	40	40	-	-	-	-	-	-	-	40	40	40	40	40	40	40	-
50	50	50	50	50	50	50	50	50	-	-	50	50	50	50	50	50	50	-
63	63	63	63	63	63	63	63	63	-	63	63	63	63	63	63	63	63	63
80	80	80	80	80	80	80	80	80	-	80	-	-	-	-	-	-	-	-
-	-	-	100	100	100	100	100	100	100	100	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
•											•							
35...50											35...45							
< 15											10...15							
< 60											45...60							
45...60											50...60							
... 100.000											... 100.000							
... 30.000											... 30.000							
... 30.000											... 30.000							
... 50											... 50							
460-600											631	631	631	631	642	642	661	
428											570	700	570	700	700	700	700	
450-750											424	424	424	424	424	424	424	
150	210	150	210	210	275	210	275	275	210	275	210	275	210	275	275	275	275	
94-245											108	115	108	115	137	137	137	
000001	000002	000001	000002	000003	000004	000003	000004	000004	-	-	000005	000006	000005	000006	000007	000007	000007	
700206											- 5 ... + 40							
- 5 ... + 40											- 5 ... + 40							
•											•							
•											•							

Selection and ordering

Fixed circuit breakers

Types of VM1 (12 - 17,5 - 24 kV) fixed version circuit breakers available

Complete the circuit breaker selected with the optional accessories indicated on the following pages.

VM1 fixed circuit breaker without bottom and top terminals

Ur kV	Isc kA	Rated uninterrupted current (40 °C) [A]								Type of circuit breaker
		H = 461 D = 424 u/l = 205 l/g = 217.5 I = 150 W = 450	H = 475 D = 428 u/l = 310 l/g = 237.5 I = 210 W = 600	H = 475 D = 428 u/l = 310 l/g = 237.5 I = 210 W = 600	H = 616 D = 424 u/l = 310 l/g = 237.5 I = 275 W = 750	H = 475 D = 428 u/l = 310 l/g = 237.5 I = 210 W = 600	H = 475 D = 428 u/l = 310 l/g = 237.5 I = 275 W = 750	H = 475 D = 428 u/l = 310 l/g = 237.5 I = 275 W = 750	H = 475 D = 428 u/l = 310 l/g = 237.5 I = 275 W = 750	
	16	630								VM1 12.06.16 p150
	20	630								VM1 12.06.20 p150
	25	630								VM1 12.06.25 p150
	31,5	630								VM1 12.06.32 p150
	16	1250								VM1 12.12.16 p150
	20	1250								VM1 12.12.20 p150
	25	1250								VM1 12.12.25 p150
	31,5	1250								VM1 12.12.32 p150
	16		630							VM1 12.06.16 p210
	20		630							VM1 12.06.20 p210
	25		630							VM1 12.06.25 p210
	31,5		630							VM1 12.06.32 p210
	16		1250							VM1 12.12.16 p210
	20		1250							VM1 12.12.20 p210
	25		1250							VM1 12.12.25 p210
	31,5		1250							VM1 12.12.32 p210
	40		1250							VM1 12.12.40 p210
	50		1250							VM1 12.12.50 p210
	20			1600						VM1 12.16.20 p210
	25			1600						VM1 12.16.25 p210
	31,5			1600						VM1 12.16.32 p210
	40			1600						VM1 12.16.40 p210
	50			1600						VM1 12.16.50 p210
	20			2000						VM1 12.20.20 p210
	25			2000						VM1 12.20.25 p210
	31,5			2000						VM1 12.20.32 p210
	40			2000						VM1 12.20.40 p210
	50			2000						VM1 12.20.50 p210
	50				1250					VM1 12.12.50 p275
	20				1600					VM1 12.16.20 p275
	25				1600					VM1 12.16.25 p275
	31,5				1600					VM1 12.16.32 p275
	40				1600					VM1 12.16.40 p275
	50				1600					VM1 12.16.50 p275
	20				2000					VM1 12.20.20 p275
	25				2000					VM1 12.20.25 p275
	31,5				2000					VM1 12.20.32 p275
	40				2000					VM1 12.20.40 p275
	50				2000					VM1 12.20.50 p275



VM1 fixed circuit breaker without bottom and top terminals

Ur kV	Isc kA	Rated uninterrupted current (40 °C) [A]								Type of circuit breaker
		H = 461	H = 475	H = 475	H = 616	H = 475	H = 475	H = 475	H = 475	
		D = 424	D = 428	D = 428	D = 424	D = 428	D = 428	D = 428	D = 428	
		u/l = 205	u/l = 310							
		l/g = 217.5	l/g = 237.5							
		I = 150	I = 210	I = 210	I = 275	I = 275	I = 210	I = 275	I = 275	
		W = 450	W = 600	W = 600	W = 750	W = 700	W = 600	W = 750	W = 750	
	20				2500					VM1 12.25.20 p275
	25				2500					VM1 12.25.25 p275
	31.5				2500					VM1 12.25.32 p275
	40					2500				VM1 12.25.40 p210
	50					2500				VM1 12.25.50 p210
	40						2500			VM1 12.25.40 p275
	50						2500			VM1 12.25.50 p275
12	25							3150		VM1 12.32.25 p275
	31.5							3150		VM1 12.32.32 p275
	40							3150		VM1 12.32.40 p275
	50							3150		VM1 12.32.50 p275
	25								4000	VM1 12.40.25 p275
	31.5								4000	VM1 12.40.32 p275
	40								4000	VM1 12.40.40 p275
	50								4000	VM1 12.40.50 p275

H = Circuit breaker height.

W = Circuit breaker width.

D = Circuit breaker depth.

u/l = Distance between bottom and top terminal.

l/g = Distance between bottom terminal and circuit breaker resting surface.

I = Horizontal centre distance between poles.

Selection and ordering

Fixed circuit breakers

VM1 fixed circuit breaker without bottom and top terminals

Ur kV	Isc kA	Rated uninterrupted current (40 °C) [A]								Type of circuit breaker
		H = 461 D = 424 u/l = 205 l/g = 217.5 I = 150 W = 450	H = 475 D = 428 u/l = 310 l/g = 237.5 I = 210 W = 600	H = 475 D = 428 u/l = 310 l/g = 237.5 I = 210 W = 600	H = 616 D = 424 u/l = 310 l/g = 237.5 I = 275 W = 750	H = 475 D = 428 u/l = 310 l/g = 237.5 I = 210 W = 600	H = 475 D = 428 u/l = 310 l/g = 237.5 I = 275 W = 750	H = 475 D = 428 u/l = 310 l/g = 237.5 I = 275 W = 750	H = 475 D = 428 u/l = 310 l/g = 237.5 I = 275 W = 750	
17,5	16	630								VM1 17.06.16 p150
	20	630								VM1 17.06.20 p150
	25	630								VM1 17.06.25 p150
	31,5	630								VM1 17.06.32 p150
	16	1250								VM1 17.12.16 p150
	20	1250								VM1 17.12.20 p150
	25	1250								VM1 17.12.25 p150
	31,5	1250								VM1 17.12.32 p150
	16		630							VM1 17.06.16 p210
	20		630							VM1 17.06.20 p210
	25		630							VM1 17.06.25 p210
	31,5		630							VM1 17.06.32 p210
	16		1250							VM1 17.12.16 p210
	20		1250							VM1 17.12.20 p210
	25		1250							VM1 17.12.25 p210
	31,5		1250							VM1 17.12.32 p210
	40		1250							VM1 17.12.40 p210
	20			1600						VM1 17.16.20 p210
	25			1600						VM1 17.16.25 p210
	31,5			1600						VM1 17.16.32 p210
	40			1600						VM1 17.16.40 p210
	20				2000					VM1 17.20.20 p210
	25				2000					VM1 17.20.25 p210
	31,5				2000					VM1 17.20.32 p210
40				2000					VM1 17.20.40 p210	
20					1600				VM1 17.16.20 p275	
25					1600				VM1 17.16.25 p275	
31,5					1600				VM1 17.16.32 p275	
40					1600				VM1 17.16.40 p275	
20						2000			VM1 17.20.20 p275	
25						2000			VM1 17.20.25 p275	
31,5						2000			VM1 17.20.32 p275	
40						2000			VM1 17.20.40 p275	
40							2500		VM1 17.25.40 p210	
20							2500		VM1 17.25.20 p275	
25							2500		VM1 17.25.25 p275	
31,5							2500		VM1 17.25.32 p275	

H = Circuit breaker height.

W = Circuit breaker width.

D = Circuit breaker depth.

u/l = Distance between bottom and top terminal.

l/g = Distance between bottom terminal and circuit breaker resting surface.

I = Horizontal centre distance between poles.

VM1 fixed circuit breaker without bottom and top terminals

Ur kV	Isc kA	Rated uninterrupted current (40 °C) [A]								Type of circuit breaker
		H = 461	H = 475	H = 475	H = 616	H = 475	H = 475	H = 475	H = 475	
		D = 424	D = 428	D = 428	D = 424	D = 428	D = 428	D = 428	D = 428	
		u/l = 205	u/l = 310							
		l/g = 217.5	l/g = 237.5							
		I = 150	I = 210	I = 210	I = 275	I = 275	I = 210	I = 275	I = 275	
		W = 450	W = 600	W = 600	W = 750	W = 700	W = 600	W = 750	W = 750	
17,5	40								2500	VM1 17.25.40 p275
	25								3150	VM1 17.32.25 p275
	31.5								3150	VM1 17.32.32 p275
	40								3150	VM1 17.32.40 P275

H = Circuit breaker height.

W = Circuit breaker width.

D = Circuit breaker depth.

u/l = Distance between bottom and top terminal.

l/g = Distance between bottom terminal and circuit breaker resting surface.

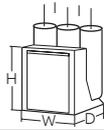
I = Horizontal centre distance between poles.

Selection and ordering

Fixed circuit breakers

VM1 fixed circuit breaker for UniGear switchgear

Circuit breaker		VM1-T12 (fixed)	VM1-T17,5 (fixed)	VM1-T24 (fixed)
Standards	IEC 62271-100	•		
Rated voltage	Ur [kV]	12	17,5	24
Withstand voltage at 50 Hz	Ud (1min) [kV]	28	38	50
Impulse withstand voltage	Up [kV]	75	95	125
Rated frequency	fr [Hz]	50-60	50-60	50-60
Rated normal current (40 °C)	Ir [A]	1250	2000	630
Rated breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	20	20	20
		25	25	25
Rated short-time withstand current (3 s)	Ik [kA]	20	20	20
		25	25	25
Making capacity	Ip [kA]	50	50	50
		63	63	63
Sequence of operations with auto-reclosing	[O - 0.3s - CO - 3min - CO]	•	•	•
Opening time	[ms]	≤16	≤16	≤16
Arc time	[ms]	≤15	≤15	≤15
Total interruption time	[ms]	≤25	≤25	≤25
Closing time	[ms]	16	16	16
Maximum overall dimensions	H [mm]	475	475	475
	W [mm]	450/570	610/750	610/750
	D [mm]	424	424	424
	Pole centre distance l [mm]	150/210	210/275	210/275
Weight	[kg]	90-140		
Operating temperature	[°C]	-5 ... +40		
Tropicalisation	IEC 60068-2-30	•		
	IEC 60721-2-1	•		
Electromagnetic compatibility	IEC 62271-1	•		



VM1 fixed circuit breaker for UniGear switchgear

Ur kV	Isc kA	Rated uninterrupted current (40 °C) [A]				Type of circuit breaker	Type of circuit breaker		
		I=150	I=210	I=210	I=275				
12	20		1250A			VM1-T 12.12.20 p210	VM1-T 12.12.20		
	25		1250A			VM1-T 12.12.25 p210	VM1-T 12.12.25		
	20			1600A		VM1-T 12.16.20 p210	VM1-T 12.16.20		
	25			1600A		VM1-T 12.16.25 p210	VM1-T 12.16.25		
	20				1600A	VM1-T 12.16.20 p275	VM1-T 12.16.20		
	25				1600A	VM1-T 12.16.25 p275	VM1-T 12.16.25		
	20					2000A	VM1-T 12.20.20 p210	VM1-T 12.20.20	
	25					2000A	VM1-T 12.20.25 p210	VM1-T 12.20.25	
	20						2000A	VM1-T 12.20.20 p275	VM1-T 12.20.20
	25						2000A	VM1-T 12.20.25 p275	VM1-T 12.20.25
	17.5	25					2000A	VM1-T 17.20.25 p210	VM1-T 17.20.25
		25						2000A	VM1-T 17.20.25 p275
24	20				1250A		VM1-T 24.12.20 p275	VM1-T 24.12.20	
	25				1250A		VM1-T 24.12.25 p275	VM1-T 24.12.25	

l = Horizontal centre distance between poles.

Standard fittings for fixed version circuit breaker

The basic versions of the fixed circuit breakers are threepole and fitted with:

- closing pushbutton (-SC1)
- opening pushbutton (-SO1)
- mechanical operation counter
- mechanical signalling device for circuit breaker open/closed
- manual emergency opening device
- lever for manual emergency opening (the quantity must be defined according to the number of pieces of apparatus ordered)
- lamp for signalling "READY" for the operation
- capacitors for energy storage for the operation
- mobile connector for direct connection to the sockets of the electronic module, for cabling the auxiliary circuits
- ED2.0 basic version control module. The following two types of feeders are available:
 - type 1: 24 ... 48 V AC / 24 .. 60 V DC
 - type 2: 100 ... 240 V AC / 110 ... 250 V DC

Preparation of the ED2.0 control module in the basic version

1) signalling contacts without potential, fitted with relay, with the following functions ⁽¹⁾:

- No. 1 contact signalling circuit breaker open (DO1)
- No. 1 contact signalling circuit breaker closed (DC1)
- No. 1 contact signalling circuit breaker ready for the operation (capacitors charged and check of circuit breaker state) (DR)
- No. 1 contact signalling circuit breaker not ready for the operation (DN, normally closed)
- No. 1 transient contact with momentary closing (for 100 ms) during the opening operation (DOR)

N.B. With the circuit breaker not supplied (without auxiliary power supply) these contacts are open, except the contact signalling circuit breaker not ready for the operation (DN).

2) binary inputs (logical inputs) for remote control:

- No. 1 input for closing control (-SC2; top active logical input)
- No. 1 input for opening control (-SO2; top active logical input)
- No. 1 input for additional opening control (-SO3; top active logical input)
- No. 1 input for circuit breaker opening on direct command from the PR512 protection release (-SO5; top active logical input)

- No. 1 input for lock on closing control (the same function as the one carried out by the locking electromagnet in the mechanical operating mechanism of the VD4 circuit breaker) (-SL1; bottom active logical input).

The binary inputs can be supplied as follows:

- 24 ... 240 V AC (tolerance – 15% ... + 10%)
- 24 ... 250 V DC (tolerance – 30% ... + 10%).

The minimum duration of the impulse for it to be considered valid is 20 ms.

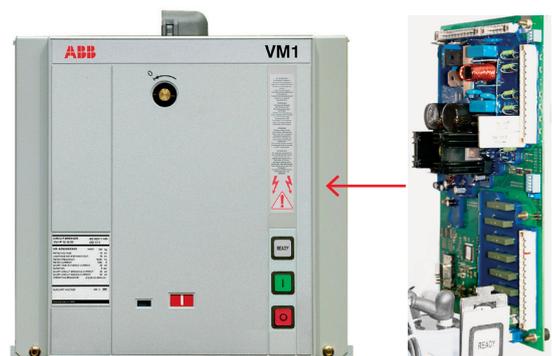
The functions carried out by the control module are:

- self-opening following detection of the incorrect state of the circuit breaker after an attempt to operate
- self-opening following charging threshold of the capacitors lower than the minimum value required for the opening operation
- anti-pumping relay function
- priority opening function in the case of simultaneous transmission of the opening and closing commands (TRIP-FREE)
- monitoring of capacitor charging with feeder turning itself off in the case of exceeding the maximum charging level
- management of opening attempts: after 10 unsuccessful attempts, the control electronics block and the DR and DN signalling contacts are activated to indicate that the circuit breaker is not ready for the operation
- reclosing function according to the ANSI (ANSI RECLOSE) standards.

These functions can be disabled by means of dip-switches in the card ⁽²⁾.

(1) For the characteristics of the contacts without potential see chapter "Specific product characteristics".

(2) Changing the settings by means of dip-switches must take place with the control module not supplied and capacitor discharged because the selections set and/or modified are only acquired by the control electronics at the moment it is turned on.



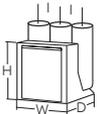
Selection and ordering

Withdrawable circuit breakers

General characteristics of withdrawable VM1 circuit breakers for UniGear switchgear (12 - 17.5 - 24 kV)



Circuit breaker	VM1/P 12 ⁽³⁾										
Standards	IEC 62271-100 • CEI 17-1 (File 1375) •										
Rated voltage	Ur [kV] 12										
Rated insulation voltage	Us [kV] 12										
Withstand voltage at 50 Hz	Ud (1 min) [kV] 28										
Impulse withstand voltage	Up [kV] 75										
Rated frequency	fr [Hz] 50-60										
Rated normal current (40 °C)	⁽¹⁾ Ir [A] 630 1250 1250 1600 1600 2000 2000 2500 3150 4000 ⁽⁴⁾										
Rated breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	16	16	-	-	-	-	-	-	-	-
		20	20	-	20	20	20	20	20	-	-
		25	25	-	25	25	25	25	25	25	25
		31.5	31.5	-	31.5	31.5	31.5	31.5	31.5	31.5	31.5
		-	-	40	40	40	-	40	40	40	40
		-	-	50	50	50	-	50	50	50	50
Rated short-time withstand current (3 s)	Ik [kA]	16	16	-	-	-	-	-	-	-	-
		20	20	-	20	20	20	20	20	-	-
		25	25	-	25	25	25	25	25	25	25
		31.5	31.5	-	31.5	31.5	31.5	31.5	31.5	31.5	31.5
		-	-	40	40	40	-	40	40	40	40
		-	-	50	50	50	-	50	50	50	50
Making capacity	Ip [kA]	40	40	-	-	-	-	-	-	-	-
		50	50	-	50	50	50	50	50	-	-
		63	63	-	63	63	63	63	63	63	63
		80	80	-	80	80	80	80	80	80	80
		-	-	100	100	100	-	100	100	100	100
		-	-	125	125	125	-	125	125	125	125
Operation sequence	•										
Opening time	[ms] 35...50										
Arc time	[ms] < 15										
Total interruption time	[ms] < 60										
Closing time	[ms] 45...60										
Mechanical operations (cycles)	Actuator ... 100.000										
	Interrupters ... 30.000										
Electrical operations (cycles)	Rated current ... 30.000										
	Under short-circuit ... 50										
Maximum overall dimensions	H [mm] 550-1000										
	W [mm] 450/570/600/750										
	D [mm] 428										
	Pole centre distance l [mm] 150 150 210 210 275 210 275 275 275 275										
Weight	≤25 kA [kg] -										
Standardised table of dimensions	31.5 kA [kg] 215-290										
	1VCD 000008 000008 - 000009 000010 000011 - - - -										
	(>31.5kA or >2500A) 1VBM 704912										
Operating temperature	[°C] - 5 ... + 40										
Tropicalisation	IEC: 60068-2-30; 60721-2-1 •										
Electromagnetic compatibility	IEC: 62271-1 •										



(1) Rated uninterrupted currents guaranteed with withdrawable circuit breaker installed in switchgear with 40 °C air temperature.

(2) The 2300 A rated uninterrupted current is guaranteed with natural ventilation. The 2500 A rated uninterrupted current is guaranteed with forced ventilation.

(3) The circuit breakers up to 17.5 kV - 1250 A - 31.5 kA, are made with polyamide poles.

(4) 4000 A guaranteed with forced ventilation

VM1/P 17 ⁽³⁾										VM1/P 24							
.										.							
.										.							
17.5										24							
17.5										24							
38										50							
95										125							
50-60										50-60							
630	1250	1250	1600	1600	2000	2000	2500	3150	4000 ⁽⁴⁾	630	630	1250	1250	1600	2000	2500 ⁽²⁾	
16	16	-	-	-	-	-	-	-	-	16	16	16	16	16	16	16	
20	20	-	20	20	20	20	20	-	20	20	20	20	20	20	20	20	
25	25	-	25	25	25	25	25	25	25	25	25	25	25	25	25	25	
31.5	31.5	-	31.5	31.5	31.5	31.5	31.5	31	31	-	-	-	-	-	-	-	
-	-	40	-	40	-	40	40	40	40	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
16	16	-	-	-	-	-	-	-	-	16	16	16	16	16	16	16	
20	20	-	20	20	20	20	20	-	20	20	20	20	20	20	20	20	
25	25	-	25	25	25	25	25	25	25	25	25	25	25	25	25	25	
31.5	31.5	-	31.5	31.5	31.5	31.5	31.5	31	31	-	-	-	-	-	-	-	
-	-	40	-	40	-	40	40	40	40	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
40	40	-	-	-	-	-	-	-	-	40	40	40	40	40	40	40	
50	50	-	50	50	50	50	50	-	-	50	50	50	50	50	50	50	
63	63	-	63	63	63	63	63	-	50	63	63	63	63	63	63	63	
80	80	-	80	80	80	80	80	63	63	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	80	80	-	-	-	-	-	-	-	
-	-	100	-	100	-	100	100	100	100	-	-	-	-	-	-	-	
.										.							
35...45										35...45							
< 15										10...15							
< 60										45...60							
45...60										50...60							
... 100.000										... 100.000							
... 30.000										... 30.000							
... 30.000										... 30.000							
... 50										... 50							
550-1000										790	790	790	790	834	834	834	
450/570/600/750										653	853	653	853	853	853	853	
428										802	802	802	802	790	790	790	
150	150	210	210	275	210	275	275	275	275	210	275	210	275	275	275	275	
-										148	152	148	152	255	255	255	
215-290										-	-	-	-	-	-	-	
000008 000008 -	000009	000010	000009	000010	000011	-	-	-	-	000012	000013	000012	000013	000014	000014	000014	
704912										-	-	-	-	-	-	-	
- 5 ... + 40										- 5 ... + 40							
.										.							
.										.							

Selection and ordering

Withdrawable circuit breakers

Types of withdrawable version circuit breakers available for UniGear switchgear (12 - 17,5 - 24 kV)

Complete the circuit breaker selected with the optional accessories indicated on the following pages.

VM1/P withdrawable circuit breaker for UniGear switchgear

Ur kV	Isc kA	Rated uninterrupted current (40 °C) [A]							Type of circuit breaker
		W = 650 l = 150 u/l = 205 ø = 35	W = 800 l = 210 u/l = 310 ø = 79	W = 1000 l = 275 u/l = 310 ø = 79	W = 1000 l = 275 u/l = 310 ø = 109	W = 800 l = 210 u/l = 310 ø = 35	W = 1000 l = 275 u/l = 310 ø = 109	W = 1000 l = 275 u/l = 310 ø = 109	
12	16	630							VM1/P 12.06.16 p150
	20	630							VM1/P 12.06.20 p150
	25	630							VM1/P 12.06.25 p150
	31.5	630							VM1/P 12.06.32 p150
	40		1250						VM1/P 12.12.40 p210
	50		1250						VM1/P 12.12.50 p210
	20		1600						VM1/P 12.16.20 p210
	25		1600						VM1/P 12.16.25 p210
	31.5		1600						VM1/P 12.16.32 p210
	40		1600						VM1/P 12.16.40 p210
	50		1600						VM1/P 12.16.50 p210
	20		2000						VM1/P 12.20.20 p210
	25		2000						VM1/P 12.20.25 p210
	31.5		2000						VM1/P 12.20.32 p210
	20			1600					VM1/P 12.16.20 p275
	25			1600					VM1/P 12.16.25 p275
	31.5			1600					VM1/P 12.16.32 p275
	40			1600					VM1/P 12.16.40 p275
	50			1600					VM1/P 12.16.50 p275
	20			2000					VM1/P 12.20.20 p275
	25			2000					VM1/P 12.20.25 p275
	31.5			2000					VM1/P 12.20.32 p275
	40				2000				VM1/P 12.20.40 p275
	50				2000				VM1/P 12.20.50 p275
	20				2500				VM1/P 12.25.20 p275
	25				2500				VM1/P 12.25.25 p275
	31.5				2500				VM1/P 12.25.32 p275
	40				2500				VM1/P 12.25.40 p275
	50				2500				VM1/P 12.25.50 p275
	25					3150			VM1/P 12.32.25 p275
	31.5					3150			VM1/P 12.32.32 p275
40					3150			VM1/P 12.32.40 p275	
50					3150			VM1/P 12.32.50 p275	
25						4000		VM1/P 12.40.25 p275	
31.5						4000		VM1/P 12.40.32 p275	
40						4000		VM1/P 12.40.40 p275	
50						4000		VM1/P 12.40.50 p275	

W = Width of the switchgear.

l = Horizontal centre distance between poles.

u/l = Distance between bottom and top terminal.

ø = Diameter of isolating contact.

VM1/P withdrawable circuit breaker for UniGear switchgear

Ur kV	Isc kA	Rated uninterrupted current (40 °C) [A]							Type of circuit breaker
		W = 650 l = 150 u/l = 205 ø = 35	W = 800 l = 210 u/l = 310 ø = 79	W = 1000 l = 275 u/l = 310 ø = 79	W = 1000 l = 275 u/l = 310 ø = 109	W = 800 l = 210 u/l = 310 ø = 35	W = 1000 l = 275 u/l = 310 ø = 109	W = 1000 l = 275 u/l = 310 ø = 109	
	16	630							VM1/P 17.06.16 p150
	20	630							VM1/P 17.06.20 p150
	25	630							VM1/P 17.06.25 p150
	31.5	630							VM1/P 17.06.32 p150
	16	1250							VM1/P 17.12.16 p150
	20	1250							VM1/P 17.12.20 p150
	25	1250							VM1/P 17.12.25 p150
	31.5	1250							VM1/P 17.12.32 p150
	40		1250						VM1/P 17.12.40 p210
	20		1600						VM1/P 17.16.20 p210
	25		1600						VM1/P 17.16.25 p210
	31.5		1600						VM1/P 17.16.32 p210
	20		2000						VM1/P 17.20.20 p210
	25		2000						VM1/P 17.20.25 p210
	31.5		2000						VM1/P 17.20.32 p210
	20			1600					VM1/P 17.16.20 p275
	25			1600					VM1/P 17.16.25 p275
	31.5			1600					VM1/P 17.16.32 p275
	40			1600					VM1/P 17.16.40 p275
	20			2000					VM1/P 17.20.20 p275
	25			2000					VM1/P 17.20.25 p275
	31.5			2000					VM1/P 17.20.32 p275
	40				2000				VM1/P 17.20.40 p275
	20				2500				VM1/P 17.25.20 p275
	25				2500				VM1/P 17.25.25 p275
	31.5				2500				VM1/P 17.25.32 p275
	40					2500			VM1/P 17.25.40 p275
	25					3150			VM1/P 17.32.25 p275
	31.5					3150			VM1/P 17.32.32 p275
	40					3150			VM1/P 17.32.40 p275
	20						4000		VM1/P 17.40.20 p275
	25						4000		VM1/P 17.40.25 p275
	31.5						4000		VM1/P 17.40.32 p275
	40						4000		VM1/P 17.40.40 p275

W = Width of the switchgear.

l = Horizontal centre distance between poles.

u/l = Distance between bottom and top terminal.

ø = Diameter of isolating contact.

Selection and ordering

Withdrawable circuit breakers

VM1/P withdrawable circuit breaker for UniGear switchgear

Ur kV	Isc kA	Rated uninterrupted current (40 °C) [A]							Type of circuit breaker	
		W = 650	W = 800	W = 1000	W = 1000	W = 800	W = 1000	W = 1000		
		I = 150	I = 210	I = 275	I = 275	I = 210	I = 275	I = 275		
		u/I = 205	u/I = 310							
		ø = 35	ø = 79	ø = 79	ø = 109	ø = 35	ø = 35	ø = 79		
24	16	630							VM1/P 24.06.16 p210	
	20	630							VM1/P 24.06.20 p210	
	25	630							VM1/P 24.06.25 p210	
	16	1250							VM1/P 24.12.16 p210	
	20	1250							VM1/P 24.12.20 p210	
	25	1250							VM1/P 24.12.25 p210	
	16						630		VM1/P 24.06.16 p275	
	20						630		VM1/P 24.06.20 p275	
	25						630		VM1/P 24.06.25 p275	
	16						1250		VM1/P 24.12.16 p275	
	20						1250		VM1/P 24.12.20 p275	
	25						1250		VM1/P 24.12.25 p275	
	16						1600		VM1/P 24.16.16 p275	
	20						1600		VM1/P 24.16.20 p275	
	25						1600		VM1/P 24.16.25 p275	
	16						2000		VM1/P 24.20.16 p275	
	20						2000		VM1/P 24.20.20 p275	
	25						2000		VM1/P 24.20.25 p275	
	16						2300		VM1/P 24.25.16 p275	
	20						2300		VM1/P 24.25.20 p275	
	25						2300		VM1/P 24.25.25 p275	
	16						2500		VM1/P 24.25.16 p275	
	20						2500		VM1/P 24.25.20 p275	
	25						2500		VM1/P 24.25.25 p275	

W = Width of the switchgear.

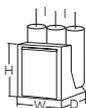
I = Horizontal centre distance between poles.

u/I = Distance between bottom and top terminal.

ø = Diameter of isolating contact.

VM1/P withdrawable circuit breaker for UniGear switchgear

Circuit breaker	VM1-T 12 (withdrawable)					VM1-T 24 (withdrawable)
	Standards	IEC 62271-100 •				
Rated voltage	Ur [kV]	12	12	12	12	24
Withstand voltage at 50 Hz	Ud (1min) [kV]	28	28	28	28	50
Impulse withstand voltage	Up [kV]	75	75	75	75	125
Rated frequency	fr [Hz]	50-60	50-60	50-60	50-60	50-60
Rated normal current (40 °C)	Ir [A]	630	1250	1600	2000	1250
Rated breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	16				
		20	20	20	20	20
Rated short-time withstand current (3 s)	Ik [kA]	16				
		20	20	20	20	20
Making capacity	Ip [kA]	40				
		50	50	50	50	50
Sequence of operations with auto-reclosing	[O - 0.3s - CO - 3min - CO] •	•	•	•	•	•
Opening time	[ms]	<=10	<=10	<=10	<=10	<=10
Arc time	[ms]	<=15	<=15	<=15	<=15	<=15
Total interruption time	[ms]	<=25	<=25	<=25	<=25	<=25
Closing time	[ms]	16	16	16	16	16
Maximum overall dimensions	H [mm]	628	628	688	688	788
	W [mm]	503	503	653	653	653
	D [mm]	609	609	569	569	474
	Pole centre distance l [mm]	150	150	210	210	210
Weight	[kg]	127	131	135	135	142
Operating temperature	[°C]	- 5 ... + 40				
Tropicalisation	IEC 60068-2-30 •					
	IEC 60721-2-1 •					
Electromagnetic compatibility	IEC 62271-1 •					

**VM1/P withdrawable circuit breaker for UniGear switchgear**

Ur kV	Isc kA	Rated uninterrupted current (40 °C) [A]		Type of circuit breaker
		l=150	l=210	
12	16	630A		VM1-T 12.06.25 p150
	16	1250A		VM1-T 12.12.16 p150
	20	1250A		VM1-T 12.12.20 p150
	25	1250A		VM1-T 12.12.25 p150
	20	1600A		VM1-T 12.16.20 p210
	25	1600A		VM1-T 12.16.25 p210
	25	2000A		VM1-T 12.20.25 p210
24	20	1250A		VM1-T 24.12.20 p210

l = Horizontal centre distance between poles.

Selection and ordering

Withdrawable circuit breakers

Standard fittings for withdrawable circuit breakers for UniGear switchgear

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

- closing pushbutton (-SC1)
 - opening pushbutton (-SO1)
 - mechanical operation counter
 - mechanical signalling device for circuit breaker open/closed
 - manual emergency opening device
 - lever for manual emergency opening (the quantity must be defined according to the number of pieces of apparatus ordered)
 - lamp for signalling "READY" for the operation
- capacitors for energy storage for the operation
 - isolating contacts
 - cord with connector (plug only) for auxiliary circuits, with striker pin which does not allow insertion 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)
 - ED2.0 basic version control module. The following two types of feeders are available:
 - type 1: 24 ... 48 V AC / 24 .. 60 V DC
 - type 2: 100 ... 240 V AC / 110 ... 250 V DC



Preparation of the ED2.0 control module in the basic version

1) signalling contacts without potential, fitted with relay, with the following functions ⁽¹⁾:

- No. 1 contact signalling circuit breaker open (DO1)
- No. 1 contact signalling circuit breaker closed (DC1)
- No. 1 contact signalling circuit breaker ready for the operation (capacitors charged and check of circuit breaker state) (DR)
- No. 1 contact signalling circuit breaker not ready for the operation (DN, normally closed)
- No. 1 transient contact with momentary closing (for 100 ms) during the opening operation (DOR)

N.B. With the circuit breaker not supplied (without auxiliary power supply) these contacts are open, except the contact signalling circuit breaker not ready for the operation (DN).

2) binary inputs (logical inputs) for remote control:

- No. 1 input for closing control (-SC2; top active logical input)
- No. 1 input for opening control (-SO2; top active logical input)
- No. 1 input for additional opening control (-SO3; top active logical input)
- No. 1 input for circuit breaker opening on direct command from the PR512 protection release (-SO5; top active logical input)
- No. 1 input for lock on closing control (the same function as the one carried out by the locking electromagnet in the mechanical operating mechanism of the VD4 circuit breaker)(-SL1; bottom active logical input).

The binary inputs can be supplied as follows:

- 24 ... 240 V AC (tolerance – 15% ... + 10%)
- 24 ... 250 V DC (tolerance – 30% ... + 10%).

The minimum duration of the impulse for it to be considered valid is 20 ms.

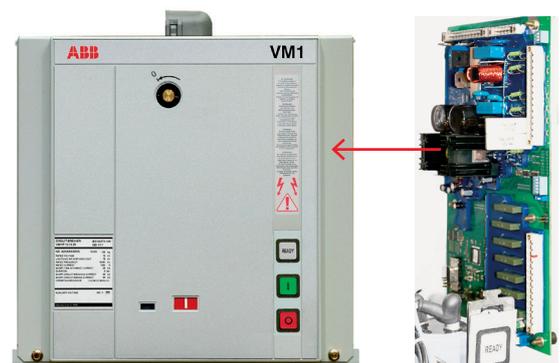
The functions carried out by the control module are:

- self-opening following detection of the incorrect state of the circuit breaker after an attempt to operate
- self-opening following charging threshold of the capacitors lower than the minimum value required for the opening operation
- anti-pumping relay function
- priority opening function in the case of simultaneous transmission of the opening and closing commands (TRIP-FREE)
- monitoring of capacitor charging with feeder turning itself off in the case of exceeding the maximum charging level
- management of opening attempts: after 10 unsuccessful attempts, the control electronics block and the DR and DN signalling contacts are activated to indicate that the circuit breaker is not ready for the operation
- reclosing function according to the ANSI (ANSI RECLOSE) standards.

These functions can be disabled by means of dip-switches in the card ⁽²⁾.

(1) For the characteristics of the contacts without potential see chapter "Specific product characteristics".

(2) Changing the settings by means of dip-switches must take place with the control module not supplied and capacitor discharged because the selections set and/or modified are only acquired by the control electronics at the moment it is turned on.

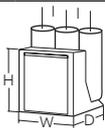


Selection and ordering

Withdrawable circuit breakers

General characteristics of VM1 withdrawable circuit breakers for PowerCube modules (12 - 17.5 - 24 kV)

Circuit breaker	VM1/P 12					VM1/P 17					
	PowerCube module	PB1	PB1	PB2	PB2	PB3	PB1	PB1	PB2	PB2	PB3
Standards	IEC 62271-100	•					•				
	CEI 17-1 (File 1375)	•					•				
Rated voltage	Ur [kV]	12					17.5				
Rated insulation voltage	Us [kV]	12					17.5				
Withstand voltage at 50 Hz	Ud (1 min) [kV]	28					38				
Impulse withstand voltage	Up [kV]	75					95				
Rated frequency	fr [Hz]	50-60					50-60				
Rated normal current (40 °C) ⁽¹⁾	Ir [A]	630	1250	1600	2000	2500	630	1250	1600	2000	2500
		16	16	–	–	–	16	16	–	–	–
Rated breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	20	20	20	20	20	20	20	20	20	20
		25	25	25	25	25	25	25	25	25	25
		31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5
		–	–	–	–	–	–	–	–	–	–
		–	–	–	–	–	–	–	–	–	–
Rated short-time withstand current (3 s)	Ik [kA]	16	16	–	–	–	16	16	–	–	–
		20	20	20	20	20	20	20	20	20	20
		25	25	25	25	25	25	25	25	25	25
		31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5
Making capacity	Ip [kA]	40	40	–	–	–	40	40	–	–	–
		50	50	50	50	50	50	50	50	50	50
		63	63	63	63	63	63	63	63	63	63
		80	80	80	80	80	80	80	80	80	80
Operation sequence	[O-0.3s-CO-3min-CO]	•					•				
Opening time	[ms]	35...45					35...45				
Arc time	[ms]	10...15					10...15				
Total interruption time	[ms]	45...60					45...60				
Closing time	[ms]	50...60					50...60				
Mechanical operations (cycles)	Actuator	... 100,000					... 100,000				
	Interrupters	... 30,000					... 30,000				
Electrical operations (cycles)	Rated current	... 30,000					... 30,000				
	Under short-circuit	... 50					... 50				
Maximum overall dimensions	H [mm]	628	628	690	690	690	628	628	690	690	690
	W [mm]	503	503	653	653	853	503	503	653	653	853
	D [mm]	662	662	642	642	642	662	662	642	642	642
	Pole centre distance I [mm]	150	150	210	210	275	150	150	210	210	275
Weight	≤25 kA [kg]	137	137	192	192	196	137	137	192	192	196
	31,5 kA [kg]	144	144	192	192	196	144	144	192	192	196
Standardised table of dimensions	1VCD	00008	00008	00009	00009	00011	00008	00008	00009	00009	00011
Operating temperature	[°C]	– 5 ... + 40					– 5 ... + 40				
Tropicalisation	IEC: 60068-2-30; 60721-2-1	•					•				
Electromagnetic compatibility	IEC: 62271-1	•					•				



(1) Rated uninterrupted currents guaranteed with withdrawable circuit breaker installed in switchgear with 40 °C air temperature.

(2) The 2300 A rated uninterrupted current is guaranteed with natural ventilation. The 2500 A rated uninterrupted current is guaranteed with forced ventilation.

(3) The circuit breakers up to 17.5 kV - 1250 A - 31.5 kA, are made with polyamide poles.

VM1/P 24					VM1/W 12 ⁽³⁾		VM1/W 17 ⁽³⁾	
PB4	PB4	PB5	PB5	PB5	PB2	PB2	PB2	PB2
.					.		.	
.					.		.	
24					12		17.5	
24					12		17.5	
50					28		38	
125					75		95	
50-60					50-60		50-60	
630	1250	1600	2000	2500	630	1250	630	1250
16	16	16	16	16	16	16	16	16
20	20	20	20	20	20	20	20	20
25	25	25	25	25	25	25	25	25
-	-	-	-	-	31.5	31.5	31.5	31.5
16	16	16	16	16	16	16	16	16
20	20	20	20	20	20	20	20	20
25	25	25	25	25	25	25	25	25
-	-	-	-	-	31.5	31.5	31.5	31.5
40	40	40	40	40	40	40	40	40
50	50	50	50	50	50	50	50	50
63	63	63	63	63	63	63	63	63
-	-	-	-	-	80	80	80	80
.					.		.	
35...45					35...45		35...45	
10...15					10...15		10...15	
45...60					45...60		45...60	
50...60					50...60		50...60	
... 100,000					... 100,000		... 100,000	
... 30,000					... 30,000		... 30,000	
... 30,000					... 30,000		... 30,000	
... 50					... 50		... 50	
790	790	834	834	834	632	632	632	632
653	653	853	853	853	503	503	503	503
802	802	790	790	790	664	664	664	664
210	210	275	275	275	210	210	210	210
148	148	255	255	255	141	141	141	141
-	-	-	-	-	148	148	148	148
00012	00012	00014	00014	00014	00074	00074	00074	00074
- 5 ... + 40					- 5 ... + 40			
.					.		.	
.					.		.	

Selection and ordering

Withdrawable circuit breakers

Types of VM1 withdrawable version circuit breakers available for PowerCube modules (12 - 17,5 - 24 kV)

Complete the circuit breaker selected with the optional accessories indicated on the following pages.

VM1/P - VM1/W withdrawable circuit breaker for PowerCube modules

Ur kV	Isc kA	Rated uninterrupted current (40 °C) [A]						Type of circuit breaker
		W = 600 l = 150 u/l = 205 ø = 35	W = 750 l = 210 u/l = 310 ø = 35	W = 750 l = 210 u/l = 310 ø = 79	W = 1000 l = 275 u/l = 310 ø = 109	W = 750 l = 210 u/l = 310 ø = 35	W = 1000 l = 275 u/l = 310 ø = 79	
PowerCube		PB1	PB2	PB2	PB3	PB4	PB5	
12	16	630						VM1/P 12.06.16 p150
	20	630						VM1/P 12.06.20 p150
	25	630						VM1/P 12.06.25 p150
	31.5	630						VM1/P 12.06.32 p150
	16	1250						VM1/P 12.12.16 p150
	20	1250						VM1/P 12.12.20 p150
	25	1250						VM1/P 12.12.25 p150
	31.5	1250						VM1/P 12.12.32 p150
	16		630					VM1/W 12.06.16 p210
	20		630					VM1/W 12.06.20 p210
	25		630					VM1/W 12.06.25 p210
	31.5		630					VM1/W 12.06.32 p210
	16		1250					VM1/W 12.12.16 p210
	20		1250					VM1/W 12.12.20 p210
	25		1250					VM1/W 12.12.25 p210
	31.5		1250					VM1/W 12.12.32 p210
	20				1600			VM1/P 12.16.20 p210
	25				1600			VM1/P 12.16.25 p210
	31.5				1600			VM1/P 12.16.32 p210
	20				2000			VM1/P 12.20.20 p210
25				2000			VM1/P 12.20.25 p210	
31.5				2000			VM1/P 12.20.32 p210	
20					2500		VM1/P 12.25.20 p275	
25					2500		VM1/P 12.25.25 p275	
31.5					2500		VM1/P 12.25.32 p275	

W = Width of the switchgear.

l = Horizontal centre distance between poles.

u/l = Distance between bottom and top terminal.

ø = Diameter of isolating contact.

VM1/P - VM1/W withdrawable circuit breaker for PowerCube modules

Ur kV	Isc kA	Rated uninterrupted current (40 °C) [A]						Type of circuit breaker	
		W = 600 l = 150 u/l = 205 ø = 35	W = 750 l = 210 u/l = 310 ø = 35	W = 750 l = 210 u/l = 310 ø = 79	W = 1000 l = 275 u/l = 310 ø = 109	W = 750 l = 210 u/l = 310 ø = 35	W = 1000 l = 275 u/l = 310 ø = 79		
PowerCube		PB1	PB2	PB2	PB3	PB4	PB5		
17,5	16	630						VM1/P 17.06.16 p150	
	20	630						VM1/P 17.06.20 p150	
	25	630						VM1/P 17.06.25 p150	
	31,5	630						VM1/P 17.06.32 p150	
	16	1250						VM1/P 17.12.16 p150	
	20	1250						VM1/P 17.12.20 p150	
	25	1250						VM1/P 17.12.25 p150	
	31,5	1250						VM1/P 17.12.32 p150	
	16		630					VM1/W 17.06.16 p210	
	20		630					VM1/W 17.06.20 p210	
	25		630					VM1/W 17.06.25 p210	
	31,5		630					VM1/W 17.06.32 p210	
	16		1250					VM1/W 17.12.16 p210	
	20		1250					VM1/W 17.12.20 p210	
	25		1250					VM1/W 17.12.25 p210	
	31,5		1250					VM1/W 17.12.32 p210	
	20				1600			VM1/P 17.16.20 p210	
	25				1600			VM1/P 17.16.25 p210	
	31,5				1600			VM1/P 17.16.32 p210	
	20				2000			VM1/P 17.20.20 p210	
	25				2000			VM1/P 17.20.25 p210	
	31,5				2000			VM1/P 17.20.32 p210	
	20					2500		VM1/P 17.25.20 p275	
	25					2500		VM1/P 17.25.25 p275	
	31,5					2500		VM1/P 17.25.32 p275	
	24	16					630		VM1/P 24.06.16 p210
		20					630		VM1/P 24.06.20 p210
		25					630		VM1/P 24.06.25 p210
16						1250		VM1/P 24.12.16 p210	
20						1250		VM1/P 24.12.20 p210	
25						1250		VM1/P 24.12.25 p210	
16							1600	VM1/P 24.16.16 p275	
20							1600	VM1/P 24.16.20 p275	
25							1600	VM1/P 24.16.25 p275	
16							2000	VM1/P 24.20.16 p275	
20							2000	VM1/P 24.20.20 p275	
25							2000	VM1/P 24.20.25 p275	

W = Width of the switchgear.

l = Horizontal centre distance between poles.

u/l = Distance between bottom and top terminal.

ø = Diameter of isolating contact.

Selection and ordering

Withdrawable circuit breakers

Standard fittings for withdrawable circuit breakers for PowerCube modules

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

- closing pushbutton (-SC1)
- opening pushbutton (-SO1)
- mechanical operation counter
- mechanical signalling device for circuit breaker open/closed
- manual emergency opening device
- lever for manual emergency opening (the quantity must be defined according to the number of pieces of apparatus ordered)
- lamp for signalling "READY" for the operation
- capacitors for energy storage for the operation
- isolating contacts
- cord with connector (plug only) for auxiliary circuits, with striker pin which does not allow insertion 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)
- ED2.0 basic version control module. The following two types of feeders are available:
 - type 1: 24 ... 48 V AC / 24 .. 60 V DC
 - type 2: 100 ... 240 V AC / 110 ... 250 V DC

Preparation of the ED2.0 control module in the basic version

- 1) signalling contacts without potential, fitted with relay, with the following functions ⁽¹⁾:
- No. 1 contact signalling circuit breaker open (DO1)
 - No. 1 contact signalling circuit breaker closed (DC1)
 - No. 1 contact signalling circuit breaker ready for the operation (capacitors charged and check of circuit breaker state) (DR)
 - No. 1 contact signalling circuit breaker not ready for the operation (DN, normally closed)
 - No. 1 transient contact with momentary closing during the opening operation (DOR)
- N.B. With the circuit breaker not supplied (without auxiliary power supply) these contacts are open, except the contact signalling circuit breaker not ready for the operation (DN).

2) binary inputs (logical inputs) for remote control:

- No. 1 input for closing control (-SC2; top active logical input)
- No. 1 input for opening control (-SO2; top active logical input)
- No. 1 input for additional opening control (-SO3; top active logical input)
- No. 1 input for circuit breaker opening on direct command from the PR512 protection release (-SO5; top active logical input)
- No. 1 input for lock on closing control (the same function as the one carried out by the locking electromagnet in the mechanical operating mechanism of the VD4 circuit breaker)(-SL1; bottom active logical input).

The binary inputs can be supplied as follows:

- 24 ... 240 V AC (tolerance – 15% ... + 10%)
- 24 ... 250 V DC (tolerance – 30% ... + 10%).

The minimum duration of the impulse for it to be considered valid is 20 ms.

The functions carried out by the control module are:

- self-opening following detection of the incorrect state of the circuit breaker after an attempt to operate
- self-opening following charging threshold of the capacitors lower than the minimum value required for the opening operation
- anti-pumping relay function
- priority opening function in the case of simultaneous transmission of the opening and closing commands (TRIP-FREE)
- monitoring of capacitor charging with feeder turning itself off in the case of exceeding the maximum charging level
- management of opening attempts: after 10 unsuccessful attempts, the control electronics block and the DR and DN signalling contacts are activated to indicate that the circuit breaker is not ready for the operation
- reclosing function according to the ANSI (ANSI RECLOSE) standards.

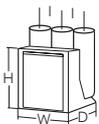
These functions can be disabled by means of dip-switches in the card ⁽²⁾.

(1) For the characteristics of the contacts without potential see chapter "Specific product characteristics".

(2) Changing the settings by means of dip-switches must take place with the control module not supplied and capacitor discharged because the selections set and/or modified are only acquired by the control electronics at the moment it is turned on.

General characteristics of VM1 withdrawable circuit breakers for UniGear switchgear ZS/Z8

Circuit breaker	VM1/Z8 12		VM1/Z8 17		VM1/Z8 24		
Standards	IEC 62271-100 •		•		•		
	CEI 17-1 (File 1375) •		•		•		
Rated voltage	Ur [kV] 12		17.5		17.5		
Rated insulation voltage	Us [kV] 12		17.5		17.5		
Withstand voltage at 50 Hz	Ud (1 min) [kV] 28		38		38		
Impulse withstand voltage	Up [kV] 75		95		95		
Rated frequency	fr [Hz] 50-60		50-60		50-60		
Rated normal current (40 °C) (1)	Ir [A] 630		1250		630		
	1250		630		1250		
Rated breaking capacity (rated symmetrical short-circuit current)	16		16		16		
	20		20		20		
	Isc [kA]	25		-		25	
		-		-		-	
		-		-		-	
		-		-		-	
Rated short-time withstand current (3 s)	16		16		16		
	20		20		20		
	Ik [kA]	25		-		25	
		-		-		-	
		-		-		-	
		-		-		-	
Making capacity	40		40		40		
	50		50		50		
	Ip [kA]	63		-		63	
		-		-		-	
		-		-		-	
		-		-		-	
Operation sequence	[O-0.3s-CO-3min-CO] •		•		•		
Opening time	[ms] 35...50		35...50		35...50		
Arc time	[ms] 10...15		10...15		10...15		
Total interruption time	[ms] 45...65		45...65		45...65		
Closing time	[ms] 45...60		45...60		45...60		
Mechanical operations (cycles)	Actuatore ... 100,000		... 100,000		... 100,000		
	Interrupters ... 30,000		... 30,000		... 30,000		
Electrical operations (cycles)	Rated current ... 30,000		... 30,000		... 30,000		
	Under short-circuit ... 50		... 50		... 50		
Maximum overall dimensions	H [mm] -		-		-		
	W [mm] -		-		-		
	D [mm] -		-		-		
	Pole centre distance l [mm] 150		150		210		
Weight	≤ 25 kA [kg] -		-		-		
	31,5 kA [kg] -		-		-		
Standardised table of dimensions	1VBM -		-		-		
Operating temperature	[°C] - 5 ... + 40		- 5 ... + 40		- 5 ... + 40		
Tropicalisation	IEC: 60068-2-30; 60721-2-1 •		•		•		
Electromagnetic compatibility	IEC: 62271-1 •		•		•		



Selection and ordering

Accessories on request

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

1 Control module with full options

The ED2.0 control module with full options is available on request as alternative to the basic version ED2.0 control module and must be selected during the ordering stage since replacement of the basic module is not foreseen. The ED2.0 control module with full options is available with two types of feeders:

- type 1: 24 ... 48 V AC / 24 ... 60 V DC
- type 2: 100 ... 240 V AC / 110 ... 250 V DC

and provides the following signalling, command and control functions:

- 1) signalling contacts without potential, fitted with relay, with the following functions ⁽¹⁾ ⁽²⁾:
- No. 2 contacts signalling circuit breaker open (DO1, DO2)
 - No. 2 contacts signalling circuit breaker closed (DC1, DC2)

- No. 1 contact signalling circuit breaker ready for the operation (DR). It is a closed contact when the circuit breaker is ready for the operations, i.e. when the following conditions are satisfied:
 - capacitor charged (the stored energy is sufficient to carry out a closing and opening operation if the circuit breaker is in the “open” state, or an opening operation if the circuit breaker is in the “closed” state),
 - circuit breaker in a well-defined state (either “open” or “closed”),
 - positive outcome of the magnetic actuator opening and closing coil continuity check.
- No. 1 contact signalling circuit breaker not ready for the operation (DN). This contact is of the normally closed type therefore, even when there is no auxiliary voltage, its indication “the circuit breaker is not ready for the operation” is always correct; there is the indication of circuit breaker not ready for the operation when one of the following conditions occurs:
 - capacitor not charged (the stored energy is insufficient or there is no auxiliary voltage),
 - circuit breaker in an undefined state (neither “open” nor “closed”),
 - lack of magnetic actuator opening and closing coil continuity
- No. 1 transient contact with momentary closing (for 100ms) during the opening operation (DOR). This contact has the same function as the one carried out by the contact –BB4 in the VD4 circuit breaker mechanical operating mechanism.

N.B. With the circuit breaker not supplied (without auxiliary power supply), these contacts are open, except the contact signalling circuit breaker not ready for the operation (DN).



(1) For the characteristics of the contacts without potential see chapter “Specific product characteristics”.

(2) With circuit breaker not supplied (without auxiliary power supply) these contacts are open, except the contact signalling circuit breaker not ready for the operation (DN).

2) binary inputs (logical inputs) for remote control:

- No. 1 input for closing control (-SC2) (top active logical input)
- No. 1 input for opening control (-SO2) (top active logical input)
- No. 1 input for additional opening control and safety (-SO3) (top active logical input)
- No. 1 input for circuit breaker opening on direct command from the PR512 protection release (-SO5) (top active logical input)
- No. 1 input for lock on closing control (the same function as the one carried out by the – RL1 locking electromagnet in the mechanical operating mechanism of the VD4 circuit breaker) (-SL1) (bottom active logical input).
- No. 1 input for opening control for undervoltage (-SO4). The function can be excluded (bottom active logical input).

The binary inputs can be supplied as follows:

- 24 ... 240 V AC (tolerance – 15% ... + 10%)
- 24 ... 250 V DC (tolerance – 30% ... + 10%).

A binary input is considered valid when the impulse applied has a duration of at least 20 ms.

3) the functions carried out by the control module are:

- self-opening following detection of the incorrect state of the circuit breaker after an attempt to operate
- self-opening following charging threshold of the capacitors lower than the minimum value required for the opening operation
- anti-pumping relay function
- priority opening function in the case of simultaneous transmission of the opening and closing commands (TRIP-FREE)
- monitoring of capacitor charging with feeder turning itself off in the case of exceeding the maximum charging level

- opening for undervoltage; the rated voltage can be set (values foreseen: 24-30 V DC, 48-60V DC, 100-127 V AC / V DC, 220-240 V AC / V DC) and opening can also be delayed (trip delays foreseen: 0-0.5-1-2-3-4-5 sec).
- Furthermore, you can select between “block in open position” (the closing command is only accepted after resetting the opening function for undervoltage) and “enabled reclosing” (the closing command is accepted even if the opening function for undervoltage is still active (-SO4))
- watchdog of the power circuit electronics with feeder turning itself off in the case of overtemperature and/or overcurrent
- slow capacitor charging function (the charging power passes from 100 watt to 40 watt, doubling the charging time. This function is useful when self-supply by means of a voltage transformer is to be made)
- monitoring continuity of the opening and closing coils
- management of opening attempts: after 10 unsuccessful attempts, the control electronics blok and the DR and DN signalling contacts are activated to indicate that the circuit breaker is not ready for the operation
- reclosing function according to the ANSI (ANSI RECLOSE) standards
- watchdog (DN)
- limitation of the inrush current of the feeder
- serial RS232 for local connection (only to be used by ABB personnel).

N.B. Some of the control module functions can be excluded/set by means of special dip-switches present in the card. Changing the dip-switch settings must always be carried out with the control module not supplied and capacitor/s discharged, both for personnel safety and because the adjustments set are only detected by the control electronics when it is turned on.

Selection and ordering

Accessories on request

2 Circuit breaker auxiliary contacts

It is possible to have electrical signalling of circuit breaker open/closed by means of make and break contacts. The following configurations are available.

For fixed circuit breaker (-BB1; -BB2; -BB3; -BB8)
 2A Set of 5 make contacts plus 5 break contacts
 2B Set of 10 make contacts plus 10 break contacts

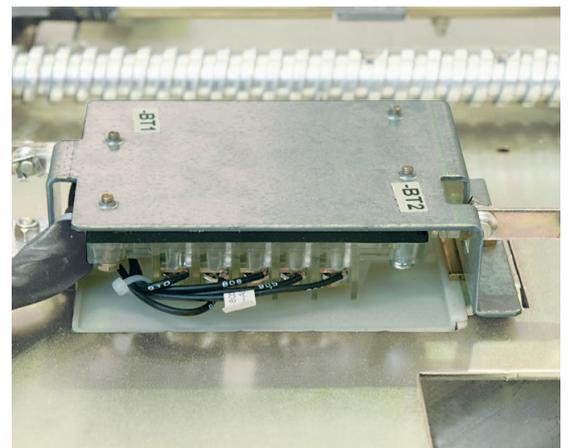
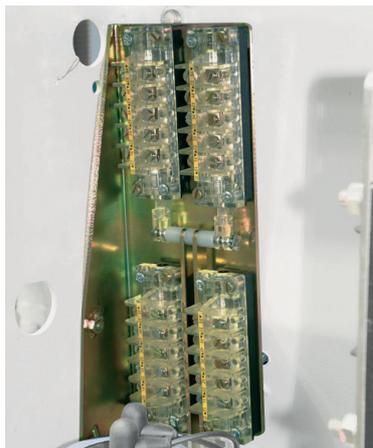
For withdrawable circuit breaker (-BB1; -BB2)
 2C Set of 5 make contacts plus 5 break contacts

Characteristics

Un:	24 ... 250 V AC - DC			
Rated current:	$I_{th}^2 = 10 \text{ A}$			
Insulation voltage:	2500 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

3 Transmitted contacts in the truck (-BT1; -BT2)

Transmitted contacts of the withdrawable circuit breaker (installed in the circuit breaker truck - only for withdrawable circuit breaker for UniGear switchgear and PowerCube enclosure). These contacts are either in addition or as an alternative to the position contacts (for signalling circuit breaker racked out) located in the unit. They also carry out the function of the position contact (-BT3).



4 Position contact (-BT3)

The position contact (-BT3) is used, together with binary input SL1, to prevent remote circuit breaker closing during traverse into the unit. It is only supplied for the withdrawable version circuit breaker when the transmitted contacts in the truck are not requested (-BT1; -BT2).

5 Motorised truck (-MT) (only for withdrawable version circuit breaker for UniGear switchgear)

This allows the circuit breaker racking operation into and out of the switchgear remotely.

Characteristics

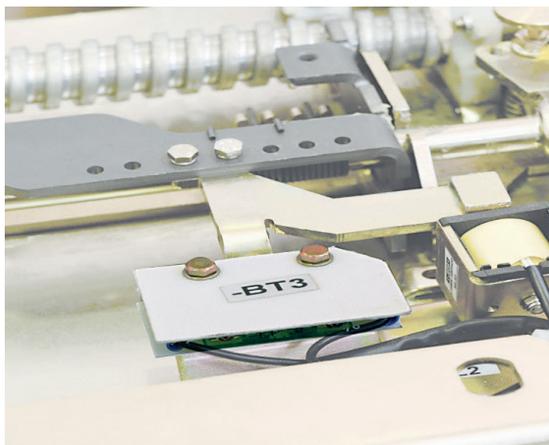
Un:	110 - 220 V~
Operating limits:	85 ... 110% Un
Rated power (Pn):	40 W

6 Device for rapidly discharging the capacitor/s

Before accessing the circuits in the control box, it is compulsory to make sure that the capacitor/s is/are discharged.

Even without auxiliary power supply, more than about ten minutes are needed to completely discharge the capacitor/s.

The rapid discharging device allows the waiting time to be reduced to just one minute and guarantees safe access to the zcircuits which might be live.



Specific product characteristics

Resistance to vibrations

The VM1 circuit breakers are available in special versions (approved by shipping registers) able to withstand mechanical vibrations outside their normal limits.

Please contact us for the versions approved by the shipping registers.



Tropicalisation

The VM1 circuit breakers are manufactured in compliance with the strictest regulations for use in hot-humid-saline climates.

All the most important metal parts are treated against corrosive factors corresponding to class C according to the UNI 3564-65 Standards. Galvanisation 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 VM1 series of apparatus and their accessories comply with climate graph 8 of the IEC 60721-2-1 and IEC 60068-2-2 (Test B: Dry Heat) / IEC 60068-2-30 (Test Db: Damp Heat, cyclic) Standards.



Altitude

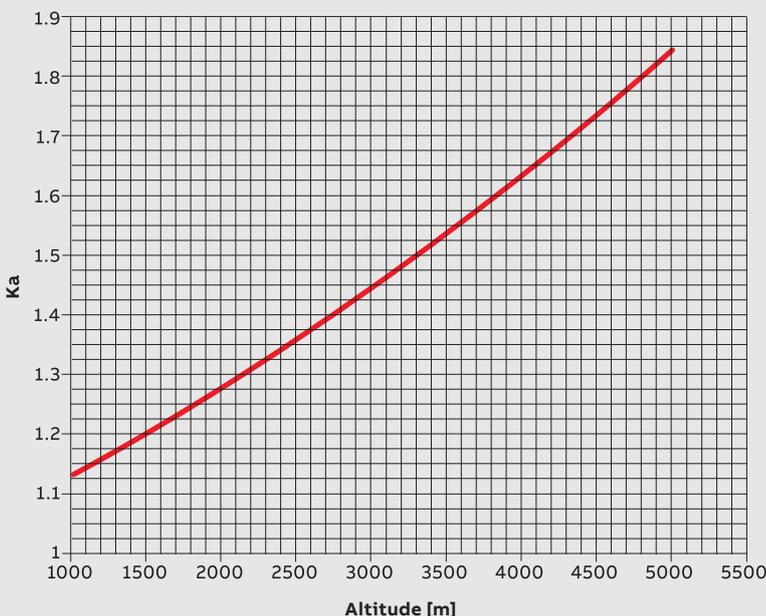
The insulating property of air decreases as the altitude increases, therefore this phenomenon must be taken into account for external insulation of the apparatus (the internal insulation of the interrupters does not undergo any variations as it is guaranteed by the vacuum).

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

In this case a correction coefficient must be considered, which can be taken from the following graph, built up on the basis of the indications in the IEC 60694 Standards.

The following example gives a clear interpretation of the indications given above.

Graph for determining the Ka correction factor according to the altitude, Example (IEC):



- Installation altitude: 2000 m
- Service at a rated voltage of 7 kV
- Withstand voltage at power frequency 20 kV rms
- Impulse withstand voltage 60 kVp
- Ka Factor = 1.28 (see graph).

Taking the above parameters into consideration, the apparatus will have to withstand the following values (under test at zero altitude i.e. at sea level):

- withstand voltage at power frequency equal to:
20 x 1.28 = 25,6 kVrms
- impulse withstand voltage equal to: 60 x 1.28 = 76,8 kVp.

From the above, it can be deduced that for installations at an altitude of 2000 m above sea level, with a service voltage of 7 kV, apparatus with a rated voltage of 17 kV characterized by insulation levels at power frequency of 38 kV rms and with 95 kVp impulse withstand voltage must be provided.

$$K_a = e^{mH/8150} \text{ with } m=1$$

H = altitude in metres

m = value referred to industrial frequency and the atmospheric impulse withstand voltages and those between phase and phase. Defined value for m = 1

Specific product characteristics

Environmental protection programme

The VM1 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 minimising 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.

REF542plus multi-purpose unit

The REF542plus unit carries out integration of all the secondary functions relative to the switchgear, in a single module fitted with self-diagnosis. Thanks to the flexibility of its software, the unit is able to satisfy a wide range of installation requirements: protection, measurement, switching, signalling, interlock, automation and communication. The high functionality of this unit is supported by a simple and easy-to-use user interface. Thanks to use of the REF542plus unit, each medium voltage panel becomes an integrated and independent unit able to carry out all the required functions. Furthermore, the REF542plus unit directly controls circuit breaker opening and closing by means of the binary inputs connected to the -S02 and -SC2 pushbuttons/contacts (see electrical diagram). For further information regarding to the REF542plus unit, please consult technical catalogue 1VTA100001.

Spare parts and ordering

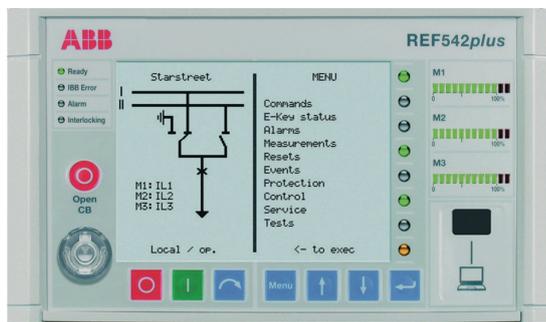
- Circuit breaker auxiliary contacts
- Position sensors
- Position contact of the withdrawable truck
- Contacts signalling connected/isolated
- Isolation interlock with the door
- Set of six isolating contacts.

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

Characteristics of the contacts without potential

The contacts without potential are supplied with special relays. For the characteristics of the contacts, please see the table and curves given below.

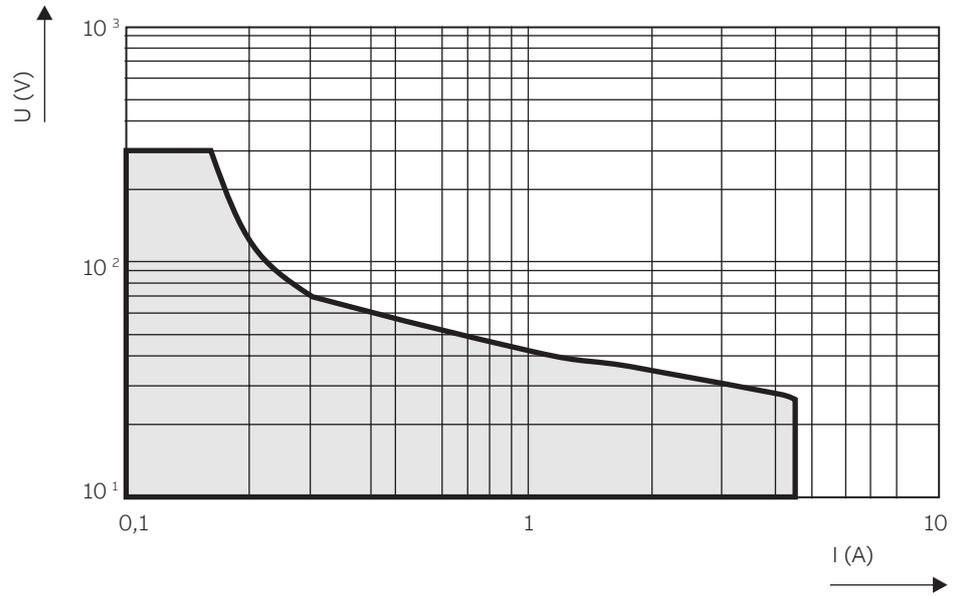
Rated voltage (range of operation)	0 ... 264 V~ 50/60 Hz 0 ... 280 V-
Maximum power applicable	1500 VA (V a.c. on resistive load) (V d.c. on resistive load - curve A)
Maximum voltage applicable	400 V~ 50/60 Hz 300 V-
Maximum current applicable	6 A
Rated current	6 A (250 V~ 50/60 Hz - resistive load)
Maximum contact resistance	≤ 100 mohm (measured at 6 V- / 1 A)
Maximum capacity	≤ 1.5 pF
Maximum closing time	≤ 5 ms
Maximum opening time	≤ 3 ms
Insulation between contacts and coil	4000 Vrms (50 Hz / 1 min)
Resistance with contacts open	Min. 10 ³ Mohm (measured at 500 V-)
Operating temperature	- 40 °C ... + 85 °C
Storage temperature	- 40 °C ... + 100 °C
Mechanical life	500,000 operations (at 180 operations/min)
Electrical life	50,000 operations (at 6 A / 277 V~ 50/60 Hz - resistive load - see curves B and C)



Note
In the case of inductive loads, the contacts must be protected against overvoltages by varistors. For other characteristics refer to IEC 62271-1.5.4.4.5.4 (Ed. 2.2), Class 3.

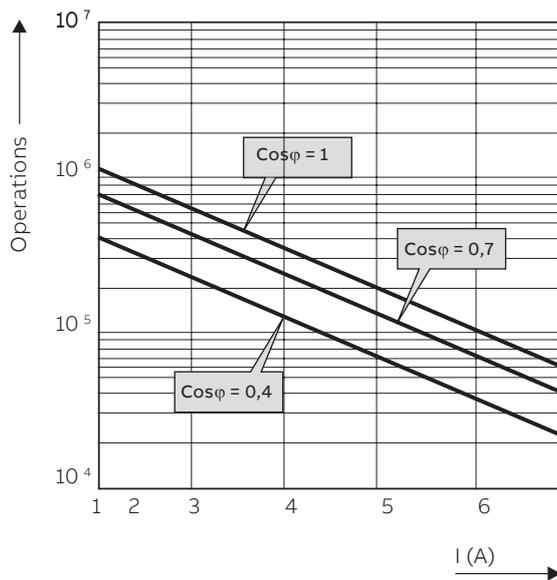
Curve A

Maximum power applicable (V d.c. on resistive load).



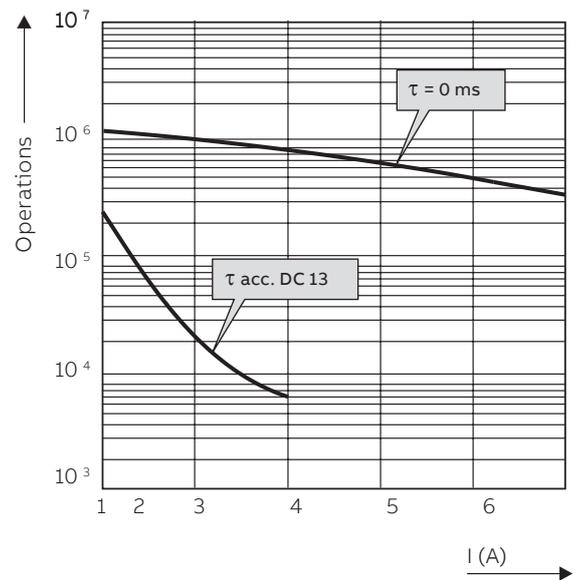
Curve B

Electrical life of the contacts at 250 V a.c.



Curve C

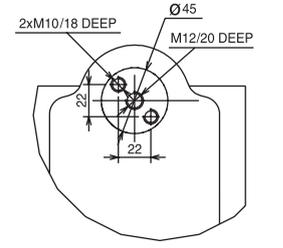
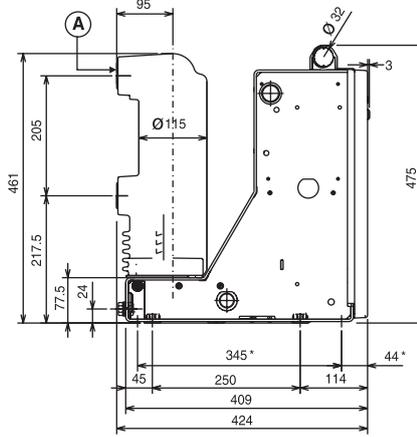
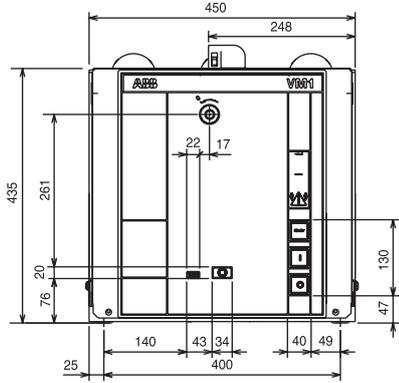
Electrical life of the contacts at 24 V d.c.



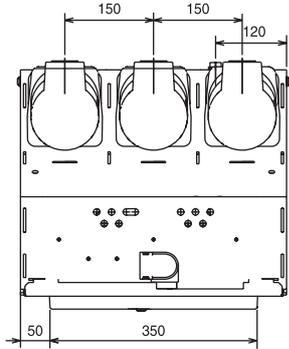
Overall dimensions

Fixed circuit breakers

VM1	
TN	1VCD00001 (E0148)
Ur	12 kV
Ir	630 A
	1250 A
Isc	16 kA
	20 kA
	25 kA
	31.5 kA

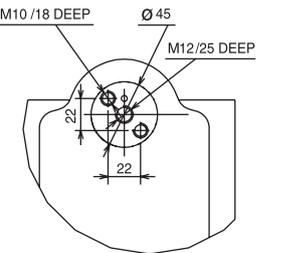
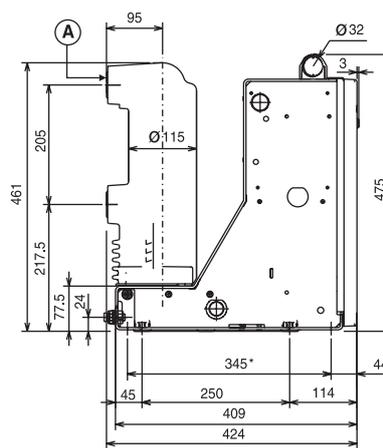
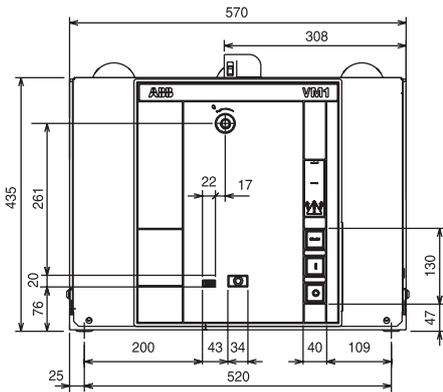


VM1	
TN	1VCD00001 (E0148)
Ur	17.5 kV
Ir	630 A
	1250 A
Isc	16 kA
	20 kA
	25 kA
	31.5 kA

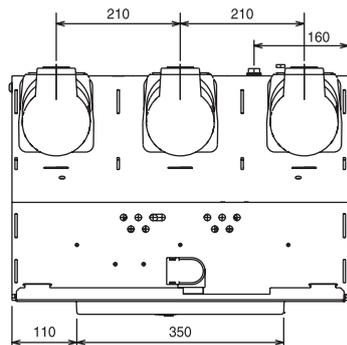


(* Fixing interchangeable with the previous series (345 x 400).

VM1	
TN	1VCD00002 (E0148)
Ur	12 kV
Ir	630 A
	1250 A
Isc	16 kA
	20 kA
	25 kA
	31.5 kA

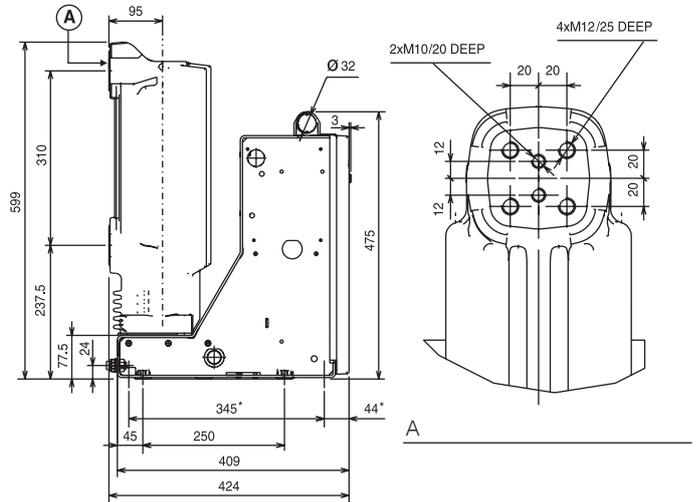
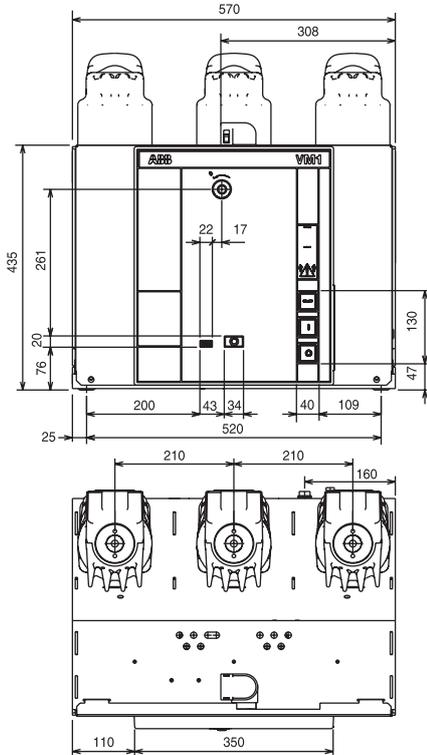


VM1	
TN	1VCD00002 (E0148)
Ur	17.5 kV
Ir	630 A
	1250 A
Isc	16 kA
	20 kA
	25 kA
	31.5 kA



(* Fixing interchangeable with the previous series (345 x 520).

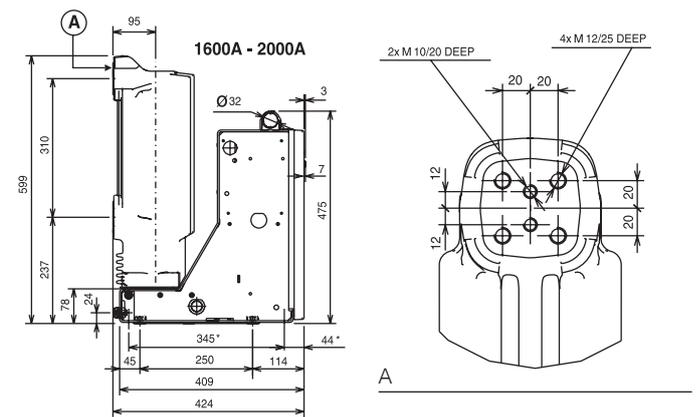
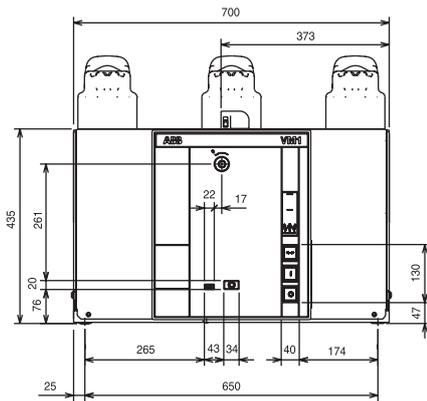
VM1	
TN	1VCD00003 (E0148)
Ur	12 kV
Ir	1600 A 2000 A
Isc	20 kA 25 kA 31.5 kA



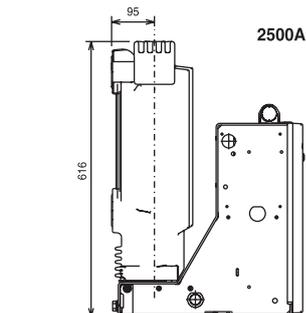
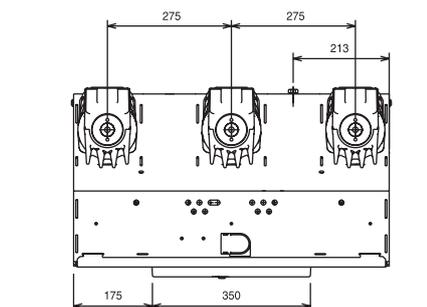
VM1	
TN	1VCD00003 (E0148)
Ur	17.5 kV
Ir	1600 A 2000 A
Isc	20 kA 25 kA 31.5 kA

(*) Fixing interchangeable with the previous series (345 x 520).

VM1	
TN	1VCD00004 (E0148)
Ur	12 kV
Ir	1600 A 2000 A
Isc	20 kA 25 kA 31.5 kA



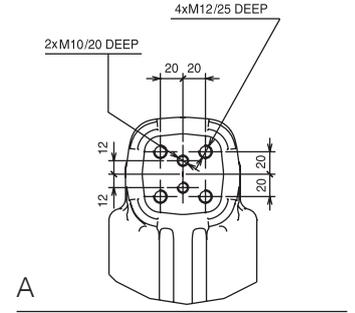
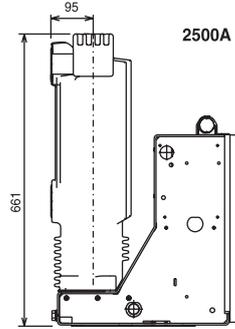
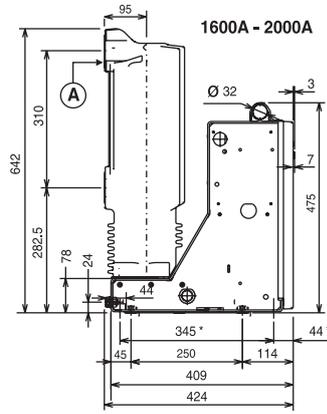
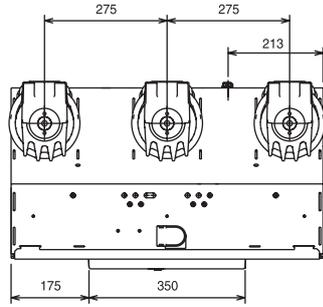
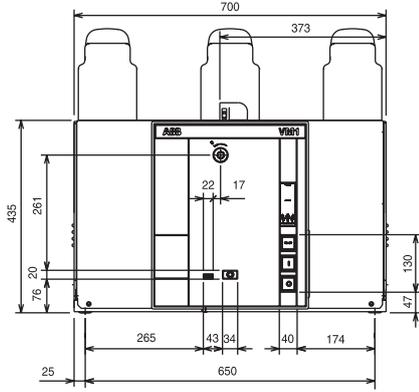
VM1	
TN	1VCD00004 (E0148)
Ur	17.5 kV
Ir	1600 A 2000 A
Isc	20 kA 25 kA 31.5 kA



(*) Fixing interchangeable with the previous series (345 x 650).

VM1	
TN	1VCD00007 (E0148)
Ur	24 kV
	1600 A
Ir	2000 A
	2500 A
	16 kA
Isc	20 kA
	25 kA

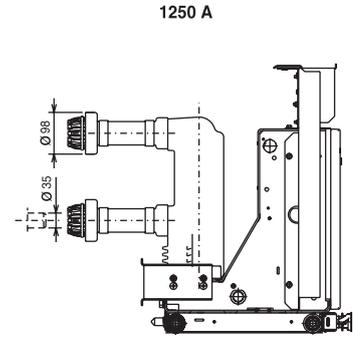
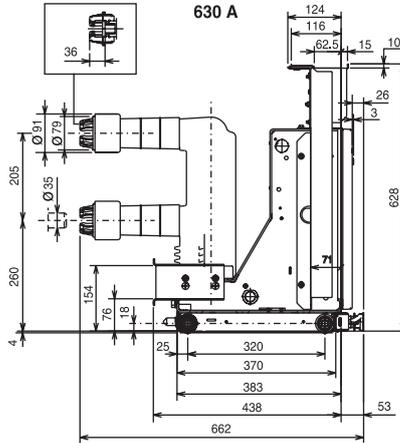
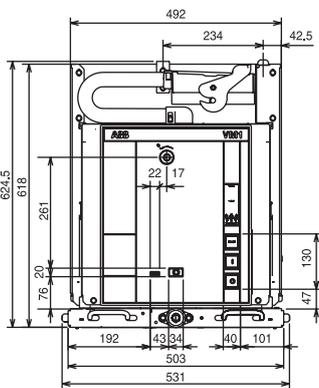
(*) Fixing interchangeable with the previous series (345 x 650).



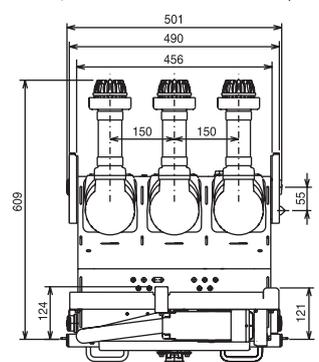
Overall dimensions

Withdrawable circuit breakers for UniGear switchgear and PowerCube modules

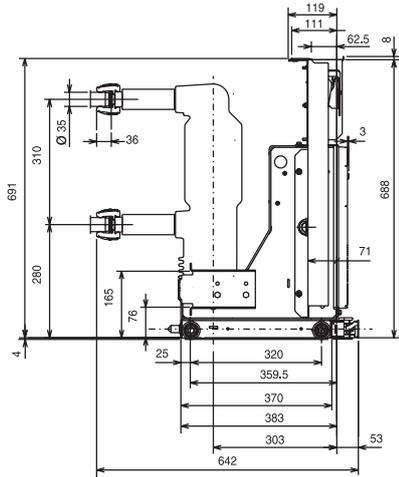
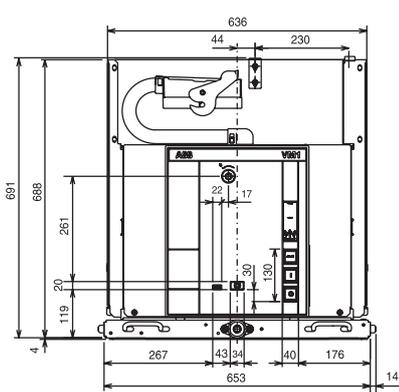
VM1/P	
TN	1VCD00008 (E0148)
Ur	12 kV
Ir	630 A
	1250 A
Isc	16 kA
	20 kA
	25 kA
	31.5 kA



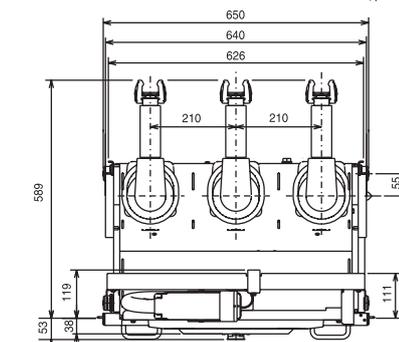
VM1/P	
TN	1VCD00008 (E0148)
Ur	17.5 kV
Ir	630 A
	1250 A
Isc	16 kA
	20 kA
	25 kA
	31.5 kA



VM1/W ^(*)	
TN	1VCD00074 (E0148)
Ur	12 kV
Ir	630 A
	1250 A
Isc	16 kA
	20 kA
	25 kA
	31.5 kA



VM1/W ^(*)	
TN	1VCD00074 (E0148)
Ur	17.5 kV
Ir	630 A
	1250 A
Isc	16 kA
	20 kA
	25 kA
	31.5 kA



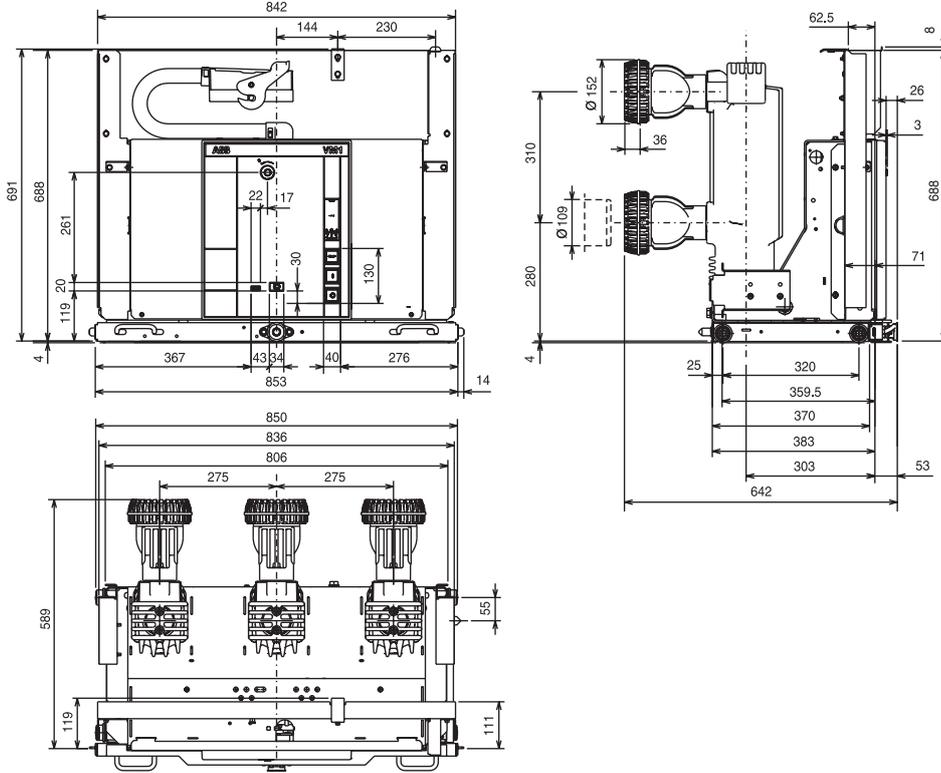
(*) Only for PowerCube PB2 modules.

Overall dimensions

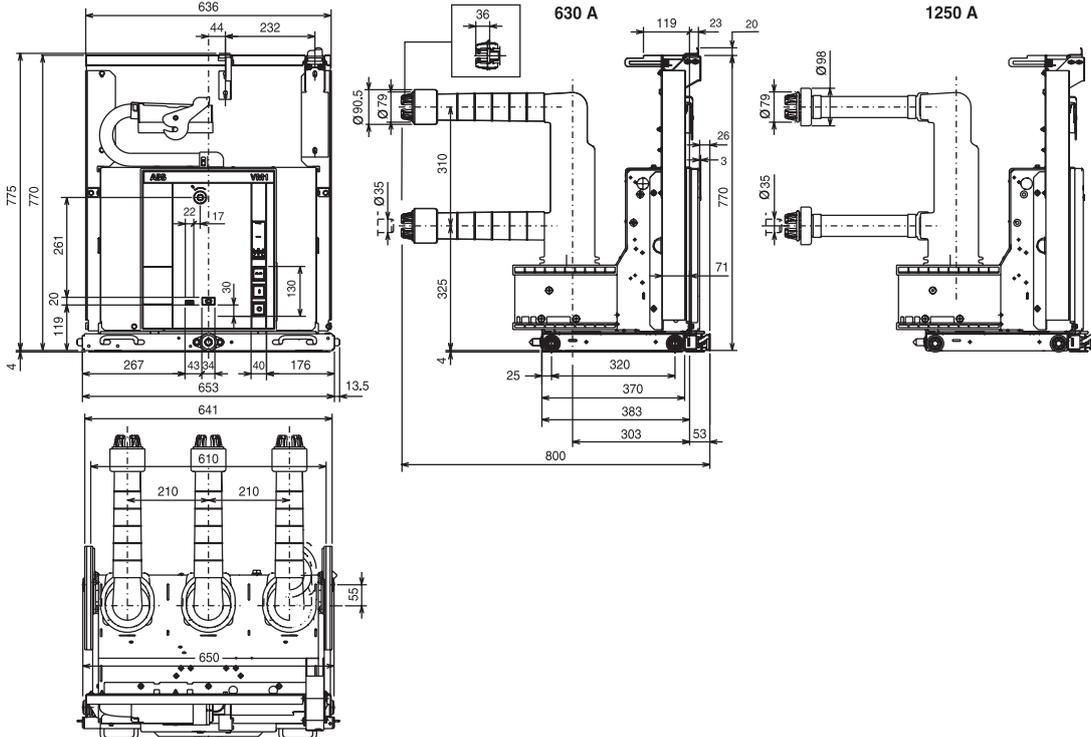
Withdrawable circuit breakers for UniGear switchgear and PowerCube modules

VM1/P	
TN	1VCD00011 (E0148)
Ur	12 kV
Ir	2500 A
Isc	16 kA
	20 kA
	25 kA
	31.5 kA

VM1/P	
TN	1VCD00011 (E0148)
Ur	17.5 kV
Ir	2000 A
Isc	16 kA
	20 kA
	25 kA
	31.5 kA



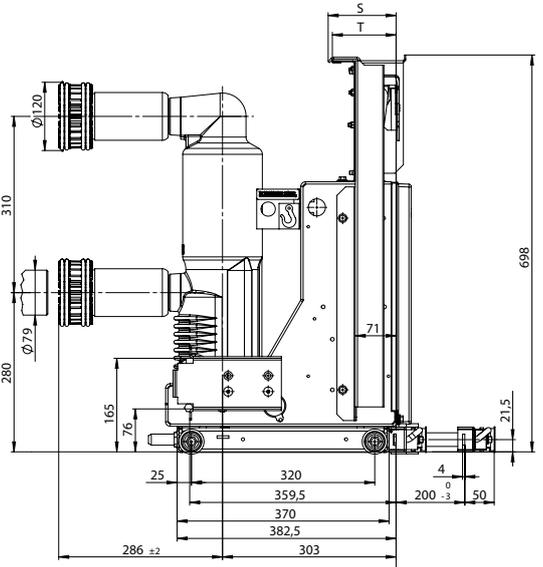
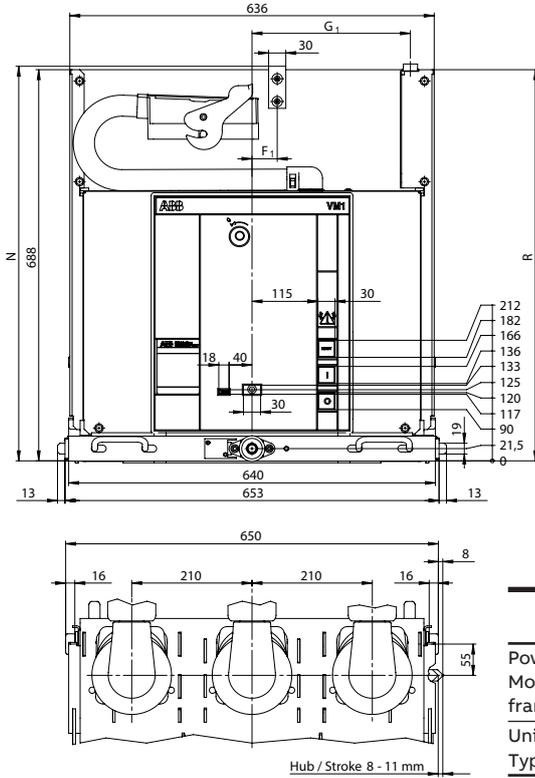
VM1/P	
TN	1VCD00012 (E0148)
Ur	24 kV
Ir	630 A
Isc	1250 A
	16 kA
	20 kA



Overall dimensions

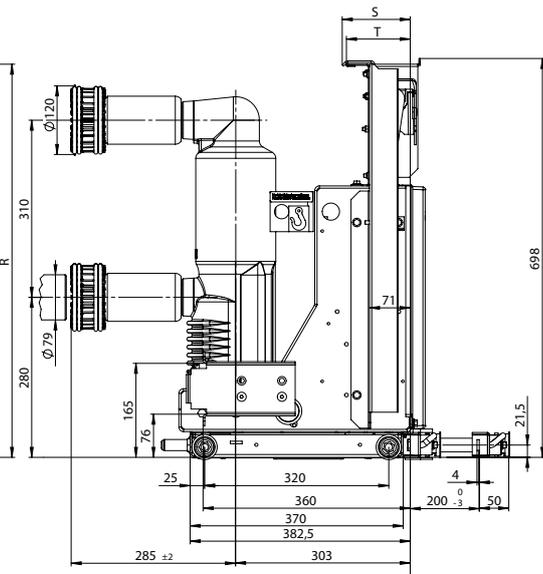
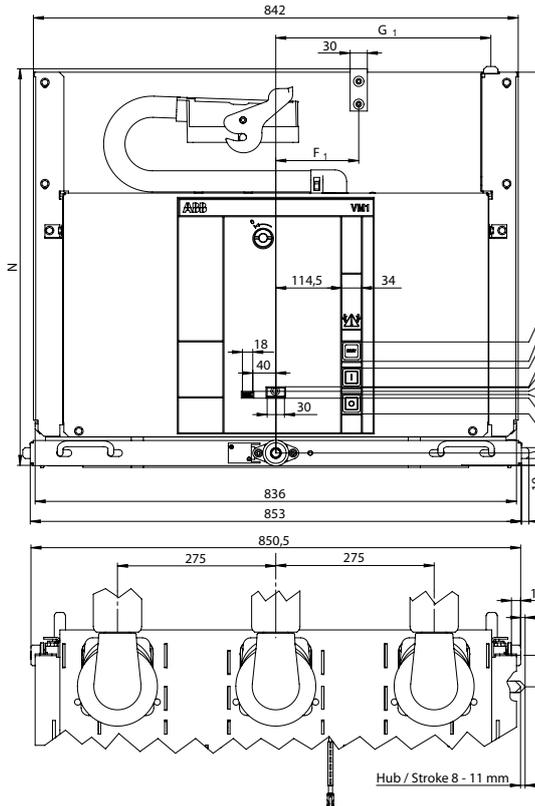
Withdrawable circuit breakers for UniGear switchgear and PowerCube modules

VM1/P	
TN	1VBM794912 (P0001)
Ur	12 kV
Ir	1250 A
Isc	1600 A
Isc	40 kA
TN	1VBM794912 (P0001)
Ur	17 kV
Ir	1250 A
Isc	1600 A
Isc	40 kA



	N	R	S	T	F ₁	G ₁	Weight 4) ca kg
Powerbloc/ Mounting frame	694	688	118	110	44	276	215
UniGear Type ZS1	691±2	688±2	119	111±1	44±2	273±2	215

VM1/P	
TN	1VBM794912 (P0002)
Ur	12 kV
Ir	1600 A
Isc	40 kA
TN	1VBM794912 (P0002)
Ur	17 kV
Ir	1600 A
Isc	40 kA



	N	R	S	T	F ₁	G ₁	Weight 4) ca kg
ZS1 Powerbloc/ Mounting frame	694	688	118	110	144	376	220
UniGear Type ZS1	691±2	688±2	119	111±1	144±1	373±2	220

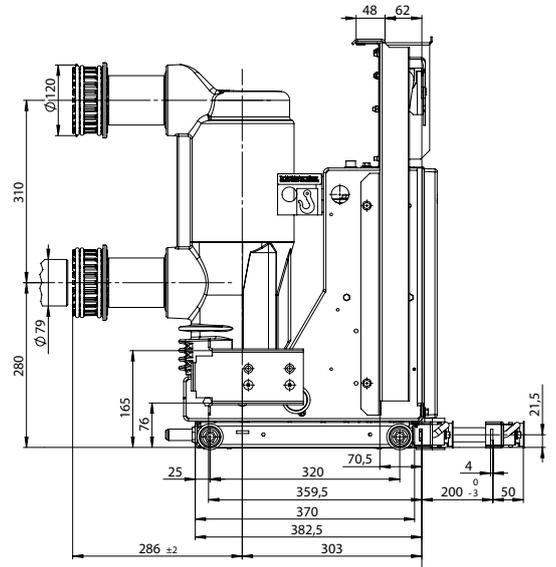
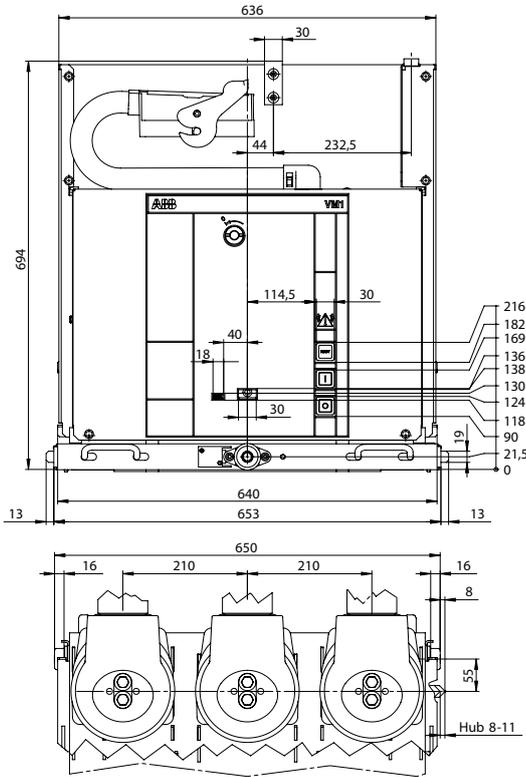
VM1/P

TN 1VBM794912
(P0003)

Ur 12 kV

Ir 1600 A

Isc 50 kA



VM1/P

TN 1VBM794912
(P0004)

Ur 12 kV

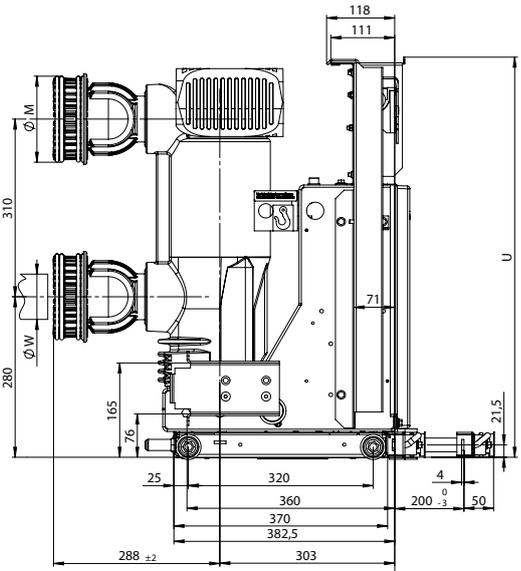
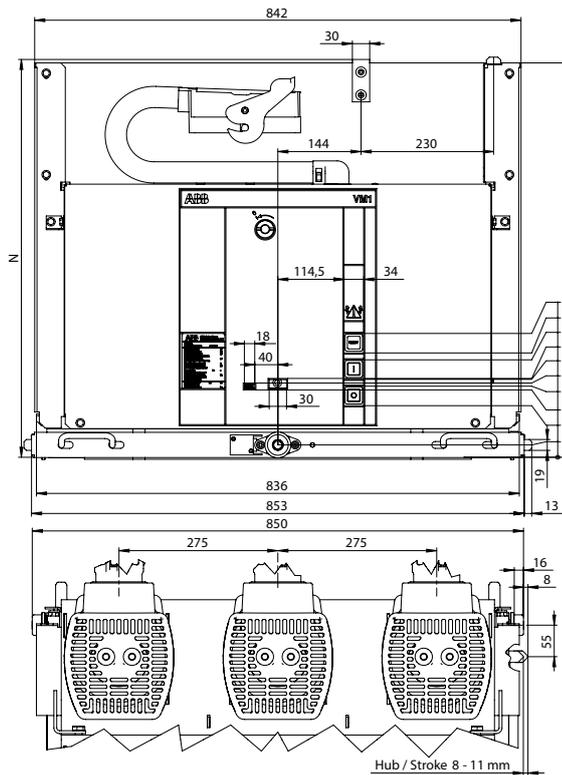
2000 A

2500 A

3150 A

4000 A

Isc 50 kA

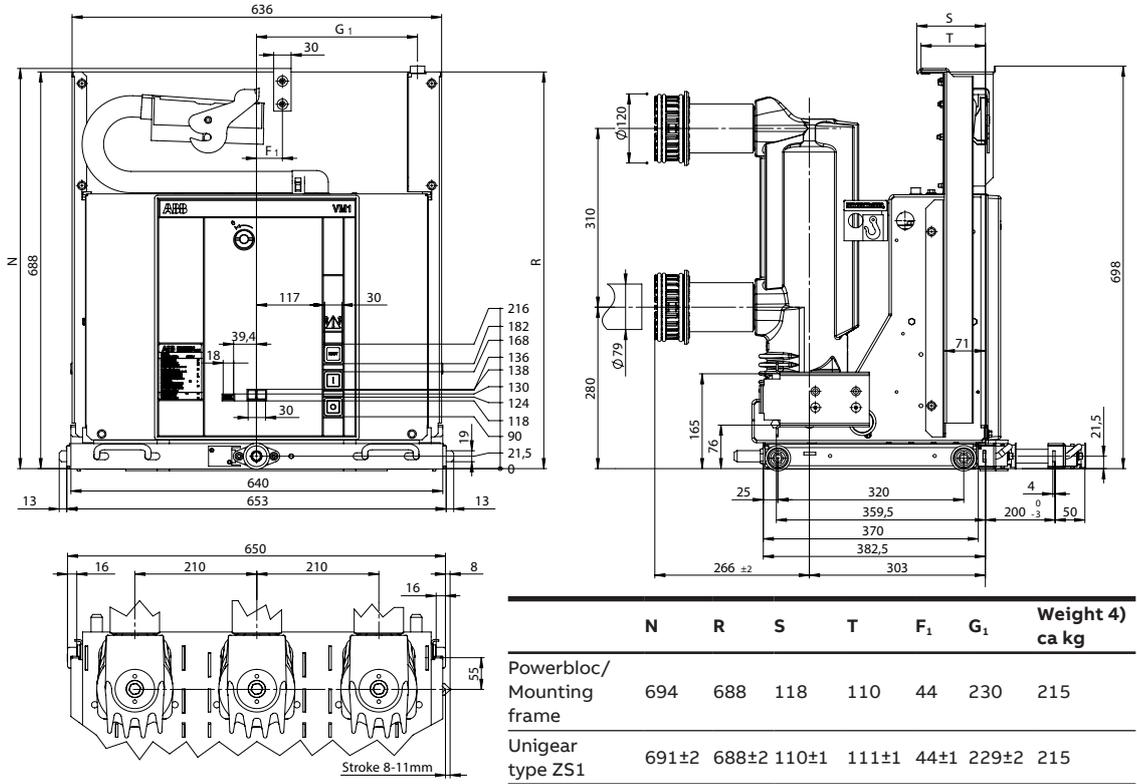


		M	W	U
UniSafe/ UniGear type ZS1/ Powerbloc/ Mounting frame	2000A	120	79	694
	2500A	149	109	694
	1600A	120	79	694
ZS1	2500A	149	109	694
	3150A/4000A	158	109	735

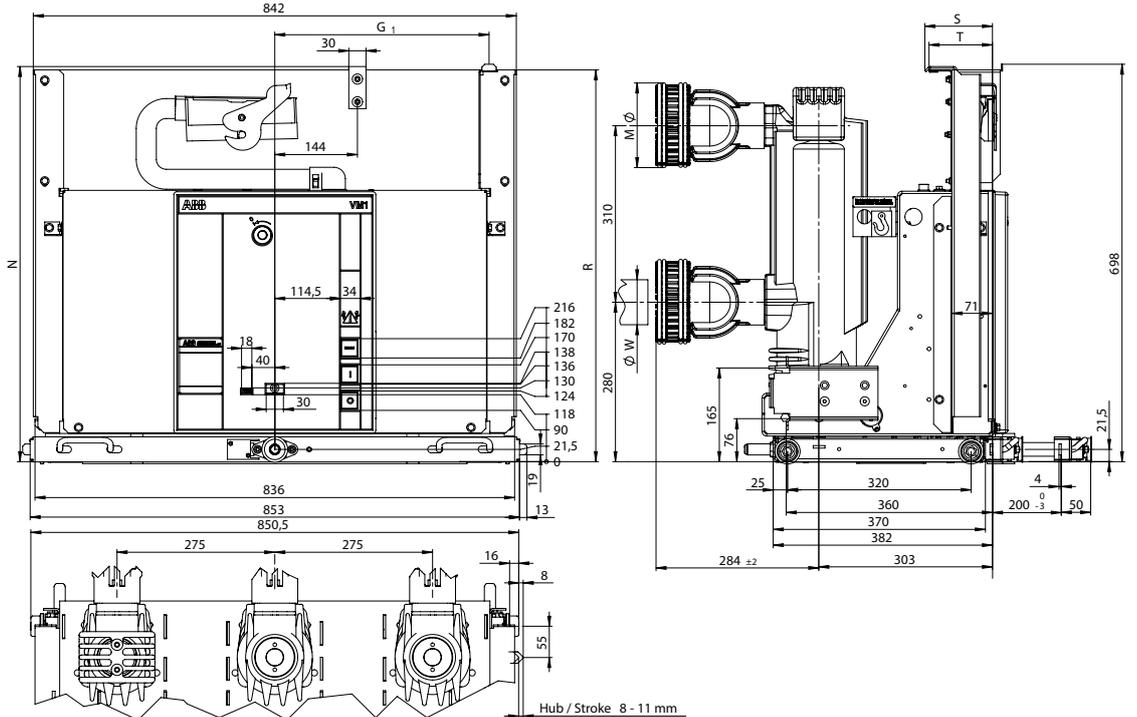
Overall dimensions

Withdrawable circuit breakers for UniGear switchgear and PowerCube modules

VM1/P	
TN	1VBM794912 (P0005)
Ur	12 kV
Ir	2000 A
Isc	40 kA
<hr/>	
TN	1VBM794912 (P0005)
Ur	17 kV
Ir	2000 A
Isc	40 kA



VM1/P	
TN	1VBM794912 (P0006)
Ur	12 kV
Ir	2500 A
Isc	40 kA
<hr/>	
TN	1VBM794912 (P0006)
Ur	17 kV
Ir	2500 A
Isc	40 kA



Electric circuit diagram

Diagrams of the applications

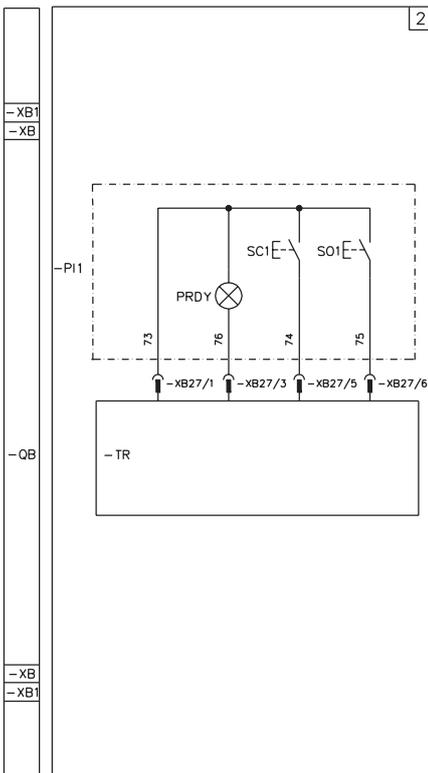
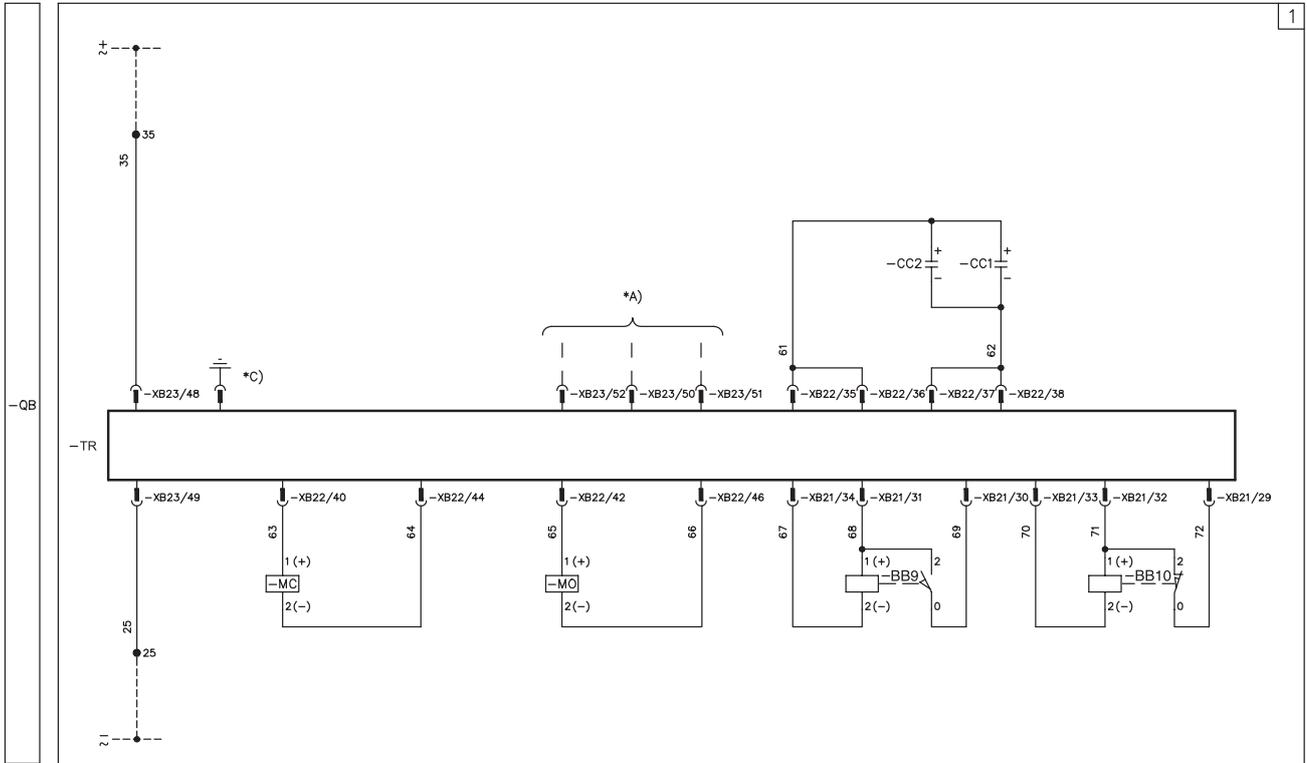
The following diagram (No. 1VCD400051 - EO119) shows the circuits of the VM1/P fixed circuit breakers up to 24 kV, delivered to the customer by means of the “-XB” connector.

For withdrawable circuit breakers with motorised truck, please ask for the specific diagram 1VCD400052. For fixed circuit breakers please ask for diagram 1VCD400050.

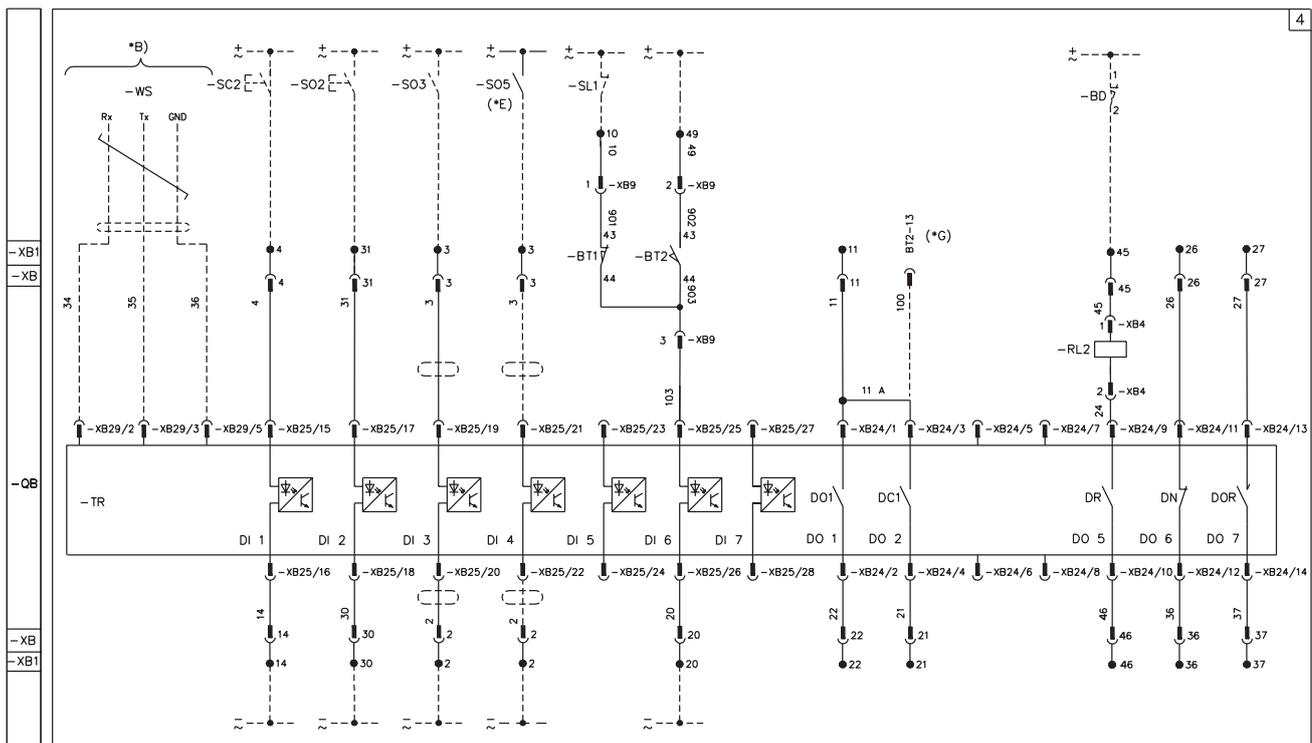
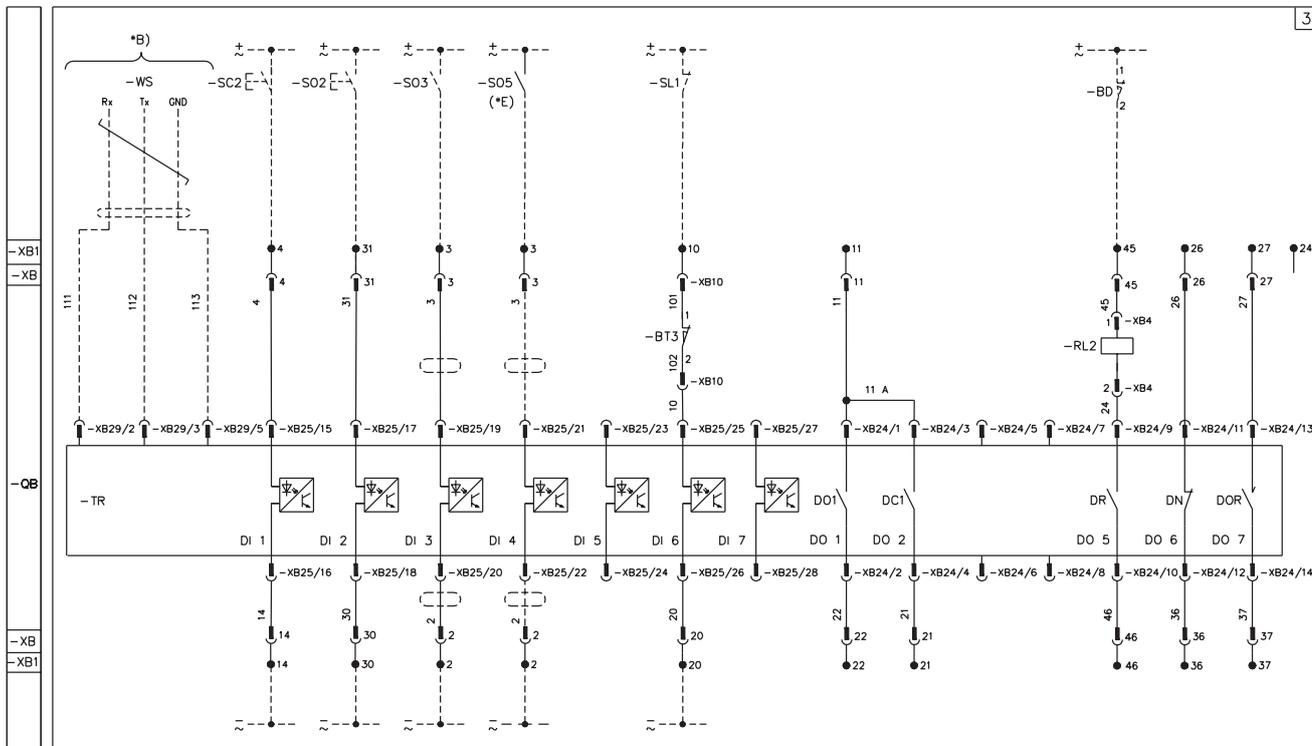
In any case, to take into account product development, it is always useful to refer to the circuit diagram provided with each circuit breaker.

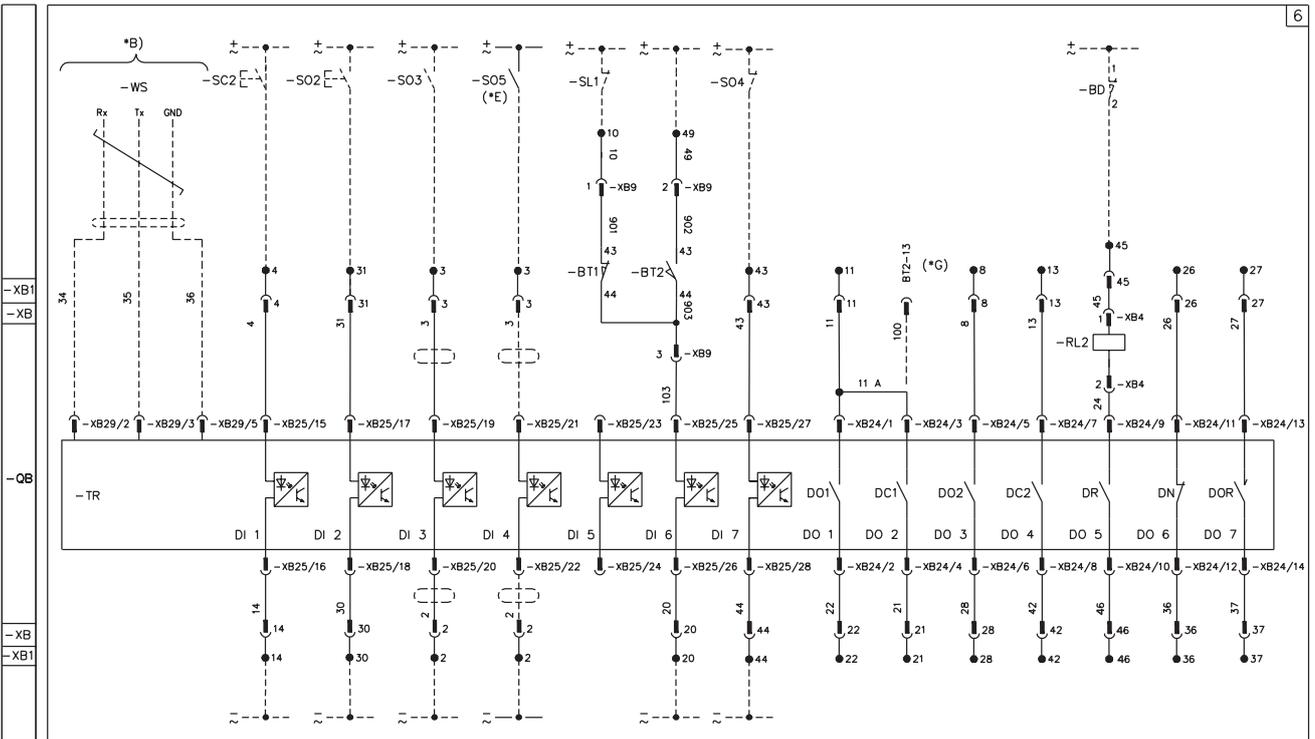
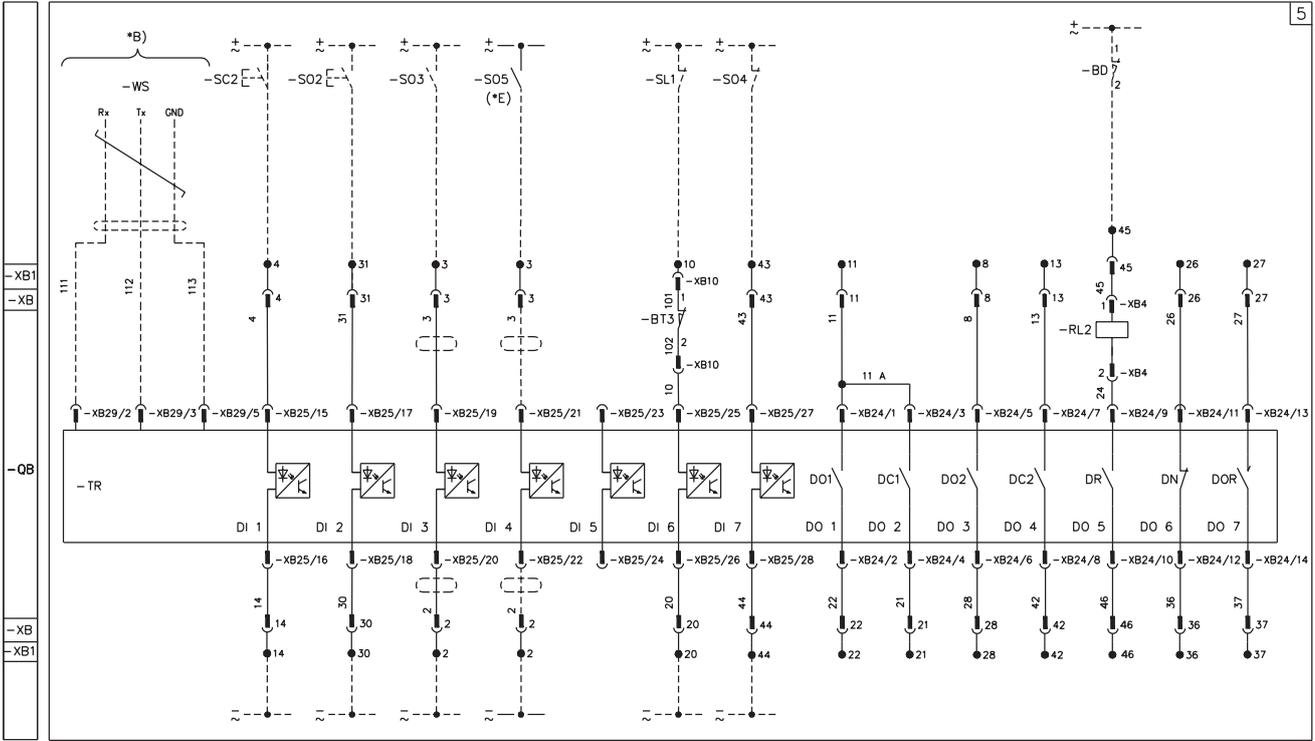
Graphic symbols for electrical diagrams (IEC 60617 and CEI 3-14...3-26)

	Thermal effect		Mass, frame		Capacitor (general symbol)		Closing position contact (limit switch)
	Electromagnetic effect		Conductors in shielded cable (two conductors shown)		Motor (general symbol)		Opening position contact (limit switch)
	Timing		Connection of conductors		Rectifier with two half-waves (bridge)		Power circuit breaker with automatic opening
	Pushbutton control		Terminal or clamp		Make contact		Control coil (general symbol)
	Key control		Socket and plug (female and male)		Break contact		Lamp (general symbol)
	Earth (general symbol)		Resistor (general symbol)		Change-over break before make contact		
	Corded conductors or cables (two conductors shown)		Delayed movement (in the direction of the movement of the arc towards its centre)		Passing make contact closing momentarily during release		

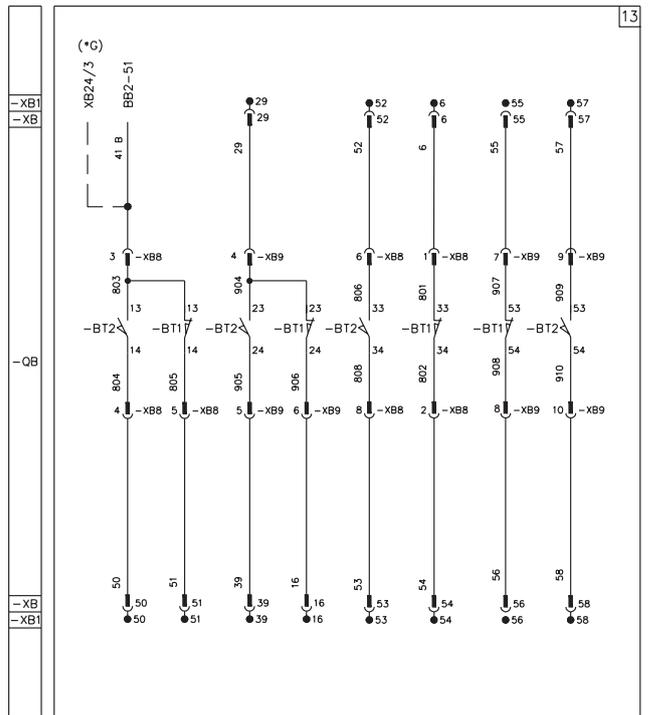
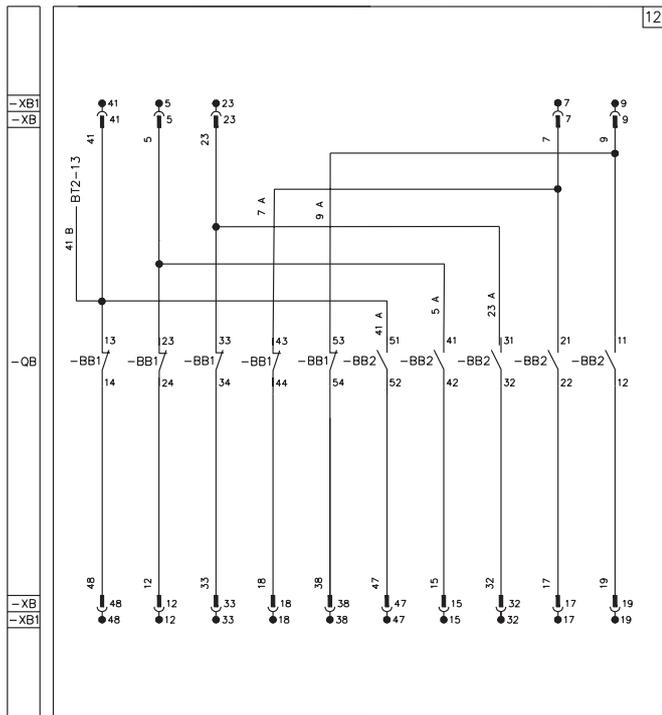
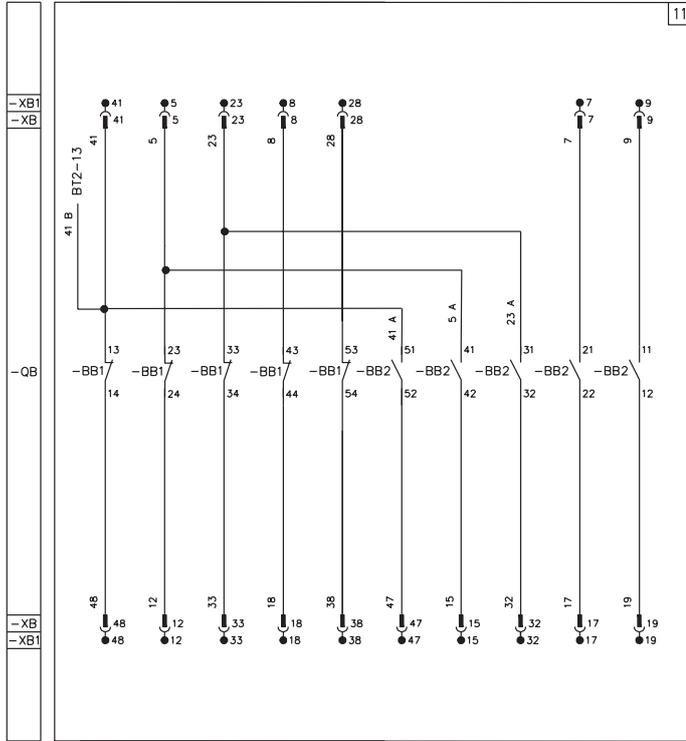


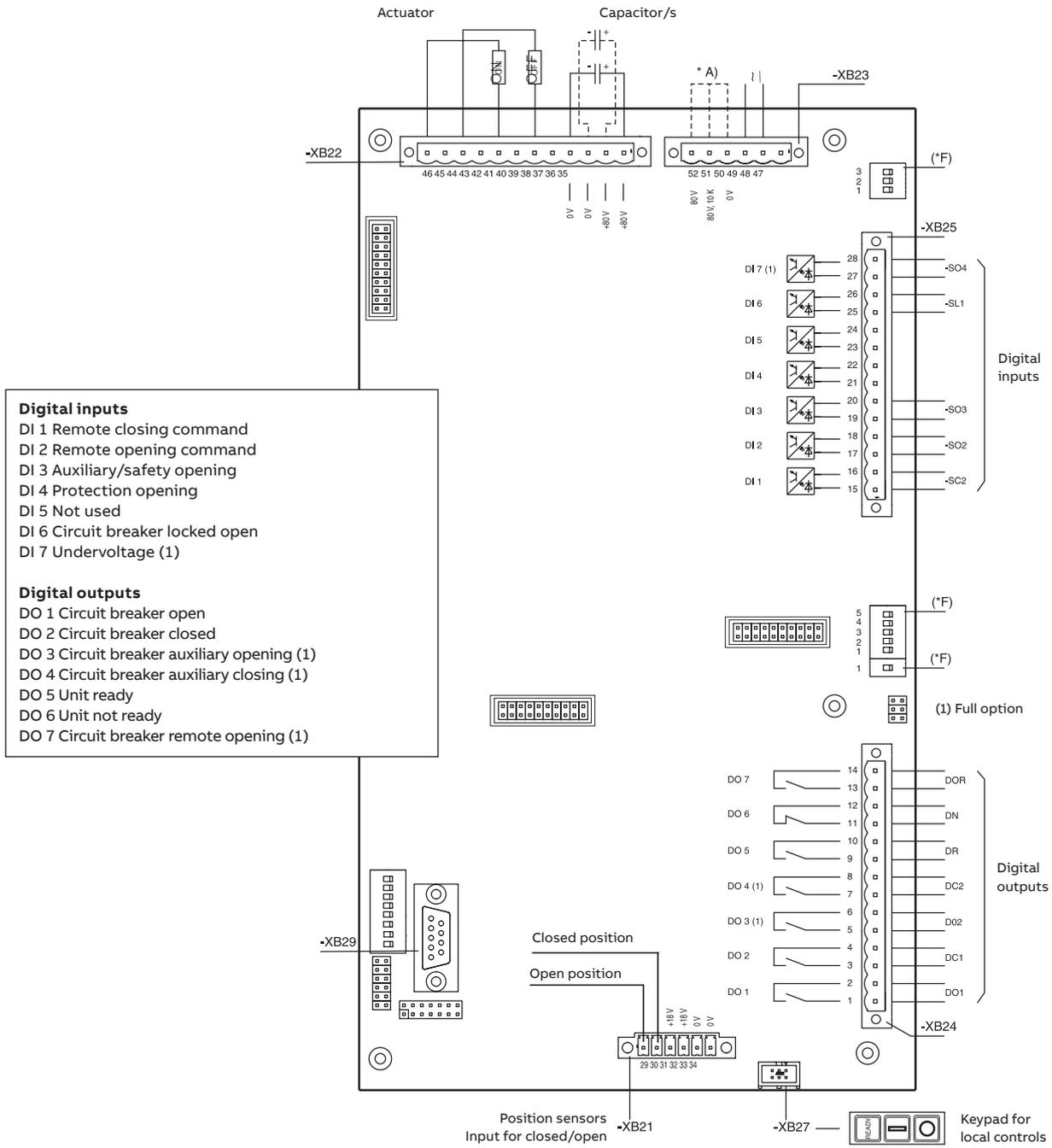
Electric circuit diagram





Electric circuit diagram





Electric circuit diagram

State of operation shown

The diagram shows the following conditions:

- circuit breaker open and connected
- circuits de-energised.

Caption	
□	= Reference number of diagram figure
*	= See note indicated by the letter
- QB	= Circuit breaker accessories
- TR	= Control and switching unit
- DR	= Contact for signalling control and actuation unit ready (checks correct position and capacity level)
- DN	= Contact for signalling unit not ready
- DC1-2	= Contact for signalling circuit breaker in closed position
- DO1-2	= Contact for signalling circuit breaker in open position
- DOR	= Contact for signalling remote opening control (closed for 100 ms)
- BB1-2	= Circuit breaker auxiliary contacts
- BB9	= Position contact for signalling circuit breaker closed (limit switch with auxiliary power supply)
- BB10	= Position contact for signalling circuit breaker open (limit switch with auxiliary power supply)
- BD	= Position contact of the door
- BT1	= Truck auxiliary contacts for electrical signalling of circuit breaker connected
- BT2	= Truck auxiliary contacts for electrical signalling of circuit breaker isolated
- BT3	= Position contact of the circuit breaker, open during the isolation run
- CC1 - CC2	= Capacitors
- PI1	= Human/machine interface keypad with opening and closing pushbuttons and "ready" indication
- PRDY	= Green LED lamp for signalling control and actuation unit ready (checks correct position and capacity level)
- SC1	= Pushbutton for closing the circuit breaker
- SO1	= Pushbutton for opening the circuit breaker

- MC	= Closing coil
- MO	= Opening coil
- RL2	= Locking magnet on truck: de-energised it mechanically prevents connection or isolation
- SC2	= Pushbutton or contact for remote circuit breaker closing
- SL1	= Contact for the lock on circuit breaker closing (closing enabled with contact closed)
- SO2	= Pushbutton or contact for remote circuit breaker opening
- SO3	= Auxiliary opening and safety contact
- SO4	= Pushbutton or contact for opening due to lack of circuit breaker voltage (contact closed with voltage present)
- SO5	= Contact for only opening the circuit breaker by means of release (PR512)
- WS	= Serial interface for service operations (RS232 interface)
- XB	= Connector of the circuit breaker circuits
- XB1	= Connector of the switchgear circuits
- XB8 - XB9	= Connector of the connected and isolated auxiliary contacts
- XB10	= Circuit breaker position contact connector
- XB15	= Connector for final internal tests
- XB21	= Connector for position sensors -BS3 and -BS4
- XB22	= Connector for the actuator and for the capacitor/s
- XB23	= Connector for the auxiliary power supply
- XB24	= Connector for the output contacts
- XB25	= Connector for the binary input contacts
- XB27	= Connector for the local pushbutton panel
- XB29	= Connector for the serial interface

Description of figures		Notes
Fig. 1	= Basic circuit breaker and MABS1 magnetic drive circuits	A) Short-circuit XB23/50 with XB23/51 to obtain slow charging of the capacitors. Short-circuit XB23/50 with XB23/52 with a 10 ohm/50 watt resistor in series to obtain rapid discharging of the capacitors
Fig. 2	= Keypad for local controls	B) Serial interface for service operations (RS232 interface)
Fig. 3	= Input/Output for circuit breakers with standard ED2 card	C) Fix the strip of copper for the earth connection under the vibrostop in the unpainted area
Fig. 4	= Input/Output for circuit breakers with standard ED2 card when the auxiliary contacts on the truck are requested	D) The circuit breaker is only fitted with the applications specified in the order confirmation. To make out the order, please consult the catalogue of the apparatus
Fig. 5	= Input/Output for circuit breakers with full options ED2 card	E) The –SO5 contact for PR 512 excludes the –SO3 contact
Fig. 6	= Input/Output for circuit breakers with full options ED2 card when the auxiliary contacts on the truck are requested	F) To set the Dip-switches, please see the VM1 Instruction Manual
Fig. 11	= Circuit breaker auxiliary contacts available with standard ED2 card	G) Connect when BB1 and BB2 are not requested.
Fig. 12	= Circuit breaker auxiliary contacts available with full options ED2 card	
Fig. 13	= Available auxiliary contacts of the truck.	

Incompatibility

The circuits indicated by the following figures cannot be supplied at the same time on the same circuit breaker:

Fig. 3-4-5-6

Combinations allowed:

Fig. 3-11 | Fig. 5-11 | Fig. 4-12 | Fig. 6-12



Notes

A large grid of small dots for taking notes, consisting of 20 columns and 30 rows of dots.



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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