

**24kV ET1 Removable AC Metal-enclosed Switchgear
With VE24 Encapsulated Pole Vacuum Circuit Breaker**





Automotive



Aerospace



Truck



Hydraulics



Electrical

Powering business worldwide

Eaton delivers the power inside hundreds of products that are answering the demands of today's fast changing world.

We help our customers worldwide manage the power they need for buildings, aircraft, trucks, cars, machinery and entire businesses. And we do it in a way that consumes fewer resources.

Next generation transportation

Eaton is driving the development of new technologies – from hybrid drivetrains and emission control systems to advanced engine components – that reduce fuel consumption and emissions in trucks and cars.

Higher expectations

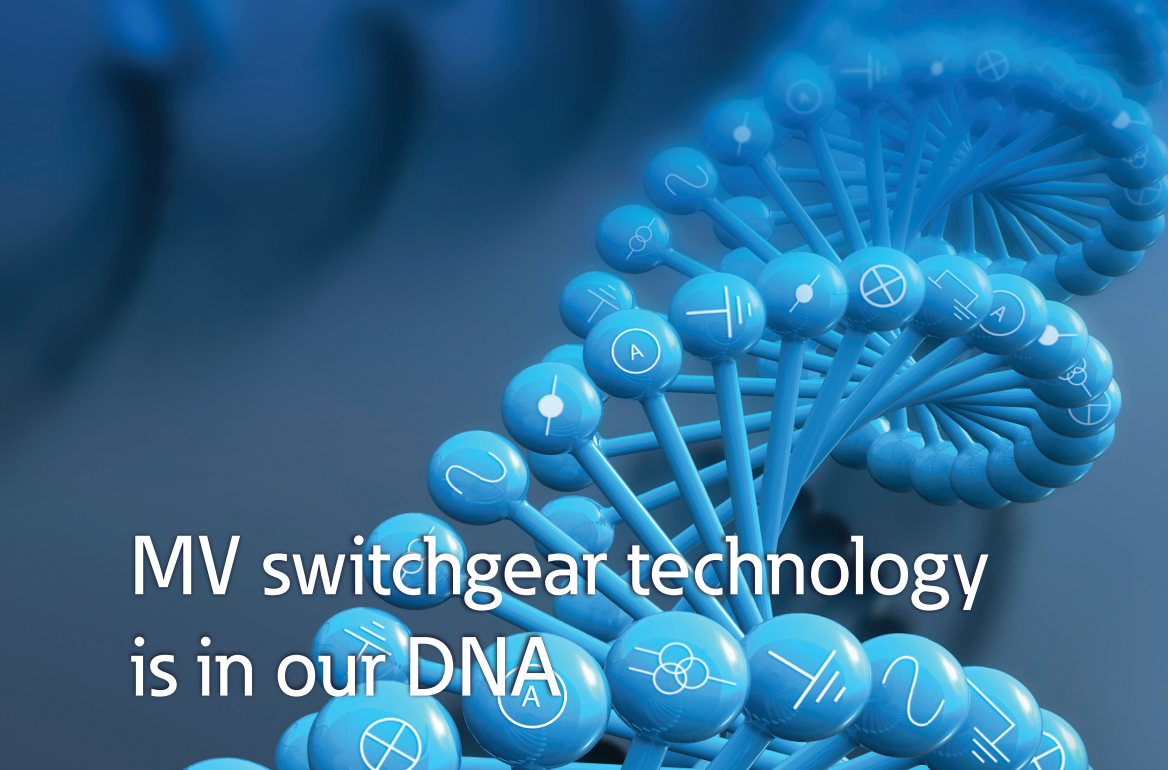
We continue to expand our aerospace solutions and services to meet the needs of new aviation platforms, including the high-flying light jet and very light jet markets.

Building on our strengths

Our hydraulics business combines localised service and support with an innovative portfolio of fluid power solutions to answer the needs of global infrastructure projects, including locks, canals and dams.

Powering Greener Buildings and Businesses

Eaton's Electrical Group is a leading provider of power quality, distribution and control solutions that increase energy efficiency and improve power quality, safety and reliability. Our solutions offer a growing portfolio of "green" products and services, such as energy audits and real-time energy consumption monitoring. Eaton's Uninterruptible Power Supplies (UPS), variable-speed drives and lighting controls help conserve energy and increase efficiency.



MV switchgear technology is in our DNA

Eaton Corporation is a worldwide leader in the design, manufacture, and sale of safe, reliable and high-performance medium voltage power distribution equipment in accordance with IEC, ANSI and GB / DL standards

Complete Global Medium Voltage Switchgear Solutions

Eaton, a premier leader in designing and manufacturing power distribution and protection equipment in the electrical industry, offers a comprehensive range of medium voltage (MV) solutions to meet the needs of virtually every application. From products that feature cutting-edge design that allow for easy access, maintenance and space savings, to arc-resistant products that enhance safety, Eaton's medium voltage solutions provide a variety of products for every need. Additionally, Eaton's global service network provides maximum customer support in all regions of the world.

As one of the few completely vertically integrated and diversified industrial manufacturers in the world, Eaton designs not only MV assemblies, but also the key components that comprise the MV solutions – from steel housing and circuit breaker compartments to vacuum interrupters, circuit breakers, bus systems and fuses.

Eaton's MV heritage, strengthened by acquisitions such as Westinghouse DCBU, Cutler Hammer, MEM and Holec, has resulted in breakthrough MV technologies and numerous international patents over the years.

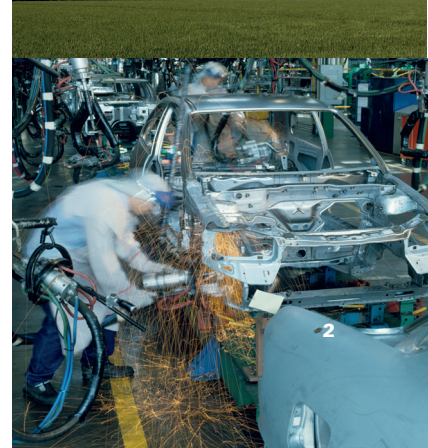
Part of Eaton's complete electrical PowerChain Solutions – which help businesses minimize risks while realizing greater reliability, cost efficiencies, capital utilization and safety – Eaton's medium voltage equipment meets all applicable standards and certifications such as IEC, NEMA / ANSI, GB / DL, UL, IEEE, KEMA and CSA.

When it comes to medium voltage solutions, you can trust the one name with a long history of proven performance: Eaton.

Eaton's range of
SF₆ free switchgear
for Medium Voltage



An Eaton Green Solution



24kV ET1

Removable AC metal-enclosed switchgear

With VE24 Encapsulated pole VCB



24kV ET1 switchgear with advanced technology

Safe and reliable

- Metal-clad and fully enclosed structure
- Adoption of balanced electric field, with main conductors using thermal shrinkage material for insulation, providing higher dielectric performance
- LV compartment is separate from each HV compartment
- Fast closing earthing switch is used for earthing and provides short-circuit current closing capacity
- All operations can be conducted when the door panel is closed, including breaker switching on and off, breaker trolley's drawing in or out, as well as earthing switch's switching on and off.
- Reliable latch device is used to effectively prevent misoperation
- Through the front and rear observation windows in the door panel, breaker's switching status, trolley position, mechanism energy stored status, earthing switch switching position and cable end connection status can be clearly viewed
- In line with IEC62271, GB3906 and China power industry standards

Highly practical

- Enclosure protection degree is IP4X can prevent sewage and little animals from entrance
- VCB trolley is maintenance free and the equipped operating mechanism requires only a little maintenance
- Good interchangeability of trolleys, very easy to replace circuit breakers
- Secondary wire is laid in ample wire casing, neat and convenient for inspection

Wide application

- Can be used for incoming and outgoing of cable and busbar or mixed incoming and outgoing of cable and busbar
- Normal standard cable end can be used
- Can be connected to several cables

Applications

- Infrastructure
- Utility
- Commercial buildings
- Industries and corporations
- Airports and hospitals

Applied standards

- GB3906
- GB/T11022
- DL402
- DL404
- DL593
- IEC62271

ET1-24 switchgear technical data

Main switchgear technical data

Rated voltage	kV	24	24
Rated frequency	Hz	50	50
Rated 1min power frequency withstand voltage	kV	65	65
Rated lightning impulse voltage(BIL)	kV	125	125
Power frequency voltage of auxiliary control circuit	V	2000	2000
Rated current	A	630,1250,1600,2000,2500,3150	630,1250,1600,2000,2500,3150
Rated short-time withstand current (4s)	kA	25	31.5
Rated peak withstand current	kA	63	80
Rated short-circuit breaking current	kA	25	31.5
Rated short-circuit making current	kA	63	80
Rated voltage of auxiliary control circuit	V	DC/AC 110/220	DC/AC 110/220
Protection degree		IP 4X (compartment: IP2X when breaker door is open)	IP 4X (compartment: IP2X when breaker door is open)
Dimension (WxDxH)		800*/1000x1800x2400,800*/1000x2200/2300x2400	800*/1000x1800x2400,800*/1000x2200/2300x2400
Weight	kg	840-1440	840-1440

Note: *800mm width panel available for 630&1250A rated current.

Main technical data of VE24 VCB

Rated voltage	kV	24	24
Rated frequency	Hz	50	50
Rated 1min power frequency withstand voltage	kV	65	65
Rated lightning impulse voltage(BIL)	kV	125	125
Rated current	A	630,1250	630,1250,1600,2000,2500,3150
Rated short-time withstand current (4s)	kA	25	31.5
Rated peak withstand current	kA	63	80
Rated short-circuit breaking current	kA	25	31.5
Rated short-circuit making current	kA	63	80
Rated short-circuit operating sequence		0-0.3s-CO-180s-CO	0-0.3s-CO-180s-CO

24kV ET1 Removable AC Metal-enclosed Switchgear

Structure and operating principles

Structure overview

24kV ET1 switchgear is composed of cubicle and removable parts (so called trolley). The cubicle is separated into several functional compartments by metal sheet, including busbar compartment, circuit breaker compartment, cable compartment and LV compartment.

Switchgear removable parts can be equipped with VCB trolley, voltage transformer trolley, lightning arrester trolley and fuse trolley.

Pressure relief device

Pressure relief devices are installed above trolley compartment, busbar compartment and cable compartment. Special sealing ring on the door seals the panel door. In case of faults inside the compartments resulting in arc, the pressure is going up inside the switchgear and the pressure relief equipped on the top will open automatically, to release pressure and high temperature gas. In this way, it can ensure the safety of operating staff and the switchgear.

Secondary plug and trolley position interlocking

The secondary connection of the switchgear and trolleys are conducted via secondary plug coordination. The secondary plug is connected to trolleys through a nylon bellow. The plug is located on the upper right side of switchgear's trolley compartment. Only when the trolley is on Test position, the secondary plug can be plug in or out. When the trolley is on Operating position, the plug is locked.

Electrical indication device

The switchgear can install electrical indication device in primary circuit. The device includes high voltage sensors and an indicator, and can indicate high voltage circuit electrical status. It can also cooperate with electromagnetic lock to conduct compulsory latching on operating handle, cubicle door and adjacent cubicles. Thus, it can prevent from withdrawing isolation trolley with loads, prevent earthing switch from energized closing, and prevent from entrance of energized compartment. In this way, it can increase prevention performance of the equipped products.

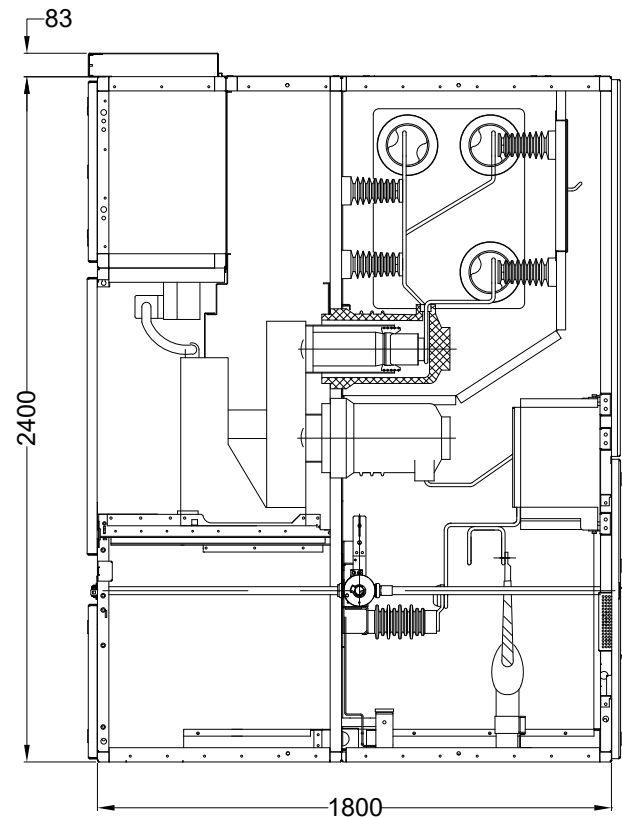
Prevention of condensation

In order to prevent condensation in high humidity or dramatically changed temperature environment, electrical heater is installed separately in circuit breaker compartment and cable compartment, to avoid dielectric accidents in the above conditions.

Earthing device

Cable compartment installs additionally 60*5 mm² earthing copper bus which goes through adjacent cubicles and with good connection to cubicles. The copper bus is used for direct earthing components. Since the whole cubicle is joint by aluminum zinc coated steel plates, the cubicle is in good earthing status, thus ensuring safety of operating staff.

Structural diagram of 24kV ET1 switchgear

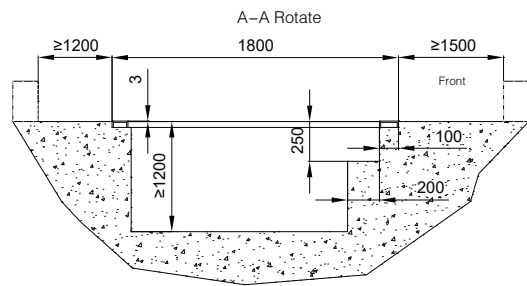
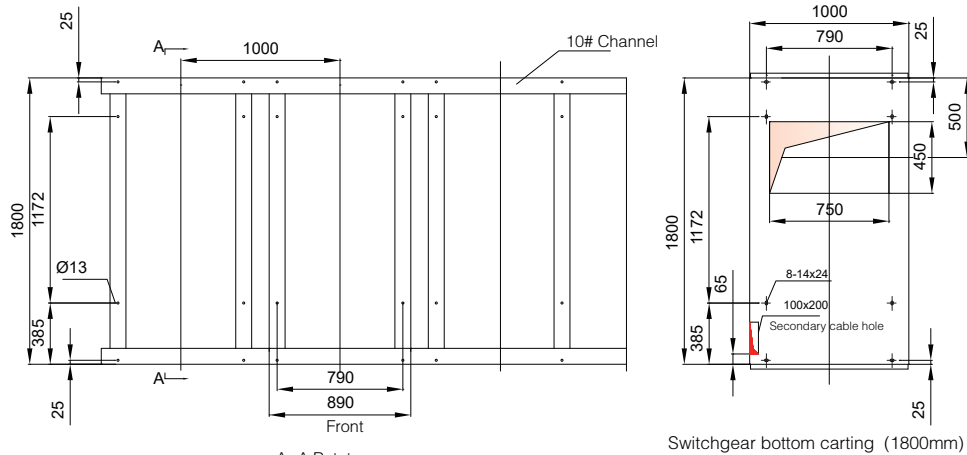


Interlock devices to prevent misoperations

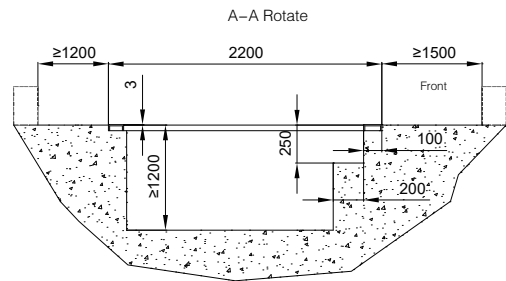
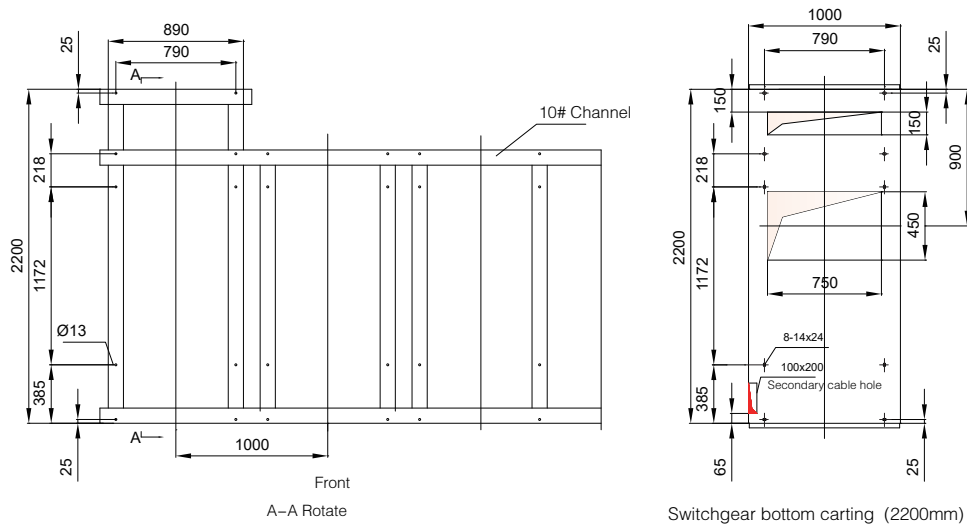
24kV ET1 switchgear has a series of interlock devices to fundamentally prevent dangerous situations and misoperations which may result in serious consequences, and thus effectively ensuring safety of operating staff and the switchgear itself. The detailed interlock includes:

- When circuit breaker and earthing switch are in opening position, the trolley can move from TEST/isolation position to SERVICE position. If the circuit breaker is in closing condition and is racked, the trolley will trip automatically when moving from TEST/isolation position to SERVICE position. Reverse movement has the same result (mechanical interlock)
- Only when the trolley is completely engaged in TEST or SERVICE position, the circuit breaker can close (mechanical interlock)
- If the trolley is in TEST or SERVICE position without control voltage, the circuit breaker can not close. It can only be manually opened (mechanical interlock)
- If the trolley is in SERVICE position, the control plug is locked and can not be pulled out.
- When the earthing switch is closed, the trolley can not move from TEST/isolation position to SERVICE position; when the trolley is in SERVICE position, the earthing switch can not be closed (mechanical interlock)

Switchgear's mounting basis and base plate cutout dimension diagram

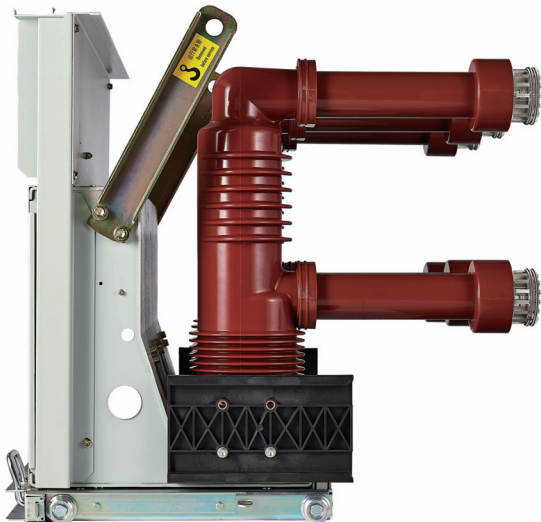


Installation basic Schematic(1800mm)



Installation basic Schematic(2200mm)

VE24 VCB



VE 24 VCB is Eaton's new generation of indoor vacuum circuit breaker with integrated encapsulated pole, with ratings of 24kV, 630A to 3150A / 25kA to 31.5kA.

VE24 VCB is an indoor circuit breaker of 3-phase, 50-60Hz, and 24kV rated voltage. It is applicable for protection and control units of power grid equipment, industrial and mining power equipments. The product is equipped with unique advancing mechanism and thus become a trolley unit. Its primary circuit is encapsulated by epoxy resin using APG technology to prevent vacuum interrupter and other main circuit parts from collision, dust and condensation. VE24 VCB is used in circumstances which require frequent operation of rated operating current or repeatedly switching of short-circuit current. It is also used in harsh environmental applications.

Normal service condition:

- Ambient temperature:
Maximum temperature: +40°C
Minimum temperature: -15°C
- Ambient humidity:
Daily average RH: ≤95%
Monthly average RH: ≤90%
Daily average vapor pressure: ≤2.2*10⁻³Mpa
Monthly average vapor pressure: ≤1.8 *10⁻³Mpa
- Altitude:
Not more than 1000m
- Seismic intensity not over 8 degree
- Surrounding air is not polluted by dust, smoke, corrosive and/or combustible gas, steam or salt fog

Technical features

- VE24 adopts proved APG technology to make vacuum interrupter and main conduction circuit embedded into insulating cylinder. In this way, it solves the problem that the insulation parts are influenced by environment with reduced withstand voltage level, ensuring that the VCB can be applicable in harsh environment.
- VE24 uses China's top-class vacuum interrupter with high breaking capacity and high reliability. It meets actual operation requirements, with primary section of maintenance free.
- Proven spring mechanism provides stable and reliable performance and long service life. It is easy to operate with superior anti-corrosion capacity, requiring only very little maintenance within its lifetime.
- Type tests are conducted, according to GB1984-2003's extended electrical life of E2 level, extended mechanical life of M2 level and capacitive current switching of C2 level with very low re-strike probability.
- Products are assembled to guarantee product consistency. Before products are delivered, push-in tests are conducted for standard panels, ensuring interchangeability and universality.
- All products have passed hundreds of mechanical operation run-in tests before delivered in factories, ensuring product performance at its most stable stage.
- Advance imported testing equipments are used to make records of empty load mechanical features for each product, and to provide users with concerned characteristic curves. In this way, it ensures reliability of product quality.

Standards

- GB 1984-2003 HV AC Circuit Breaker
- JB 3855-1996 3.6-40.5kV Indoor AC HV Vacuum Circuit Breaker
- DL/T 403-2000 12-40.5kV HV Vacuum Circuit Breaker Ordering Technical Conditions
- IEC 62271-100:2001 HV Switchgear and Control Equipment – Part 100: HV AC Circuit Breaker

Spring operating mechanism data

Technical data of stored energy motor

Item	Data	
Rated operating voltage (V)	AC, DC110	AC, DC220
Motor rated input power (W)	65(80 when over 2500A)	65(80 when over 2500A)
Normal operating voltage range	85%-110% of rated operating voltage	85%-110% of rated operating voltage
Stored energy time at rated operating voltage (s)	≤ 15	≤ 15

Technical data of opening and closing coils

Item	Data	
Rated operating voltage (V)	AC, DC110	AC, DC220
Rated operating current (A)	2.0	1.0
Coil resistance at 20°C	1.8	0.9
Normal operating voltage range	Closing: 80%-110% of rated operating voltage Closing: 65%-120% of rated operating voltage; Not closing when ≤ 30% rated operating voltage	Closing: 80%-110% of rated operating voltage Closing: 65%-120% of rated operating voltage; Not closing when ≤ 30% rated operating voltage

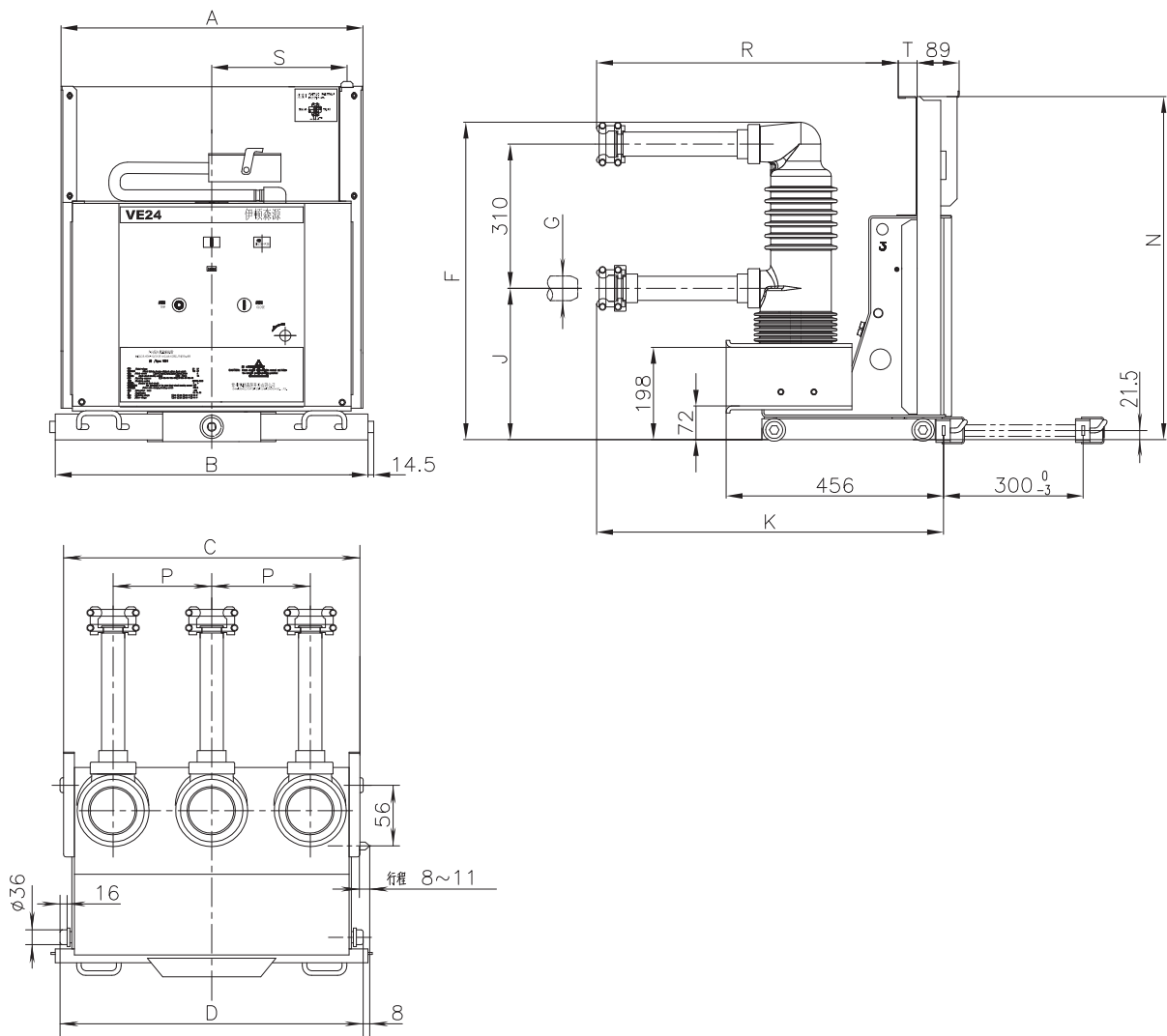
Technical data of VE24 vacuum circuit breaker

Rated voltage	kV	24	24
Rated frequency	Hz	50	50
Rated 1min power frequency withstand voltage	kV	65	65
Rated lighten impulse voltage	kV	125	125
Rated current	A	630/1250	630/1250/1600/2000/2500/3150
Rated short-time withstand current (4s)	kA	25	31.5
Rated peak withstand current	kA	63	80
Rated short-circuit breaking current	kA	25	31.5
Rated short-circuit making current	kA	63	80
Rated short-circuit operating sequence		0-0.3s-CO-180s-CO	0-0.3s-CO-180s-CO
Conduction circuit resistance per phase	μΩ	≤ 60(630) ≤ 35(1600~2000A)	≤ 50(1250) ≤ 25 (over 2500A)
Average closing speed	m/s	0.8~1.2	0.8~1.2
Average opening speed	m/s	1.1~1.7	1.1~1.7
Closing time	ms	35~70	35~70
Opening time	ms	20~50	20~50
Bounce time when contact closing	ms	≤ 2	≤ 2
Non-periodicity of 3-phase closing and opening	ms	≤ 2	≤ 2
Allowable wearing thickness of moving and fixed contacts	mm	3	3

VE24 VCB

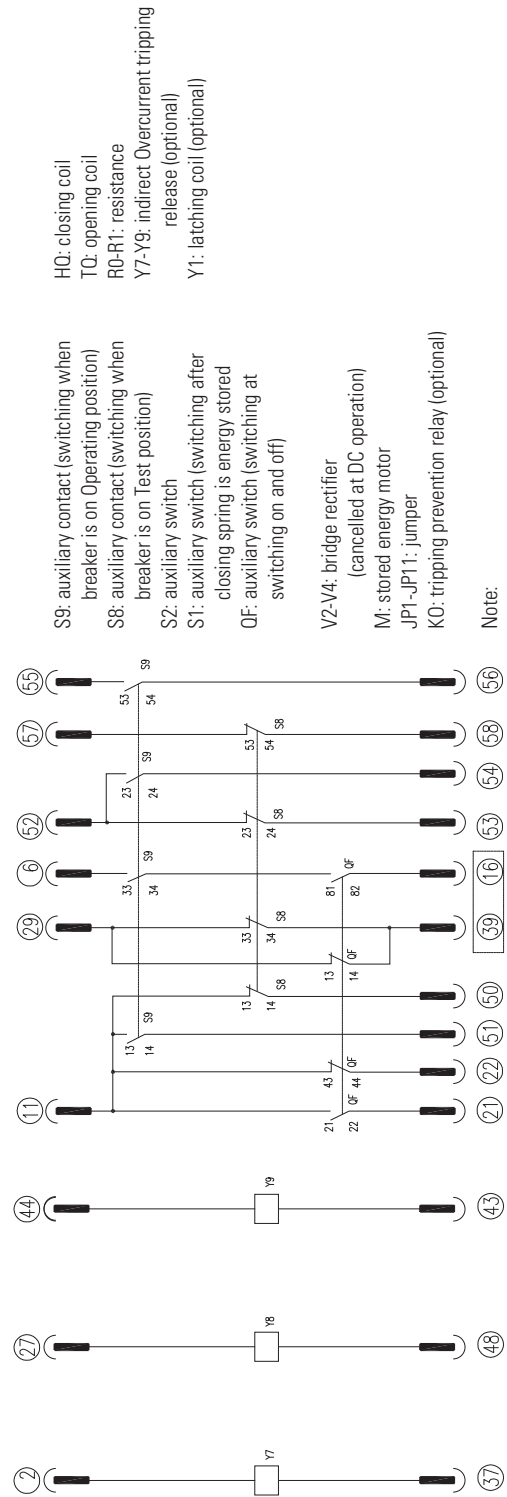
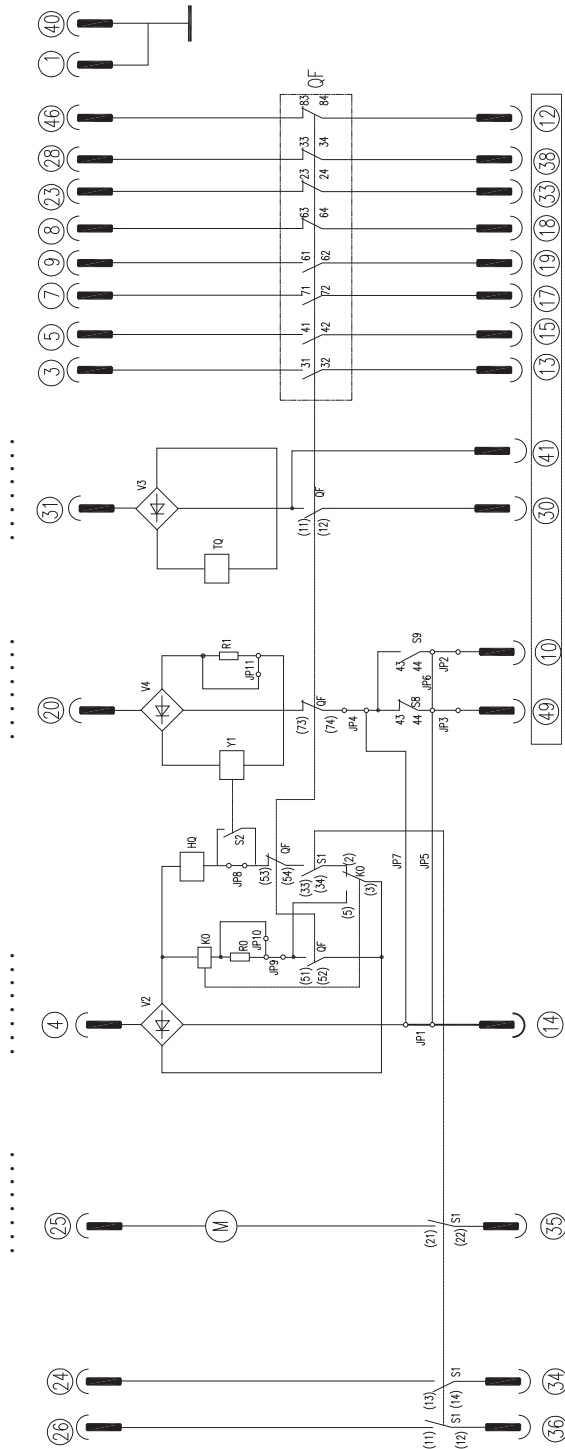
Dimension

Dimension diagram of VE24 vacuum circuit breaker



Cubicle width	Rated current	Rated short-circuit breaking current (kA)	P	A	B	C	D	F	G	J	K	N	R	S	T
800	630	25	210	638	652	640	650	685	ø35	325	745	737	655	277	40
800	630	31.5	210	638	652	640	650	705	ø35	345	745	757	655	277	40
800	1250	25	210	638	652	640	650	685	ø49	325	745	737	655	277	40
800	1250	31.5	210	638	652	640	650	705	ø49	345	745	757	655	277	40
1000	630	25	275	838	852	840	850	685	ø35	325	745	737	655	377	40
1000	630	31.5	275	838	852	840	850	705	ø35	345	745	757	655	377	40
1000	1250	25	275	838	852	840	850	685	ø49	325	745	737	655	377	40
1000	1250	31.5	275	838	852	840	850	705	ø49	345	745	757	655	377	40
1000	1600-2000	31.5	275	838	852	840	850	705	ø79	345	735	757	685	377	0
1000	2500-3150	31.5	275	838	852	840	850	781	ø109	345	735	825	685	377	0

Internal electrical wiring principle diagram of VE 24 vacuum circuit breaker



Note:
 1. The diagram shows circuit breakers at Test position, energy unsaved, closing status
 2. When operating supply is DC, polarity in the virtual box is the same

Eaton's mission is to improve the quality of life and the environment through the use of power management technologies and services. We provide sustainable solutions that help our customers effectively manage electrical, hydraulic, and mechanical power – more safely, more efficiently, and more reliably. Eaton's 2019 revenues were \$21.4 billion, and we sell products to customers in more than 175 countries. We have approximately 95,000 employees.

Eaton began operation in China more than 20 years ago. Since entering the Chinese market in 1993, Eaton's presence has grown significantly in the country. In 2004, Eaton moved its Asia Pacific headquarters from Hong Kong to Shanghai.

In the Greater China region, Eaton has nearly 9,800 employees, 29 manufacturing bases and 5 R&D centers. Today, we make most products for all of Eaton's distinct business here.

For more information about Eaton China, visit: www.eaton.com.cn
Eaton China official social media account: **Eaton_China**

Eaton Corporation
Asia Pacific Headquarter
No.3, Lane 280, Linhong Road,
Changning District,
Shanghai 200335
www.eaton.com.cn/electrical



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