

VTM-12 Indoor Medium-voltage AC Permanent Magnet Vacuum Circuit Breaker

1 Overview



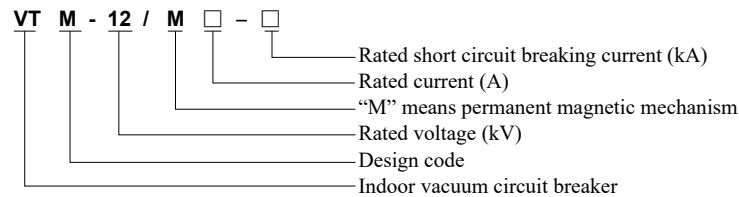
VTM-12 series indoor high voltage permanent magnet vacuum (hereinafter referred to circuit breaker) is used in the indoor switching device of the three phase AC 50Hz, 12kV power system, suitable for many applications such as switching different loads, frequent operations, and multiple breakings of short circuit current as the protection and control unit of the power grid device and the power device in the industrial and mining enterprises.

The circuit breaker adopts the operating mechanism and circuit breaker body (primary circuit) integration design, and it is used as a fixed installation unit (with fixed cabinet configured), and can form a cart unit (located in the centrally installed switchgear) together with the propulsion mechanism (chassis truck).

The circuit breaker complies with the relative requirements of GB/T 1984 High Voltage AC Circuit Breaker, JB/T3855 High Voltage AC Vacuum Circuit Breaker, DL/T 403 12~40.5kV indoor high voltage vacuum circuit breaker order technical conditions, and IEC62271-100 standard.



2 Type Designation



3 Technical Parameters

3.1 Main Technical Parameters

No.	Item	Unit	Data		
1	Rated voltage	kV	12		
2	Rated lightning impulse withstand voltage (peak)		Gap 85, interphase, and to earth 75		
3	Rated power frequency withstand voltage (1min)		Gap 48, interphase, and to earth 42		
4	Rated short circuit breaking current	kA	20, 25	31.5	40
5	Rated current	A	630 1250	1250, 1600 2000, 2500	1250, 1600, 2000 2500, 3150, 4000
6	Rated short time withstand current	kA	20, 25	33.5	40
7	Rated peak withstand current		50, 63	80	100
8	Rated short circuit making current (peak)	kA	50, 63	80	100
9	Secondary circuit power frequency withstand voltage (1min)	V	2000		
10	Rated operation sequence		O-0.3s-CO-180s-CO	O-180s-CO-180s-CO	
11	Rated short circuit duration time	s	4		
12	Rated single/back-to-back capacitor bank breaking current	A	20, 31.5kA	40kA	
13	Mechanical life	Times	30000	20000	
14	Rated short circuit current switching times		50	30	
15	Allowable wear accumulative thickness of the moving and stationary contact	mm	3		
16	Rated closing and opening operating voltage	V	220, 110		

VTM-12 Indoor Medium-voltage AC Permanent Magnet Vacuum Circuit Breaker

No.	Item	Unit	Data
17	Charging time under rated voltage	s	≤ 10
18	Contact opening distance, overstroke	mm	Opening 9±1 (11±1) Overstroke 3~3.5
19	Rated operating voltage: ON/OFF time	ms	Closed 25-60 Open 25-50
20	Contact closing bounce time		≤ 2 ≤ 3
21	Three-phase closing and opening simultaneity		≤ 2
22	Average opening speed	m/s	0.9~1.3
23	Average closing speed		0.4~0.8
24	Average closing speed	μΩ	630A: ≤ 55 1250A ≤ 50 1600, 2000A: ≤ 40 2500A and above ≤ 30
25	Main circuit resistance	N	20kA, 25kA: 2400±150 31.5kA: 3200±200 40kA: 4500±300

3.2 Technical Data of Energy-Saving Motor

This product adopts special reducer used for permanent magnet type single-phase DC motor, and the technical parameters of motor are listed in table below.

Rated voltage (V)	Rated output power (W)	Normal operating voltage range	Energy storage time under rated voltage (s)
DC220	70/100	85%~110% rated voltage	≤15

3.3 Technical Data of Electromagnet

	Closing electromagnet	Opening electromagnet	Locking electromagnet	Anti-bounce relay
Rated operating voltage (V)	DC220	DC220	DC220	DC110
Coil power (W)	368	368	4	1.0
Resistance (Ω)	131.5±5% (20°C)	131.5±5% (20°C)	13600±5% (20°C)	12100±5% (20°C)
Operating voltage range	85%~110% rated voltage	65%~120% rated voltage	85%~110% rated voltage	

VTM-12 Indoor Medium-voltage AC Permanent Magnet Vacuum Circuit Breaker

4 Working Environment Conditions

- 4.1 Ambient temperature: The max. temperature is +40°C, and the min. temperature is -15°C (storage and transport at -30°C are allowed);
- 4.2 Environmental humidity: The daily mean relative humidity is $\leq 95\%$, the monthly mean relative humidity is $\leq 90\%$; the daily mean vapor pressure is ≤ 2.2 kPa, and the monthly mean vapor pressure is ≤ 1.8 kPa;
- 4.3 The altitude does not exceed 1000m.
- 4.4 The earthquake intensity does not exceed 8 degrees;
- 4.5 There is no water drops, no flammable materials, no chemical corrosive gas and no severe vibration at the site.

5 Technical Features

5.1 Body Structure

The overall structure is of the type of front and back layout of the operating mechanism and primary part, and the main conducting circuit adopts the three-phase floor-mounted structure. The upper and lower outlets and vacuum arc-extinguishing chamber are all installed in a tubular insulating cylinder poured with epoxy resin in the APG process, not only reducing the overall dimensions of circuit breaker but also greatly decreasing the accumulation of dust on the surface of the arc-extinguishing chamber to prevent damage to the vacuum arc-extinguishing chamber due to external factor and to ensure the normal operation in the environment where there are more severe heat and fouls.

5.2 Operating Mechanism

The operating mechanism adopt the permanent magnet mechanism, and is of the single coil monostable type to drive the moving iron core move to the corresponding limit position under the exciting coil and keep it at the limit position under the magnetic energy provided by the high performance permanent magnet. The permanent magnet operating mechanism has a manual opening device to realize the power-off operation in the event of an emergency. With this mechanism, the complex and damageable energy storage and latch mechanical devices of the traditional mechanism are not required, the structure is simplified, and the part quantity is decreased by 70% and more compared with the traditional mechanism, thereby greatly improving the reliability and service life of the mechanism. Meanwhile, as the capacitor is used as an operating power supply, a high capacity special power supply for the traditional mechanism is not required, and the fluctuation of the auxiliary power supply has no influence on the mechanism operating performance.

5.3 Working Principle

5.3.1 Arc extinguishing principle

The circuit breaker adopts the vacuum as the arc extinguishing and gap insulating medium in the arc extinguishing chamber, providing very high arc extinguishing and insulation performance. When the moving and stationary contacts are open in the energized state under the function of the operating mechanism, a strong electric arc will be generated between the contacts. Furthermore, with the special structure of the contact, an appropriate longitudinal magnetic field will be generated in the contact gap to keep the electric arc is of the diffuse type and make the electric arc is evenly distributed on the surface of the contact, maintaining a low electric arc voltage. When the current is zero naturally, the residual ions, electrons and metal vapors can be combined or condensed on the contact surface and shield hood within the microsecond time, and the insulation strength of the medium in the gap of the arc extinguishing chamber will be quickly restored to extinguish electric arc for breaking purpose. As the longitudinal magnetic field is used to control electric arc, this circuit breaker has a strong and stable breaking capacity.

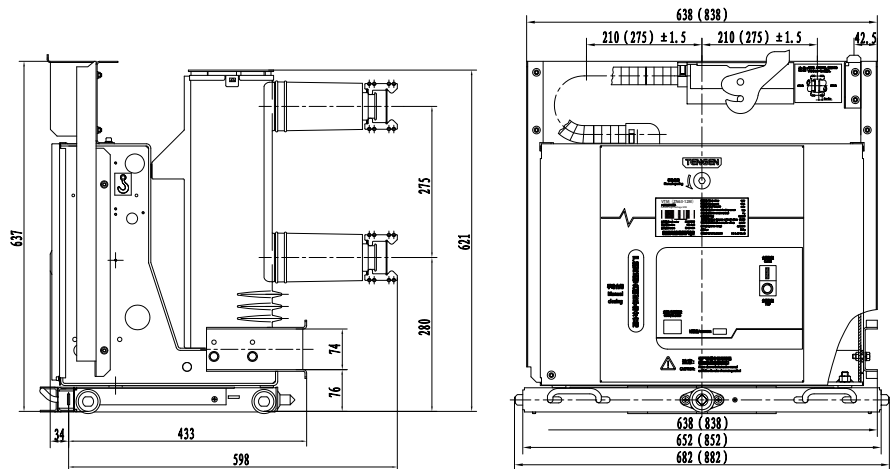
5.3.2 Operation principle

The circuit breaker can realize the ON/OFF operation of main conductive circuit through the permanent magnet operating mechanism to drive the transmission components. When the control system fails, the operating device can be manually disconnected to turn off the circuit breaker urgently.

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6 Outline and Installation Dimensions of Circuit Breaker

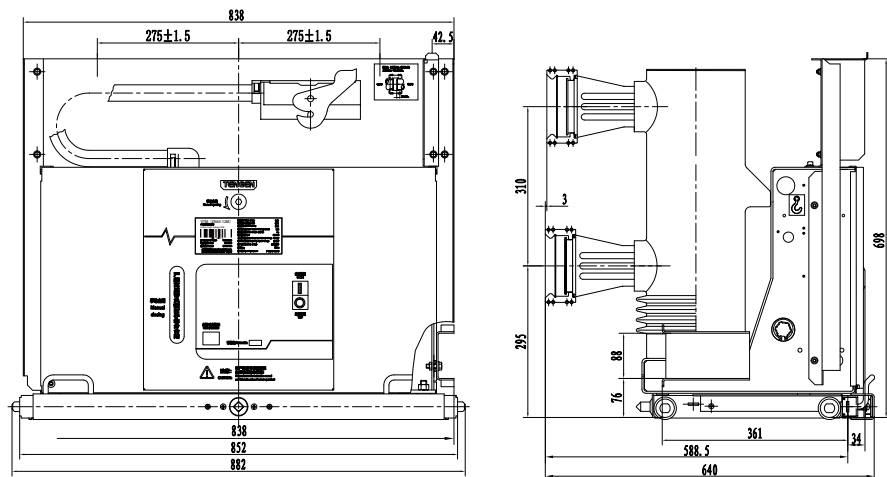
6.1 Cart Type Circuit Breaker Outline Dimensions Drawings ($\leq 1600\text{A}$)



Note: The stroke of cart is 200mm, and the size in the bracket is the width of the 1000mm cabinet.

Rated current (A)	630	1250	1600
Rated short-circuit breaking current (kA)	20, 25, 31.5	25, 31.5, 40	31.5, 40
Size of matched static contact (mm)	$\phi 35$	$\phi 49$	$\phi 55$

6.2 Cart Type Circuit Breaker Outline Dimensions Drawings (1600-4000A)

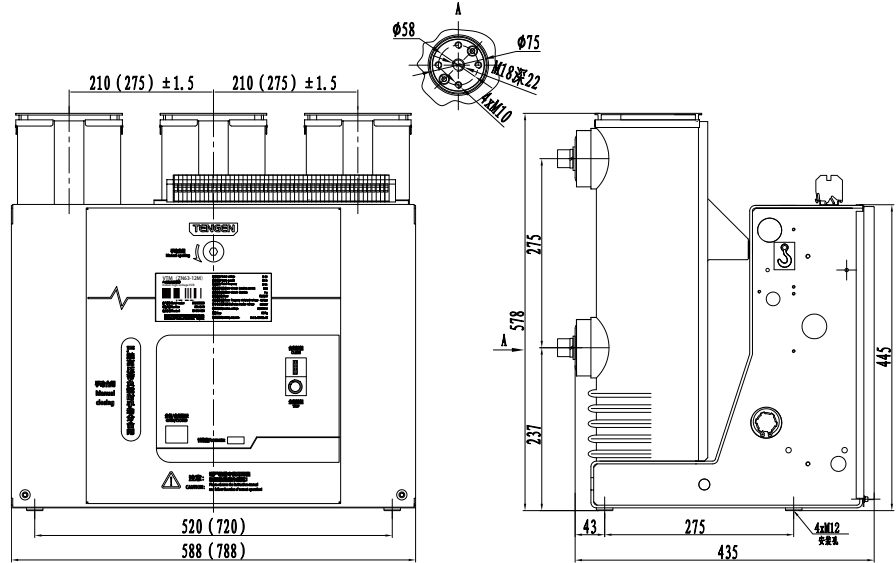


Note: The stroke of the cart is 200mm.

Rated current (A)	1600	2000	2500	3150	4000
Rated short-circuit breaking current (kA)	31.5, 40		31.5, 40		
Size of matched static contact (mm)	$\phi 79$		$\phi 109$		

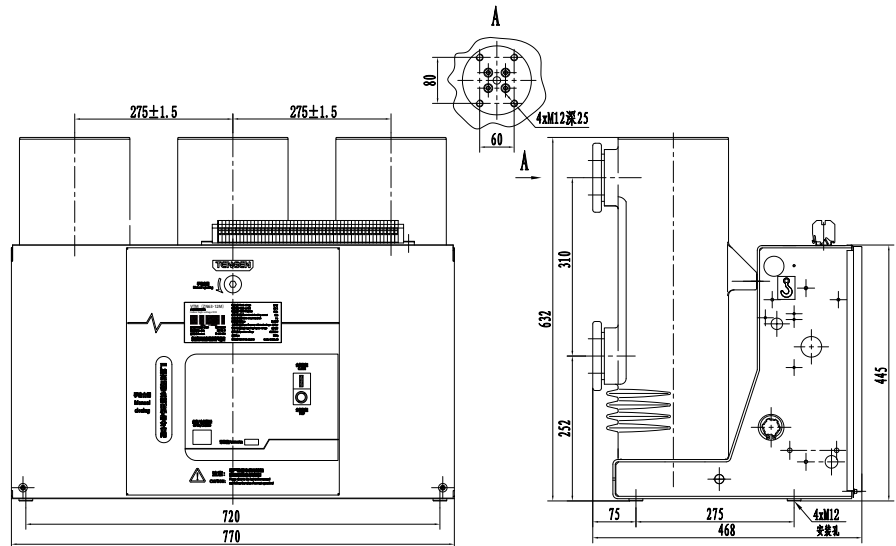
VTM-12 Indoor Medium-voltage AC Permanent Magnet Vacuum Circuit Breaker

6.3 Fixed Type Circuit Breaker Outline Dimensions Drawings ($\leq 1600\text{A}$)



Rated current (A)	630	1250	1600
Rated short circuit breaking current (kA)	20、25、31.5	25、31.5、40	31.5、40

6.4 Fixed Type Circuit Breaker Outline Dimensions Drawings (1600A-14000A)



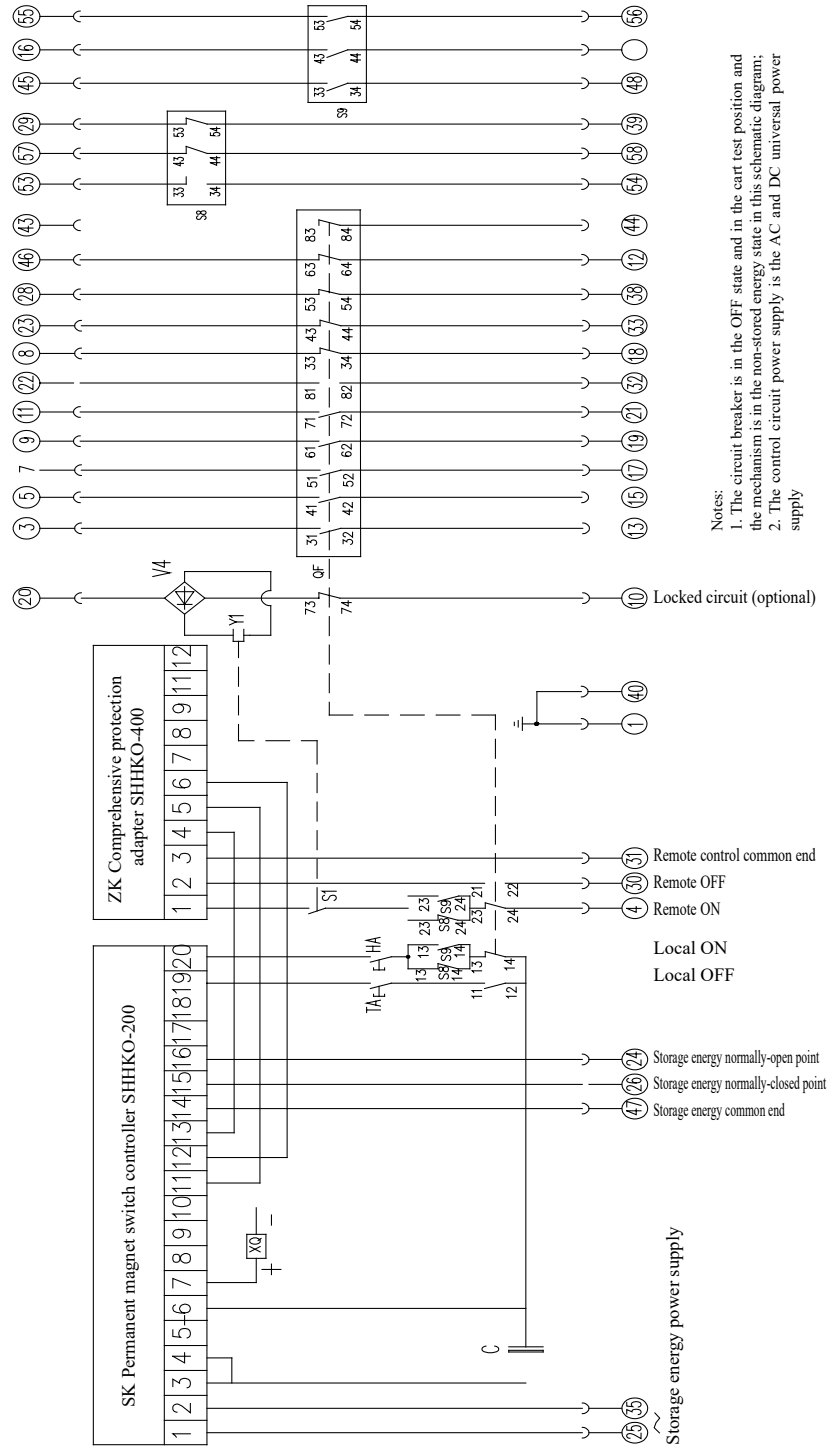
Rated current (A)	1600	2000	2500	3150	4000
Rated short circuit breaking current (kA)	31.5、40				

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7 Secondary Plan Schematic Diagram

Schematic diagram of internal electrical control of circuit breaker. The cart type circuit breaker in the test position and in the OFF state, as shown in figure; the fixed circuit breaker does not contain the chassis truck part. The figure shows the circuit breaker in the OFF state.

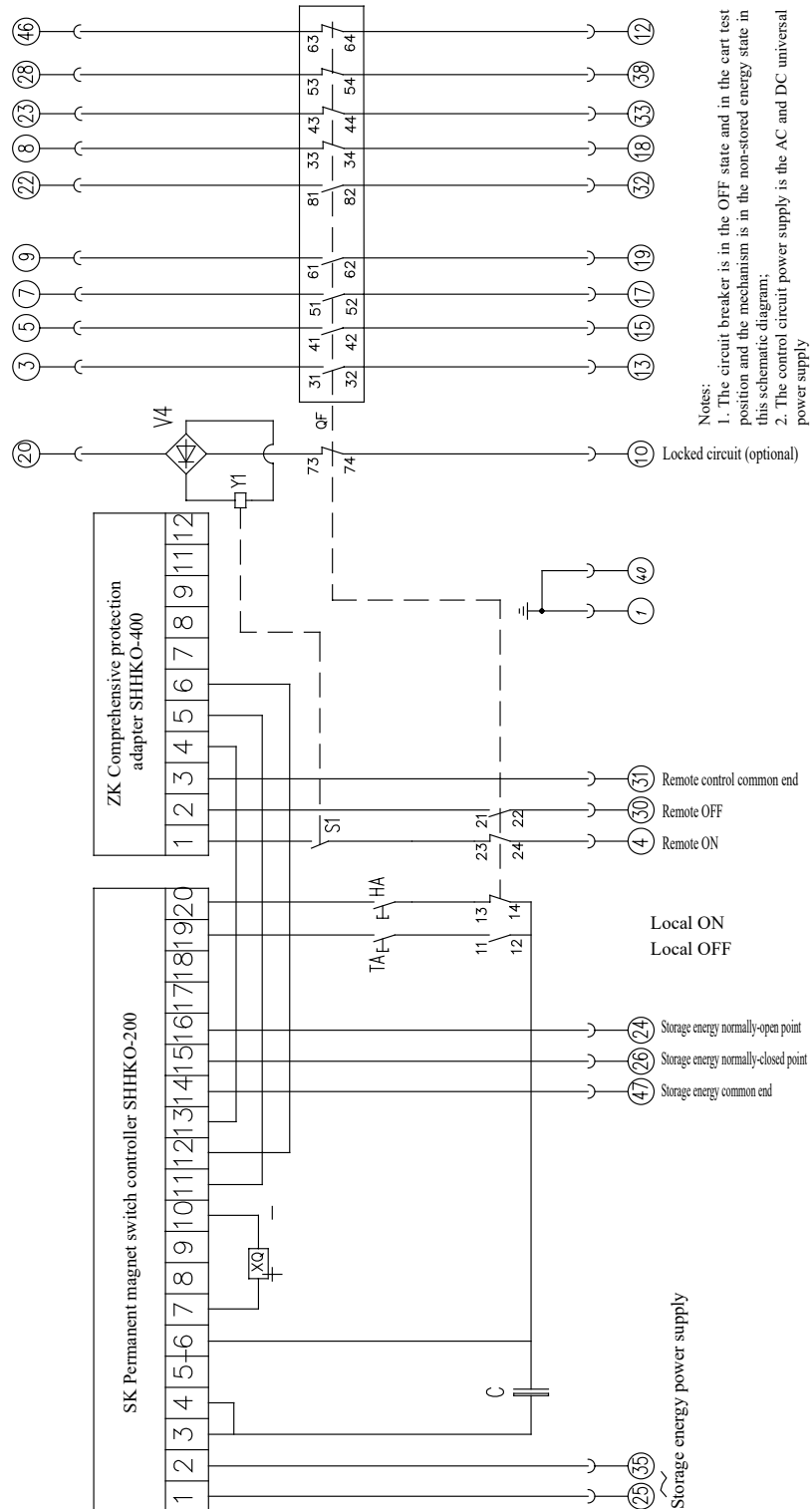
7.1 VTM-12 Cart Type Secondary Wiring Diagram Schematic Diagram



S8, S9: Test position and work position	XQ: Closing and opening coil	SK: Permanent magnet switch controller	ZK: Comprehensive protector
HA: Local ON button	TA: Local OFF button	QF: Aux. switch	C: Capacitor

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8 Ordering Technical Confirmation Form

Technical Confirmation Form for Ordering VTM-12 Indoor Medium-voltage AC Permanent Magnet Vacuum Circuit Breaker

Determine your requirements according to the items listed in table below:

Product model	<input type="checkbox"/> Handcart type <input type="checkbox"/> Fixed type	
Order quantity (pcs)		Primary structure: <input type="checkbox"/> insulated cylinder type <input type="checkbox"/> Sealed pole type
Rated current (A)	<input type="checkbox"/> 630 <input type="checkbox"/> 1250 <input type="checkbox"/> Others_____	
Rated short-circuit breaking current (kA)	<input type="checkbox"/> 20 <input type="checkbox"/> 25 <input type="checkbox"/> 31.5 <input type="checkbox"/> 40	
Phase distancing (mm)	<input type="checkbox"/> 210 <input type="checkbox"/> 275	
Operating voltage (V)	OFF, ON: <input type="checkbox"/> AC220 <input type="checkbox"/> DC220 <input type="checkbox"/> Others_____ Stored energy: <input type="checkbox"/> AC220 <input type="checkbox"/> DC220 <input type="checkbox"/> Others_____	
Lock device	ON lock: <input type="checkbox"/> No lock (standard configuration) <input type="checkbox"/> With lock, operating voltage_____V Handcart lock: <input type="checkbox"/> No lock (standard configuration) <input type="checkbox"/> With lock, operating voltage_____V	
Handcart type Chassis cart option (this option is not required for fixed type)	Earthing: <input type="checkbox"/> Bottom friction earthing (standard configuration) <input type="checkbox"/> Rails earthing at both sides <input type="checkbox"/> Contact earthing Program lock: <input type="checkbox"/> No (standard configuration) <input type="checkbox"/> With chassis cart locked <input type="checkbox"/> With circuit breaker baffle locked Cabinet door interlock: <input type="checkbox"/> No (standard configuration) <input type="checkbox"/> With door closing interlock function	
Fixed interlock (This item is not available for handcart type)	Spindle extended: <input type="checkbox"/> No (standard configuration) <input type="checkbox"/> Left____ <input type="checkbox"/> Right_____	
Secondary wiring scheme	<input type="checkbox"/> TENGEN's standard scheme (see catalog) <input type="checkbox"/> No-standard scheme (scheme should be provided)	
Outline dimensions	<input type="checkbox"/> TENGEN's standard appearance(see catalog) <input type="checkbox"/> No-standard appearance(scheme should be provided)	
Other special requirements		Ordering unit (seal) Sign: _____ Confirmation date: _____ Tel: _____

Note: If not ticked, all options shall be manufactured according to the TENGEN's standard configurations.