

PRODUCT MANUAL

VD4

Medium voltage circuit-breakers

12...17.5 kV - 630...4000 A - 25...40 kA



- Global proven reputation
- Accountable solution for safety and reliability
- Wide range offering, easy business and convenient installation

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I. For your safety!

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



Responsible behaviour safeguards your own and others' safety!

For any requests, please contact the ABB Assistance Service.

II. Introduction

This publication contains the information needed to install medium voltage VD4 circuit breakers and put them into service.

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

Like all the apparatus we manufacture, the VD4 circuit breakers are designed for different installation configurations.

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

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


Apart from this manual, it is therefore always The 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 necessary to consult the latest technical documentation (electric circuit and wiring diagrams, assembly and installation drawings, any protection coordination studies, etc.), especially regarding any variants requested in relation to the standardised configurations.

Only use original spare parts for maintenance operations.

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

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

III. Environmental protection programme

The 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.

1. Packing and transport

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

2. Checking on receipt



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

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

Also make sure that all the materials described in the shipping note are included in the supply. Should any damage or irregularity be noted in the supply on unpacking, notify ABB (directly or through the agent or supplier) as soon as possible and in any case within five days of receipt.

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

The accompanying documents inserted in the shipping packing are:

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

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

- order confirmation
- any drawings or documents referring to special configurations/conditions

3. Storage

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

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

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

Insert packets of special hygroscopic substances inside the packing, with at least one standard packet for piece of apparatus.

Should the original packing not be available and immediate installation is not possible, store in a covered, well-ventilated, dry, dust-free, noncorrosive ambient, away from any easily flammable materials and at a temperature between $-25\text{ }^{\circ}\text{C}$ and $+45\text{ }^{\circ}\text{C}$.

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

4. Handling

02a Lifting support

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

To lift and handle the circuit breaker, proceed as follows (fig. 2):

- Use a special lifting tool (1) (not supplied) fitted with ropes with safety hooks (2)
- Insert the hooks (2) in the supports (3) fixed to the frame of the circuit breaker and lift. Put the hooks (2) into the support holes (3) according to the type of apparatus (see table)
- On completion of the operation (and in any case before putting into service) unhook the lifting tool (1) and dismantle the supports (3) from the frame

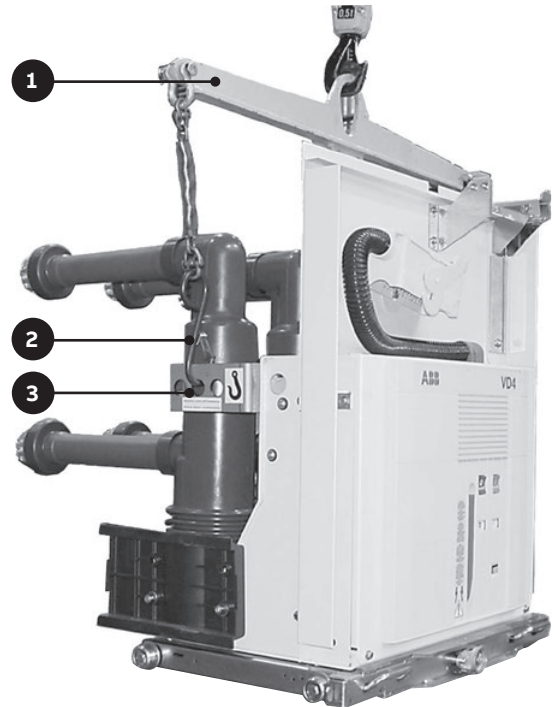
During handling, take great care not to stress the insulating parts and the terminals of the circuit breaker.

⚠ The apparatus must not be handled by putting lifting devices directly under the apparatus itself.

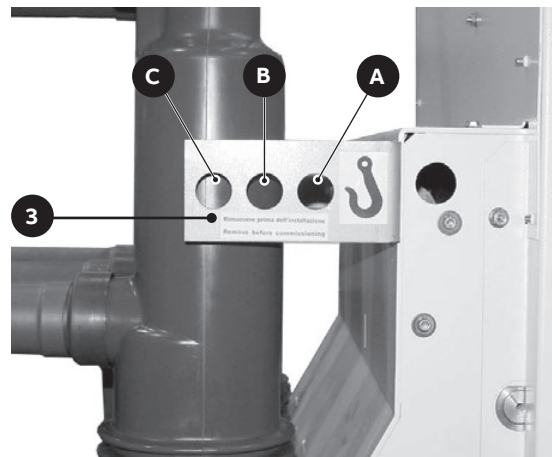
Should it be necessary to use this technique, put the circuit breaker onto a pallet or a sturdy supporting surface (see fig. 3).

In any case, it is always advisable to carry out lifting using the supports (3).

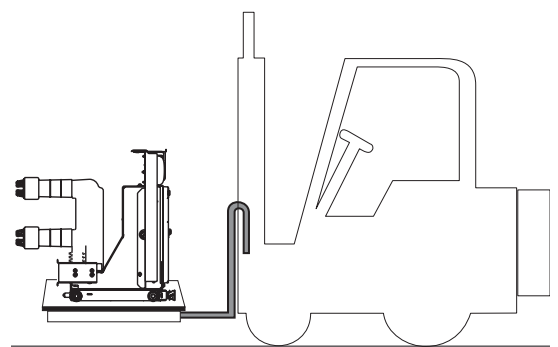
| Version | Pole centre distance | Rated current | Hole |
|--------------|----------------------|---------------------|------|
| Fixed | 150-210 mm | up to 1250 A | A |
| Fixed | 275 mm | from 1600 to 3150 A | A |
| Fixed | 210 mm | from 1600 to 2000 A | A |
| Fixed | 210-275 mm | up to 4000 A | C |
| Withdrawable | 150 mm | up to 1250 A | A |
| Withdrawable | 210 mm | from 1600 to 2500 A | B |
| Withdrawable | 275 mm | up to 1250 A | B |
| Withdrawable | 275 mm | from 1600 to 3150 A | C |
| Withdrawable | 210 mm | up to 1250 A | C |
| Withdrawable | 210-275 mm | up to 4000 A | C |



02



02a



03

5. Description

5.1. General

The VD4 are vacuum circuit breaker for indoor installation.

For the electrical performances, please refer to the corresponding technical catalogue code 1YHA000263.

For special installation requirements, please contact ABB.

The following versions are available:

- Fixed
- Withdrawable for UniGear ZS1 switchgear and PowerCube modules

5.2. Reference Standards

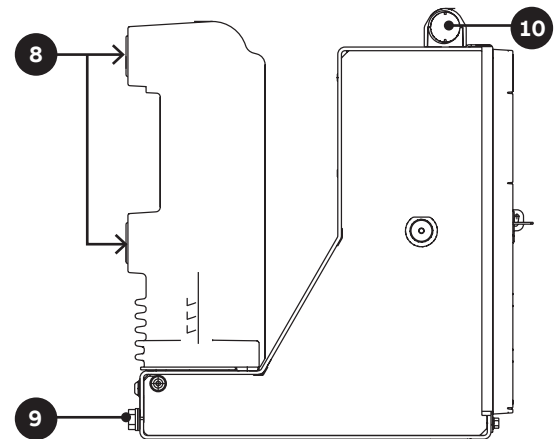
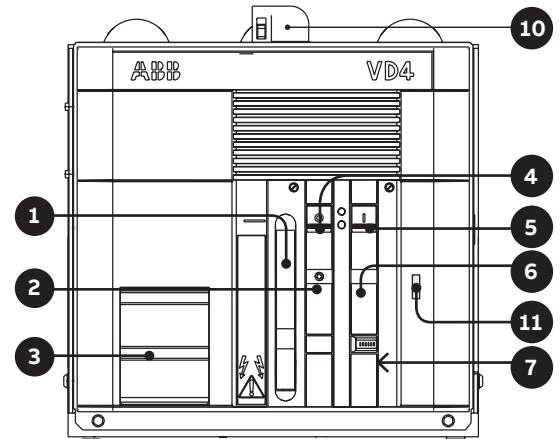
The VD4 circuit breakers conform to the IEC 62271-100, CEI - VDE - BS Standards are equivalent to IEC Standards due to harmonization with IEC.

5.3. Fixed circuit breakers

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

For the electrical connections of the circuit breaker auxiliary circuits, the terminal box is available.

The earthing screw is placed in the rear part of the circuit breaker. For further details please see the caption to figure 4.



—
04

- | | |
|----|--|
| 1 | Lever for manual closing spring charging |
| 2 | Signalling device for circuit breaker open/closed |
| 3 | Rating plate |
| 4 | Opening pushbutton |
| 5 | Closing pushbutton |
| 6 | Signalling device for closing spring charged/discharged |
| 7 | Operation counter |
| 8 | Terminals |
| 9 | Earthing screw |
| 10 | Cabling connection |
| 11 | Mechanical override of the undervoltage release (on request) |

5. Description

05 Fixed VD4 circuit-breaker



05

| Circuit-breaker | | VD4 12 | | | | | | | | |
|--|------------------------------|----------------------|------|--------|------|------|--------|--------|--------|-----|
| Standards | IEC 62271-100 | • | | | | | | | | |
| Rated voltage | Ur [kV] | 12 | | | | | | | | |
| Rated insulation voltage | Us [kV] | 12 | | | | | | | | |
| Withstand voltage at 50 Hz | Ud (1 min) [kV] | 28 | | | | | | | | |
| Impulse withstand voltage | Up [kV] | 75 | | | | | | | | |
| Rated frequency | fr [Hz] | 50-60 | | | | | | | | |
| Rated normal current (40 °C) | Ir [A] | 630 | 630 | 630 | 1250 | 1250 | 1250 | 1250 | 1250 | |
| Rated breaking capacity (rated short-circuit breaking current symmetrical) | Isc [kA] | 25 | 25 | 25 | 25 | 25 | 25 | - | - | |
| | | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 | - | - | |
| Rated short-time withstand current (3 s) | Ik [kA] | - | - | - | - | - | - | 40 | 40 | |
| | | 25 | 25 | 25 | 25 | 25 | 25 | - | - | |
| Making capacity | Ip [kA] | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 | - | - | |
| | | - | - | - | - | - | - | 40 | 40 | |
| Operation sequence | [O - 0.3 s - CO - 15 s - CO] | 63 | 63 | 63 | 63 | 63 | 63 | - | - | |
| | | 80 | 80 | 80 | 80 | 80 | 80 | - | - | |
| Opening time | [ms] | - | - | - | - | - | - | 100 | 100 | |
| | | • | • | • | • | • | • | • | • | |
| Arcing time | [ms] | 33...60 | | | | | | | | |
| Total breaking time | [ms] | 10...15 | | | | | | | | |
| Closing time | [ms] | 43...75 | | | | | | | | |
| Maximum overall dimensions | | H [mm] | 461 | 461 | 461 | 461 | 461 | 461 | 589 | 589 |
| | | W [mm] | 450 | 570 | 700 | 450 | 570 | 700 | 570 | 700 |
| | | D [mm] | 424 | 424 | 424 | 424 | 424 | 424 | 424 | 424 |
| | | Pole distance P [mm] | 150 | 210 | 275 | 150 | 210 | 275 | 210 | 275 |
| Weight | [kg] | 73 | 75 | 79 | 73 | 75 | 79 | 84 | 84 | |
| Standardised table of dimensions | TN | 7405 | 7406 | - | 7405 | 7406 | - | - | - | |
| | 1 VCD | - | - | 000051 | - | - | 000051 | 003282 | 003285 | |
| Operating temperature | [°C] | -5...+40 | | | | | | | | |
| Tropicalization | IEC: 60068-2-30, 60721-2-1 | • | | | | | | | | |
| Electromagnetic compatibility | IEC: 62271-1 | • | | | | | | | | |

1) with forced ventilation.

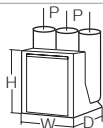
5. Description

05 Fixed VD4 circuit-breaker



05

| Circuit-breaker | | VD4 17 | | | | | | | | |
|--|------------------------------|-------------------|------|--------|------|------|--------|--------|--------|--|
| Standards | IEC 62271-100 | • | | | | | | | | |
| Rated voltage | Ur [kV] | 17.5 | | | | | | | | |
| Rated insulation voltage | Us [kV] | 17.5 | | | | | | | | |
| Withstand voltage at 50 Hz | Ud (1 min) [kV] | 38 | | | | | | | | |
| Impulse withstand voltage | Up [kV] | 95 | | | | | | | | |
| Rated frequency | fr [Hz] | 50-60 | | | | | | | | |
| Rated normal current (40 °C) | Ir [A] | 630 | 630 | 630 | 1250 | 1250 | 1250 | 1250 | 1250 | |
| Rated breaking capacity (rated short-circuit breaking current symmetrical) | Isc [kA] | 25 | 25 | 25 | 25 | 25 | 25 | - | - | |
| Rated short-time withstand current (3 s) | Ik [kA] | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 | - | - | |
| | | - | - | - | - | - | - | 40 | 40 | |
| | | 25 | 25 | 25 | 25 | 25 | 25 | - | - | |
| | | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 | - | - | |
| | | - | - | - | - | - | - | 40 | 40 | |
| | | 63 | 63 | 63 | 63 | 63 | 63 | - | - | |
| Making capacity | Ip [kA] | 80 | 80 | 80 | 80 | 80 | 80 | - | - | |
| | | - | - | - | - | - | - | 100 | 100 | |
| Operation sequence | [O - 0.3 s - CO - 15 s - CO] | • • • • • • • • • | | | | | | | | |
| Opening time | [ms] | 33...60 | | | | | | | | |
| Arcing time | [ms] | 10...15 | | | | | | | | |
| Total breaking time | [ms] | 43...75 | | | | | | | | |
| Closing time | [ms] | 30...60 | | | | | | | | |
| Maximum overall dimensions | H [mm] | 461 | 461 | 461 | 461 | 461 | 461 | 589 | 589 | |
| | W [mm] | 450 | 570 | 700 | 450 | 570 | 700 | 570 | 700 | |
| | D [mm] | 424 | 424 | 424 | 424 | 424 | 424 | 424 | 424 | |
| | Pole distance P [mm] | 150 | 210 | 275 | 150 | 210 | 275 | 210 | 275 | |
| Weight | [kg] | 73 | 75 | 79 | 73 | 75 | 79 | 84 | 84 | |
| Standardised table of dimensions | TN | 7405 | 7406 | - | 7405 | 7406 | - | - | - | |
| | 1 VCD | - | - | 000051 | - | - | 000051 | 003282 | 003285 | |
| Operating temperature | [°C] | -5...+40 | | | | | | | | |
| Tropicalization | IEC: 60068-2-30, 60721-2-1 | • | | | | | | | | |
| Electromagnetic compatibility | IEC: 62271-1 | • | | | | | | | | |



1) with forced ventilation.

5. Description

06 Withdrawable version circuit-breakers for UniGear ZS1 switchgear



06

| Circuit-breaker | | VD4/P 12 | | | | | |
|--|------------------------------|----------|------|--------|--------|------|------|
| Standards | IEC 62271-100 | • | | | | | |
| Rated voltage | Ur [kV] | 12 | | | | | |
| Rated insulation voltage | Us [kV] | 12 | | | | | |
| Withstand voltage at 50 Hz | Ud (1 min) [kV] | 28 | | | | | |
| Impulse withstand voltage | Up [kV] | 75 | | | | | |
| Rated frequency | fr [Hz] | 50-60 | | | | | |
| Rated normal current (40 °C) | Ir [A] | 630 | 1250 | 1250 | 1250 | 1600 | 1600 |
| Rated breaking capacity (rated short-circuit breaking current symmetrical) | Isc [kA] | 25 | 25 | - | - | 25 | 25 |
| | | 31.5 | 31.5 | - | - | 31.5 | 31.5 |
| Rated short-time withstand current (3 s) | Ik [kA] | - | - | 40 | 40 | - | - |
| | | 25 | 25 | - | - | 25 | 25 |
| | | 31.5 | 31.5 | - | - | 31.5 | 31.5 |
| Making capacity | Ip [kA] | - | - | 40 | 40 | - | - |
| | | 63 | 63 | - | - | 63 | 63 |
| | | 80 | 80 | - | - | 80 | 80 |
| Operation sequence | [O - 0.3 s - CO - 15 s - CO] | • | • | • | • | • | • |
| | | • | • | • | • | • | • |
| Opening time | [ms] | 33...60 | | | | | |
| Arcing time | [ms] | 10...15 | | | | | |
| Total breaking time | [ms] | 43...75 | | | | | |
| Closing time | [ms] | 30...60 | | | | | |
| Maximum overall dimensions | H [mm] | 628 | 628 | 691 | 691 | 691 | 691 |
| | W [mm] | 503 | 503 | 653 | 853 | 653 | 853 |
| | D [mm] | 662 | 662 | 641 | 642 | 642 | 642 |
| | Pole distance P [mm] | 150 | 150 | 210 | 210 | 210 | 275 |
| Weight | [kg] | 116 | 116 | 174 | 180 | 160 | 166 |
| Standardised table of dimensions | TN | 7412 | 7412 | - | - | 7415 | 7416 |
| | 1 VCD | - | - | 003284 | 003286 | - | - |
| Operating temperature | [°C] | -5...+40 | | | | | |
| Tropicalization | IEC: 60068-2-30, 60721-2-1 | • | | | | | |
| Electromagnetic compatibility | IEC: 62271-1 | • | | | | | |

1) with forced ventilation.

| | | | | | | |
|----------|--------|------|------|------|--------|--------------------|
| • | | | | | | |
| 12 | | | | | | |
| 12 | | | | | | |
| 28 | | | | | | |
| 75 | | | | | | |
| 50-60 | | | | | | |
| 1600 | 1600 | 2000 | 2000 | 2500 | 3150 | 4000 ¹⁾ |
| - | - | 25 | 25 | 25 | 25 | 25 |
| - | - | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 |
| 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| - | - | 25 | 25 | 25 | 25 | 25 |
| - | - | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 |
| 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| - | - | 63 | 63 | 63 | 63 | 63 |
| - | - | 80 | 80 | 80 | 80 | 80 |
| 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| • | • | • | • | • | • | • |
| 33...60 | | | | | | |
| 10...15 | | | | | | |
| 43...75 | | | | | | |
| 30...60 | | | | | | |
| 691 | 691 | 691 | 691 | 691 | 730 | 730 |
| 653 | 853 | 653 | 853 | 853 | 853 | 853 |
| 641 | 642 | 642 | 642 | 640 | 640 | 640 |
| 210 | 275 | 210 | 275 | 275 | 275 | 275 |
| 174 | 176 | 160 | 166 | 186 | 221 | 221 |
| - | - | 7415 | 7416 | 7417 | - | - |
| 003284 | 003286 | - | - | - | 000153 | 000153 |
| -5...+40 | | | | | | |
| • | | | | | | |
| • | | | | | | |

5. Description

06 Withdrawable version circuit-breakers for UniGear ZS1 switchgear



06

| Circuit-breaker | | VD4/P 17 | | | | | |
|--|------------------------------|----------|------|--------|--------|------|------|
| Standards | IEC 62271-100 | • | | | | | |
| Rated voltage | Ur [kV] | 17.5 | | | | | |
| Rated insulation voltage | Us [kV] | 17.5 | | | | | |
| Withstand voltage at 50 Hz | Ud (1 min) [kV] | 38 | | | | | |
| Impulse withstand voltage | Up [kV] | 95 | | | | | |
| Rated frequency | fr [Hz] | 50-60 | | | | | |
| Rated normal current (40 °C) | Ir [A] | 630 | 1250 | 1250 | 1250 | 1600 | 1600 |
| Rated breaking capacity (rated short-circuit breaking current symmetrical) | Isc [kA] | 25 | 25 | - | - | 25 | 25 |
| | | 31.5 | 31.5 | - | - | 31.5 | 31.5 |
| Rated short-time withstand current (3 s) | Ik [kA] | - | - | 40 | 40 | - | - |
| | | 25 | 25 | - | - | 25 | 25 |
| Making capacity | Ip [kA] | 31.5 | 31.5 | - | - | 31.5 | 31.5 |
| | | - | - | 40 | 40 | - | - |
| Operation sequence | [O - 0.3 s - CO - 15 s - CO] | 63 | 63 | - | - | 63 | 63 |
| | | 80 | 80 | - | - | 80 | 80 |
| Operation sequence | [O - 0.3 s - CO - 15 s - CO] | - | - | 100 | 100 | - | - |
| | | • | • | • | • | • | • |
| Opening time | [ms] | 33...60 | | | | | |
| Arcing time | [ms] | 10...15 | | | | | |
| Total breaking time | [ms] | 43...75 | | | | | |
| Closing time | [ms] | 30...60 | | | | | |
| Maximum overall dimensions | H [mm] | 632 | 632 | 691 | 691 | 691 | 691 |
| | W [mm] | 503 | 503 | 653 | 853 | 653 | 853 |
| | D [mm] | 664 | 664 | 641 | 642 | 642 | 642 |
| | Pole distance P [mm] | 150 | 150 | 210 | 275 | 210 | 275 |
| Weight | [kg] | 116 | 116 | 174 | 176 | 160 | 166 |
| Standardised table of dimensions | TN | 7412 | 7412 | - | - | 7415 | 7416 |
| | 1 VCD | - | - | 003284 | 003286 | - | - |
| Operating temperature | [°C] | -5...+40 | | | | | |
| Tropicalization | IEC: 60068-2-30, 60721-2-1 | • | | | | | |
| Electromagnetic compatibility | IEC: 62271-1 | • | | | | | |

1) with forced ventilation.

| | | | | | | |
|----------|--------|------|------|------|--------|--------------------|
| • | | | | | | |
| 17.5 | | | | | | |
| 17.5 | | | | | | |
| 38 | | | | | | |
| 95 | | | | | | |
| 50-60 | | | | | | |
| 1600 | 1600 | 2000 | 2000 | 2500 | 3150 | 4000 ¹⁾ |
| - | - | 25 | 25 | 25 | 25 | 25 |
| - | - | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 |
| 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| - | - | 25 | 25 | 25 | 25 | 25 |
| - | - | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 |
| 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| - | - | 63 | 63 | 63 | 63 | 63 |
| - | - | 80 | 80 | 80 | 80 | 80 |
| 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| • | • | • | • | • | • | • |
| 33...60 | | | | | | |
| 10...15 | | | | | | |
| 43...75 | | | | | | |
| 30...60 | | | | | | |
| 691 | 691 | 691 | 691 | 691 | 730 | 730 |
| 653 | 853 | 653 | 853 | 853 | 853 | 853 |
| 641 | 642 | 642 | 642 | 640 | 640 | 640 |
| 210 | 275 | 210 | 275 | 275 | 275 | 275 |
| 174 | 176 | 160 | 166 | 186 | 221 | 221 |
| - | - | 7415 | 7416 | 7417 | - | - |
| 003284 | 003286 | - | - | - | 000153 | 000153 |
| -5...+40 | | | | | | |
| • | | | | | | |
| • | | | | | | |

5. Description

07 Withdrawable version circuit-breakers for PowerCube modules



07

| Circuit-breaker | VD4/P 12 | | VD4/W 12 | | |
|--|------------------------------|----------|----------|------|------|
| | PowerCube module | PB1 | PB2 | | |
| Standards | IEC 62271-100 | • | • | | |
| Rated voltage | Ur [kV] | 12 | 12 | | |
| Rated insulation voltage | Us [kV] | 12 | 12 | | |
| Withstand voltage at 50 Hz | Ud (1 min) [kV] | 28 | 28 | | |
| Impulse withstand voltage | Up [kV] | 75 | 75 | | |
| Rated frequency | fr [Hz] | 50-60 | 50-60 | | |
| Rated normal current (40 °C) | Ir [A] | 630 | 1250 | 630 | 1250 |
| Rated breaking capacity (rated short-circuit breaking current symmetrical) | Isc [kA] | 25 | 25 | 25 | 25 |
| | | 31.5 | 31.5 | 31.5 | 31.5 |
| Rated short-time withstand current (3 s) | Ik [kA] | 25 | 25 | 25 | 25 |
| | | 31.5 | 31.5 | 31.5 | 31.5 |
| Making capacity | Ip [kA] | 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 | | |
| Arcing time | [ms] | 10...15 | 10...15 | | |
| Total breaking time | [ms] | 43...75 | 43...75 | | |
| Closing time | [ms] | 30...60 | 30...60 | | |
| Maximum overall dimensions | H [mm] | 628 | 628 | 691 | 691 |
| | W [mm] | 503 | 503 | 653 | 653 |
| | D [mm] | 662 | 662 | 642 | 642 |
| | Pole distance P [mm] | 150 | 150 | 210 | 210 |
| Weight | [kg] | 116 | 116 | 135 | 135 |
| Standardised table of dimensions | TN | 7412 | 7412 | 7420 | 7420 |
| | 1 VCD | - | - | - | - |
| Operating temperature | [°C] | -5...+40 | -5...+40 | | |
| Tropicalization | IEC: 60068-2-30, 60721-2-1 | • | • | | |
| Electromagnetic compatibility | IEC: 62271-1 | • | • | | |

1) with forced ventilation.

| VD4/P 12 | | | | VD4/W12 | | |
|----------|------|--------|------|----------|----------|--------------------|
| PB2 | | | | PB3 | PB3 | |
| • | | | | • | • | |
| 12 | | | | 12 | 12 | |
| 12 | | | | 12 | 12 | |
| 28 | | | | 28 | 28 | |
| 75 | | | | 75 | 75 | |
| 50-60 | | | | 50-60 | 50-60 | |
| 1250 | 1600 | 1600 | 2000 | 2500 | 3150 | 4000 ¹⁾ |
| - | 25 | - | 25 | 25 | 25 | 25 |
| - | 31.5 | - | 31.5 | 31.5 | 31.5 | 31.5 |
| 40 | - | 40 | 40 | 40 | 40 | 40 |
| - | 25 | - | 25 | 25 | 25 | 25 |
| - | 31.5 | - | 31.5 | 31.5 | 31.5 | 31.5 |
| 40 | - | 40 | 40 | 40 | 40 | 40 |
| - | 63 | - | 63 | 63 | 63 | 63 |
| - | 80 | - | 80 | 80 | 80 | 80 |
| 100 | - | 100 | 100 | 100 | 100 | 100 |
| • | | | | • | • | • |
| 33...60 | | | | 33...60 | 33...60 | |
| 10...15 | | | | 10...15 | 10...15 | |
| 43...75 | | | | 43...75 | 43...75 | |
| 30...60 | | | | 30...60 | 30...60 | |
| 691 | 691 | 691 | 690 | 691 | 730 | 730 |
| 653 | 653 | 653 | 653 | 853 | 853 | 853 |
| 641 | 642 | 641 | 642 | 640 | 640 | 640 |
| 210 | 210 | 210 | 210 | 275 | 275 | 275 |
| 174 | 160 | 174 | 160 | 186 | 221 | 221 |
| - | 7415 | - | 7415 | 7417 | - | - |
| 003284 | - | 003284 | - | - | 000152 | 000152 |
| -5...+40 | | | | -5...+40 | -5...+40 | |
| • | | | | • | • | |
| • | | | | • | • | |

5. Description

07 Withdrawable version circuit-breakers for PowerCube modules



07

| Circuit-breaker | VD4/P 17 | | VD4/W 17 | | | |
|--|------------------------------|----------------------|----------|----------|----------|----------|
| | PowerCube module | PB1 | PB1 | PB2 | | |
| Standards | IEC 62271-100 | • | • | • | | |
| Rated voltage | Ur [kV] | 17.5 | 17.5 | 17.5 | | |
| Rated insulation voltage | Us [kV] | 17.5 | 17.5 | 17.5 | | |
| Withstand voltage at 50 Hz | Ud (1 min) [kV] | 38 | 38 | 38 | | |
| Impulse withstand voltage | Up [kV] | 95 | 95 | 95 | | |
| Rated frequency | fr [Hz] | 50-60 | 50-60 | 50-60 | | |
| Rated normal current (40 °C) | Ir [A] | 630 | 1250 | 630 | 1250 | |
| Rated breaking capacity (rated short-circuit breaking current symmetrical) | Isc [kA] | 25 | 25 | 25 | 25 | |
| | | 31.5 | 31.5 | 31.5 | 31.5 | |
| | | - | - | - | - | |
| Rated short-time withstand current (3 s) | I _k [kA] | 25 | 25 | 25 | 25 | |
| | | 31.5 | 31.5 | 31.5 | 31.5 | |
| | | - | - | - | - | |
| | | 63 | 63 | 63 | 63 | |
| Making capacity | I _p [kA] | 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 | |
| Arcing time | [ms] | 10...15 | 10...15 | 10...15 | 10...15 | |
| Total breaking time | [ms] | 43...75 | 43...75 | 43...75 | 43...75 | |
| Closing time | [ms] | 30...60 | 30...60 | 30...60 | 30...60 | |
| Maximum overall dimensions | | H [mm] | 628 | 628 | 691 | 691 |
| | | W [mm] | 503 | 503 | 653 | 653 |
| | | D [mm] | 662 | 662 | 642 | 642 |
| | | Pole distance P [mm] | 150 | 150 | 210 | 210 |
| Weight | [kg] | | 116 | 116 | 135 | 135 |
| Standardised table of dimensions | TN | 7412 | 7412 | 7420 | 7420 | 7420 |
| | 1 VCD | - | - | - | - | - |
| Operating temperature | [°C] | | -5...+40 | -5...+40 | -5...+40 | -5...+40 |
| Tropicalization | IEC: 60068-2-30, 60721-2-1 | • | • | • | • | |
| Electromagnetic compatibility | IEC: 62271-1 | • | • | • | • | |

1) with forced ventilation.

| VD4/P 17 | | | | VD4/W17 | | |
|----------|------|--------|------|----------|----------|--------------------|
| PB2 | | | | PB3 | PB3 | |
| • | | | | • | • | |
| 17.5 | | | | 17.5 | 17.5 | |
| 17.5 | | | | 17.5 | 17.5 | |
| 38 | | | | 38 | 38 | |
| 95 | | | | 95 | 95 | |
| 50-60 | | | | 50-60 | 50-60 | |
| 1250 | 1600 | 1600 | 2000 | 2500 | 3150 | 4000 ¹⁾ |
| - | 25 | - | 25 | 25 | 25 | 25 |
| - | 31.5 | - | 31.5 | 31.5 | 31.5 | 31.5 |
| 40 | - | 40 | 40 | 40 | 40 | 40 |
| - | 25 | - | 25 | 25 | 25 | 25 |
| - | 31.5 | - | 31.5 | 31.5 | 31.5 | 31.5 |
| 40 | - | 40 | 40 | 40 | 40 | 40 |
| - | 63 | - | 63 | 63 | 63 | 63 |
| - | 80 | - | 80 | 80 | 80 | 80 |
| 100 | - | 100 | 100 | 100 | 100 | 100 |
| • | | | | • | • | • |
| 33...60 | | | | 33...60 | 33...60 | |
| 10...15 | | | | 10...15 | 10...15 | |
| 43...75 | | | | 43...75 | 43...75 | |
| 30...60 | | | | 30...60 | 30...60 | |
| 691 | 691 | 691 | 690 | 691 | 730 | 730 |
| 653 | 653 | 653 | 653 | 853 | 853 | 853 |
| 641 | 642 | 641 | 642 | 640 | 640 | 640 |
| 210 | 210 | 210 | 210 | 275 | 275 | 275 |
| 174 | 160 | 174 | 160 | 186 | 221 | 221 |
| - | 7415 | - | 7415 | 7417 | - | - |
| 003284 | - | 003284 | - | - | 000152 | 000152 |
| -5...+40 | | | | -5...+40 | -5...+40 | |
| • | | | | • | • | |
| • | | | | • | • | |

5. Description



5.4. Characteristics of the electrical accessories

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

1 Shunt opening release (-MO1)

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

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

This release can be controlled by the following devices: coil continuity control (CCC), opening circuit supervision (TCS)(*) or the ABB STU functionality control device (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 (-MO2)

Similarly to shunt opening release -MO1, this allows the opening command of the apparatus to be transmitted by remote control. It can be powered by the same circuit as main shunt opening release -MO1 or by a circuit that is completely separate from release -MO1.

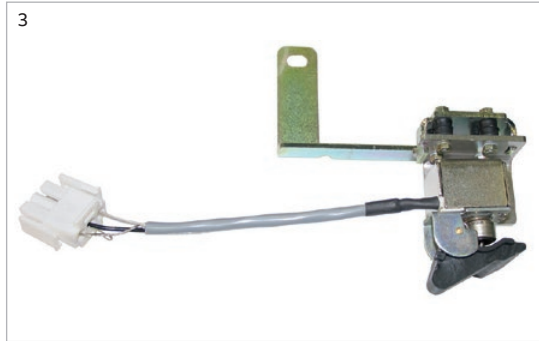
This release is suitable for both instantaneous and permanent duty. However, an auxiliary contact de-energizes it after the circuit-breaker has opened.

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).

-MO2 has the same electrical and operating characteristics as release -MO1.

(*) The minimum current that the relay with TCS function (used for monitoring coil continuity) detects as a condition denoting that the trip circuit is operating correctly (specified for each relay in the relative manual), must be sensibly higher than the current consumption of the actual coil (~1.5 mA). If this fails to occur, always add, in parallel to the TCS, a circuit able to absorb sufficient current to compensate the gap while preventing the total current in the TCS circuit from rising above the maximum threshold (Itcs < 10 mA for High Voltage coils - from 110 V to 250 V, and Itcs < 50 mA for Low Voltage coils from 24 V to 60 V). A simple resistor can be sized for the purpose, depending on the parameters of the TCS and the auxiliary voltage range used.



3 Opening solenoid (-MO3)

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

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

It is usually cooperate with self-supplied overcurrent release, i.e. REJ 603 release manufactured by ABB.

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

4 Shunt closing release (-MC)

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 -MC and under-voltage release -MU 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 (Itcs < 10 mA for High Voltage coils - from 110 V to 250 V, and Itcs < 50 mA for Low Voltage coils from 24 V to 60 V). A simple resistor can be sized for the purpose, depending on the parameters of the TCS and the auxiliary voltage range used.

5. Description



5 Undervoltage release (-MU)

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

It can be used for remote release (by means of a pushbutton of the normally closed type), for locking on automatic closing/opening in the absence of voltage in the auxiliary circuits. Supplied by means of the secondary output of a voltage transformer, it provides locking upon automatic closing/opening in the absence of voltage in the Medium Voltage main circuit.

If there is the same supply voltage for shunt closing release -MC and under-voltage release -MU 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 -KT 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 couldn't close: $\leq 35\% U_n$ |
| | - circuit-breaker opening: 35-70% U_n - circuit-breaker closing: 85-110% U_n |
| Inrush power (Ps) | 150 W/VA |
| Continuous power consumption (Pc) | 3 W (DC); 3 VA (AC) |
| Insulation voltage | 2000 V 50 Hz (for 1 min) |



5a Electronic time delay device (-KT)

The electronic time delay device must be mounted externally in relation to the circuit-breaker. It allows release trip delay 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 for d.c.

Rated voltage of the undervoltage release must be within the selected range of working of the time-delay device.

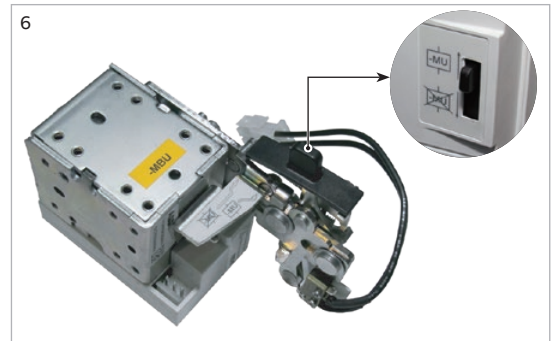
Characteristics of the time-delay device

| | |
|----|--|
| Un | 24...30 - 48 - 60 - 110...127 - 220...250 V- |
|----|--|

| | |
|----|---|
| Un | 48 - 60 - 110...127 - 220...240 - V~ 50/60 Hz |
|----|---|

Adjustable opening time (release + time delay device):

0.5-1-1.5-2-3 sec



6 Undervoltage release mechanical override

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

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

5. Description



7 Auxiliary contacts of the circuit-breaker (-BB0)
Electrical signalling of circuit-breaker open/closed is provided with a standard set of 10 auxiliary contacts.

Note: This can be provided with a maximum set of 14 if there is a clear indication in the order form.

Auxiliary contacts –BB0 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-21 A DC-22 A DC-23A AC-21 A)
- RoHS Directive

| General characteristics | |
|--------------------------------|---|
| Insulation voltage to standard | 660 V AC |
| VDE 0110, Group C | 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 mm ² |

| Electrical characteristics (according to IEC 60947) | | |
|---|-------------|---|
| Rated current Un | | Breaking capacity (10000 interruptions) |
| 220 V AC | cosφ = 0.70 | 20 A |
| 220 V DC | 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 current Un | Breaking capacity |
| 24 Vcc 20 ms | 18.8 mA |
| 60 Vcc 20 ms | 7.4 mA |
| 110 Vcc 20 ms | 4.2 mA |
| 250 Vcc 20 ms | 1.8 mA |

11



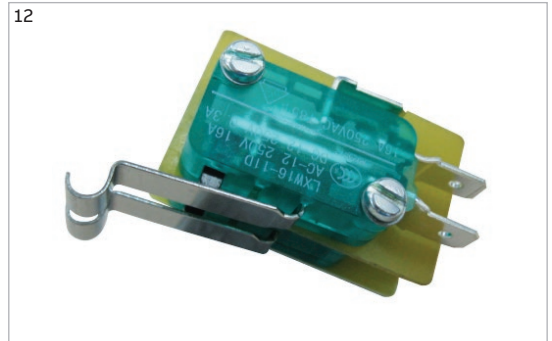
11 Motor operator (-MS)

This carries out automatic charging of the circuit-breaker operating mechanism closing spring. After circuit-breaker closing, the geared motor immediately recharges the closing springs.

In the case of a power cut or during maintenance work, the closing spring can be charged manually in any case (by means of the special crank handle incorporated in the operating mechanism).

| Characteristics | |
|----------------------|--|
| Un | 24...30 - 48...60 - 110...130 - 220...250 V- |
| Un | 100...130 - 220...250 V~ 50/60 Hz |
| Operating limits | 85 ... 110% Un |
| | ≤ 40 kA |
| Power on inrush (Ps) | DC = 600 W; AC = 600 VA |
| Rated power (Pn) | DC = 200 W; AC = 200 VA |
| Charging time | 0.2 s |
| Charging time | 6-7 s |
| Insulating voltage | 2000 V 50 Hz (for 1 min) |

12



12 Contact for signalling closing spring charged/discharged (-BS2)

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

When the spring discharged, one micro-switch is normally open while the other one is normally closed.

5. Description



Protections and locks

Various mechanical and electromechanical locking and protection devices are available.

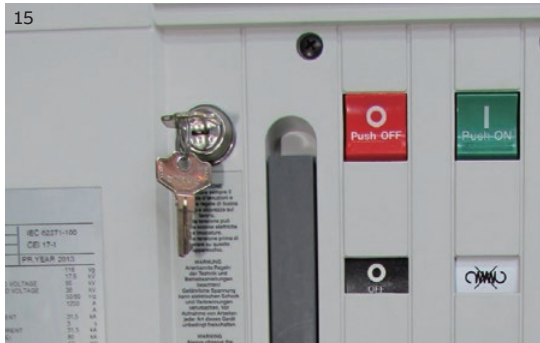
13 Opening and closing pushbutton protection

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



14 Opening and closing pushbutton padlock

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



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).

To activate the lock, keep the opening pushbutton pressed down, turn the key and remove it.

With the key removed, the opening pushbutton automatically remains in the pressed position preventing local manual closing and remote electrical closing.



16 Locking magnet on the operating mechanism (-RL1)

Only allows activation of the command with the electromagnet supplied.

The locking electromagnet in the operating mechanism has the same electrical characteristics as shunt closing release -MC.

5. Description

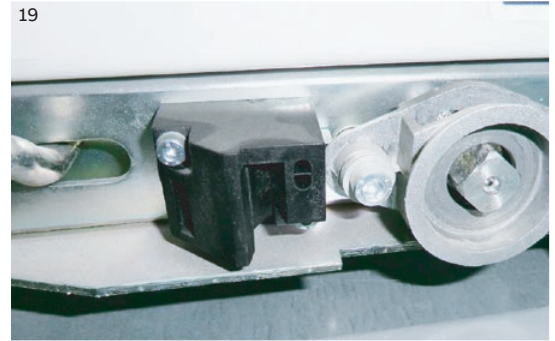


17 Locking magnet on the truck (-RL2)

Compulsory accessory for the withdrawable versions for UniGear ZS1 switchgear and PowerCube modules, to prevent circuit-breaker racking into the switchgear with the auxiliary circuit plug disconnected.

The plug also makes the anti-insertion lock for a different rated current. Special striker pins do not allow insertion of the plug in the socket if the rated current of the circuit-breaker is lower than the rated current of the panel.

| 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 |
| Rated power (Pn) | DC = 250 W; AC = 250 VA |
| Continuous power (Pc) | DC = 5 W; AC = 5 VA |
| Inrush duration | 150 ms |
| Insulating voltage | 2000 V 50 Hz (for 1 min) |



19 Mechanical interlock with the door

This device prevents circuit-breaker manually racking-in when the switchgear door is open. It is only provided for circuit-breakers used in switchgear UniGear ZS1 and PowerCube modules, fitted with a special actuator on the door.

20 Motorised truck (-MT)

It allows racking-in and racking-out of the circuit-breaker in the switchgear to be carried out remotely, (only for circuit-breaker in withdrawable version).

The motor version with clutch can be ordered on request, so that racking-in/ out can be performed 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) | 34 W |

Note: cooperate with MDC2 (digital motor driven trolley control unit) to control and protect the truck of circuit-breaker.



21 STU shunt test unit

Due to the particular construction of these releases, checking the functionality of the shunt closing (-MC) and opening (-MO1, -MO2) releases is not possible with 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 carry out a check of the functionality is the STU device. Please contact us if you want to carry out this control with devices other than STU.

This device can be combined with the shunt opening release (-MO1; -MO2) or with the shunt closing release (-MC) to check functionality and continuity.

The control/monitoring Shunt Test Unit allows the continuity of releases with a rated operating voltage between 24 V and 250 V (AC and DC) to be checked, as well as the functionality of the electronic circuit of the release.

Checking continuity is carried out cyclically with an interval of 20 seconds between one test and the next.

The unit has optical signals by means of LEDs on the front. In particular the following information is indicated:

- POWER ON: power supply present
- (-MO) TESTING: test being carried out
- 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 board the unit, which allow remote signalling of the following two events:


- Failure of a test (resetting is carried out automatically when the alarm stops)
- Failure of three tests (resetting is only carried out by means of the manual - RESET – from the front of the unit)

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

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

6. Instructions for operating the circuit breaker

6.1. Safety indications

 **The VD4 circuit breakers guarantee a minimum IP2X degree of protection when installed in the following conditions:**

- **fixed circuit breaker, installed behind a protective metal net**
- **withdrawable circuit breaker, installed in switchgear**

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

Should mechanical operations be carried out on the circuit breaker outside of the switchgear, take great care of the moving parts.

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

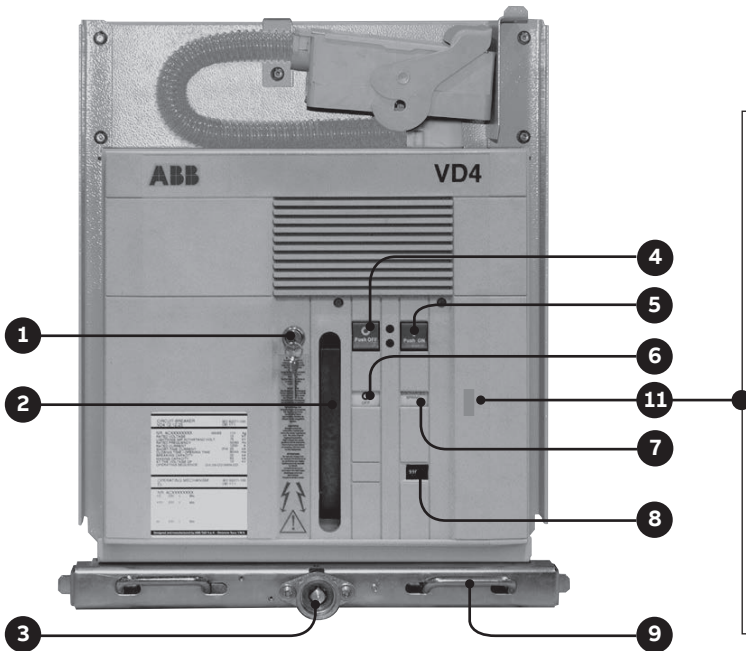
Racking the circuit breaker in and out of the switchgear must be done gradually to avoid shocks which may deform the mechanical interlocks.

Due to safety reasons, the circuit breaker has to be treated as “switched on” if the switching position cannot be clearly determined.

In this case all high voltage connections to the circuit breaker have to be de-energized and zero potential on the primary side of the circuit breaker has to be confirmed prior to commissioning, operation, maintenance or repair work.

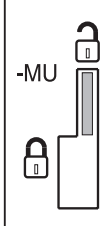
6.2. Switching and signalling parts


VD4 circuit breakers for UniGear switchgear and PowerCube modules (fig. 6a)





Mechanical override of the undervoltage release (on request)

-MU



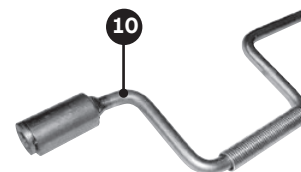
 Undervoltage release enabled. The circuit breaker can only be closed if the undervoltage release is supplied with power.



 Undervoltage release disabled. The circuit breaker can also be closed if the undervoltage release is not supplied with power.

6a

- 1 Key lock (if provided) (*)
- 2 Lever for manually charging the closing spring (except version VD4/ZS8 - see figure 6b)
- 3 Coupling lever for racking-out operation (withdrawable circuit breakers only)
- 4 Opening pushbutton
- 5 Closing pushbutton
- 6 Signalling device for circuit breaker open/closed
- 7 Signalling device for closing springs charged/discharged
- 8 Operation counter
- 9 Handles for operating the truck locks (only for withdrawable circuit breakers)
- 10 Operating lever for circuit breaker racking-in/out (there is a special version for VD4/ZS8)
- 11 Mechanical undervoltage release override (on request)



(*) Warning! To activate the key lock: open the circuit breaker, keep the opening pushbutton depressed, then turn the key and remove it from the housing.

6.3. Circuit breaker closing and opening operations

Circuit breaker operation can be either manual or electrical.

a) Manual spring charging operation

Repeatedly activate the charging lever (2) (maximum rotation angle of the lever: about 90°) until the yellow indicator (7) appears.

The maximum forces which can normally be applied to the lever: ≤ 250 N

b) Electrical spring charging operation

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

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

The geared motor automatically recharges the spring after each closing operation until the yellow indicator (7) appears. If the power is cut off during charging, the geared motor stops and automatically starts recharging the springs again when the power returns.

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

c) Circuit breaker closing

The operation can only be carried out with the closing spring completely charged.

For manual closing, press the pushbutton (5 - fig. 6a).

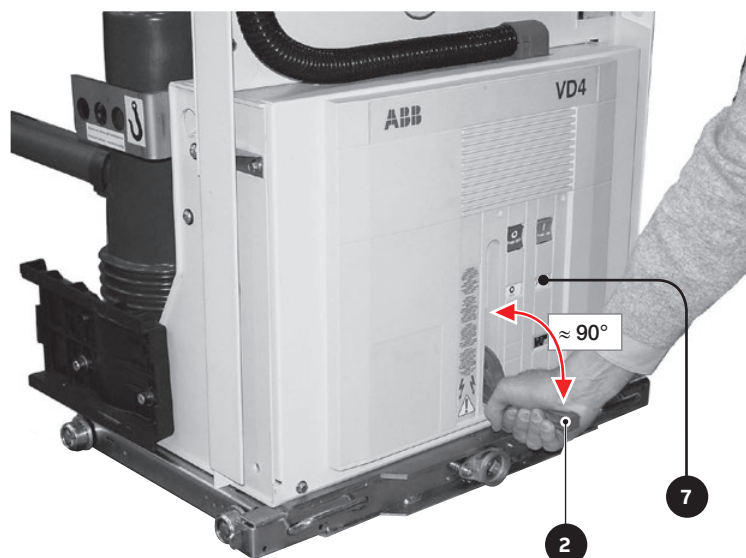
When there is a shunt closing release, the operation can also be carried out remotely by means of a special control circuit. Closing having taken place is indicated by the signalling device (6 - fig. 6a).

d) Circuit breaker opening

For manual opening, press the pushbutton (5 - fig. 6a).

When there is a shunt opening release, the operation can also be carried out remotely by means of a special control circuit.

opening having taken place is indicated by the signalling device (6 - fig. 6a).



7. Installation

7.1. General



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

7.2. Installation and operating conditions

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

- IEC 62271-1/DIN VDE 0101
- VDE 0105: Electrical installation service
- DIN VDE 0141: Earthing systems for installations with rated voltage above 1 kV
- All the accident prevention regulations in force in the relative countries

7.2.1. Normal conditions

Follow the recommendations in the IEC 62271-1 and 62271- 100 Standards. In more detail:

Ambient temperature

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

Humidity

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

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

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

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

Altitude

< 1000 m above sea level.

7.2.2. Special conditions

Installations over 1000 m a.s.l.

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

Increase in the ambient temperature

Reduction in the rated current.

Encourage heat dissipation with appropriate additional ventilation.

Climate

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

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

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



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

7.2.3. Trip curves

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

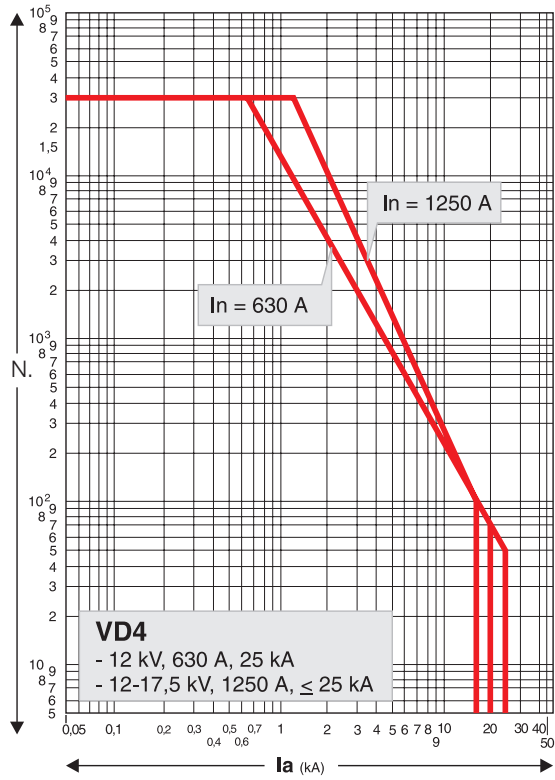


Fig. 8a

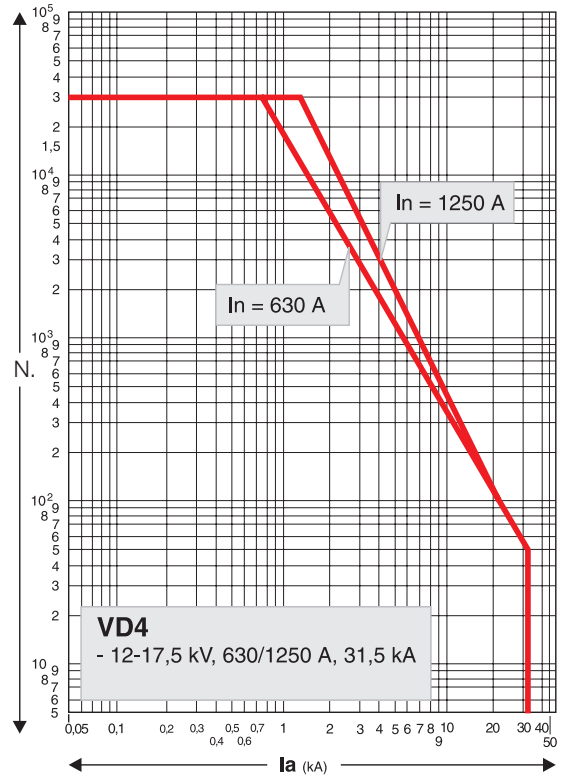


Fig. 8b

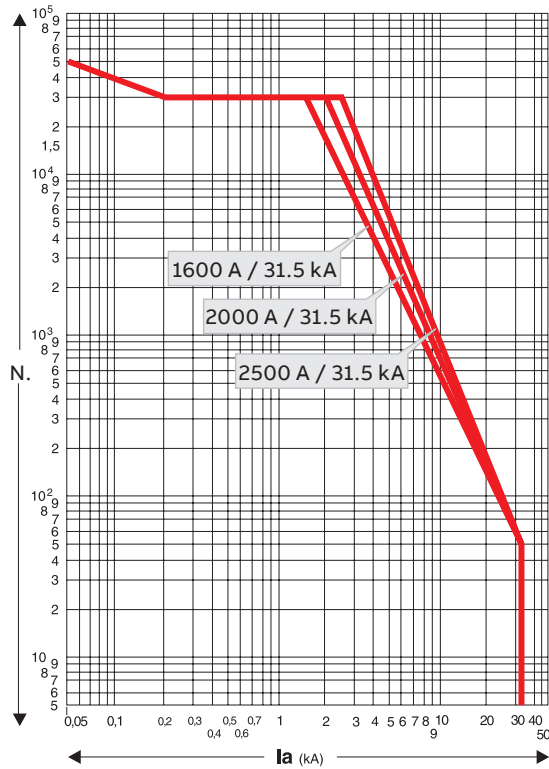


Fig. 8c

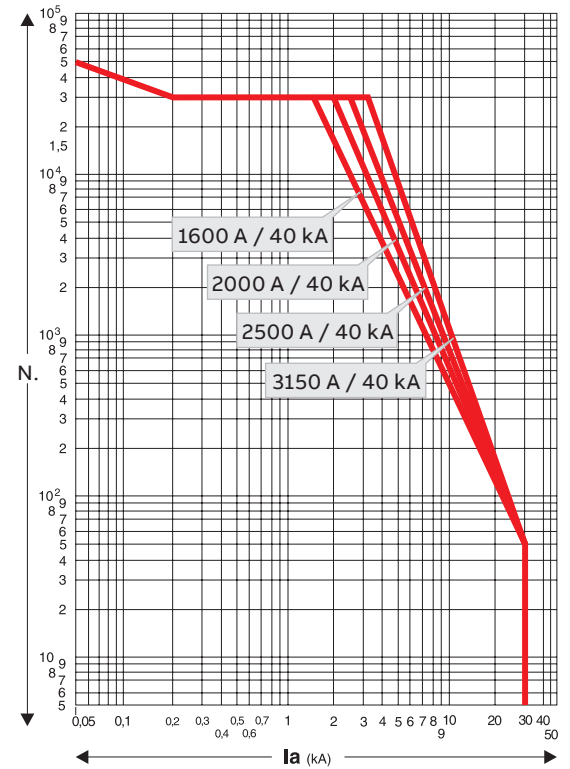


Fig. 8d

7. Installation

7.3. Preliminary operations

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

7.4. Installation of fixed circuit breakers

The circuit breaker can be mounted directly on supporting frames to be provided by the customer, or on a special supporting truck (available on request).

The circuit breaker, with supporting truck, must be suitably fixed to the floor of its own compartment by the customer.

The floor surface in correspondence with the truck wheels must be carefully levelled.

A minimum degree of protection (IP2X) must be guaranteed from the front towards live parts.

7.4.1. Mounting the circuit breaker on a truck made by other manufacturers

The VD4 circuit breakers which are not installed on ABB trucks, but on trucks made by the customer, must be fitted with one or two additional auxiliary contacts (activated by the mechanical lock and by the circuit breaker release device) to carry out the function of interrupting the shunt closing release circuit (-MC) during traverse from isolated and vice versa.

In ABB trucks, this function is carried out by the -BT1 and -BT2 auxiliary contacts which cut of the release power supply during and before activation of the mechanical lock of the screw truck racking-in device. This means that the shunt closing release power supply can only be applied at the end of activation of the mechanical lock. In this way it is certain that no electrical impulse can activate the shunt closing release with the circuit breaker in an intermediate position.

7.5. Installation of withdrawable circuit breaker

The withdrawable circuit breakers are preset for use in UniGear ZS1, and PowerCube modules.

For racking-in/racking-out of the switchgear, fully insert the lever (1) (fig. 9) in the appropriate seat (2) and work it clockwise for racking-in, and anticlockwise for racking-out, until the limit switch positions are reached.

Circuit breaker racking-in/-out must be carried out gradually to avoid shocks which may deform the mechanical interlocks and the limit switches.

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

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

Note:

To complete the racking-in/out operation, about 20 rotations of the lever are required for circuit breakers up to 17.5 kV.

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

Withdrawable circuit breakers of the same version, and therefore with the same dimensions, are interchangeable.

However, when, for example, different electrical accessory fittings are provided, a different code for the plug of the auxiliary circuits does not allow incorrect combinations between panels and circuit breakers.

For the circuit breaker installation operations, also refer to the technical documentation of the abovementioned switchgear.



- **The racking-in/-out operations must always be carried out with the circuit breaker open**
- **When putting into service for the first time, it is advisable to charge the circuit breaker operating mechanisms manually so as not to overload the auxiliary power supply circuit**

7.5.1. Circuit breakers with withdrawable motorized truck

Carry out the racking-in/racking-out test of the motorized truck in the same way as for a manual truck, following the instructions below:

- Rack the circuit breaker into the switchgear in the open and isolated position, with the power supply to the motor circuit cut off and with the enclosure door closed
- Insert the manual racking-in lever (1) in the special coupling (2) Fig. 9, and take the motorized truck to about half its run between the isolated for test and the connected position. The torque needed to carry out truck handling is < 25 Nm
- In the case of accidental inversion of the truck motor power supply polarity, this operation allows a possible error in direction to be dealt with without any damage. Verification checks:
 - a) motor rotation clockwise during circuit breaker racking-in.
 - b) motor rotation anticlockwise during circuit breaker racking-out.

- Remove the manual lever (1) from the coupling (2) Fig. 9
- Supply the truck motor circuit
- Activate the control for the electrical racking-in operation. When racking-in has taken place, check correct changeover of the relative auxiliary contact
- On completion, activate the control for the electrical racking-out operation. When racking-out has taken place, check correct changeover of the relative auxiliary contact
- In the case of a motor fault during a racking-in or racking-out operation, in an emergency the truck can be taken to the end of its run manually, after first cutting off the power supply to the motor power supply circuit and then, using the manual lever, work in the same way as with the manual truck

Note:

By means of the chain transmission, truck handling carried out using the manual lever makes the truck motor armature rotate which, behaving like a generator, can cause inverse voltage at the connection terminals. This may damage the permanent magnet of the motor, therefore all the truck racking-in and racking-out operations carried out using the manual lever must be done without power supply in the motor circuit.

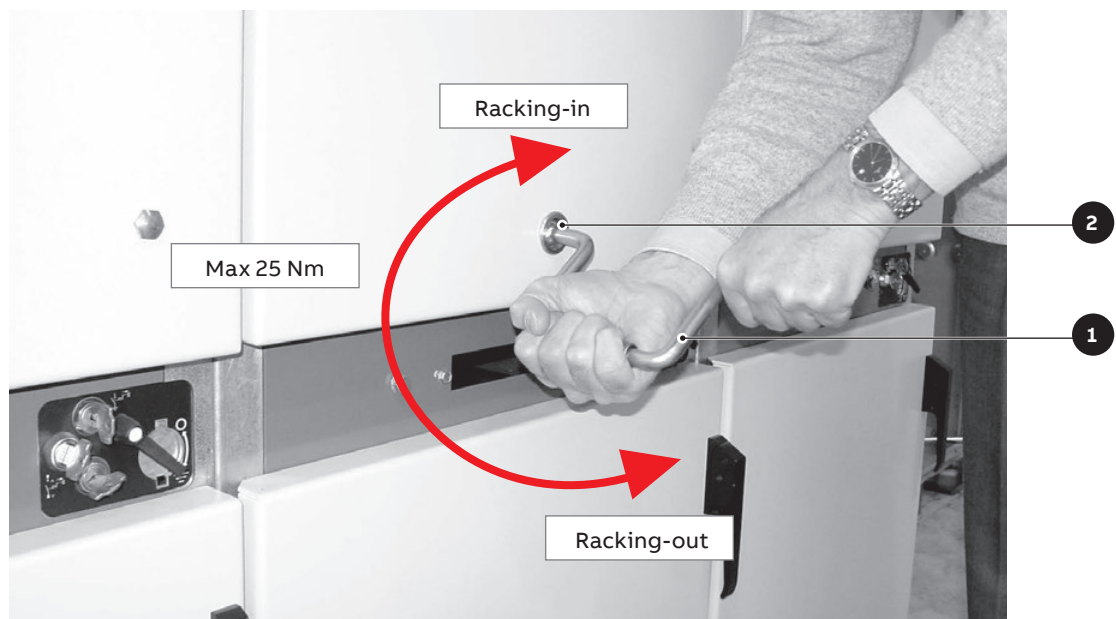


Fig. 9

7. Installation

7.6. Power circuit connections of fixed circuit breakers

7.6.1. General recommendations

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

7.6.2. Assembly of the connections

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

Assembly procedure

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

T1

| Bare copper |
|--|
| <ul style="list-style-type: none"> • Clean with a fine file or emery cloth • Tighten fully and cover the contact surfaces with 5RX Moly type grease |
| Copper or silver-plated aluminium |
| <ul style="list-style-type: none"> • Clean with a rough dry cloth • Only in the case of obstinate traces of oxidation, clean with a very fine grain emery cloth taking care not to remove the surface layer • If necessary, restore the surface treatment |

| Bare aluminium |
|--|
| <ul style="list-style-type: none"> • Clean with a metal brush or emery cloth • Cover the contact surfaces again immediately with neutral grease • Insert the copper-aluminium bimetal with surfaces shined (copper side in contact with the terminal; aluminium side in contact with the connection) between the aluminium connection and the copper terminal |

T2

| Bolt | Recommended tightening torque ⁽¹⁾ | |
|------|--|----------------------------------|
| | Without lubricant | Without lubricant ⁽²⁾ |
| M6 | 10.5 Nm | 4.5 Nm |
| M8 | 26 Nm | 10 Nm |
| M10 | 50 Nm | 20 Nm |
| M12 | 86 Nm | 40 Nm |
| M16 | 200 Nm | 80 Nm |

(1) The nominal tightening torque is based on a friction coefficient of the thread of 0.14 (distributed value the thread is subjected to which, in some cases, is not negligible). The nominal tightening torque with lubricant is according to the DIN 43673 Standards.
 (2) Oil or grease. The thread and surfaces in contact with the lubricated heads. Take into account the deviations from the general Standards table (for example, for systems in contact or terminals) as foreseen in the specific technical documentation. The thread and surfaces in contact with the heads of bolts must be slightly oiled or greased, so as to obtain a correct nominal tightening torque.

7.6.3. Earthing

For the fixed version circuit breaker, carry out earthing by means of the special screw marked with the relative symbol.

Clean and degrease the area around the screw to a diameter of about 30 mm and, on completion of assembly, cover the joint again with Vaseline grease.

Use a conductor (busbar or braid) with a crosssection conforming to the Standards in force.

8. Putting into service

8.1. General procedures



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

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

The operating forces which can be applied for racking-in withdrawable circuit breakers are indicated in paragraph 7.5.

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

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

8. Putting into service

| T3 | | | |
|------|--|--|--|
| Item | Inspected | Procedure | Positive check |
| 1 | Insulation resistance. | <p>Medium voltage circuit</p> <p>With a 2500 V megger, measure the insulation resistance between the phases and the exposed conductive part of the circuit.</p> <p>Auxiliary circuits</p> <p>With a 500 V megger (if the apparatus installed allows this), measure the insulation resistance between the auxiliary circuits and the exposed conductive part.</p> | <p>The insulation resistance should be at least 50 Mohm and in any case constant over time.</p> <p>The insulation resistance should be a few Mohm and in any case constant over time.</p> |
| 2 | Auxiliary circuits. | Check that the connections to the control circuit are correct: proceed at the relative power supply. | Operations and signals normal. |
| 3 | Manual operating mechanism. | Carry out a few closing and opening operations (see cap. 6). N.B. Supply the undervoltage release and the locking magnet on the operating mechanism at the relative rated voltage (if provided). | The operations and relative signals take place normally. |
| 4 | Motor operator (if provided). | <p>Supply the spring charging geared motor at the relative rated voltage.</p> <p>Carry out a few closing and opening operations. N.B. Supply the undervoltage release and the locking magnet on the operating mechanism at the relative rated voltage (if provided).</p> | <p>The spring is charged normally.</p> <p>The signals are normal.</p> <p>With the spring charged, the geared motor stops.</p> <p>The geared motor recharges the spring after each closing operation.</p> |
| 5 | Undervoltage release (if provided). | <p>Supply the undervoltage release at the relative rated voltage and carry out the circuit breaker closing operation.</p> <p>Cut off power to the release.</p> | <p>The circuit breaker closes normally.</p> <p>The signals are normal.</p> <p>The circuit breaker opens.</p> <p>The signalling changes over.</p> |
| 6 | Shunt opening release and additional shunt opening release (if provided). | Close the circuit breaker and supply the shunt opening release at the relative rated voltage. | <p>The circuit breaker opens normally.</p> <p>The signals are normal.</p> |
| 7 | Shunt closing release (if provided). | Open the circuit breaker and supply the shunt closing release at the relative rated voltage. | <p>The circuit breaker opens normally.</p> <p>The signals are normal</p> |
| 8 | Key lock (if provided). | <p>Open the circuit breaker, keep the opening pushbutton depressed, then turn the key and remove it from the housing. Attempt the circuit breaker closing operation.</p> <p>Put the key back in and turn it 90°.</p> <p>Carry out the closing operation.</p> | <p>Neither manual nor electrical closing takes place.</p> <p>Both electrical and manual closing take place normally; in this position the key cannot be removed.</p> |
| 9 | Locking electromagnet (-RL1) (if provided). | With the circuit breaker open, spring charged and locking electromagnet not supplied, attempt circuit breaker closing both manually and electrically. | Closing is not possible. |
| 10 | Auxiliary contacts in the operating mechanism. | <p>Insert the auxiliary contacts in suitable signalling circuits.</p> <p>Carry out a few closing and opening operations.</p> | Signals take place normally. |
| 11 | Locking electromagnet on the truck circuit breaker (-RL2) (if provided). | <p>With the circuit breaker open, in the isolated for test position and the locking electromagnet not supplied, attempt racking-in of the circuit breaker.</p> <p>Supply the locking electromagnet and carry out the racking-in operation.</p> | <p>Racking-in is not possible.</p> <p>Racking-in takes place correctly.</p> |
| 12 | Auxiliary transmitted contacts for signalling circuit breaker racked-in, isolated (UniGear switchgear or PowerCube modules). | <p>Insert the auxiliary contacts in suitable signalling circuits.</p> <p>With the circuit breaker racked into the enclosure, carry out a few traverse operations from the isolated for test position to the connected position.</p> | The signals due to the relative operations take place normally. |
| 13 | Main circuit resistance | <p>Take the circuit breaker to the racked-out position.</p> <p>Close the circuit breaker, and flow 100A DC current into each pole</p> | The tested value should not greater than the specified value declared by manufacturer. |

9. Maintenance

The maintenance operations are aimed at keeping the apparatus in good working condition for as long as possible. Please refer to BS EN 13306:2017, clause 8, for maintenance types definitions.

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

Inspection: Finding out the actual conditions
 Overhauling: Measures to be taken to maintain the specific conditions
 Repairs: Measures to be taken to restore the specific conditions.

9.1. General

The vacuum circuit breakers are characterised by simple, sturdy construction and a long life. The operating mechanism requires maintenance and functional inspections to reach the expected operating-life.

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

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

The interventions during service and their aim are determined by the ambient conditions, by the sequence of operations and by the short-circuit interruptions.

Note:


Respect the following Standards for maintenance work: the relative specifications given in the chapter on "Standards and Specifications".

- Work safety regulations in the chapter on "Putting into service and operations"
- Standards and specifications of the country where the apparatus is installed

The maintenance operations must only be carried out by trained personnel and who follow all the safety regulations.

Furthermore, it is advisable to call on ABB personnel, at least in cases for checking the performances in service and for repairs.

Cut the power supply off and put the apparatus under safe conditions during the maintenance operations.

 **Before carrying out any operations, check that the circuit breaker is open, with the spring discharged and that it is not supplied (medium voltage circuit and auxiliary circuits).**

9.1.1. Operating life expectancy

The operating life expectancy for the VD4 circuit breakers is as follows:

- Vacuum interrupters: up to 30,000 operations, according to their type (see par. 7.2.3. Trip curves)
- Switching device, actuator and transmission system: up to 30,000 operations, under normal operating conditions, according to the type of circuit breaker and with regular
- With operations correctly executed it is possible to carry out up to 1000 racking-out/in operations (as prescribed in the IEC 60271-200 Standards)
- The data regarding the operating life are basically applicable to all the components which cannot be directly affected by operator activity. The manually operated components (moving parts of isolatable parts, etc.) can vary their behaviour

9. Maintenance

9.2. Inspections and functionality tests

9.2.1. Interruption devices in general

- Check the conditions of the interruption devices with regular inspections
- Inspection at fixed intervals can be avoided when the apparatus is permanently under the control of qualified personnel
- The checks must, first of all, include visual inspection to check for any contamination, traces of corrosion or electrical discharge phenomena
- Carry out more frequent inspections when there are unusual operating conditions (including severe climatic conditions) and in the case of environmental pollution (e.g. high level of contamination or an atmosphere with aggressive agents)
- Visual inspection of the isolating contacts. It is recommended to turn the contact system alternately in order to keep the internal surface of the contact areas clean. The contact areas must be cleaned when there are signs of overheating (discoloured surface) (also see Repairs)



- In the case of abnormal conditions, take suitable overhauling measures (see Overhauling par.)

9.2.2. Stored energy operating mechanism

Carry out the functional test of the operating mechanism after 5,000 operations or during ordinary maintenance operations as specified in par. 9.2.1. and service the release devices at least every 5 years (see par. 9.3.2.).

Before doing the test, open the circuit breaker and carry out the following operations:

- In the case of withdrawable circuit breakers, take the circuit breaker to the isolated for test position
- In the case of fixed circuit breakers: cut off the power supply to the medium voltage circuit

Note:

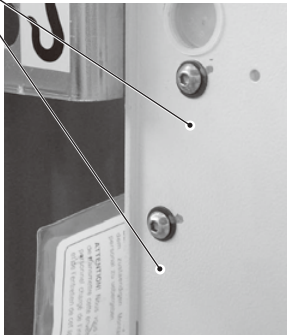
Insulate the work area and make it safe, following the safety regulations specified in the IEC/DIN VDE Standards.

Functional test

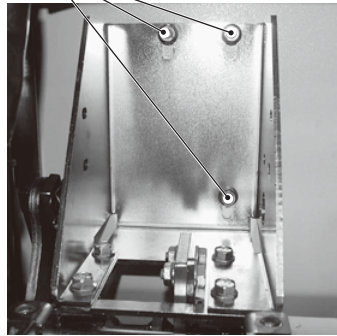
- With the circuit breaker not connected to the load, carry out a few opening and closing operations
- If foreseen, cut the power supply to the spring charging motor off. Discharge the spring by closing and opening the circuit breaker by means of the closing and opening pushbuttons
- Visually inspect the lubrication conditions of the tulip isolating contacts, of the sliding surfaces, etc
- Check correct electrical and mechanical operation of the various devices, with particular attention to the interlocks
- The screws and nuts are tightened in the factory and correct tightening is marked with a collared sign. No further tightening operations are foreseen during the operating life of the circuit breaker. However, following any maintenance interventions, should it be necessary to re-tighten the screws or nuts, it is recommended to always replace the screws and nuts and to keep to the values indicated in fig. 12

Checking tightness of the screws

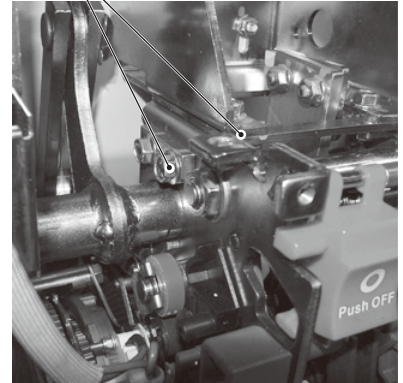
25 Nm



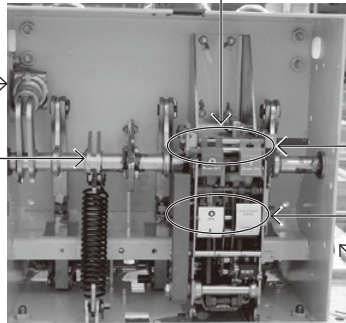
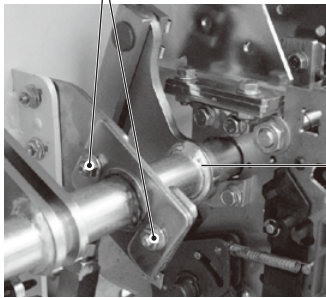
15 Nm



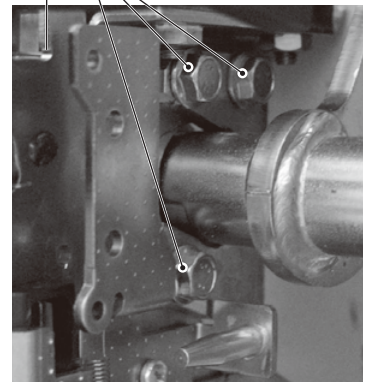
15 Nm



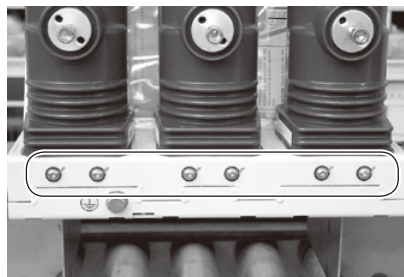
15 Nm



15 Nm



25 Nm



9. Maintenance

9.2.3. Circuit breaker pole

No other check except what has already been specified in par. 9.2.1. is necessary.

9.2.4. Withdrawable assembly (truck and circuitbreaker)

Visually inspect the components, especially those which may be damaged by incorrect operations.

Visually inspect the isolating contacts and that all the contact elements are clean, especially in cases where signs of overheating are found (also see par.9.4.).

Visually inspect and carry out the functional tests of the locks, checking their correct operation and activation without abnormal force – maximum 25 N (also see table in chap. 8).

9.3. Overhauling

9.3.1. Interruption devices in general

Should it have been necessary to clean the devices during the inspections, according to what is specified in par. 9.2.1., use the following procedure:

- Insulate the work area and make it safe, following the safety regulations specified in the IEC/DIN VDE Standards
- General cleaning of the surfaces:
 - Dry and eliminate light deposits of dirt with a soft dry cloth
 - More resistant deposits of dirt can be removed using slightly alkaline domestic type detergent or Rivolta BWR 210 type detergent
- Cleaning insulating surfaces and conductive parts:
 - After cleaning, rinse thoroughly with clean water and dry carefully

Note:
Only use detergents without halogens and never 1.1.1-trichloroethane, trichloroethylene or carbon tetrachloride!

9.3.2. Tripping device: actuator and transmission system Circuit breakers up to 17.5 kV, 2500 A, 31.5 kA

To ensure correct operation of the circuit breaker, inspection and maintenance of the tripping devices is recommended every 10,000 operations. For this purpose, please contact the ABB Service office. Complete replacement of the actuator, shock absorber and of the other transmission system parts (shaft, main levers, safety rings, etc.) must be carried out after 30,000 operations.

Circuit breakers up to 17.5 kV, 40 kA

To ensure correct operation of the circuit breaker, inspection and maintenance of the tripping devices is recommended every 5,000 operations. For this purpose, please contact the ABB Service office. Complete replacement of the actuator must be carried out every 10,000 operations.

Complete replacement of the shock absorber and of the other transmission system parts (shaft, main levers, safety rings, etc.) must be carried out after 30,000 operations.

Circuit breakers up to 17.5 kV, 3150 A, 40 kA

To ensure correct operation of the circuit breaker, inspection and maintenance of the tripping devices must be carried out every 5,000 operations. For this purpose, please contact the ABB Service office. Complete replacement of the shock absorber and of the other part of the transmission system (shaft, main levers, safety rings, etc.) must be carried out after 10,000 operations.

Details regarding overhauling

- When foreseen, cut off the power supply to the spring charging motor and manually discharge the operating mechanism spring by closing and opening the circuit breaker
- Replace the parts subjected to mechanical stress or stress due to particular environmental conditions, (contact and ABB service centre)

Note:
These operations can only be carried out by ABB personnel or by skilled and specially trained personnel.

9.3.3. Circuit breaker pole

The circuit breaker pole and relative vacuum interrupter are maintenance-free until the maximum number of electrical operations for the type of interrupter is reached (see par. 7.2.3. Trip curves). The operating life of the vacuum interrupter is defined by the sum of the ultimate currents corresponding to the specific type of interrupter in accordance with what is indicated in the graphs of par. 7.2.3. Trip curves: when the sum of the ultimate currents is reached, the whole pole must be replaced.

Note:
Dismantling and replacement of the pole can only be carried out by ABB personnel or by skilled and specially trained personnel, particularly for the necessary adjustments.


To carry out the interrupter test without dismantling the circuit breaker pole, use:

- The VIDAR vacuum tester, made by the company Programma Electric GmbH, Bad Homberg v.d.H

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

| Rated voltage of the circuit breaker | d.c. test voltage |
|--------------------------------------|-------------------|
| 12 kV | 40 kV |
| 17.5 kV | 40 kV |

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

 **Procedure for testing the degree of vacuum of the interrupter of the circuit breaker poles:**

- **Turn the power supply off and make the working area safe by following the safety regulations specified in the IEC/ DIN VDE Standards**
- **Open the circuit breaker**
- **Earth a terminal of each circuit breaker pole**
- **Connect the earth terminal of the VIDAR tester to the circuit breaker structure**
- **Connect the high voltage terminal of the VIDAR tester to the terminal of the circuit breaker pole not connected to earth (L1 phase) and carry out the test. Repeat the test for phases L2 and L3**

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


9.4. Repairs

Replacement of spare parts and accessories must only be carried out by ABB personnel or suitably qualified and specially trained personnel.

Always work with the circuit breaker open and locked so that it cannot be closed again, with the work area insulated and made safe.

The operating mechanism spring must be discharged.

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

 **Should maintenance be carried out by the customer’s personnel, responsibility for the interventions remains with the customer.**

The replacement of parts not included in the “List of spare parts/accessories” (par.12.1.) must only be carried out by ABB personnel. In particular:

- **Complete pole with bushings/connections**
- **Actuator and transmission system**
- **Closing spring set**
- **Opening spring**
- **Shock-absorber**

10. Application of the X-ray emission standards

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


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

It follows that:

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

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

11. Spare parts and accessories

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

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

- Type of circuit breaker
- Rated voltage of the circuit breaker
- Rated normal current of the circuit breaker
- Breaking capacity of the circuit breaker
- Serial number of the circuit breaker
- Rated voltage of any electrical spare parts

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

11.1. List of spare parts

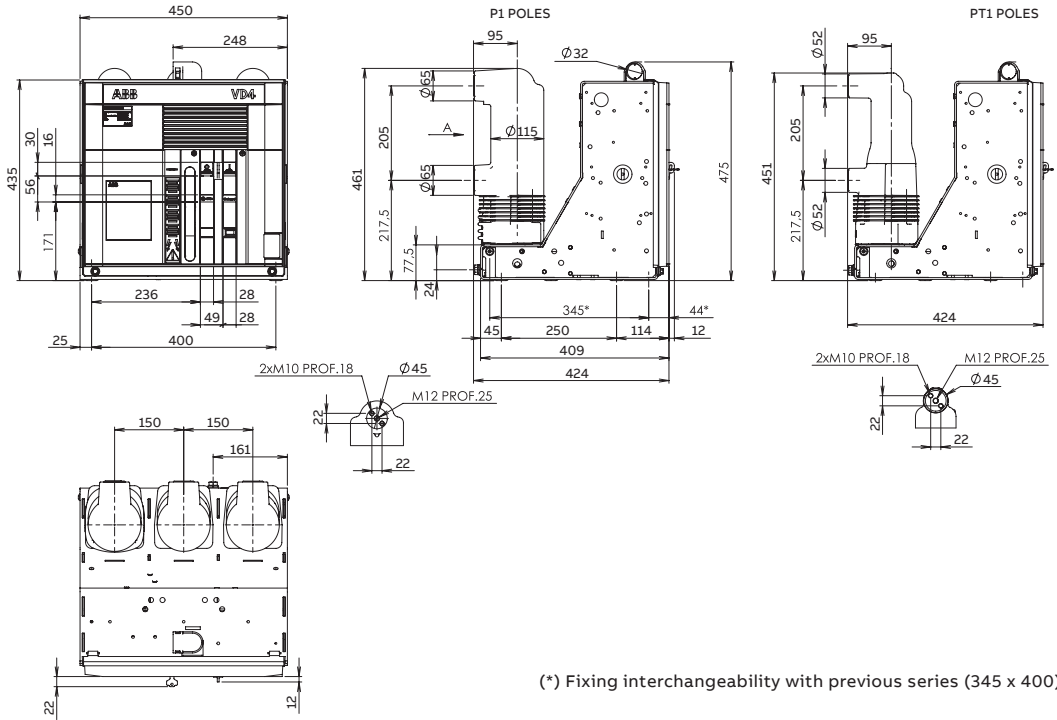
- Shunt opening release (-MO1)
- Additional shunt opening release (-MO2)
- Undervoltage release (-MU)
- Time delay device for undervoltage release
- Shunt closing release (-KT)
- Spring charging geared motor (-MS)
- Closing spring signaling contact (-BS2)
- Circuit-breaker auxiliary contacts (-BB0)
- Locking electromagnet on the operating mechanism (-RL1)
- Opening solenoid (-MO3)
- Key lock in open position
- Protection for opening pushbutton
- Protection for closing pushbutton
- Locking electromagnet on the withdrawable truck(-RL2)
- Padlock for pushbutton

12. Overall dimensions

Fixed circuit-breakers

| VD4 | |
|-----|------------------|
| TN | 7405 |
| Ur | 12 kV 17.5 kV |
| Ir | 630 A 1250 A |
| Isc | 25 kA 31.5 kA |

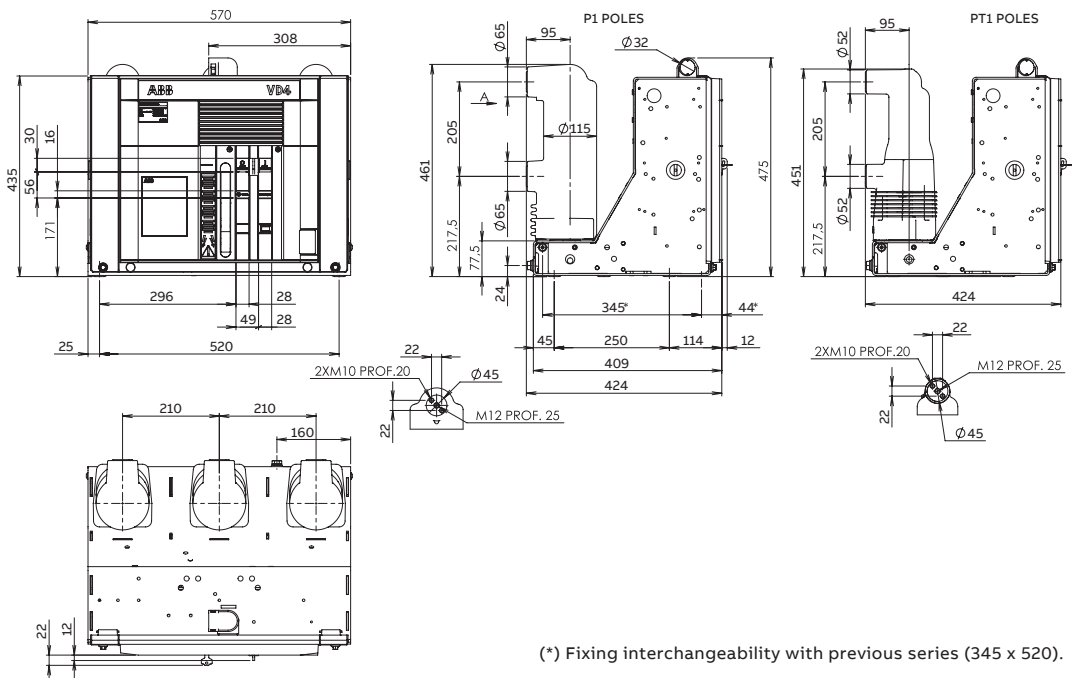
VD4 with PT pole would be offered currently, dimensions of VD4 with P pole is for reference only.



Fixed circuit-breakers

| VD4 | |
|-----|------------------|
| TN | 7406 |
| Ur | 12 kV 17.5 kV |
| Ir | 630 A 1250 A |
| Isc | 25 kA 31.5 kA |

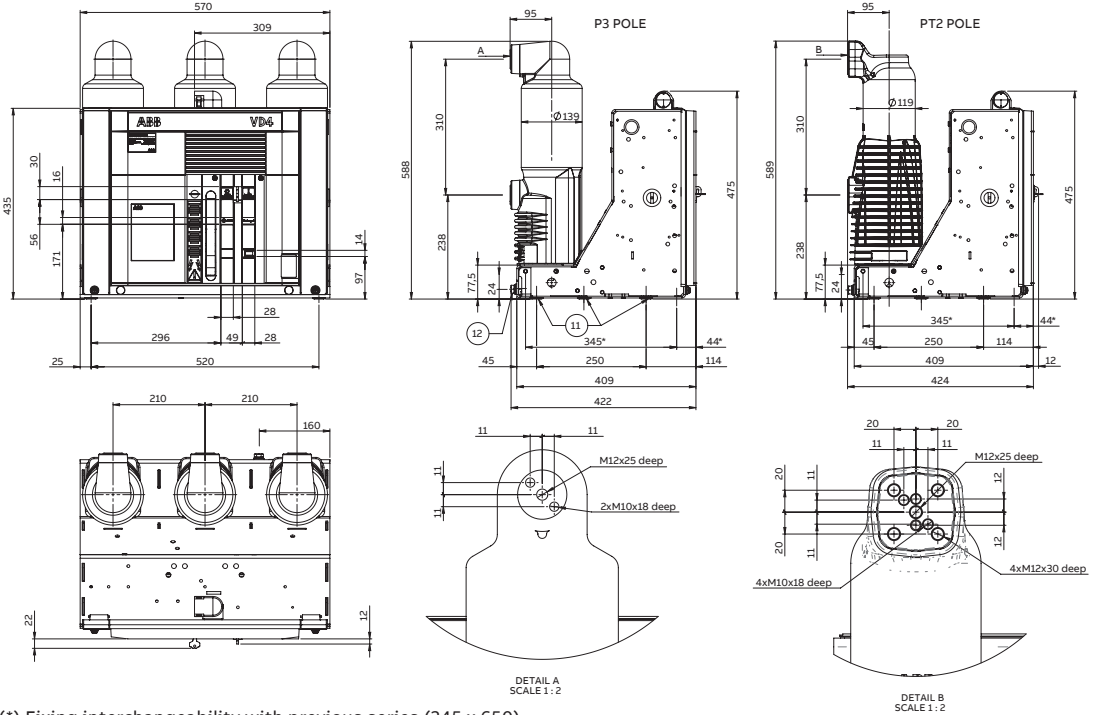
VD4 with PT pole would be offered currently, dimensions of VD4 with P pole is for reference only.



Fixed circuit-breakers

| |
|---------------|
| VD4 |
| TN 1VCD003282 |
| Ur 12 kV |
| 17.5 kV |
| Ir 1250 A |
| 1600 A |
| Isc 40 kA |

VD4 with PT pole would be offered currently, dimensions of VD4 with P pole is for reference only.

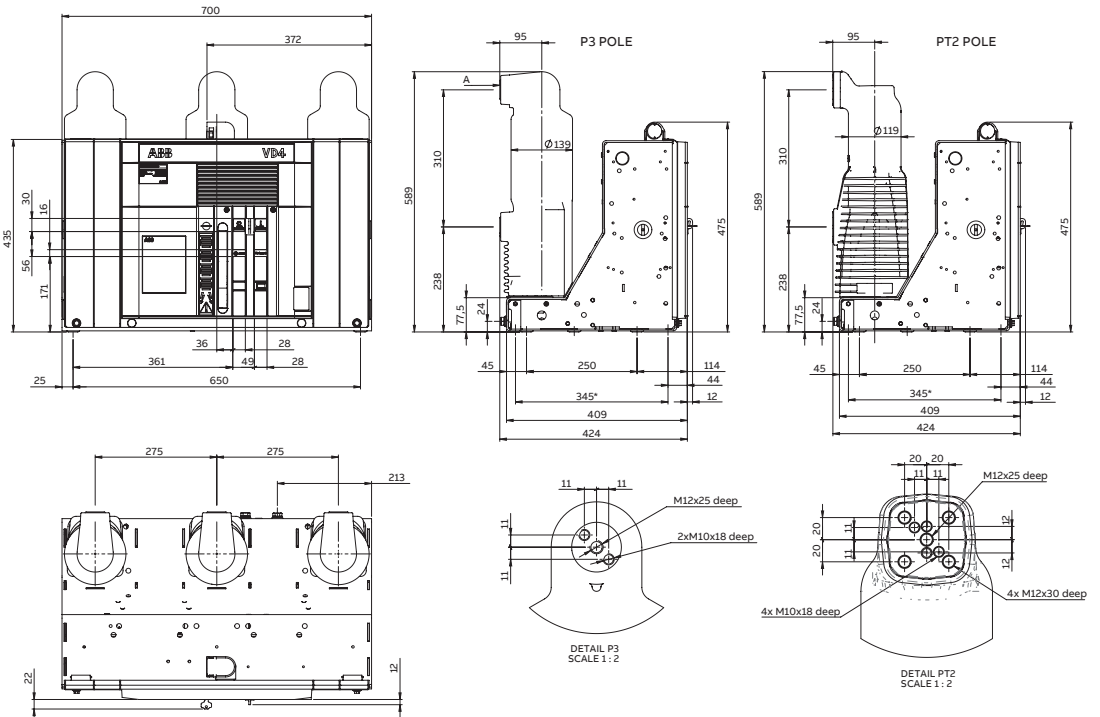


(*) Fixing interchangeability with previous series (345 x 650).

Fixed circuit-breakers

| |
|---------------|
| VD4 |
| TN 1VCD003285 |
| Ur 12 kV |
| 17.5 kV |
| Ir 1250 A |
| 1600 A |
| Isc 40 kA |

VD4 with PT pole would be offered currently, dimensions of VD4 with P pole is for reference only.



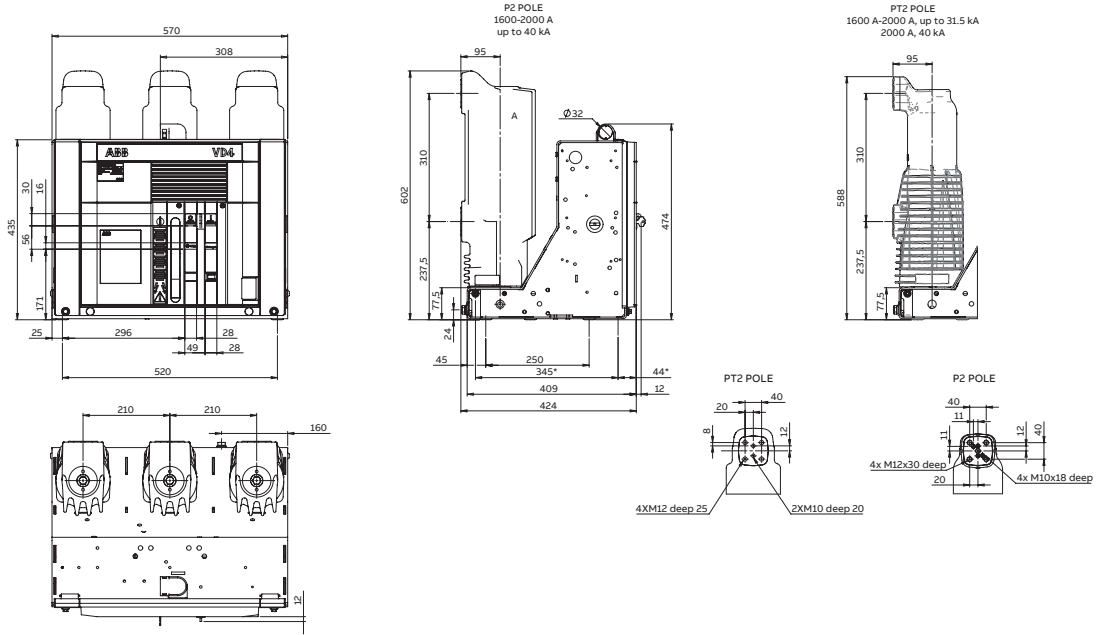
(*) Fixing interchangeability with previous series (345 x 650).

12. Overall dimensions

Fixed circuit-breakers

| | |
|------------|---------------------------|
| VD4 | |
| TN | 7407 |
| Ur | 12 kV 17.5 kV |
| Ir | 1600 A |
| Isc | 25 kA 31.5 kA |
| VD4 | |
| TN | 7407 |
| Ur | 12 kV 17.5 kV |
| Ir | 2000 A |
| Isc | 25 kA 31.5 kA 40 kA |

VD4 with PT pole would be offered currently, dimensions of VD4 with P pole is for reference only.

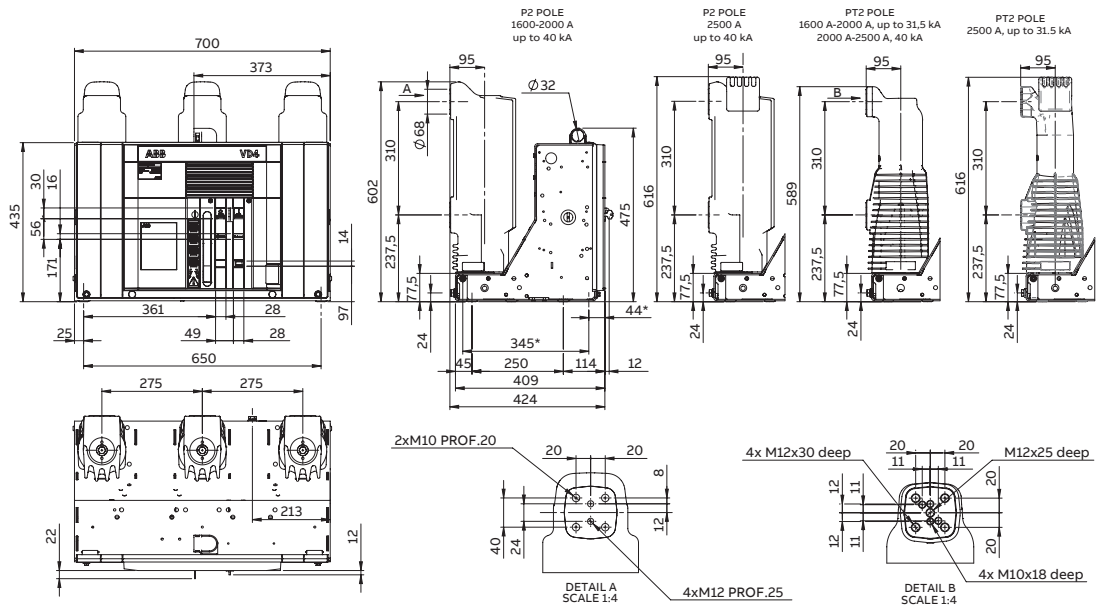


(* Fixing interchangeability with previous series (345 x 650).

Fixed circuit-breakers

| | |
|------------|---------------------------|
| VD4 | |
| TN | 7408 |
| Ur | 12 kV 17.5 kV |
| Ir | 1600 A |
| Isc | 25 kA 31.5 kA |
| VD4 | |
| TN | 7408 |
| Ur | 12 kV 17.5 kV |
| Ir | 2000 A 2500 A |
| Isc | 25 kA 31.5 kA 40 kA |

VD4 with PT pole would be offered currently, dimensions of VD4 with P pole is for reference only.



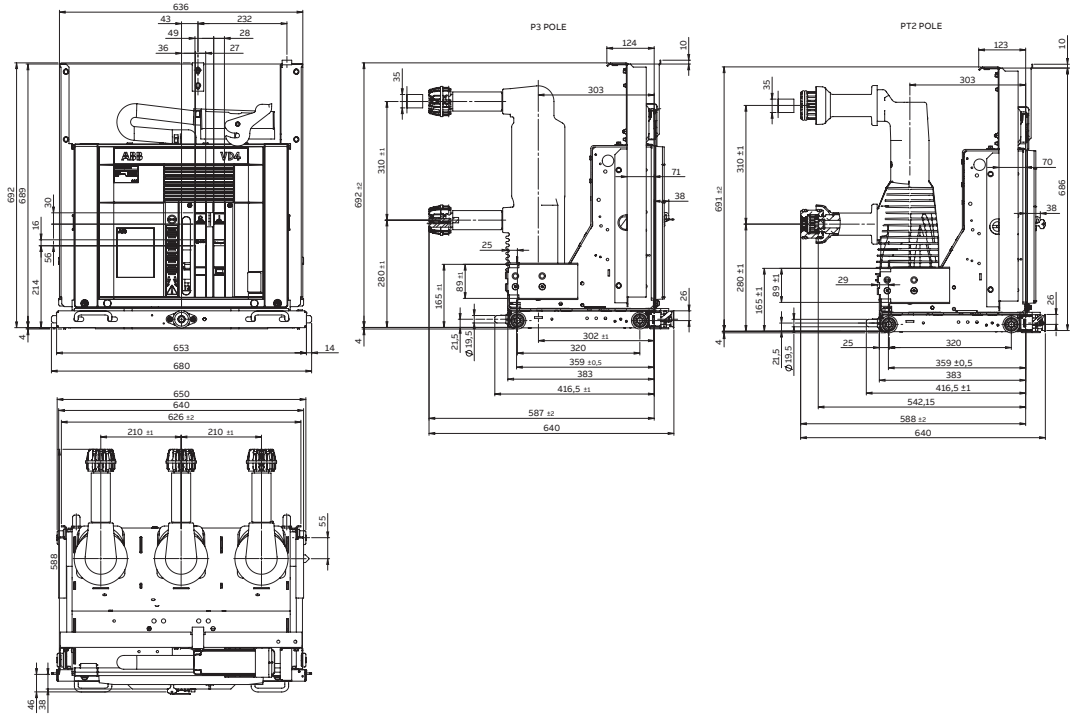
(* Fixing interchangeability with previous series (345 x 650).

12. Overall dimensions

Withdrawable circuit-breakers for PowerCube PB2 modules

| VD4/W | |
|-------|------------------|
| TN | 7420 |
| Ur | 12 kV 17.5 kV |
| Ir | 630 A 1250 A |
| Isc | 25 kA 31.5 kA |

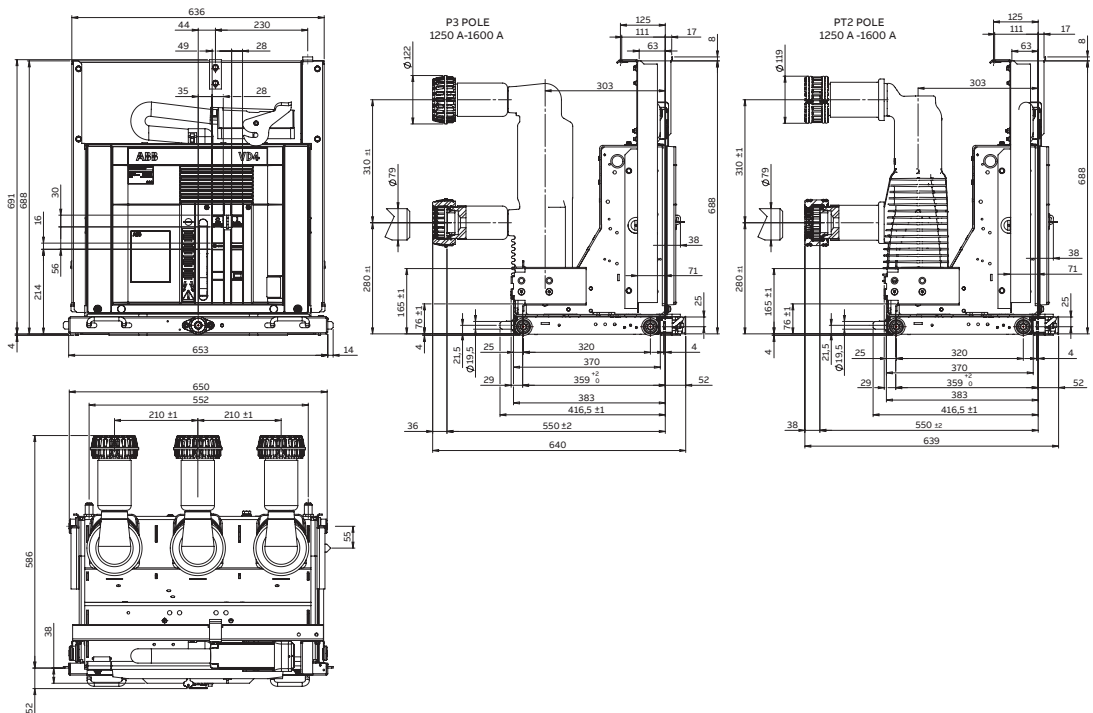
VD4 with PT pole would be offered currently, dimensions of VD4 with P pole is for reference only.



Withdrawable circuit-breakers for UniGear ZS1 switchgear and PowerCube PB2 modules

| VD4/P | |
|-------|------------------|
| TN | 1VCD003284 |
| Ur | 12 kV 17.5 kV |
| Ir | 1250 A 1600 A |
| Isc | 40 kA |

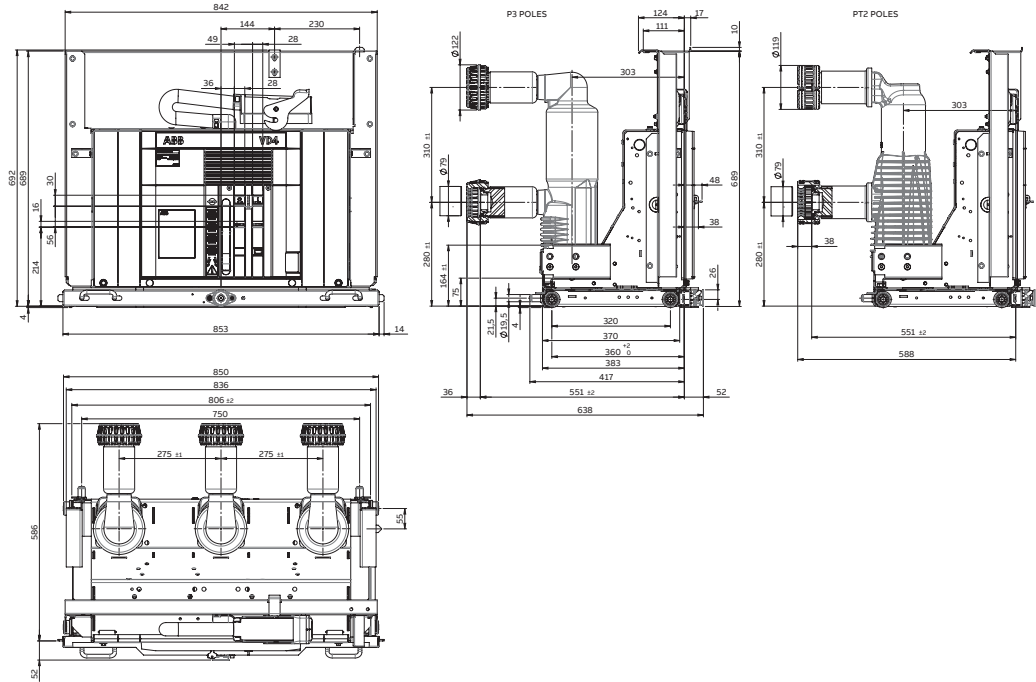
VD4 with PT pole would be offered currently, dimensions of VD4 with P pole is for reference only.



Withdrawable circuit-breakers for UniGear ZS1 switchgear

| | |
|--------------|------------|
| VD4/P | |
| TN | 1VCD003286 |
| Ur | 12 kV |
| | 17.5 kV |
| Ir | 1250 A |
| | 1600 A |
| Isc | 40 kA |

VD4 with PT pole would be offered currently, dimensions of VD4 with P pole is for reference only.

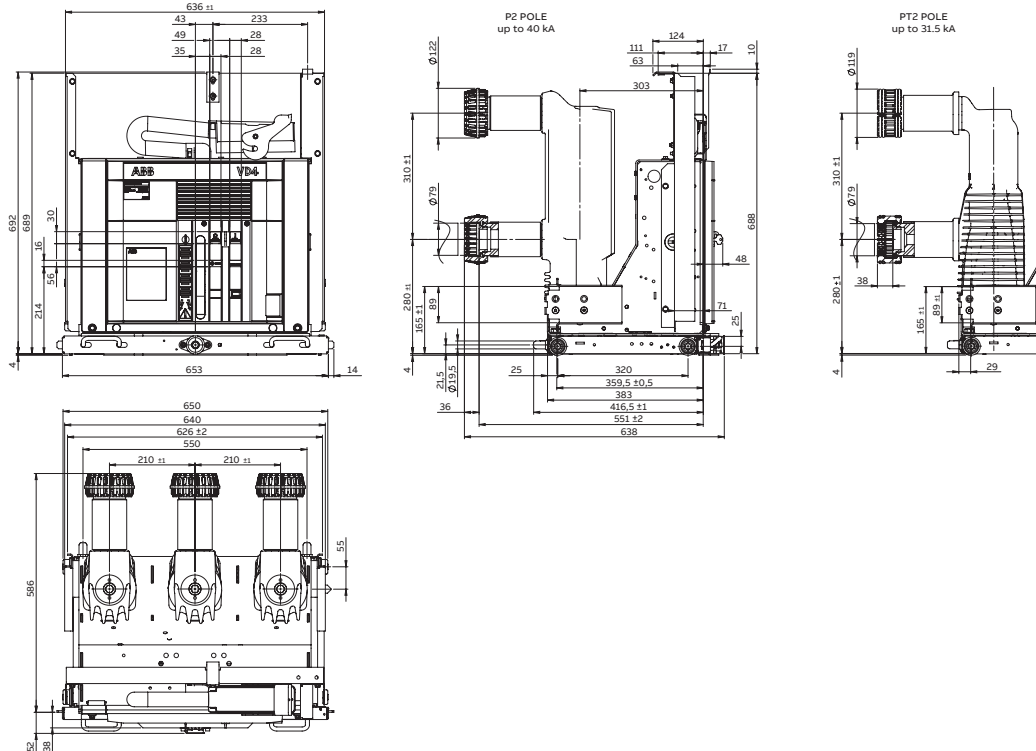


Withdrawals for UniGear ZS1 switchgear and PowerCube PB2 modules

| | |
|--------------|---------|
| VD4/P | |
| TN | 7415 |
| Ur | 12 kV |
| | 17.5 kV |
| Ir | 1600 A |
| | 2000 A |
| Isc | 25 kA |
| | 31.5 kA |

| | |
|--------------|---------|
| VD4/P | |
| TN | 7415 |
| Ur | 12 kV |
| | 17.5 kV |
| Ir | 2000 A |
| Isc | 40 kA |

VD4 with PT pole would be offered currently, dimensions of VD4 with P pole is for reference only.



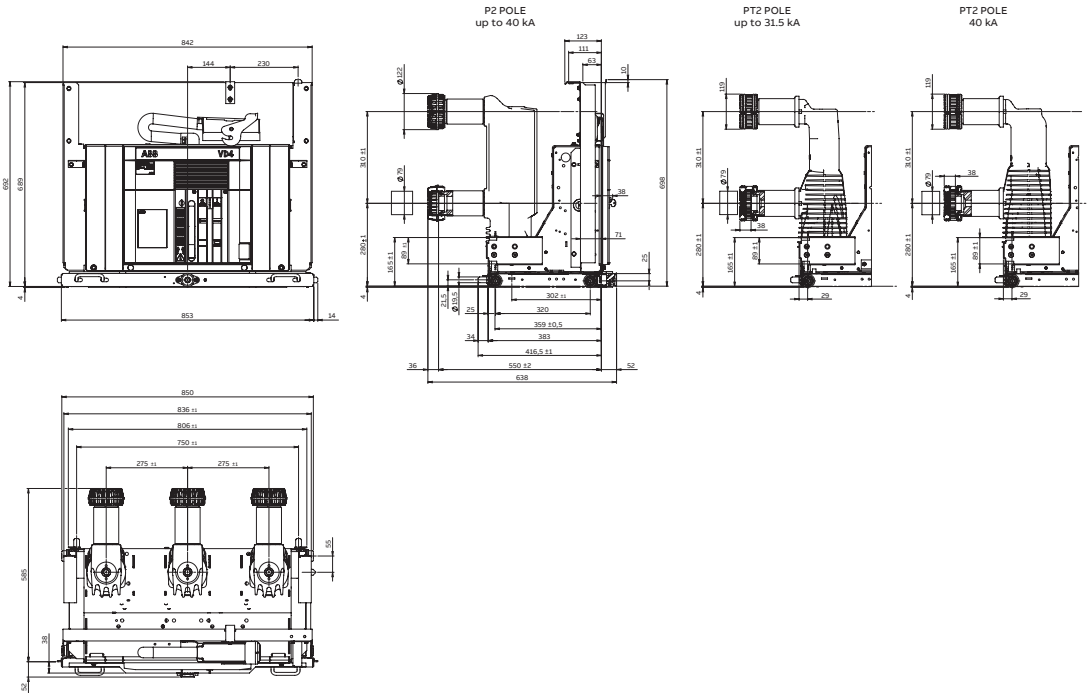
12. Overall dimensions

Withdrawable circuit-breakers for UniGear ZS1 switchgear

| VD4/P | |
|-------|---------|
| TN | 7416 |
| Ur | 12 kV |
| | 17.5 kV |
| Ir | 1600 A |
| | 2000 A |
| Isc | 25 kA |
| | 31.5 kA |

| VD4/P | |
|-------|---------|
| TN | 7416 |
| Ur | 12 kV |
| | 17.5 kV |
| Ir | 2000 A |
| Isc | 40 kA |

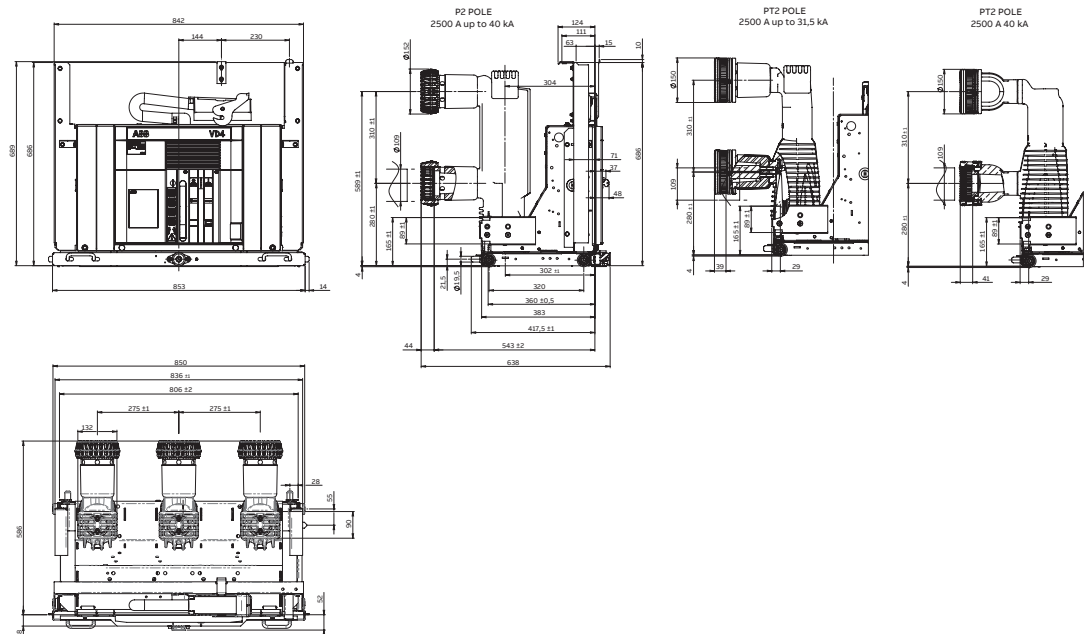
VD4 with PT pole would be offered currently, dimensions of VD4 with P pole is for reference only.



Withdrawable circuit-breakers for UniGear ZS1 switchgear and PowerCube PB3 modules

| VD4/P | |
|-------|---------|
| TN | 7417 |
| Ur | 12 kV |
| | 17.5 kV |
| Ir | 2500 A |
| | 25 kA |
| Isc | 31.5 kA |
| | 40 kA |

VD4 with PT pole would be offered currently, dimensions of VD4 with P pole is for reference only.

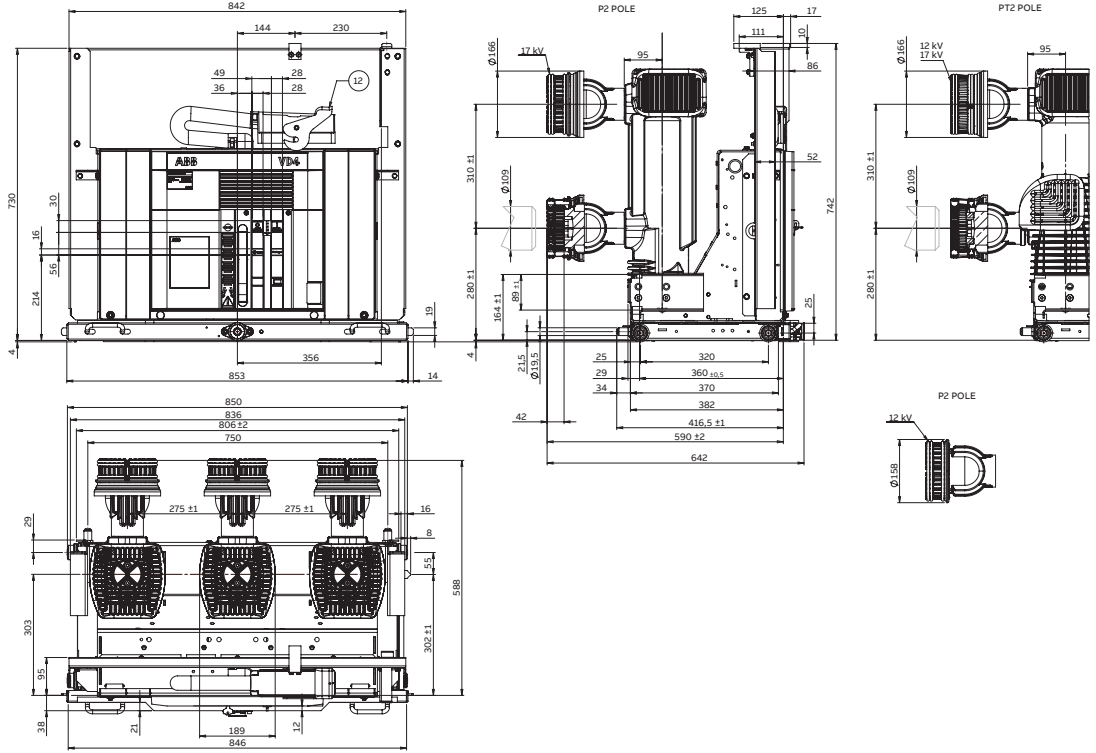


Withdrawable circuit-breakers for PowerCube PB3 modules

| | |
|--------------|--|
| VD4/W | |
| TN | 1VCD000152 |
| Ur | 12 kV 17.5 kV |
| Ir | 3150 A 4000 A ^(*) 25 kA |
| Isc | 31.5 kA 40 kA |

(*) with forced ventilation

VD4 with PT pole would be offered currently, dimensions of VD4 with P pole is for reference only.

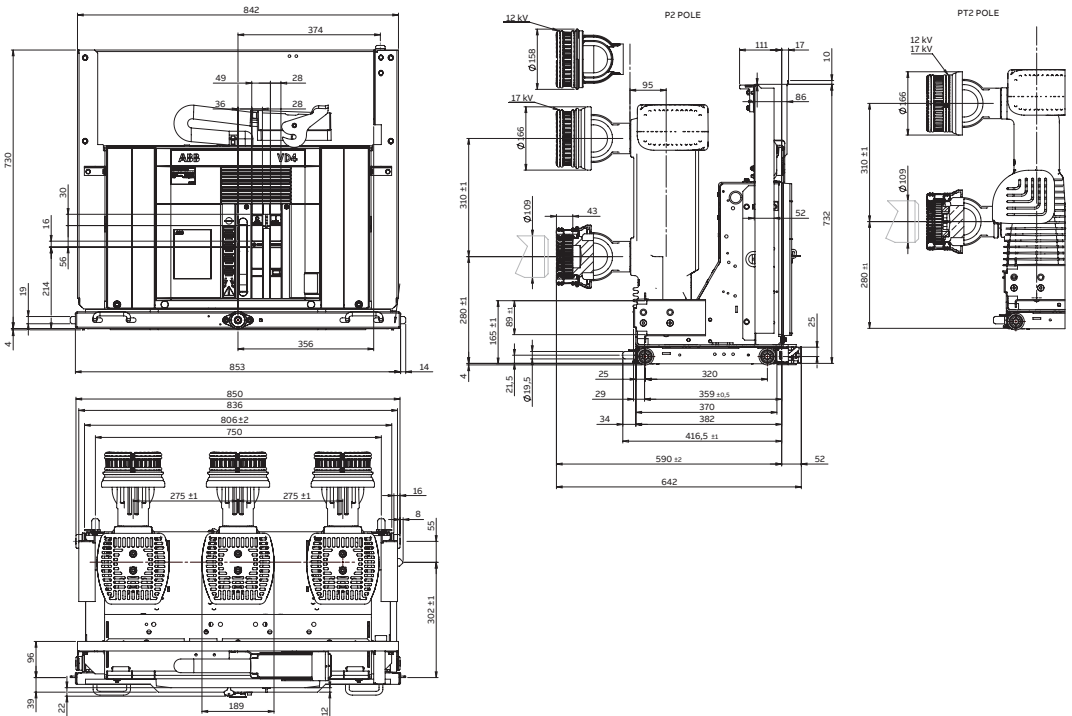


Withdrawable circuit-breakers for UniGear ZS1 switchgear

| | |
|--------------|--|
| VD4/P | |
| TN | 1VCD000153 |
| Ur | 12 kV 17.5 kV |
| Ir | 3150 A 4000 A ^(*) 40 kA |

(*) with forced ventilation

VD4 with PT pole would be offered currently, dimensions of VD4 with P pole is for reference only.



13. Electrical circuit diagram

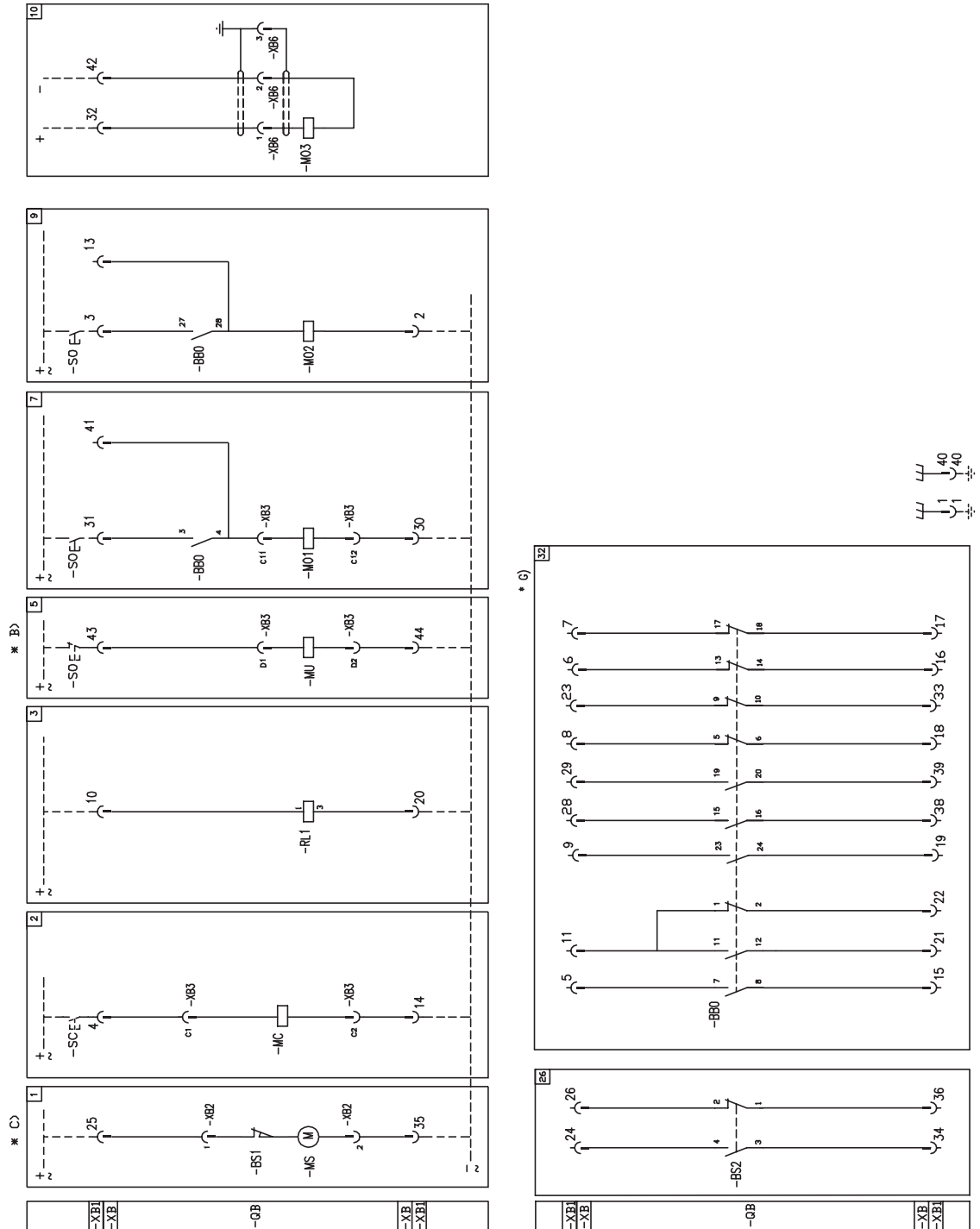
The standard VD4 circuit breaker electric circuit diagrams are as follows:

Free standing version
5NC-5NO: 1YHD000000A1946

Withdrawable version
5NC-5NO: 1YHD000000A1858

Each circuit breaker is always provided with the standard electric diagram or with a specific diagram in the case of a circuit breaker with nonstandard cabling.

Diagrams for fixed circuit breaker 5NO-5NC



13. Electrical circuit diagram

State of operation shown

The diagram indicates the following conditions:

- Circuit-breaker open and racked-in
- Circuits de-energized
- Closing springs discharged

Caption

| | |
|-----------|--|
| □ | =Number of diagram figure |
| * | =See note indicated by the letter |
| -QB | =Circuit-breaker applications |
| -MS | =Closing spring charging motor (see note C) |
| -BB0 | =Circuit-breaker auxiliary contacts |
| -BS1 | =Spring charging motor limit contact |
| -BS2 | =Contact for signalling closing springs charged/discharged |
| -SC | =Pushbutton or contact for circuit-breaker closing |
| -SO | =Pushbutton or contact for circuit-breaker opening |
| -XB | =Connector of the circuit-breaker circuits |
| -XB2...11 | =Application connectors |
| -XB1 | =Terminal box in the switchgear (outside the circuit breaker) |
| -RL1 | =Locking magnet. When de-energised it mechanically prevents circuit-breaker closing. |
| -MC | =Shunt closing release |
| -MO1 | =First shunt opening release |
| -MO2 | =Second shunt opening release |
| -MO3 | =Opening solenoid for release outside the circuit-breaker |
| -MU | =Under-voltage release (see note B) |

Description of figures

| | |
|---------|---|
| Fig. 1 | =Closing spring charging motor circuit (see note C) |
| Fig. 2 | =Shunt closing release (anti-pumping is carried out mechanically) |
| Fig. 3 | =Locking magnet. When de-energised it mechanically prevents circuit-breaker closing |
| Fig. 5 | =Instantaneous undervoltage release (see note B) |
| Fig. 7 | =First shunt opening release circuit with possibility of continuous control of the winding |
| Fig. 9 | =Second shunt opening release circuit with possibility of continuous control of the winding |
| Fig. 10 | =Opening solenoid for release outside the circuit breaker |
| Fig. 26 | =Electrical signalling for closing spring |

charged and discharged

Fig. 32 =Available circuit-breaker auxiliary contacts

Standard configuration

| | | |
|---------|------|---|
| Fig. 1 | -MS | Closing spring charging motor |
| Fig. 2 | -MC | Shunt closing release |
| Fig. 7 | -MO1 | First shunt opening release |
| Fig. 26 | -BS2 | Contact for signalling closing springs charged/discharged |
| Fig. 32 | -BB0 | Circuit-breaker auxiliary contacts |

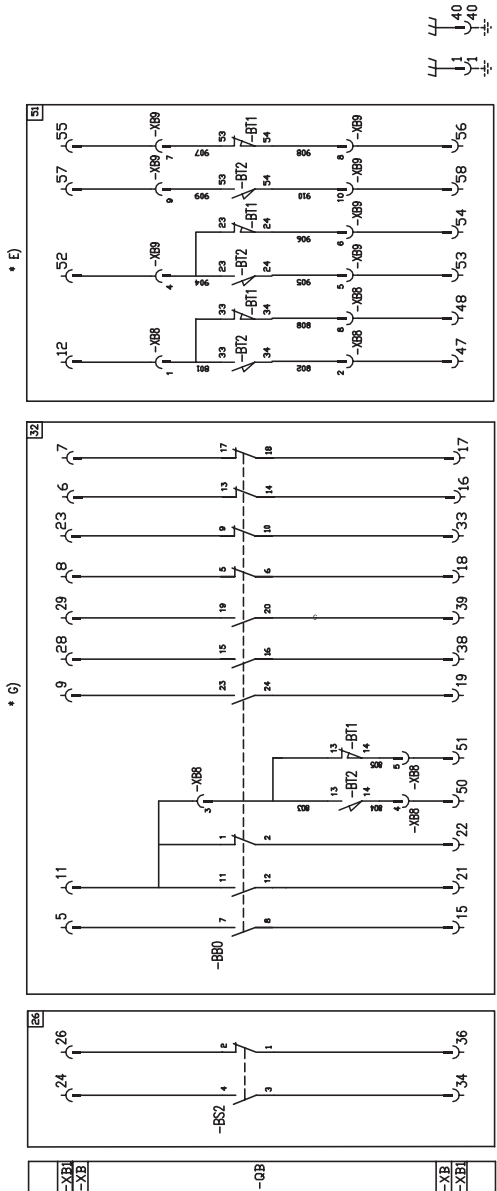
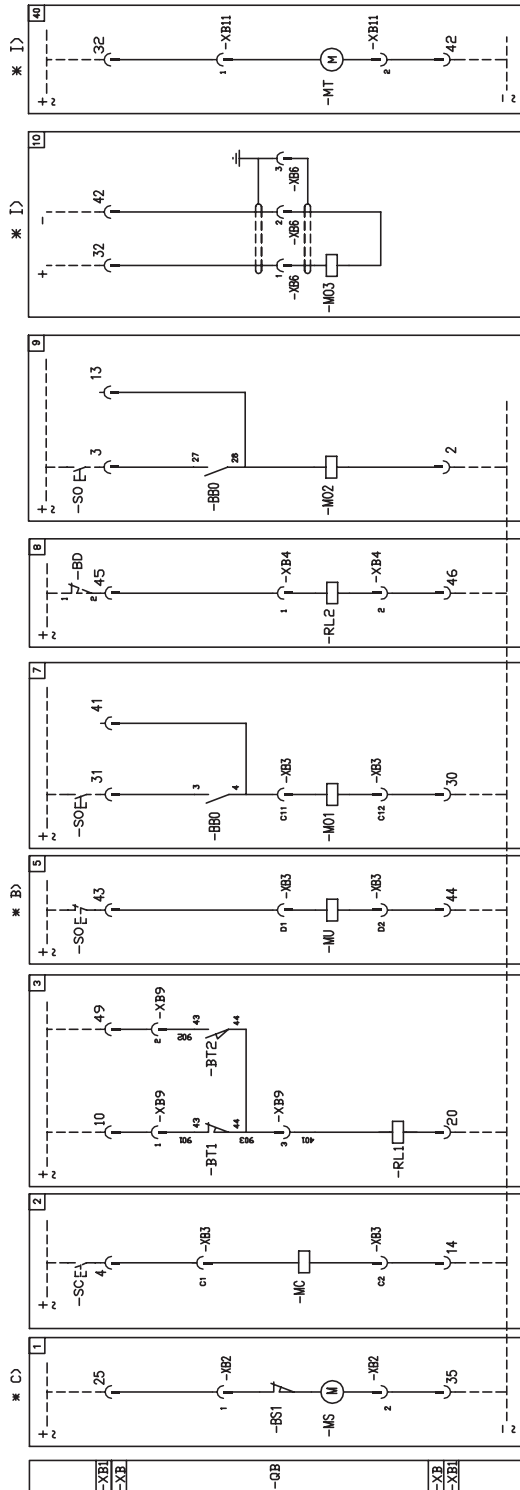
Optional configuration

| | | |
|---------|------|--|
| Fig. 3 | -RL1 | Locking magnet |
| Fig. 5 | -MU | Under-voltage release |
| Fig. 9 | -MO2 | Second shunt opening release |
| Fig. 10 | -MO3 | Opening solenoid for release outside the circuit-breaker |

Notes

- A) The circuit-breaker is only fitted with the accessories specified in the order confirmation. To make out the order, please consult the catalogue of the apparatus. In any case, considering the possibility of different configuration of the circuit breaker, or the circuit breaker itself might be updated, the actual control circuit might be updated.
- B) The undervoltage release can be supplied for power supply with voltage branched on the supply side of the circuit-breaker or from an independent source. Circuit-breaker closing is only allowed with the release energised (the lock on closing is made mechanically). Should there be the same power supply for the shunt closing and undervoltage releases and automatic circuit-breaker closing on return of the auxiliary voltage is required, it is necessary to introduce a delay of 50 ms between the moment of undervoltage release consent and energisation of the shunt closing release.
- C) Check the power available in the auxiliary circuit to verify the possibility of starting several motors at the same time to recharge the closing springs. To prevent excessive absorption, the springs must be charged manually before energising the auxiliary circuit.
- G) 10 auxiliary switch in total (5NO 5NC) is supplied as standard. To extend auxiliary contacts, please contact with ABB.

Diagrams for withdrawable circuit breaker 5NO-5NC



13. Electrical circuit diagram

State of operation shown

The diagram indicates the following conditions:

- Circuit-breaker open and racked-in
- Circuits de-energized
- Closing springs discharged

Description of figures

- Fig. 1 =Closing spring charging motor circuit (see note C)
- Fig. 2 =Shunt closing release (anti-pumping is carried out mechanically)
- Fig. 3 =Locking magnet. When de-energised it mechanically prevents circuit-breaker closing
- Fig. 5 =Instantaneous undervoltage release (see note B)
- Fig. 7 =First shunt opening release circuit with possibility of continuous control of the winding
- Fig. 9 =Second shunt opening release circuit with possibility of continuous control of the winding
- Fig. 10 =Opening solenoid for release outside the circuit breaker
- Fig. 26 =Electrical signalling for closing spring charged and discharged
- Fig. 40 =Electric drive circuit for truck.(see note I)
- Fig. 32 =Available circuit-breaker auxiliary contacts
- Fig. 51 =Contacts for electrical signalling of circuit breaker in the racked-in and isolated positions, located on the circuit-breaker

Standard configuration

- Fig. 1 -MS Closing spring charging motor
- Fig. 2 -MC Shunt closing release
- Fig. 3 -RL1 Locking magnet
- Fig. 7 -MO1 First shunt opening release
- Fig. 26 -BS2 Contact for signalling closing springs charged/discharged
- Fig. 32 -BB0 Circuit-breaker auxiliary contacts
- Fig. 51 -BT1, -BT2
Contacts for signaling circuit breaker's position, racked-in or racked-out

Caption

- =Number of diagram figure
- * =See note indicated by the letter

- QB =Circuit-breaker applications
- MS =Closing spring charging motor (see note C)
- MT =Truck driving motor (see note I)
- BB0 =Circuit-breaker auxiliary contacts
- BS1 =Spring charging motor limit contact
- BS2 =Contact for signalling closing springs charged/discharged
- BD =Position contact of the enclosure door
- BT2 =Contacts for electrical signalling of circuit-breaker in isolated position (see note E)
- BT1 =Contacts for electrical signalling of circuit-breaker in racked-in position (see note E)
- SC =Pushbutton or contact for circuit-breaker closing
- SO =Pushbutton or contact for circuit-breaker opening
- XB =Connector of the circuit-breaker circuits
- XB2...11 =Application connectors
- XB1 =Terminal box in the switchgear (outside the circuit breaker)
- RL1 =Locking magnet. When de-energised it mechanically prevents circuit-breaker closing
- RL2 =Locking magnet. When de-energised it mechanically prevents circuit-breaker connection and isolation
- MC =Shunt closing release
- MO1 =First shunt opening release
- MO2 =Second shunt opening release
- MO3 =Opening solenoid for release outside the circuit-breaker
- MU =Under-voltage release (see note B)

Incompatibility

The circuits indicated by the following figures cannot be supplied at the same time in the same circuit-breaker:10 - 40.

Optional configuration



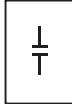


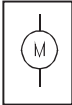
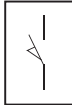
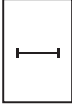



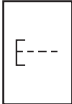
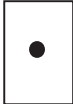

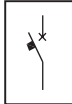
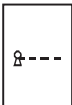
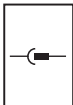

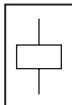

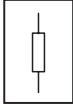
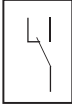
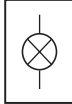
- Fig. 5 -MU Under-voltage release
- Fig. 8 -RL2 Locking magnet for rack-in/out operation
- Fig. 9 -MO2 Second shunt opening release
- Fig. 10 -MO3 Opening solenoid for release outside the circuit-breaker
- Fig. 40 -MT Truck driving motor

Notes

- A) The circuit-breaker is only fitted with the accessories specified in the order confirmation. To make out the order, please consult the catalogue of the apparatus. In any case, considering the possibility of different configuration of the circuit breaker, or the circuit breaker itself might be updated, the actual control circuit might be updated.
- B) The undervoltage release can be supplied for power supply with voltage branched on the supply side of the circuit-breaker or from an independent source. Circuit-breaker closing is only allowed with the release energised (the lock on closing is made mechanically). Should there be the same power supply for the shunt closing and undervoltage releases and automatic circuitbreaker closing on return of the auxiliary voltage is required, it is necessary to introduce a delay of 50 ms between the moment of undervoltage release consent and energisation of the shunt closing release.
- C) Check the power available in the auxiliary circuit to verify the possibility of starting several motors at the same time to recharge the closing springs. To prevent excessive absorption, the springs must be charged manually before energising the auxiliary circuit.
- E) The contacts for electrical signalling of circuitbreaker in the racked-in and isolated position (- BT1 and -BT2) shown in figs. 51 are located on the circuit-breaker (moving part).
- G) 10 auxiliary switch in total (5NO 5NC) is supplied as standard. To extend auxiliary contacts, please contact with ABB.
- I) Fig. 10 and Fig. 40 can not be chosen simultaneously, that is, truck driving motor -MT and Opening solenoid -MO3 should not be chosen at the same time.

13. Electrical circuit diagram

Graphical symbols for electrical diagrams (IEC 60617 standard)

| | | | | | | | |
|---|------------------------|---|---|--|--|---|---|
|  | 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) |
|  | 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) |

14. Product quality and environmental protection

The apparatus are produced in compliance with the requirements of international standards for the quality management system and environmental management system. In these fields, the excellent level is proved by quality certificates according to ISO 9001 and by the EMS according to ISO 14001.

End of life of product

The ABB company is committed to complying with the relevant legal and other requirements for environment protection according to the ISO 14001 standard.

The duty of company is to facilitate subsequent recycling or disposal at the end of product life. During disposal of the product, it is always necessary to act in accordance with local legal requirements in force.

Methods of disposal

Disposal can either be carried out thermally in an incineration plant or by storing on a waste site.

| Raw material | Recommended method of disposal |
|--|---|
| Metal material (Fe, Cu, Al, Ag, Zn, W, others) | Separation and recycling |
| Thermoplasts | Recycling or disposal |
| Epoxy resin | Separation of metal material and the disposal of rest |
| Rubber | Disposal |
| Oil as dielectric (transformer oil) | Draining from equipment and further recycling or disposal |
| Packing material – wood | Recycling or disposal |



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