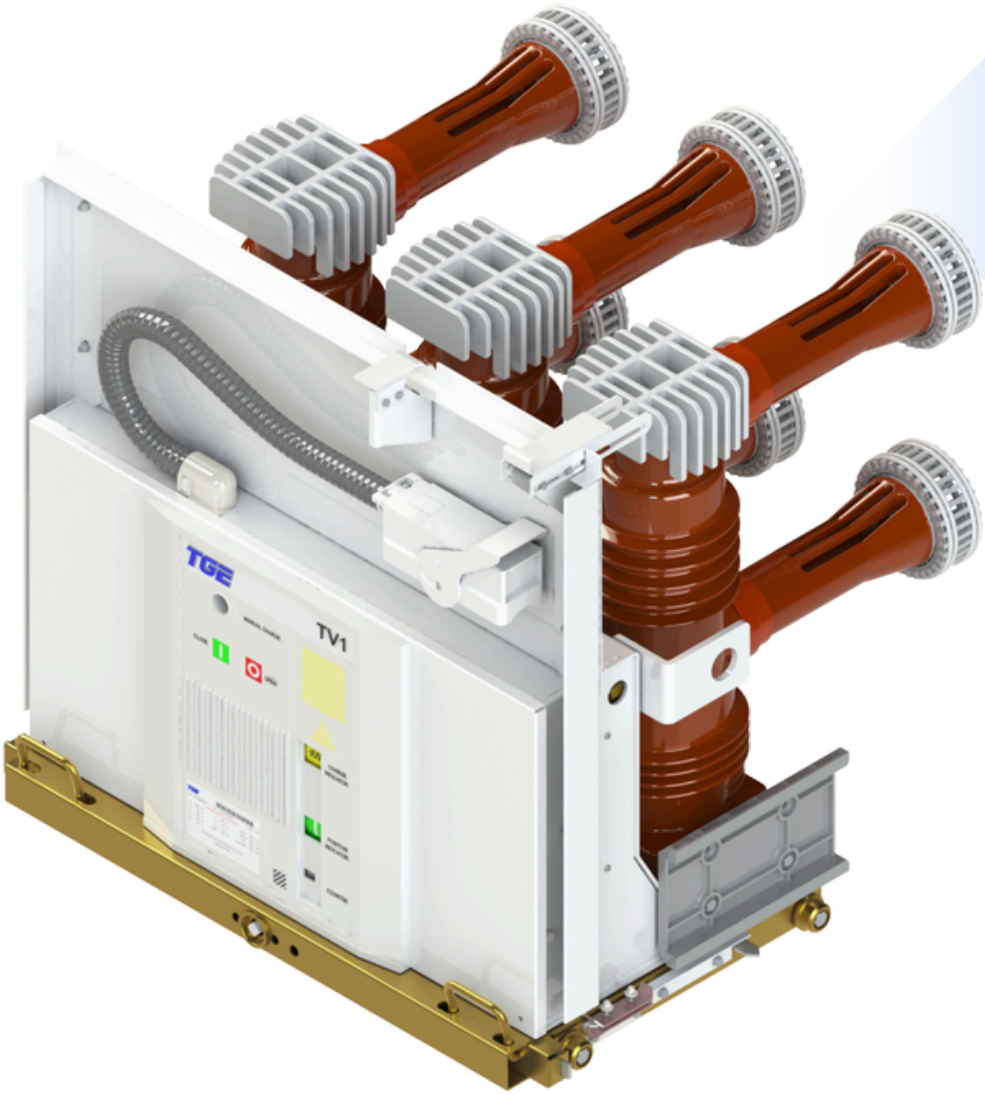
TGE *Switching to a brighter future*

TV1

VACUUM CIRCUIT BREAKER up to 24kV

Embedded Pole



KEMA IEC

Contents

TV1

VACUUM CIRCUIT BREAKER up to 24kV

Embedded Pole

TGE offers a comprehensive range of medium voltage solutions, catering to diverse applications. Their products boast advanced features for easy access, maintenance, and space-saving, while anti-arc options prioritize safety. Additionally, TGE's global support network helps businesses enhance reliability, efficiency, and safety.

Years of innovation have yielded TGE's reliable vacuum interrupters, capable of handling normal and high-fault currents. They achieve superior dielectric strength within the epoxy resin enclosure.

The TMS1 targets the electrical industry, including power distribution, generation, nuclear, oil & gas, mining, marine, and offshore applications.

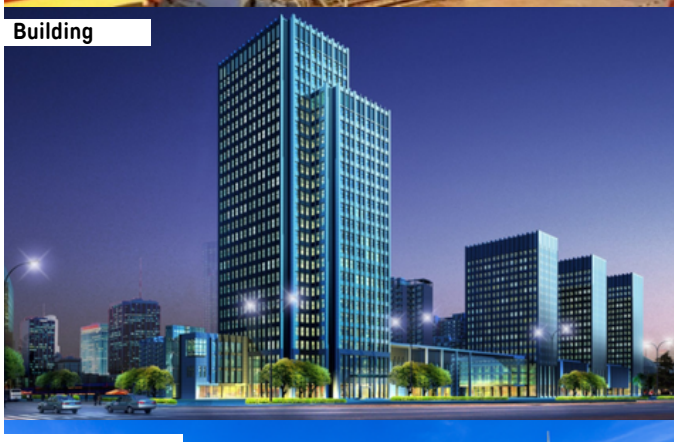
Committed to environmental responsibility, TGE's latest technologies minimize environmental impact.

Oil

AirPort

Mining

Building



Solar

Off Shore

Benefits

Efficiency

Efficiency
- Compact dimension
- Suitable with space small installation
- Reduced civil works costs

Reliability

Reliability
- Comply with the standards IEC
- Fully type-tested equipment
- Limited maintenance with Vacuum interrupters embedded in the poles

Safety

Safety
- Apply the latest technology design
- With mechanical interlocks and electrical to avoid wrong operator
- Vacuum interrupters embedded inside the epoxy resin
- Environmentally friendly solution

Easy to install

Easy to install
- Withdrawal version available
- Swift rack in/out for circuit breaker maintenance
- Fully prepped circuit breaker for switchgear installation
- Compact and lightweight for effortless and convenient transport

Easy for operation

Easy to operation
- Simple operations
- Local and remote operation and operation from front view
- Wide choice of configurations
- Easy integration

Services and training

Services and training
- Local services
- Provide optimal and efficient solution for customers' request
- Installation and maintenance training available

Description

TV1

Vacuum circuit breaker

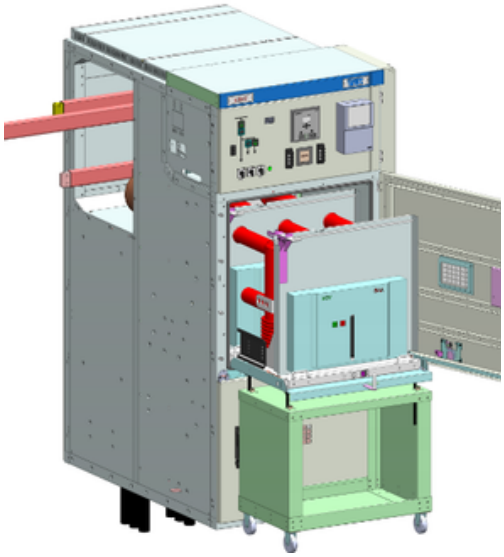
Conformance to the latest IEC standards.

TV1 circuit breaker are designed and comply with IEC 62271-100 Standards. Developed by TGE, it was the first vacuum breaker embedded pole to be manufactured in Vietnam and successfully tested at KEMA.

Vacuum circuit breaker

TV1 circuit breaker:

- Exceed IEC 62271-100 standards for electrical and mechanical endurance (E2, M2).
- Comply with IEC 62271-1 and -100.
- Meet endurance classes C2, E2, M2, S1 (IEC 62271-100) and operating sequence O-0.3s-CO-15s-CO.
- Incorporate cutting-edge design and technology.
- Offer fixed and draw-out frontal types, rated current 630-2500A.
- Enable remote control and withstand dust, impact, and high humidity.
- Feature full interlocks (optional) to prevent human error.
- Suitable for air-insulated electrical cabinets.



TV1 Vacuum circuit breaker with TMS1

The 2019 upgrade to TMS1 (TMS1-2019) introduced several safety enhancements, including increased electrical safety, impulse withstand capability, and electromechanical durability. Additionally, TMS1-2019 boasts a comprehensive interlock system featuring:

- Magnetic closure (M&E)
- Truck lock
- Key lock (open position)
- Protected pushbuttons (open/close) with padlocking options:
  - Individual or combined padlocking
  - Separate padlocking for open/close buttons
  - Transient contact

Description

Design by Blocks

Vacuum Interrupter

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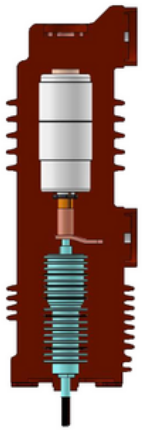

Embedded Pole unit

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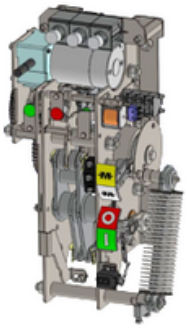

Operating mechanism

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Function Block

Leveraging their extensive engineering experience, TGE has designed the TV1 circuit breaker as a modular system. Comprised of three key components – vacuum interrupter, epoxy resin embedded pole, and mechanism assembly – each block contributes to the overall exceptional safety, reliability, and performance of the TV1.

Checking

Each block undergoes rigorous inspection at every stage before complete assembly and testing. The final VCB then requires successful routine testing for customer delivery.

Type test Items

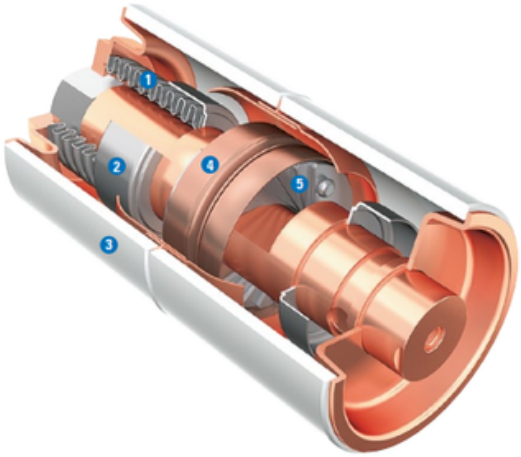
TV1 circuit breaker comply with the IEC 62271-100 standard, undergoing the following tests:

- Dielectric tests
- Main circuit resistance measurement
- Temperature rise tests
- Short-time and peak withstand current tests
- Protection degree verification
- Tightness tests
- Auxiliary and control circuit tests (if applicable)
- Mechanical operation at ambient temperature
- Short-circuit making and breaking
- Extended mechanical endurance (M2 class)
- Electrical endurance (E2 class)
- Capacitive current switching:
  - Line-charging current breaking
  - Cable-charging breaking
  - Single capacitor bank in rush making
- Out-of-phase making and breaking
- Back-to-back capacitor breaking (optional)

Description

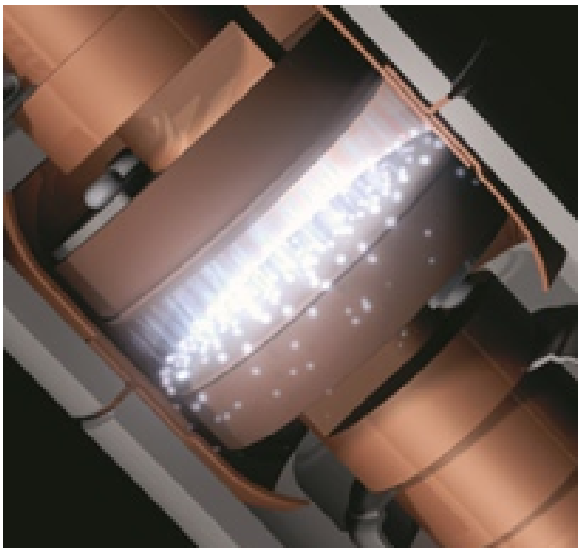
TV1

At the heart of the TV1 IEC circuit breaker portfolio is Eaton's proven vacuum interruption technology and eighty-year expertise in this field.



1. Bellows
2. Bellows shield
3. Ceramic insulators
4. Movable contact
5. Magnetic laminations

Leveraging advanced computer modeling, TGE's vacuum interrupters achieve optimized designs, minimizing environmental impact during production due to their cutting-edge technology. The special contact geometry and material selection ensure a short arc duration, reducing thermal and dielectric stress.



Negligible contact erosion

- Eaton Vacuum Interrupters: Minimal Contact Wear
- Eaton's vacuum interrupters feature a unique "diffuse discharge" with numerous parallel arcs during interruption. This results in low arc voltage, short arc duration, and minimal contact erosion.

Benefits:

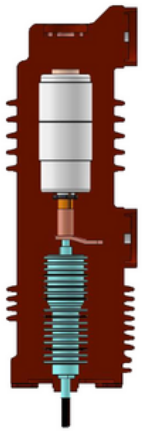
Reliable & Maintenance-Free: Eaton's vacuum interrupters leverage years of research for proven reliability, safety and performance. They are hermetically sealed for extended vacuum integrity and require no maintenance.

Key Points:

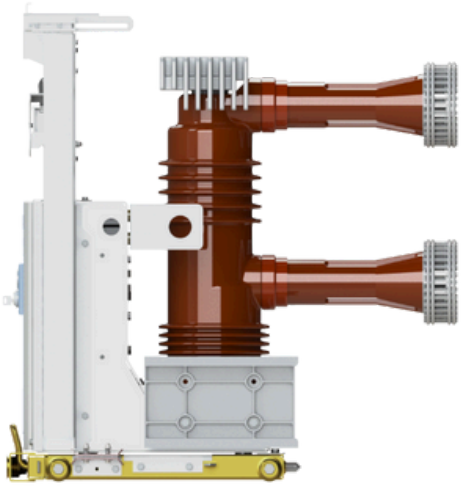
- Minimal contact wear due to low arc energy
- Hermetically sealed for long life and reliability
- Maintenance-free design

Description

TV1's medium-voltage circuit breaker utilize vacuum interrupters encapsulated in epoxy resin, leveraging our extensive design and manufacturing experience. This design offers protection against dust, humidity, small animals, pollution, and high altitude.



Embedded Pole unit



Embedded Pole With arm

Long life

Encapsulating a vacuum interrupter in epoxy resin creates highly durable circuit breaker pole units. The epoxy protects the interrupter from mechanical impacts and harsh environments, offering excellent vibration and shock resistance with long-lasting durability.

Electric field

Conversely, the embedded pole design integrates conductive parts within the epoxy resin, serving as both primary insulation and mechanical support. This optimizes electric field distribution compared to diaphragm structures, significantly enhancing TV1's insulation strength.

High performance

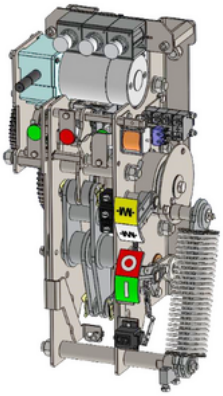
Engineered for outdoor applications, Eaton's encapsulated pole units utilize a robust epoxy resin insulation that offers exceptional thermal conductivity, high electrical resistivity, minimal moisture absorption, superior resistance to creepage current, and unmatched mechanical strength, ensuring complete homogeneity and eliminating the risk of partial surface discharge.

Compact

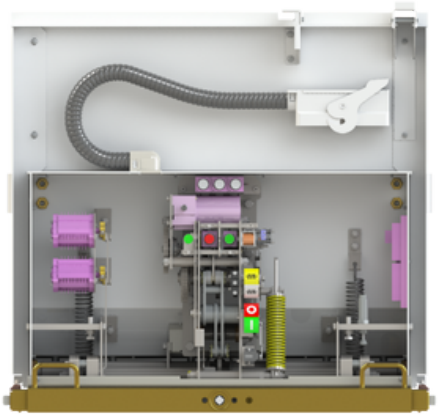
- Due to its compact size, TV1 integrates seamlessly into small electrical cabinets, minimizing installation space and reducing user costs.
- The compact design minimizes maintenance effort and cost for the highly reliable mechanism, resulting in an optimal sales price.

Circuit breaker operating mechanism

The VCB TV1 embedded pole vacuum circuit breaker is equipped with modularized and standardized components.



Mechanish assembly



TV1 without cover

Circuit Breaker Operation

The circuit breaker uses a stored-energy spring mechanism for operation. This mechanism transmits force to the pole assemblies through levers.

The closing spring can be charged electrically or manually. An interlock prevents errors after charging and automatically latches upon completion.

This mechanism stores the open-close-open sequence needed for automatic reclosing on the system side. All such mechanisms handle synchronization, rapid load transfer, and auto-reclosing duties.

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Long life and reliability

- Special plating on metal components extends mechanical life, prevents corrosion, and minimizes maintenance.

Simple Installation & Operation:

- The simplified design allows for easy replacement, operation, and reduces complexity.
- Open-type shock absorbers contribute to TV1 successfully passing the IEC C2 class breaker type test.

Easy to Use:

- TGE's anti-pump relay ensures smooth operation.
- Clear status indication and low manual force requirement provide effortless use.
- Lightweight and quiet design enhances user experience.

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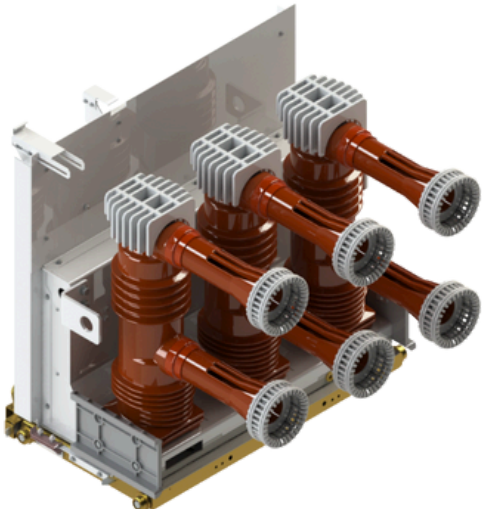


Description

The State of the art Processing and Advanced Quality Control

TV1 adheres to ISO 9001 standards, utilizing modern Japanese and European equipment on automated production lines.

Step carried

All embedded poles must undergo the following inspections and tests in the factory before entering the breaker assembly line:

- X-ray inspection
- Power frequency withstand voltage test
- Partial discharge measurement
- Extremely high and low temperature impulse test

Quality

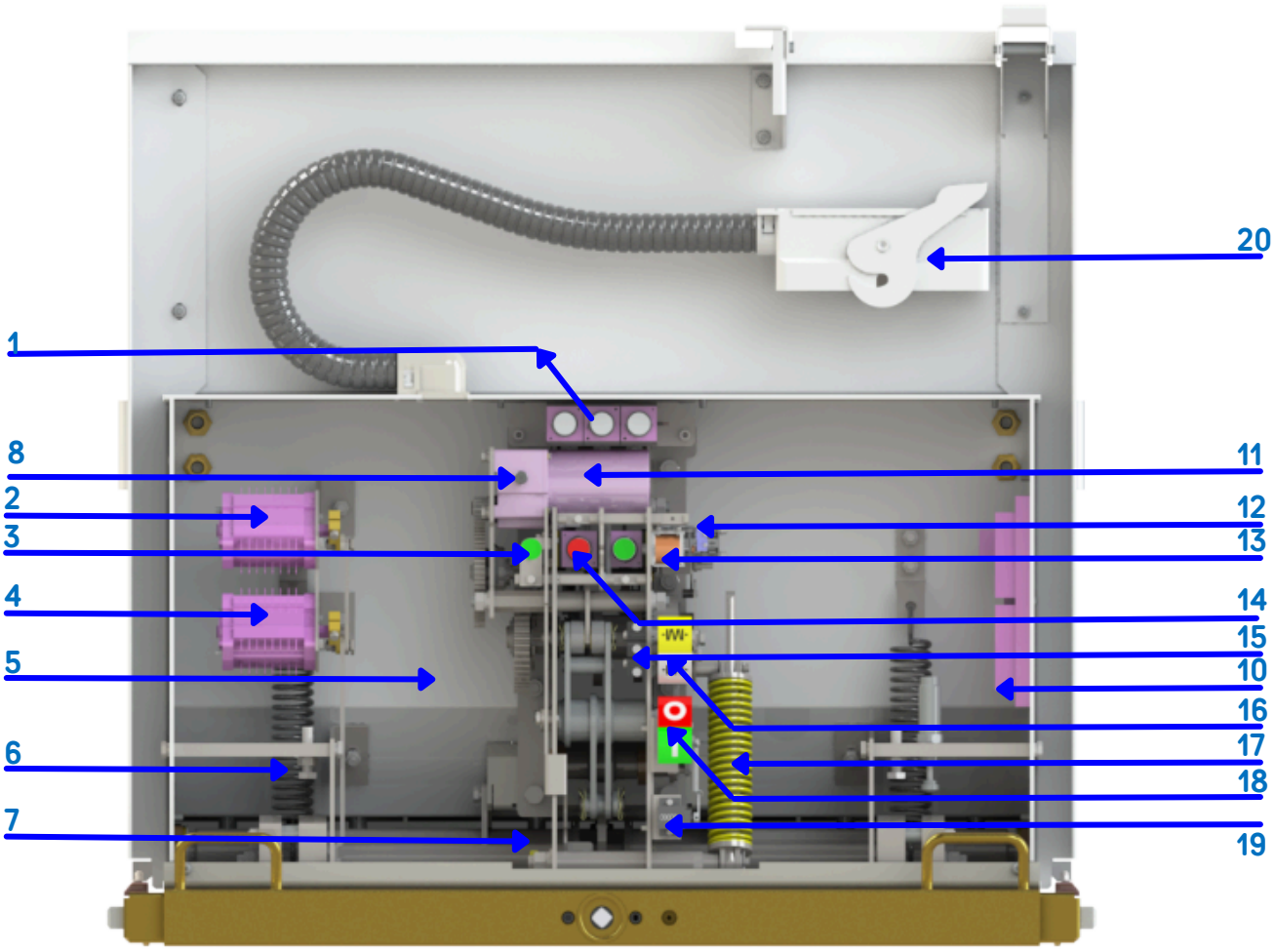
We are committed to offering our customers the highest quality products that meet international standards.

Routine tests

VCBs undergo rigorous quality control to ensure each delivered unit matches the performance of the type-tested model. This includes:

- 3D inspection of all components for dimensional accuracy.
    - Routine testing: Dielectric strength of the main circuit
    - Auxiliary and control circuit functionality
    - Main circuit resistance measurement
    - Leak tightness test
    - Design verification and visual inspection
    - Mechanical operation testing

Mechanism assembly

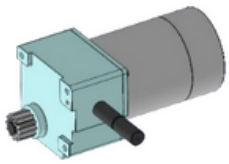


1 Second opening release/Under voltage release (Y9/Y4)
2 Open/closed auxiliary contacts of VCB (S7)
3 First opening release (Y2)
4 Open/closed auxiliary contacts of VCB (S6 – Spare)
5 Auxiliary terminal of VCB (T)
6 Opening spring
7 Locking for truck
8 Manual crank
9 Auxiliary terminal of Truck (X)
10 Closed-Open control circuit board
11 Charing motor (M)
12 Auxiliary switch of Motor (S2,S3,S4,S5)
13 Block closing magnet (Y1)
14 Closing release (Y3)
15 Auxiliary switch on charging motor
16 Signaling device for closing springs loaded/discharged
17 Closing spring
18 Mechanical signaling device for circuit breaker open/closed
19 Mechanical operation counter
20 Secondary plug assembly

Description

Auxiliary

Standard Accessories

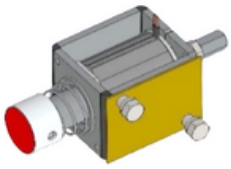


Spring charging motor (M)

Standard: This device charges the mechanism's closing spring electrically. In the event of a loss of power, the mechanism's closing spring can be charged manually.

Attributes:

- Rated voltage (DC): 110Vdc/220Vdc
- Rated current (A): 1.6/0.8
- Rated speed (r/min) : 155
- Rated torque (Nm): 5.55
- Insulation class: E
- Working duty: S2-1

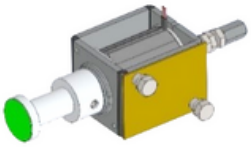


Shunt opening release (Y2)

Standard: This device allows for local or remote opening of the circuit breaker and can operate with both direct and alternating current.

Attributes:

- Rated voltage (DC): 110 Vdc/220 Vdc
- Energy duty : 5%
- Coil resistance at 20°C (Ω): Max. 66.3/289 Min. 58.4/250

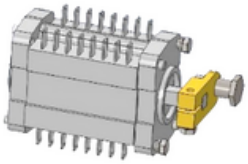


Shunt closing release (Y3)

Standard: This device allows for local or remote closing of the circuit breaker and can operate with both direct and alternating current.

Attributes:

- Rated voltage (DC): 110/220 V
- Energy duty : 5%
- Coil resistance at 20°C (Ω): Max. 66.3/289 Min. 58.4/250
- Insulation: Bsen/IEC 60317-20 solderable polyurethane (155°C)

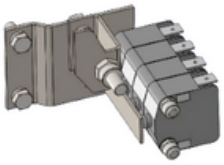


Breaker auxiliary contacts (S6,S7)

Standard: Standard circuit breaker contain a 16NO auxiliary switch, therein 8NO action when CB close, 8NO action when CB open. Up to 32NO with option.

Attributes:

- 10A in accordance with 380V. 5A in accordance with 220V
- Ambient temperature : -40°C - 40°C
- Altitude < 3000m
- Oscillatory acceleration: 15m/s2



Auxiliary switch of VCB (S2,S3,S4,S5)

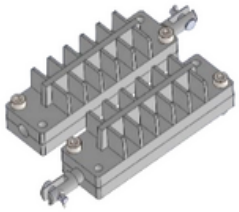
Standard: This device is used to signal whether the operating mechanism's closing spring is charged or discharged. It uses a micro-switch that allows remote signaling of the state of the closing spring.

Attributes:

- Rated current: 16A/380V
- Ambient temperature -10°C -85°C
- Contact resistance < 20MΩ

Auxiliary

Standard Accessories

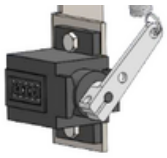


Position contacts (S8,S9)

Standard only for withdrawal: These contacts are used to identify if the CB is in the service, test position. This device also acts as an electrical interlock to prevent unsafe operations.

Attributes:

- Rated voltage: 660VAC
- Rated frequency: 50Hz
- Rated current: 15A



Mechanical operation counter

Standard: This is a device that counts the number of circuit breaker. Working duty: S2-1

Auxiliary switch of motor (S1)

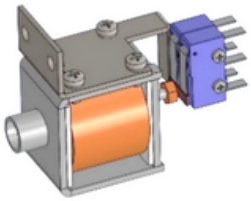
Standard: This device is used to signal whether the operating mechanism's closing spring is charged or discharged. It uses a micro-switch that allows remote signaling of the state of the closing spring.

Attributes:

- Rated current in 125 VDC : 10 A
- Rated current in 250 VDC : 3 A
- Insulation resistance 100 MΩ min. (at 500 VDC)
- Degree of protection against electric shock: Class I

Manual crank

- Standard only withdrawal: This device is used to manually rack the circuit breaker into the switchgear.
- One unit of this device can be used for all of the circuit breaker on a particular site.
- Degree of protection against electric shock: Class I



Block closing magnet (Y1)

Optional: This device allows block closing if interlocking is not ready.

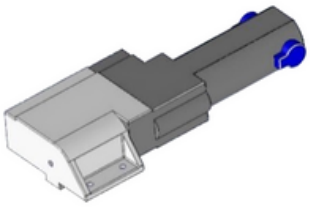
Attributes:

- Rated voltage (DC): 110Vdc/220 Vdc
- Energy duty : 5%
- Coil resistance at 20°C (Ω):
  - Max. 66.3/289
  - Min. 58.4/250
- Insulation: Bsen/IEC 60317-20 solderable polyurethane (155°C)

Description

Auxiliary

Standard Accessories

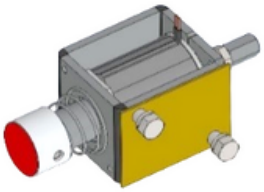


Motor truck

Optional: This device allows control truck by manual or remote with motor.

Attributes:

- Rated voltage (DC): 110Vdc/220Vdc
- Rated current (A): 4/2
- Rated power (W): 180
- Rated speed (r/min) : 42
- Rated torque (Nm): 40.9



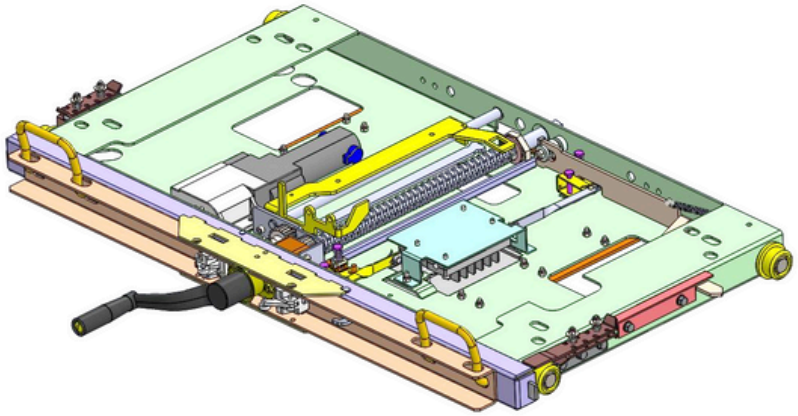
Second opening release (Y9)

Optional: Like the shunt opening release, this device allows for local or remote opening of the CB. It can be supplied by a circuit completely independent from the first shunt opening release. This device can operate with direct and alternating current.

Attributes:

- Rated voltage (DC): 110/220 V
- Energy duty : 5%
- Coil resistance at 20oC (Ω):
  - Max. 66.3/289
  - Min. 58.4/250

VCB Truck



- VCB Truck: Moves circuit breaker between test and service positions by racking them clockwise.
- VCB Truck (withdrawal version): Allows racking in/out of switchgear with doors closed.
- Motorized Option: Enables remote racking of breaker for safe positioning without needing an operator in front of the switchgear.
- Truck Interlocking Magnet:
  - Prevents incorrect breaker installation
  - Ensures correct current rating
  - Requires auxiliary circuit connection
- Safety Locks: Prevent hazardous operations through the operating mechanism and truck.

Electrical Characteristics

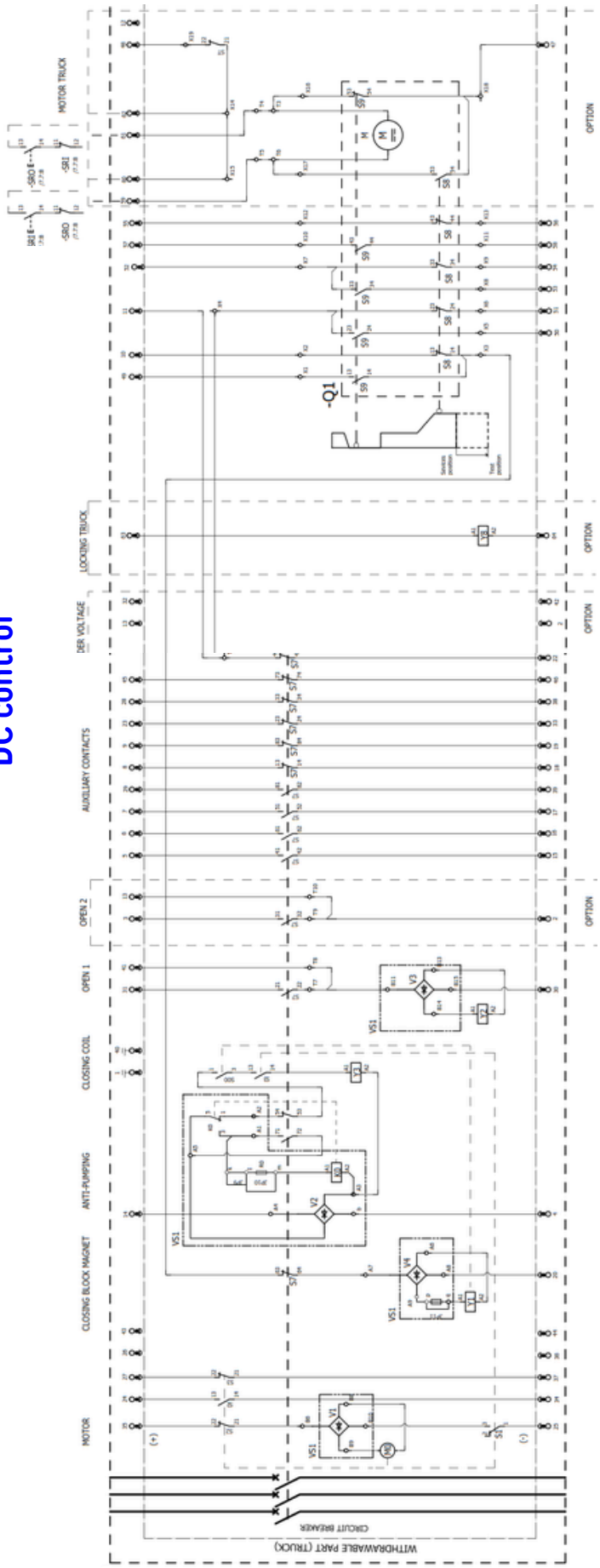
Standard		IEC 62271-100		
Rated Voltage (*)	Ur (kV)	Up to 12	17.5	24
Rated power frequency withstand voltage /1min	Ud (kV)	28	38	50
Rated lightening impulse withstand voltage (peak values)	Up (kV)	75	95	125
Rated frequency	Fr (Hz)	50-60		
Rated current (*)	Ir (A)	630 1250 1600 2000 2500 3150 4000	630 1250 1600 2000 2500 3150 4000	630 1250 1600 2000 2500
Rated short circuit breaking current	Isc (kA)	25/31.5/40/50	25/31.5/40/50	25/31.5
Rated short circuit making current	Ip (kA)	63/80/100/125	63/80/100/125	63/80
Rated duration of short circuit	tk (s)	3/4		
Rated operating sequence (*)		O – 0.3s – CO – 15s – CO O – 0.3s – CO – 180s – CO O – 180s – CO		
Open time	ms	⩽45		
Arcing time	ms	⩽15		
Closing time	ms	Approx 60		
Total breaking time	ms	⩽60		
Spring charging time	s	⩽12		
Rated Cable charging	A (class)	31.5 C2		
Mechanical endurance	Operation (Class)	10.000 (M2)		
Electrical endurance	Class	E2		
Operating temperature	°C	-15 °C to +40 °C		
Line charging breaking current	A (class)	10 (C2)		
Cable charging breaking current	A (class)	31.5 (C2)		
Maximum overall dimensions – H x W x D	mm	Fixed up to 1250A: 656 x 640 x 799 Fixed up to 2500A: 711 x 840 x 799 Drawout up to 1250A: 795 x 640 x 799 (P=210) 795 x 747 x 799 (P=275) Drawout up to 2500A: 838 x 882 x 786		
Pole-center distance (*)	mm	120/150/210/275	150/210/275	210/275
Weight	Fixed (kg)	105 (⩽ 1250A) 175 (⩽ 2500A)		
	Drawout (kg)	145 (⩽ 1250A) 235 (⩽ 2500A)		
Altitude	m	1000		

(*)**Other** version available on request.

Wiring diagram

Withdrawal type

DC control



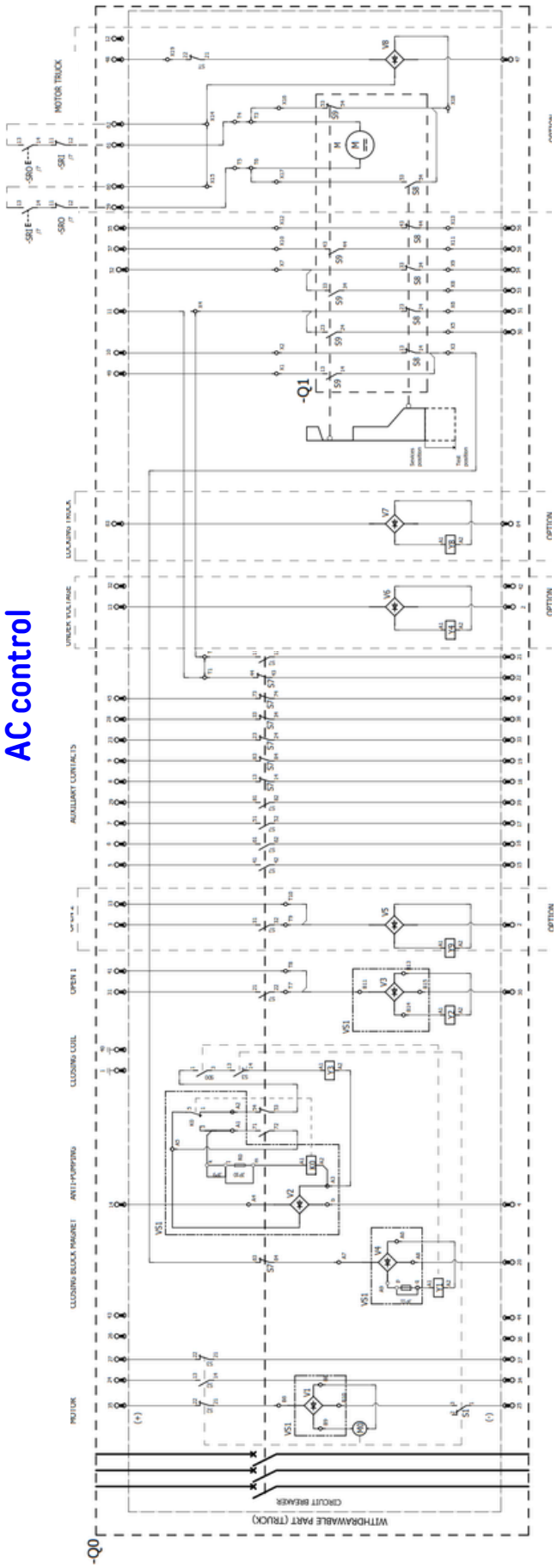
NOTICE:

- **-Y1 :** Closing block magnet
- **-Y2 :** First opening release
- **-Y9 :** Second opening release
- **-Y3 :** Closing release
- **-Y4 :** Under voltage release
- **-Y8 :** Locking for truck
- **-M:** Charging motor
- **-K0 :** Anti-pumping relay
- **-S1 :** Auxiliary switch on charging motor
- **-S2, S3, S4, S5 :** Auxiliary switch of VCB
- **-S6, S7 :** Auxiliary switch on block magnet
- **-S8 :** Limit switch test position
- **-S9 :** Limit switch service position
- **-S00, S01 :** Contact of coil magnet Y1
- **-ST :** Auxiliary contact of lock rotate truck by crank

More of presentnation :

1. Aux. switch S1 shown for CB Mechanism discharged CB
2. VCB opening and service status
3. The optional components are not included in basic version if not specified
4. T: Auxiliary terminal (10 pins)
5. X: Auxiliary terminal (20 pins)
6. Q0: VCB
7. Q1: Truck

Withdrawal type



NOTICE:

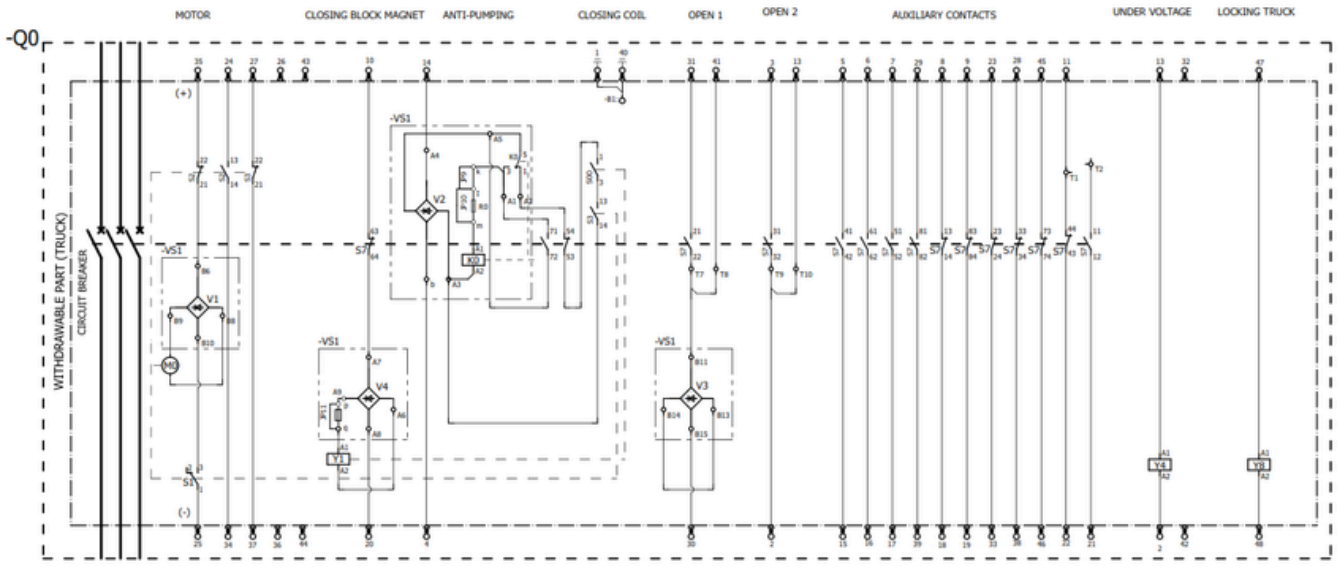
- **-Y1 :** Closing block magnet
- **-Y2 :** First opening release
- **-Y9 :** Second opening release
- **-Y3 :** Closing release
- **-Y4 :** Under voltage release
- **-Y8 :** Locking for truck
- **-M:** Charging motor
- **-K0 :** Anti-pumping relay
- **-S1 :** Auxiliary switch on charging motor
- **-S2, S3, S4, S5 :** Auxiliary switch of VCB
- **-S6, S7 :** Auxiliary switch on block magnet
- **-S8 :** Limit switch test position
- **-S9 :** Limit switch service position
- **-S00, S01 :** Contact of coil magnet Y1
- **-ST :** Auxiliary contact of lock rotate truck by crank

More of presentnation :

1. Aux. switch S1 shown for CB Mechanism discharged CB
2. VCB opening and service status
3. The optional components are not included in basic version if not specified
4. T: Auxiliary terminal (10 pins)
5. X: Auxiliary terminal (20 pins)
6. Q0: VCB
7. Q1: Truck

Wiring diagram

Fixed type



DC control

NOTICE:

- Y1 : Closing block magnet
- Y2 : First opening release
- Y9 : Second opening release
- Y3 : Closing release
- Y4 : Undervoltage release
- M : Charging motor
- K0 : Anti-pumping relay
- S1 : Auxiliary switch on charging motor
- S2, S3, S4, S5 : Auxiliary switch of VCB
- S6, S7 : Auxiliary contact for VCB
- S8 : Limit switch test position
- S9 : Limit switch service position
- S00, S01 : Contact of coil magnet

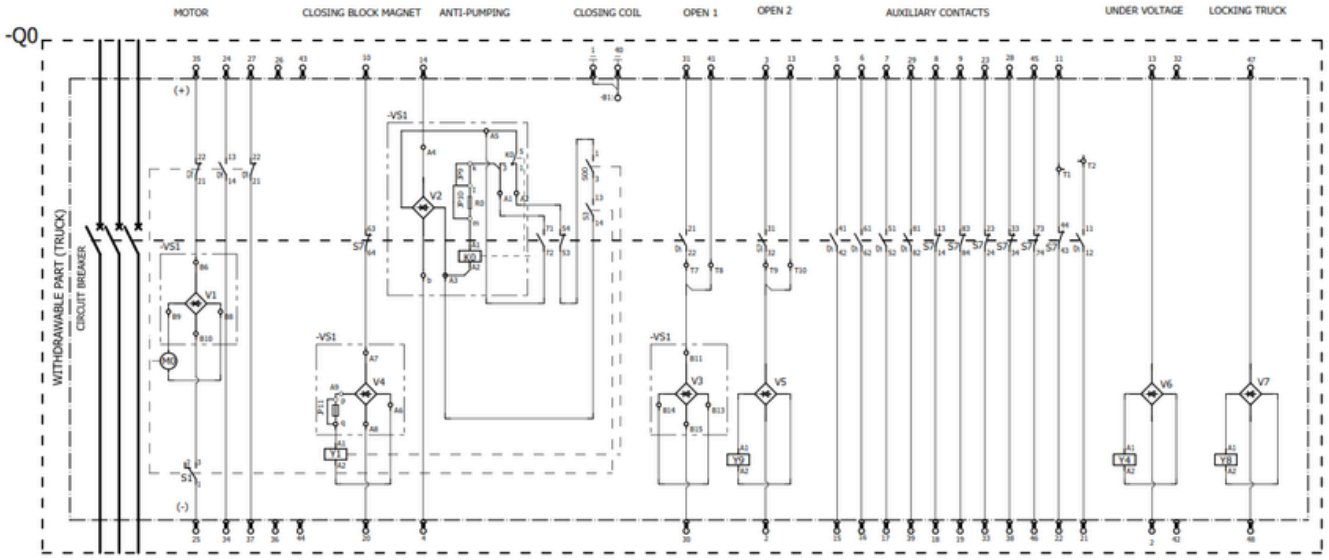
More of presentation :

1. Aux switch S1 shown for CB Mechanism discharged CB
2. VCB opening and service status
3. The optional components are not included in basic version if not specified
4. T: auxiliary contacts for VCB

Wiring diagram

TV1

Fixed type



AC control

NOTICE:

- Y1 :	Closing block magnet
- Y2 :	First opening release
- Y9 :	Second opening release
- Y3 :	Closing release
- Y4 :	Under voltage release
- M :	Charging motor
- K0 :	Anti-pumping relay
- S1 :	Auxiliary switch on charging motor
- S2, S3, S4, S5 :	Auxiliary switch of VCB
- S6, S7 :	Auxiliary contact for VCB
- S8 :	Limit switch test position
- S9 :	Limit switch service position
- S00, S01 :	Contact of coil magnet

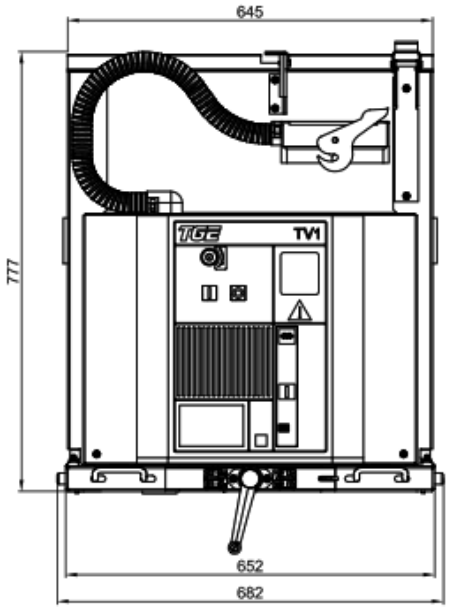
More of presentation :

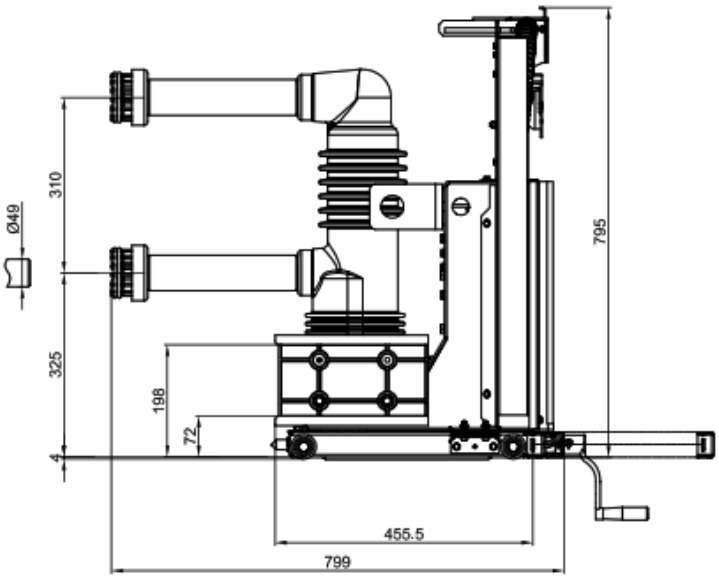
1. Aux switch S1 shown for CB Mechanism discharged CB
2. VCB opening and service status
3. The optional components are not included in basic version if not specified
4. T: auxiliary contacts for VCB

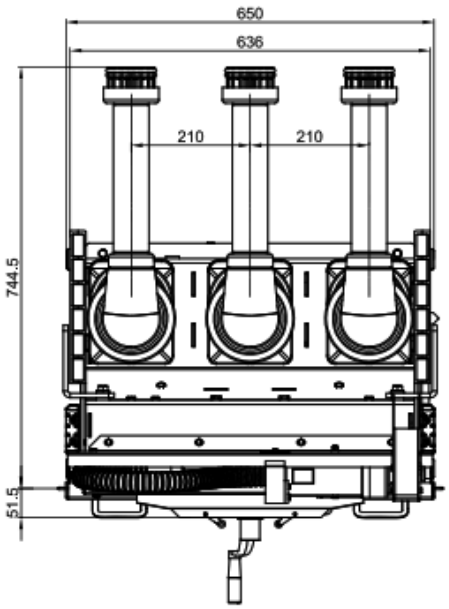
Dimensions

Drawout installation

24kV, up to 1250A, 25/31.5kA







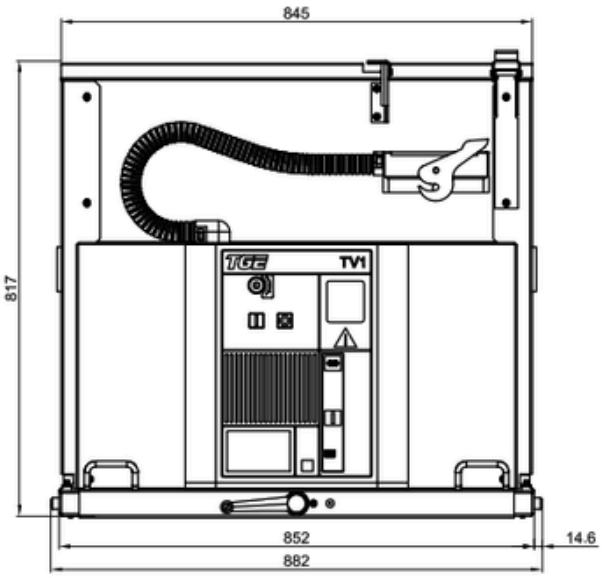
Rated current (A)		Rated short-circuit current (kA)	
630	1250	25	31.5

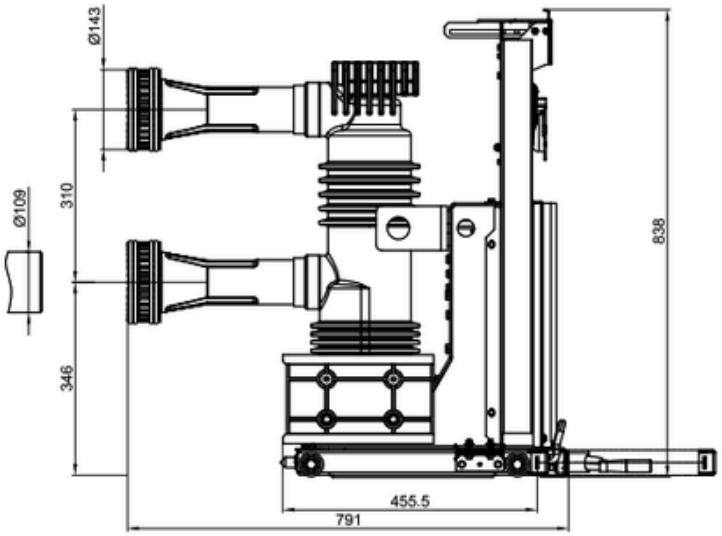
Dimensions

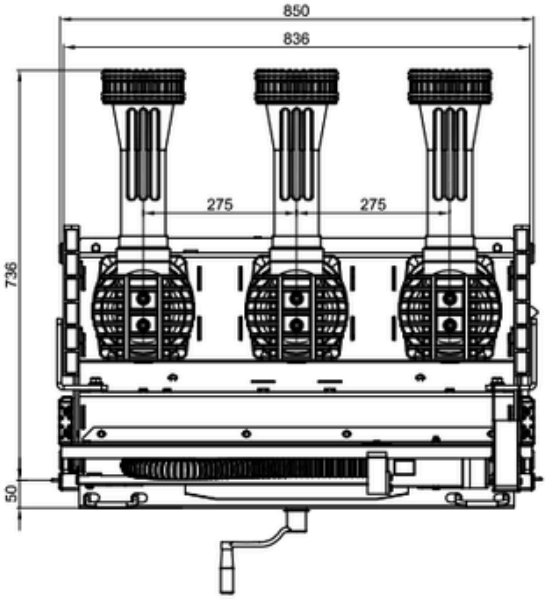
TV1

Drawout installation

24kV, up to 2500A, 25/31.5kA



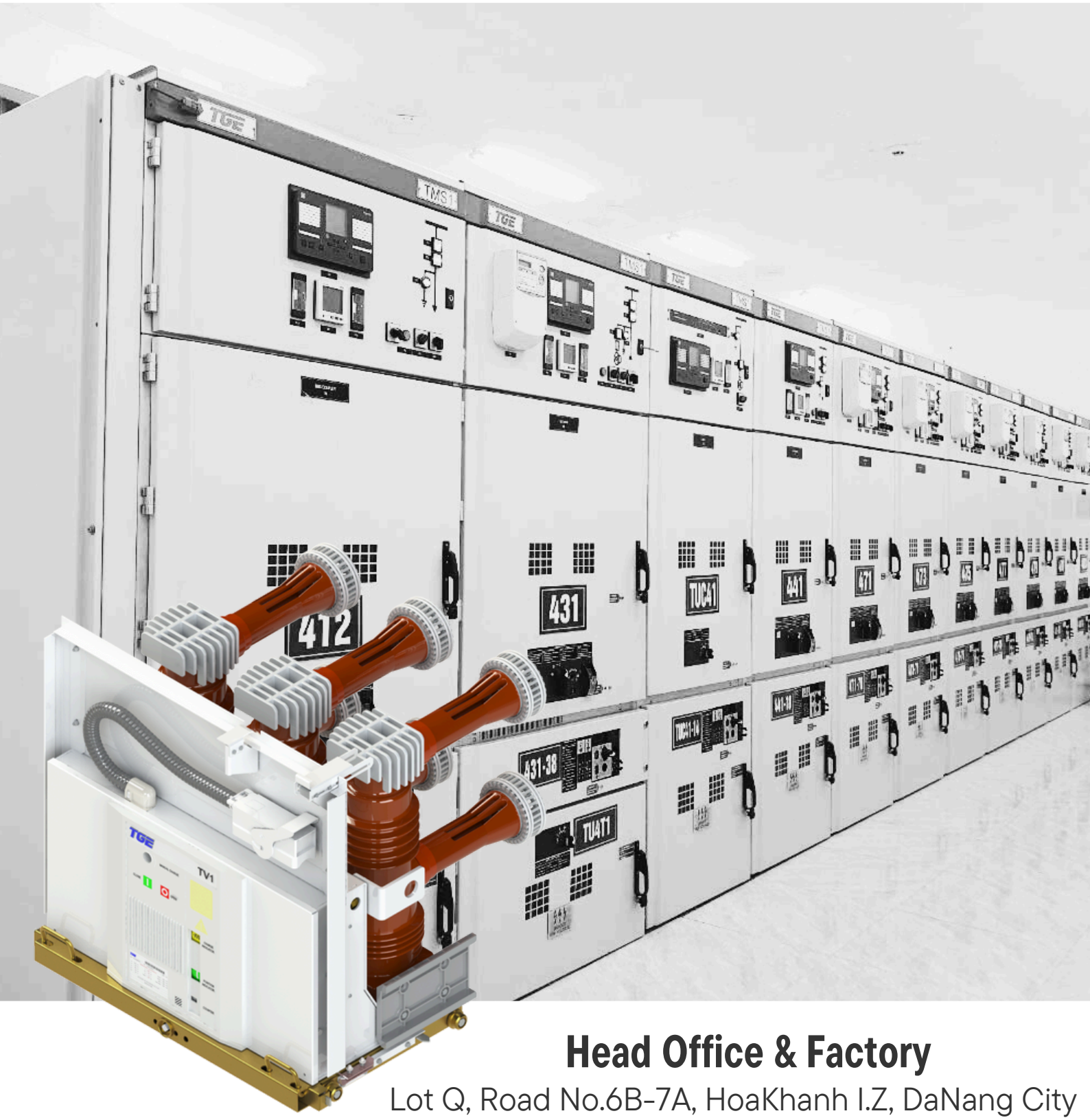




Rated current (A)			Rated short-circuit current (kA)	
1600	2000	2500	25	31.5

TGE

Switching to a brighter future



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