

TECHNICAL SPECIFICATION

# 15kV VD4 Medium Voltage Indoor Vacuum Circuit Breaker

CID

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PREPARED 2022-10-18	Michael Christian	STATUS Approved	SECURITY LEVEL Public		
APPROVED 2022-10-18	Michael Christian	DOCUMENT KIND Neutral Technical Specification			
OWNING ORGANIZATION ABB	DOCUMENT ID. MV Indoor Products Circuit Breaker VD4 15kV IEEE 2022-1018	REV. A	LANG. en	PAGE 1/9	

# PART 1-GENERAL

## 1.1. Scope of supply

This specification describes the medium voltage vacuum circuit breaker for indoor application. Vacuum circuit breakers are used in both primary and secondary distribution switchgear to switch medium voltage powerlines, motors, transformers, capacitor banks, energy generation and storage systems.

## 1.2. Related Standards

The following standards shall apply:

1. C37.04- Ratings and Requirements for AC High Voltage Circuit Breakers with Rated Maximum Voltage Above 1000 V
2. C37.09- IEEE Standard Test Procedures for AC High-Voltage Circuit Breakers with Rated Maximum Voltage Above 1000 V
3. C37.54-2002 For Indoor Alternating Current High-Voltage Circuit Breakers Applied as Removable Elements in Metal-Enclosed Switchgear Conformance Test Procedures
4. C37.55-2020 - Medium-Voltage Metal-Clad Switchgear Assemblies - Conformance Test Procedures
5. C37.20.2-2015 IEEE Standard for Metal-Clad Switchgear - Annex C for Partial Discharge testing
6. UL: 1008A Out-of-phase switching compliance in accordance with IEEE C37.09

## 1.3. Submittals of documents

The following circuit breaker documentation shall be available on request:

- Technical catalogue.
- Instruction manual.
- Electrical schematic.
- Dimensional drawings:
  - 2D (PDF and DXF)
  - 3D (Step format)
- Datasheet.
- Spare part list.
- Spare parts or kits assembly/replacement instruction whenever the activity can be performed without Vendor intervention.

Vendor is entitled to require a non-disclosure agreement before releasing documents or drawings which can be considered sensitive and/or confidential information.

## 1.4. Quality Assurance

The circuit breakers shall be fully type-tested according to C37.09.  
Declaration of conformity shall be submitted by the vendor.

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Test certificates, as the evidence of successful completion of type tests shall be submitted on request by the vendor.

### 1.4.1. Type tests

The circuit-breakers shall comply to IEEE C37.09, C37.54; these are the mandatory type tests:

- Temperature-rise
- Withstand insulation at industrial frequency and impulse
- Short-time and peak withstand current
- Mechanical endurance test (open-close of circuit breaker)
- Mechanical endurance test (racking in enclosure, for drawout and roll-on-floor versions)
- Making and breaking of short-circuit currents
- Capacitive current switching test (cable-charging or B2B capacitor switching)

The following not mandatory type tests are also required even if not mandatory:

- C37.20.2-2015 Annex C for Partial Discharge testing
- Class M2, 10,000 extended mechanical endurance

### 1.4.2. Routine tests

Routine tests must be carried out according to C37.09 requirements and routine test report shall be available, on request, for each circuit breaker.

The circuit-breakers must satisfactorily undergo the following routine tests:

- Design and visual check
- Open/close operation test (5 O/C operations at rated supply voltage, 5 O/C operations at max. supply voltage, 5 O/C operations at min. supply voltage)
- Power frequency withstand voltage test of the main circuits
- Power frequency withstand voltage test of the auxiliary and control circuits
- Measurement of the main circuit resistance (Voltage drop test with 200 A d.c.)
- Contact speed test (closing and opening speeds, contact simultaneity)
- Operating time (closing and opening time at rated supply voltage / max. supply voltage / min. supply voltage).

All vacuum interrupters will undergo production conditioning, leakage testing with X-ray inspection for quality assurance prior to installation in the circuit breaker.

### 1.4.3. Factory certification

Circuit breaker manufacturing facility shall be certified by external independent organizations according:

- Quality System:  
ISO 9001 Standards
- Environmental Management System:  
ISO 14001 Standards
- Health and Safety Management System:  
OHSAS 18001 Standards, which also applies to our building site activities

Certificates shall be submitted on request by the Vendor.

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## 1.5. Delivery, Storage and Handling

All indication to properly handle and storage of the product shall be included in the relevant instruction manual

## 1.6. Warranty

Vendor should warrant that the material will be free from defects in design, material and workmanship for [12] months from the date of commissioning or [18] months max from notification of readiness for shipment, whichever expires earlier.

# PART 2-PRODUCT

## 2.1. Technical Data Requirement

### 2.1.1. Data Requirement

1. Interrupting class: **31.5, 40** kA
  - a. Maximum design voltage (V): 15 kV
  - b. Voltage class 17kV
  - c. Impulse withstand voltage: **95kV**
  - d. Interrupting current (I) at maximum design voltage: **31.5, 40** kA
  - e. Rated Current **1200A, 2000A,**
  - f. Voltage range factor (K): 1.0
  - g. Short time withstand current: **31.5, 40** kA
  - h. Momentary withstand and closing and latching current: **82, 104** kA peak.
  - i. Rated frequency 50/60Hz
  - j. Short circuit withstand 3 seconds
  - k. Interrupting time <50ms / < 3cycles
  - l. Power frequencies withstand 36kV
  - m. Mechanical endurance class M2
  - n. Maximum permissible tripping delay: 2 seconds
  - o. Capacitive switching C2 1200A Back-to-Back
  - p. Duty Cycle O-CO-15s-CO
  - q. Weight <360lbs

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### 2.1.2. Rated Current

The rated normal current is the rated uninterrupted current defined at 40°C peak ambient temperature. The rated normal currents of the vacuum circuit breaker are 1200A and 2000A. For continuous current derating and overload capability IEEE Std C37.20.2 shall apply for the complete switchgear assembly.

## 2.2. Requirement for application environment

### 2.2.1. Temperature limits and environment

The circuit breaker shall be able to carry out the rated normal current continuously, at its rated frequency and ambient temperature of 40°C peak (35°C average on 24h), with a temperature-rise not exceeding the values stated by IEEE Std C37.20.2.

Rated operational temperature: -25 °C ... +40 °C peak (35°C average on 24h)

The circuit breaker shall be suitable, if required, for application:

At low temperature down to -30°C tested according to IEEE Std for complete switchgear

At high temperature up to 55°C for 16 hours for draw out (withdrawable) units; ambient temperature around the switchgear (considering 15°C as delta temperature from ambient temperature around the switchgear and the temperature in circuit breaker compartment close to the electronic parts).

**Altitude:**

The insulation inside to the vacuum interrupter is not subjected to deratings (guaranteed by the vacuum). The insulating property of external housing is affected by altitude as insulating and thermal dissipation capability of air decreases as the altitude increases.

Circuit breakers shall be suitable for high altitude installation with following constraints:

For installation over 3300 ft (1000m) above sea level:

Apply the proper correction coefficient in accordance with the C37.20.2 for rated voltage, current carrying and impulse lightning voltage derating. No correction coefficient shall be required from power frequency withstand voltage perspective.

### 2.2.2. Environmental protection

The circuit breaker shall be manufactured in compliance with the ISO 14001 STDs (Guidelines for Environmental Management System).

Recycling information for end-of-life product dismiss shall be available within instruction manual.

REACH declaration shall be available

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## 2.3. Product Features

The circuit breaker shall use vacuum quenching technology. Vacuum circuit breaker shall have 3 single standalone poles to improve partial discharge behavior and each vacuum interrupter shall be assembled in a single encapsulated pole with a spring charged pushrod assembly. Vacuum interrupters, which make up the primary circuit breaking part, shall be a sealed pressure system.

A. The circuit breakers shall be horizontal drawout type, capable of being rolled directly onto the floor. The breakers shall be operated by a motor-charged stored energy spring mechanism, charging of the circuit breaker is normally performed by an electric motor and in an emergency by a manual charging handle.

B. The primary disconnecting contact and exposed copper shall be silver-plated copper.

C. Each circuit breaker shall contain three vacuum interrupters separately mounted in a self-contained, removable self-aligning pole unit. The vacuum interrupter pole unit shall be mounted inside encapsulated epoxy poles. No adjustment of breaker mechanism or measurement of contact wear gap indicator will be required for maintenance of the breaker.

D. The breaker front panel shall be removable when the breaker is withdrawn for ease of inspection and maintenance.

E. The secondary contacts shall be silver-plated and shall automatically engage in the breaker Test position. The secondary connections to the breaker will remain during the racking of the breaker between the Test and Connected or service positions.

F. Interlocks shall be provided to prevent the closing of a breaker between disconnect, test, and connected positions. Also interlocks to trip breakers upon insertion or removal from switchgear and to force a discharge of the stored energy mechanisms upon insertion or removal of withdrawable units from the switchgear.

G. The breaker shall be secured positively in the switchgear between each racking position Test and Connect.

H. Provide capability for manual racking of the breaker to and from the Test and Connected positions with the door closed.

I. The breakers shall be electrically operated by the following nominal voltages:

- Control voltages: 24, 48, 125, 250 VDC - 120, 240 VAC
- Close voltages: 24, 48, 125, 250 VDC - 120, 240 VAC
- Trip voltages: 24, 48, 125, 250 VDC, - 120, 240 VAC

J. Each breaker will provide green and red mechanical indicators for close and open conditions. Each breaker will have a visual mechanical indicator and dry output contact to indicate if the breaker is charged or discharged status.

K. Each circuit breaker shall be provided with an integrated racking assembly with the following features:

1. Allow moving the breaker between the test, connect, positions with the breaker compartment door closed.
2. Breaker position shall be indicated via dry output contacts.

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3. The system shall be designed such that it allows manual racking of the circuit breaker using the manual racking handle with less than 25Nm of torque.

L. The encapsulated pole assemblies will be constructed of thermoplastic recyclable materials.

**MOC Contacts:**

**Auxiliary contacts**

The breaker’s main operating shaft shall directly drive the MOC or auxiliary contacts. The contacts shall be labeled according to UL standards and have a protection class of IP20. The contacts will be rotary wiping type with a maximum rated current of 10A

**Open/Close Indicator**

A mechanical signaling device for circuit breaker open/closed shall be available and visible from the front of the circuit breaker.

**Counter:**

A mechanical impulse operation counter shall be provided as standard

**The rejection or Interface plates**

An interface plate will allow the interface of the circuit breaker with the same or lower-rated compartment shall be available. This plate shall be fixed in the breaker compartment and interact with the rejection pins on the circuit breaker bottom to guarantee correspondence of rating.

Other features

**Mechanical interchangeability:**

The wiring and mounting position of the circuit breaker base to the panel shall be identical for all 15kV class 1200A, and 2000A units.

**Interlocking features (draw out)**

To ensure proper operation and to prevent dangerous situations and incorrect operation, the following series of interlocks shall be provided to protect the operators and the switchgear itself:

- one mechanical interlock shall prevent rack-in / rack-out of the circuit breaker with the circuit breaker closed
- one electrical interlock shall prevent the closing of the circuit breaker during the translation
- one mechanical interlock shall prevent rack-in / rack-out of the circuit breaker if VI contacts are welded
- one interlocking self-aligning auxiliary circuit plug preventing disconnection of auxiliary circuit plug during racking of the circuit breaker between Test and Connected positions (located in breaker compartment)
- one interlock shall prevent racking-in of the circuit breaker in a panel with a different rated normal current

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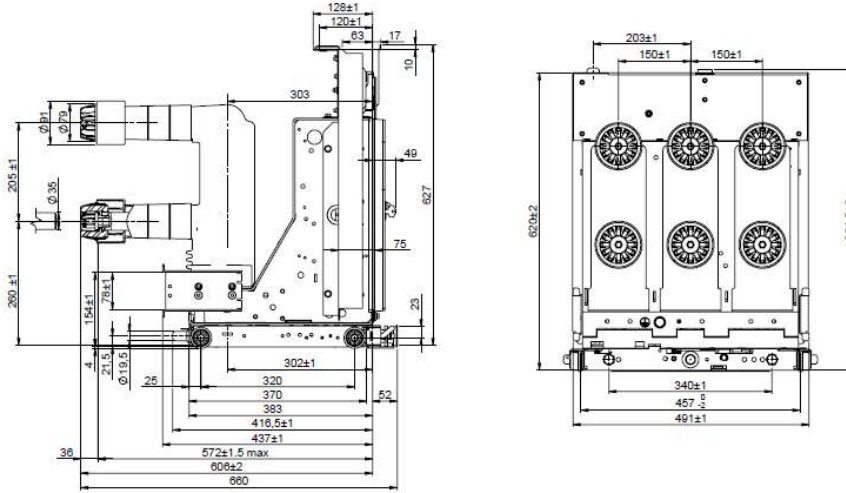
# PART 3-EXECUTION

## 3.1. Installation

Please refer to Installation and service instructions manual 647654/001 – MB.

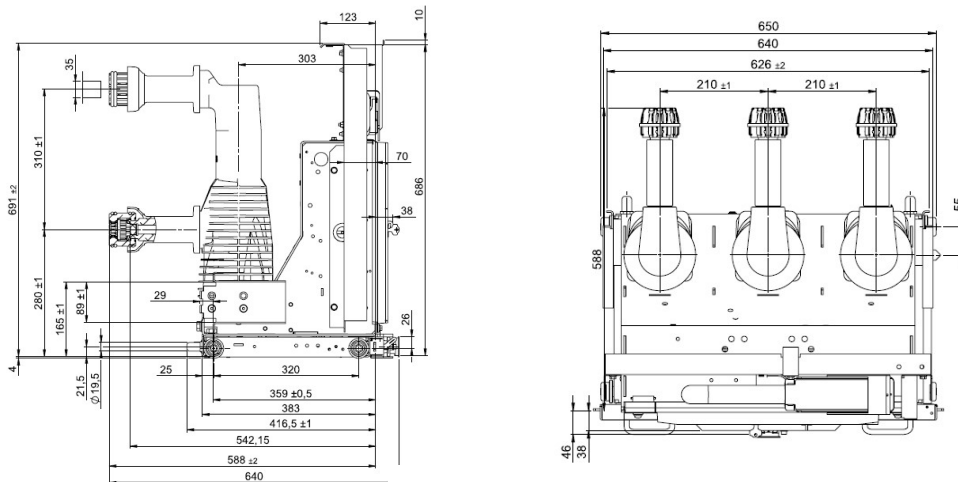
### 3.1.1. Dimensions

For VD4 15kV 31.5kA 1200A the primary buss spacing, and connections will comply with a phase-to-phase distance of 150mm and upper to lower spacing of 205mm. The withdrawable version will be compatible for Powercube PB1 enclosure integration



For VD4 15kV 31.5kA 1200A, VD4 15kV 40kA 1200A, and VD4 15kV 40kA 2000A the primary buss spacing, and connections will comply with a phase-to-phase distance of 210mm and upper to lower spacing of 310mm. The withdrawable version will be compatible for Powercube PB2 enclosure integration

**PT2 POLE**



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## 3.2. Training

Contractor, on request, shall be able to provide a quotation for a proper training for the product to the End-User/Client. These training will not cover service activities reserved to the manufacturer service department.

Training schedule/agenda shall be submitted for approval in (15) days prior to delivery date.

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