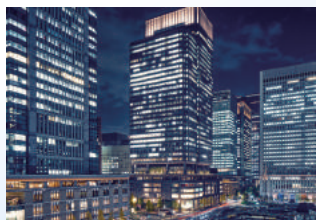


24kV

Medium Voltage Switchgear / Controlgear

VC-V20A-1

Comply with IEC62271-200



Smaller size, but the same high safety. This switchgear contributes to stable operation

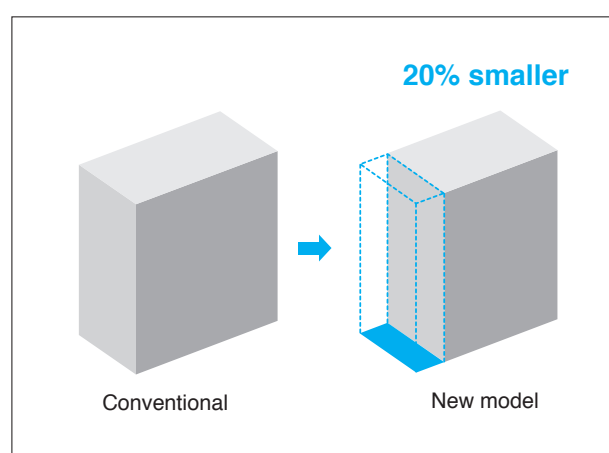
Fuji Electric has delivered switchgears to customers around the world for more than 40 years. In our latest model VC-V20A-1, we have thoroughly reduced the size of the main circuit configuration, achieving a top class compact design in our industry.

This switchgear is housed in a metal enclosure, using a compact and easy to maintain VCB (vacuum circuit breaker).

Top-class space saving, enabling more flexible layouts

We have made the main circuit configuration more compact with the latest insulation technology, reducing the installation area by nearly 20% (compared to our conventional models).

We have achieved top class space savings and made site layout design more flexible.



Reliable interrupting performance keeps equipment safe

Using our wealth of knowledge, we have realized excellent insulation recovery characteristics with VCB.

It can be breaking all currents, from small currents to short-circuit current, and exhibits stable interrupting performance even in double earth fault and out-of-phase currents which are hard on circuit breakers.

Perfect security

The safety design uses interlocks in each part, in addition to the metal enclosure. In particular, the withdrawable breaker has a complete mechanical interlock, which contributes to preventing mistaken operations. A padlock can be attached to the door, and every effort has been made to deal with accidents caused by careless mistaken operation.



of equipment with a stable power supply.

Excellent applicability

The 24 kV switchgear has a broad rating design (Up to 2500 A, 25 kA). A suitable system can be planned for various industrial equipment and power plants.

Rated area

Rated voltage		[kV]	24				
Rated breaking current		[kA]	12.5	20	25	31.5	40
Rated current [A]	630	○	○	○	—	—	
	1250	○	○	○	—	—	
	2000	○	○	○	—	—	
	2500	○	○	○	—	—	
	3150	—	—	—	—	—	

Long useful life and high maintainability

Using VCB ensures excellent mechanical and electrical endurance, and realizes a high life cycle. It is also withdrawable, making it easier to do maintenance and inspections.



Structure

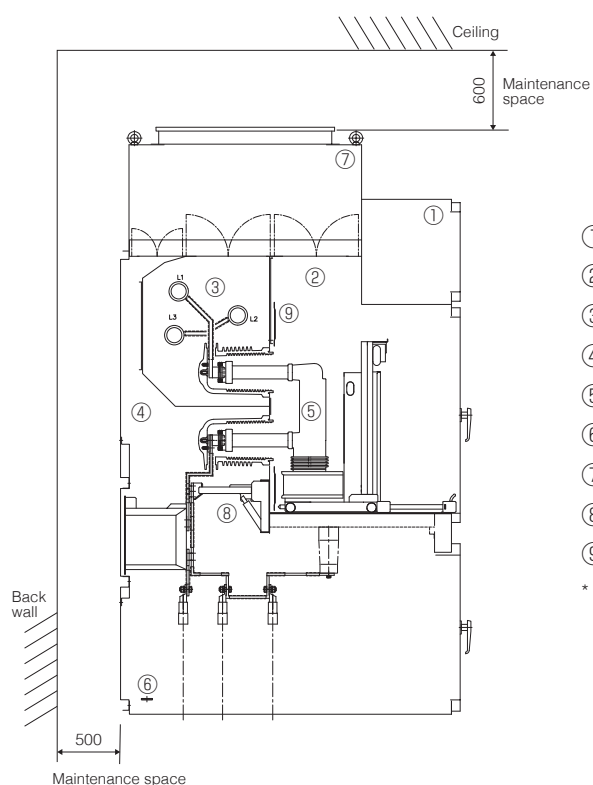


Enclosure and partitions

- With the thin plate structure of its enclosure, the VC-V20A-1 series is designed to be installed indoors. As shown in Figure 2-1, the switchgear is configured with four sections: circuit breaker compartment, busbar compartment, cable compartment, and control compartment.
- Each compartment is partitioned with earthing metal to ensure that inspections can be performed safely. In addition, the enclosure is designed to minimize the effects of hot gas passing through the partitions into other compartments in the event of an

internal arc accident.

- The terminal block for the control cables is provided in the control compartment. Since the control cables to the outside are arranged together, the control circuit can be inspected in the low voltage control compartment.
- An automatic safety shutter is installed in the circuit breaker compartment to prevent accidental contact with the charging unit.



Cross-sectional structure diagram

- ① Control and operation compartment
- ② Circuit breaker compartment
- ③ Busbar compartment
- ④ Cable compartment
- ⑤ Vacuum circuit breaker
- ⑥ Earthing busbar
- ⑦ Arc gas cooling device (optional)
- ⑧ Earthing switch (optional)
- ⑨ Automatic safety shutter

* Outer cable can be connected up to $3 \times 1 \times 500 \text{ mm}^2$ /phase

Busbar compartment/busbar

- A round conductor is used in the main busbar, which makes it more compact by reducing the electrical field.
- The main busbars and connections are covered with insulators.



Main busbars (air insulated) with tin plating

Vacuum circuit breaker (VCB)

● Safety interlocks

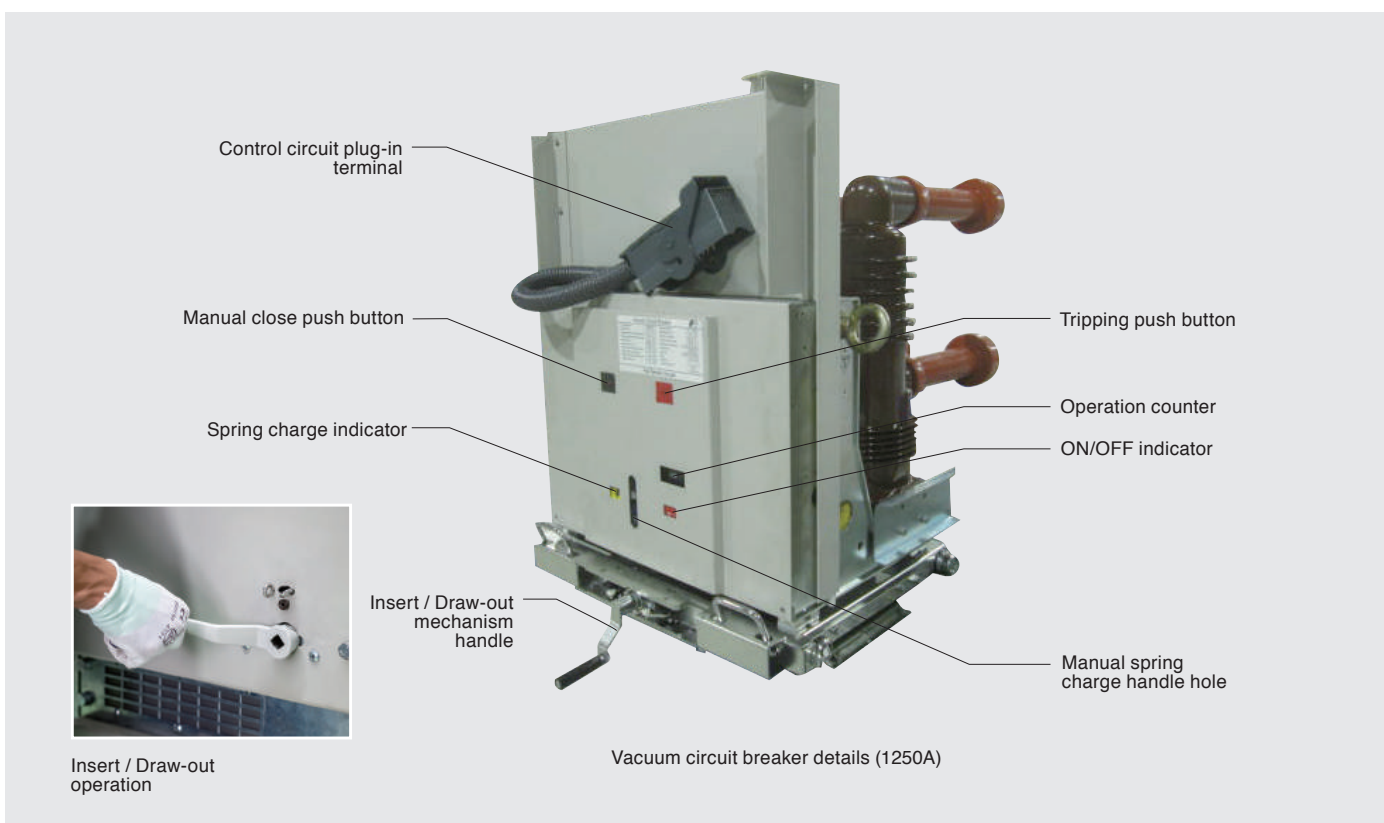
The following mechanical interlocks are provided for safety.

- (1) The vacuum circuit breaker can be inserted and drawn out to the service position or test position only while it is in the open state.
- (2) The vacuum circuit breaker can be closed only while it is in the service position or test position.
- (3) Only while the door is closed, the circuit breaker can be inserted and drawn out to the service position or test position.
- (4) The door can be opened / closed only while the vacuum circuit breaker is in the test position.

VCB position and status

No.	position	Status
1	Service position	The main contact and the auxiliary circuit are connected.
2	Test position	The main contact is disconnected, and the auxiliary circuit is connected.
3	Disconnected position	The main contact and the auxiliary circuit are disconnected.

*While 2) and 3) are in the same position, 3) is in a state in which the auxiliary circuit plug is disconnected.



Safety shutters

Automatic safety shutters are installed in the circuit breaker compartment to cover the primary junction contacts from the busbar compartment and cable compartment. The shutters are made of metal and close automatically when the circuit breaker is withdrawn. Each of the shutters can be separately moved manually for testing and inspection, and can be locked in the

open position. The shutter hold-open mechanism is released automatically when the circuit breaker is set to the "service" position.

Also, the shutters are configured to be in the closed state when the vacuum circuit breaker is in the test position.



Shutters open (VCB)

Metal shutter by individual operation



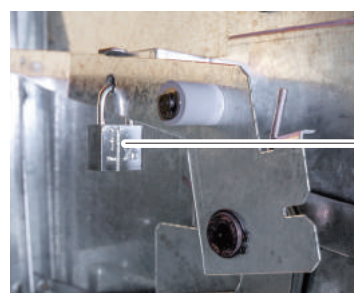
Shutters closed (VCB)

- As shown below, the shutters operate on the busbar and cable sides. The shutters for the upper and lower primary junctions can be closed and opened individually, and can be (optionally) padlocked in the closed position.
- The shutters are made of metal and the following sign can be (optionally) provided.

Example:

[BUSBAR] marking on shutter on the busbar side: Red
(Lettering color: white)

[CABLE] marking on shutter on the cable side: Yellow
(Lettering color: white)



Padlock (option)

Shutter padlocked in the closed position (Option)

Cable compartment / Current transformer

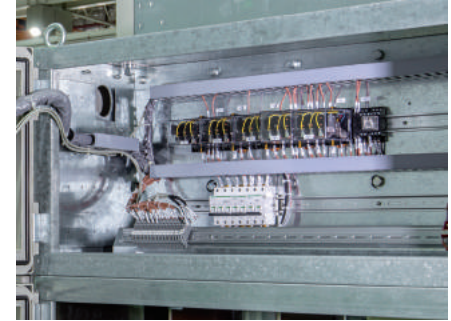
- The cable compartment is fitted with a current transformer (CT) and a voltage transformer (VT) with a fuse.



Current transformers are installed in the cable compartment

Control and operation compartment / Wiring

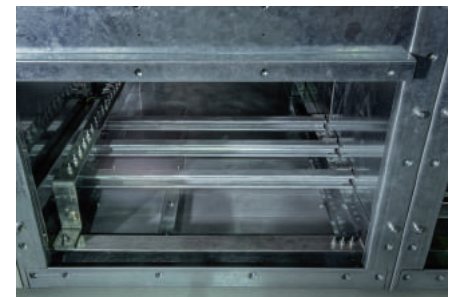
- Necessary control equipment such as auxiliary relays, terminal blocks and fuses are located in the control compartment.
- Ducting and bundling ensure that control wiring is systematic and neat.
- External cable for the control circuit can be connected from the top and bottom of the compartment.
- Plastic protective tubing is provided to prevent damage to wiring connected to devices installed in the door when the door is opened and closed.



Control compartment

Earthing busbar

- The earthing busbar is made of copper conductor.
- An unplated earthing busbar is provided as the standard specification.
A plated earthing busbar can be provided upon request. (Option)
- An earthing busbar is installed along the full length of the switchgear structure, with provision for earth cable connection at each end.
- The earthing busbar is easily accessible by removing the cover at the bottom of the cable compartment.
- The earthing busbar is configured to withstand the short circuit fault current in the event that short circuit accident occurs.



Plated earthing busbar (Optional)

Safety interlocks

Interlock list

Operation \ Necessary conditions	[VCB] Open	[VCB Truck] Service position	[VCB Truck] test position	[CB compartment door] Close	[E.SW] Open	[E.SW] Close	[Others] Electrical interlock
[VCB Truck] Operation to the service position from the test position	○		○	○	○		
[VCB Truck] Operation to the test position from the service position	○	○		○	○		
[VCB] Close	○	○	○	○	○		
[CB compartment door] Open/Close			○				
[E.SW] Close			○				○ (VD OFF)
[Cable compartment cover] Open (Option)						○	

[Others Interlock function]

- Mechanical manually forced TRIP mechanism at the VCB service position
- Forced cancellation of the locking mechanism of the circuit breaker compartment door at the VCB service position
- Forced lock cancellation of the cable compartment cover (when an optional earthing switch (ES) with interlock is provided)

Standard ratings

Switchgear

Item		Abbreviation	Specification
Type designation			VC-V20A-1
Applied standard			IEC 62271-200
Rated voltage [kV, rms]		<i>Ur</i>	24
Rated frequency [Hz]		<i>fr</i>	50/60
Rated insulation level	Short-duration power frequency withstand voltage, 1 min. [kV, rms]	<i>Ud</i>	50
	Lightning impulse withstand voltage (1.2×50 μS) [kV, peak]	<i>Up</i>	125
Rated normal main busbar current [A, rms]		<i>Ir</i>	630/1250/2000/2500
Rated short-time withstand current, symmetrical [kA, rms]		<i>Ik</i>	12.5/20/25
Rated peak withstand current [kA, peak]		<i>Ip</i>	50 Hz: 2.5 × <i>Ik</i> , 60 Hz: 2.6 × <i>Ik</i>
Rated duration of short-circuit [sec]		<i>tk</i>	3.0
Verification of the protection	Enclosure		IP4X
	Partitions		IP2X
Loss of Service continuity category			LSC2B-PM
Internal Arc Classification ^{*1}	Accessibility type	<i>IAC</i>	AFLR
	Arc test current [kA]		25
	Arc test current duration [sec]		1.0
Heat loss of primary circuits by section			About 900 W at incoming 2500 A About 410 W at outgoing 1250 A

*1. Optional.

Service Conditions

Location		Indoor
Ambient temperature [°C]		-5 to 40
Altitude a.s.l. [m]		1000 max.
Humidity	R.H. [%]	95 max.
	Water vapour pressure [kPa]	2.2 average

Current transformers

Applied standard	IEC60044-1 / IEC61869-1,2				
Rated voltage	24kV				
Rated short-time withstand current, symmetrical	25kA 3s				
Applied panel	Incomer		Out going		Bus tie
Application	Protection	Metering	Protection	Metering	Protection
Rated primary currents	2000/2500A		1250A		2000/2500A
Rated secondary currents	1A (or 5A)				
Accuracy class	5P15/30	0.5/1.0	5P15	0.5/1.0	5P15
Rated burden	1.0/2.5VA	1.0/2.5VA	1.0/2.5VA	2.5/5VA	1.0/2.5VA

* Current transformer is a double core type.

Vacuum circuit breaker

Item		Abbreviation	Specification
Applied standard			IEC 62271-100
Rated voltage [kV, rms]		<i>Ur</i>	24
Rated frequency [Hz]		<i>fr</i>	50/60
Rated normal current (self-cooling) [A]		<i>Ir</i>	630/1250/2000/2500
Rated insulation level	Short-duration power frequency withstand voltage, 1 min. [kV, rms]	<i>Ud</i>	50
	Lightning impulse withstand voltage (1.2×50 μS) [kV, peak]	<i>Up</i>	125
Rated normal main busbar current [kA, rms]		<i>Ik</i>	12.5/20/25
Rated peak withstand current [kA, rms]		<i>Ip</i>	50 Hz: 2.5 × <i>Ik</i> , 60 Hz: 2.6 × <i>Ik</i>
Rated duration of short-circuit [sec]		<i>tk</i>	3.0
Rated short-circuit breaking current [kA, rms]		<i>Isc</i>	25
Rated short-circuit making current [kA, peak]		<i>Ip</i>	50 Hz: 2.5 × <i>Ik</i> , 60 Hz: 2.6 × <i>Ik</i>
Rated control voltage [V DC]		<i>Ua</i>	110, 125
Rated operating sequence			O- (3min)-CO-(3min)-CO O- (0.3s)-CO-(3min)-CO O- (0.3s)-CO-(1min)-CO O- (0.3s)-CO-(15s)-CO

Voltage transformers

Applied standard	IEC60044-2 / IEC61869-1,3
Rated primary voltage	22kV
Rated secondary voltage	110V
Accuracy class	0.5
Rated burden	50VA

Standard design

Enclosure and structure

● Front and rear structure

Position	Structure	Hinge location	Handle location
Front of breaker compartment	Hinged doors	Left	Right
Front of cable compartment	Hinged doors	Left	Right
Rear of cable compartment	Bolt tightening cover	—	—

● International Protection Code

Enclosure	IP4X
Internal partitions	IP2X

Busbar and connecting conductor

Conductor material	Copper
Surface treatment	Tin plating at busbar joints

Earthing busbar

Conductor material	Copper
Surface treatment	None (bare)
Standard dimensions	6 mm x 50 mm

Withdrawable equipment

Apparatus	Main circuit	Control circuit	Earthing circuit (Carriage frame)
Vacuum circuit breaker	Automatic connection	Manual connection	Automatic connection

● The withdrawable equipment has the following three positions.

Operating position: Main circuit, control circuit - Connected

Test position: Main circuit - disconnected
Control circuit - Connected
(can be disconnected manually)

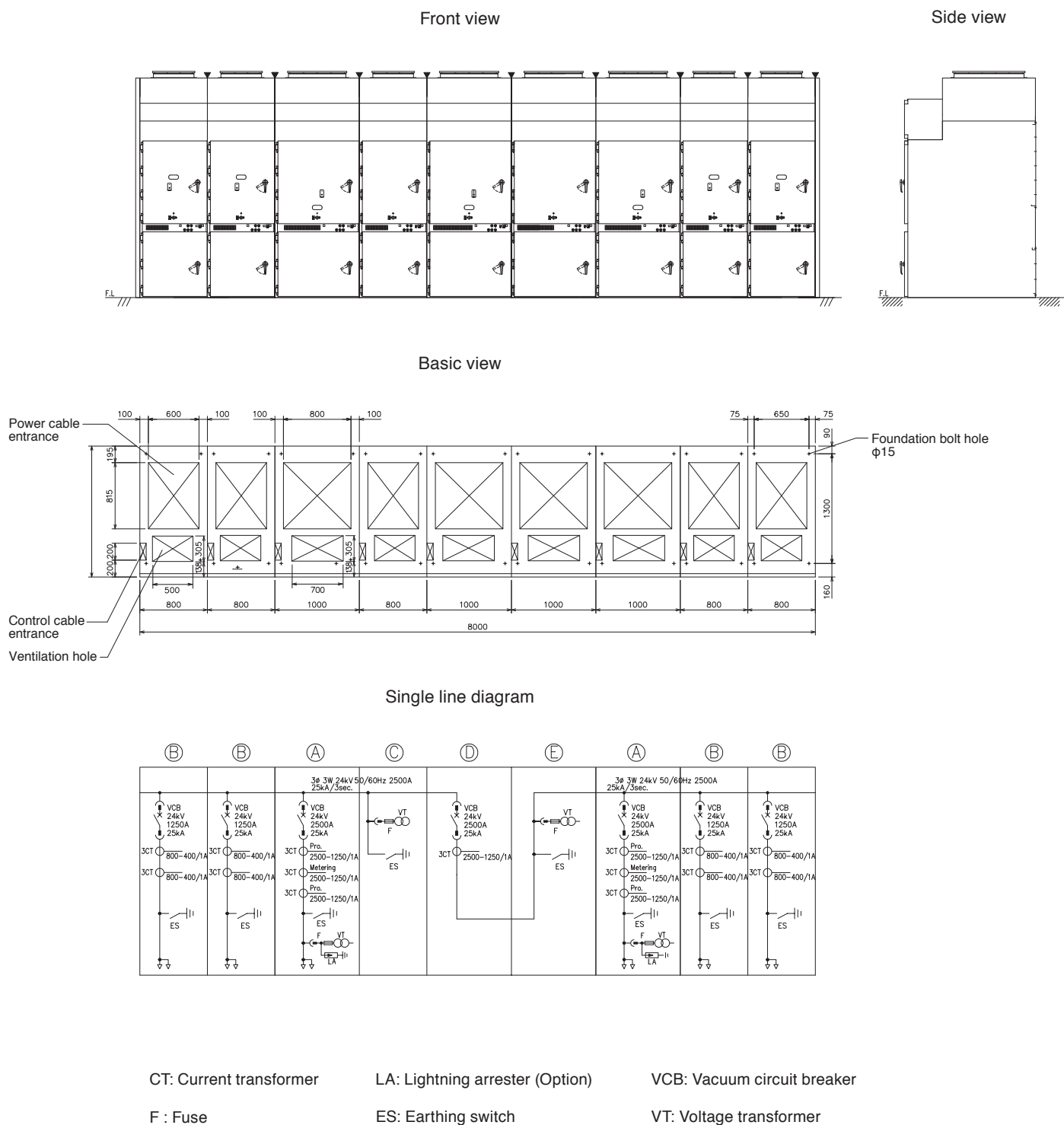
Disconnected position: Main circuit - Disconnected
Control circuit - Disconnected or connected

Note: Operating position and disconnected position is in the same position.

● The front door can be opened/ closed when the withdrawable equipment is Test/ Disconnected position.

Switchgear arrangement

Example of two-lines incoming power



Standard section view and dimensions

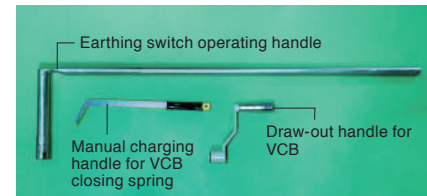
Panel type	Single line diagram	Rated circuit [A]		Dimensions [mm]		
		Busbar	Circuit breaker	Wide [W]	Depth [D]	Height [H]
A (Incomer)		630	630	800	1550	2350 (2500)*1
		1250	1250			
		2000	2000	1000		
		2500	2500			
B (Out going)		630	630	800	1550	2350 (2500)*1
		1250	1250			
C (Bus VT)		630	630	800	1550	2350 (2500)*1
		1250	1250			
		2000	2000			
		2500	2500			
D (Bus Tie)		630	630	800	1550	2350 (2500)*1
		1250	1250			
		2000	2000	1000		
		2500	2500			
E (Bus Riser)		630	630	800	1550	2350 (2500)*1
		1250	1250			
		2000	2000	1000		
		2500	2500			

*1: Figures in parentheses () are the dimension with an arc gas cooling device included.

Accessories

Standard accessories

- Draw-out handle for VCB
- Manual charging handle for VCB closing spring
- Earthing switch operating handle



Standard accessories

Designated accessories

- Lamps
- Fuses
- Test plug
- VCB test cable
- Lifter

Earthing devices

Optional earthing devices can be used for safety during cable and busbar maintenance and/or inspection.

The following earthing switches can be optionally provided upon request.

- Integral earthing switch
In the case of cable-side earthing, the earthing switch is integrated within the cable compartment.
- A mechanical interlock is equipped between the earthing switch and the circuit breaker.
- The busbar side earthing switch is installed inside the switchgear that normally houses the voltage transformer, and it is electrically interlocked with the circuit breakers of adjacent switchgear.
- The mechanical indicator for the earthing switch's state can be checked from the front of the panel through a inspection window.



Rear view of earthing switch



Earthing switch operation

Arc gas cooling device

- An arc gas cooling device can be installed when the optional arc classification (IAC) is required for this product.
The arc gas cooling device makes use of heat exchange with the internal metal in the event of an internal arc accident and rapidly cools the hot gas.
Therefore, unlike the conventional structure in which an exhaust duct is installed to route hot gas to the outside of the panels room, it is possible to protect personnel near the panel from hot gas without making any modifications to the panels room.

- The gas exhaust duct and gas cooling device are dismantled from the panels prior to shipping, and are reattached on site.

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