B5 Vacuum Transfer Switches

CONTENTS

Vacuum Transfer Switches, VTS
7.2kV, 400/600A

VITZRO EM Vacuum Transfer Switch uses a vacuum interrupter and BMC barrier that improved the insulation and is built-in with an electrical and mechanical interlock device and an over-current lock device. It is a power transfer switch that can prevent failures due to an interruption faults in case of a short circuit and over-current conduction.

An electrical and mechanical interlock is built-in.

- There are no malfunctions since the transfer device is equipped with the electrical and mechanical interlock.
- It is easy to design since there is no need to consider the electrical and mechanical interlock at outside.

It ensures a long operational cycle and long durability.

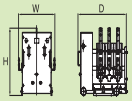
- The vacuum interrupter used at the switch part consumes very little contacts and the vacuum cycle is 20 years or more.
- The mechanical part is structured in the minimized solenoid method which is superior in its durability.

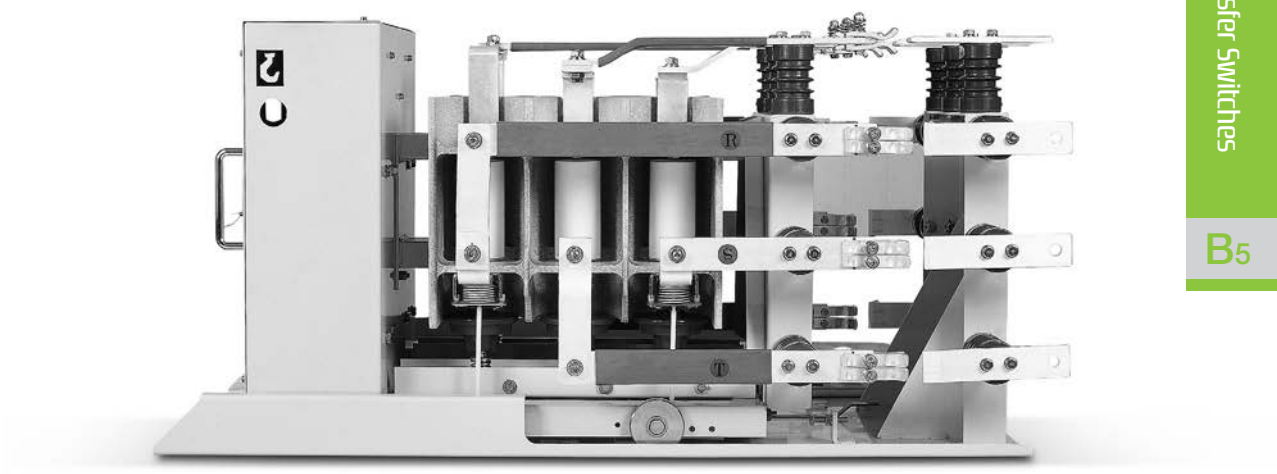
It is easy to perform a maintenance work.

- VTS is in a draw-in/out structure which enables to perform various inspections easily and the molded insulation barrier is an open-type that allows easy cleaning and inspection. The transfer operation is carried out by an instantaneous excitation mode and its power is consumed only during the transfer so it is economical.

Ratings / Application

Ratings

Type		Fixed Type	VTS-6N4		VTS-6N6	
		Draw-Out Type	VTS-6N4E		VTS-6N6E	
Rated Current		A	400		600	
Rated Voltage		kV	7.2			
Poles		P	3			
Short Time Current (1sec)		kA	12.5			
Rated Closing Current		kA	31.5			
Lock Current		A	2500			
Operational Cycle	Rated Current Switch	times	10,000			
	Continuous No-Load Switch	times	10,000			
Transfer Sequence			A ↔ off (trip) ↔ B			
Power Frequency Withstand Voltage	Main Circuit-Earth	kV	22			
	Between Phase-Shifting Main Circuits	kV	22			
	Between In-Phase Main Circuits	kV	35			
	Control Circuit-Earth	kV	2			
Impulse Withstand Voltage	Main Circuit-Earth	kV	60			
	Between Phase-Shifting Main Circuits	kV	60			
	Between In-Phase Main Circuits	kV	70			
Operation Mode			Magnetic Operation (Instantaneous Excitation Mode)			
Operating Power	Closing		DC 100/110V, 30A or below			
	Trip		DC 100/110V, 5A or below			
	Control		DC 100/110V, 0.3A or below			
External Dimensions & Weight						
Weight	Fixed Type	kg	120		130	
	Draw-Out Type	kg	140		150	
Dimensions (mm) 			Fixed Type	Draw-Out Type	Fixed Type	Draw-Out Type
		H	585	545	585	545
		W	530	592	530	592
		D	700	870	700	870
Reference Standards			JIS C4605			



Comparison on Equipment Application

Type	VTS Type Transfer Switch	Transfer using Mounting Type Switch	Two Circuit Breakers
Product Price	Built-in with an electrical and mechanical interlock, Instantaneous Excitation Mode	Built-in with an electrical and mechanical interlock, Instantaneous Excitation Mode	It requires a mechanical interlock to ensure safety when using
	Medium Price	**Low Price**	**High Price**
Panel Installation Price	It is possible to install 3 VTS+VCB at one side of cubicle which is the minimum installation space	It requires at least 2 sides since it can install 3 Mounting Type+VCB	It requires at least 2 sides since it can install total of 5 circuit breakers
	Low Price	**High Price**	**High Price**
Maintenance Cost	It is a draw-out type so it is easy to draw out from the panel and an inspection of each part can be done in a short time	It is a mounting-type so it is difficult to draw out from the panel and it requires a long time an inspection of each part	After the inspection, it is necessary to check each operation of the interlock part
	Low Price	**High Price**	**Medium Price**
General Comparison	Low Price	Medium Price	High Price

Applied Locations

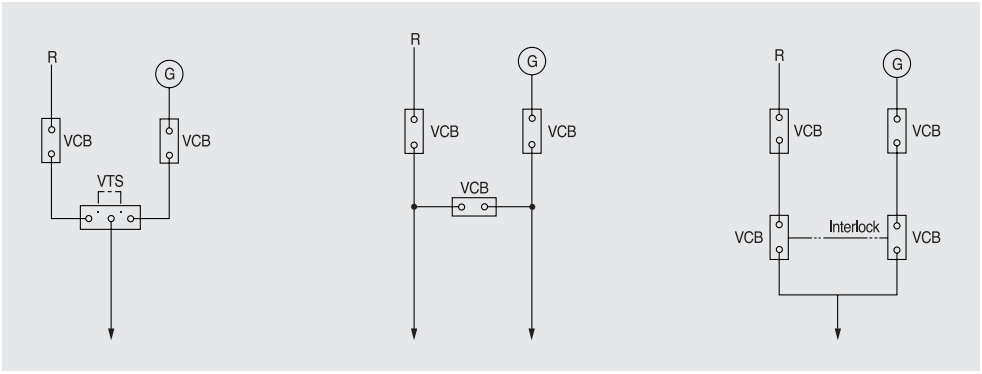
- Industrial plant facilities that may suffer a loss due to a power failure
- A place that is restricted due to the dimensions of the underground transformer room
- Facilities that permit no power failure including hospitals, broadcasting stations, airports, banks and so on
- Special fire-prevention facilities that are regulated in the Fire Services Act (Department stores, theaters, hotels and etc)

Application

On MV Power Transfer

Example on Power Transfer Circuit

Currently, there are no standardized opinions and regulations on circuit composition and equipment used for the medium-voltage power transfer (2-line circuit, power-receiving commercial power-emergency power transfer, commercial power - isolated power generation transfer) and the designers are responsible for the selection of methods and equipment, so their role is critical.
The following is an example on the power transfer circuit.



Reasons for Using a Switch for Power Transfer

According to the 「MV Power-Receiving Equipment」, it is specified that a section switch should be installed at the demarcation point for the security. A section switch refers to a switch that divides the electric lines and it has a role to prevent line mixing by increasing the withhold voltage between in-phase main circuit terminals of the equipment, higher than the other parts (for example, higher than main circuit-earth), and by performing a ground fault for the abnormal voltage from outside and inside.

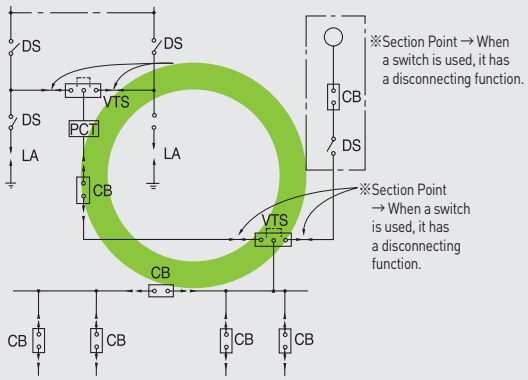
Main MV Equipment Performance
(When appplying short circuit current of 8kA or 12.5kA at 7.2kV power incoming point)

Main Performance \ Name of Equipment			Disconnecting Switch	Switch	Circuit Breaker	Contact Switch
Section Switch (Disconnecting) Performance			○	○	×	×
Withstand Voltage	Power Frequency	Between In-Phase Main Circuits	35kV	35kV	22kV	16kV
		Between Phase-Shifting Main Circuits	22kV	22kV	22kV	16kV
		Between Main Circuit-Earth	22kV	22kV	22kV	16kV
	Impulse	Between In-Phase Main Circuits	70kV	70kV	60kV	No Regulation
		Between Phase-Shifting Main Circuits	60kV	60kV	60kV	45kV
		Between Main Circuit-Earth	60kV	60kV	60kV	45kV
Load Current Breaking			×	○	○	○
Short Circuit Current Breaking			×	× (Lock when it exceeds the breaking current of the switch)	○	× (4.4kA is max.)
Short Time Current			○	○	○	× (4.4kA is max.)
Closing Current			×	○	○	×

Currently, there are no standardized opinions and regulations on circuit composition and equipment used for the high-voltage power transfer (2-line circuit, power-receiving commercial power-emergency power transfer, commercial power - isolated power generation transfer) and the designers are responsible for the selection of methods and equipment, so their role is critical.
The following figure 1 is a representative power transfer skeleton diagram. If you observe this circuit in detail by comparing with the 「MV Power-Receiving Equipment Manual」, for the transfers between commercial power (A) ↔ commercial power (B) or commercial power ↔ isolated power generation, it will be dangerous if a switch with the disconnecting function is not used.

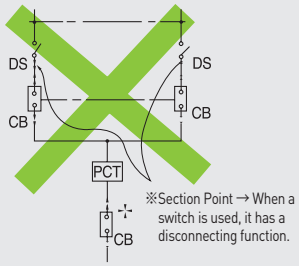
Cradle Diagram

(1) When VTS is used



* Section Point → Theoretically, it requires a section switch (disconnecting) function like the demarcation point.

(2) When 2 circuit breakers are used



* Generally, there is an electrical interlock for 2 CBs and it is very risky if there is no mechanical interlock.

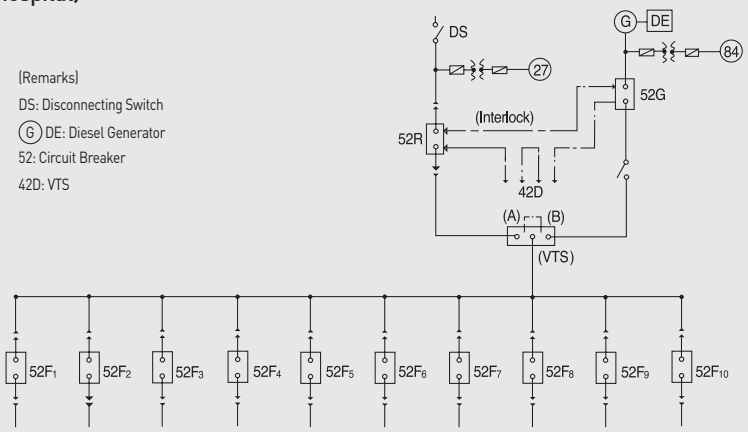
Example on VTS Application

(1) Example on Commercial Power - Isolated Power Generation

When recovered to the commercial power, there is a delay time which is based on the 「Generation Facility Manual」 and when there is a commercial power failure, there is no restriction in setting the transfer time from the commercial power to the isolated power generation.

Example on Transfer Using VTS
(In case of a hospital)

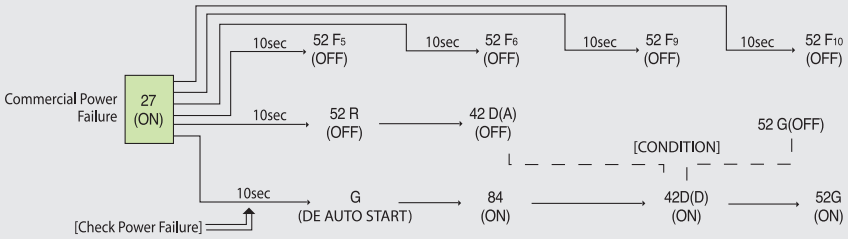
(Remarks)
DS: Disconnecting Switch
(G) DE: Diesel Generator
52: Circuit Breaker
42D: VTS



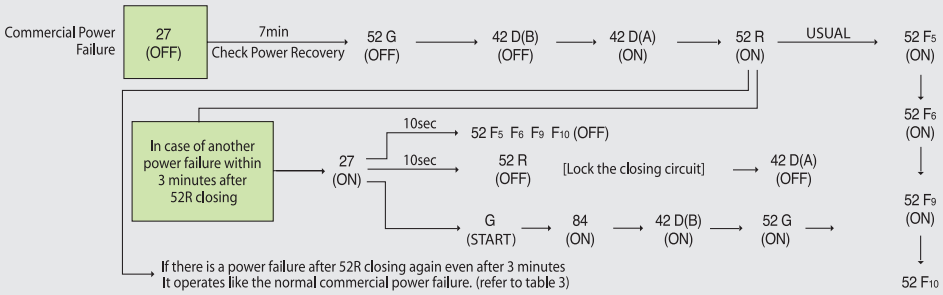
Application

On MV Power Transfer

Operation Flow in case of a Commercial Power Failure



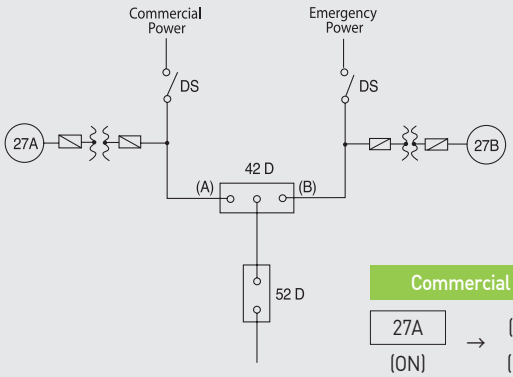
Operation Flow in case of a Commercial Power Recovery



(2) Example on Commercial Power-Emergency Power Transfer (2-line circuit power-receiving)

A commercial power-emergency power transfer circuit and its operation are marked on figure5, but it is rare in new cases, rather used by remodeling the existing installation. In this case, there are no restrictions on transfer time and so forth, but the time should be set according to the number of contact relays, section switches and so on to prevent the re-closing to the fault lines.

Commercial Power-Emergency Power Transfer Circuit & Operation Flow



(Conditions)
- There is a preferred commercial power circuit.
- In case of a power recovery, it is transferred only when power is supplied for more than 3 minutes at the emergency line. Also, it is the same condition when transferring to the emergency line.

Commercial Power Failure

27A	→	(52R)	→	42D(B)	→	42D(A)	→	(52R)
(ON)		(OFF)		(OFF)		(ON)		(ON)

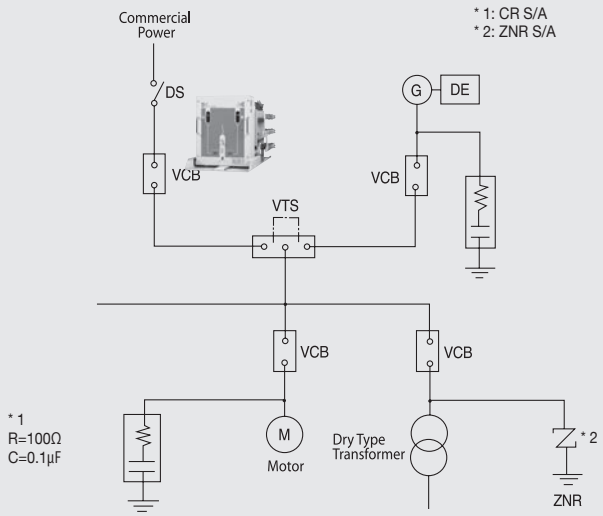
Commercial Power Recovery

27A	→	(52R)	→	42D(B)	→	42D(A)	→	(52R)
(ON)		(OFF)		(OFF)		(ON)		(ON)

On MV Power Transfer

Surge Protection when Using VTS

Operation Flow in case of a Commercial Power Failure



A vacuum device interrupts arc at a high-vacuum state so it has an excellent breaking capability due to the high dielectric strength of vacuum and the high-speed diffusion of arc. However, when switching the rotating machines such as no-load motors and generators or switching the transformers, the current is interrupted before it reaches a zero point. This generates an over-voltage due to the current chopping and it may destruct the insulator of motors so a surge protection is required.

VTS performs the transfer at no-voltage, so it does not require a surge protection. (However, if VCB is used as a circuit breaker, a surge protection is required.)

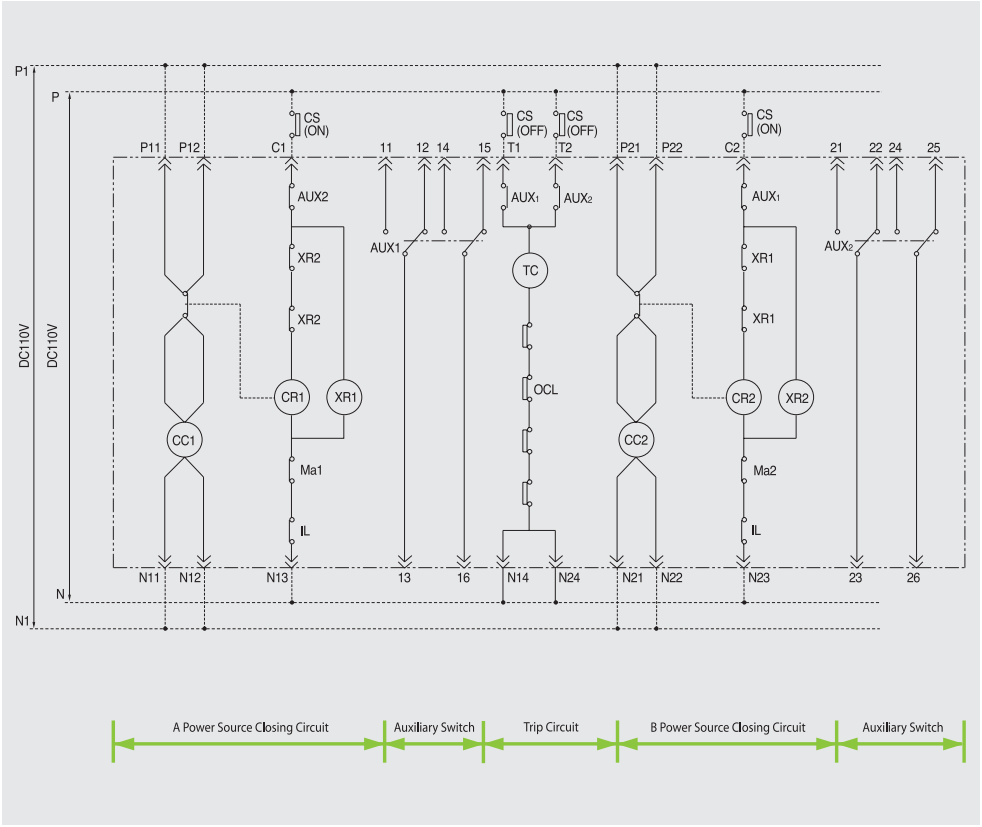
- Refer to our S/A catalogue for standard on selecting a surge absorber (S/A).

Rating of Surge Absorber


Type		KMSA-3.6	KMSA-7.2
Rated Voltage	kV	3.3	6.6
Applied Circuit Voltage	kV	3.6	7.2
Operation Starting Voltage	kV	9 ~ 10	18 ~ 20
Residual Voltage	kV	13 or below	26 or below
Classification Current	kA	5	5
Discharge Withstand Current (4×10μs)	kA	40	40
Rated Frequency	Hz	60	60
Weight	kg	0.41	0.6

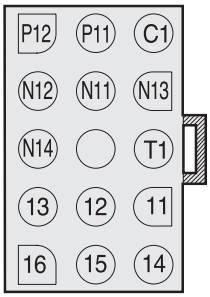
Control Circuit Diagram & Dimensions

Control Circuit Diagram

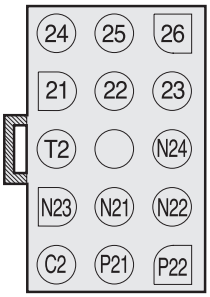


Name

CC : Closing Coil
TC : Trip Coil
AUX : Auxiliary Switch
CR : Closing Control Relay
XR : Interlock Relay
Ma : Check Switch
IL : Interlock Contact (Draw-out Type)
OCL : Over-current Lock Contact



A Power Source

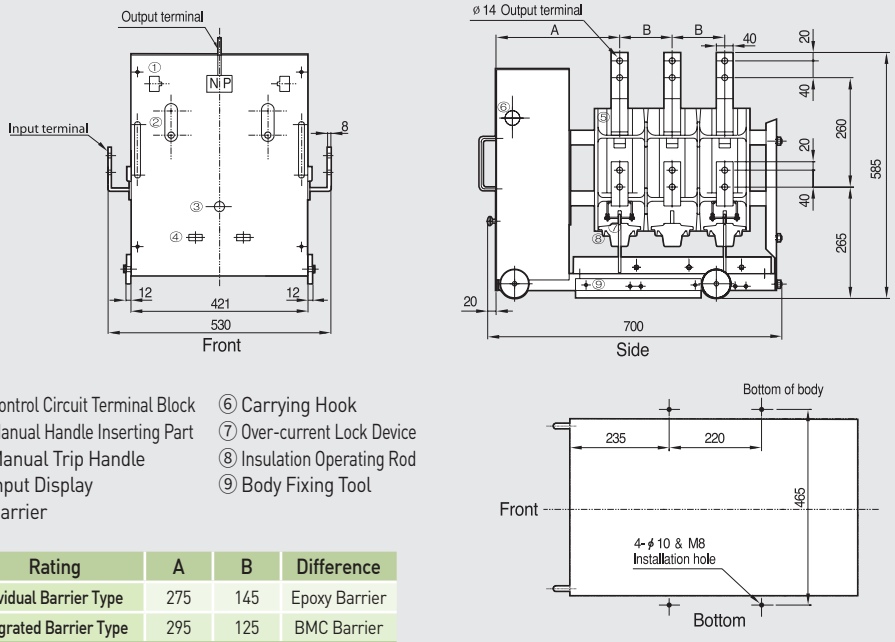


B Power Source

* When composing a circuit using an operating transformer at operating power, a display lamp should be connected to the AC part.

Dimensions

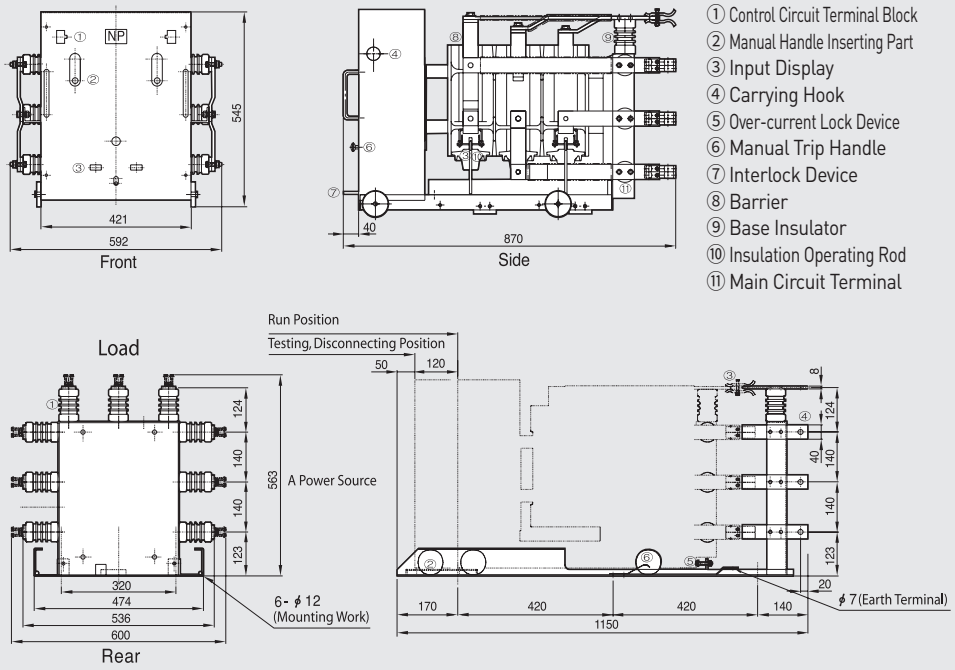
Fixed Type(N)



① Control Circuit Terminal Block
② Manual Handle Inserting Part
③ Manual Trip Handle
④ Input Display
⑤ Barrier
⑥ Carrying Hook
⑦ Over-current Lock Device
⑧ Insulation Operating Rod
⑨ Body Fixing Tool

Rating	A	B	Difference
Individual Barrier Type	275	145	Epoxy Barrier
Integrated Barrier Type	295	125	BMC Barrier

Draw-Out Type(E)



① Control Circuit Terminal Block
② Manual Handle Inserting Part
③ Input Display
④ Carrying Hook
⑤ Over-current Lock Device
⑥ Manual Trip Handle
⑦ Interlock Device
⑧ Barrier
⑨ Base Insulator
⑩ Insulation Operating Rod
⑪ Main Circuit Terminal

① Base Insulator
② Interlock Guide
③ Main Circuit Disconnecting Part
④ Main Circuit Terminal
⑤ Stop Bar
⑥ Earth Contact