VD4

Medium voltage vacuum circuit-breakers

12 ... 24 kV - 630 ... 2500 A - 16 ... 31.5 kA

PRELIMINARY

FONLEE
福立自动控制设备有限公司
WWW.FONLEE.COM.TW

ABB VD4

1

DESCRIPTION

DESCRIPTION

General

The new VD4 are a synthesis of the renowned technology in designing and constructing vacuum interrupters embedded in resin poles, and of excellency in design, engineering and production of circuit-breakers.
The VD4 medium voltage circuit-breakers use vacuum interrupters embedded in resin poles. Embedding the interrupter in resin makes the circuit-breaker poles particularly sturdy and protects the interrupter against shocks, accumulation of dust and humidity.
The vacuum interrupter houses the contacts and makes up the interrupting chamber.

Current interruption in vacuum

The vacuum circuit-breaker does not require an interrupting and insulating medium.
In fact the interrupters, does not contain ionisable material.

In any case, on separation of the contacts a metal vapour arc is generated made up exclusively of melted and vaporised contact material.
The metal vapour only remains supported by the external energy until the current is cancelled in the vicinity of natural zero. At that instant, the rapid reduction in the load density carried and the rapid condensation of the metal vapour, leads to extremely rapid dielectric recovery.
The vacuum interrupter therefore recovers the insulating capacity and the capacity to withstand the transient return 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 contacts design and material as well as the limited duration and the low voltage of the arc guarantee minimum contact wear and long life. Furthermore, the vacuum prevents their oxidation and contamination.

EL type operating mechanism

The low speed of the contacts together with the reduced run and the low mass limit the energy required for the operation and therefore guarantee extremely limited wear of the system. The circuit-breaker is therefore limited in maintenance.
The VD4 circuit-breakers use a mechanical operating mechanism, with stored energy and free release.

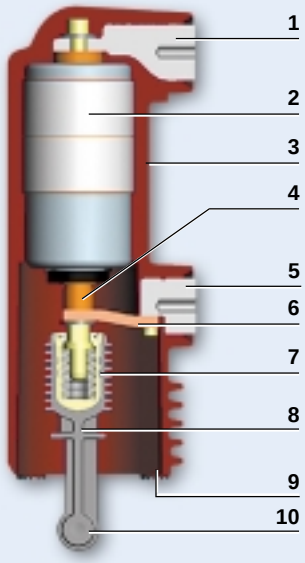
These characteristics allow opening and closing operations independent of the operator.
The VD4 circuit-breaker operating mechanism is is of simple conception and use and can be customised with a wide range of accessories which are easy and rapid to install. This simplicity converts into greater reliability of the apparatus.

The structure

The operating mechanism 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 switchboard or enclosure with the door closed.

- **Vacuum interruption technique**
- **No contacts oxidation in vacuum**
- **Vacuum interrupter embedded in the resin poles**
- **Interrupter protected against shocks, dust and humidity**
- **Operation under different climatic conditions**
- **Limited switching energy**
- **Stored energy operating mechanism with anti-pumping device supplied as standard**
- **Simple customisation with a complete range of accessories**
- **Fixed and withdrawable version**
- **Compact dimensions**
- **Sealed-for-life poles**
- **Sturdiness and reliability**
- **Limited maintenance**
- **Circuit-breaker racking in and racking out with door closed**
- **Incorrect and hazardous operations are prevented thanks to special locks in the operating mechanism and in the truck**
- **Excellent environmental compatibility**

Vacuum interrupter embedded in resin pole

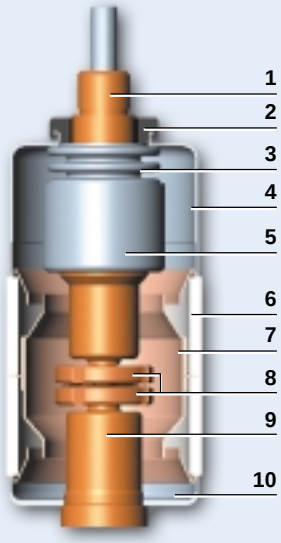


1 Upper terminal
2 Vacuum interrupter
3 Epoxy resin housing
4 Stem of moving contact
5 Lower terminal
6 Flexible connection
7 Contact force springs
8 Push-rod
9 Pole fixing
10 Connection to operating mechanism

DESCRIPTION

Interrupting principle of ABB interrupters

Vacuum interrupter



1 Stem/terminal
2 Twist protection
3 Bellows
4 Interrupter lid
5 Shield
6 Ceramic insulator
7 Shield
8 Contacts
9 Terminal
10 Interrupter lid

In a vacuum interrupter, separation of current-carrying contacts initiates the vacuum arc and this is maintained until the next current zero and can be influenced by magnetic fields.

Vacuum arcs – diffuse or contracted

Following contact separation, single melting points form on the entire surface of the cathode, producing metal vapours which support the arc. The diffuse vacuum arc is characterised by expansion over the contact surface and by an even distribution of thermal stress on the contact surfaces.
At the rated current of the vacuum interrupter, the electric arc is always of the diffuse type. Contact erosion is negligible, 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 further it tends to become sharply defined. 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.

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 and this 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 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 charge and rapid condensation of the metal vapours simultaneously with the zero current, means maximum dielectric strength can be restored between the interrupter contacts within microseconds.

Versions available

The VD4 circuit-breakers are available in the fixed and withdrawable version with front operating mechanism. The withdrawable version is available for UniGear ZS1 type switchboards and Unisafe switchboards.

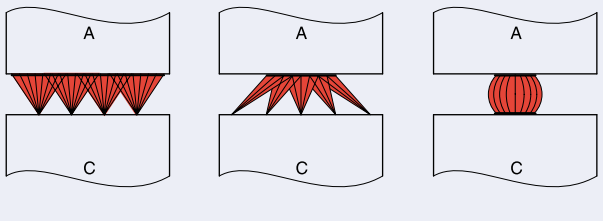
Fields of application

The VD4 circuit-breakers are used in electrical distribution for control and protection of cables, overhead lines, transformer and distribution substations, motors, transformers, generators and capacitor banks.

Standards and approvals

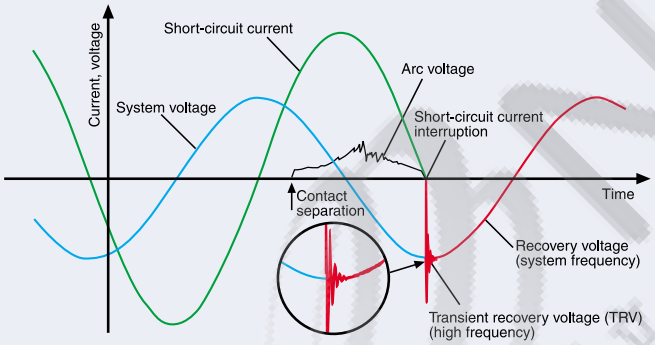
The VD4 circuit-breakers comply with the IEC 62271-100, CEI 17-1 file 1375 Standards and with those of the major industrialised countries. The VD4 circuit-breakers have undergone the tests indicated below and guarantee the safety and reliability of the apparatus in service in any installation.

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

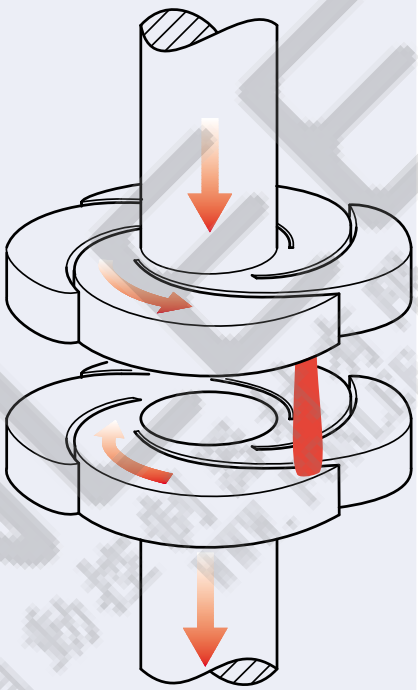


Diffuse arc. | Contraction over anode. | Contraction over anode and cathode.

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



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



Radial magnetic field contact arrangement with a rotating vacuum arc.

- **Individual tests:** insulation of the main circuits with voltage at industrial frequency, auxiliary circuit and operating mechanism insulation, measurement of the main circuit resistance, mechanical and electrical operation.

Service safety

Thanks to the complete range of mechanical and electrical locks (available on request), it is possible to construct safe distribution switchboards with the VD4 circuit-breakers.
The locking devices have been studied to prevent incorrect operations and to inspect the installations guaranteeing maximum operator safety.

Key locks or padlock devices enable opening and closing operations and/or racking in and racking out.
The racking-out device with the door closed allows the circuit-breaker to be racked into or out of the switchboard with the door closed only.
Anti-racking-in locks prevent circuit-breakers with different rated currents from being racked in, and the racking-in operation with the circuit-breaker closed.

DESCRIPTION

Accessories

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

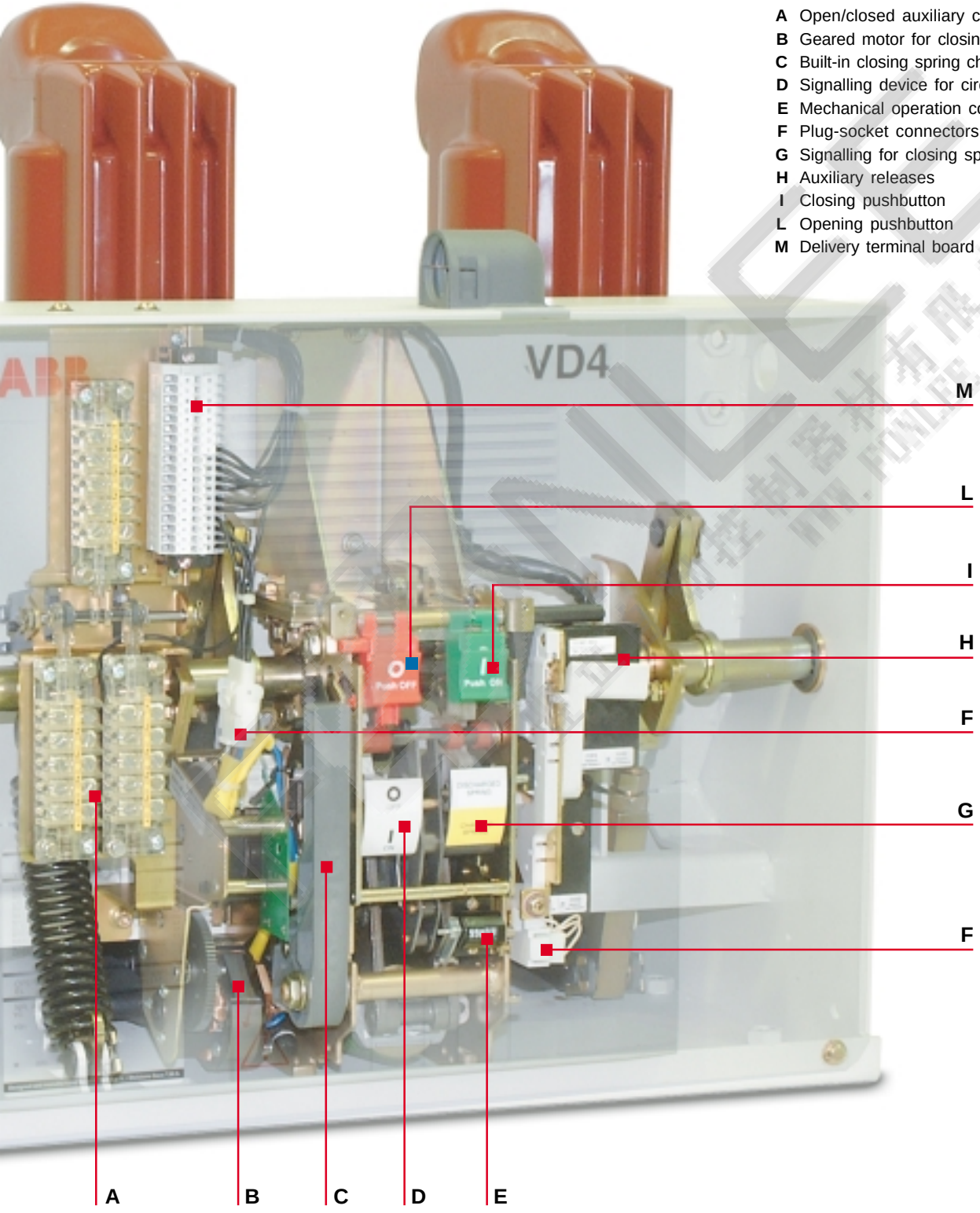
Operating mechanism

The operating mechanism is of the stored energy type and has the anti-pumping device mounted as standard and is fitted with suitable locks to prevent incorrect operations.
Each operation sequence is only enabled if all the conditions ensuring it being carried out correctly are respected.
The accessories are the same for all the type VD4s of circuit-breaker.
To facilitate assembly and replacement of accessories, assembly seats with appropriated fixed strikers are provided.

- **Highly reliable operating mechanisms thanks to featuring a low number of components and manufactured using production systems for large quantities**
- **Extremely limited and simple maintenance**
- **The accessories are common to the whole range and are identical for either a.c. or d.c. applications**
- **The electrical accessories can be easily and rapidly installed or replaced thanks to the cabling already prepared with its own plug-socket connectors**
- **Mechanical anti-pumping device is supplied as standard**
- **Built-in closing spring charging lever**
- **Key lock with circuit-breaker open**
- **Protective covering over the opening and closing pushbuttons to be operated using a special tool**
- **Padlock device on the switching pushbuttons**

Circuit-breaker operating mechanism

- **A** Open/closed auxiliary contacts
- **B** Geared motor for closing spring charging
- **C** Built-in closing spring charging lever
- **D** Signalling device for circuit-breaker open/closed
- **E** Mechanical operation counter
- **F** Plug-socket connectors of electrical accessories
- **G** Signalling for closing springs charged/discharged
- **H** Auxiliary releases
- **I** Closing pushbutton
- **L** Opening pushbutton
- **M** Delivery terminal board of the auxiliary circuits



Technical documentation

To obtain in-depth knowledge of technical and application aspects of the VD4 circuit-breakers please ask for the following publications:

– UniSafe switchboards	code 649228
– UniGear ZS1 type switchboards	code 649424
– REF 542*plus* unit	code 649423
– PR512 protection unit	code 649092

Quality Assurance System

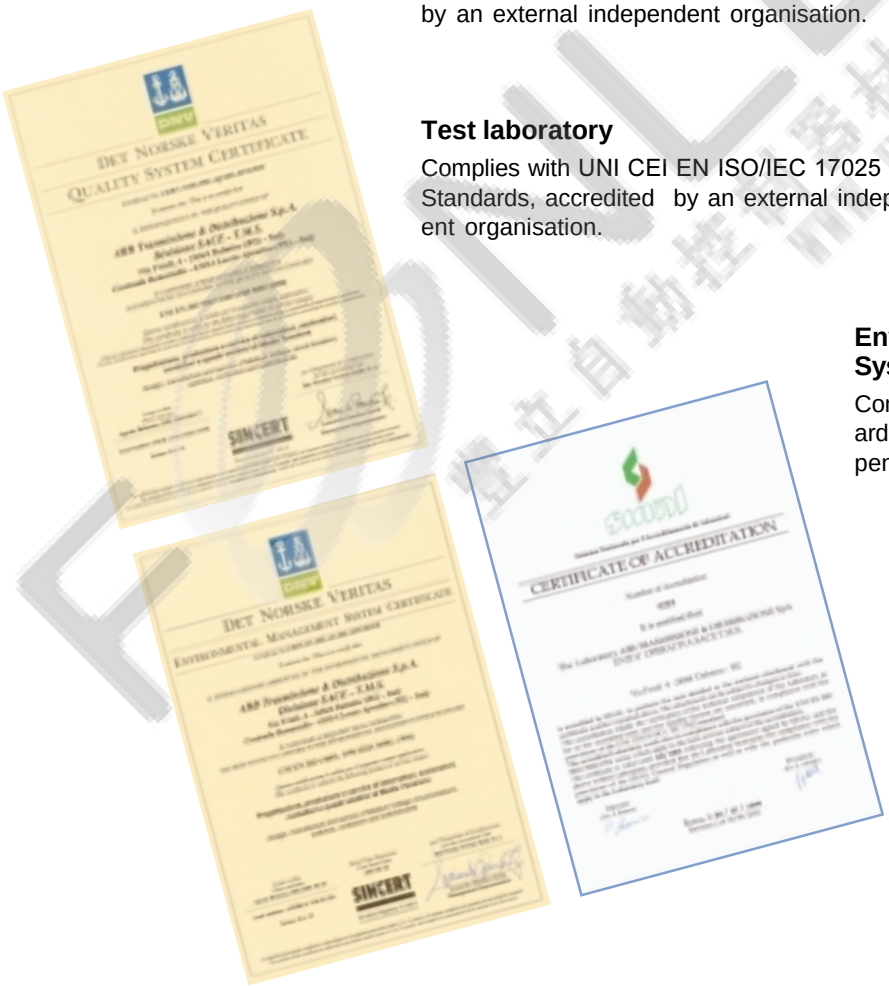
Complies with the ISO 9001 Standards, certified by an external independent organisation.

Test laboratory

Complies with UNI CEI EN ISO/IEC 17025 Standards, accredited by an external independent organisation.

Environmental Management System

Complies with the ISO 14001 Standards, certified by an external independent organisation.



2

CIRCUIT-BREAKER SELECTION AND ORDERING

General characteristics of fixed circuit-breakers (12 - 17.5 - 24 kV)

Circuit-breaker		VD4 12								
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)	(2) **Ir** [A]	630	630	1250	1250	1600	1600	2000	2000	2500
Rated breaking capacity	**Isc** [kA]	16	16	16	16	–	–	–	–	–
(rated symmetrical short		20	20	20	20	20	20	20	20	20
circuit current)		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
Rated short-time	**Ik** [kA]	16	16	16	16	–	–	–	–	–
withstand current (3 s)		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	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
		63	63	63	63	63	63	63	63	63
		80	80	80	80	80	80	80	80	80
Operation sequence	[O-0,3s-CO-3min-CO]	■								
Opening time	[ms]	~ 45								
Arcing time	[ms]	10-15								
Total breaking time	[ms]	55-60								
Closing time	[ms]	~ 80								
Maximum overall dimensions	**H** [mm]	461	461	461	461	599	599	599	599	616
	L [mm]	450	570	450	570	570	700	570	700	700
	P [mm]	424	424	424	424	424	424	424	424	424
Poles center lines	**I** [mm]	150	210	150	210	210	275	210	275	275
Dimension standardized table		TN7405	TN7406	TN7405	TN7406	TN7407	TN7408	TN7407	TN7408	TN7408
Operating temperature	[°C]	– 5 ... + 40								
Tropicalization	**IEC: 60068-2-30**	■								
	721-2-1	■								
Electromagnetic compatibility	**IEC: 60694, 61000-6-2**	■								
	61000-6-4	■								

	VD4 17									**VD4 24**							
	■									■							
	■									■							
	17.5									24							
	17.5									24							
	38									50							
	95									125							
	50-60									50-60							
	630	630	1250	1250	1600	1600	2000	2000	2500	630	630	1250	1250	1600	2000	2500	
	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	–	
	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	–	–	–	–	–	–	–	
	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	–	
	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	–	–	–	–	–	–	–	
	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	–	
	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63		
	80	80	80	80	80	80	80	80	80	–	–	–	–	–	–	–	
	■									■							
	~ 45									~ 45							
	10-15									10-15							
	55-60									55-60							
	~ 80									~ 80							
	461	461	461	461	599	599	599	599	616	631	631	631	631	642	642	661	
	450	570	450	570	570	700	570	700	700	570	700	570	700	700	700	700	
	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	
	150	210	150	210	210	275	210	275	275	210	275	210	275	275	275	275	
	TN7405	TN7406	TN7405	TN7406	TN7407	TN7408	TN7407	TN7408	TN7408	TN7409	TN7410	TN7409	TN7410	TN7411	TN7411	TN7411	
	– 5 ... + 40									– 5 ... + 40							
	■									■							
	■									■							
	■									■							
	■									■							

Types of fixed version circuit-breakers available

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

VD4 fixed circuit-breaker without bottom and top terminals

Ur	Isc	Rated normal current (40°C) [A]									
kV	kA	H = 461 D = 424 u/l = 205 l/g = 217..5		H = 599 D = 424 u/l = 310 l/g = 237.5		H = 616 D = 424 u/l = 310 l/g = 237.5	H = 631 D = 424 u/l = 310 l/g = 282.5		H = 642 D = 424 u/l = 310 l/g = 282.5	H = 661 D = 424 u/l = 310 l/g = 282.5	Circuit-breaker type
		I = 150 L = 450	I = 210 L = 570	I = 210 L = 570	I = 275 L = 700	I = 275 L = 700	I = 210 L = 570	I = 275 L = 700	I = 275 L = 700	I = 275 L = 700	
12	16	630									VD4 12.06.16 p150
	20	630									VD4 12.06.20 p150
	25	630									VD4 12.06.25 p150
	31.5	630									VD4 12.06.32 p150
	16	1250									VD4 12.12.16 p150
	20	1250									VD4 12.12.20 p150
	25	1250									VD4 12.12.25 p150
	31.5	1250									VD4 12.12.32 p150
	16		630								VD4 12.06.16 p210
	20		630								VD4 12.06.20 p210
	25		630								VD4 12.06.25 p210
	31.5		630								VD4 12.06.32 p210
	16		1250								VD4 12.12.16 p210
	20		1250								VD4 12.12.20 p210
	25		1250								VD4 12.12.25 p210
	31.5		1250								VD4 12.12.32 p210
	20			1600							VD4 12.16.20 p210
	25			1600							VD4 12.16.25 p210
	31.5			1600							VD4 12.16.32 p210
	20			2000							VD4 12.20.20 p210
	25			2000							VD4 12.20.25 p210
	31.5			2000							VD4 12.20.32 p210
	20				1600						VD4 12.16.20 p275
	25				1600						VD4 12.16.25 p275
	31.5				1600						VD4 12.16.32 p275
	20				2000						VD4 12.20.20 p275
	25				2000						VD4 12.20.25 p275
	31.5				2000						VD4 12.20.32 p275
	20					2500					VD4 12.25.20 p275
	25					2500					VD4 12.25.25 p275
	31.5					2500					VD4 12.25.32 p275
17,5	16	630									VD4 17.06.16 p150
	20	630									VD4 17.06.20 p150
	25	630									VD4 17.06.25 p150
	31.5	630									VD4 17.06.32 p150
	16	1250									VD4 17.12.16 p150
	20	1250									VD4 17.12.20 p150
	25	1250									VD4 17.12.25 p150
	31.5	1250									VD4 17.12.32 p150
	16		630								VD4 17.06.16 p210
	20		630								VD4 17.06.20 p210
	25		630								VD4 17.06.25 p210
	31.5		630								VD4 17.06.32 p210
	16		1250								VD4 17.12.16 p210
	20		1250								VD4 17.12.20 p210
	25		1250								VD4 17.12.25 p210
	31.5		1250								VD4 17.12.32 p210
	20			1600							VD4 17.16.20 p210
	25			1600							VD4 17.16.25 p210
	31.5			1600							VD4 17.16.32 p210
	20			2000							VD4 17.20.20 p210
	25			2000							VD4 17.20.25 p210
	31.5			2000							VD4 17.20.32 p210
	20				1600						VD4 17.16.20 p275
	25				1600						VD4 17.16.25 p275
	31.5				1600						VD4 17.16.32 p275
	20				2000						VD4 17.20.20 p275
	25				2000						VD4 17.20.25 p275
	31.5				2000						VD4 17.20.32 p275
	20					2500					VD4 17.25.20 p275
	25					2500					VD4 17.25.25 p275
	31.5					2500					VD4 17.25.32 p275

Notes

H = Circuit-breaker height.
L = 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.

VD4 fixed circuit-breaker without bottom and top terminals

Ur	Isc	Rated normal current (40°C) [A]									
kV	kA	H = 461 D = 424 u/l = 205 l/g = 217.5		H = 599 D = 424 u/l = 310 l/g = 237.5		H = 616 D = 424 u/l = 310 l/g = 237.5	H = 631 D = 424 u/l = 310 l/g = 282.5		H = 642 D = 424 u/l = 310 l/g = 282.5	H = 661 D = 424 u/l = 310 l/g = 282.5	Circuit-breaker type
		I = 150 L = 450	I = 210 L = 570	I = 210 L = 570	I = 275 L = 700	I = 275 L = 700	I = 210 L = 570	I = 275 L = 700	I = 275 L = 700	I = 275 L = 700	
24	16						630				VD4 24.06.16 p210
	20						630				VD4 24.06.20 p210
	25						630				VD4 24.06.25 p210
	16						1250				VD4 24.12.16 p210
	20						1250				VD4 24.12.20 p210
	25						1250				VD4 24.12.25 p210
	16							630			VD4 24.06.16 p275
	20							630			VD4 24.06.20 p275
	25							630			VD4 24.06.25 p275
	16							1250			VD4 24.12.16 p275
	20							1250			VD4 24.12.20 p275
	25							1250			VD4 24.12.25 p275
	16								1600		VD4 24.16.16 p275
	20								1600		VD4 24.16.20 p275
	25								1600		VD4 24.16.25 p27
	16								2000		VD4 24.20.16 p275
	20								2000		VD4 24.20.20 p275
	25								2000		VD4 24.20.25 p275
	25									2500	VD4 24.25.25 p275

Notes

H = Circuit-breaker height.
L = 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.

– operation counter
– set of ten circuit-breaker open/closed auxiliary contacts
– lever for manually charging the closing springs
– auxiliary circuit support terminal board.

Fixed circuit-breaker standard fittings

The basic versions of the fixed circuit-breakers are three-pole and fitted with:
– EL type manual operating mechanism
– mechanical signalling device for closing springs charged/discharged
– mechanical signalling device for circuit-breaker open/closed
– closing pushbutton
– opening pushbutton

General characteristics of withdrawable circuit-breakers for UniGear type ZS1 switchgears (12 - 17.5 - 24 kV)

Circuit-breaker		**VD4/P 12**						
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	1600	1600	2000	2000	2500
Rated breaking capacity	**Isc** [kA]	16	16	–	–	–	–	–
(rated symmetrical short		20	20	20	20	20	20	20
circuit current)		25	25	25	25	25	25	25
		31.5	31.5	31.5	31.5	31.5	31.5	31.5
Rated short-time	**Ik** [kA]	16	16	–	–	–	–	–
withstand current (3 s)		20	20	20	20	20	20	20
		25	25	25	25	25	25	25
		31.5	31.5	31.5	31.5	31.5	31.5	31.5
Making capacity	**Ip** [kA]	40	40	–	–	–	–	–
		50	50	50	50	50	50	50
		63	63	63	63	63	63	63
		80	80	80	80	80	80	80
Operation sequence	[O-0,3s-CO-3min-CO]	■						
Opening time	[ms]	~ 45						
Arcing time	[ms]	10-15						
Total breaking time	[ms]	55-60						
Closing time	[ms]	~ 80						
Maximum overall dimensions	**H** [mm]	632	632	690	690	690	690	690
	L [mm]	503	503	653	853	653	853	853
	P [mm]	664	664	642	642	642	642	642
Poles center lines	**I** [mm]	150	150	210	275	210	275	275
Dimension standardized table		TN7412	TN7412	TN7415	TN7416	TN7415	TN7416	TN7417
Operating temperature	[°C]	– 5 ... + 40						
Tropicalization	**IEC: 60068-2-30**	■						
	721-2-1	■						
Electromagnetic compatibility	**IEC: 60694, 61000-6-2**	■						
	61000-6-4	■						

(1) Rated uninterrupted currents guaranteed with withdrawable circuit-breaker installed in UniGear type ZS1 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.

	VD4/P 17							VD4/P 24						
	■							■						
	■							■						
	17.5							24						
	17.5							24						
	38							50						
	95							125						
	50-60							50-60						
	630	1250	1600	1600	2000	2000	2500	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
	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	–	–	–	–	–	–	–
	16	16	–	–	–	–	–	16	16	16	16	16	16	16
	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
	31.5	31.5	31.5	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	50	50	50	50	50
	63	63	63	63	63	63	63	63	63	63	63	63	63	63
	80	80	80	80	80	80	80	–	–	–	–	–	–	–
	■							■						
	~ 45							~ 45						
	10-15							10-15						
	55-60							55-60						
	~ 80							~ 80						
	632	632	690	690	690	690	690	794	794	794	794	838	838	838
	503	503	653	853	653	853	853	653	853	653	853	853	853	853
	664	664	642	642	642	642	642	802	802	802	802	790	790	790
	150	150	210	275	210	275	275	210	275	210	275	275	275	275
	TN7412	TN7412	TN7415	TN7416	TN7415	TN7416	TN7417	TN7413	TN7414	TN7413	TN7414	TN7418	TN7418	TN7418
	– 5 ... + 40							– 5 ... + 40						
	■							■						
	■							■						
	■							■						
	■							■						

Types of widrawable version circuit-breakers available for UniGear type ZS1 switchboards

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

VD4/P withdrawable circuit-breaker for UniGear type ZS1 switchboards

Ur	Isc	Rated normal current (40°C) [A] (*)							
kV	kA	L = 650 I = 150 u/I = 205 ø = 35	L = 800 I = 210 u/I = 310 ø = 79	L = 1000 I = 275 u/I = 310 ø = 79	L = 1000 I = 275 u/I = 310 ø = 109	L = 800 I = 210 u/I = 310 ø = 35	L = 1000 I = 275 u/I = 310 ø = 35	L = 1000 I = 275 u/I = 310 ø = 79	Circuit-breaker type
12	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	1000							VD4/P 12.12.16 p150
	20	1000							VD4/P 12.12.20 p150
	25	1000							VD4/P 12.12.25 p150
	31.5	1000							VD4/P 12.12.32 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
	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
	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
	20			1600					VD4/P 12.16.20 p275
	25			1600					VD4/P 12.16.25 p275
	31.5			1600					VD4/P 12.16.32 p275
	20			2000					VD4/P 12.20.20 p275
	25			2000					VD4/P 12.20.25 p275
	31.5			2000					VD4/P 12.20.32 p275
	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
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	1000							VD4/P 17.12.16 p150
	20	1000							VD4/P 17.12.20 p150
	25	1000							VD4/P 17.12.25 p150
	31.5	1000							VD4/P 17.12.32 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
	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
	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
	20			1600					VD4/P 17.16.20 p275
	25			1600					VD4/P 17.16.25 p275
	31.5			1600					VD4/P 17.16.32 p275
	20			2000					VD4/P 17.20.20 p275
	25			2000					VD4/P 17.20.25 p275
	31.5			2000					VD4/P 17.20.32 p275
	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

Notes

L = Width of the switch-board.
I = Horizontal centre distance between poles.
u/I = Distance between bottom and top terminal.
Ø = Diameter of isolating contact.

VD4/P withdrawable circuit-breaker for UniGear type ZS1 switchboards

Ur	Isc	Rated normal current (40°C) [A] (*)							
kV	kA	L = 650 I = 150 u/l = 205 ø = 35	L = 800 I = 210 u/l = 310 ø = 79	L = 1000 I = 275 u/l = 310 ø = 79	L = 1000 I = 275 u/l = 310 ø = 109	L = 800 I = 210 u/l = 310 ø = 35	L = 1000 I = 275 u/l = 310 ø = 35	L = 1000 I = 275 u/l = 310 ø = 79	Circuit-breaker type
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					1000			VD4/P 24.12.16 p210
	20					1000			VD4/P 24.12.20 p210
	25					1000			VD4/P 24.12.25 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
	16						630		VD4/P 24.06.16 p275
	20						630		VD4/P 24.06.20 p275
	25						630		VD4/P 24.06.25 p275
	16						1000		VD4/P 24.12.16 p275
	20						1000		VD4/P 24.12.20 p275
	25						1000		VD4/P 24.12.25 p275
	16						1250		VD4/P 24.12.16 p275
	20						1250		VD4/P 24.12.20 p275
	25						1250		VD4/P 24.12.25 p275
	16							1600	VD4/P 24.16.16 p275
	20							1600	VD4/P 24.16.20 p275
	25							1600	VD4/P 24.16.25 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
	16							2300	VD4/P 24.25.16 p275
	20							2300	VD4/P 24.25.20 p275
	25							2300	VD4/P 24.25.25 p275
	16							2500	VD4/P 24.25.16 p275
	20							2500	VD4/P 24.25.20 p275
	25							2500	VD4/P 24.25.25 p275

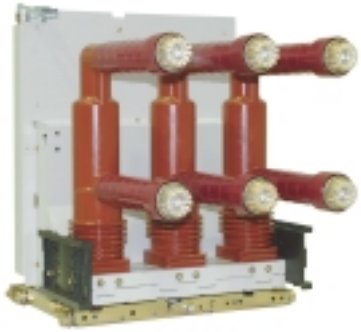
Notes

L = Width of the switchboard.
I = Horizontal centre distance between poles.
u/l = Distance between bottom and top terminal.
Ø = Diameter of isolating contact.
(*) The 2300 A rated uninterrupted current is guaranteed with natural ventilation.
The 2500 A rated uninterrupted current is guaranteed with forced ventilation.

Standard fittings of withdrawable circuit-breakers for UniGear type ZS1 switchboards

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

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



General characteristics of withdrawable circuit-breakers for Unisafe switchgears (12 - 17.5 - 24 kV)

Circuit-breaker		VD4/P 12						
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	630	1250	1600	2000	2500
Rated breaking capacity	**Isc** [kA]	16	16	16	16	–	–	–
(rated symmetrical short		20	20	20	20	20	20	20
circuit current)		25	25	25	25	25	25	25
		31.5	31.5	31.5	31.5	31.5	31.5	31.5
Rated short-time	**Ik** [kA]	16	16	16	16	–	–	–
withstand current (3 s)		20	20	20	20	20	20	20
		25	25	25	25	25	25	25
		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
		63	63	63	63	63	63	63
		80	80	80	80	80	80	80
Operation sequence	[O-0,3s-CO-3min-CO]	■						
Opening time	[ms]	~ 45						
Arcing time	[ms]	10-15						
Total breaking time	[ms]	55-60						
Closing time	[ms]	~ 80						
Maximum overall dimensions	**H** [mm]	632	632	632	632	690	690	690
	L [mm]	503	503	503	503	653	653	853
	P [mm]	664	664	664	664	642	642	642
Poles center lines	**I** [mm]	150	150	210	210	210	210	275
Dimension standardized table		TN7412	TN7412	(2)	(2)	TN7415	TN7415	TN7417
Operating temperature	[°C]	– 5 ... + 40						
Tropicalization	**IEC: 60068-2-30**	■						
	721-2-1	■						
Electromagnetic compatibility	**IEC: 60694, 61000-6-2**	■						
	61000-6-4	■						

(1) Rated uninterrupted currents guaranteed with withdrawable circuit-breaker installed in UniSafe switchboard with 40°C air temperature
(2) Please ask us for the overall dimensions.

	VD4/P 17							**VD4/P 24**			
	■							■			
	■							■			
	17.5							24			
	17.5							24			
	38							50			
	95							125			
	50-60							50-60			
	630	1250	630	1250	1600	2000	2500	630	1250	1600	2000
	16	16	16	16	–	–	–	16	16	16	16
	20	20	20	20	20	20	20	20	20	20	20
	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	–	–	–	–
	16	16	16	16	–	–	–	16	16	16	16
	20	20	20	20	20	20	20	20	20	20	20
	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	–	–	–	–
	40	40	40	40	–	–	–	40	40	40	40
	50	50	50	50	50	50	50	50	50	50	50
	63	63	63	63	63	63	63	63	63	63	63
	80	80	80	80	80	80	80	–	–	–	–
	■							■			
	~ 45							~ 45			
	10-15							10-15			
	55-60							55-60			
	~ 80							~ 80			
	632	632	632	632	690	690	690	794	794	853	853
	503	503	503	503	653	653	853	653	653	853	853
	664	664	664	664	642	642	642	802	802	790	790
	150	150	210	210	210	210	275	210	210	275	275
	TN7412	TN7412	(2)	(2)	TN7415	TN7415	TN7417	TN7413	TN7413	TN7418	TN7418
	– 5 ... + 40							– 5 ... + 40			
	■							■			
	■							■			
	■							■			
	■							■			

Types of widrawable version circuit-breakers available for UniSafe switchboards

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

VD4/P withdrawable circuit-breaker for UniSafe switchboards

Ur	Isc	Rated normal current (40°C) [A]						
kV	kA	L = 600 I = 150 u/I = 205 ø = 35	L = 750 I = 210 u/I = 310 ø = 35 (1)	L = 750 I = 210 u/I = 310 ø = 79	L = 1000 I = 275 u/I = 310 ø = 109	L = 800 I = 210 u/I = 310 ø = 35	L = 1000 I = 275 u/I = 310 ø = 79	Circuit-breaker type
12	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/P 12.06.16 p210
	20		630					VD4/P 12.06.20 p210
	25		630					VD4/P 12.06.25 p210
	31.5		630					VD4/P 12.06.32 p210
	16		1250					VD4/P 12.12.16 p210
	20		1250					VD4/P 12.12.20 p210
	25		1250					VD4/P 12.12.25 p210
	31.5		1250					VD4/P 12.12.32 p210
	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
	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
	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
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/P 17.06.16 p210
	20		630					VD4/P 17.06.20 p210
	25		630					VD4/P 17.06.25 p210
	31.5		630					VD4/P 17.06.32 p210
	16		1250					VD4/P 17.12.16 p210
	20		1250					VD4/P 17.12.20 p210
	25		1250					VD4/P 17.12.25 p210
	31.5		1250					VD4/P 17.12.32 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
	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
	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

Notes

L = Width of the switch-board.

I = Horizontal centre distance between poles.

u/I = Distance between bottom and top terminal.

Ø = Diameter of isolating contact.

(1) Please contact us for availability of this version.

VD4/P withdrawable circuit-breaker for UniSafe switchboards

Ur	Isc	Rated normal current (40°C) [A]						
kV	kA	L = 600 I = 150 u/I = 205 ø = 35	L = 750 I = 210 u/I = 310 ø = 35 (1)	L = 750 I = 210 u/I = 310 ø = 79	L = 1000 I = 275 u/I = 310 ø = 109	L = 800 I = 210 u/I = 310 ø = 35	L = 1000 I = 275 u/I = 310 ø = 79	Circuit-breaker type
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
	16						1600	VD4/P 24.16.16 p275
	20						1600	VD4/P 24.16.20 p275
	25						1600	VD4/P 24.16.25 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

Notes

L = Width of the switchboard.
I = Horizontal centre distance between poles.
u/I = Distance between bottom and top terminal.
Ø = Diameter of isolating contact.
(1) Please contact us for availability of this version.

Standard fittings of withdrawable circuit-breakers for UniSafe switchboards

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

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

Optional accessories

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

1 Shunt opening release (-M01)

This allows remote opening control of the apparatus.
The release can operate both in direct and alternating current.
This release is suitable for instantaneous service. In this case, the minimum current impulse time must be 100 ms.

Characteristics

Un: 124 V–	
Un: 130 - 48 - 60 - 110 - 120 - 120 - 127 - 220 - 240 - 250 - 380 - 400 - 440 V– / V ~	
Un: 480 V ~	
Operating limits:	70 ... 110 % Un
Power on inrush (Ps):	DC 200 W; AC = 200 VA
Inrush duration:	approx. 100 ms
Maintenance power (Pc):	DC = 5 W; AC = 5 VA
Opening time:	max 60 ms
Insulation voltage:	2500 V 50 Hz (per 1 min)

2A Additional shunt opening release (-M02)

Like the shunt opening release described above, this allows remote opening control of the apparatus and can be supplied by a circuit completely separate from the -MO1 release.
It keeps all the electrical and operating characteristics of the shunt opening release.

2B Opening solenoid (-MO3) (1)

The opening solenoid is a special release with demagnetisation.
Please contact us for availability of this accessory.

3 Shunt closing release (-MC)

This allows remote closing control of the apparatus.
The release can operate both in direct and alternating current.
This release is suitable both for instantaneous and permanent service.
In the case of instantaneous service, the minimum current impulse time must be 100 ms. The permanently supplied release carries out the electrical anti-pumping function.
It keeps all the electrical and operating characteristics of the shunt opening release.
The opening solenoid is a special release with demagnetisation.
Please contact us for availability of this accessory.

4 Undervoltage release (-MU)

The undervoltage release opens the circuit-breaker when there is notable lowering or lack of its power supply. It can be used for remote release (by means of normally closed type push-buttons), lock on closing or to control the voltage in the auxiliary circuits.
The circuit-breaker can only close with the release supplied (the closure lock is made mechanically).

The release can operate both in direct and alternating current.
The undervoltage release is available in the following versions:

4A Undervoltage release with power supply branched on the supply side.

4B Undervoltage release with electronic time delay device (0.5 - 1 - 1.5 - 2 - 3 s) (power supply branched on the supply side). This device is set at 0.5 s (for adjustment, please see the Electric Circuit Diagram chapter).

Characteristics

Un:	24 V –	120-127 V ~
Un:	30 V ~	220-240 V ~
Un:	48 V ~	240-250 V ~
Un:	60 V ~	380-400 V ~
Un:	110-120 V ~	440-480 V ~
Operating limits: – circuit-breaker opening: 35-70% Un – circuit-breaker closing: 85-110% Un		
Power on inrush (Ps):		DC 200 W; AC = 200 VA
Inrush duration		approx.100 ms
Maintenance power (Pc):		DC = 5 W; AC = 5 VA
Opening time:		30 ms
Insulation voltage:		2500 V 50 Hz (per 1 min)

Electronic time delay device

The electronic time delay device must be mounted externally in relation to the circuit-breaker. It allows release trip with established and adjustable times.
The use of the undervoltage release is recommended in order to prevent trips when the power supply network of the release may be subject to cuts or voltage drops of short duration.
If it is not supplied, circuit-breaker closing is disabled.
The time delay device must be combined with an undervoltage release with the same voltage as the delay device.

Characteristics of the time-delay device

Un: 24-30-48-60-110-115-220-250 V
Adjustable opening time (release + time delay device): 0.5-1-1.5-2-3 s

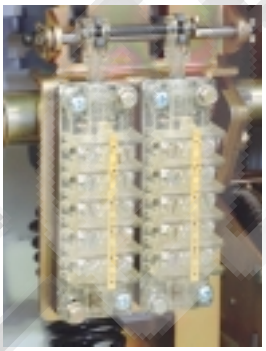
5 Undervoltage release mechanical override

This is a mechanical device which allows the undervoltage release trip to be temporarily excluded.
It is always fitted with electrical signalling. Please contact us for availability of this accessory.

6 Contact for signalling undervoltage energised/de-energised

The undervoltage releases can be fitted with a contact (normally closed or open as desired) for signalling whether the undervoltage release is energised or de-energised, and for remote signalling of the release state.
The contact provides the following indication:
– contact open: release energised
– contact closed: release de-energised.

7 Circuit-breaker auxiliary contacts



Electrical signalling of circuit-breaker open/closed can be provided with a set of 15 auxiliary contacts as an alternative to the 10 provided as standard (*).

Characteristics

Un:	24 ... 220 V AC-DC
Rated current	Ith2 = 10 A
Insulation voltage:	2500 V 50 Hz (per 1 min)
Electric resistance:	3 mOhm

Rated current and breaking capacity in category AC11 e DC11:

Un	Cos ϕ	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

8 Transient contact

Transient contact **(-BB4)** with momentary closing during circuit-breaker opening.
Please contact us for availability of this accessory.

(*) With the group of 10 auxiliary contacts and the maximum of the requested applications, available contacts will be four opening contacts, signalling circuit-breaker open and three closing contacts, signalling circuit-breaker closed.
With the group of 15 auxiliary contacts and the maximum of the requested applications, available contacts will be five opening contacts, signalling circuit-breaker open and six closing contacts, signalling circuit-breaker closed.

9 Position contact

Position contact **(-BT3)** of the withdrawable circuit-breaker open during isolating stroke (installed on the truck, only available for withdrawable/P circuit-breaker, when the locking magnet is provided **(-RL1)** on the operating mechanism and the transmitted contacts are not provided). It prevents remote closing during traverse into the unit.

10 Transmitted contacts

Transmitted contacts of the withdrawable circuit-breaker (installed on the truck, only available for withdrawable circuit-breaker).
These contacts are either in addition to or as an alternative to the position contacts (for signalling circuit-breaker racked out) located in the unit.

11 Motor operator (-MS)

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

Characteristics

Un:	24-30-48-60-100-130-220-250 V
Operating limits:	85 ... 110 % Un
Power on inrush (Ps):	DC 500 W; AC = 500 VA
Rated power (Pn):	DC = 200 W; AC = 200 VA
Inrush duration:	0,2 s
Charging time:	4-5 s
Insulating voltage:	2500 V 50 Hz (per 1 min)

12 Contact for signalling closing springs charged/discharged

Mounted as standard when the motor operator is provided. This consists of a microswitch which allows remote signalling of the state of the circuit-breaker operating mechanism springs.
The contact provides the following indication:
– contact open: signalling of springs discharged
– contact closed: signalling of springs charged.

Protections and locks

Various mechanical and electromechanical locking and protection devices are available.

13 Opening and closing pushbutton protection

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

14 Opening and closing pushbutton padlocks

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

15 Key lock in open position

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

16 Locking magnet on the operating mechanism (-RL1)

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

Characteristics

Un:	24 - 30 - 48 - 60 - 100 - 125 - 220 - 250 V–
Un:	48 - 110 - 120 (127) - 230 (220/240) V~ 50 Hz
Un:	110 (127) - 230 (220/240) V~ 60 Hz
Operating limits:	85 … 110 % Un
Power on inrush (Ps):	DC 250 W; AC = 250 VA
Continuous power (Pc):	DC = 5 W; AC = 5 VA
Inrush duration:	150 ms

17 Locking magnet on truck (-RL2)

Compulsory accessory for the withdrawable versions for UniSafe and UniGear ZS1 type switchboards, to prevent circuit-breaker racking into the switchboard with the auxiliary circuit plug disconnected. The plug realises the anti-racking in lock for different rated current (by means of special pins).
For the electrical characteristics, see the locking magnet on the operating mechanism (accessory 16).

18 Interlock for fixed circuit-breaker

Device for fixed circuit-breakers which are converted into withdrawable ones by the customer.
Please contact us for availability of this accessory.

19 Mechanical interlock

This device prevents the switchboard door being opened with the circuit-breaker racked-in. Only provided for circuit-breakers used in UniSafe switch-boards, fitted with special striker on the switchboard.
Please contact us for availability of this accessory.

3

SPECIFIC PRODUCT CHARACTERISTICS

Resistance to vibrations

VD4 circuit-breakers are unaffected by mechanically generated vibrations.
For the versions approved by the naval registers, please contact us.

Tropicalization

VD4 circuit-breakers are manufactured in compliance with the strictest regulations for use in hot-humid-saline climates.
All the most important metal components are treated against corrosive factors according to UNI 3564-65 Standards environmental class C.
Galvanisation is carried out in accordance with UNI ISO 2081 Standards, classification code Fe/Zn 12, with a thickness of $12x10^{-6}$ m, protected by a conversion layer mainly consisting of chromates in compliance with the UNI ISO 5420 Standards.
These construction characteristics mean that the whole VD4 series of circuit-breakers and its 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 Bd: Damp Heat, cyclic) Standards.

Altitude

The insulating property of air decreases as the altitude increases, therefore this must always be taken into account for external insulation of the apparatus (the internal insulation of the interrupters do not undergo any variations as it is guaranteed by vacuum).
The phenomenon must always be taken into consideration 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 graph to the side, built up on the basis of the indications in the IEC 60694 Standards.
The following example is a clear interpretation of the indications given above.

Graph for determining the Ka correction factor according to the altitude

H = altitude in metres;
m = value referred to industrial frequency and the atmospheric impulse withstand voltages and those between phase and phase.

Example

- Installation altitude 2000 m
- Operation at the rated voltage of 12 kV
- Withstand voltage at industrial frequency 28 kV rms
- Impulse withstand voltage 75 kVp
- Factor Ka obtained from graph = 1.13.

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

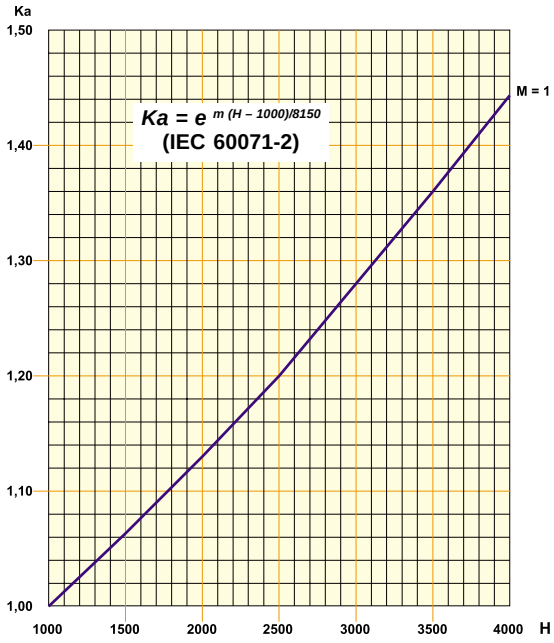
– withstand voltage at industrial frequency equal to:

28 x 1.13 = 31.6 kVrms

– impulse withstand voltage equal to:

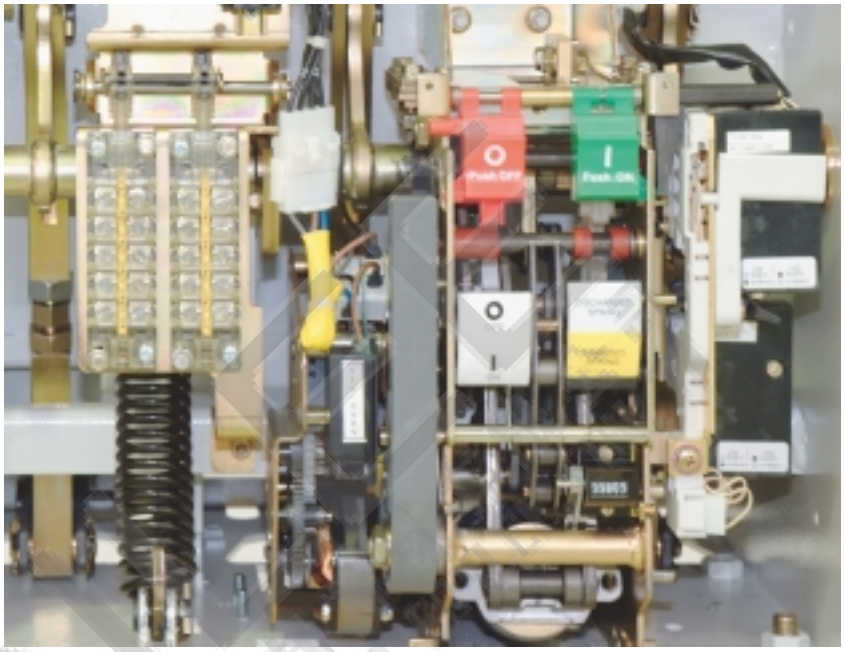
75 x 1.13 = 84.7 kVp.

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



Anti-pumping device

The EL operating mechanism on HD4 circuit-breakers (in all versions) is fitted with a mechanical anti-pumping device which prevents re-closing due to either electrical or mechanical commands.
Should both the closing command and any one of the opening commands be active at the same time, there would be a continuous succession of opening and closing operations.
The anti-pumping device avoids this situation, ensuring that each closing operation is only followed by a single opening operation and that there is no closing operation after this. To obtain a further closing operation, the closing command must be released and then relaunched.
Furthermore, the anti-pumping device only allows circuit-breaker closure if the following conditions are present at the same time:
– operating mechanism springs fully charged
– opening pushbutton and/or opening release (-MO1/-MO2) not enabled
– circuit-breaker open.



Environmental protection programme

VD4 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.

PR512 protection device

The self-supplied PR512 is available for protection of the installations.
depending on the version, the PR512 carries out the following functions:
- 50-51-50N-51N protection
- current measurement with display of the maximum value between phases
- dialogue.

For further information about the PR512, please consult technical catalogue 649092.

Spare parts

Replacement can only be carried out by trained personnel and/or in our workshops:
– opening springs
– closing springs
– complete pole
– operating mechanism box
– bushings, terminals and insulating protections.

Replacement which can be carried out by the customer:
– isolating contacts
– geared motor limit switch contact.

Ordering

For availability and ordering of spare parts, please contact our Service, specifying the circuit-breaker serial number.

4

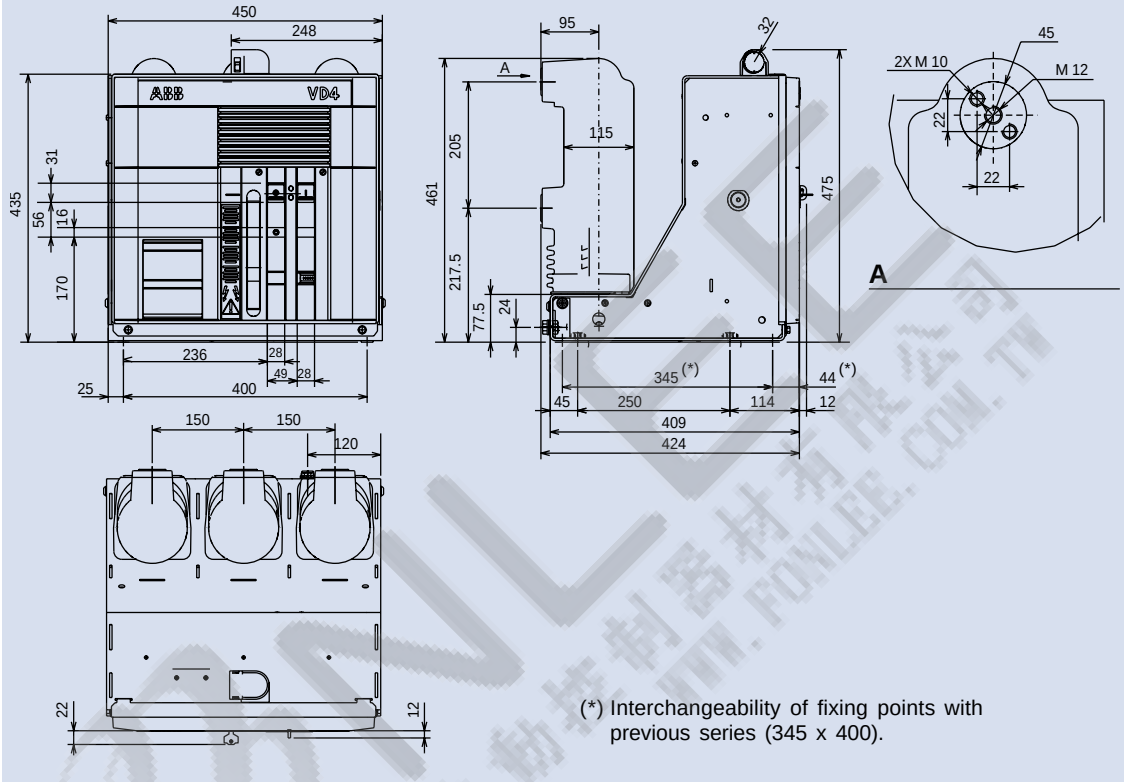
OVERALL DIMENSIONS

OVERALL DIMENSIONS

Fixed circuit-breakers

VD4		
TN	7405	
Ur	12	kV
Ir	630	A
	1250	A
Isc	16	kA
	20	kA
	25	kA
	31,5	kA

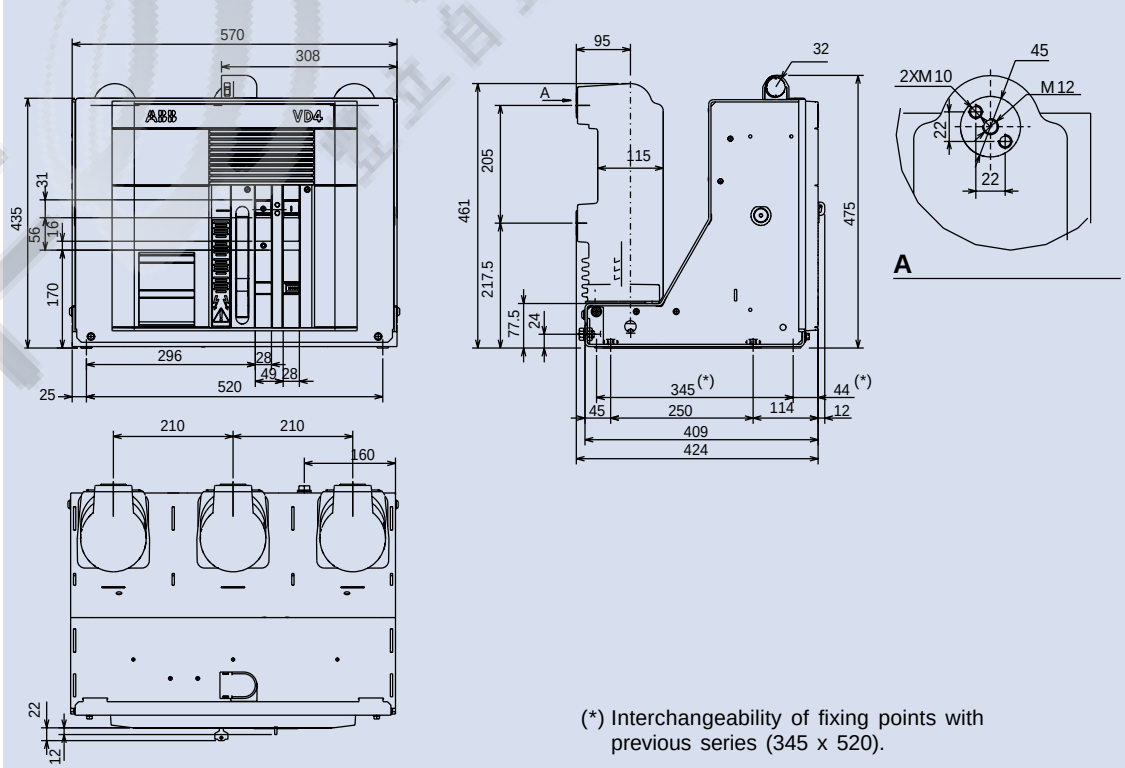
VD4		
TN	7405	
Ur	17,5	kV
Ir	630	A
	1250	A
Isc	16	kA
	20	kA
	25	kA
	31,5	kA



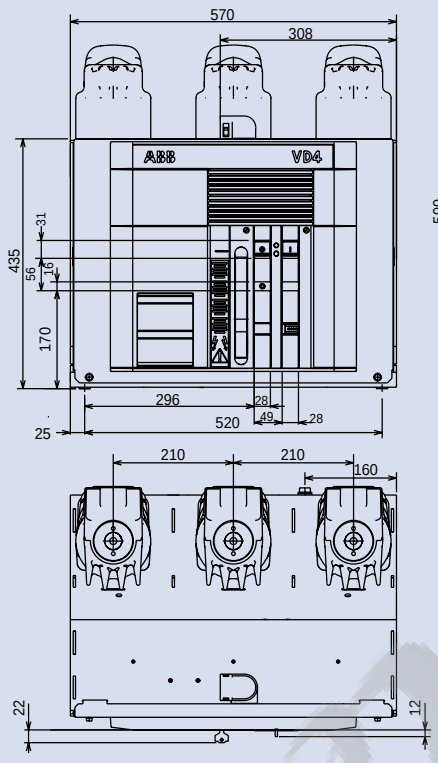
(*) Interchangeability of fixing points with previous series (345 x 400).

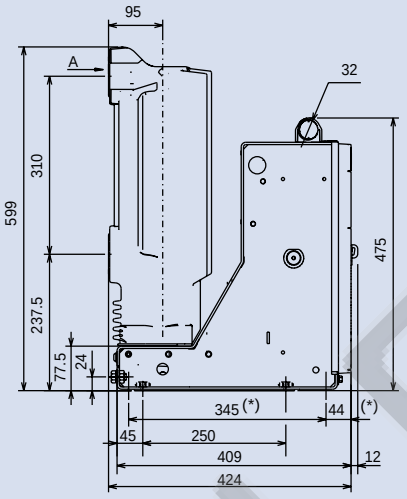
VD4		
TN	7406	
Ur	12	kV
Ir	630	A
	1250	A
Isc	16	kA
	20	kA
	25	kA
	31,5	kA

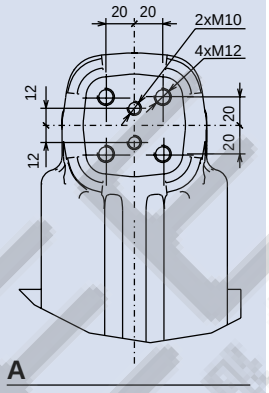
VD4		
TN	7406	
Ur	17,5	kV
Ir	630	A
	1250	A
Isc	16	kA
	20	kA
	25	kA
	31,5	kA



(*) Interchangeability of fixing points with previous series (345 x 520).



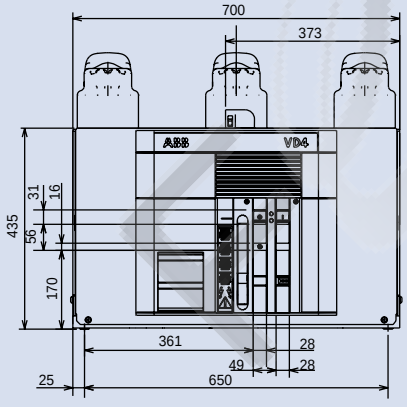


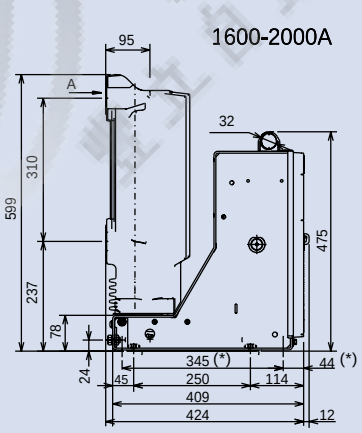


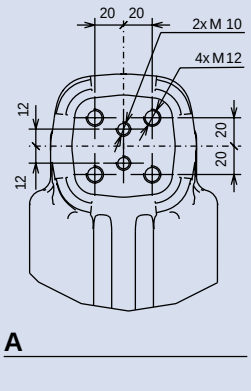
(*) Interchangeability of fixing points with previous series (345 x 520).

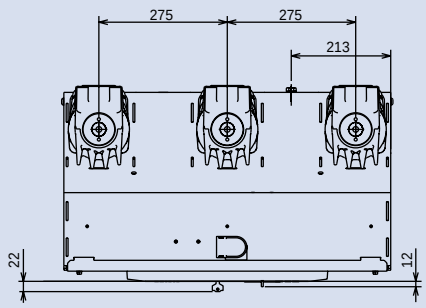
VD4		
TN	7407	
Ur	12	kV
Ir	1600	A
	2000	A
Isc	20	kA
	25	kA
	31,5	kA

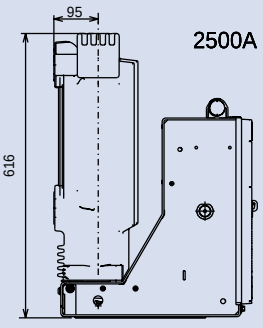
VD4		
TN	7407	
Ur	17,5	kV
Ir	1600	A
	2000	A
Isc	20	kA
	25	kA
	31,5	kA











(*) Interchangeability of fixing points with previous series (345 x 650).

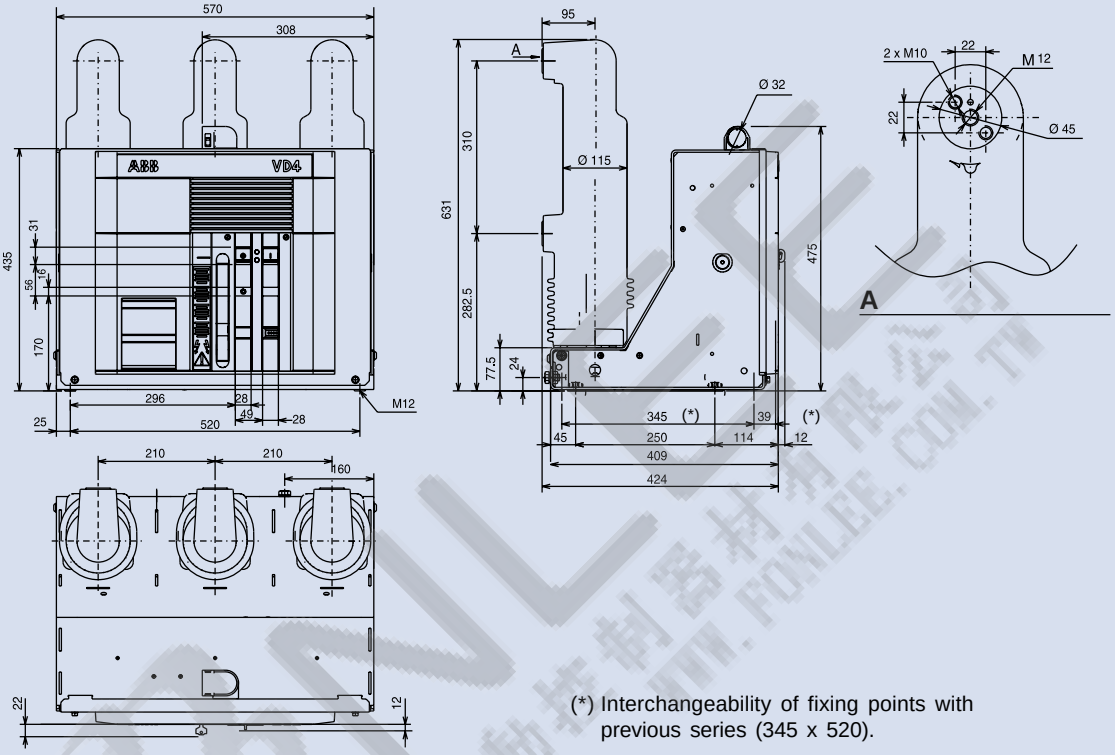
VD4		
TN	7408	
Ur	12	kV
Ir	1600	A
	2000	A
	2500	A
Isc	20	kA
	25	kA
	31,5	kA

VD4		
TN	7408	
Ur	17,5	kV
Ir	1600	A
	2000	A
	2500	A
Isc	20	kA
	25	kA
	31,5	kA

OVERALL DIMENSIONS

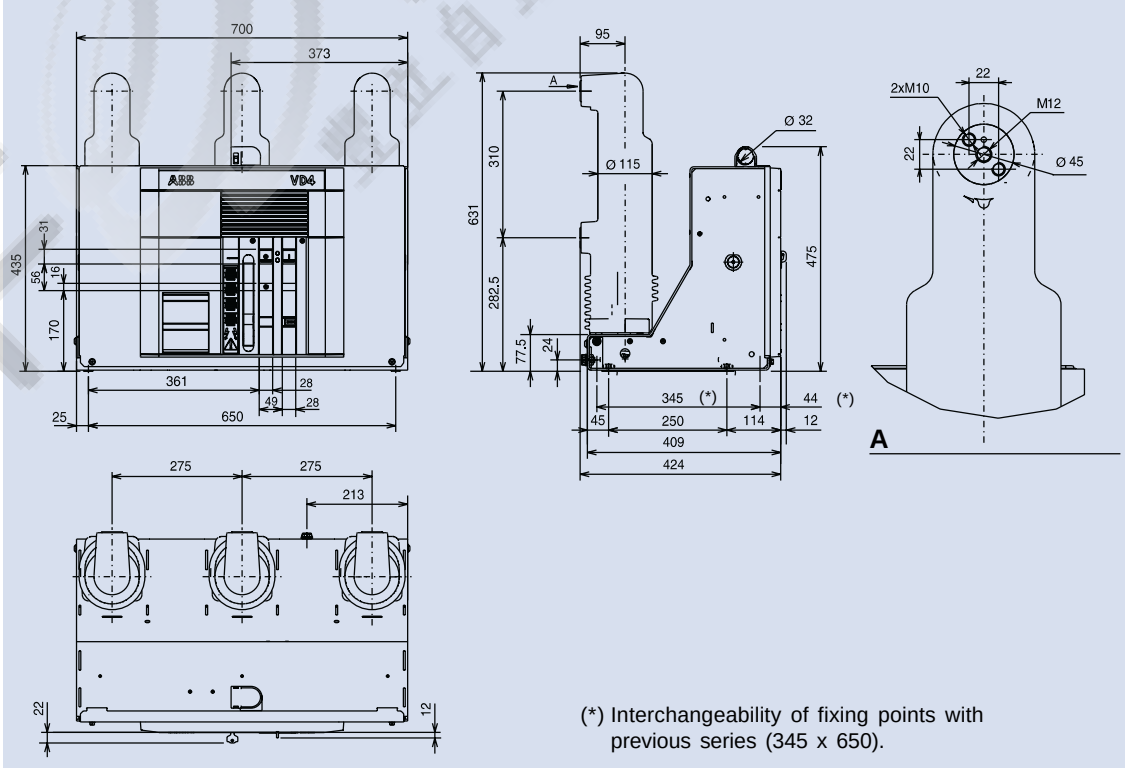
Fixed circuit-breakers

VD4		
TN	7409	
Ur	24	kV
Ir	630	A
	1250	A
Isc	16	kA
	20	kA
	25	kA

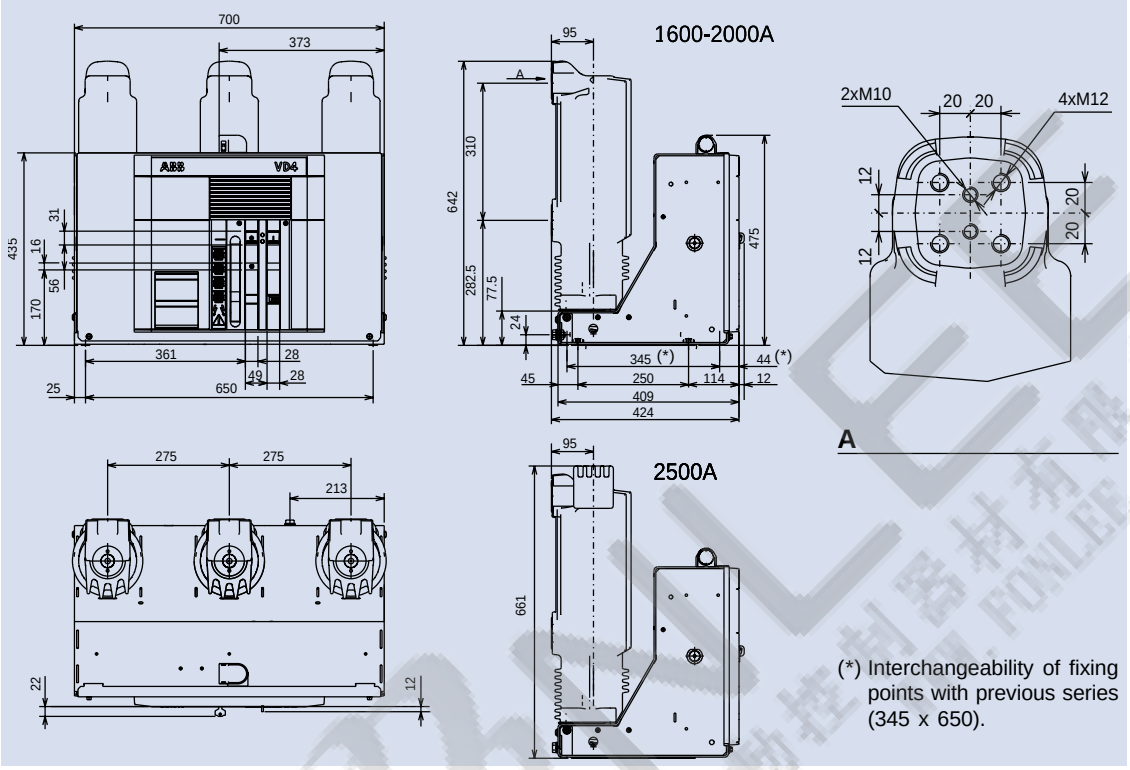


(*) Interchangeability of fixing points with previous series (345 x 520).

VD4		
TN	7410	
Ur	24	kV
Ir	630	A
	1250	A
Isc	16	kA
	20	kA
	25	kA



(*) Interchangeability of fixing points with previous series (345 x 650).



(*) Interchangeability of fixing points with previous series (345 x 650).

VD4		
TN	7411	
Ur	24	kV
Ir	1600	A
	2000	A
Isc	16	kA
	20	kA
	25	kA

VD4		
TN	7411	
Ur	24	kV
Ir	2500	A
Isc	25	kA

OVERALL DIMENSIONS

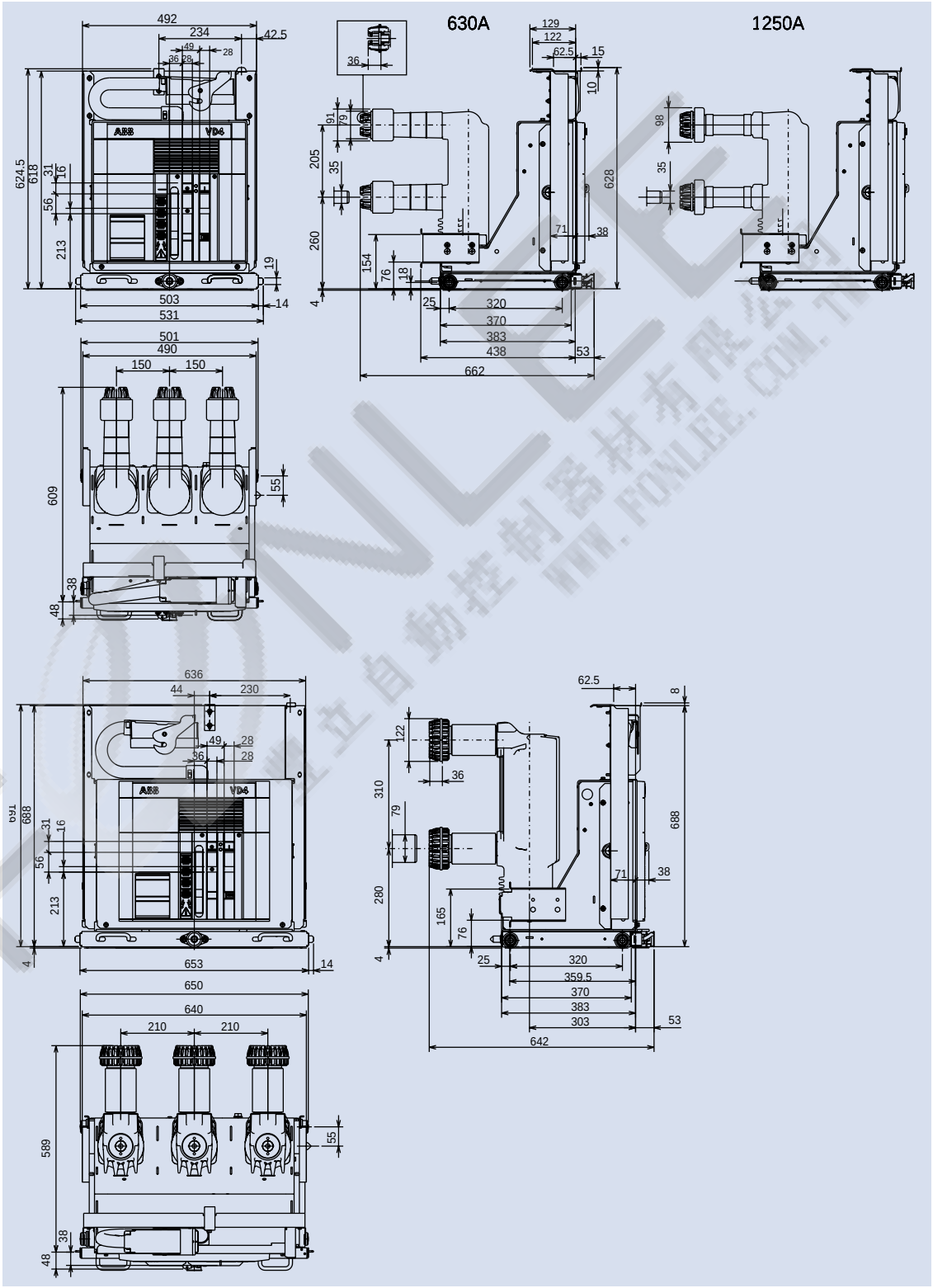
Withdrawable circuit-breakers for UniGear type ZS1 and UniSafe switchgears

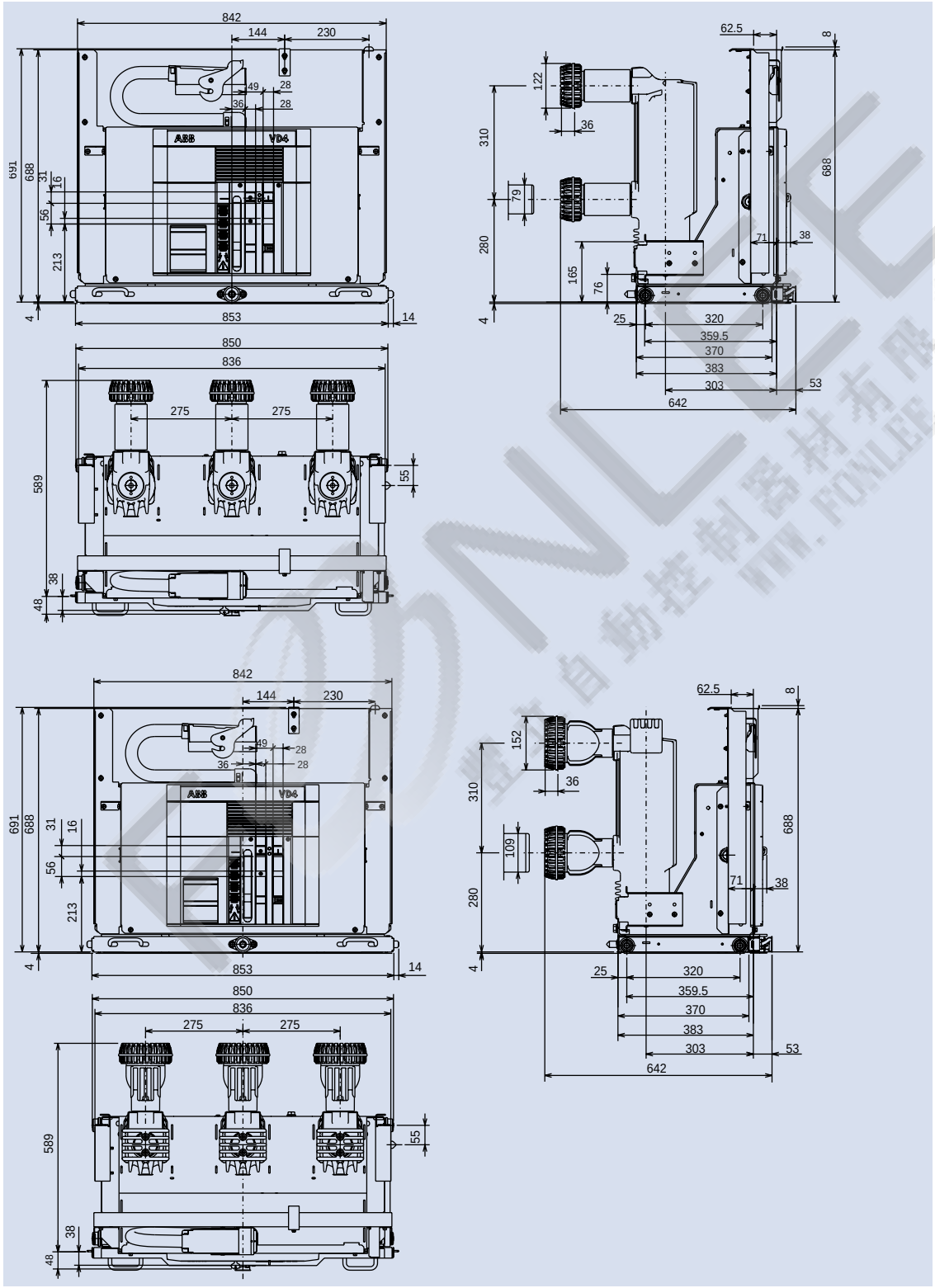
VD4/P		
TN	7412	
Ur	12	kV
Ir	630	A
	1250	A
Isc	16	kA
	20	kA
	25	kA
	31,5	kA

VD4/P		
TN	7412	
Ur	17,5	kV
Ir	630	A
	1250	A
Isc	16	kA
	20	kA
	25	kA
	31,5	kA

VD4/P		
TN	7415	
Ur	12	kV
Ir	1600	A
	2000	A
Isc	20	kA
	25	kA
	31,5	kA

VD4/P		
TN	7415	
Ur	17,5	kV
Ir	1600	A
	2000	A
Isc	20	kA
	25	kA
	31,5	kA





VD4/P (1)		
TN	7416	
Ur	12	kV
Ir	1600	A
	2000	A
Isc	20	kA
	25	kA
	31,5	kA

VD4/P (1)		
TN	7416	
Ur	17,5	kV
Ir	1600	A
	2000	A
Isc	20	kA
	25	kA
	31,5	kA

(1) For UniGear type ZS1 only.

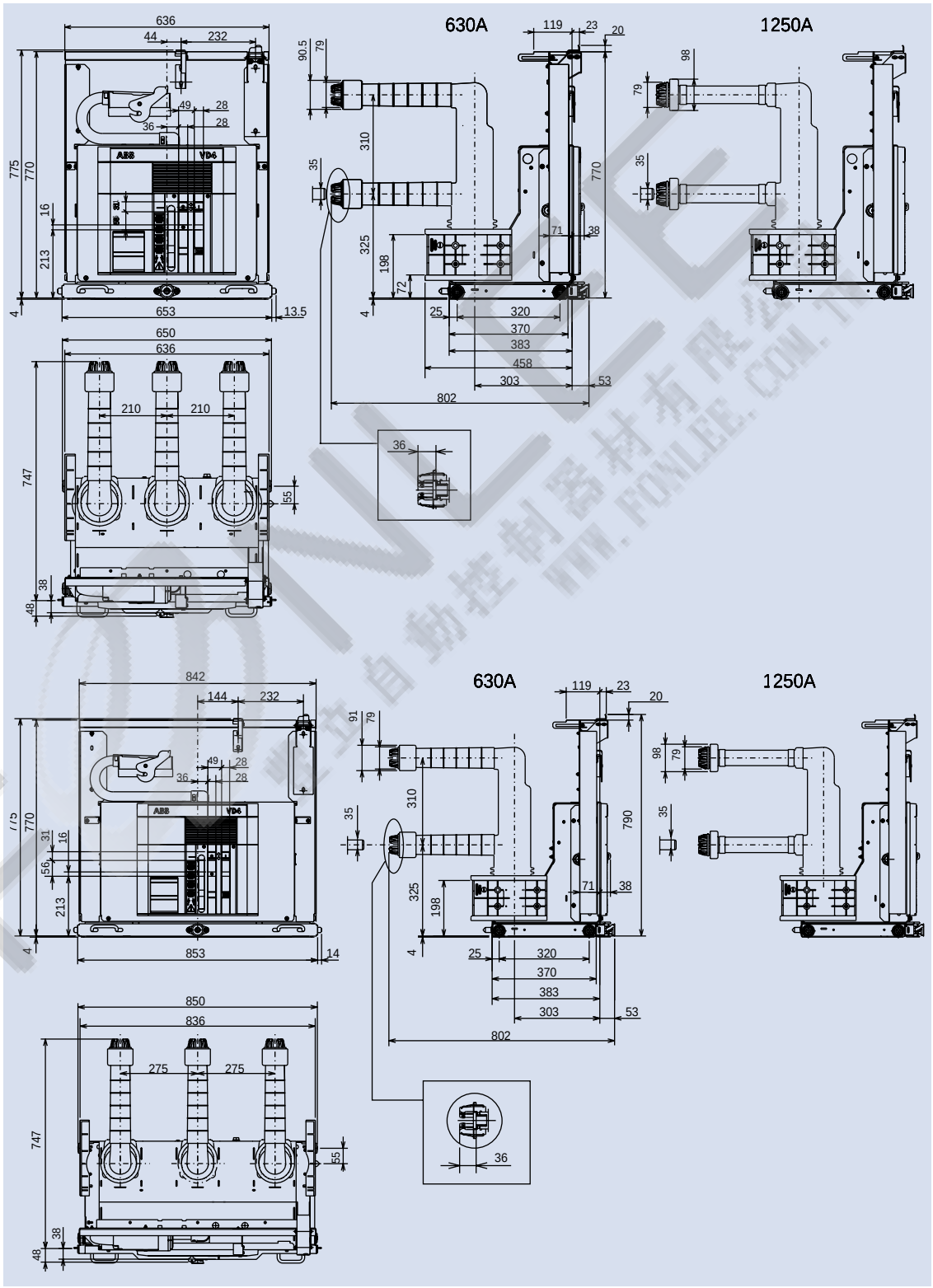
VD4/P		
TN	7417	
Ur	17,5	kV
Ir	2500	A
Isc	20	kA
	25	kA
	31,5	kA

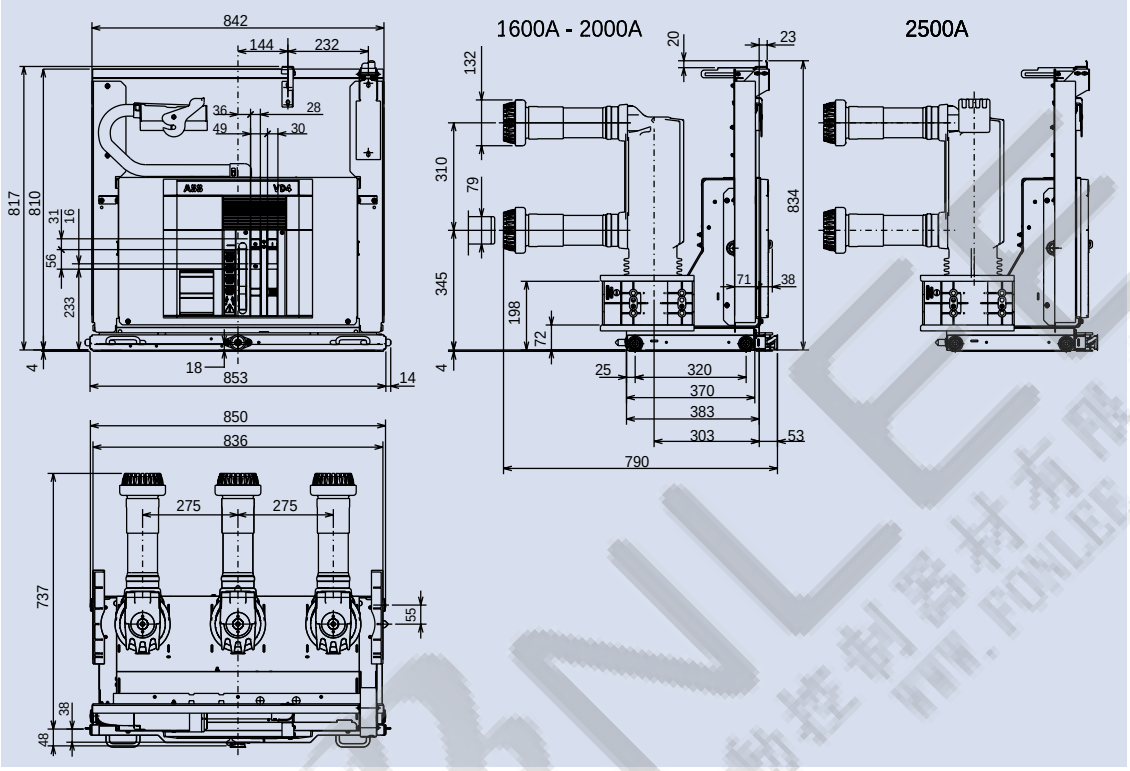
Withdrawable circuit-breakers for UniGear type ZS1 and UniSafe switchgears

VD4/P		
TN	7413	
Ur	24	kV
Ir	630	A
	1250	A
Isc	16	kA
	20	kA
	25	kA

VD4/P (1)		
TN	7414	
Ur	24	kV
Ir	630	A
	1250	A
Isc	16	kA
	20	kA
	25	kA

(1) For UniGear type ZS1 only.





VD4/P		
TN	7418	
Ur	24	kV
Ir	1600	A
	2000	A
	2500	A (2)
Isc	16	kA
	20	kA
	25	kA

(2) For UniGear type ZS1 only.
Rated normal current of 2300 A is guaranteed with natural ventilation.
Rated normal current of 2500 A is guaranteed with forced ventilation.

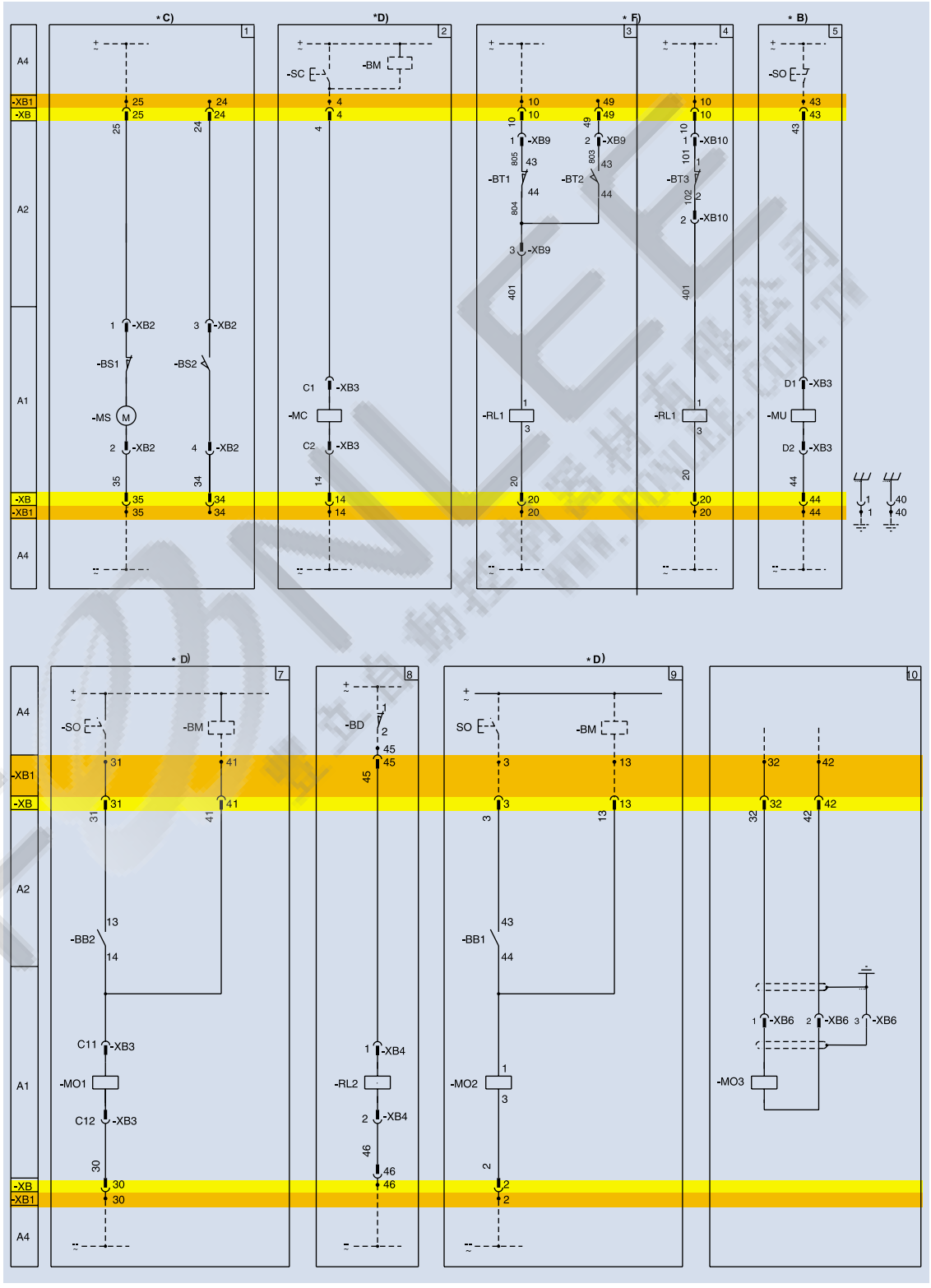
5

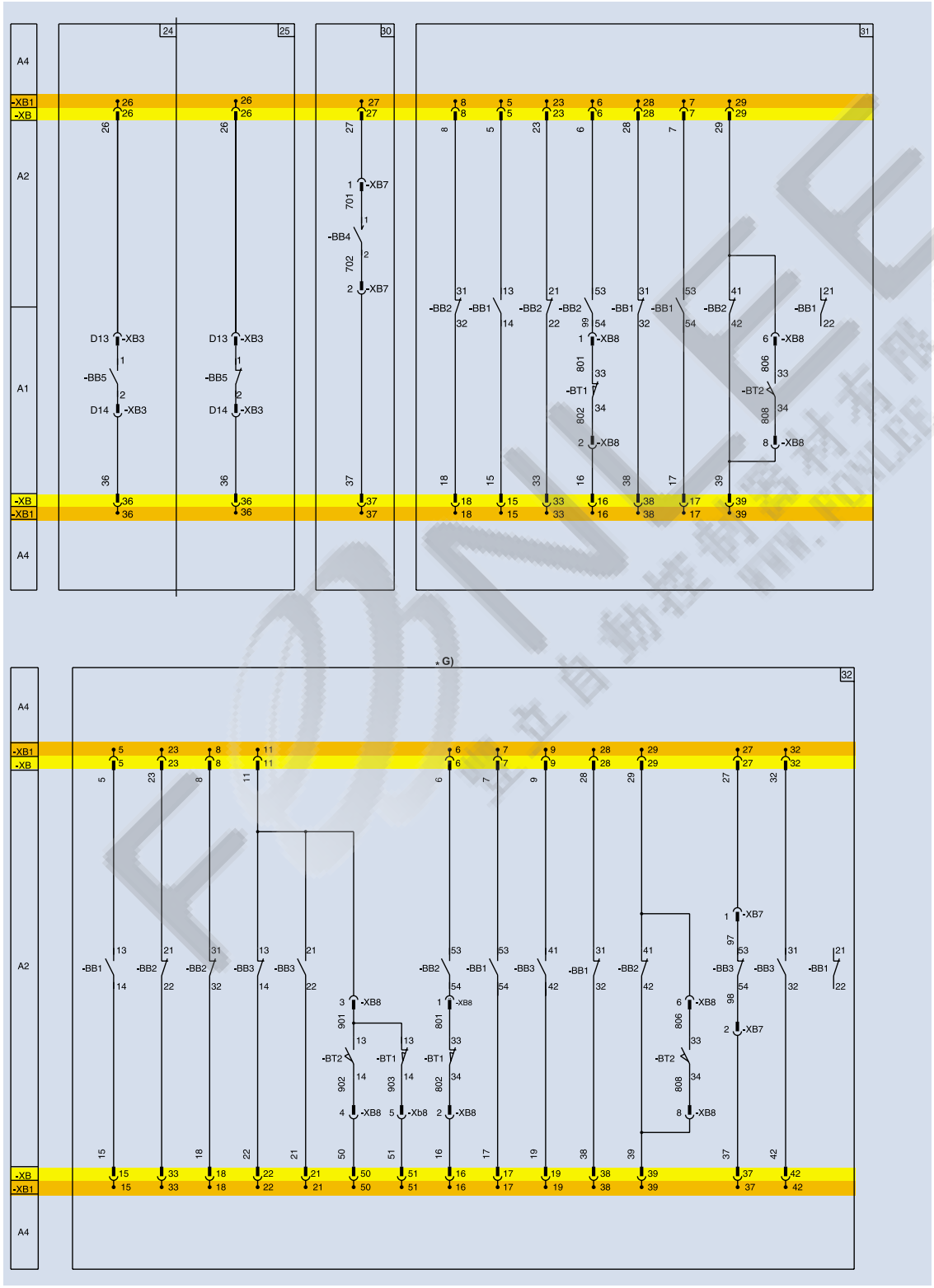
ELECTRICAL CIRCUIT DIAGRAM

Application diagrams

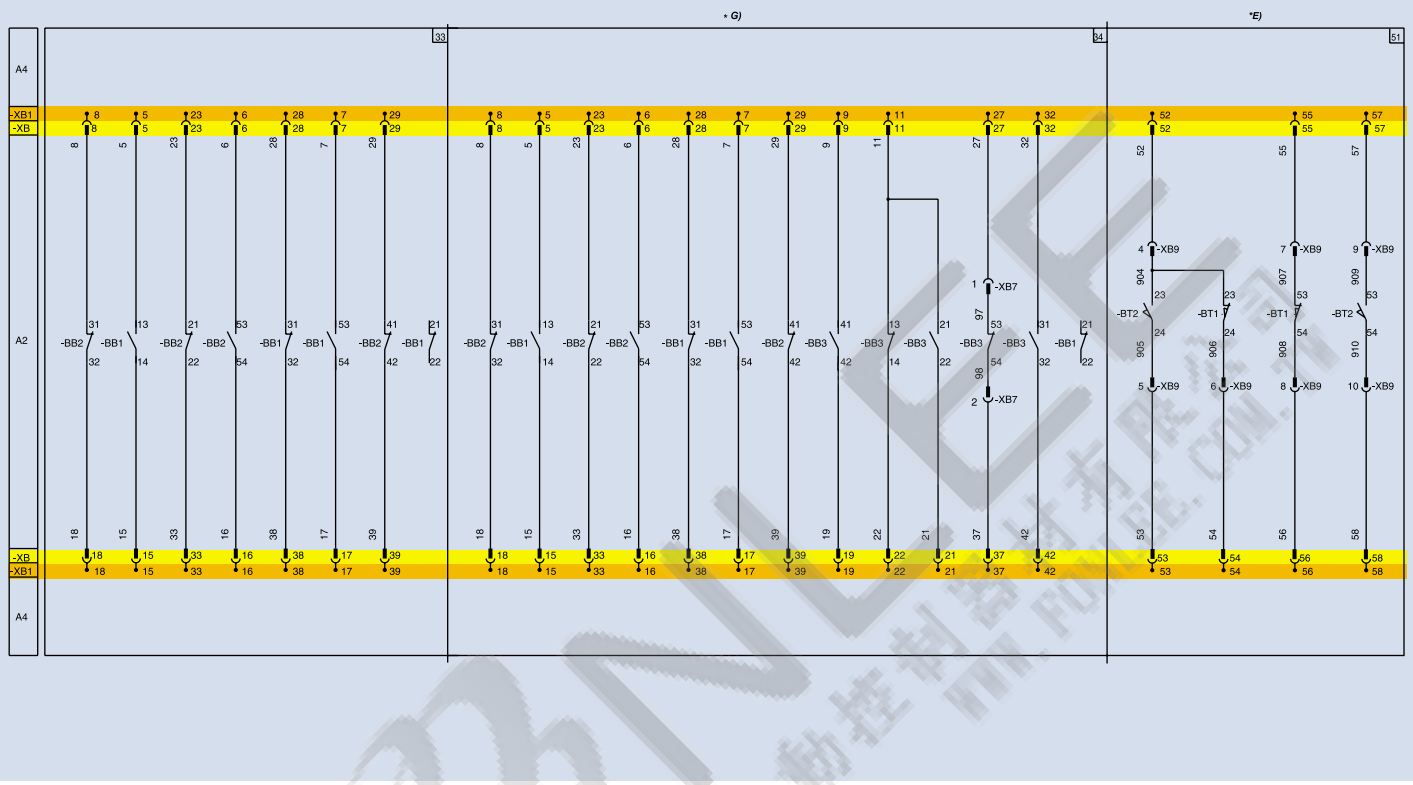
The following diagram (No. 401806) shows the circuits of the withdrawable circuit-breakers up to 24 kV type VD4/P, delivered to the customer by means of connector “-XB”.
For fixed circuit-breakers is available the specific diagram No. 401805.

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




A4
A2
A1
-XB1
-XB
24
25
30
31
32
D13 -XB3
D14 -XB3
-BB5
-BB4
-XB7
-XB8
-BT1
-BT2
-BB1
-BB2
-BB3
-Xb8
*G)

ELECTRICAL CIRCUIT DIAGRAM



Represented operational state

The diagram indicates the following conditions:
– circuit-breaker off and connected
– circuits de-energized
– closing springs discharged.

Caption

□	= Reference number of diagram figure
*	= See note indicated by the letter
A1	= Accessories of circuit-breaker operating mechanism
A2	= Circuit-breaker accessories (external to the operating mechanism)
A4	= Accessories of switchboard (indicative devices and connections for control and signalling)
-BM	= Device SOR Test unit for the supervision of shunt opening release and shunt closing release coil continuity (see note D)
-MS	= Motor for the closing springs charging (see note C)
-BB1..2-3	= Circuit-breaker auxiliary contacts
-BS1..2	= Limit switches of the spring-charging motor
-BD	= Position contact of the enclosure door
-BB4	= Passing auxiliary make contact closing momentarily when c.breaker opens.
-BT1	= Contacts signalling circuit-breaker in the connected position (see note E)
-BT2	= Contacts signalling circuit-breaker in the removed position (see note E)
-BT3	= Circuit-breaker position contact. It is open during the travel of the breaker.
-SC	= Pushbutton or contact for the circuit-breaker closing
-SO	= Pushbutton or contact for the circuit-breaker opening
-XB	= Connector for the circuit-breaker circuits

-XB 2..9 = Connectors of accessories

-XB1 = Switchboard terminal board (mounted externally to the circuit-breaker breaker)

-RL1 = Locking magnet. If de-energized it prevents the circuit-breaker closing mechanically (it is possible to limit it consumption by connecting in series a delaying pushbutton enabling the operation)

-RL2 = Locking magnet. If de-energized it prevents the circuit-breaker racking-in and racking-out mechanically (it is possible to limit its consumption by connecting in series a delaying pushbutton enabling the operation)

-MC = Shunt closing release (see note D)

-MO1 = First shunt opening release (see note D)

-MO2 = Second shunt opening release (see note D)

-MO3 = Opening solenoid for release external to the circuit-breaker

-MU = Undervoltage release (see note B)

Diagram figures decription

Fig. 1 = Spring charging-motor circuit with contact signalling closing spring charged (see note C).

Fig. 2 = Shunt closing release (antipumping is achieved m echanically).

Fig. 3 = Locking magnet. If de-energized it prevents the circuit-breaker closing mechanically (this fig. must be given when are request –BT1, -BT2). (it is possible to limit its consumption by connecting in series a delaying pushbutton enabling the operation)

Fig. 4 = Locking magnet.If de-energized it prevents the circuit-breaker closing mechanically (this fig. must be given when are not request –BT1, -BT2 and is given –BT1). (It is possible to limit its consumption by connecting in series a delaying pushbutton enabling the operation)

Fig. 5 = Instantaneous undervoltage release (see note B)

Fig. 7 = First shunt opening release circuit with possibility of permanent supervision of coil continuity (see note D).

Fig. 8 = Locking magnet. If de-energized it prevents the c. breaker racking-in and racking-out mechanically (itis possible to limit its consumption by connecting in series a delaying pushbutton enabling the operation).

Fig. 9 = Second shunt opening release circuit with possibility of permanent supervision of coil continuity (see note D).

Fig. 10 = Opening solenoid for microprocessor based release external to the c. breaker.

Fig. 24 = Contact signalling undervoltage
Fig. 25 release energized (see note B). It is possible to have open or close contact.

Fig. 30 = Passing auxiliary make contact closing momentarily when circuit-breaker opens.

Fig. 31 = Circuit-breaker available auxiliary
Fig. 32 contacts when are given the contact – BT1, -BT2.

Fig. 33 = Circuit-breaker available auxiliary
Fig. 34 contacts when are not given the contact –BT1, -BT2.

Fig. 51 = Contacts signalling circuit-breaker in the connected and isolated positions located on the circuit-breaker.

Incompatibility

The combinations of circuits given in the figures below are not possible on the same c. breaker:

3-4	**31-32-33-34**	**33-34-51**
24-25		

ELECTRICAL CIRCUIT DIAGRAM

Notes

A) The circuit-breaker is delivered complete with the accessories listed in the ABB order acknowledgement only. To draw up the order examine the apparatus catalogue.

B) The undervoltage release is available in the version suitable for circuit-breaker supply side feeding or for feeding from an independent source. Circuit-breaker may be closed only if the undervoltage release is energized (lock on closing is achieved mechanically). In case of the same voltage supply for closing and undervoltage releases and if it is required the circuit-breaker automatic closing when the auxiliary voltage supply restores, it is necessary to delay the energization of the closing release by 50 ms after the undervoltage release acceptance. This can be achieved through a circuit external to the breaker including a permanent closing contact, contact given in fig. 24 and a time-delaying relay.

C) Check the power supply available on the auxiliary circuit to verify if it is adequate to start several closing spring-charging motors simultaneously. To prevent excessive consumption the closing springs must be charged manually before energizing the auxiliary circuit.

D) The circuit for the supervision of shunt opening and closing release coil continuity shall be used for this function only. Is possible to use the SOR Test Unit device for to check the coil continuity.

E) Contacts signalling circuit-breaker in the connected and isolated positions (-BT1 and –BT2) given in fig. 51 are located on the circuit-breaker (moving part) and are available at request.

F) Fig. 3 is given when are requested –BT1 and –BT2 , fig. 4 when aren't requested –BT1 and –BT2 (in this case –BT3 is obligatory) .

G) When fig.10 is requested contact –BB3 31-32 given in fig. 32-34 is not available. When fig. 30 is requested contact –BB3 53-54 given in fig. 32-34 is not available.

Graphical symbols for electrical diagrams (IEC 60617 Standards)

Thermal effect	Mass, frame	Capacitor (general symbol)	Passing make contact closing momentarily during release
Electromagnetic effect	Conductors in shielded cable (two conductors shown)	Motor (general symbol))	Closing position contact (limit switch)
Delay	Connections 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
Operated by key	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)

FONLEE
福立自动控制设备有限公司
WWW.FONLEE.COM.TW

1VCP000001 – Rev. –, en – Technical catalogue – 2002.12 (VD4 - 31kA)

ABB Trasmissione & Distribuzione S.p.A.
Unità Operativa Sace T.M.S.
Via Friuli, 4
I-24044 Dalmine
Tel: +39 035 395111
Fax: +39 035 395874
E-mail: sacetms.tipm@it.abb.com
Internet://www.abb.com

ABB Calor Emag Mittelspannung GmbH
Oberhausener Strasse 33 Petzower Strasse 8
D-40472 Ratingen D-14542 Glindow
Phone: +49(0)2102/12-1230, Fax: +49(0)2102/12-1916
E-mail: calor.info@de.abb.com
Internet:http://www.abb.de/calor