

VACUUM CIRCUIT BREAKER (RETROFIT)

Retrofit VCBs for Replacement of Existing MBBs

MELVAC MV



for a greener tomorrow

Eco Changes is the Mitsubishi Electric Group's environmental statement, and expresses the Group's stance on environmental management. Through a wide range of businesses, we are helping contribute to the realization of a sustainable society.

 **Safety Warning**

To ensure proper use of the products listed in this catalog, please be sure to read the instruction manual prior to use.

MITSUBISHI ELECTRIC CORPORATION

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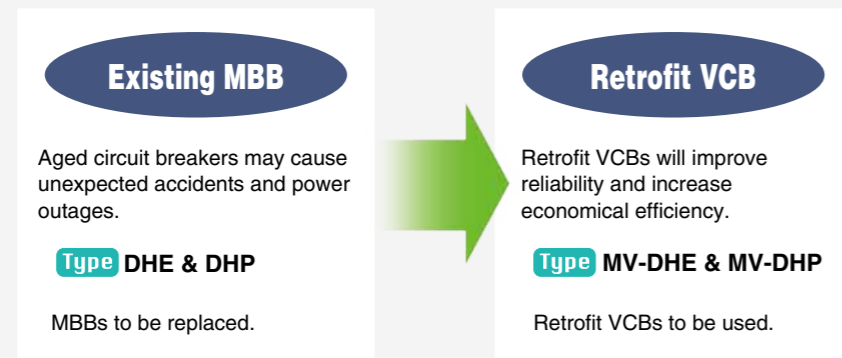
for a greener tomorrow



We recommend to replace the existing Magnetic Blast Breakers with new Vacuum Circuit Breakers in order to ensure the safe and reliable operation of your switchgear.

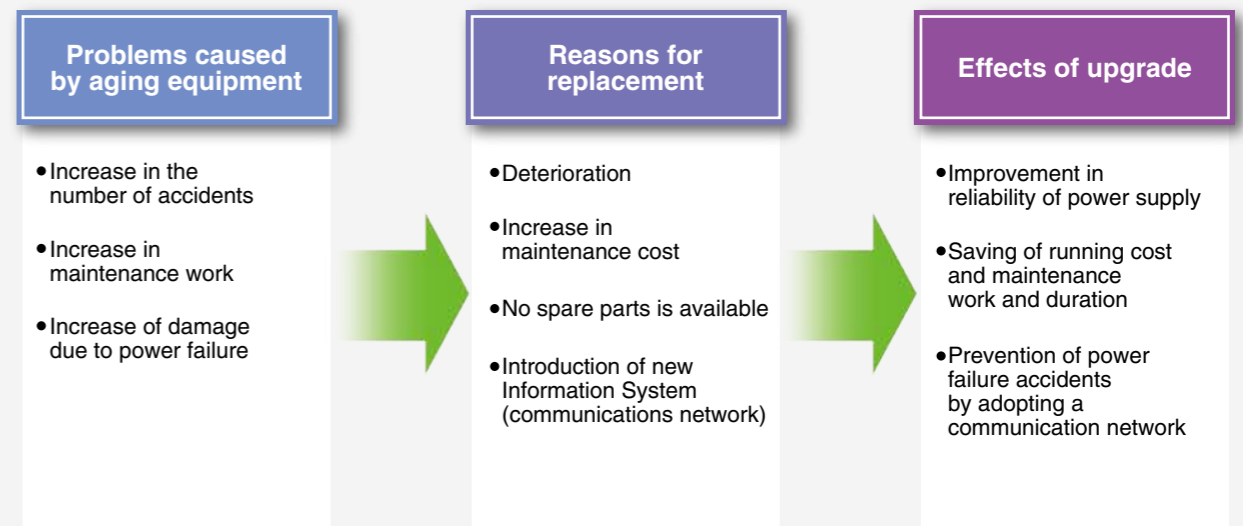
Our solution for Magnetic Blast Breakers (MBB)

Manufacturing of MBBs halted in 1985 and their replacement parts have been supplied since 1985 for around 20 years. Replacement of MBBs with new VCB (Retrofit VCB) is recommended since supply of MBB parts was discontinued at the end of 2005.



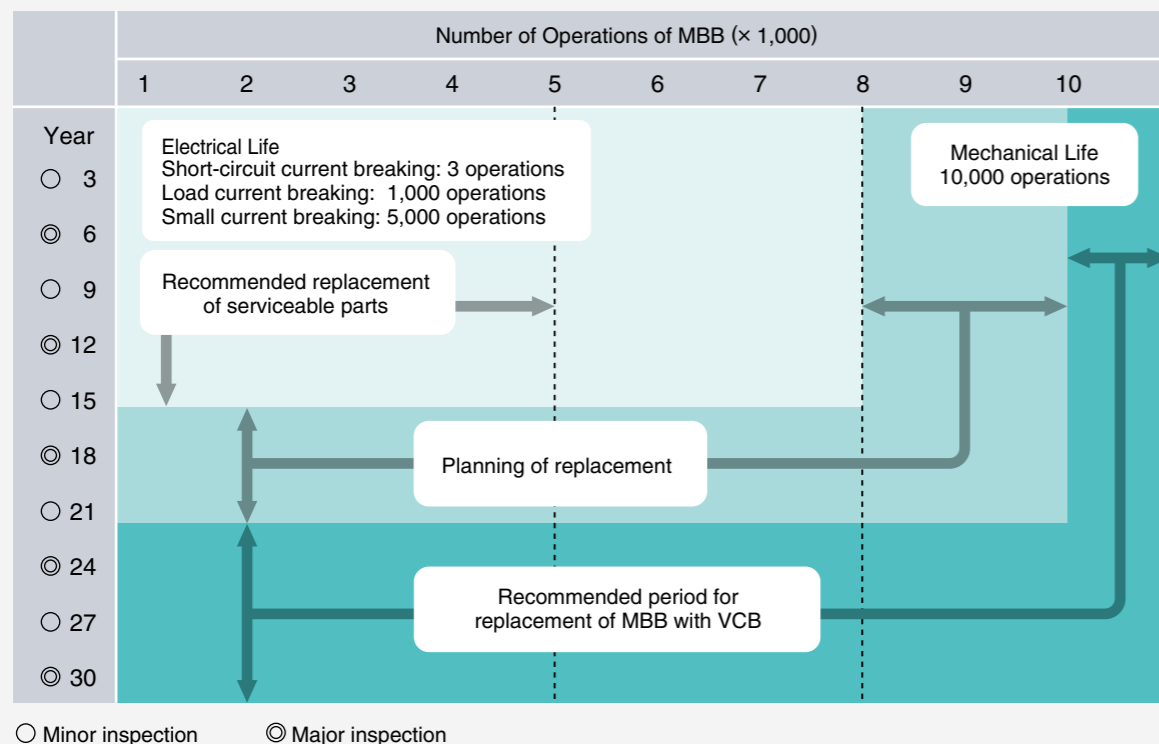
MV General Background of Replacement

Use of aged equipment can increase the incidence of accidents, and jeopardize the reliable operation failure of the system.



MV Maintenance Chart for MBBs

We recommend to replace the aged MBBs with compatible VCBs to extend the switchgear's life and to ensure the safe operation according to the table below.



Why Retrofit VCB?

Replacement Options	1 Retrofit VCB	2 Replacement of panel
Item		
Initial cost	😊😊😊	😊 (Including construction)
Outage time	9 hour/panel *see note	2 weeks / arrangement
Maintenance after replacement	😊😊😊	😊😊😊
Reliability after replacement	😊😊😊	😊😊😊

Best solution

NOTE : Outage time may be changed depending on site condition.

MV Ratings

The MV Retrofit VCB complies with the international standard IEC 60056.

Retrofit VCB Type MV-S	3MV16DHE-310	3MV40DHE-325	6MV13DHE-615	6MV20DHE-625				
Closing operation mechanism	Motorised stored energy spring mechanism							
Rated voltage (kV)	3.6		7.2					
Rated current (A)	600/1200	600/1200/2000						
Rated frequency (Hz)	50/60							
Rated short-circuit breaking current (kA)	16	40	12.5	20				
Breaking capacity (MVA)	100	250	150	250				
Rated short-circuit making current (kA)	40	100	32	50				
Rated short-time withstand current (kA)	16	40	12.5	20				
Rated opening time (s)	0.06							
Rated breaking time (cycles)	5							
Power frequency withstand voltage (kV)	20							
Lightning impulse withstand voltage (kV)	60							
Rated operating sequence	O-1min.-CO-3min.-CO							
Weight (kg)	200	200/200/215						
Type of interchangeable MBB	3DHE10 3DHE10M	3DHE16 3DHE16M	3DHE25 3DHE25M	3DHE40 3DHE40M	6DHE15 6DHE15M	6DHE13 6DHE13M	6DHE25 6DHE25M	6DHE20 6DHE20M

NOTE : Contact MITSUBISHI ELECTRIC via a distributor, if the application of ANSI standards are required.

Retrofit VCB Type MV-L	6MV44DHP-650	6MV40DHP-650	10MV25DHP-1050	10MV40DHP-1083				
Closing operation mechanism	Motorised stored energy spring mechanism							
Rated voltage (kV)	6.6	7.2	12					
Rated current (A)	1200	1200/3000	1200					
Rated frequency (Hz)	50/60							
Rated short-circuit breaking current (kA)	43.8	40	25	40				
Breaking capacity (MVA)	500		520	830				
Rated short-circuit making current (kA)	110	100	63	100				
Rated short-time withstand current (kA)	43.8	40	25	40				
Rated opening time (s)	0.06							
Rated breaking time (cycles)	5							
Power frequency withstand voltage (kV)	20		28					
Lightning impulse withstand voltage (kV)	60		75					
Rated operating sequence	O-1min.-CO-3min.-CO							
Weight (kg)	280	280/350	280					
Type of interchangeable MBB	6DHE50 6DHE50M	6DHE40 6DHE40M	6DHP40 6DHP40M	10DHE50 10DHE50M	10DHE25 10DHE25M	10DHP25 10DHP25M	10DHE40 10DHE40M	10DHP40 10DHP40M

NOTE : Contact MITSUBISHI ELECTRIC through our distributor, if the application of ANSI standard is required.

MV Features of Retrofit VCB

High reliability

- The highly reliable BH-2 operating mechanism is incorporated in the Retrofit VCB. This operating mechanism is used in Mitsubishi's latest VCBs.

Saving maintenance time

- Short maintenance time: less moving parts yields a shorter working time.
- 15 years maintenance-free BH-2 mechanism.

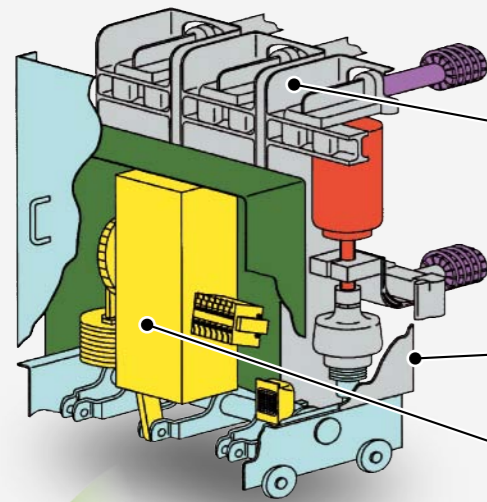
Full compatibility

- Small wiring modification must be performed for cases of solenoid-operated MBBs. In the case of spring-operating MBBs, retrofitting work is performed more readily.

Saving energy

- 20% reduction in power consumption compared with the MBB.

MV High Reliability & Saving Maintenance Time

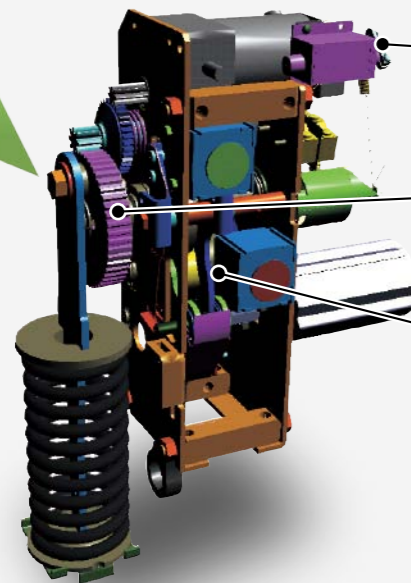


Retrofit VCB

- Improved insulated frame (BMC: Bulk Moulded Compound)**
Superior anti-tracking characteristics & mechanical strength. Single mould-no use of glue.
- Reduction in number of parts**
50% of that of previous model
- Increased life**
Electrical life is increased compare with MBB

BH-2 operating mechanism

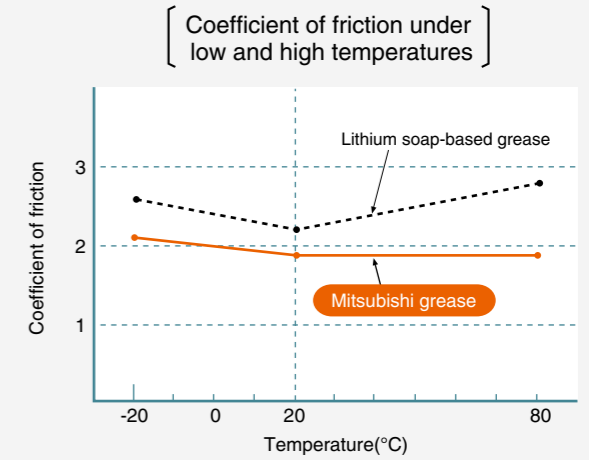
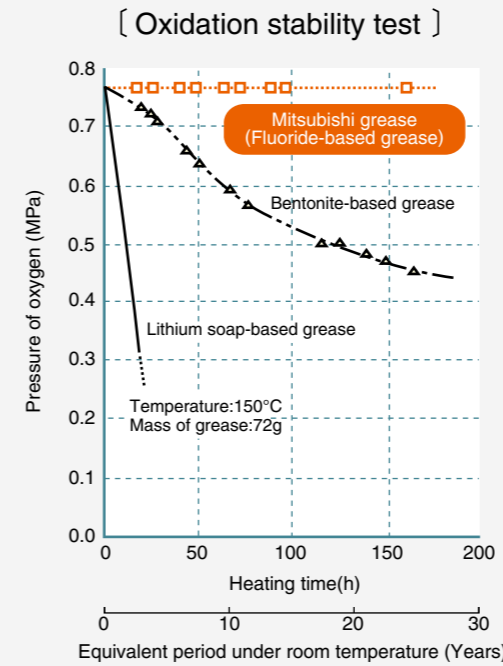
- 20% reduction in control power consumption when compared to previous model
- Greaseless**
Special low-friction NiP surface treatment of gears
- High performance grease**
Special "long-life" grease for other surfaces. Maintenance free for 15 years due to high quality parts and grease



MV Maintenance free

Maintenance free for 15 years or more.
(Maintenance interval may be changed depending on environment condition)

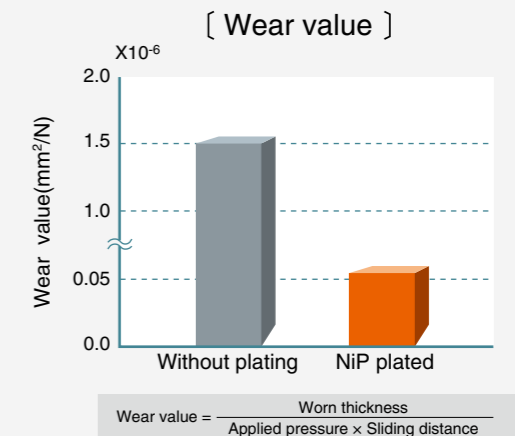
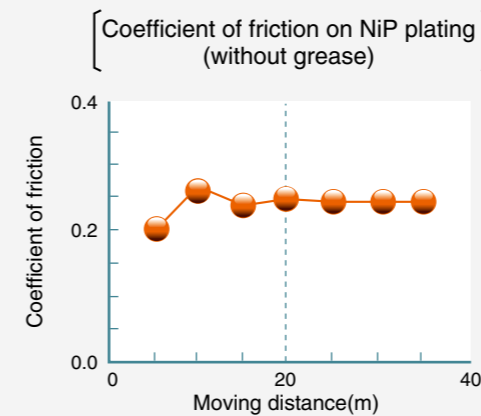
Mitsubishi Grease is fluoride-based. There was no evidence of oxidation during tests on Mitsubishi grease. It has also been confirmed that there is no increase in friction after these tests were completed. The coefficient of friction remains small and regular under both low and high temperature conditions unlike other types of grease.



MV Greaseless surface treatment of the gears

NiP plating removes the need for grease.

Friction between the gear surfaces increases due to surface wear resulting from contamination. Gears easily gather contamination if they have grease applied to their surface and when they are not located in an enclosed area. The gears of a Mitsubishi vacuum circuit breaker are NiP plated in order to eliminate the need for application of grease. The coefficient of friction remains low even if no grease is applied. The wear at the contact is small due to the hardness of the NiP plating.

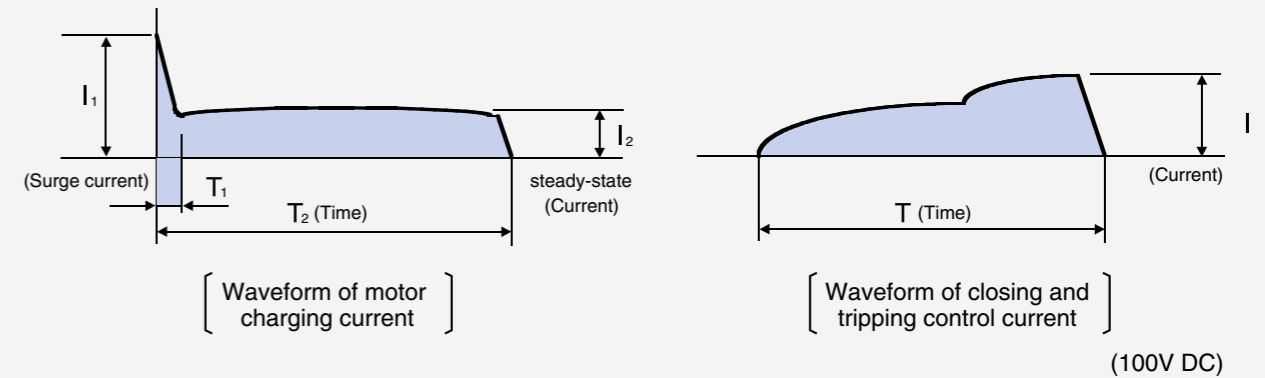


MV Ready Interchangeability with the MBB



MV Operating & Control Current of CB

Reduction in power consumption compared with the MBB



Operating & control current/ Closing and tripping time		Retrofit VCB	MBB Solenoid operated	MBB Motor spring operated
Motor charging	Current I_2 (A)	1.2	—	7
	Time (s)	6	—	5
Closing	Current I (A)	4	100	12
	Time (s)	0.05	0.3	0.1
Tripping	Current I (A)	4	9	6
	Time (s)	0.05	0.07	0.07

NOTE : Other than 100V DC control source are available.

Retrofit VCB Series

Rated voltage	Rated breaking current				
	12.5/16kA	20kA	25kA	40kA	43.8kA
3.6kV	3MV16DHE-310 (3-DHE-10/16)	MV-S series		3MV40DHE-325 (3-DHE-25/40) (4-DHE-25/32)	—
7.2kV	6MV13DHE-615 (6-DHE-15/13)	6MV20DHE-625 (6-DHE-25/20)	—	6MV40DHP-650 (6-DHP-40) (6-DHE-50/40)	6MV44DHP-650 (6-DHP-40/40M)
12kV	MV-L series		10MV25DHP-1050 (10-DHP-25) (10-DHE-50/25)	10MV40DHP-1083 (10-DHP-40) (10-DHE-40)	—

NOTE : The catalogue numbers in parentheses are of the MBBs to be replaced

Optional

Surge protection for motor feeder (3/6kV) (See Note)	MV-S: 3.6 / 7.2 kV, 1200 A...Low surge VST MV-L: 7.2 kV / 1200 A.....CR
Recommended spare parts	•Tripping coil unit • Closing coil unit
Procedural manuals and training	Detailed instructions for the replacement procedure supplied.

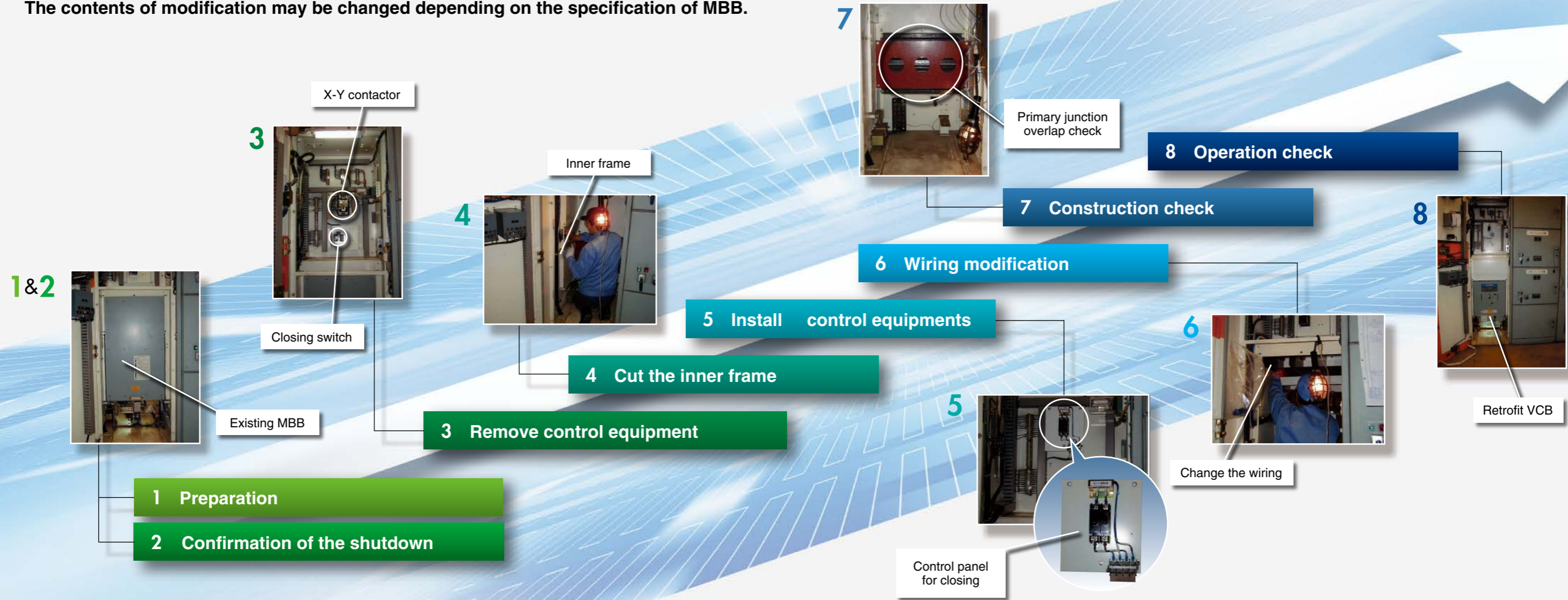
NOTE : For surge protection of 12 kV motor feeders, a CR suppressor will be supplied along with additional housing on the top of the panel. Therefore, it is necessary to disconnect the main supply during mounting and wiring.

Operating current and time of closing / tripping and motor control at 100V DC

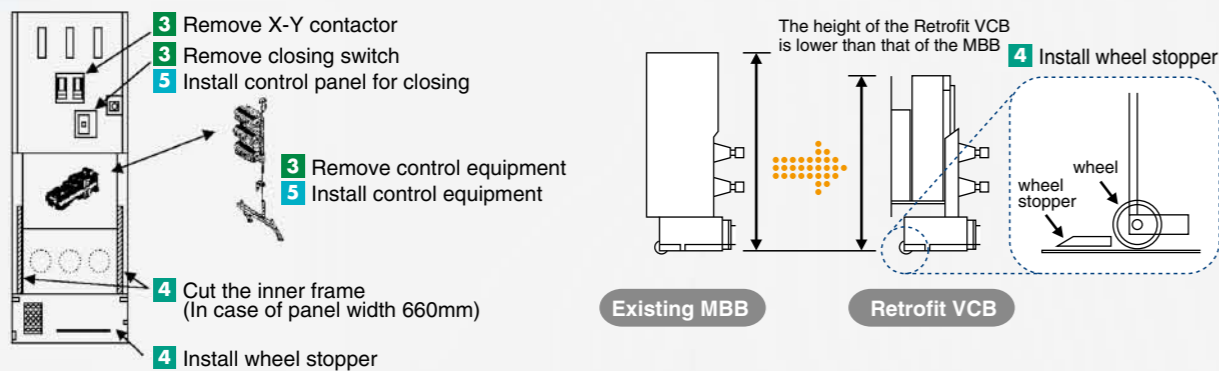
Control Voltage (v)		Direct current (DC) 100							
Item		closing		tripping		Motor			
Series	Type of Retrofit VCB	I (A)	T (s)	I (A)	T (s)	I_1 (A)	I_2 (A)	T_1 (s)	T_2 (s)
DHE	3MV16DHE-310	4.0	0.05	4.0	0.05	6	1.2	0.1	6
	3MV40DHE-325								
	6MV13DHE-615								
	6MV20DHE-625								
DHP	6MV40DHP-650	4.0	0.05	4.0	0.05	6	1.2	0.1	6
	6MV44DHP-650								
	10MV25DHP-1050								
	10MV40DHP-1083								

MV Procedure of modifying from MBB to Retrofit VCB

Example from MBB type 3-DHE-25 to Retrofit VCB type 3MV40DHE-325
 The contents of modification may be changed depending on the specification of MBB.



Main contents of modification



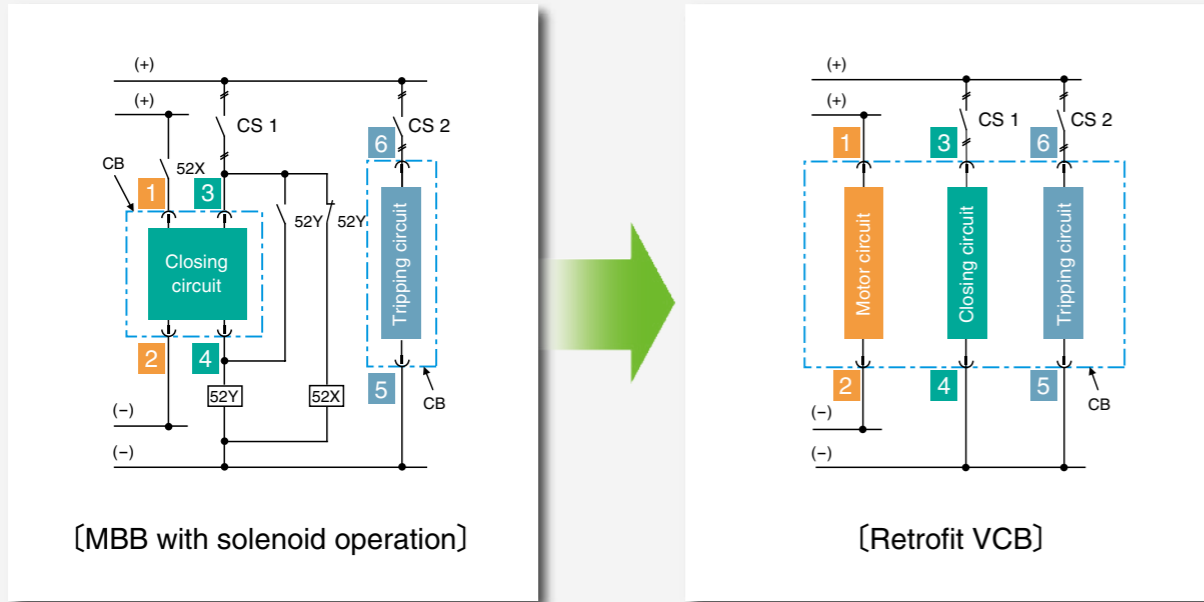
Working time for the each steps

Items	Time (hour)	1	2	3	4	5	6	7	8	9
1. Preparation	1.0	█								
2. Confirmation of the shutdown	0.5		█							
3. Remove Control equipment	2.0		█	█	█					
4. Cut the inner frame	0.5				█					
5. Install control equipments	2.0				█	█	█			
6. Wiring modification	2.0						█	█	█	
7. Construction check	0.5								█	
8. Operation check	0.5									█

NOTE : Items and time may be changed depending on the specification

MV Wiring Modification of Switchgear Panel

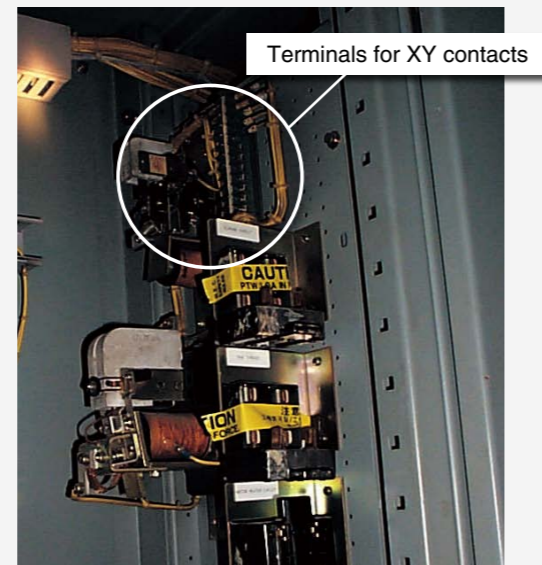
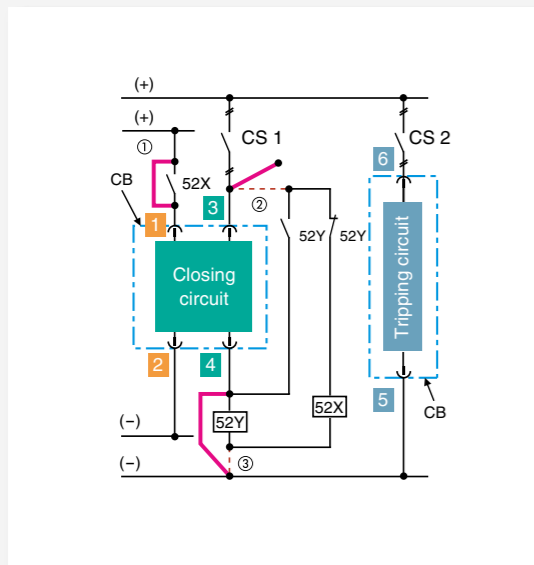
MV VCB & MBB Comparison



[MBB with solenoid operation]

[Retrofit VCB]

MV Details of Wiring Modification



[Auxiliary relay (X,Y) in panel]

No.	Modification
1	Short-circuit 52 X contacts with wire ① at the XY terminal block.
2	Move wire ② to an unused terminal of XY terminal block.
3	Move wire ③ so that auxiliary relay 52 Y is by-passed.

Item	6-DHP-40M 6-DHE-40M (3000 A)	6-DHP-40M 6-DHE-40M (1200 A)	3-DHP-40M 3-DHE-40M (600 / 1200 A)
Wiring modification	No	No	No

Comparison of Life of VCB & MBB

Unit	Item	Retrofit VCB	MBB
Mechanical life	Number of operations	10,000 times	10,000 times
	Short circuit breaking	10 times	3 times
Electrical life	Load current breaking	10,000 times	1,000 times
	Small current (less than 100 A) breaking	10,000 times	5,000 times
Life of whole circuit breaker	Number of operations	10,000 times	10,000 times

NOTE : The above switching number of time is the actual capacity checked in the short-term continuous switching test, and does not guarantee the life for a long period of time. Perform the maintenance and inspection according to the standard of the inspection manual to keep the service life.

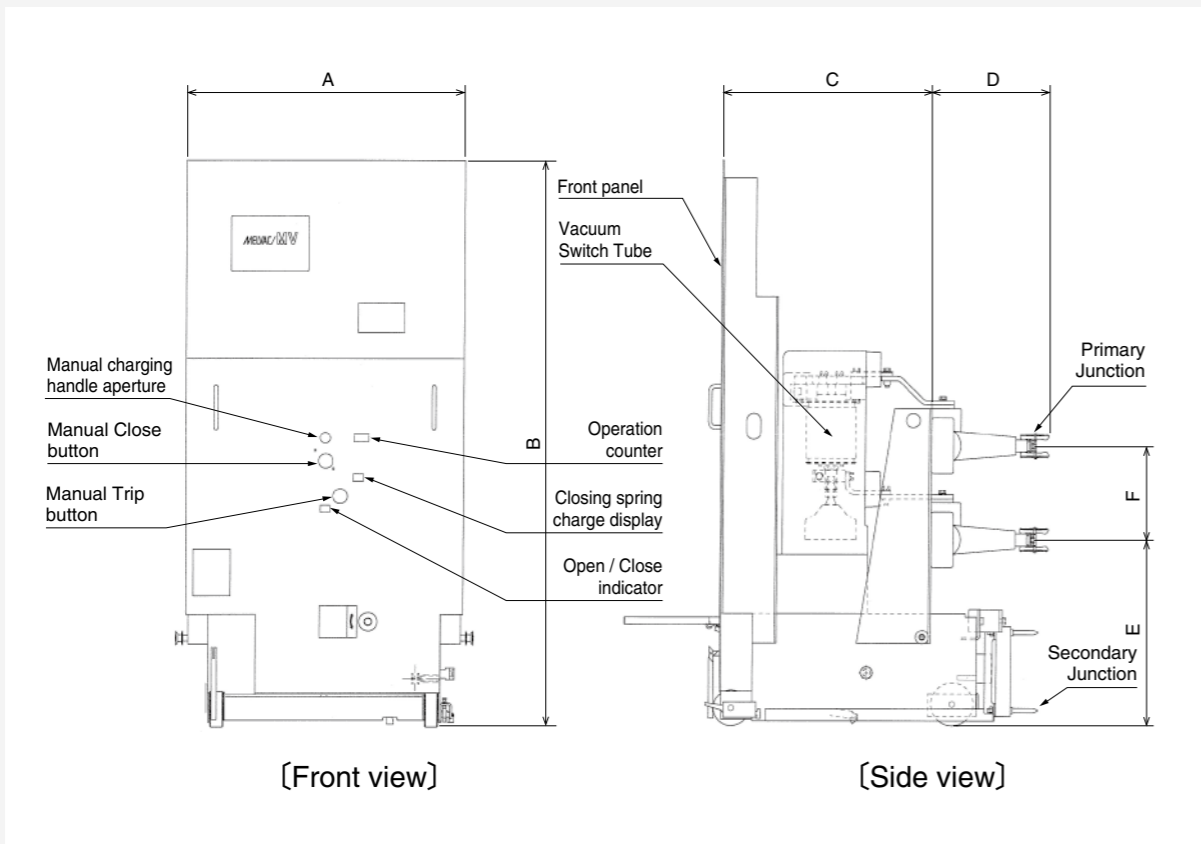
Comparison of Scheduled Maintenance

Periodic Inspection	Retrofit VCB	MBB
General	Every 3 years Man-hours: 1.5 hr x 2 men	Every 3 years Man-hours: 14 hr x 2 men
	<ul style="list-style-type: none"> Visual check and cleaning Check of insulation resistance 	<ul style="list-style-type: none"> Visual check and cleaning Check of insulation resistance Lubrication of mechanism, primary & secondary junctions
Detailed	Every 6 years Man-hours: 3 hr x 2 men	Every 6 years Man-hours: 8 hr x 2 men
	<ul style="list-style-type: none"> Check of vacuum pressure and wipe length Lubrication of primary & secondary junctions, if necessary Operation test 	<ul style="list-style-type: none"> Removal, inspection and cleaning of arc chutes Inspection and adjustment of contact parts Operation test
Replacement of breaking part	When the number of operations exceeds the values below, the VST(Vacuum Switch Tube) should be replaced. - Load current: 10,000 times (replacement of entire VCB) - Short-circuit current: 10 times	When the number of operations exceeds the values below, main contacts and arcing contacts should be replaced. - Load current: 1,000 times - Small current: 5,000 times - Short-circuit current: 3 times

Comparison of Structure

Unit or Part	Retrofit VCB	MBB
Control circuit	Stored energy motor operation. (BH-2 operating mechanism)	400 /1200 A MBBs: Solenoid operation. 3000 A: Stored energy motor operation.
Interlocking	1. During withdrawal Close push button cannot be operated. 2. Same as MBB.	1. Prevent closing of CB during withdrawal Trip-free operation. Prevent withdrawal of closed CB Operation handle cannot be rotated.
Insulation	Epoxy-resin molding for main conductors and BMC (Bulk Mold Compound) for separation of VSTs.	Epoxy resin molding.
Drawout mechanism	As for MBB.	Withdrawn by pulling of handle.
Truck		Position switch, automatic safety shutters.
Primary junction		Tulip type connector, self-coupling.
Secondary junction		Self-coupling
Ext. aux-switch		Mechanically linked operating mechanism.

MV Outline and Dimensions



UNIT (mm)

Series	Type of Retrofit VCB	A	B	C	D	E	F
MV-S	3MV16DHE-310	550	920	483	186	418	216
	3MV40DHE-325						
	6MV13DHE-615						
	6MV20DHE-625						
MV-L	6MV40DHP-650	748	1525	695	194.5	502	254
	6MV44DHP-650						
	10MV25DHP-1050						
	10MV40DHP-1083						

NOTE : Dimensions may be changed depending on the specification.

MV Applicable Standards

Special Environment and Application

• Operation Environment

MV type vacuum circuit breaker conforms to the JEC-2300 and IEC 60056 (high voltage alternating current circuit breaker) and designed/manufactured as an indoor unit. Therefore, this circuit breaker should be operated under normal environments specified in right table.

Daily and periodical check and maintenance should be carried out enough according to VCB's instruction manuals. If it is necessary to operate this circuit breaker under special condition not listed in right table, consult the manufacture.

• Instructions for Installation

If it is necessary to operate this circuit breaker in a dusty place, a place with corrosive gas, at a location exposed to abnormal vibration or impact, or in an outdoor panel environment, etc., special care must be paid to deal with items such as dust, corrosion, vibration, impact, water drops, condensation, and etc.

Normal operation condition

- Altitude: 1,000m or less**
- Ambient temp: -5°C~40°C**
(The average temperature for 24 hours must not exceed 35°C.)
- Relative humidity: 45%~85%**
(Relative humidity; there must be no dew condensation.)
- Degree of pollution: There must be no pollution.**
(As a guideline, the equivalent salt deposit density should be less than 0.01 mg/cm²)
- Poisonous gas etc.: There must be no corrosive gas.**
- Powder dust: There must be no excessive powder dust.**
(As a guideline, the powder dust should be less than 2 mg/m³)

Application of Surge Protection Device

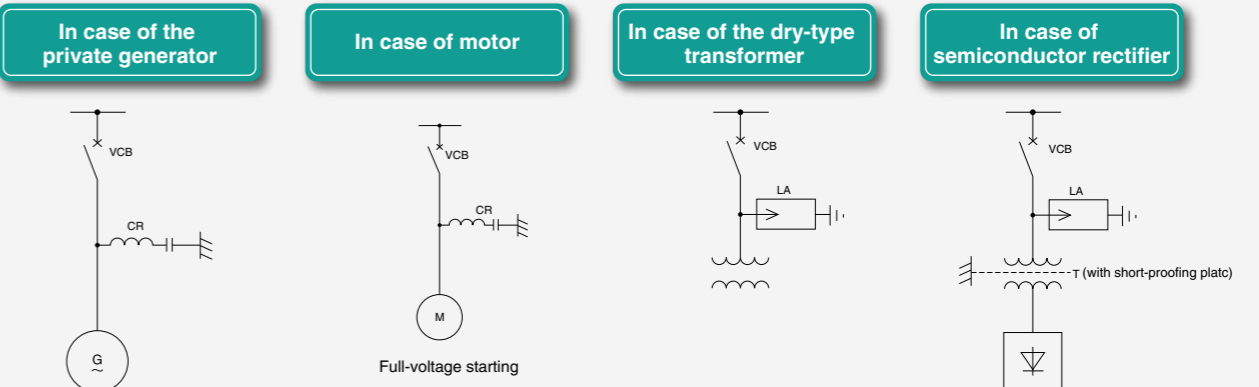
For the actual applications of vacuum circuit breaker, the surge protection standards for the load circuit so used, and actual application will be shown as below table. Use the as below table of standard bellows as reference when selecting models.

• Surge Protection Standards

VCB type	Generator	Motor	Dry-type transformer	Oil transformer	Mitsubishi molded transformer and oil transformer (Note 4)	Phase-advance capacitor
General purpose product	CR suppressor	CR suppressor	Lightning arrester (Note 1)	Not required (Note 1)	Not required (Notes 1,2)	Not required
Low-surge product	Not required	Not required (Note 3)	Not required	Ditto	Not required	Not required

- NOTE : 1. To directly switch the semiconductor rectifier unit (for example, electric power thyristor rectifier unit) in the secondary side of a transformer, use the transformer with contact-protective plate. Provide a general-purpose arrester in the primary side and the surge protective device such as a filter capacitor in the secondary side.
 2. Avoid interrupting the no-load excitation inrush current of molded transformer. When such currents must be interrupted, apply general-purpose arrester. To use any molded transformer made by other manufactures, consult the manufacturer. However, low-surge VCBs require no general-purpose arrester.
 3. For motors in applications where inching is the predominant switching duty (cranes, conveyor, etc.), use CR suppressor.
 4. Mitsubishi molded transformer and oil transformer are for 6kV with the impulse withstand voltage 60kV and for 3kV with the impulse withstand voltage 45kV.
 5. In case of kondorfer starting system, carry out the switching operation of the neutral point of the auto-transformer after the starting current become the stationary.

Surge Protection Standards (In case of general-purpose VCB)



Note : When MV retrofit VCB applies to switch for the reactor, please contact us.