DISTRIBUTION SOLUTIONS

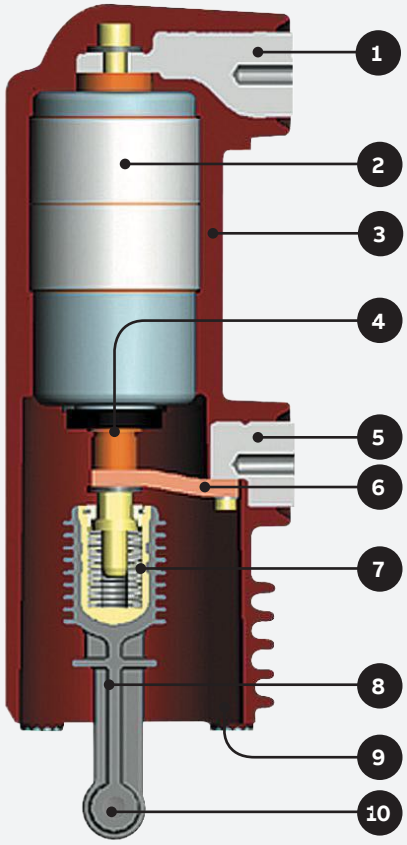
VD4

Medium voltage vacuum circuit breakers 12...40.5 kV - 630...4000 A - 16...63 kA

Description

These new VD4 circuit breakers exemplify ABB's proven vacuum interrupter engineering and manufacturing technology, as well as the superior design standards employed in the production of circuit breakers.
VD4 medium voltage circuit breakers use vacuum interrupters embedded in the poles. This construction technique makes the poles of the circuit breaker particularly sturdy and protects the interrupter from shocks, dust and condensation. The vacuum interrupter houses the contacts and forms the interruption chamber.

Vacuum current interruption
The vacuum circuit breaker does not require an interrupting and insulating medium. Interrupters do not, in fact, contain ionizable material.
The electric arc that generates when the contacts separate is merely formed by melted and vaporized contact material.
Supported by the external energy, the electric arc persists until the current annuls near natural zero crossing. In that instant, the dielectric properties are very rapidly restored by the sharp reduction in the density of the conveyed load and rapid condensation of the metallic vapor.
Thus the vacuum interrupter recovers insulating capacity and the ability to withstand transient recovery voltage, thereby definitively extinguishing the arc.



1 Upper terminal
2 Vacuum interrupter
3 Enclosure/pole
4 Stem of moving contact
5 Lower terminal
6 Flexible connection
7 Tie-rod spring fork
8 Tie-rod
9 Pole fixing
10 Connection to operating mechanism

Vacuum interrupter embedded in the pole

- **Vacuum interruption technique**
- **Vacuum contacts protected against oxidation and contamination**
- **Vacuum interrupter embedded in the pole**
- **Interrupter protected against shocks, dust and condensation**
- **Operation under different climatic conditions**
- **Limited switching energy**
- **Stored energy operating mechanism with anti-pumping device supplied as standard**
- **Simple customizing with a complete range of accessories**
- **Fixed and withdrawable version**
- **Compact dimensions**
- **Sealed-for-life poles**
- **Sturdy and reliable**
- **Limited maintenance**
- **Circuit breaker racked in and out with door closed**
- **Incorrect and hazardous operations are prevented thanks to special locks in the operating mechanism and truck**
- **High environmental compatibility**

Since high dielectric strength can be reached in the vacuum, even with minimum distances, circuit breaking is also guaranteed when the contacts separate a few milliseconds before natural current zero crossing.
The special shape of the contacts, the material used, as well as the limited duration and low voltage of the arc, guarantee minimum contact wear and long life. In addition, the vacuum also prevents contact oxidation and contamination.

Operating mechanism
The low speed of the contacts, their reduced travel and exposed conductive part, limit the energy required for the operation and therefore guarantee extremely low wear on the system.
This means that the circuit breaker only requires very little maintenance.

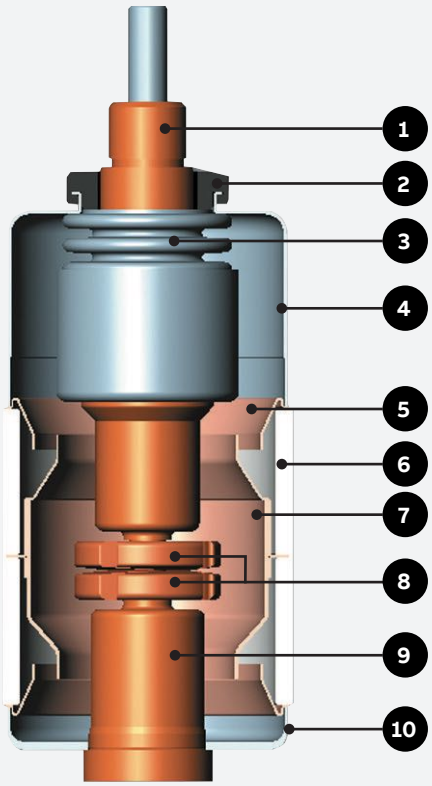
VD4 circuit breakers have mechanical operating mechanisms with stored energy and free trip. These characteristics allow opening and closing operations to be performed independently of the operator. The operating mechanism is of a simple design, easy to use and can be customized with a wide range of accessories which are straightforward and rapidly installed. This simplicity enhances the reliability of the apparatus.

The structure
The operating mechanism and the poles are fixed to a metal frame which also acts as the support for the fixed version of the circuit breaker.
The compact structure is sturdy and ensures mechanical reliability.
Apart from the isolating contacts and the cord with plug for connecting the auxiliary circuits, the withdrawable version is complete with truck for racking it in and out of the switchgear or enclosure with the door closed.

Description

Interruption principle of ABB interrupters

In a vacuum interrupter, the electric arc begins the instant in which the contacts separate. It persists until zero current is reached and can be influenced by the magnetic field.



1. Stem/terminal
2. Twist protection
3. Metal bellows
4. Interrupter enclosure
5. Centring ring
6. Ceramic insulator
7. Shield
8. Contacts
9. Terminal
10. Interrupter enclosure

Vacuum interrupter

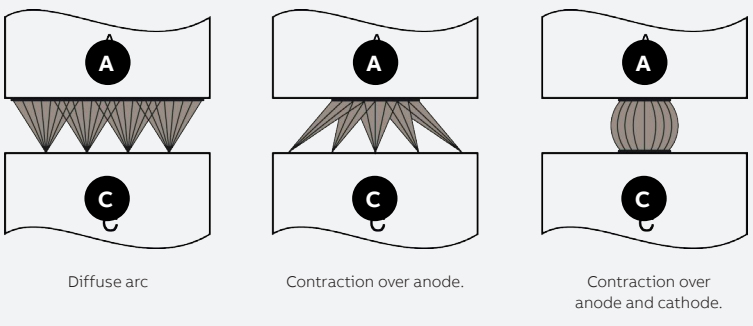


Diagram of transition from diffuse arc to contracted arc in a vacuum interrupter.

Vacuum arc – diffuse or contracted

Individual melting points form on the surface of the cathode after the contacts separate. This leads to the formation of metallic vapors which support the arc itself.

The diffuse vacuum arc is characterized by expansion over the contact surface 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 (beyond rated value), the electric arc tends to change from the diffuse to contracted type, owing to the Hall effect.

Starting out from the anode, the arc contracts and tends to concentrate as the current increases. There is a temperature rise on a level with the affected area and the contact is consequently subjected to thermal stress.

To prevent the contacts from overheating and becoming eroded, the arc is made to rotate. By turning, the arc becomes similar to a moving conductor through which current passes.

The spiral shape of ABB vacuum interrupter contacts

The special spiral shape of the contacts generates a radial magnetic field in all parts of the arc column, concentrated around the circumferences of the contacts.

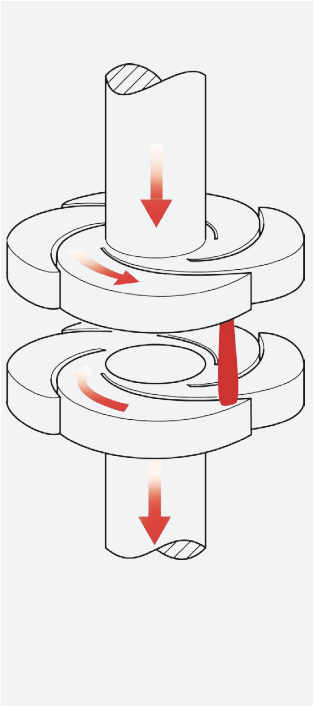
The electromagnetic force that self-generates, acts tangentially and causes the arc to spin rapidly around the axis of the contacts.

This forces the arc to turn and affect a larger area than that of a fixed contracted arc.

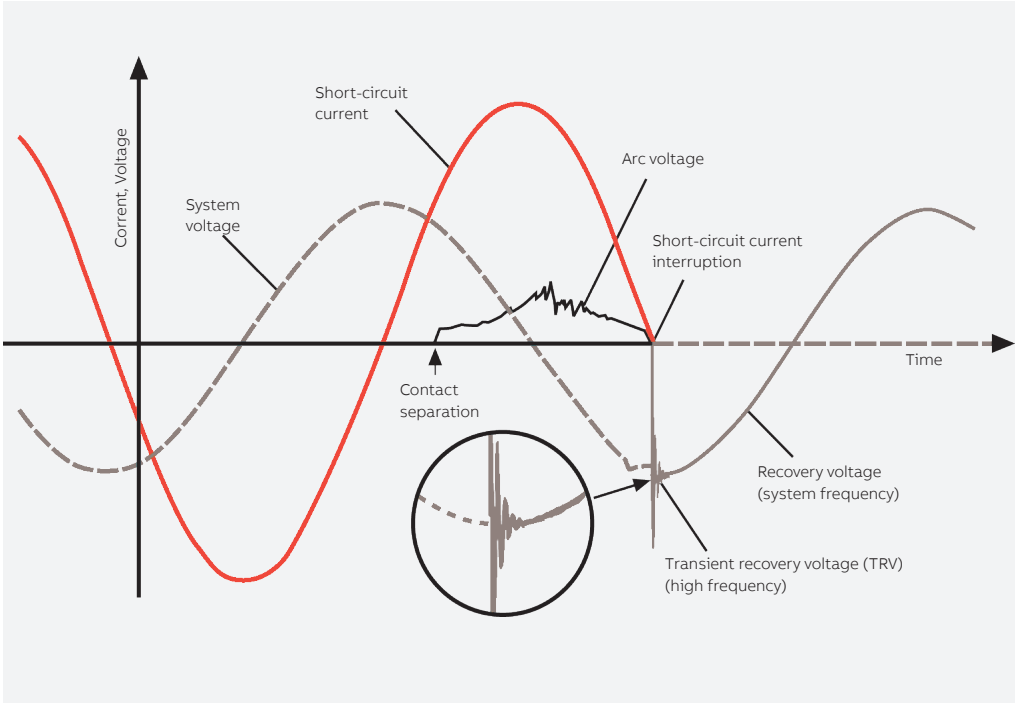
Besides minimizing the thermal stress to which the contacts are subjected, all this ensures that these latter are only eroded to a negligible extent and, above all, allows the interruption process to be controlled even with very high short-circuit current values.

ABB vacuum interrupters interrupt at natural current zero crossing, thereby preventing the arc from restriking after this has occurred.

Rapid reduction in current density at the same time as the zero current instant allow maximum dielectric strength to be re-established between the interrupter contacts within a few microseconds.



Geometry of radial magnetic field contact with a rotating vacuum arc.



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

Description

Versions available

VD4 circuit breakers are available in the fixed and withdrawable versions with front operating mechanism.
The withdrawable version is available for UniGear ZS1, ZS2, ZS8.4 and UniSec switchgear and for PowerCube and Powerbloc enclosures.

Fields of application

VD4 circuit breakers are used in power distribution systems for controlling and protecting cables, transformer and distribution substations, motors, transformers and capacitor banks.

Standards

VD4 circuit breakers comply with IEC 62271-100 Standards and those of the major industrialized countries.
VD4 circuit breakers undergo the tests indicated below and guarantee the safety and reliability of apparatus in service in every installation.

- **Type tests:** temperature rise, tests to verify the insulation level (tests with rated lightning impulse withstand voltage and power frequency withstand voltage), peak and short-time withstand current tests, mechanical life, shortcircuit current making and breaking capacity.
- **Individual tests:** insulation of the main circuits with voltage at power frequency, auxiliary and operating circuit insulation, measurement of the main circuit resistance, mechanical and electrical operation.

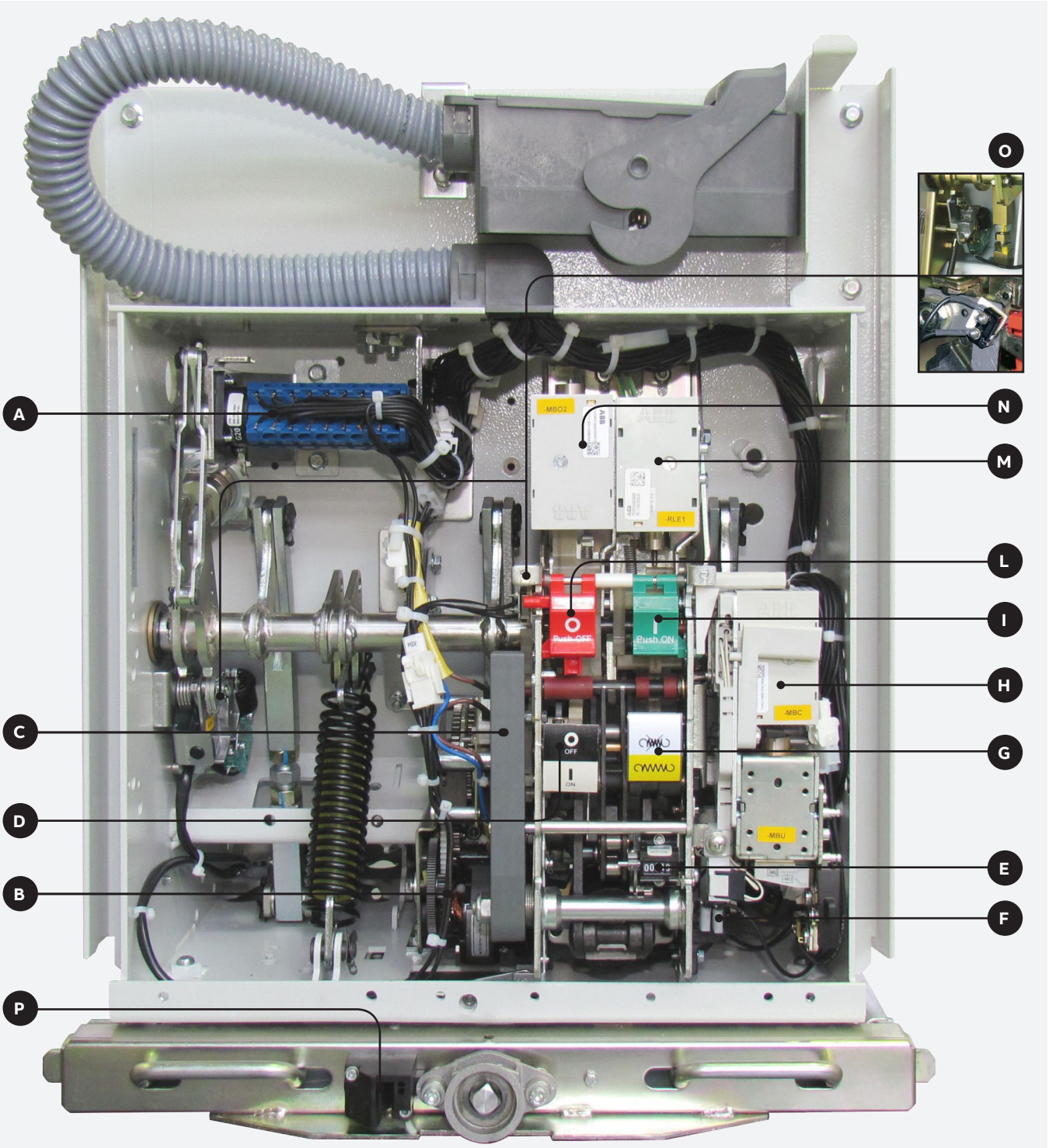
Safe service

Thanks to the complete range of mechanical and electrical locks (available on request), VD4 circuit breakers can be used to create reliable distribution switchgear.
The locking devices are designed to prevent incorrect operations and allow the installations to be inspected in conditions of operator safety.
Key locks or padlocks enable the opening and closing and/or racking in and out operations.
The device for racking-out with the door closed only allows the circuit breaker to be racked in or out of the switchgear with the door closed.
Anti-racking-in locks prevent circuit breakers with different rated currents from being racked in, and racking-in and out operations with the circuit breaker closed.

- **Highly reliable operating mechanisms since they have very few components**
- **Extremely limited, simple maintenance**
- **Accessories common to the entire range**
- **Electrical accessories that can be easily and quickly installed or replaced thanks to wiring pre-engineered with plug-socket connectors**
- **Mechanical anti-pumping device supplied as standard equipment**
- **Built-in closing spring loading lever**
- **Circuit breaker open key lock**
- **Protective covering over the opening and closing pushbuttons that can only operated with a special tool**
- **Padlock device on the operating pushbuttons**

Accessories

VD4 circuit breakers have a complete range of accessories able to meet all installation requirements.
The operating mechanism has a standardized range of accessories and replacement parts which are easy to identify and order.
The accessories are installed conveniently from the front of the circuit breaker. Electrical connection is performed with plug-socket connectors.
Use, maintenance and operation of the apparatus are simple and require limited use of resources.



Circuit breaker operating mechanism

A Open/closed auxiliary contacts
B Geared motor for loading closing spring
C Built-in closing spring loading lever
D Mechanical signaling device for circuit breaker open/closed
E Mechanical operation counter
F Contacts for signaling spring loaded/discharged
G Signaling device for closing springs loaded/discharged
H Service releases
I Closing pushbutton
L Opening pushbutton
M Operating mechanism locking electromagnet
N Additional shunt opening release
O Transient contact
P Lock that prevents racking-in when door is open

Description

VD4 evo
Evolution that Empowers

Complete health status assessment for intelligent operation and maintenance

30%

Reduction of unexpected outages

Reliability

60%

Operation and maintenance efficiency increase

Efficiency

15%

Footprint optimization and time savings

Productivity

Improve your OpEx by cutting outages and maintenance cost with the future of medium voltage circuit breakers

VD4 is now available with the new VD4 evo series of accessories and configuration coming from the ABB family of Digital components.

The primary components of the circuit breaker are the same assuring full interchangeably with previous version and keeping same reliability and performance, but enhancing Digital features.

Such new accessories can be equipped on the new units recognizable from the new cover design, that will be available on all the VD4 family very soon.

VD4 evo can be ordered with different configurations specific for your need: either fully equipped device option for Advanced Monitor & Diagnostic features or as a standard configuration, but with possibility of future upgrade. Check the accessories section of the catalogue for the full list and the rating table section for the available ratings.

Digital transformation starts from breaker evolution

Available versions

VD4 in VD4 evo version evo is available in either Standard or Digital configurations, depending on customer application needs.

The Digital version is available in 3 main packages:

- **Basic,** offers a basic yet comprehensive health and status management of the main circuit breaker components like the actuator and conductor integrity via thermal monitoring;
- **Advanced,** in addition to basic offering it is possible to get more comprehensive mechanical checks with travel curve monitoring, dynamic thermal monitoring and VI life check;
- **Flexible,** features can be selected individually depending on the application needs.

The Standard VD4 evo offers the possibility of upgrade to Digital version with the “Digital upgrade” kits, but does not provide monitoring and diagnostic features by default.

Features	Digital			Standard
	VD4 evo Basic	VD4 evo Advanced	VD4 evo Flexible	VD4 evo
Warnings and alarms with suggestions from expert	•	•	•	Upgradable
Environmental temperature and humidity monitoring	•	•	•	
Basic mechanical kinematic chain anomalies detection	•	•	•	
Accessories monitoring and replacement suggestions	•	•		
Loose connections detection and CB contacts monitoring	•	•		
Predict CB mechanical failures		•	•	
Advanced thermal checks & VI life		•	•	
Advanced mechanical chain and travel curve monitor		•		

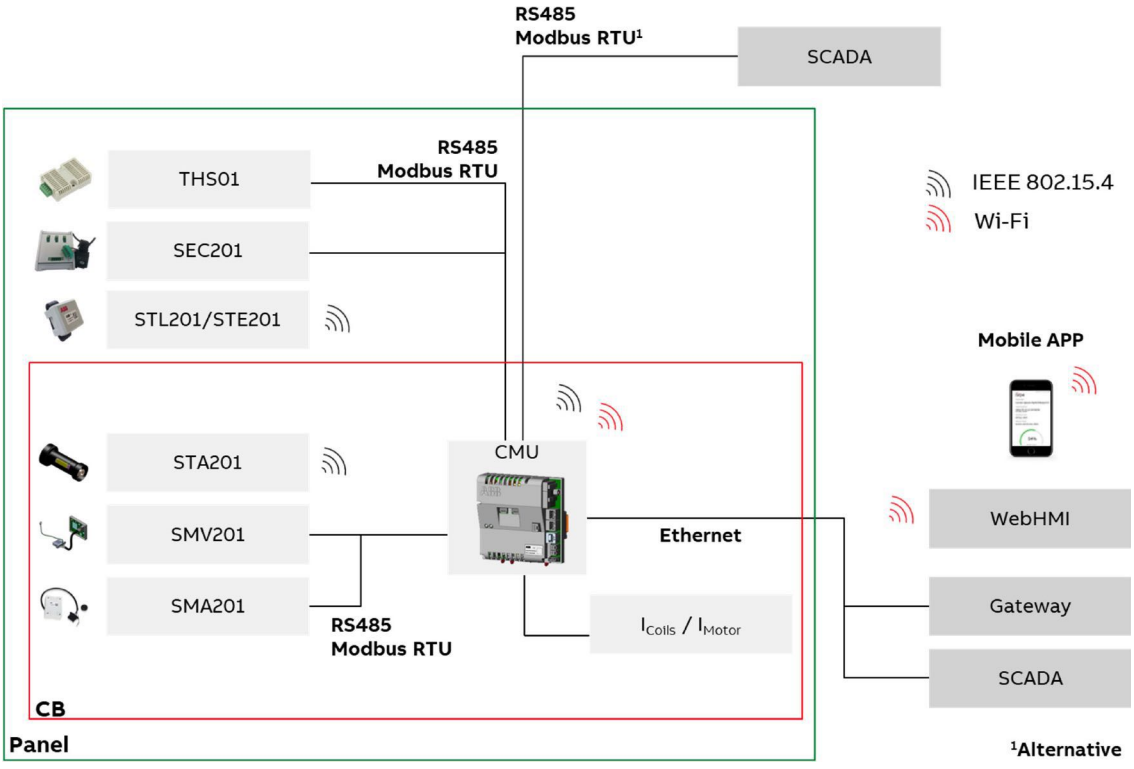
See the accessories section of the catalogue for more information on the available sensors and kits.

Interfaces

You have access to the circuit breaker information from the new dedicated WebHMI, that was designed to be intuitive and familiar as other ABB products. To access the Digital features, there are different connectivity options:

- Locally in site using the breaker hotspot Wi-Fi connection, with the option of using the Mobile APP RXplore for one-click connection via QR-CODE
- Via ethernet cable included in the breaker plug (if selected)
- Connecting the breaker to a SCADA system through Modbus TCP

For connections details and instruction see the dedicated Configuration Manual.



*SMV201 Vibration sensor coming soon

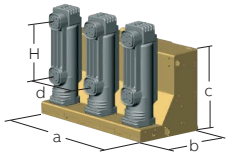
Description

General characteristics of the VD4 series

The VD4 series of vacuum circuit breakers conform to the specifications of the following standards:

- IEC 62271-1
- IEC 62271-100

Rated voltage (1)	**kV**	**12**			
Rated frequency	Hz	50 - 60			
Rated thermal current	A	630 . . . 4000 (2)			
Short-time withstand current and breaking capacity	kA	16 ... 31.5	40	50	63
Making capacity	kA	40 ... 80	100	125 (3)	164
Admissible short-time withstand current	s	3	3	3	3 (8)
Fixed / withdrawable version		•/•	•/•	•/•	•/•
Maximum overall dimensions (fixed version)	d (mm)	150 - 275	150 - 210 - 275 - 275	210 - 275	275
	H (mm)	205 - 310	310	310	310
	a (mm)	450 - 700	450 - 570 - 700	600 - 750	750
	b (mm)	424	424	459	459
	c (mm)	461 - 599	599 (5)	608 (7)	677
Weight	kg	73 - 105	94 - 180	147 - 260	260
Embedded poles		•	•	•	-
Assembled poles		-	-	-	•



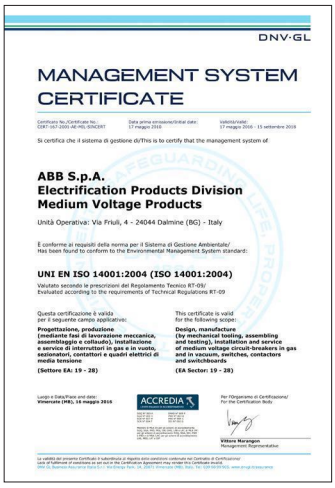
(1) Test voltage according to IEC 62271-1 Standards table 1a, VDE 0670, - part 1000, list 2
(2) With forced ventilation
(3) Higher values on request
(4) 360 mm for fixed version, 280 mm for withdrawable version
(5) Circuit breaker with heat sink 616 mm (2500 A)
(6) Withdrawable version
(7) Circuit breaker with heat sink 634 mm (3150 A)
(8) 1s for withdrawable version
(9) 40.5kV up to 2000A
(10) Withdrawable only up to 36kV

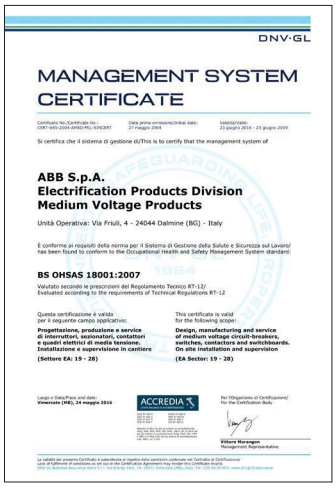
Technical documentation

Order the following publications for more details about the technical aspects and applications of VD4 circuit breakers:

- PowerCube modules code 1VCP000091
- Powerbloc modules code BA441/03E
- UniGear ZS1 switchgear code 1VCP000138
- ZS8.4 switchgear code L2288
- REF542*plus* unit code 1VTA100001
- UniSec cod. 1VFM200003


DNV·GL
MANAGEMENT SYSTEM CERTIFICATE
ABB S.p.A.
Electrification Products Division
Medium Voltage Products
UNI EN ISO 9001:2008 (ISO 9001:2008)


DNV·GL
MANAGEMENT SYSTEM CERTIFICATE
ABB S.p.A.
Electrification Products Division
Medium Voltage Products
UNI EN ISO 14001:2004 (ISO 14001:2004)


DNV·GL
MANAGEMENT SYSTEM CERTIFICATE
ABB S.p.A.
Electrification Products Division
Medium Voltage Products
BS OHSAS 18001:2007


ACCREDIA
CERTIFICATO DI ACCREDITAMENTO
Accreditation Certificate
ABB S.p.A. Power Products Division

17.5			**24**	**36/40.5**	**36/40.5**
50 - 60			50 - 60	50-60	50-60
630 . . . 4000 ([2])			630 . . . 3150 ([2])	630 ... 3150 ([9])	630 ... 3150
16 ... 31.5	40 ... 50	63	16 ... 31.5	16 ... 31.5	16 ... 40
40 ... 80	100 ... 125	164	40 ... 80	40 ... 80	40 ... 100
3	3	3 ([8])	3	3	3
•/•	•/•	•/•	•/•	•/• ([10])	•/•
150 - 275	150 - 210 - 275	275	210 - 275	275	280 - 360 ([4])
205 - 310	310	310	310	328	328
450 - 700	450 - 570 - 700	750	570 - 700	786 / 853 ([6])	895 ([6]) - 1000
424	424	459	424	492 / 789 ([6])	555 - 686 ([6])
461 - 599 ([5])	599 ([5]) ([7])	677	631 - 661	876 / 973 ([6])	1575
73 - 105	94 - 180	260	100 - 110	170 / 210	290 - 350
•	•	-	•	•	•
-	-	•	-	•	•

Quality System
Complies with EN ISO 9001 Standards, certified by an independent organisation.

Test Laboratory
Complies with EN ISO/IEC 17025 Standards, accredited by an independent organisation.

Environmental Management System
Complies with EN ISO 14001 Standards, certified by an independent organisation.

Health and Safety Management System
Complies with OHSAS 18001 Standards, certified by an independent organisation.


Translation

Deutsche Akkreditierungsstelle Technik (DATech) e.V.
Signatory of the Multilateral Agreement of EA and ILAC for the mutual recognition
represented in the

Deutschen AkkreditierungsRat

Akkreditierung

The **German Accreditation Body Technology (DATech) e.V.** certifies that the Testing Laboratory

PEHLA Testing Laboratories Ratingen
Oberhausener Str. 33
D-40472 Ratingen

is competent under the terms of DIN EN ISO/IEC 17025 to carry out testing in the fields

High-Voltage Switchgear and Controlgear,
Current and Voltage Transformers,
Power Transformers and Busbar Systems

according to the annexed list of standards and specifications.
The accreditation is valid until: **October 14th, 2008**
The annex is deemed part of this certificate and comprises **2** pages.
DAR-Registration No.: **DAT-P-032/93-62**
Frankfurt/Main, October 15th, 2003

i.V. Dipl.-Ing. (FH) R. Egner
Head of the Accreditation Body

Member in EA, ILAC, IAF

Translation for information purposes only. The German Accreditation Certificate is authoritative. See notes overleaf


Deutsche Akkreditierungsstelle Technik (DATech) e.V.
vertreten im

Deutschen AkkreditierungsRat

Akkreditierung

Die **Deutsche Akkreditierungsstelle Technik (DATech) e.V.** bestätigt hiermit, dass das Prüflaboratorium

PEHLA Testing Laboratories Ratingen
Oberhausener Str. 33
D-40472 Ratingen

die Kompetenz nach DIN EN ISO/IEC 17025 besitzt, Prüfungen in den Bereichen

Hochspannungsschaltanlagen und -schaltgeräte,
Strom- und Spannungswandler, Transformatoren und Sammelschienensysteme

nach den in der Anlage aufgeführten Normen und Spezifikationen auszuführen.
Die Akkreditierung ist gültig bis: **14.10.2008**
Die Anlage ist Bestandteil der Urkunde und besteht aus **2** Seiten.
DAR-Registriernummer: **DAT-P-032/93-62**

Frankfurt/Main, 15.10.2003

i.V. Dipl.-Ing. (FH) R. Egner
Leiter der Akkreditierungsstelle

Akkreditierungsstelle in der TGA – Trägergemeinschaft für Akkreditierung GmbH

Siehe Hinweise auf der Rückseite


Deutsche Akkreditierungsstelle Technik (DATech) e.V.
vertreten im

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Akkreditierung

Die **Deutsche Akkreditierungsstelle Technik (DATech) e.V.** bestätigt hiermit, dass das Prüflaboratorium

ABB AG – Division Energietechnik
Calor Emag Mittelspannungsprodukte
Oberhausener Str. 33
D-40472 Ratingen

die Kompetenz nach DIN EN ISO/IEC 17025 besitzt, Prüfungen in den Bereichen

Hochspannungsschaltanlagen und -schaltgeräte,
Niederspannungs-Schaltgerätekombinationen,
Strom- und Spannungswandler, Transformatoren und Sammelschienensysteme

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DAR-Registriernummer: **DAT-P-032/93-62**

Frankfurt/Main, 29.07.2005

i.V. Dipl.-Ing. (FH) R. Egner
Leiter der Akkreditierungsstelle

Akkreditierungsstelle in der TGA – Trägergemeinschaft für Akkreditierung GmbH

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Calor Emag Medium Voltage Products
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Member in EA, ILAC, IAF

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Standard equipment of withdrawable circuit breakers for UniGear ZS1, ZS2, ZS3.2 switchgear and similar panels

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

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

  Note: three break contacts (signaling circuit breaker open) and four make contacts (signaling circuit breaker closed) are available with the group of ten auxiliary contacts supplied as standard and the maximum number of electrical applications.
- lever built into operating mechanism for linear loading of closing spring
- isolating contacts
- cord with connector (plug only) for auxiliary circuits, with striker pins which prevent the plug from being inserted into the socket if the rated current of the circuit breaker is lower than the rated current of the panel
- racking-out/in lever (the quantity depends on the number of apparatuses ordered)
- locking electromagnet in the truck (mandatory for ABB switchgear). This device prevents the circuit breaker from being racked into the switchgear when the auxiliary circuits are not connected (plug not in in the socket)
- door interlock (mandatory for ABB switchgear). This device prevents the circuit breaker from being racked into the switchgear when the switchgear door is open.

VD4 with poles in polyamide

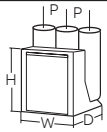
VD4 - 36 kV

VD4 - up to 24 kV

VD4 - 36/40 kV in floor rolling version

Selection and ordering
Withdrawable circuit breakers

Withdrawable circuit breakers for PowerCube modules (24 kV) ([4])

Circuit breaker		**VD4/P 24**				
	PowerCube module	**PB4**		**PB5**		
Standards	IEC 62271-100	•		•		
Rated voltage	Ur [kV]	24		24		
Rated insulation voltage	Us [kV]	24		24		
Withstand voltage at 50 Hz	Ud (1 min) [kV]	50		50		
Impulse withstand voltage	Up [kV]	125		125		
Rated frequency	fr [Hz]	50-60		50-60		
Rated thermal current (40 °C) ([1])	Ir [A]	630	1250	1600	2000	2500 ([2])
Rated breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	16	16	16	16	16
		20	20	20	20	20
		25	25	25	25	25
		–	31.5	31.5	31.5	31.5
Rated short-time withstand current (3s)	Ik [kA]	16	16	16	16	16
		20	20	20	20	20
		25	25	25	25	25
		–	31.5	31.5	31.5	31.5
Making capacity	Ip [kA]	40	40	40	40	40
		50	50	50	50	50
		63	63	63	63	63
		–	80	80	80	80
Operation sequence	[O - 0.3 s - CO - 15 s - CO]	•	•	•	•	•
Opening time	[ms]	33 ... 60	33 ... 60	33 ... 60	33 ... 60	33 ... 60
Arcing time	[ms]	10 ... 15	10 ... 15	10 ... 15	10 ... 15	10 ... 15
Total breaking time	[ms]	43 ... 75	43 ... 75	43 ... 75	43 ... 75	43 ... 75
Closing time	[ms]	30 ... 60	30 ... 60	30 ... 60	30 ... 60	30 ... 60
Maximum overall dimensions 	H [mm]	794	794	838	838	838
	W [mm]	653	653	853	853	853
	D [mm]	802	802	790	790	790
	Pole center distance P [mm]	210	210	275	275	275
Weight	[kg]	140	140/146 ([3])	228	228	228
Standardized dimensions table	TN	7413	7413	7418	7418	7418
	1VCD	–	000173 ([3])	–	–	–
Operating temperature	[°C]	- 5 ... + 40				
Tropicalization	IEC: 60068-2-30, 60721-2-1	•				
Electromagnetic compatibility	IEC: 62271-1	•				

([1]) Rated current guaranteed with circuit breaker installed in PowerCube enclosure and with 40 °C ambient temperature.
([2]) 2300 A rated uninterrupted current guaranteed with natural ventilation; 2500 A rated uninterrupted current guaranteed with forced ventilation.
([3]) 31.5 kA version.
([4]) On request, the closing spring can be loaded by means of a removable crank handle outside the operating mechanism (instead of linear loading, only possible with the door open, by means of a lever built into the front of the operating mechanism).

Selection and ordering
Withdrawable circuit breakers

Types of withdrawable circuit breakers available for PowerCube modules

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

VD4 (12 kV) withdrawable circuit breaker

Ur	Isc	Rated thermal current (40 °C) [A]				
		W=650	W=750	W=750	W=1000	
		P=150	P=210	P=210	P=275	
kV	kA	u/l=205	u/l=310	u/l=310	u/l=310	Circuit breaker type
		ø=35	ø=35	ø=79	ø=109	
	16	630				VD4/P 12.06.16 p150
	20	630				VD4/P 12.06.20 p150
	25	630				VD4/P 12.06.25 p150
	31,5	630				VD4/P 12.06.32 p150
	16	1250				VD4/P 12.12.16 p150
	20	1250				VD4/P 12.12.20 p150
	25	1250				VD4/P 12.12.25 p150
	31,5	1250				VD4/P 12.12.32 p150
	16		630			VD4/W 12.06.16 p210
	20		630			VD4/W 12.06.20 p210
	25		630			VD4/W 12.06.25 p210
	31,5		630			VD4/W 12.06.32 p210
	16		1250			VD4/W 12.12.16 p210
	20		1250			VD4/W 12.12.20 p210
	25		1250			VD4/W 12.12.25 p210
	31,5		1250			VD4/W 12.12.32 p210
	40		1250			VD4/W 12.12.40 p210
	40			1250		VD4/P 12.12.40 p210
	50			1250		VD4/P 12.12.50 p210
12	20			1600		VD4/P 12.16.20 p210
	25			1600		VD4/P 12.16.25 p210
	31,5			1600		VD4/P 12.16.32 p210
	40			1600		VD4/P 12.16.40 p210
	50			1600		VD4/P 12.16.50 p210
	20			2000		VD4/P 12.20.20 p210
	25			2000		VD4/P 12.20.25 p210
	31,5			2000		VD4/P 12.20.32 p210
	40			2000		VD4/P 12.20.40 p210
	50			2000		VD4/P 12.20.50 p210
	20				2500	VD4/P 12.25.20 p275
	25				2500	VD4/P 12.25.25 p275
	31,5				2500	VD4/P 12.25.32 p275
	40				2500	VD4/P 12.25.40 p275
	50				2500	VD4/P 12.25.50 p275
	20				3150 (1)	VD4/W 12.32.20 p275
	25				3150 (1)	VD4/W 12.32.25 p275
	31,5				3150 (1)	VD4/W 12.32.32 p275
	40				3150 (1)	VD4/W 12.32.40 p275
	50				3150 (1)	VD4/W 12.32.50 p275

W = Enclosure width.
P = Horizontal center distance of poles.
u/l = Distance between bottom and top terminal.
ø = Diameter of isolating contact.
(1) Up to 4000 A with forced ventilation.

VD4 (17.5 kV) withdrawable circuit breaker

Ur	Isc	Rated thermal current (40 °C) [A]				
		W=650	W=750	W=750	W=1000	
		P=150	P=210	P=210	P=275	
kV	kA	u/l=205	u/l=310	u/l=310	u/l=310	Circuit breaker type
		ø=35	ø=35	ø=79	ø=109	
17.5	16	630				VD4/P 17.06.16 p150
	20	630				VD4/P 17.06.20 p150
	25	630				VD4/P 17.06.25 p150
	31.5	630				VD4/P 17.06.32 p150
	16	1250				VD4/P 17.12.16 p150
	20	1250				VD4/P 17.12.20 p150
	25	1250				VD4/P 17.12.25 p150
	31.5	1250				VD4/P 17.12.32 p150
	16		630			VD4/W 17.06.16 p210
	20		630			VD4/W 17.06.20 p210
	25		630			VD4/W 17.06.25 p210
	31.5		630			VD4/W 17.06.32 p210
	16		1250			VD4/W 17.12.16 p210
	20		1250			VD4/W 17.12.20 p210
	25		1250			VD4/W 17.12.25 p210
	31.5		1250			VD4/W 17.12.32 p210
	40			1250		VD4/P 17.12.40 p210
	50			1250		VD4/P 17.12.50 p210
	20			1600		VD4/P 17.16.20 p210
	25			1600		VD4/P 17.16.25 p210
	31.5			1600		VD4/P 17.16.32 p210
	40			1600		VD4/P 17.16.40 p210
	50			1600		VD4/P 17.16.50 p210
	20			2000		VD4/P 17.20.20 p210
	25			2000		VD4/P 17.20.25 p210
	31.5			2000		VD4/P 17.20.32 p210
	40			2000		VD4/P 17.20.40 p210
	50			2000		VD4/P 17.20.50 p210
	20				2500	VD4/P 17.25.20 p275
	25				2500	VD4/P 17.25.25 p275
	31.5				2500	VD4/P 17.25.32 p275
	40				2500	VD4/P 17.25.40 p275
	50				2500	VD4/P 17.25.50 p275
	20				3150 (1)	VD4/W 17.32.20 p275
	25				3150 (1)	VD4/W 17.32.25 p275
	31.5				3150 (1)	VD4/W 17.32.32 p275
	40				3150 (1)	VD4/W 17.32.40 p275
	50				3150 (1)	VD4/W 17.32.50 p275

W = Enclosure width.
P = Horizontal center distance of poles.
u/l = Distance between bottom and top terminals.
ø = Diameter of isolating contact.
(1) Up to 4000 A with forced ventilation.

Selection and ordering
Withdrawable circuit breakers

VD4 (24 kV) withdrawable circuit breaker

Ur	Isc	Rated thermal current (40 °C) [A]		Circuit breaker type
		W=800	W=1000	
kV	kA	P=210	P=275	
		u/l=310	u/l=310	
		ø=35	ø=79	
24	16	630		VD4/P 24.06.16 p210
	20	630		VD4/P 24.06.20 p210
	25	630		VD4/P 24.06.25 p210
	16	1250		VD4/P 24.12.16 p210
	20	1250		VD4/P 24.12.20 p210
	25	1250		VD4/P 24.12.25 p210
	31.5	1250		VD4/P 24.12.32 p210
	16		1600	VD4/P 24.16.16 p275
	20		1600	VD4/P 24.16.20 p275
	25		1600	VD4/P 24.16.25 p275
	31.5		1600	VD4/P 24.16.32 p275
	16		2000	VD4/P 24.20.16 p275
	20		2000	VD4/P 24.20.20 p275
	25		2000	VD4/P 24.20.25 p275
	31.5		2000	VD4/P 24.20.32 p275
	16		2300 (1)	VD4/P 24.25.16 p275
	20		2300 (1)	VD4/P 24.25.20 p275
	25		2300 (1)	VD4/P 24.25.25 p275
	31.5		2300 (1)	VD4/P 24.25.32 p275

W = Enclosure width.
P = Horizontal center distance of poles.
u/l = Distance between bottom and top terminals.
ø = Diameter of isolating contact.
(1) Up to 2500 A rated current guaranteed with forced ventilation.

Standard equipment of withdrawable circuit breakers for PowerCube modules

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

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

  Note: three break contacts (signaling circuit breaker open) and four make contacts (signaling circuit breaker closed) are available with the group of ten auxiliary contacts supplied as standard and the maximum number of electrical applications.
- lever built into the operating mechanism for linear loading of closing spring
- isolating contacts
- cord with connector (plug only) for auxiliary circuits, with striker pins which prevent the plug from being inserted into the socket if the rated current of the circuit breaker is different from the rated current of the switchgear
- racking-in/out lever (the quantity depends on the number of apparatuses ordered)
- locking electromagnet in the truck. This prevents the circuit breaker from being racked into the switchgear when the auxiliary circuits are not connected (plug not in in the socket).
- door interlock (mandatory for ABB switchgear); this device prevents the circuit breaker from being racked into the switchgear when the switchgear door is open.

Selection and ordering
Optional accessories

For circuit breakers up to 36 kV, 50 kA with EL operating mechanism
Accessories with the same number are alternative to each other.

1 Shunt opening release (-MBO1)
Allows the opening command of the apparatus to be enabled by remote control.
This release is suitable for both instantaneous and permanent duty. However, there is always an auxiliary contact, -BGB1, that de-energizes it after the circuit breaker has opened. In the case of instantaneous service, the current impulse must last at least 100 ms.
This release can be controlled by the following devices: coil continuity control (CCC), opening circuit supervision (TCS)(*) or the ABB STU functionality control device (see accessory 21, supplied on request).

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

2 Additional shunt opening release (-MBO2)
Similarly to shunt opening release -MBO1, this allows the opening command of the apparatus to be transmitted by remote control. It can be supplied by the same circuit as main shunt opening release -MBO1 or by a circuit that is completely separate from release -MBO1.
This release is suitable for both instantaneous and permanent duty. However, there is always an auxiliary contact, -BGB1, that de-energizes it after the circuit breaker has opened.
To guarantee the release action, the current impulse must last at least 100 ms.
Continuity functionality can be checked with a continuity control device (CCC), opening circuit supervision (TCS)(*) or the STU functionality control device (see accessory 21, supplied on request).
-MBO2 has the same electrical and operating characteristics as release -MBO1.

(*) The minimum current that the relay with TCS function (used for monitoring coil continuity) detects as a condition denoting that the trip circuit is operating correctly (specified for each relay in the relative manual), must be sensibly higher than the self-consumption current of the actual coil (~1.5 mA).
If this fails to occur, always add, in parallel to the TCS, a circuit able to absorb sufficient current to compensate the gap while preventing the total current in the TCS circuit from rising above the maximum threshold up to 100mA.
A simple resistor can be sized for the purpose, depending on the parameters of the TCS and the auxiliary voltage range used.
For further details consult the Guidelines for use of the Smart Coil 1VCD601416

3 Opening solenoid (-MBO3)

The opening solenoid (-MBO3) is a special demagnetization release to be used in conjunction with an overcurrent protection relay of the self-supplied type.
It is situated in the operating mechanism (in the left side) and is not an alternative to the additional shunt opening release **(-MBO2).**
It is not available for 40 and 50 kA circuit breakers.
Should this accessory be required, specify at the time of order since it cannot be installed later on by the customer.
Note: ask ABB for info for use in conjunction with the protection relay.

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

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

4 Shunt closing release (-MBC)

Allows the closing command of apparatus to be transmitted by remote control.
This release is suitable for both instantaneous and permanent duty. An auxiliary contact that de-energizes it after the circuit breaker has closed is not envisaged.
The permanently supplied release provides the electrical anti-pumping function with both electrical opening and re-closing commands maintained. To guarantee the closing action, the current impulse must last at least 100 ms.
If there is the same supply voltage for shunt closing release -MBC and under-voltage release -MBU and the circuit breaker must close automatically when auxiliary voltage returns, there must be a delay of at least 50 ms between under-voltage release energizing and energizing of the shunt closing release to allow the closing operation to take place. Continuity functionality can be checked with a continuity control device (CCC), opening circuit supervision (TCS)(*) or the STU functionality control device (see accessory 21, supplied on request).

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

(*) The minimum current that the relay with TCS function (used for monitoring coil continuity) detects as a condition denoting that the trip circuit is operating correctly (specified for each relay in the relative manual), must be sensibly higher than the current consumption of the actual coil (~1.5 mA).
If this fails to occur, always add, in parallel to the TCS, a circuit able to absorb sufficient current to compensate the gap while preventing the total current in the TCS circuit from rising above the maximum threshold up to 100mA.
A simple resistor can be sized for the purpose, depending on the parameters of the TCS and the auxiliary voltage range used.
For further details, consult the Guidelines for use of the Smart Coil 1VCD601416

Selection and ordering
Optional accessories

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

The undervoltage release is available in the following versions:

5A Undervoltage release (with supply shunted from a transformer on the supply side of the circuit breaker or from an auxiliary power supply, regardless of the state in which the circuit breaker is to be found).

5B Undervoltage release with -KFT electronic time-lag device (0.5 - 1 - 1.5 - 2 - 3 s) (with power supply as indicated for 5A); this device is supplied with a 0.5 s setting (the adjustments are described in the Circuit diagrams chapter)

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

Note
As an alternative to the undervoltage release, an additional shunt opening release (-MBO4) with the same electrical and operating specifications as shunt opening release (-MBO1) can be installed on request (only for 12..17.5 kV circuit breakers up to 40 kA and 24 kV up to 31.5 kA).
Warning! Since installation of the additional shunt opening release (-MBO4) requires a special mounting plate for releases, ask for application (-MBO4) when ordering and not after delivery.

5C Electronic time-lag device (-KFT)

The electronic time-lag device must be installed outside the circuit breaker. It allows release tripping to be delayed by preset and adjustable times.

Use of the undervoltage release is recommended for the purpose of preventing trips when the power supply network of the release may be subject to interruptions or voltage drops of short duration.

If it is not being energized, circuit breaker closing is inhibited.

The time-lag device must be used in conjunction with an undervoltage release for d.c.

The voltage of the undervoltage release must be within the operating range of the electronic time-lag device.

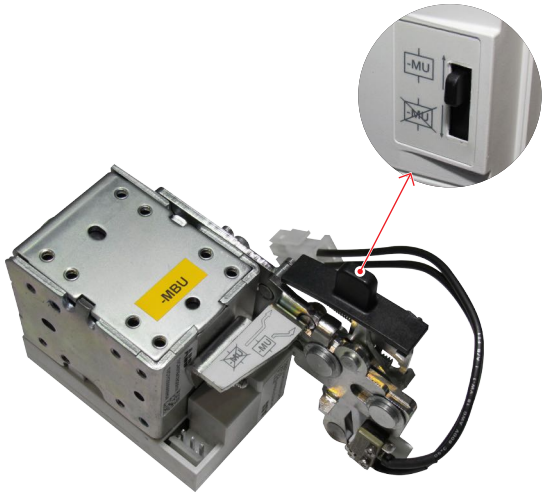
Characteristics of the time-lag device	
Un	24...30 - 48 - 60 - 110...127 - 220...250 V–
Un	48 - 60 - 110...127 - 220...240 - V~ 50/60 Hz
Adjustable opening time (release + time-lag device):	0.5-1-1.5-2-3 s

6 Mechanical override of the undervoltage release

This is a mechanical device which allows the undervoltage release trip to be temporarily excluded.

It is always equipped with electrical signaling.

If this accessory is required, it must be specified at the time of order since it cannot be installed later on by the customer.



Selection and ordering
Optional accessories

7a Auxiliary contacts of the circuit breaker (-BGB1) for 12 to 24 kV versions

Electrical signaling of circuit breaker open/closed can be obtained with a group of 10, 16, 20 or 24 auxiliary contacts for the fixed version and 10 or 16 auxiliary contacts for the withdrawable version. The standard equipment comprises 10 auxiliary contacts.

Note

The following are available using the standard group of ten auxiliary contacts and the maximum number of electrical accessories:

- for fixed circuit breakers: three closing contacts “a” for signaling circuit breaker open and five opening contacts “b” for signaling circuit breaker closed;
- for withdrawable circuit breakers: three closing contacts “a” for signaling circuit breaker open and four opening contacts “b” for signalling circuit breaker closed.

Circuit breakers in the fixed version are available with two finishing accessories (to be specified when ordering):

- non-wired auxiliary contacts; wiring to the terminals of the contacts is at the customer’s charge (photo at left; the terminal box to which the other electrical accessories are wired is at the top); ask for instructions 1VCD601204 (available in the main languages) which describe how to remove, wire the auxiliary contacts more easily and fit the auxiliary contact unit back into its housing;
- auxiliary contacts already wired to the terminal box (see photo at right)

Consult circuit diagrams 1VCD400151 for fixed circuit breakers and 1VCD400155 for withdrawable circuit breakers.

Note: The main shunt opening release and/or the additional shunt opening release use 1 and/or 2 closing contacts “a”, thereby reducing the number of auxiliary contacts available. Always check the maximum number of contacts available with non-standard equipment.

The new diagrams are interchangeable with the existing ones, with the following exceptions:

- diagram 1VCD400151 (substitutes 1VCD400046 and 1VCD400099)
  - fig. 34 on the previous diagrams is represented by fig. 31 + fig. 32 on the new diagram;
  - fig. 33 and fig. 35 on the previous diagrams are not available with the new layout
- diagram 1VCD400155 (substitutes 1VCD400047)

Auxiliary contacts –BGB1 conform to the following standards/regulations/directives:

- IEC 62271-100
- IEEE C37.54
- EN 61373 cat. 1 class B / impact and vibration test
- Germanish Loyd regulation / vibrations envisaged by the shipping registers
- UL 508
- EN 60947 (DC-21A DC-22A DC-23A AC-21A)
- RoHS Directive

General characteristics	
Insulation voltage to standard VDE 0110, Group C	660 V AC 800 V DC
Rated voltage	24 V ... 660 V
Test voltage	2 kV for 1 min
Maximum rated current	10 A - 50/60 Hz
Breaking capacity	Class 1 (IEC 62271-1)
Number of contacts	5
Groups of contacts	10 / 16 / 20
Contact travel	90°
Actuating force	0.66 Nm
Resistance	<6.5 mΩ
Storage temperature	–30 °C ... +120 °C
Operating temperature	–20 °C ... +70 °C (-30° ref. ANSI 37.09)
Contact overtemperature	10 K
Mechanical life	30.000 mechanical operations
Protection class	IP20
Cable section	1 mm²

Electrical characteristics (according to IEC 60947)		
Rated current Un		Breaking capacity (10000 interruptions)
220 V AC	Cosφ = 0.70	20 A
220 V AC	Cosφ = 0.45	10 A
24 V DC	1 ms (*)	12 A
	15 ms	9 A
	50 ms	6 A
60 V DC	1 ms	10 A
	15 ms	6 A
	50 ms	4.6 A
110 V DC	1 ms	7 A
	15 ms	4.5 A
	50 ms	3.5 A
220 V DC	1 ms	2 A
	15 ms	1.7 A
	50 ms	1.5 A
250 V DC	1 ms	2 A
	15 ms	1.4 A
	50 ms	1.2 A

Electrical characteristics (according to IEC 62271-100 class 1)	
Rated voltage Un	Breaking capacity
24 V DC 20 ms	18.8 mA
60 V DC 20 ms	7.4 mA
110 V DC 20 ms	4.2 mA
250 V DC 20 ms	1.8 mA

(*) For application at 24Vdc and with currents lower than 2,5mA golden contacts are recommended.

8 Transient contact (-BGB4)

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

Selection and ordering
Optional accessories

9 Position contact (-BGT3)
This contact is used, together with the locking magnet in the operating mechanism **(-RLE1)**, to prevent remote closing as the circuit breaker is racked into the compartment.
It is only supplied for withdrawable circuit breakers for UniGear ZS1 switchgear and PowerCube modules.
It cannot be supplied when transmitted contacts in the truck are requested **(-BGT1; -BGT2)**.

10 Transmitted contacts (*) in the truck (-BGT1; -BGT2)
Transmitted contacts of withdrawable circuit breakers (installed in the circuit breaker truck - only for VD4/P withdrawable circuit breakers). These contacts are either in addition or alternatives to the position contacts (for signaling circuit breaker racked out). They also act as position contacts **(-BGT3)**.

(*) For application at 24Vdc and with currents lower than 10mA golden contacts are recommended.

11 Motor operator (-MAS)

Automatically loads the closing springs of the circuit breaker operating mechanism. After circuit breaker closing, the geared motor immediately reloads the closing springs.
If there is a power cut or during maintenance work, the closing spring can be loaded in the manual mode (by means of the special crank handle built into in the operating mechanism).

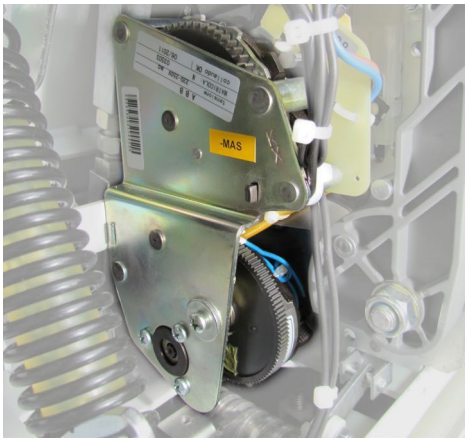
Characteristics		
Un	24...30 - 48...60 - 110...130 - 220...250 V–	
Un	100...130 - 220...250 V~ 50/60 Hz	
Operating limits	85 ... 110% Un	
Inrush power (Ps)	≤ 40 kA	50 kA
	DC = 600 W; AC = 600 VA	DC = 900 W; AC = 900 VA
Rated power (Pn)	DC = 200 W; AC = 200 VA	DC = 350 W; AC = 350 VA
Inrush duration	0.2 s	0.2 s
Loading time	6-7 s	6-7 s
Insulation voltage	2000 V 50 Hz (for 1 min)	2000 V 50 Hz (for 1 min)

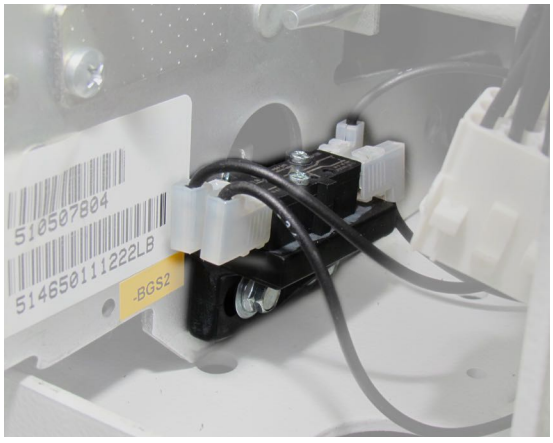
12 Contact for signaling closing spring loaded/ discharged (-BGS2)

Consists of a microswitch which allows the state of the closing spring of the circuit breaker operating mechanism to be remotely signaled.
The following signals are possible:
- contact open: spring loaded signal
- contact closed: spring discharged signal.

The two signals must be used for circuits with the same power supply voltage.

Rated voltage (a.c.)	250	V
Rated current	10	A
Thermal capacity	17	A
Short-time withstand current	20	A for 30 sec
Withstand voltage at 50 Hz for 1 minute between live parts and ground	>2000	V
Distance between open contacts	0.5	mm



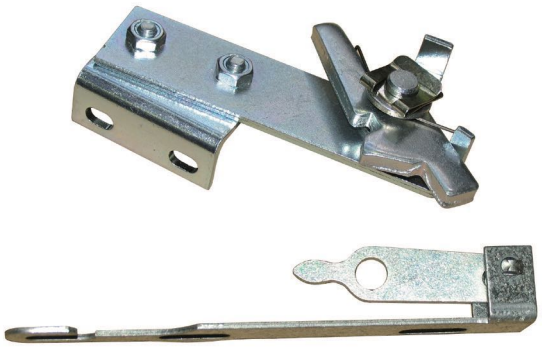


Selection and ordering
Optional accessories

17 Locking magnet on the truck (-RLE2)
Mandatory accessory for withdrawable circuit breakers for UniGear ZS1 switchgear and PowerCube modules. Prevents the circuit breaker from racking into the switchgear when the auxiliary circuit plug is disconnected.
The plug also acts as an anti-insertion lock if the rated current is different. Special striker pins prevent the plug from being inserted into the socket if the rated current of the circuit breaker is lower than the rated current of the panel.
Note: a specific version for the circuit breakers of ZS8.4 switchgear is available on request. This accessory is not available when the motor-operated truck is required

Characteristics	
Un	24 - 30 - 48 - 60 - 110 - 125 - 127 - 132 - 220 - 240 V–
Un	24 - 30 - 48 - 60 - 110 - 125 - 127 - 220 - 230 ... 240 V~ 50/60 Hz
Operating limits	85 ... 110% Un
Inrush power (Pn)	DC 250 W; AC = 250 VA
Continuous power (Pc)	DC = 5 W; AC = 5 VA
Inrush duration	150 ms
Insulation voltage	2000 V 50 Hz (for 1 min)

18 Interlock for fixed circuit breakers
Device for fixed circuit breakers which have been converted into withdrawable ones by the customer. It allows a mechanical lock to be created by the customer to prevent racking-out/in with the circuit breaker closed and prevents circuit breaker closing while moving.
Note: The device must be requested when ordering since it must be assembled and tested in the factory.



19 Mechanical interlock with door

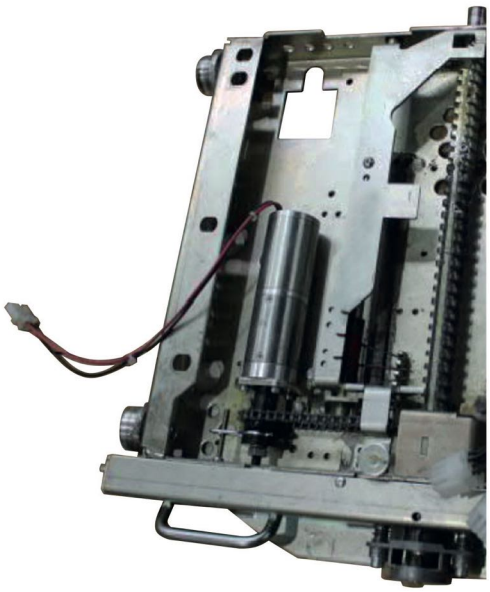
This device prevents the circuit breaker from being racked-in when the switchgear door is open. It is only provided for circuit breakers used in UniGear ZS1 switchgear and PowerCube modules equipped with a special actuator on the door.
It is not available for circuit breakers with motor-driven truck (-MAT).

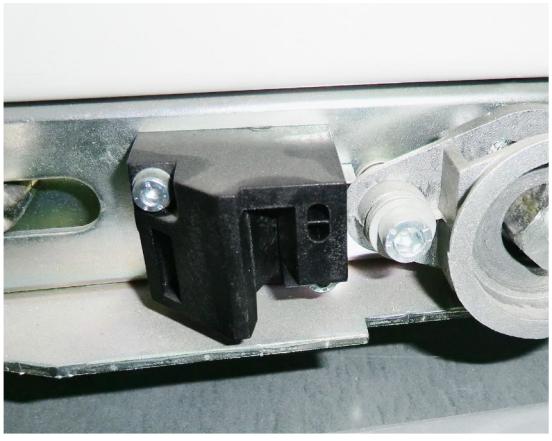
20 Motor-driven truck (-MAT)

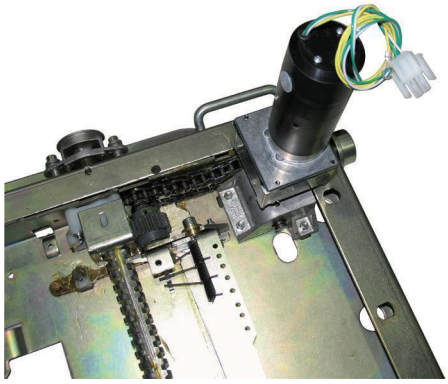
Allows the circuit breaker to be remotely racked-in and out of the switchgear (only for withdrawable circuit breakers for UniGear ZS1 and ZS8.4 switchgear and PowerCube modules).
The motor-driven version with clutch can be ordered on request. It enables the circuit breaker to be racked-in/out in an emergency if the truck motor fails to operate.

Characteristics	
Un	24 - 30 - 48 - 60 - 110 - 220 V–
Operating limits	85 … 110% Un
Rated power (Pn)	40 W

It is also possible to order the magnetothermic micro circuit breaker protect the motor from over current and temperature. Provided as loose part.







Selection and ordering
Optional accessories

21 STU Shunt Test Unit
Device which monitors the functionality and continuity of opening/closing shunt releases. Owing to their particular construction, checking the functionality of closing (-MBC) and opening (-MBO1, -MBO2) shunt releases cannot be performed by dedicated relays (e.g. TCS Test Control Supervision, CCC Control Coil Continuity) or with the REF control and protection unit. The only device able to monitor the functionality of these releases is the STU device. Please contact us if this function must be provided by devices other than STU.
The STU Shunt Test Unit can be used in conjunction with the shunt opening release **(-MBO1; -MBO2)** or shunt closing release **(-MBC)** to check their functionality and continuity.
The Shunt Test Unit allows the continuity of releases with rated operating voltage between 24 V and 250 V (AC and DC) to be monitored, as well as the functionality of the electronic circuit of the release.
Continuity is monitored cyclically with intervals of 20 seconds between one test and the next.
The unit has optical signals with LEDs on the front. The following information is given:
- POWER ON: power supply present
- (-MO) TESTING: test in progress
- TEST FAILED: signal following a failed test or in the absence of auxiliary power supply
- ALARM: signal after three failed tests.

Two relays and a changeover are also available on the unit and allow the following two events to be remotely signaled:
- failure of a test (with automatic reset when alarm ceases)
- failure of three tests (resetting can only be obtained by means of the manual - RESET – from the front of the unit).

There is also a manual - RESET – key on the front of the unit.

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

22 Extension cord for 58 pins plug
The extension cord with 58 pins available in two lengths 1.5m and 3m, in addition to the standard plug.

Digital accessories for VD4 evo

23 CMU

The CMU is an embedded Monitoring & Diagnostic unit, capable of advanced local data analytics. It also embeds sensors for basic breaker monitoring features. It can be ordered stand alone or in combination with a range of Sensors from ABB sensors portfolio, depending on the monitoring needs (see next section).

For more details please see the CMU datasheet 2RDA044111 6 and CMU Dashboard Manual 2RDA044113.

Parameter	Unit	Min Value	Max Value
AUX Rated voltage	AC (V) DC (V)	85 110	250 370
Working temperature range	°C	-20	+55
Storage temperature	°C	-30	+80

24 Monitor & Diagnostic Sensors

24a STA201 Primary contacts thermal monitoring

The STA201 sensors embedded in the primary contact arms allow direct measurement of the temperature in one of the most critical points of the circuit breaker. The measurement is shared through wireless to the concentrator unit for Monitor & Diagnostic features.

For installation or replacements please consult dedicated device documentation.

24b SMA201 Smart Angle sensor

The SMA201 sensor is assembled on the breaker kinematic chain to allow direct measurement of the most important characteristic of a proper Opening or Closing operation. The measurement is shared to with the concentrator unit for Monitor & Diagnostic features.

For installation or replacements please consult dedicated device documentation.

24c STE201/STL201 Cables/BusBars thermal monitoring

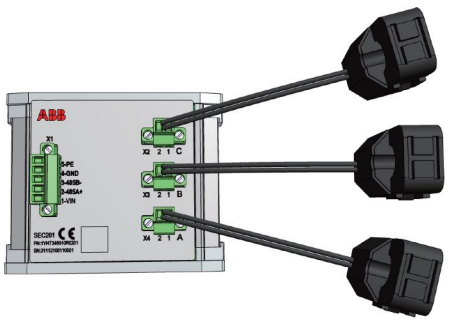
The STE201/STL201 Temperature monitoring devices are key components in ABB's switchgear and apparatus monitoring & diagnostic solutions. The devices are battery-free, self-powered smart temperature sensors, using wireless communication technology for connecting to ABB's monitoring and diagnostics data concentrators. The sensor devices can be installed directly on high-voltage parts, inside medium-voltage switchgear.

For installation or replacements please consult dedicated device documentation.

Selection and ordering
Optional accessories

24d THS01 Environmental monitoring
The THS01 senors allows the monitoring of the circuit breaker at room parameters for monitor and diagnostic purposes.
For installation or replacements please consult dedicated device documentation.

24e SEC201 Primary Current Sensor
The SEC201 sensor allows the measurement of primary currents for monitor and diagnostic of the circuit breaker from the current transformer secondary circuit. It allows electrical life monitoring and in combination with the thermal sensors enables advanced thermal monitoring and diagnostic features.
For installation or replacements please consult dedicated device documentation.



25 Digital upgrade KIT
It is available a complete kit to upgrade a VD4 evo with Digital feature for monitor and diagnostic.
It includes the necessary connectors, concentrator unit CMU, and a flexible selection of ABB sensors.
Please contact your sales representative for more information.
Please contact ABB for more details based on your needs.

26 Serial Hub
The Serial communication hub is automatically delivered when more than one sensor with serial communication embedded in the CB has been ordered.
To be purchased separately in case of sensors upgrade after the ordering of the circuit breaker.

For circuit breakers up to 40.5 kV, 40 kA with Classic operating mechanism

Accessories with the same number are alternatives to each other.

1 Shunt opening release -MO1 (-Y2)

The shunt opening release allows the apparatus to be opened by remote control.
An auxiliary contact -BB2 (-S4) always de-energizes it after opening.

Characteristics	
Ua: 24 - 30 - 48 - 60 - 110 - 125 - 220 - 240 V-	
Ua: 100 - 110 - 125 - 220 - 230 - 240 V ~ 50 … 60 Hz	
Service tolerances:	DC 70 … 110% Ua
	AC 85 … 110% Ua
Short-term power consumption:	approx. DC 250 W; approx. AC 250 VA
Admissible maximum operating time:	8 s

2 Additional shunt opening release -MO2 (-Y9)

The additional shunt opening release has the same function as shunt opening release -MO1 (-YO2).
The additional shunt opening release is available on request and requires use of auxiliary contact -BB1 (-S3), which is part of the standard equipment.

Characteristics	
Ua: 24 - 30 - 48 - 60 - 110 - 125 - 220 - 240 V-	
Ua: 100 - 110 - 125 - 220 - 230 - 240 V ~ 50 … 60 Hz	
Service tolerances:	DC 70 … 110% Ua
	AC 85 … 110% Ua
Short-term power consumption:	approx. DC 250 W; approx. AC 250 VA
Admissible maximum operating time:	8 s

Selection and ordering
Optional accessories

3 Shunt closing release -MC (-Y3)

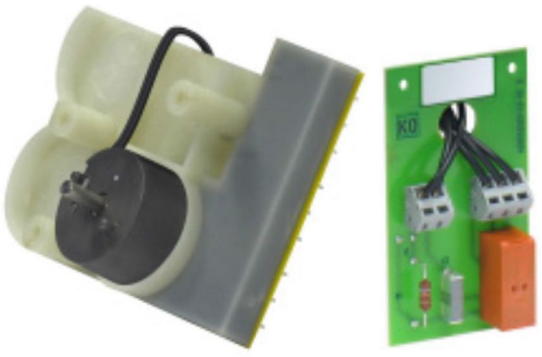
The shunt closing release allows the circuit breaker to be closed by remote control.
Auxiliary contact -BS1 (-S1) cuts off the power supplied to the release after the closing springs have been loaded, while auxiliary contact -BB1 (-S3) cuts off the power supplied to the release after the circuit breaker has closed.
Both are required and are part of the standard equipment.
The shunt closing release is optional in circuit breakers with manual opening mechanisms but mandatory for circuit breakers with motor-operated drives.
Application of the shunt closing release includes anti-pumping relay -K0.
The permanently supplied release provides the electrical anti-pumping function with both electrical opening and re-closing commands maintained.
Circuit breaker closing is only re-enabled once the active closing command has been interrupted.

Characteristics	
Ua: 24 - 30 - 48 - 60 - 110 - 125 - 220 - 240 V-	
Ua: 100 - 110 - 125 - 220 - 230 - 240 V ~ 50 ... 60 Hz	
Service tolerances:	DC 70 ... 110% Ua
	AC 70 ... 110% Ua
Short-term power consumption:	approx. DC 250 W; approx. AC 250 VA
Admissible maximum operating time:	8 s

4 Locking magnet on operating mechanism RL1 (-Y1) with auxiliary contacts -BL1 (-S2)

Only allows the operating mechanism to be activated when the electromagnet is energized.
To enable the circuit breaker to close, the locking magnet must be energized for at least 100 ms before the circuit breaker closing command.
Auxiliary contact -BL1 (-S2) is required and is part of the standard equipment.

Characteristics	
Ua: 24 - 30 - 48 - 60 - 110 - 125 - 220 - 240 V-	
Ua: 100 - 110 - 125 - 220 - 230 - 240 V ~ 50 ... 60 Hz	
Service tolerances:	DC 85 ... 110% Ua
	AC 85 ... 110% Ua
Short-term power consumption:	approx. DC 10 W; approx. AC 10 VA
Admissible maximum operating time:	unlimited



5 Undervoltage release -MU (-Y4)

The undervoltage release opens the circuit breaker when there is an appreciable drop or lack of the voltage that supplies it.
It trips when the auxiliary voltage is between 70% and 30% of its rated value.
The circuit breaker can only close again when the voltage reaches 85% of its rated value.
The undervoltage release trips instantaneously, but can also be accompanied by an electronic time-lag device.

Characteristics of the non-delayed version	
Ua: 24 - 30 - 48 - 60 - 110 - 125 - 220 V-	
Ua: 100 - 110 - 125 - 220 V ~ 50 … 60 Hz	
Power consumption:	approx. DC 10 W
	approx. AC 11 VA
Maximum service tolerance:	110% Ua
Voltage for readiness closing:	> 85% UN
Trip voltage:	30 … 70% Ua
Operating time:	immediate
Admissible maximum operating time:	none

5.1 Electronic time-lag device -KT (-RN3U)

Use of the delayed undervoltage release is useful for preventing trips when the supply network of the release may be subject to power cuts or brief voltage dips.
The voltage of the undervoltage release must be within the operating range of the electronic time-lag device (a coupler transformer must be connected in series for rated voltages other than 100-110 V AC).
The electronic time-lag device must be assembled externally in relation to the circuit breaker. It allows the tripping action of the release to be delayed on the basis of preset and adjustable time settings.

Characteristics	
Ua: 100 - 110 V ~ 50 … 60 Hz	
Power consumption:	approx. AC 10 VA
Service tolerances:	110% Ua
Voltage for readiness closing:	> 70% Ua
Trip voltage:	< 70% Ua
a) standard: operating time 0.5... 4 s, adjustable in 0.5 s steps	
b) when closing is performed by means of auxiliary contacts: operating time is 0.5... 2s, adjustable in 0.5s steps with suitable coil	
Admissible maximum operating time:	none

Selection and ordering
Optional accessories

6 Opening solenoid -MO3 (-Y7)

Use of the overcurrent release may be advisable in systems where the auxiliary voltage is unable to provide reliable continuity of service.
The release must receive the opening pulse on the basis of the current from the secondary winding of an intermediate current transformer or a delayed overvoltage relay.
During continuous service, the secondary winding of the MO3 is short-circuited by an auxiliary contact.

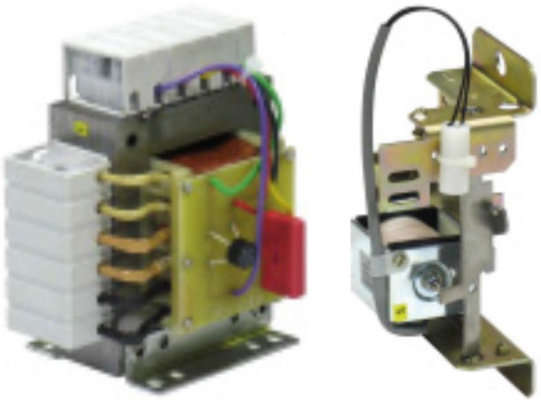
Characteristics	
Power consumption in continuous service mode:	connection to 2 phases 35 VA connection to 3 phases 2 VA
Trippping power consumption:	approx. 15 VA
Readiness tripping:	70% IN
Power consumption of intermediate current transformer at IN = 5 A and continuous operation (short-circuited secondary winding):	Winding A 1 VA Winding B 1 VA Winding C 1.5 VA
Power consumption of intermediate current transformer at IN = 5 A and continuous operation (open secondary winding):	Winding A 15 VA Winding B 15 VA Winding C 25 VA
Primary current of intermediate current transformer:	3 x 5
Secondary current of intermediate current transformer:	~ 0.4 A

7 Auxiliary contacts of circuit breaker -BS1, -BB1, -BB2, -BB3 (S1, S3, S4, S5)

The circuit breaker can be equipped with five-pole auxiliary contacts for monitoring, interlocking and signaling. Auxiliary contact -BB2 (-S4) is part of the basic equipment of all circuit breakers with motor-driven operating mechanisms.
Auxiliary contact -BB3 (-S5) is optional.
Also consult the circuit-diagram.

Characteristics	
Ua:	24 (*) ... 250 V
Test voltage:	2.5 kV
Rated current:	Ith^2 = 10 A

(*) For application at 24Vdc and with currents lower than 10 mA golden contacts are recommended.



8 Auxiliary contact for signaling effective opening -BB4 (-S7)

Auxiliary contact -BB4 (-S7), also known as transient contact, is part of the basic equipment of all circuit breakers.
It is used for signaling effective opening of the circuit breaker (the transient signal lasts 30ms).

Characteristics	
Ua:	24 (*) ... 250 V
Test voltage:	2.5 kV
Rated current:	Ith^2 = 10 A

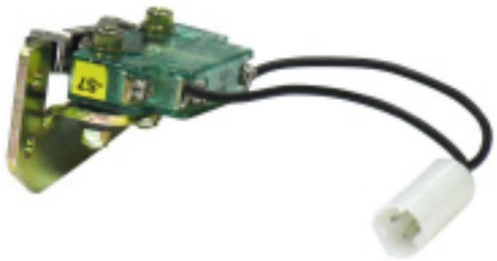
(*) For application at 24Vdc and with currents lower than 10 mA golden contacts are recommended.

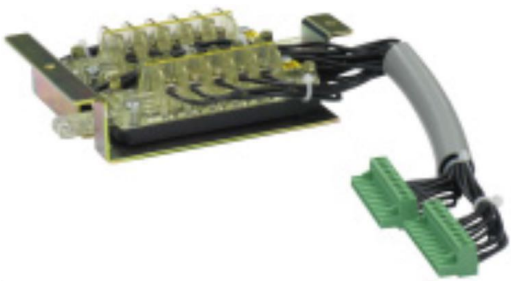
9 Transmitted contacts in truck -BT1, -BT2 (-S8, -S9)

The auxiliary contacts signal whether the circuit breaker is racked in or out.
In the intermediate position, the circuit breaker is mechanically interlocked.

Characteristics	
Ua:	24 (*) ... 250 V
Test voltage:	2.5 kV
Rated current:	Ith^2 = 10 A

(*) For application at 24Vdc and with currents lower than 10 mA golden contacts are recommended.





Selection and ordering
Optional accessories

10 Motor-operated drive -MS (-M0)

The spiral spring of circuit breakers with motor-operated drive is automatically loaded by an electric motor installed in the actual drive on the load side of each closing operation.

Characteristics	
Ua:	24 - 30 - 48 - 60 - 110 - 125 - 220 - 240 V-
Ua:	110 - 240 V ~ 50 ... 60 Hz
Loading time:	max. 15 s
Reloading time:	max. 15 s
Service tolerances:	85 ... 110% Ua
Power consumption during loading:	approx. DC 230 ... 260 W; approx. AC 260 VA
Weight:	1.5 kg

Fuse motor:

rated supply voltage	power consumption	Fuse motor (ABB-Stotz mcb)	loading time (maximum)
V	VA/W	A	S
AC 110	260	1.6 S 281 UC-K	10
220	260	0.75	10
240	260	0.75	10
DC 110	230	1.60	10
125	260	1.60	10
220	240	0.75	10
240	260	0.75	10
24			15
30			15
48			15
60			15

Properties of Gefeg motor	
Ua:	24 - 48 - 60 - 110 - 125 - 220 - 240 V-
Ua:	110 - 240 V ~ 50 ... 60 Hz
Loading time:	max. 15 s
Reloading time:	max. 15 s
Service tolerances:	85 ... 110% Ua
Power consumption during loading:	app. DC 130 ... 140 W; app. AC 150 – 170 VA
Weight:	1.5 kg

Fuse motor:

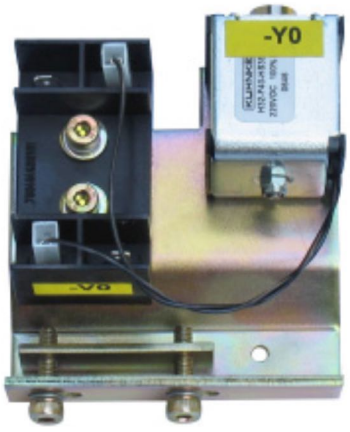
rated supply voltage	power consumption	Fuse motor (ABB-Stotz mcb)	loading time (maximum)
V	VA/W	A	S
AC 110	150	1.6 S 281 UC-K	15
220	150	0.75	15
240	170	0.75	15
DC 24	130	4.0 S 282 UC-K	15
48	130	3.00	15
60	130	2.00	15
110	140	1.00 / 1.60 *	10
125	160	1.00 / 1.60 *	15
220	140	0.75	15
240	150	0.75	15

* VD4 63 kA motor

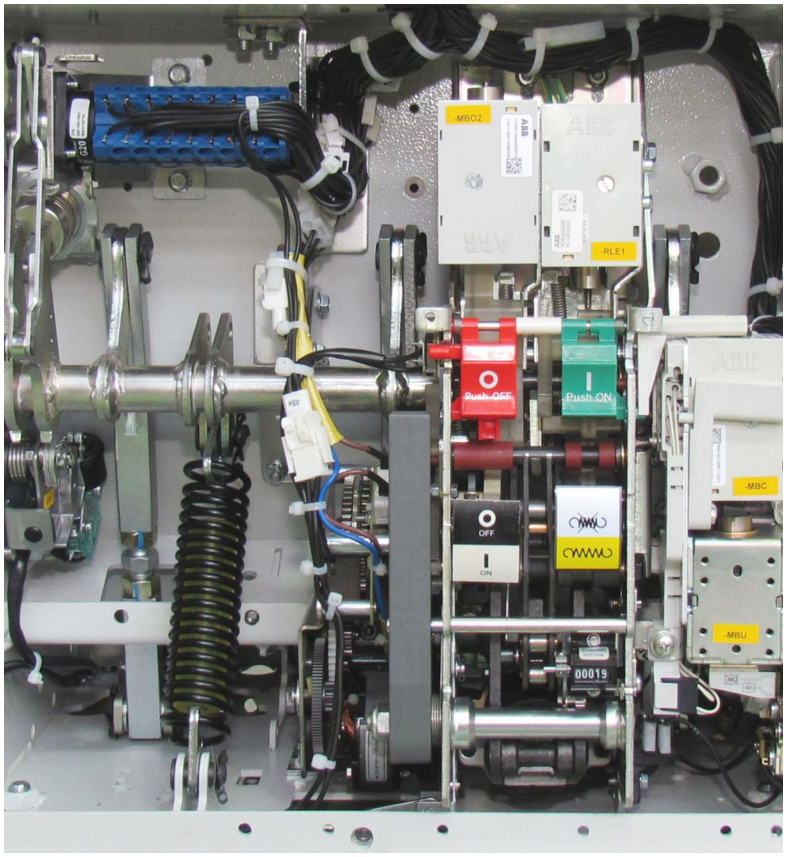
11 Locking magnet on truck -RL2 (-Y0)

The locking magnet on the truck prevents circuit breaker travel in the absence of auxiliary voltage.

Characteristics	
Ua: 24 - 30 - 48 - 60 - 110 - 125 - 220 - 240 V-	
Ua: 100 - 110 - 125 - 220 - 230 - 240 V ~ 50 … 60 Hz	
Service tolerances:	DC; AC 85 … 110% Ua
Power consumption:	approx. DC 10 W; approx. AC 10 VA
Admissible maximum operating time:	unlimited



Specific product characteristics



Anti-pumping device

The EL operating mechanism of VD4 circuit breakers (in all versions) is equipped with a mechanical anti-pumping device which prevents re-closing due to both electrical and mechanical commands.
Should both the closing command and any one of the opening commands (local or remote) be active at the same time, there would be a continuous succession of opening and closing commands.
The anti-pumping device prevents this situation by ensuring that each closing operation is only followed by an opening operation and that there is no other closing operation after this. To obtain a further closing operation, the closing command must be released and then enabled again.
Furthermore, the anti-pumping device only allows the circuit breaker to be closed if the following conditions are present at the same time:

- operating mechanism spring fully loaded
- opening pushbutton and/or shunt opening release (-MBO1/-MBO2) not activated
- circuit breaker open.

REF 601 protection device

On request, the REF 601 switchgear protection device is available for protecting the installations. It requires an auxiliary power supply in order to operate, unlike the previous PR512 which was a self-supplied relay.
REF 601 has protections and trip curves that conform to IEC 255-3 Standards. It protects against overloads (51), against instantaneous and delayed short-circuits (50-51) and against instantaneous and delayed homopolar earth faults (50N and 51N). It also detects the second harmonic component to prevent unwarranted tripping when a transformer is switched-in (68).

The unit has 3 inputs from current sensors of the Rogowsky coil type and one input from an external ring-type CT. 4 rated currents can be set via the keyboard: 40, 80, 250 and 1250 A.
If the unit is connected to 3 current sensors, the 50N and 51N protection functions are obtained by means of the vectorial sum of the phase currents.
If only 2 current sensors are used, an external ring-type current transformer must be provided for functions 50N and 51N.
The external ring-type current transformer can have an openable or closed core and any transformation ratio so long as the secondary current is 1 A.
The ABB current sensors of the Rogowsky coil type provided for REF 601 are only suitable for installation on MV insulated cables.
The characteristics of the device are:

- trip precision
- broad adjustment ranges
- single and simultaneous adjustment of the three phases
- no limitation (due to the current sensors) to the rated breaking capacity or short-time withstand current of the circuit breaker
- pushbuttons for local electrical operation of the circuit breaker (opening and closing pushbutton
- 5 distinct indicators: “relay operating”, “relay in trip threshold”, “relay tripped”, “relay tripped due to phase current having been exceeded”, “relay tripped for earth fault current having been exceeded”
- interface consisting of an LCD display and “arrow”, “enter” and “esc” keys for facilitated navigation in the “measurement” menu, “data recording”, “event recording”, “settings”, “configuration” and “test” menus

- three user levels: “operator” (display only, with free access by keeping this key pressed for at least 5 sec.), “configurator” (same as the previous level) but also with authorization to set the protection parameters (i.e. times and thresholds), and communication if present (access limited by a password), “administrator” (same as the previous levels), but also with authorization to set the password and configure the basic settings of the device, such as the rated current (access limited by a password)
- continuous display of the current on the most highly loaded phase and of the earth current
- recording of the value of the currents which caused the device to trip
- storage of the number of openings carried out by the device
- event log (storage of the parameters described above in the last 5 trips of the device) in a non-volatile memory
- curves “ß = 1” or “ß = 5” and curve “RI” specifically designed for the Belgian market (only REF 601 IEC)
- circuit breaker opening by means of an undervoltage release (only REF 601 CEI)
- version, on request, with RS485 4-wire serial communication
- MODBUS RTU full duplex protocol
- multi-voltage feeder 24 … 240 V AC- DC
- REF 601 is also available in a version specifically designed for the Italian market to CEI 0-16 standards (see brochure entitled “Solutions for upgrading to CEI 0-16 standards”) , with 80 or 250 A rated current which can be selected via the keyboard. It is always supplied with 3 sensors for installation on insulated MV cable, a 40/1 A ring-type CT for homopolar protection and undervoltage release for the circuit breaker opening operation.

Environmental protection programme

VD4 circuit breakers are manufactured in accordance with the ISO 14000 Standards (Guidelines for environmental management).
The production processes are implemented in accordance with the environmental protection standards as to the reduction of energy consumption and the production of waste.
All this is achieved thanks to the environmental management system applied in the medium voltage apparatus manufacturing facility.
Assessment of the environmental impact during the life-cycle of the product obtained by reducing the overall energy consumption and use of raw materials to the minimum, is put into effect during the design engineering stage through an accurate choice of materials, processes and packaging.
This to allow the products and components to be recycled to the utmost degree at the end of their useful life.

Spare parts

- Shunt opening release
- Additional shunt opening release
- Undervoltage release
- Time-lag device for undervoltage release
- Shunt closing release
- Spring loading geared motor with electrical signaling of spring loaded
- Contact signaling geared motor protection circuit breaker open/closed
- Contact signaling closing spring loaded/ discharged
- Transient contact with momentary closing during circuit breaker opening
- Circuit breaker auxiliary contacts
- Locking electromagnet on the operating mechanism
- Position contact of the withdrawable truck
- Contacts signaling connected/isolated
- Opening solenoid
- Open position key lock
- Isolation interlock with door
- Protection for opening pushbutton
- Protection for closing pushbutton
- Locking electromagnet on withdrawable truck
- Set of six isolating contacts.

Ordering

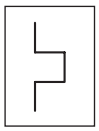
For availability and to order spare parts, please contact our Service department, specifying the circuit breaker serial number.

Electric circuit diagram

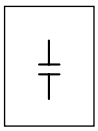
Note
The wiring diagrams in this section might not be the latest versions and are shown as exemplary of possible electrical wiring configurations. The wiring diagram depends on the specific circuit breaker configuration selected during ordering phase.
For VD4 evo Digital version refer please refer to documents 1VCD400316, 1VCD400311 and 1VCD400312

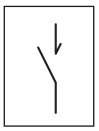
Operating state shown
The diagrams are shown the following conditions:
- Circuit breaker open and connected (only withdrawable circuit breaker)
- Circuits de-energized
- Closing springs discharged

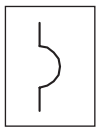
Graphical symbols for electric diagrams

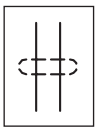

Thermal effect

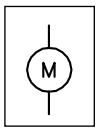

Exposed conductive part, frame


Capacitor (general symbol)

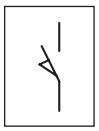

Passing make contact closing momentarily during release

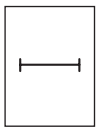

Electromagnetic effect

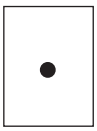

Conductors in shielded cable (e.g. two conductors)

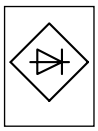


Motor (general symbol)

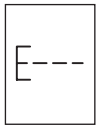

Closing position contact (limit switch)

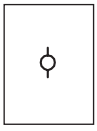

Timing

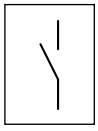

Connection of conductors

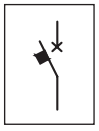

Rectifier with two half-waves (bridge)

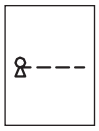

Opening position contact (limit switch)


Pushbutton control

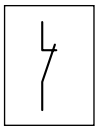

Terminal or clamp

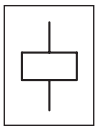

Make contact

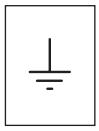

Power circuit breaker with automatic opening

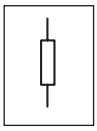

Key control

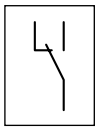

Socket and plug (female and male)

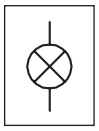

Break contact


Control coil (general symbol)


Earth (general symbol)


Resistor (general symbol)


Change-over break before make contact


Lamp (general symbol)

Electric circuit diagram

Incompatibility				
The circuits indicated in the following figures cannot be supplied at the same time in the same circuit breaker:				
3-4	**3-33-34**	**4-31-32**	**5-6**	**10-11**
31-32-33-34	**31-32-52**	**33-34-51**	**51-52**	

Notes	
A)	The circuit breaker is equipped solely with the applications specified in the order confirmation. Consult this catalog for information about how to make out an order.
B)	The undervoltage release can be supplied for energizing with voltage derived from the supply side of the circuit breaker or from an independent source. Circuit breaker closing is only allowed when the release is energized (closing lock is obtained mechanically). If there is the same power supply for the shunt closing and under-voltage releases and the circuit breaker must close automatically when auxiliary voltage returns, there must be a 50 ms delay between the undervoltage release's enabling instant and energizing of the shunt closing release. Incompatible with -MBO4.
C)	Check power of auxiliary circuit to find out whether several motors for loading the closing springs can be operated at the same time. To prevent excessive power draw, springs must be loaded by hand before auxiliary circuit is powered.
D)	The circuit for monitoring the continuity of the release windings must only be used for that purpose. The SOR Test Unit can be used for checking the continuity of the various different releases. -MBO4 incompatible with -MBU.
E)	When fig. 6 is required, contact -BGB3 (41-42) of fig. 32-34 is not available. When fig. 9 is required, contact -BGB1 (43-44) of fig. 31-32-33-34 is not available. When fig. 10 or 11 are required, contact -BGB3 (31-32) of fig. 32 and 34 is not available. When fig. 30 is required, contact -BGB3 (53-54) of fig. 32 and 34 is not available.
F)	The contacts for electrical signaling of circuit breaker in racked-in and isolated positions (-BGT1 and -BGT2) shown in fig. 51-52 are located on circuit breaker truck (moving part).
G)	Fig. 3 is supplied when fig. 31 or 32 are required. Fig. 4 is supplied when fig. 33 or 34 are required (in this case, it is obligatory for -BGT3 to be supplied).
H)	Fig. 10 is only available for VD4 up to 31.5 kA. Fig. 11 is only available for VD4 up to 31.5 kA.
I)	The energizing voltage must be the same for both signals.

Key		
☐	=	Reference number of diagram figure
*	=	See note indicated by the letter
-BER	=	Device for the supervision of shunt opening release coil continuity (see note E)
-BGB1, ..., -BGB3	=	Circuit breaker auxiliary contacts
-8GB4	=	Auxiliary passing contact (closing momentarily when circuit breaker opens)
-8GB12	=	Auxiliary contact for block closing of the circuit breaker
-BGS	=	Limit switch signalling closing springs charged or discharged
-BGT1	=	Contacts signalling circuit breaker in the connected position
-BGT2	=	Contacts signalling circuit breaker in the isolated position
-MAS	=	Motor for the closing charging springs {see note C)
-MBC	=	Shunt closing release
-MBO1	=	First shunt opening release (see note E)
-MBO2	=	Second shunt opening release (see note E)
-MBO3	=	Indirect overcurrent relay
-MBU	=	Instantaneous undervoltoge release
-KFN	=	Antipumping relay
-QAB	=	Main circuit breaker
-RAR	=	Resistor
-RLE1	=	Locking magnet. If de-energized it prevents the circuit breaker closing
-RLE2	=	Locking magnet on the truck. If de-energized it prevents the circuit breaker racking-in and racking-out mechanically
-SFC	=	Pushbutton or contact for the circuit breaker closing
-SFO	=	Pushbutton or contact for the circuit breaker opening
-SFL1	=	Contact locking the circuit breaker closing
-SFL2	=	Contact locking the circuit breaker racking-in and racking-out
-TB1	=	Rectifier for -MO1
-TB2	=	Rectifier for -MO2
-TB3	=	Rectifier for -MBC and -KFN
-TB4	=	Rectifier for -RLE1
-TB6	=	Rectifier for -MBU
-GQ2	=	Ventilator
-XDB	=	Connector for the circuit breaker circuits
-XDB2	=	Connector of the accessories
-XDB71, -XDB72	=	Connectors of the accessories

Description of the figures		
Fig. 1	=	Springs charging-motor circuit {see note C)
Fig. 2	=	Shunt closing release
Fig. 3	=	Locking magnet on the operating mechanism. If de-energized it prevents the circuit breaker closing
Fig. 4	=	Locking magnet on the truck. If de-energized it prevents the circuit breaker racking-in and racking-out mechanically
Fig. 5	=	Instantaneous undervoltage release
Fig. 7	=	First shunt opening release circuit with possibility of permanent supervision of coil continuity (see note E)
Fig. 9	=	Second shunt opening release circuit with possibility of permanent supervision of coil continuity (see note E)
Fig. 10	=	Indirect overcurrent relay
Fig. 26	=	Contact signalling charged or discharged closing springs (see note I)
Fig. 30	=	Wiping contact 35ms for C.B. tripped indication
Fig. 32	=	Circuit breaker available auxiliary contacts
Fig. 44	=	Ventilation circuit

Notes	
A)	The circuit breaker is delivered complete with the accessories listed in the order aknowledgement only. To draw up the order examine the apparatus catalogue.
C)	Check the power eupply available on the auxiliary circuit to verify if it is adeguate to start several closing spring-charging motors simultaneously. To prevent excessive consumption the closing springs must be charged manually before energizing the auxiliary circuit.
E)	The circuit for the supervision of shunt opening release coil continuity shall be used for this function only.
I)	Both limit switches signalling must be working at the same supply voltage.

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