MEIDEN
Quality connecting the next

Recommendation of Upgrading to Retrofit Type Vacuum Circuit Breakers

Installed unit (model VE-2)

Retrofit unit (model VR-2SDR)

Recommendation of equipment upgrading to retrofit VCB

The retrofit VCB is ideal for preventing downtime of equipment and disasters caused by equipment failure, thus realizing stable operation and energy savings.

Risks due to aging of circuit breakers

Occurrence of failure or accidents

- Interference with operation due to grease sticking, etc.
- Decrease in durability due to aging deterioration, resulting in breakdown of parts
- Occurrence of burnout accidents
- Three-phase short-circuit accidents caused by deterioration of the insulation mold
- Motor burning caused by insulation deterioration of the coil wires

Depletion of replacement parts

- Difficulty of procuring parts or materials because they are no longer manufactured

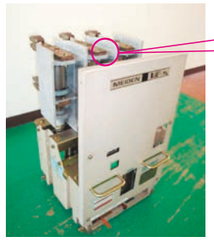
Increased maintenance and restoration expenses

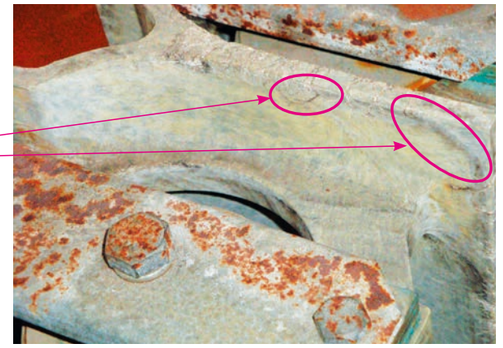
- Occurrence of damage and loss caused by downtime of production equipment
- Increased expenses and time required for restoration

Accident examples

Occurrence of partial discharge caused by insulation

When there is contamination or moisture absorption of the insulation material, the insulation function decreases and partial discharge occurs.





The parts with black discoloration in a tree shape or in the form of soot are locations where tracking occurs.

(Tracking:Partial discharge occurs at the surface because of insulation deterioration and the surface shows traces of carbonization)

Estimated causes

Insulation contamination, moisture absorption, etc. → Insulation resistance reduction → **Occurrence of partial discharge** ····▶ Progress to short-circuit between phases

The recommended time for upgrading circuit breakers is 20 years after start of use or when the specified number of switching actions has been reached (2,000 times)*.

* The mechanical or electrical switching cycle life listed in the manufacturer's catalog or instruction manual or the switching cycle life agreed upon between the user and the manufacturer. (Source: JEM-TR174 High-voltage circuit breaker maintenance and inspection guide)

We recommend early upgrading to the newest retrofit VCB to ensure sound equipment and safe operation.

Advantages of retrofit VCB

What is a retrofit VCB?

This VCB is for replacement or upgrading and is compatible in regard to electrical functions, performance, and construction. As the upgrade work is easy, the work time at the site is short, increasing reliability and offering other advantages too.

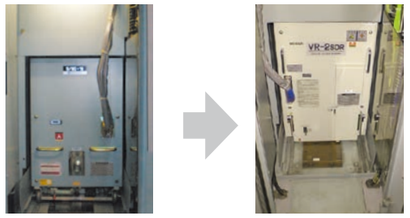
Simplification and shortening of the upgrade work time at the site

① Shut-down of the bus bar is not required, and upgrading can be done while other circuits are still operating.

② As upgrading is possible without panel modification, the upgrading work time can be shortened.

Note:In some cases, upgrading without bus bar shut-down and without panel modification may not be possible. Please contact us for details.

Retrofit upgrade example



VE-1-type VCB
(before upgrade)

VR-2SDR-type VCB
(after upgrade)

Improved reliability

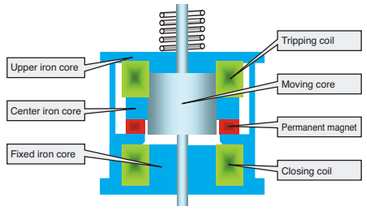
③The insulation withstand voltage is improved (greaseless VCB: type VR-DR)
The 6-kV VC, VE insulation frame used a three-phase collective type, but the VR-DR uses a three-phase separate type which suppresses insulation deterioration.

④Reduced sticking problems of component parts
The use of high-performance grease reduces sticking problems caused by grease deterioration (comparison by our company). For some models, the operation mechanism is greaseless, so no lubrication is required. As a result, problems with sticking are eliminated.

⑤Reduction of component parts of the mechanism (greaseless VCB: type VR-DR)
The VR-DR VCB uses a latch mechanism with a permanent magnet, so that a mechanical latch mechanism is not required. There is also no complicated link mechanism.

● Electromagnetic operation equipment

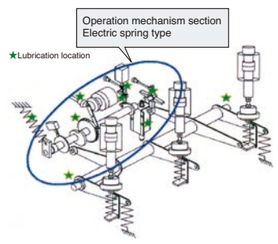
There are only 10 component parts. The reliability has been improved by changing to a greaseless type.



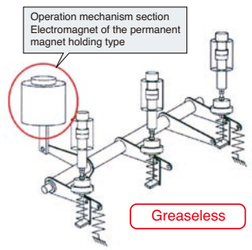
● Conceptual diagram of the operation mechanism

•The mechanism is simple because there is no latch mechanism.

•A greaseless mechanism has been realized by using a solid lubricant for bearings and sliding parts.



VJ electric spring
operation mechanism



VR-DR electromagnetic
operation mechanism

Reduced power consumption (greaseless VCB:type VR-DR)

⑥ As the operation current is reduced, the power consumption can be reduced.

Example: Operation current comparison for a 6 kV–20/25 kA at DC 100 V VCB

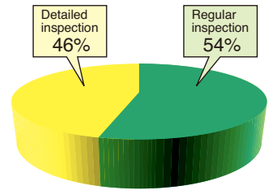
30 A (type VC)
56 A (type VE)
} **20 A (type VR-DR)**

Reduced expense of inspection (greaseless VCB: type VR-DR)

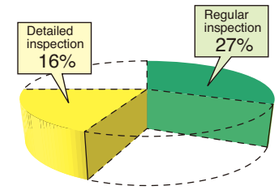
⑥ As the mechanism no longer requires lubrication, the work load at the time of inspection can be greatly reduced (the amount of work is 43% of that for existing equipment). Furthermore, the improved reliability makes it possible to extend the periodic inspection interval (from 3 to 6 years).

In comparison to existing VCBs, the inspection work load has been greatly reduced.

By using an electromagnetic actuator of the permanent magnet holding type without a latch mechanism or an accumulation mechanism, a greaseless mechanism is achieved and lubrication work for the operation mechanism is no longer required.



Inspection work load for existing VCBs
100%



Inspection work load for a VR-DR VCB
(electromagnetic)
43%

* The above pie graphs show a comparison of the inspection work load for 24 years of use.

Inspection type	Main inspection item	Inspection interval for existing VCBs	Inspection interval for VR-DR VCBs (electromagnetic operation)
Regular inspection	Cleaning of vacuum interrupter	3year	**6year**
	Cleaning of insulation material	3year	**6year**
	Switching operation test	3year	**6year**
	Measuring of main circuit insulation resistance	3year	**6year**
	Measuring of control circuit insulation resistance	3year	**6year**
Detailed inspection	Confirmation of contact wear of vacuum interrupter	6year	**12year**
	Judgment of vacuum quality	6year	**12year**
	Cleaning and grease-up of main circuit disconnection part	6year	**12year**
	Lubrication of operation mechanism	6year	**Unnecessary**
	Confirmation of switching characteristics	6year	**12year**

Retrofit VCB/VCS list

7.2 kV/3.6 kV retrofit VCB

Existing circuit breaker				Retrofit VCB		
Type	Model	Model (example)	Rating	Model	Model	Rating
OCB	QS-1B	QSH-1FZ62SB	7.2/3.6kV-600A-12.5/16kA	VJ-2SR	VBJD-6220BF-ER	7.2/3.6kV-600A-12.5/16kA
	QS-1D	QSH-1FZ62SD			VBJD-6220BG-ER/FR	
		QSH-1FZ65SD	7.2/3.6kV-1200A-12.5/16kA	VJ-2R	VBJD-6525BG-ER/FR	7.2/3.6kV-1200A-12.5/16kA
	QS-2B	QSH-2FZ62SB	7.2/3.6kV-600A-20/25kA		VBJD-6225BF-ER	7.2/3.6kV-600A-20/25kA
	QS-2D	QSH-2FZ62SD			VBJD-6225BG-ER/FR	
	QS-2B	QSH-2FZ65SB	7.2/3.6kV-1200A-20/25kA		VBJD-6525BF-ER	7.2/3.6kV-1200A-20/25kA
	QS-2D	QSH-2FZ65SD			VBJD-6525BG-ER/FR	
VCB	VC-1	VBCD-6215S_-E/F	7.2/3.6kV-600A-12.5/16kA	VR-2SDR	NVBRD-6213SC-ER/FR	7.2/3.6kV-600A-12.5/16kA
		VBCD-6515S_-E/F	7.2/3.6kV-1200A-12.5/16kA		NVBRD-6513SC-ER/FR	7.2/3.6kV-1200A-12.5/16kA
	VC-2	VBCD-6225S_-E/F	7.2/3.6kV-600A-20/25kA		NVBRD-6220SC-ER/FR	7.2/3.6kV-600A-20kA
		VBCD-6525S_-E/F	7.2/3.6kV-1200A-20/25kA		NVBRD-6520SC-ER/FR	7.2/3.6kV-1200A-20kA
		VBCD-6725S_-E/F	7.2/3.6kV-2000A-20/25kA		NVBRD-6720SC-ER/FR	7.2/3.6kV-2000A-20kA
	VE-1	VBED-6213S_-E/F	7.2/3.6kV-600A-12.5kA	VR-2SDR	NVBRD-6213SE-ER/FR	7.2/3.6kV-600A-12.5kA
	VE-1L	VBED-6213S_-EL/FL		VR-1LDR	NVBRD-6213SE-ELR/FLR	
	VE-2S	VBED-6220S_-E/F	7.2/3.6kV-600A-20kA	VR-2SDR	NVBRD-6220SE-ER/FR	7.2/3.6kV-600A-20kA
	VE-2	VBED-6525S_-E/F	7.2/3.6kV-1200A-25kA		NVBRD-6520SE-ER/FR	7.2/3.6kV-1200A-20kA
		VBED-6725S_-E/F	7.2/3.6kV-2000A-25kA		NVBRD-6720SE-ER/FR	7.2/3.6kV-2000A-20kA
	VN-1	VBND-6213S-M	7.2/3.6kV-600A-12.5kA	VR-1DR	VBRD-6213SN-MR	7.2/3.6kV-600A-12.5kA
	VE-4	VBED-6540S_-E/F	7.2/3.6kV-1200A-40kA	VE-14C	VBED-10540BU-E/F-S	7.2/3.6kV-1200A-40kA
		VBED-6740S_-E/F	7.2/3.6kV-2000A-40kA		VBED-10740BU-E/F-S	7.2/3.6kV-2000A-40kA
		VBED-6840S_-E/F	7.2/3.6kV-3000A-40kA		VBED-10840BU-E/F-S	7.2/3.6kV-3000A-40kA

12 kV retrofit VCB

Existing circuit breaker				Retrofit VCB		
Type	Model	Model (example)	Rating	Model	Model	Rating
VCB	VE-14	VBED-10536B_-E/F	12kV-1200A-36.1kA	VE-14C	VBED-10540BU-E/F	12kV-1200A-40kA
	VE-14A	VBED-15537B_-E/F	12kV-1200A-40kA		VBED-10740BU-E/F	12kV-2000A-40kA
	VE-14	VBED-10736B_-E/F	12kV-2000A-36.1kA		VBED-10840BU-E/F	12kV-3000A-40kA
	VE-14A	VBED-15737B_-E/F	12kV-2000A-40kA			
	VE-14	VBED-10836B_-E/F	12kV-3000A-36.1kA			
	VE-14A	VBED-15837B_-E/F	12kV-3000A-40kA			

24 kV retrofit VCB

Existing circuit breaker				Retrofit VCB/VCS		
Type	Model	Model (example)	Rating	Model	Model	Rating
VCB/ VCS	VB-210	VBBD-202100S-E/F	24kV-600A-25kA	VE-210R	VBED-20225BL-E/F	24kV-600A-25kA
	VB-210	VBBD-205100S-E/F	24kV-1200A-25kA		VBED-20525BL-E/F	24kV-1200A-25kA
	VB-210	VBBD-207100S-E/F	24kV-2000A-25kA		VBED-20725BL-E/F	24kV-2000A-25kA
	VB-210	VBBD-207100BC			VBED-20725BD-R	
	VB-210	VBBD-208100BC	24kV-3000A-25kA		VBED-20825BD-R	24kV-3000A-25kA
	VS-210	VBSD-20513BC	24kV-1200A	VSE-210R	VSED-20503BD-R	24kV-1200A
	VE-22	VBED-20225B_-E/F	24kV-600A-25kA	VE-22N	VBED-20225BN-E/F	24kV-600A-25kA
	VE-22	VBED-20525B_-E/F	24kV-1200A-25kA	VE-22N	VBED-20525BN-E/F	24kV-1200A-25kA
	VE-22	VBED-20725B_-E/F	24kV-200A-25kA	VE-22N	VBED-20725BN-E/F	24kV-200A-25kA

The "yellow-colored" items are greaseless VCBs and the "light-blue-colored" items are VCBs/VCSs that use high-performance grease (note).

Note: This grease does not solidify compared with those used for the existing devices.

For upgrading

Please provide the following information if you plan to upgrade.

1. Types of existing equipment
2. Number of upgrade units
3. Production No. and year of production of existing equipment
4. Planning time

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