

**MRVS1-12/24 Series**  
Indoor HV Vacuum Circuit Breaker



Installation and Operation Manual



MINGRI ELECTRIC CO., LTD.

Address: No. 288, 16th Wei Road, Economic Development Zone, Yueqing City, Wenzhou City,  
Zhejiang Province, China

Tel: +86-0577-61679669

E-mail: [mr@mingrielec.com](mailto:mr@mingrielec.com)

Http: [www.mingrielec.com](http://www.mingrielec.com)



## BRIEF INTRODUCTION

www.mingriele.com

Mingri Electric Co., Ltd. specializes in R&D and manufacturing of high - voltage vacuum circuit breakers, load switches and disconnectors. With years of experience, we are one of the leading domestic manufacturers in this industry.

Our product range includes indoor vacuum circuit breakers, vacuum load switches, gas-insulated load switches, disconnectors, earthing switches, arresters, bushings, sensors and supporting accessories. Our products are sold nationwide and exported to Southeast Asia, North America and other regions, and well recognized by customers.

We have obtained ISO9000, AA-level standardized good behavior and CQC certifications.

Focused on talents and product quality, we own experienced technical teams, advanced production and testing equipment. We deliver high-quality products and reliable after-sales service. We serve famous domestic enterprises and act as OEM partners for global brands, selling products both in China and overseas.

Our Mission: We pursue maximum customer satisfaction by superior quality and service. Adhering to the spirit of Pragmatism, Innovation, Unity and Enterprise, we grow our brand from China to the world with technology and quality.



## PRODUCT CATALOG

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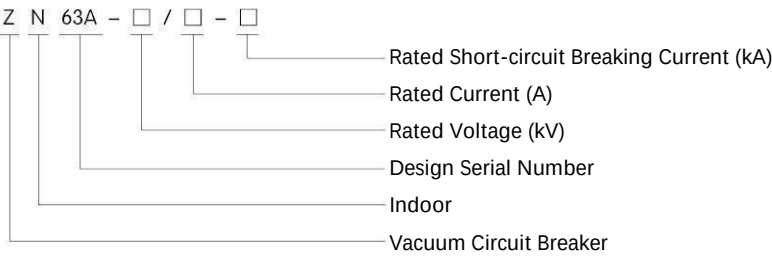
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1. General Description

MRVS1-12/24 indoor high-voltage vacuum circuit breaker is indoor switchgear for 12-24kV power systems. It protects and controls power grid and industrial facilities. With excellent vacuum performance, it suits frequent operation and repeated short-circuit breaking.

It features integrated operating mechanism & breaker body. Available in fixed type or truck type with dedicated withdrawal mechanism.

2. Model Designation and Description



3. Service Environmental Conditions

3.1 Normal Service Conditions

- Ambient temperature: Max +40℃, Min -15℃
- Ambient humidity: Daily average relative humidity ≤95%, monthly average relative humidity ≤90%,  
Daily average vapour pressure ≤2.2 ×10<sup>-3</sup> MPa, monthly average vapour pressure ≤1.8 ×10<sup>-3</sup> MPa
- Altitude: ≤2000 m
- Seismic intensity: ≤Grade 8
- The site shall be free of dripping water, flammable/explosive hazards, corrosive gases and severe vibration.

3.2 Special Service Conditions

- For special service conditions, the manufacturer and user shall negotiate and reach an agreement for customized design and supply.
- Special service conditions refer to:
  - ① Sites with altitude over 2000m
  - ② Locations with high humidity or risk of condensation under sharp humidity fluctuation

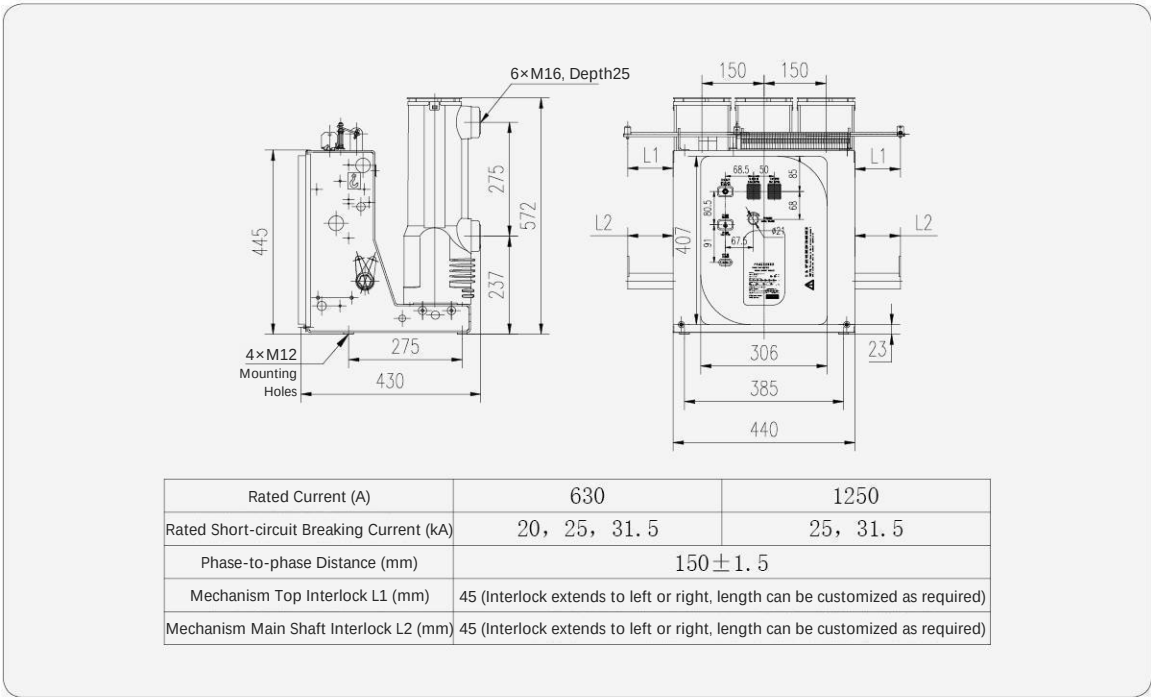
4. Technical Parameters

| No. | Item                                                           |                                                  | Unit  | Parameter                                  |                               |                                 |
|-----|----------------------------------------------------------------|--------------------------------------------------|-------|--------------------------------------------|-------------------------------|---------------------------------|
| 1   | Rated Voltage                                                  |                                                  | kV    | 12                                         | 24                            |                                 |
| 2   | Rated Insulation Level                                         | 1min Power Frequency Withstand Voltage (r.m.s.)  |       | 42                                         | 65                            |                                 |
| 3   |                                                                | Lightning Impulse Withstand Voltage (peak value) |       | 75                                         | 125                           |                                 |
| 4   | Rated Frequency                                                |                                                  | Hz    | 50/60                                      |                               |                                 |
| 5   | Rated Current                                                  |                                                  | A     | 630,1250                                   | 630,1250,1600, 2000,2500,3150 | 1250,1600,2000, 2500,3150,4000* |
| 6   | Rated Short-circuit Breaking Current                           |                                                  | kA    | 20/25                                      | 31.5                          | 40                              |
| 7   | Rated Short-time Withstand Current                             |                                                  |       | 20/25                                      | 31.5                          | 40                              |
| 8   | Rated Short-circuit Duration                                   |                                                  | s     | 4                                          |                               |                                 |
| 9   | Rated Peak Withstand Current                                   |                                                  | kA    | 50/63                                      | 80                            | 100                             |
| 10  | Rated Short-circuit Making Current                             |                                                  |       | 50/63                                      | 80                            | 100                             |
| 11  | Rated Capacitor Bank Breaking Current                          |                                                  | A     | 630                                        |                               |                                 |
| 12  | Number of Rated Short-circuit Breaking Operations              |                                                  | times | 30 (Class E2)                              |                               |                                 |
| 13  | Mechanical Endurance                                           |                                                  |       | ≥ 20000 (Class M2)                         |                               |                                 |
| 14  | Contact Gap                                                    |                                                  | mm    | 9 ± 1                                      | 13 ± 1                        |                                 |
| 15  | Contact Travel                                                 |                                                  |       | 3.5 ± 0.5                                  | 4 ± 1                         |                                 |
| 16  | Average Closing Speed                                          |                                                  | m/s   | 0.6 ± 0.2                                  | 0.8 ± 0.2                     |                                 |
| 17  | Average Opening Speed                                          |                                                  |       | 1.1 ± 0.2                                  | 1.3 ± 0.2                     |                                 |
| 18  | Opening Time (at rated voltage)                                |                                                  | ms    | ≤ 40                                       | ≤ 50                          |                                 |
| 19  | Closing Time (at rated voltage)                                |                                                  |       | ≤ 60                                       | ≤ 75                          |                                 |
| 20  | Contact Closing Bounce Time                                    |                                                  |       | ≤ 2                                        |                               |                                 |
| 21  | 3-phase Closing Asynchronism                                   |                                                  |       | ≤ 2                                        |                               |                                 |
| 22  | Permitted Cumulative Wear Thickness of Moving & Fixed Contacts |                                                  | mm    | 3                                          |                               |                                 |
| 23  | Main Circuit Resistance                                        |                                                  | μ Ω   | ≤ 60(630A)                                 | ≤ 50(1250A)                   | ≤ 35(1600 ~ 4000A)              |
| 24  | Rated Operating Sequence                                       |                                                  |       | O–0.3s–CO–180s–CO; O–180s–CO–180s–CO(40kA) |                               |                                 |

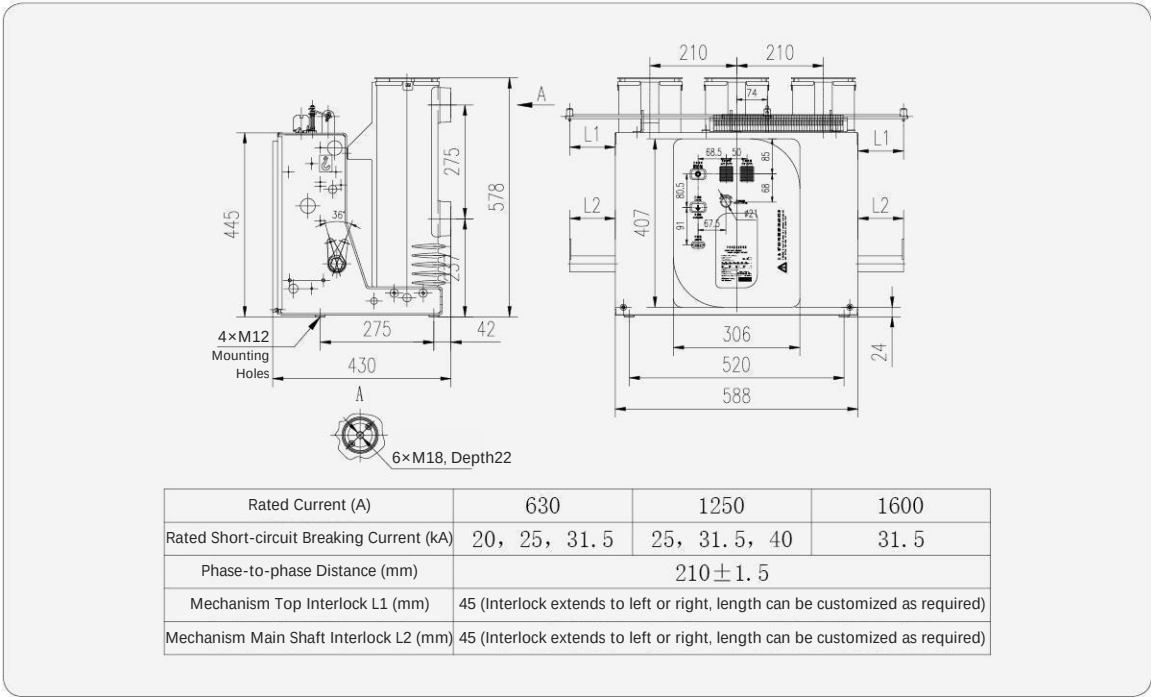
Note: For current above 4000A, forced air cooling is required.

5. Outline And Installation Dimensions

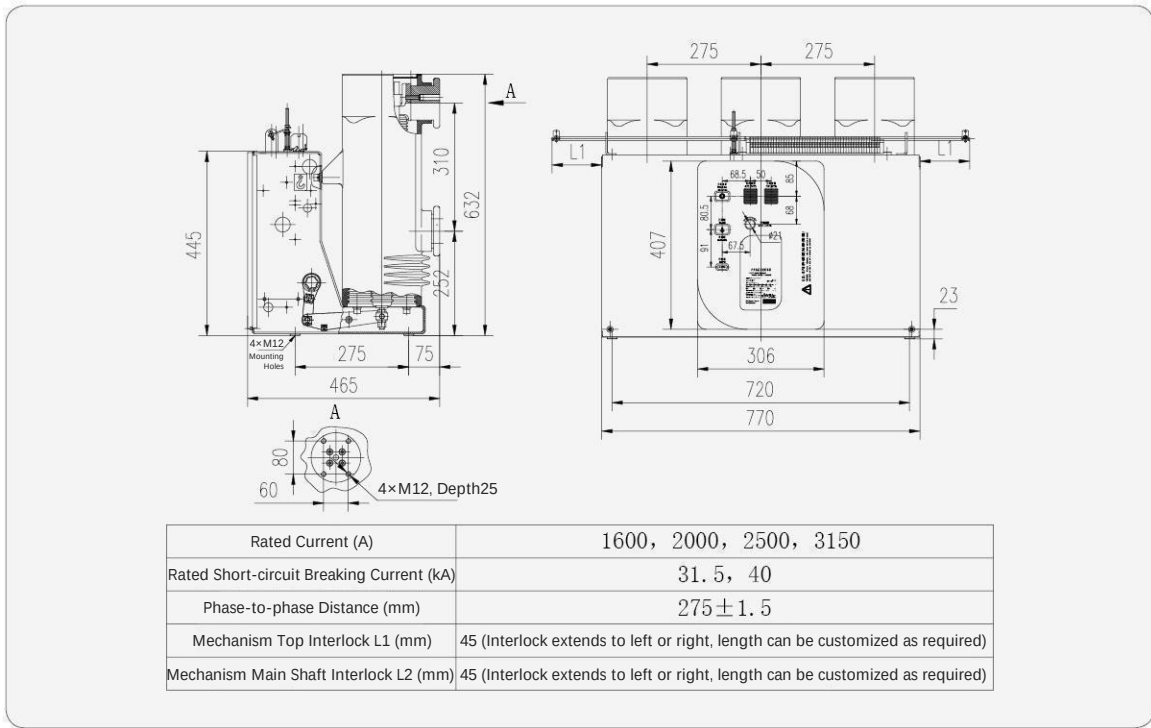
5.1 MRVS1-12 Fixed Circuit Breaker (150mm Phase Spacing) - Outline Dimension Drawing



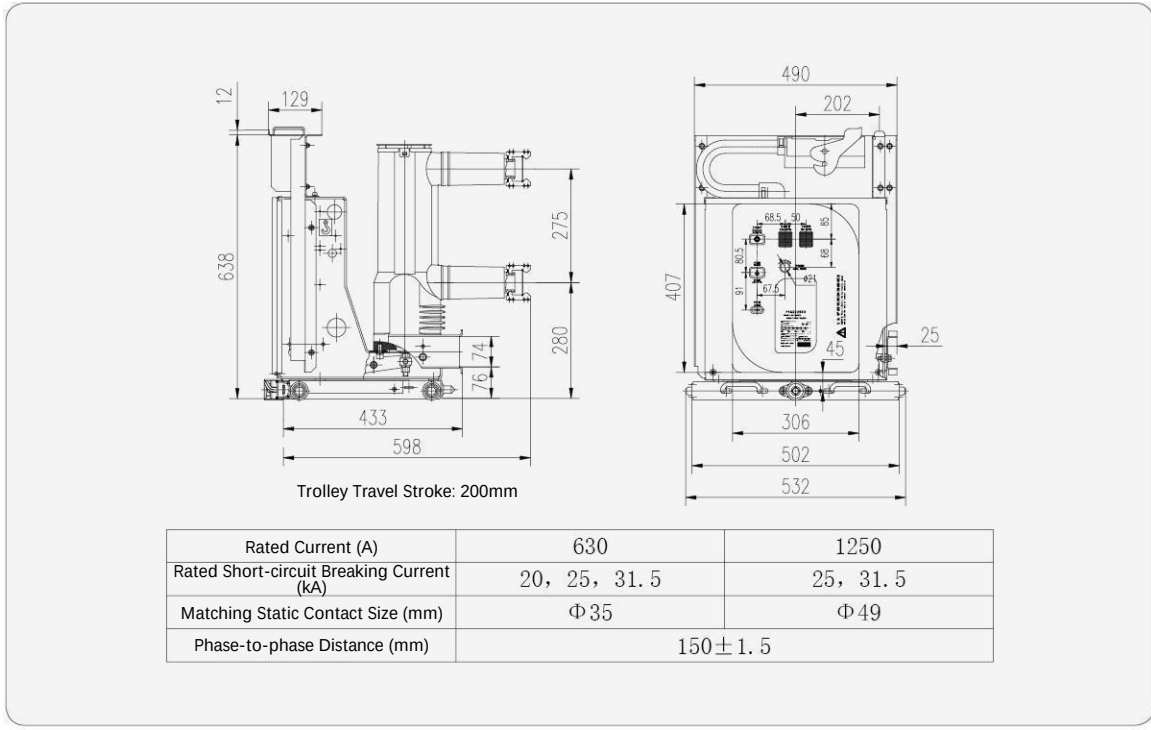
5.2 MRVS1-12 Fixed Circuit Breaker (210mm Phase Spacing) - Outline Dimension Drawing



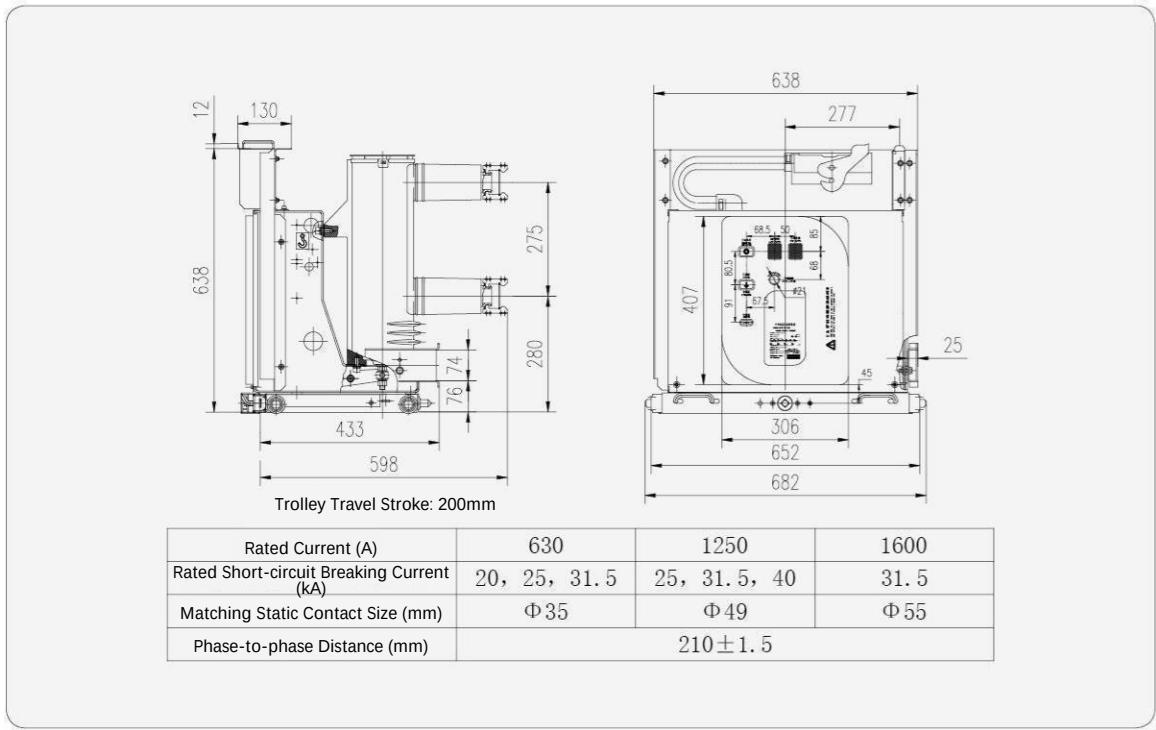
5.3 MRVS1-12 Fixed Circuit Breaker (275mm Phase Spacing) - Outline Dimension Drawing



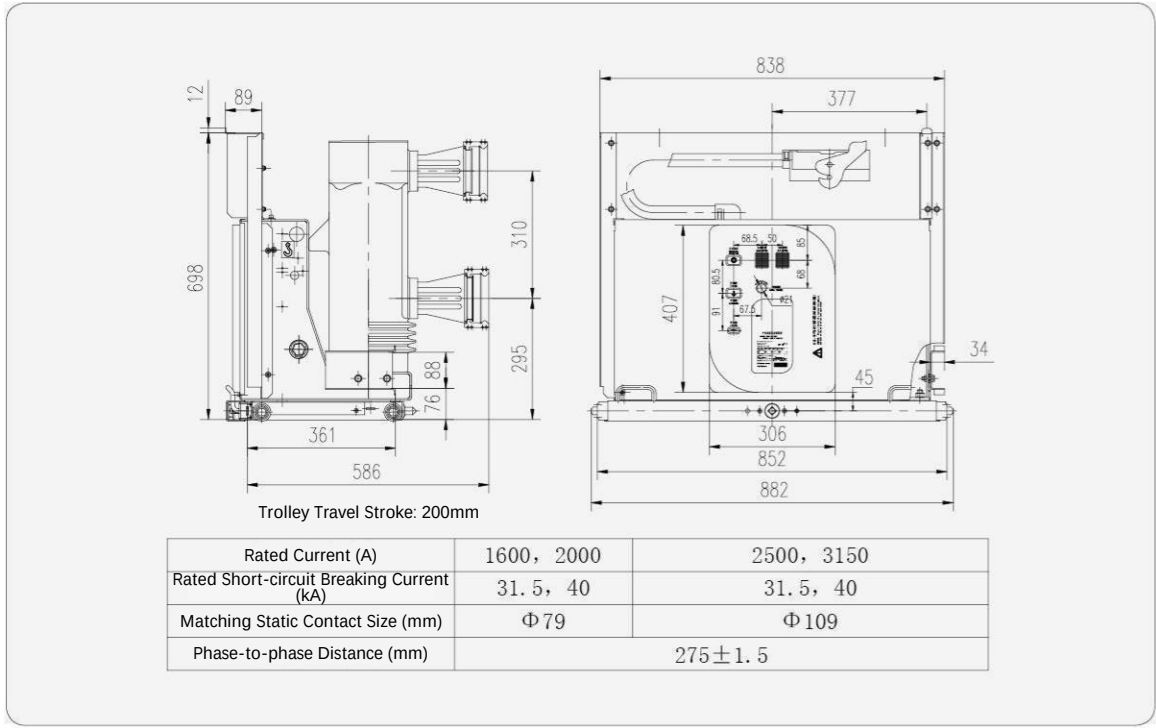
5.4 MRVS1-12 Withdrawable Circuit Breaker (150mm Phase Spacing) - Outline Dimension Drawing



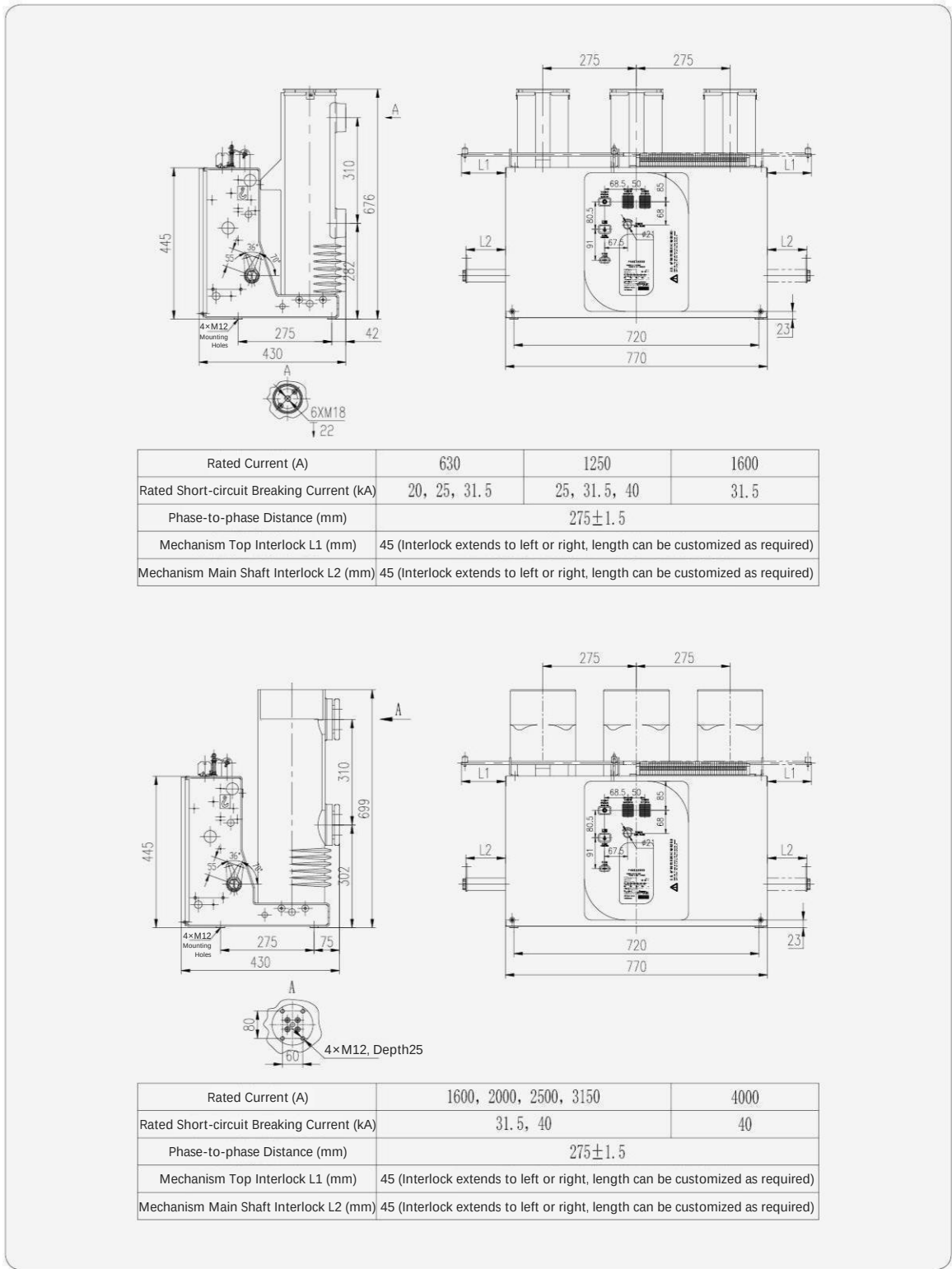
5.5 MRVS1-12 Withdrawable Circuit Breaker (210mm Phase Spacing) - Outline Dimension Drawing



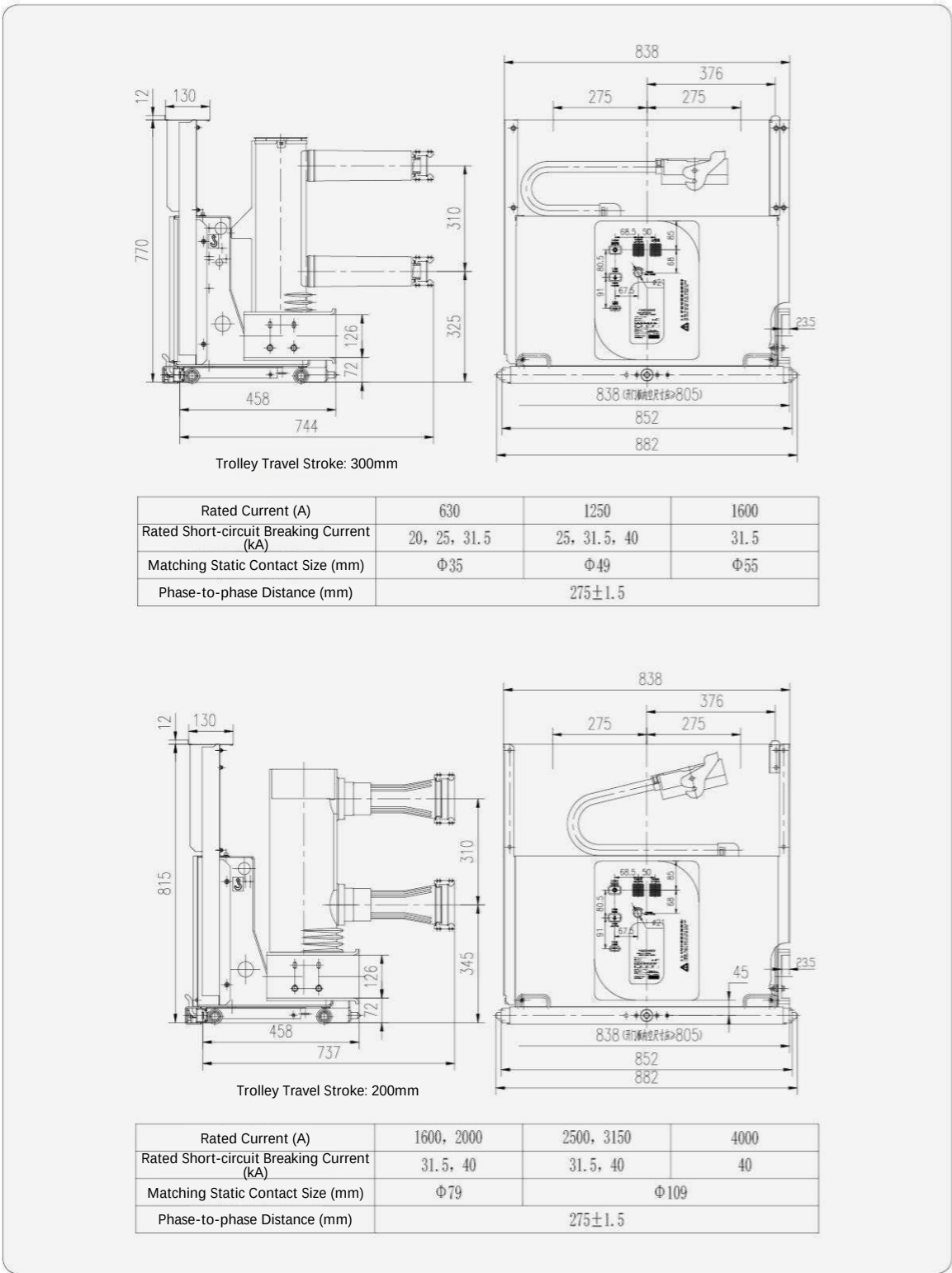
5.6 MRVS1-12 Withdrawable Circuit Breaker (275mm Phase Spacing) - Outline Dimension Drawing



5.7 MRVS1-24 Fixed Circuit Breaker Outline Dimension Drawing



5.7 MRVS1-24 Withdrawable Circuit Breaker Outline Dimension Drawing

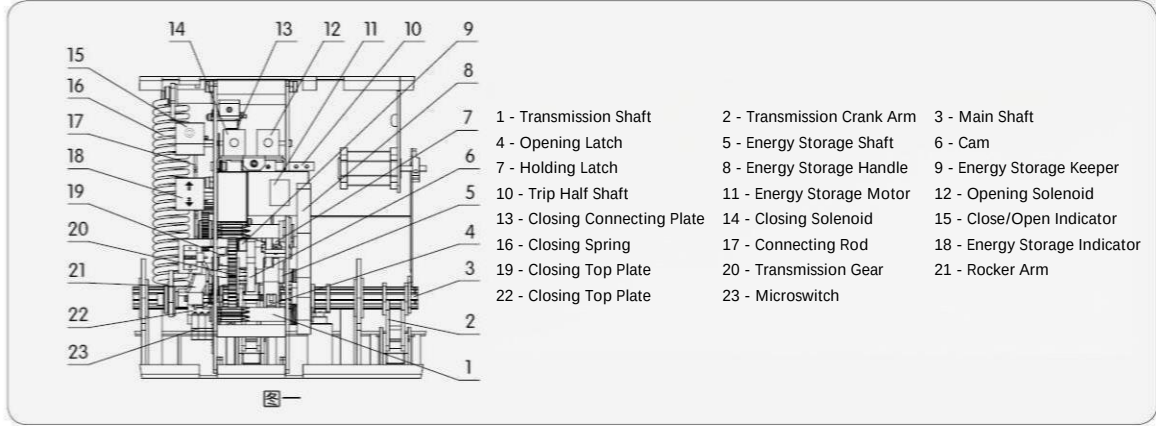


6. Working Principle

6.1 Arc Extinguishing Principle

The MRVS1-12/24 series circuit breakers adopt high-vacuum vacuum interrupters. During normal opening or short-circuit breaking, the operating mechanism separates moving and static contacts and generates an electric arc. The special contact design creates an axial magnetic field to spread the arc evenly over contact surfaces with low arc voltage. When the arc current crosses zero, residual ions, electrons and vapors quickly recombine and condense on contacts and shields. The interrupter gap restores dielectric strength rapidly to extinguish the arc and break the circuit.

6.2 Operating Principle (See Figure 1)



6.2.1 Energy Storage Operation

Activate the energy storage motor (11) or manually operate the energy storage handle (8). The transmission shaft (1) drives gears (20) and rocker arm (21) to stretch the closing spring (16). After energy storage, the holding latch (7) locks the spring. The cam (6) actuates the microswitch (23) to cut off power to the storage motor (11).

6.2.2 Closing Operation

With stored energy, the closing signal energizes the closing solenoid (14) to release the energy storage keeper (9). The closing spring (16) releases energy and rotates the cam (6). The crank arm (2) turns the main shaft (3), driving the link and insulated pull rod upward to complete closing.

6.2.3 Opening Operation

After closing, the opening signal triggers the opening solenoid (12) to trip the trip half shaft (10). Driven by opening spring and contact spring force, the main shaft (3) rotates counterclockwise. The insulated pull rod pulls the vacuum interrupter moving conductive rod downward to finish opening.

6.3 Interlock Functions of Circuit Breaker

The MRVS1-12/24 series circuit breakers are equipped with complete anti-misoperation functions.

The standard electrical closing interlock prevents closing operation when the interlock is not unlocked. (Power rating: 3W, operating voltage: 0.65 ~ 1.1 times rated voltage).

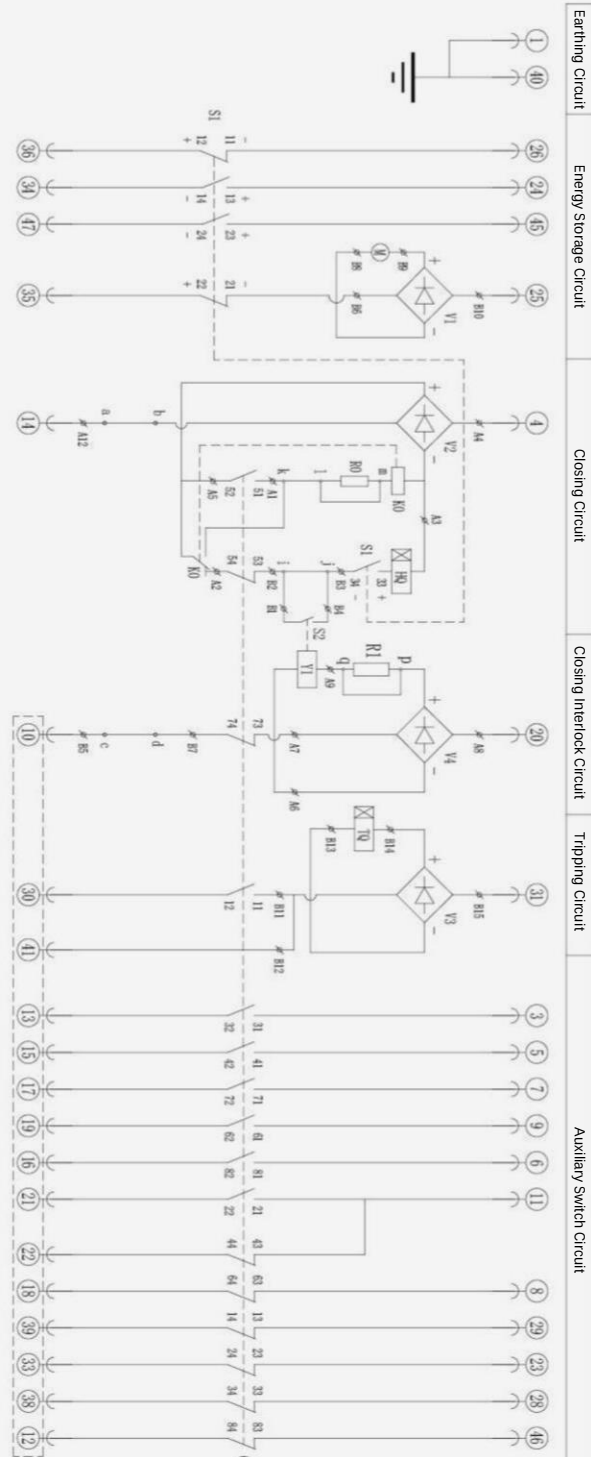
When the breaker is closed, reliable interlock prohibits re-closing.

After closing, if the closing signal persists, the built-in anti-pumping circuit cuts off the closing circuit to avoid repeated closing.

For withdrawable circuit breaker: closing is prohibited at any position between test position and working position, to prevent moving closed breaker into working position.

Once the withdrawable breaker is closed at working or test position, interlock locks the truck from movement, avoiding pushing or pulling the truck under load.

#### 6.4 Internal Electrical Schematic of Fixed Circuit Breaker



| Operation Power Selection: |         |
|----------------------------|---------|
| Configuration              | p-q m-l |
| AC/DC220V                  | / /     |
| AC/DC110V                  | ✓ ✓     |

**Operation Power Selection:**

| Status            | Jumper            |                 | a-b | c-d | i-j | k-l |
|-------------------|-------------------|-----------------|-----|-----|-----|-----|
|                   | With Anti-Pumping | No Anti-Pumping |     |     |     |     |
| Configuration     | With Jumper       | No Jumper       | ✓   | ✓   | ✓   | ✓   |
| With Anti-Pumping | No Jumper         | With Jumper     | ✓   | ✓   | ✓   | ✓   |
| No Anti-Pumping   | With Jumper       | No Jumper       | ✓   | ✓   | ✓   | ✓   |

Optional Wiring Setting      Note: [ / ] = Disconnected; [ ✓ ] = Connected

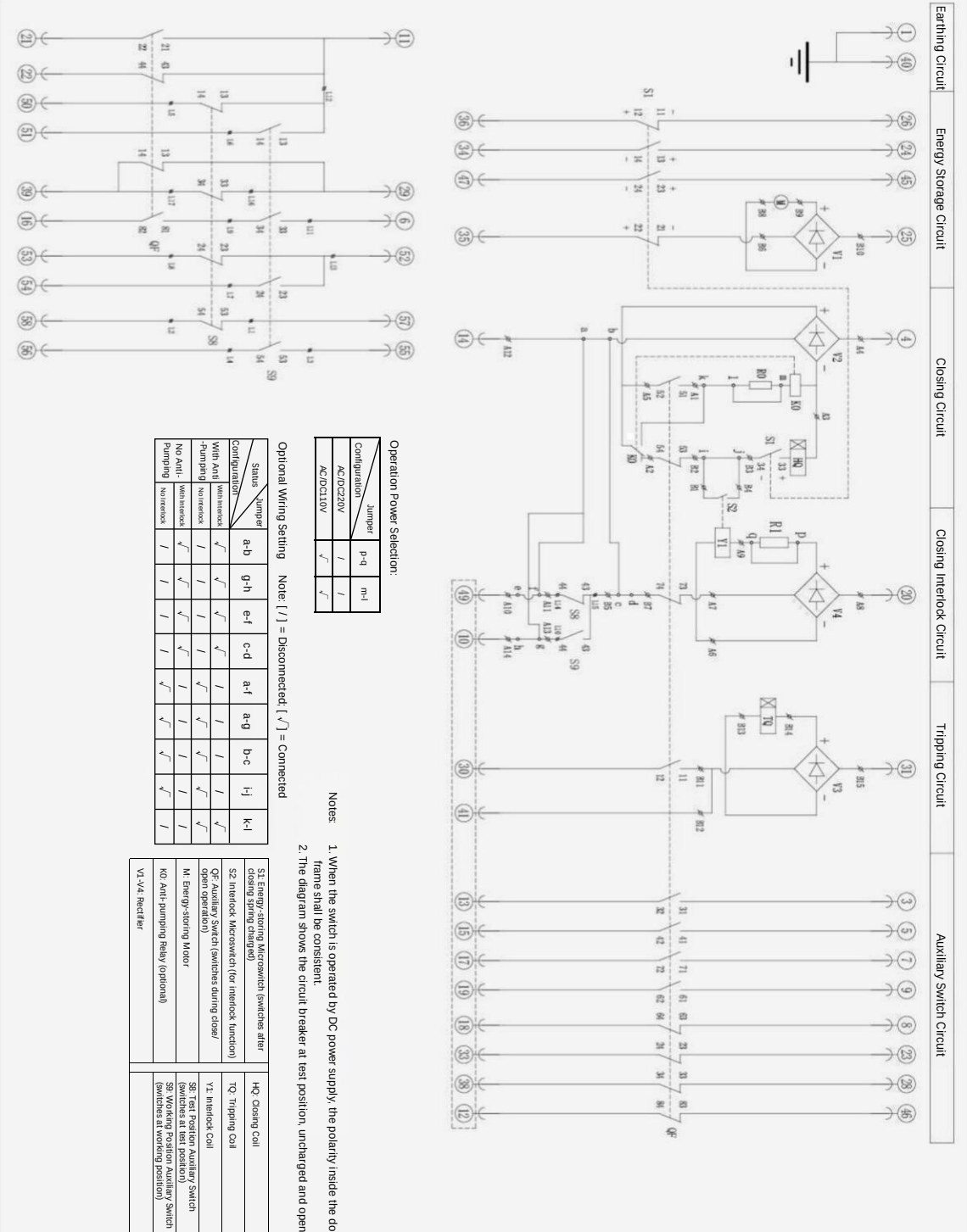
|                                                                        |                    |
|------------------------------------------------------------------------|--------------------|
| S1: Energy-storing microswitch (switches after closing spring charges) | HQ: Charging Coil  |
| S2: microswitch (for interlock function)                               | Y1: Tripping Coil  |
| QF: Auxiliary Switch (switches during close/open operation)            | Y1: Interlock Coil |
| M: Energy-storing Motor                                                | Y1+4: Releer       |
| K0: Anti-pumping Relay (optional)                                      |                    |

Notes: 1. When the switch is operated by DC power supply, the polarity inside the dotted frame shall be consistent

2. The diagram shows the circuit breaker at uncharged and open state.

2. The diagram shows the circuit breaker at uncharged and open state.

### 6.5 Internal Electrical Schematic of Withdrawable Circuit Breaker



| Jumper / Configuration | p-q | m-l |
|------------------------|-----|-----|
| AC/DC220V              | /   | /   |
| AC/DC110V              | √   | √   |

Operation Power Selection:

[illegible]

**Optional Wiring Setting**      **Note:** [ / ] = Disconnected; [ ✓ ] = Connected

|                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>S1 Energy-storing Microcircuit (switches after closing circuit, latched)</p> <p>S2 Interlock Microswitch (for interlock, function open operation)</p> <p>SF Auxiliary Switch (switches during close)</p> <p>M Energy-storing motor</p> <p>K0 Anti-pumping Relay (optional)</p> <p>V1-V4 Rectifier</p> | <p>HQ Closing Coil</p> <p>YQ Tripping Coil</p> <p>Y1 Interlock Coil</p> <p>S0 Test Position Auxiliary Switch (switches at test position)</p> <p>S0 Working Position Auxiliary Switch (switches at working position)</p> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Notes:

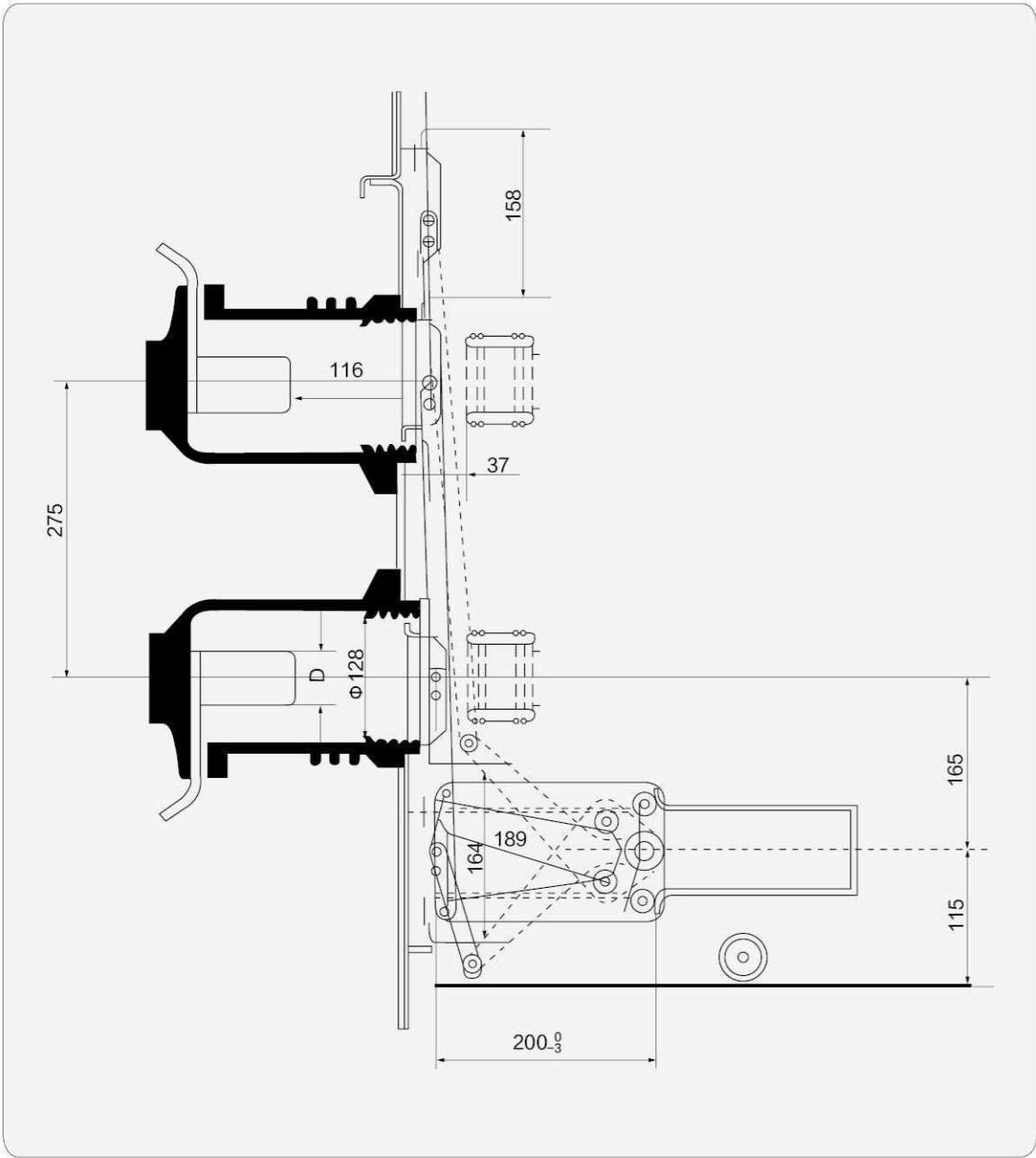
1. When the switch is operated by DC power supply, the polarity inside the dotted frame shall be consistent.

2. The diagram shows the circuit breaker at test position, uncharged and open state.

6.6 Circuit Breaker and Cubicle Mounting / Compatibility Dimensions

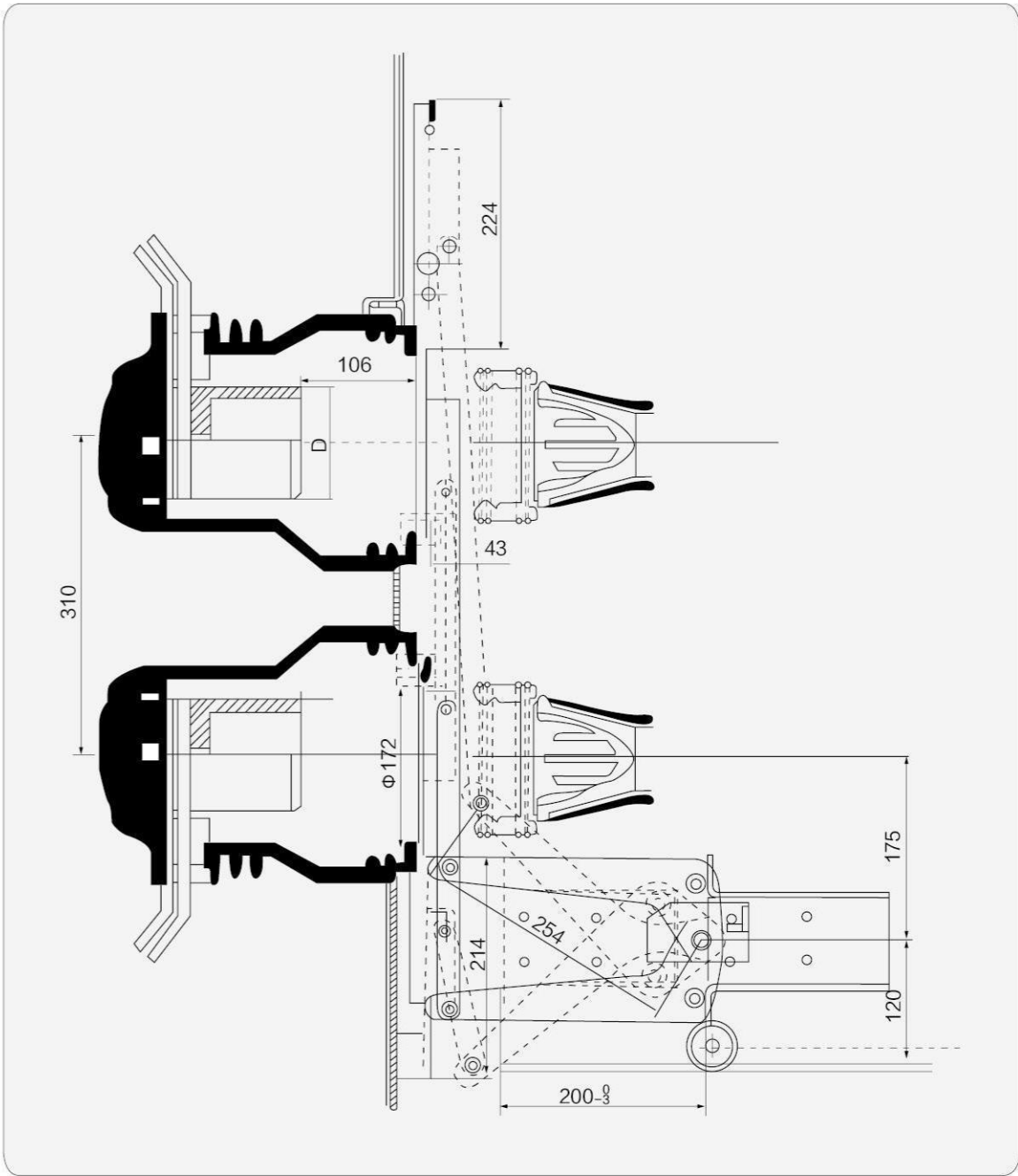
6.6.1 MRVS1(650) Circuit Breaker and Cubicle (650) Recommended Mounting Dimensions

6.6.2 MRVS1(800) Circuit Breaker and Cubicle (800) Recommended Mounting Dimensions



| Rated Current (A)                         | 630          | 1250             | 1600      |
|-------------------------------------------|--------------|------------------|-----------|
| Rated Short-circuit Breaking Current (kA) | 20, 25, 31.5 | 20, 25, 31.5, 40 | 31.5      |
| Matching Static Contact Dimension (mm)    | $\Phi 35$    | $\Phi 49$        | $\Phi 55$ |

6.6.3 MRVS1(1000) Circuit Breaker and Cubicle (1000) Recommended Mounting Dimensions

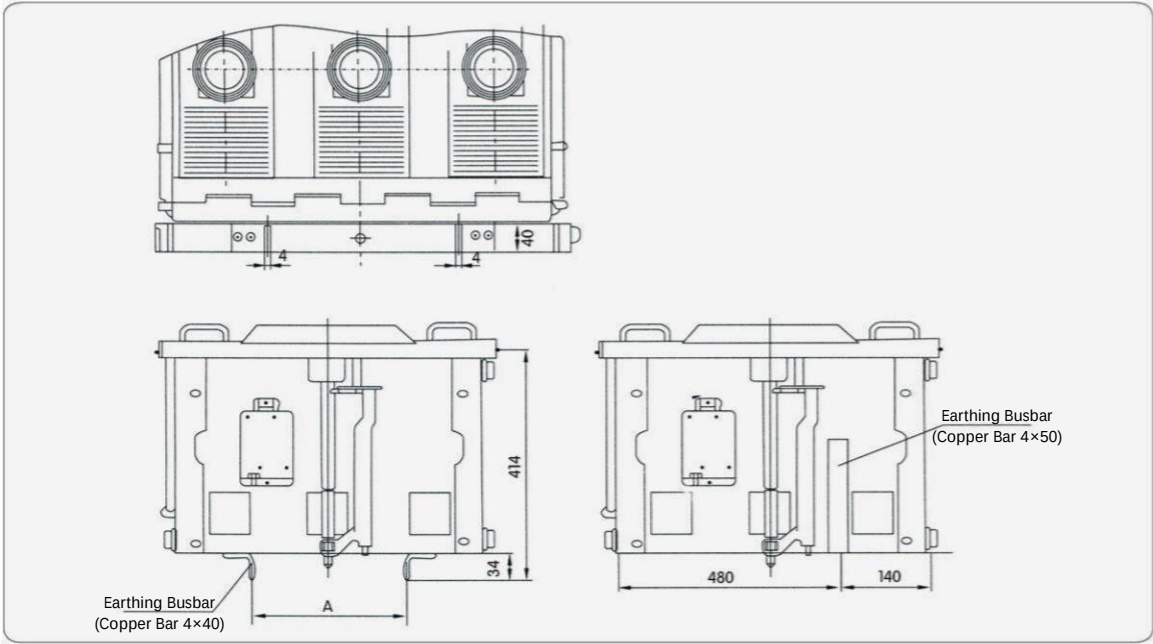


| Rated Current (A)                         | 1600      | 2000     | 2500     | 3150       | *4000 |
|-------------------------------------------|-----------|----------|----------|------------|-------|
| Rated Short-circuit Breaking Current (kA) | 31.5, 40  | 31.5, 40 | 31.5, 40 | 31.5, 40   | 40    |
| Matching Static Contact Dimension (mm)    | $\Phi 79$ |          |          | $\Phi 109$ |       |

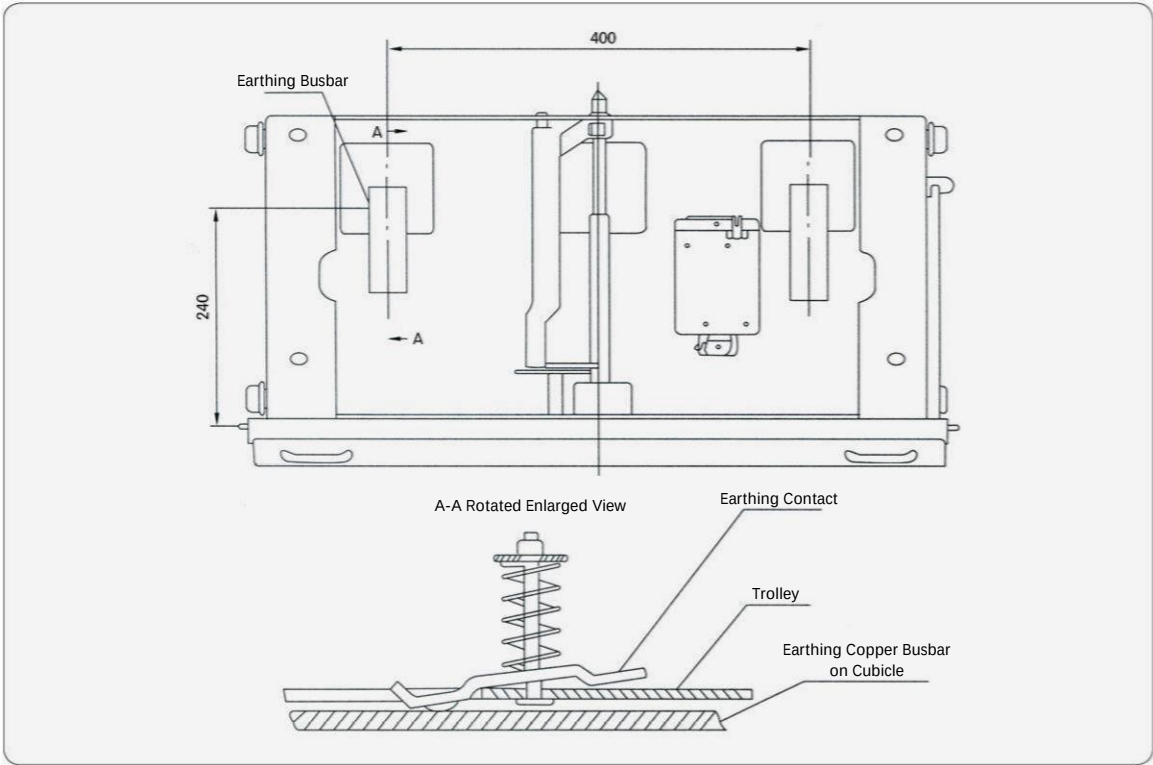
Note: For rated current above 4000A, forced air cooling is required.

6.7 Earthing Device Assembly Dimensions

6.7.1 Assembly Dimension Drawing of Earthing Device for 650mm Cubicle and 800mm Cubicle:



6.7.2 Assembly Dimension Drawing of Earthing Device for 1000mm Cubicle:



7. Secondary Configuration

7.1 Secondary Control Voltage

DC220V, AC220V, DC110V, AC110V

7.2 Optional Secondary Control Configuration

7.2.1 Interlock Device: Function – Prevent closing when secondary control power is disconnected or below technical requirement.  
7.2.2 Overcurrent Device: Function – In case of overload or short-circuit in primary circuit, the overcurrent relay energizes the overcurrent coil to trip the circuit breaker. Normally fitted on Phase A & C, or all three phases. When the secondary output capacity of current transformer is sufficient, indirect overcurrent release (3.5A / 5A) is adopted. If insufficient, intermediate transformer scheme is used.  
7.2.3 Undervoltage Release Device: Function – When terminal voltage drops below 35% rated voltage, undervoltage interlock energizes the undervoltage release coil to trip the circuit breaker.  
Note: If undervoltage release is selected, maximum two overcurrent protections can be equipped.

7.3 Technical Data of Charging Motor

This product adopts permanent magnet single-phase DC motor with dedicated reducer. See table for motor parameters.

| Rated Voltage (V) | Rated Output Power (W) | Operating Voltage Range     | Charging Time at Rated Voltage (S) |
|-------------------|------------------------|-----------------------------|------------------------------------|
| DC220/110         | 70/1005                | 85% ~ 110% of rated voltage | ≤ 15                               |

7.4 Technical Data of Closing & Tripping Solenoids, see table

|                             | Closing Solenoid         |       | Tripping Solenoid        |       | Interlock Solenoid       |       | Anti-Pumping Relay |
|-----------------------------|--------------------------|-------|--------------------------|-------|--------------------------|-------|--------------------|
| Rated Operating Voltage (V) | DC220                    | DC110 | DC220                    | DC110 | DC220                    | DC110 | DC220/110          |
| Coil Power (W)              | 368                      | 368   | 368                      | 338   | 4.8                      | 4.8   | 1.1                |
| Rated Current (A)           | 1.7                      | 3.3   | 1.7                      | 3.3   | 23mA                     | 44mA  | 18.3mA             |
| Operating Voltage Range     | 80% ~ 110% rated voltage |       | 65% ~ 110% rated voltage |       | 85% ~ 110% rated voltage |       |                    |

8 Installation and Commissioning

8.1 Unpacking

When lifting the circuit breaker out of the packaging box, the hook shall be attached to the marked lifting points on the breaker. Do not apply force to the upper and lower terminal arms during handling, and avoid heavy impact or vibration to the circuit breaker.

Note: Remove the lifting device as required before installing the breaker into the cubicle.

8.2 Pre-installation Inspection

- 8.2.1 The circuit breaker has passed strict factory tests before delivery, and all parameters meet technical requirements. Complete the following preparations before energizing the primary circuit:
- a) Check nameplate, certificate and packing list against purchase order and delivered goods.
  - b) Inspect breaker for damage; discontinue use if damaged.
  - c) Clean surfaces (especially insulation). Test vacuum interrupter via power-frequency withstand voltage (42kV, 1min, breaker open).
  - d) Manually execute energy storage, close and open per specs; verify energy storage and on/off indicators.

e) Operate breaker for energy storage, close and open via control power; check energy storage and on/off indicators.

### 8.2.2 Circuit breaker operation steps:

Insert the crank handle into the crank hole. Clockwise rotation = rack-in; counter-clockwise = rack-out. Total travel ~200mm. With breaker open, smoothly rack to service or test position at moderate speed. Continuous “click” sound indicates full position (Do not overforce to avoid mechanism damage), and the position indicator circuit is activated.

### 8.2.3 Possible phenomena during operation

| No. | Phenomenon                                       | Cause                                                                                                                                                                                                                   |
|-----|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Cannot close                                     | 1. Not charged<br>2. Already in closed position<br>3. Truck-type breaker not fully at service or test position<br>4. Closing interlock fitted; auxiliary power missing or below rating<br>5. Incorrect secondary wiring |
| 2   | Shutter hole cannot be opened with racking crank | 1. Breaker is closed<br>2. Racking handle not fully inserted<br>3. Racking mechanism not fully at test position; latch not unlocked from cubicle<br>4. Cubicle earthing interlock not released                          |

If problems remain after above checks, contact manufacturerc.

## 9. Maintenance

Our circuit breakers adopt special sliding bearings, anti-rust surface treatment and long-life grease. Under normal service conditions, no maintenance is required for 10 – 20 years. Necessary inspection is still needed due to varying site environments.

- a) Inspect breaker every 6 – 12 months based on working conditions. After visual check, clean dirty and damp surfaces. Wipe insulators with dry cloth; remove other dirt with solvent-dampened silk cloth (use plastic-compatible cleaner only).
- b) Long storage may cause sticking of moving parts. Perform at least 5 cycles of energy storage, close & open operations annually.
- c) Carry out insulation test at least once per year to detect vacuum interrupter gas leakage or insulation degradation.

## 10. Supplied Documents & Accessories

- a) 1 set of Certificate of Conformity
- b) 1 set of Factory Test Report
- c) 1 Operating Instruction Manual
- d) 1 set of spare parts & operating crank

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