



 DISTRIBUTION SOLUTIONS

# **DR Breaker Retrofit**

Medium Voltage Service Marketing and Sales



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# Retrofit Concept

## Retrofit Aim

RETROFIT means the implementation of modern components (primary switching devices and digital protection/control technology) in the existing MV installation with following benefits

- Cheaper than a complete replacement
- Short implementation time for replacement
- Minimum shutdown of the switchboard
- Remaining service life extension
- Improved operator protection
- Minimization of further maintenance costs
- Warranty on the conversion work
- Spare parts availability for long time



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# General description

Original Diarc circuit breaker

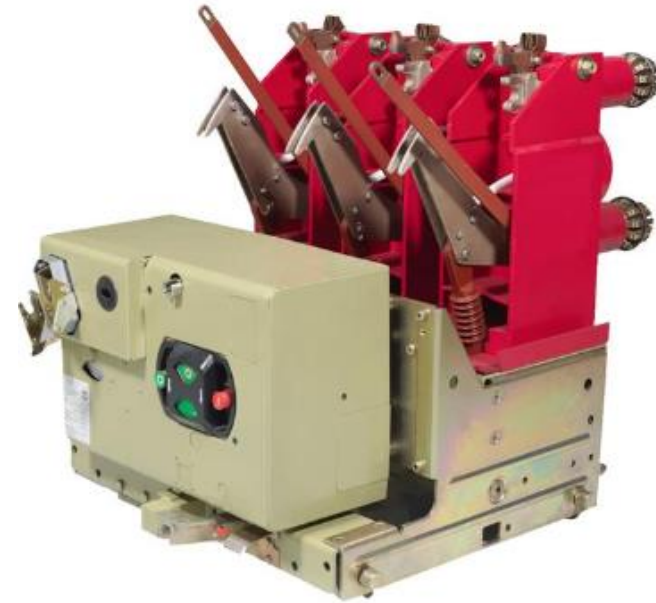
## Diarc

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## Diarc detail

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Pole assembly and operating mechanism

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# General description

HD4 and VD4 – Diarc Retrofitting

## HD4-DR

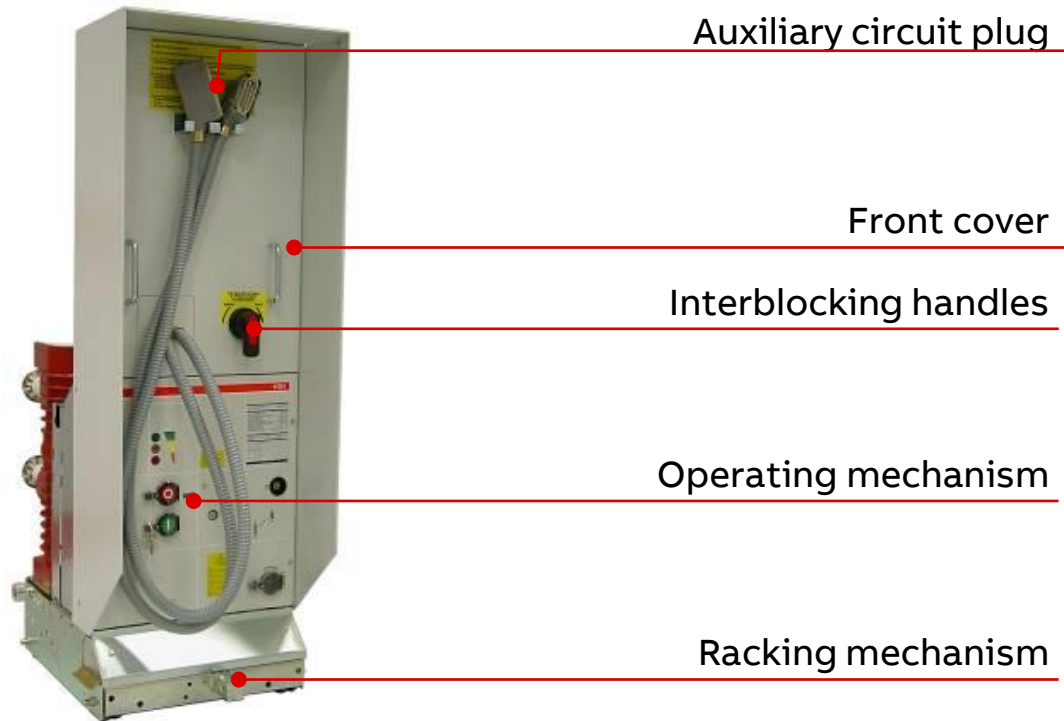


## VD4-DR

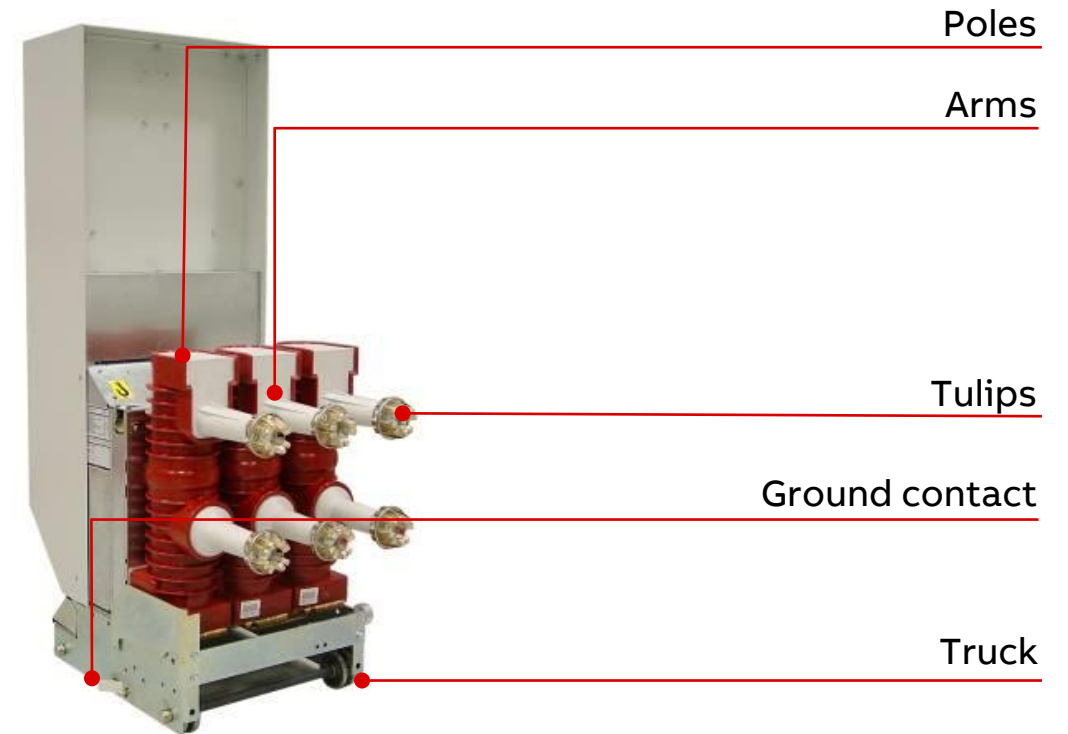


# General description

## Front view



## Rear view





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# Technical specification

## HD4-DIARC ratings

Rated voltage	kV		12	17.5	24
Rated insulation voltage	kV		12	17.5	24
Rated power frequency withstand voltage	kV		28	38	50
Rated lightning impulse withstand voltage	kV		75	95	125
Rated frequency	Hz		50-60	50-60	50-60
Rated short-time withstand current	kA 3s	Up to	50	40	40
Peak current	kA	Up tp	125	125	80
Internal arc withstand current	kA 1s	Up to	50	50	40
Rated current	A	Up to	4,000	4,000	2,500

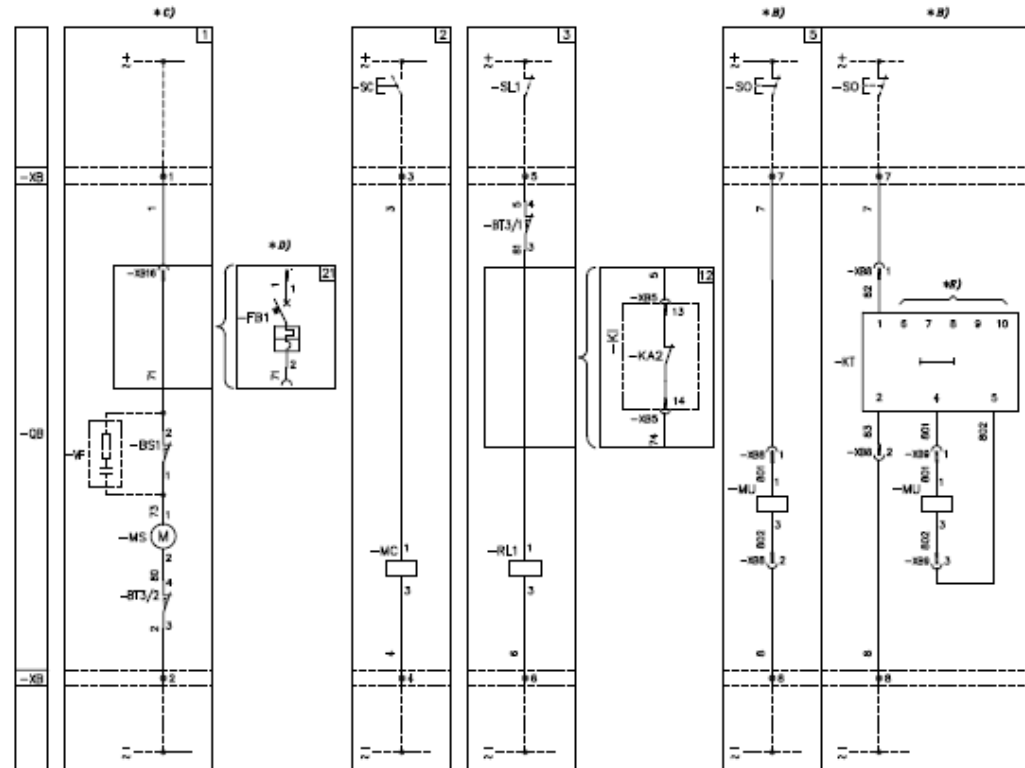
# Technical specification

## VD4-DIARC ratings

Rated voltage	kV	12
Rated insulation voltage	kV	12
Rated power frequency withstand voltage	kV	28
Rated lightning impulse withstand voltage	kV	75
Rated frequency	Hz	50-60
Rated short-time withstand current	kA 3s	Up to 50
Peak current	kA	Up tp 125
Internal arc withstand current	kA 1s	Up to 50
Rated current	A	Up to 3,250

# Technical specification

New schematic diagram – Circuit breaker schematic diagram based on standard VD4 and HD4



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# Necessary details for standard retrofit solutions

## VD4 and HD4-DIARC Retrofit solution development

Essential technical data <sup>(1)</sup>

Name plate on the existing breaker with

- Serial number
- **Type**
- **Rated Voltage**
- **Rated Current**
- **Real operational current**
- **Short Time withstand Current**
- Auxiliary voltage for coils and spring charging motor

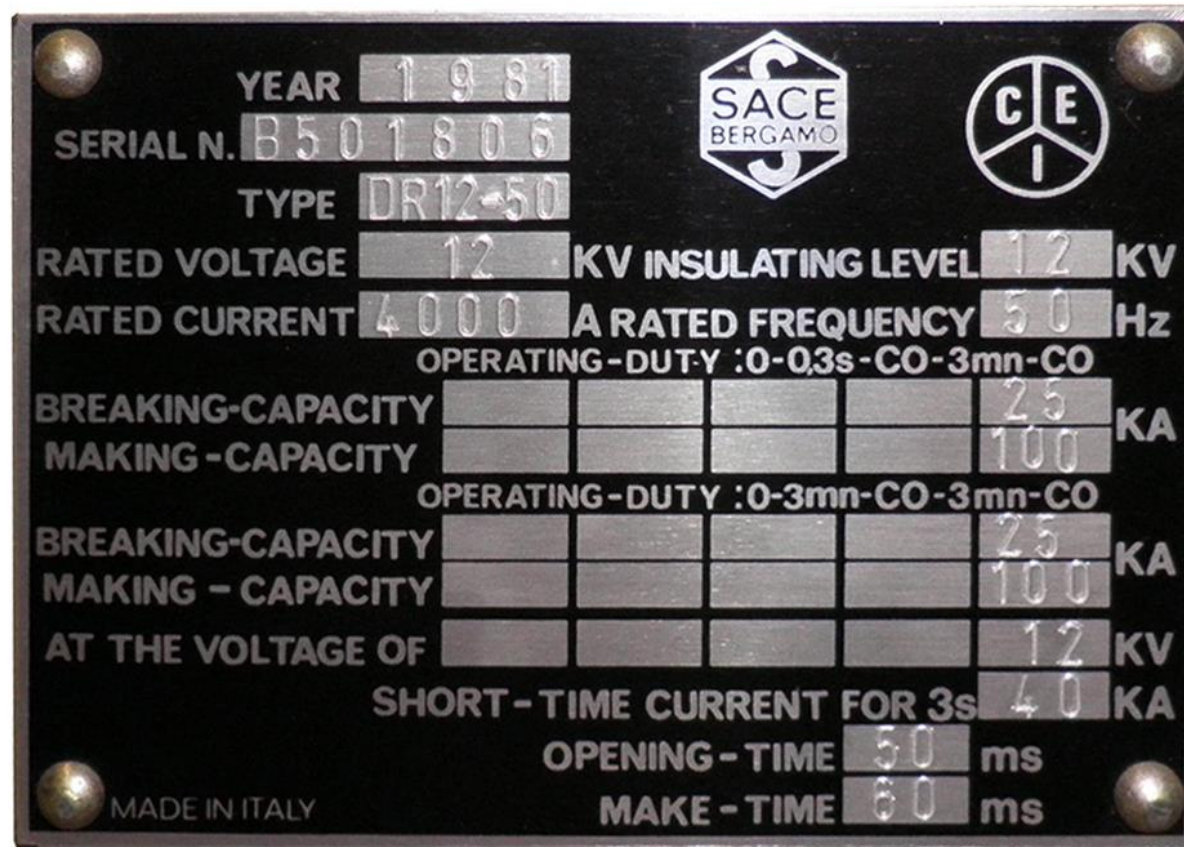
<sup>(1)</sup> In case of Generator CB, to be filled the relevant data sheet

Clarification of electrical/mechanical interchangeability

- **Front, Rear, Side CB pictures** (preferable bottom side and front top)
- Internal view of the MV panel enclosure (preferable bottom side and rear side)
- Shutters condition
- Anti-introduction interlock position
- Main contacts resin insulation
- **Existing CB panel schematic diagram**

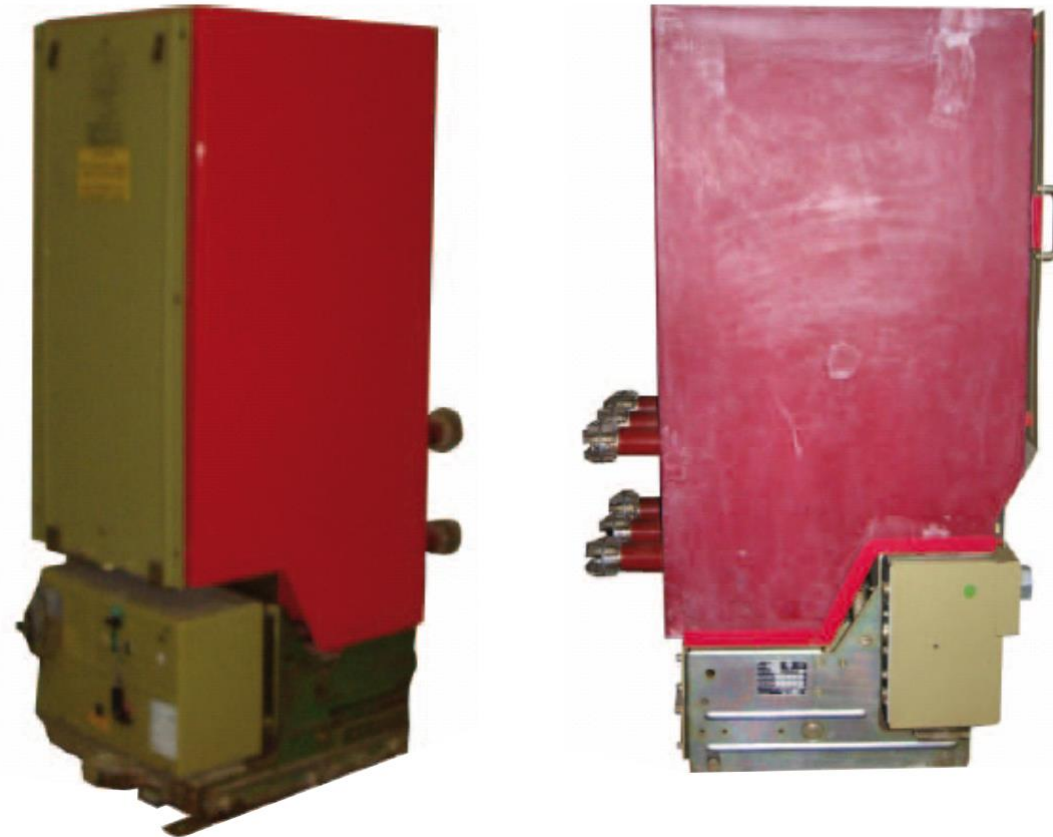
# Necessary details for standard retrofit solutions

## Name plate



# Necessary details for standard retrofit solutions

Front, rear, side pictures





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# Necessary details for standard retrofit solutions

Enclosure view

Circuit breaker inside the panel



Empty panel



# Necessary details for standard retrofit solutions

## Poles distance

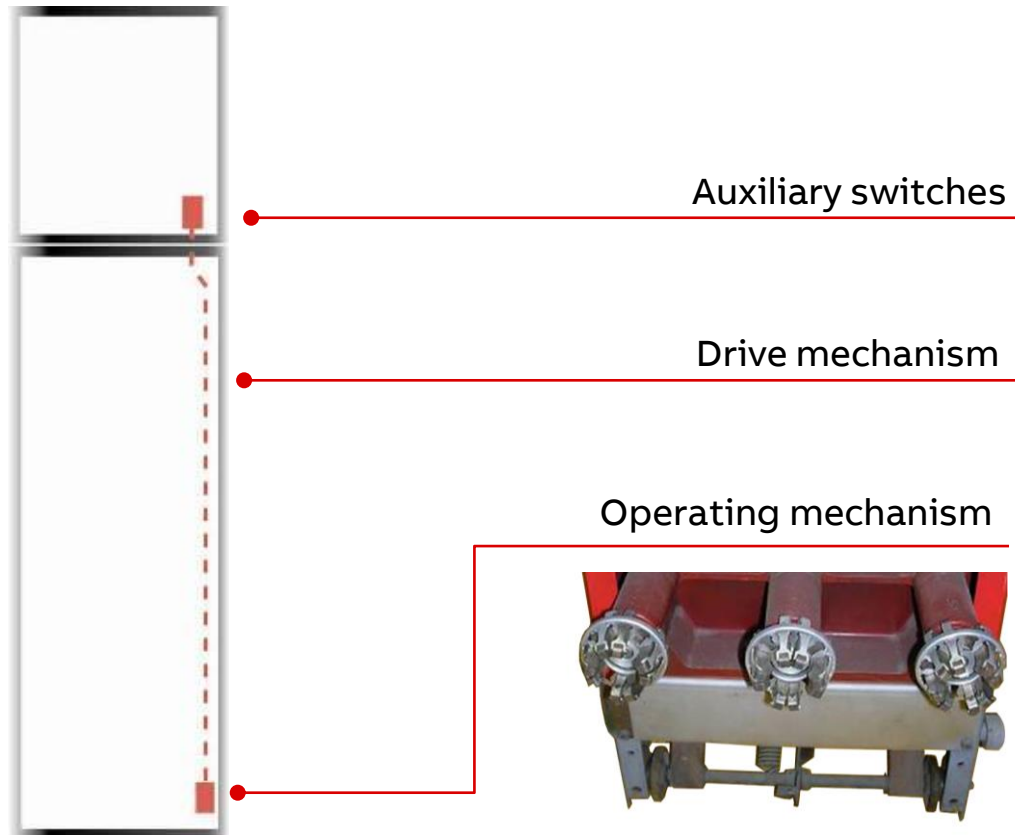


Some breakers were available in different shapes (pole distance changes) even if with the same ratings.

This information is not linked to the serial number and therefore it is very important to check it at site.

# Necessary details for standard retrofit solutions

## Auxiliary contacts



Mechanically driven auxiliary contacts (open and closed status) were available to connect directly the circuit breaker mechanism to the LV compartment auxiliary switches.

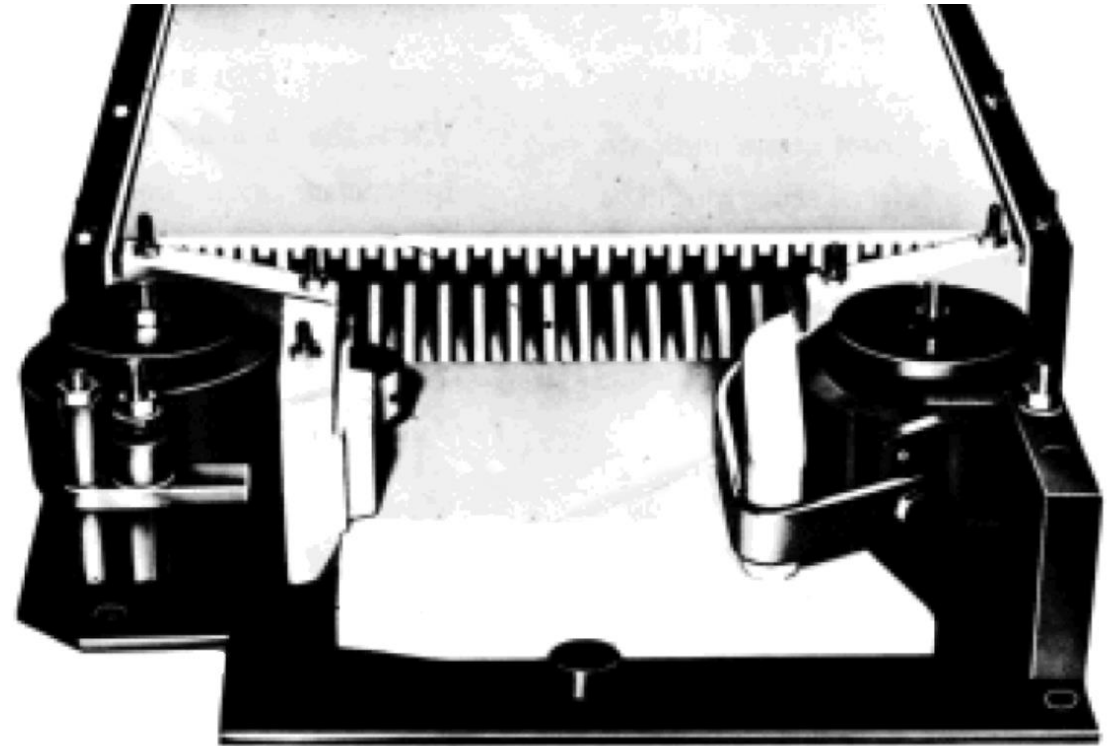
The same is not always possible with retrofit circuit breakers and therefore they must be re-arranged with the use of auxiliary relays.

# Necessary details for standard retrofit solutions

## Asbestos

The original design included some asbestos parts. The same has been removed from production at the time the asbestos was recognized unhealthy.

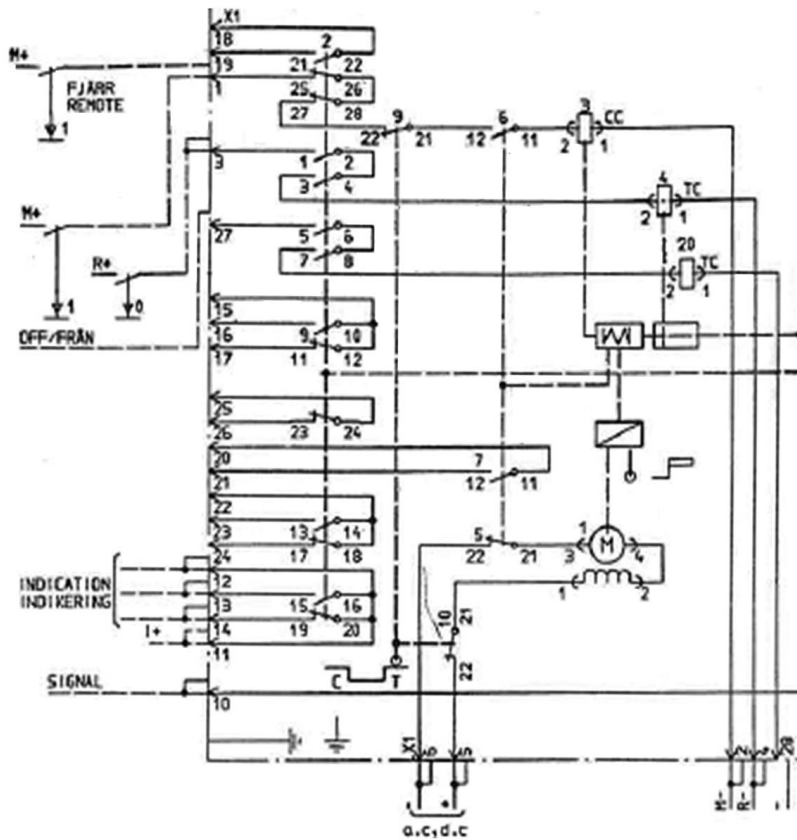
Specific handling procedures have then to be applied during maintenance and performed by certified operators only.



Arcing chamber

# Necessary details for standard retrofit solutions

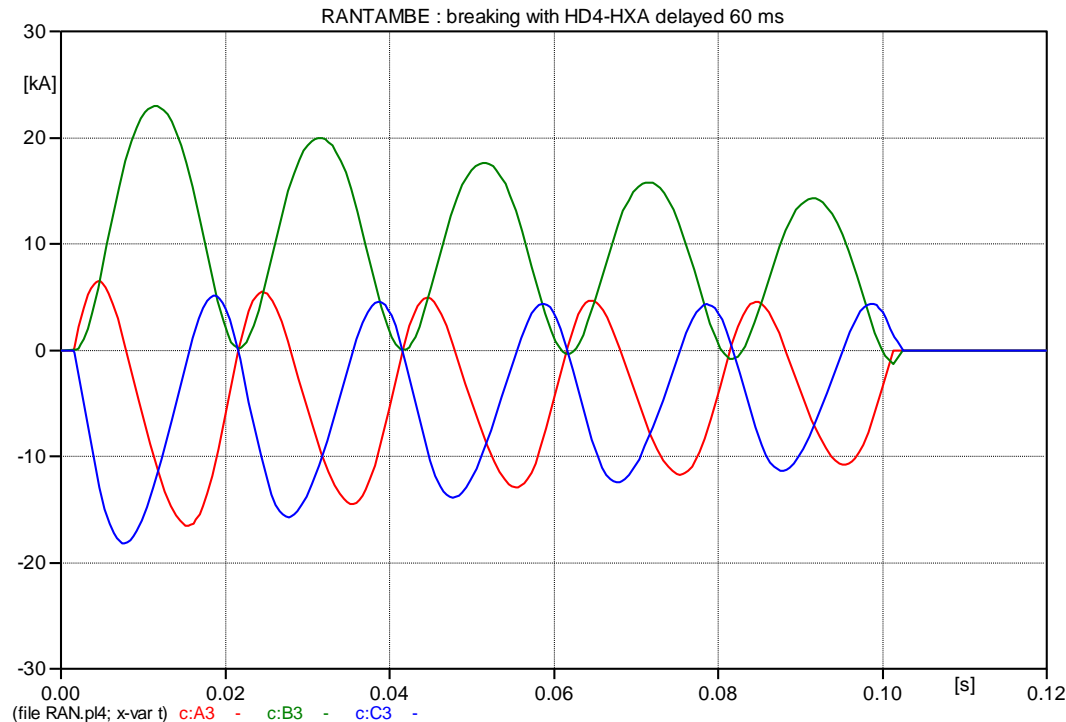
## Existing panel schematic diagram



Panel schematic diagram clarifies the accessories included into the existing breaker and the auxiliary contacts wired to the sliding plug

# Necessary details for standard retrofit solutions

## Generator Breaker replacement



- In order to use a distribution breaker like HD4 or VD4 correctly, we have to calculate the DC current in case of generator short circuit
- Why? The distribution breaker can only open when DC current is going to a reasonable low level where the energy can not destroy the breaker
- The opening time might be increased and sometimes capacitors could be requested at generator site

**! Please fill out the generator data request list !**

# Necessary details for standard retrofit solutions

## Generator Breaker data sheet

### 2. Technical data of generator

Rated voltage	Ur	[kV]	} Generator information
Rated apparent power	Sr	[MVA]	
Rated frequency	fr	[Hz]	
Subtransient direct axis reactance (saturated)	Xd''	[%]	
Transient direct axis reactance (saturated)	Xd'	[%]	
Synchronous direct axis reactance (saturated)	Xd	[%]	
Subtransient short-circuit time constant	Td''	[ms]	
Transient short-circuit time constant	Td'	[ms]	
Armature short-circuit time constant	Ta	[ms]	

### 3. Data of network

Short circuit power of high voltage network	Sk''	[MVA]	} Net information
Rated power of main transformer	Sr	[MVA]	
Impedance voltage of main transformer	Uk	[%]	
Rated power of auxiliary transformer *)	Sr	[MVA]	
Impedance voltage of auxiliary transformer *)	Uk	[%]	
Rated power of connected medium voltage motor(s) *)	Pr	[MW]	
Rated motor current related to motor starting current *)	Ir/Ia	[p.u.]	
Single line diagram of network			

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# Manufacture process

## Base breaker assembling line



# Manufacture process

## Retrofit customization & routine tests

### Retrofit assembling



- Bushings
- Customized truck

### Retrofit test



- Voltage drop test
- Insulation auxiliary circuit 24 kV
- Schematic dgr check
- SF6 leakage test
- Dimensional check
- Interlock check

### Routine test



- Closing time
- Tripping time
- Contacts simultaneousness

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# Certification

## Type Test Availability

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- Dielectric Test
- Mechanical Interlocks Operations Test
- Mechanical Operations Test
- Short Time Withstand Current Test
- Temperature Rise Test

Retrofit apparatus certification is covered by the type tests of the basic circuit breaker they are based on and by some specific tests performed by the retrofit device inside the original panel.

Some non destructive type tests can also be performed on customer request inside its own panel if available.

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## Other solutions

### Contactor retrofit

**Fused vacuum contactor is also available for replacing motor starter units.**

- They are mechanically interchangeable with circuit breakers having poles distance equal to 150mm (600 or 650mm wide panels).
- Wiring must be modified to convert the circuit breaker scheme into the contactor one.
- VSC contactor scheme is “circuit breaker oriented” because can be configured for having the same operating coils (opening, closing and undervoltage ones).

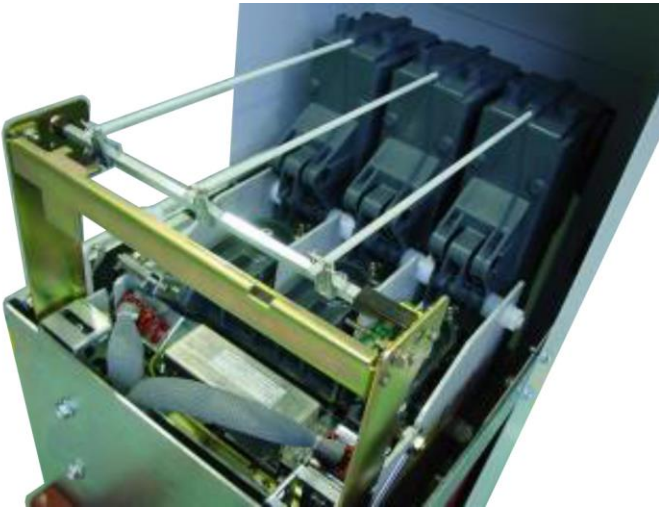


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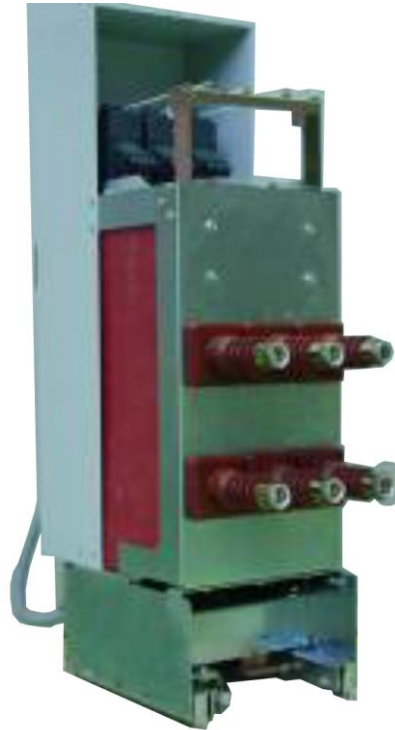
## Other solutions

Contactor-DIARC retrofit

**Fuses holder and operating mechanism**



**Rear view**



**Front view**





## Other Solutions

### Marine applications

Shipping Registers certified apparatus can be provided.  
Lloyd and DNV Marine classifications.

Above IEC type tests, inclination and vibration tests have been performed.



40 kA processed



31.5 kA classified



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# TruckMaster FR

Remote racking solutions for enhanced personnel safety

Suitable for withdrawable circuit breakers ratchet linear racking system

Carry out the racking in and out operations from a safe distance with panel door closed

Arc flash consequences exposure reduction

Cost effective way to bring the operator to a new level of safety without any need to modify the existing panel

Only one portable driver required for the whole switchgear motorization system

Installation and commissioning: switchgear upgrade needed



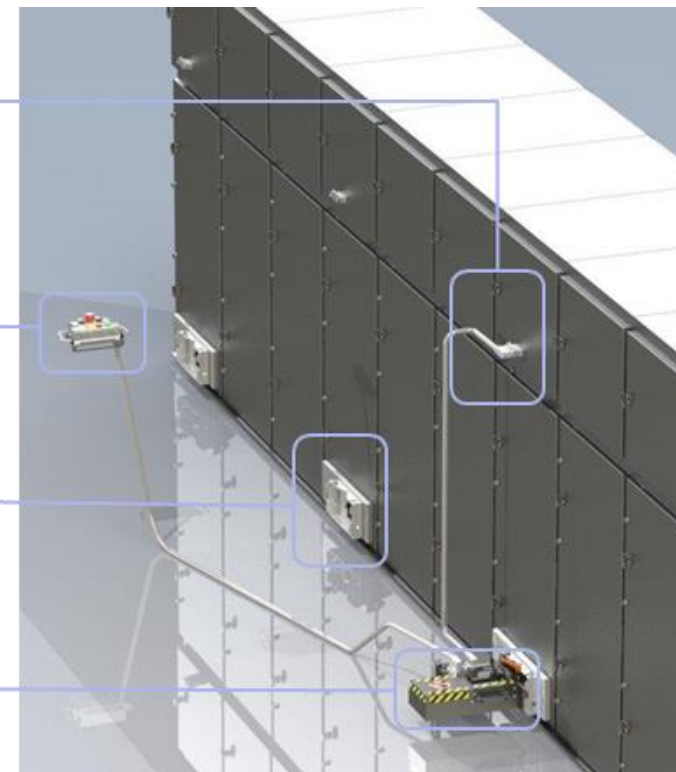
[Online video](#)

Switchgear signal port

Remote console

Driver docking

Portable driver



# MyRemoteCare

## Remote condition monitoring

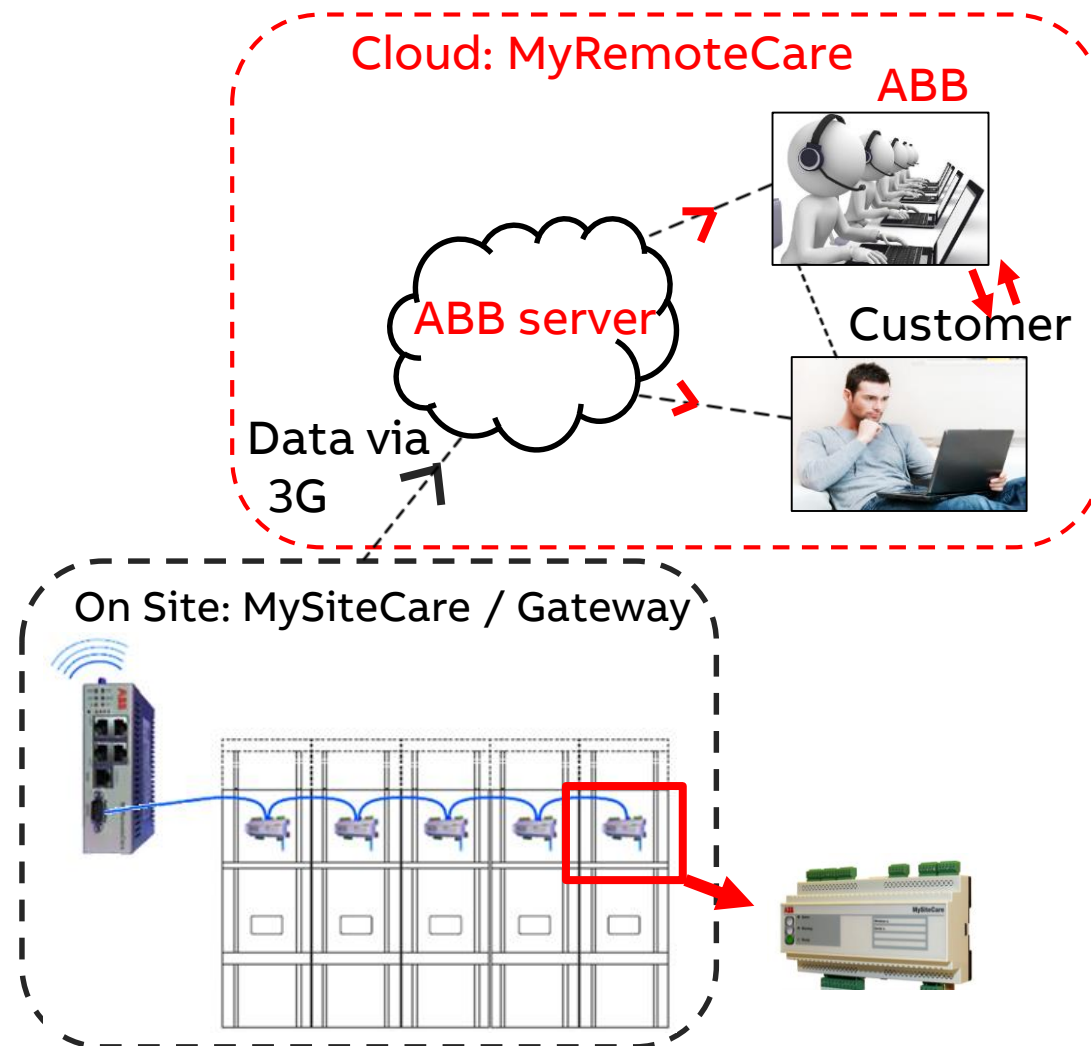
Condition-based maintenance services enables the prediction of equipment faults

ABB service engineers and operations teams monitor remotely assets and performance trends to define the correct maintenance procedures at the right time

MyRemoteCare provide continuous monitoring of switchgear and circuit breakers and evaluates events, alarms and trips for specific maintenance and essential working issue



[MyRemoteCare webpage](#)



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# Service support and contacts

## Medium Voltage Service Contacts for Diarc Retrofit



Please contact us if you need more information or support for Medium Voltage Services

- Service Manager – Claudio Zappella
  - Email: [claudio.zappella@it.abb.com](mailto:claudio.zappella@it.abb.com)
- Service Marketing and Sales Manager – Sebastiano Masper
  - Email: [sebastiano.masper@it.abb.com](mailto:sebastiano.masper@it.abb.com)
- Service Operation Manager – Giorgio Previtali
  - Email: [giorgio.previtali@it.abb.com](mailto:giorgio.previtali@it.abb.com)

[Diarc webpage:](#)



**ABB**