



 DISTRIBUTION SOLUTIONS

HA 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 HA circuit breakers

HA1



HA2



HA3



HA is the family name of a wide range of SF6 gas circuit breakers.

General description

Original HA circuit breakers

Many variants have been produced during their life cycle.

Specific versions can be identified looking the apparatus name on the label and taking the part after the slash e.g.:

Switchgear/enclosures	HA version
Univer C / CBE	HA1/ZC – HA/C
UniSafe	HA/WA-HA/WSA
ABB ZS1	HA1...3/ZC – HA/Z
UniVerG12	HA/sG - HA/NFsG



HA3 NF/sG

Electrical characteristic

HA ratings

SACE	HA1		HA2		HA3	
U	In	Isc	In	Isc	In	Isc
12 kV	630 A	12 kA	1250 A	25 kA 31,5 kA	1600/2000 A	31,5 kA 40 kA 50 kA
	1250 A	12 kA 16 kA 20 kA 25 kA	1600 A	25 kA 31,5 kA	2500/3150 A	25 kA 31,5 kA 40 kA 50 kA
17,5 kV	630 A	12 kA	1250 A	25 kA	1600/2000/2500/3150 A	25 kA 31,5 kA 40 kA
	1250 A	12 kA 16 kA 20 kA	1600 A	20 kA 25 kA		
24 kV	630 A	12 kA	1250 A	25 kA	1600/2000/2500/3150 A	25 kA 31,5 kA 40 kA
	1250 A	12 kA 16 kA 20 kA	1600 A	20 kA 25 kA		

N.B.

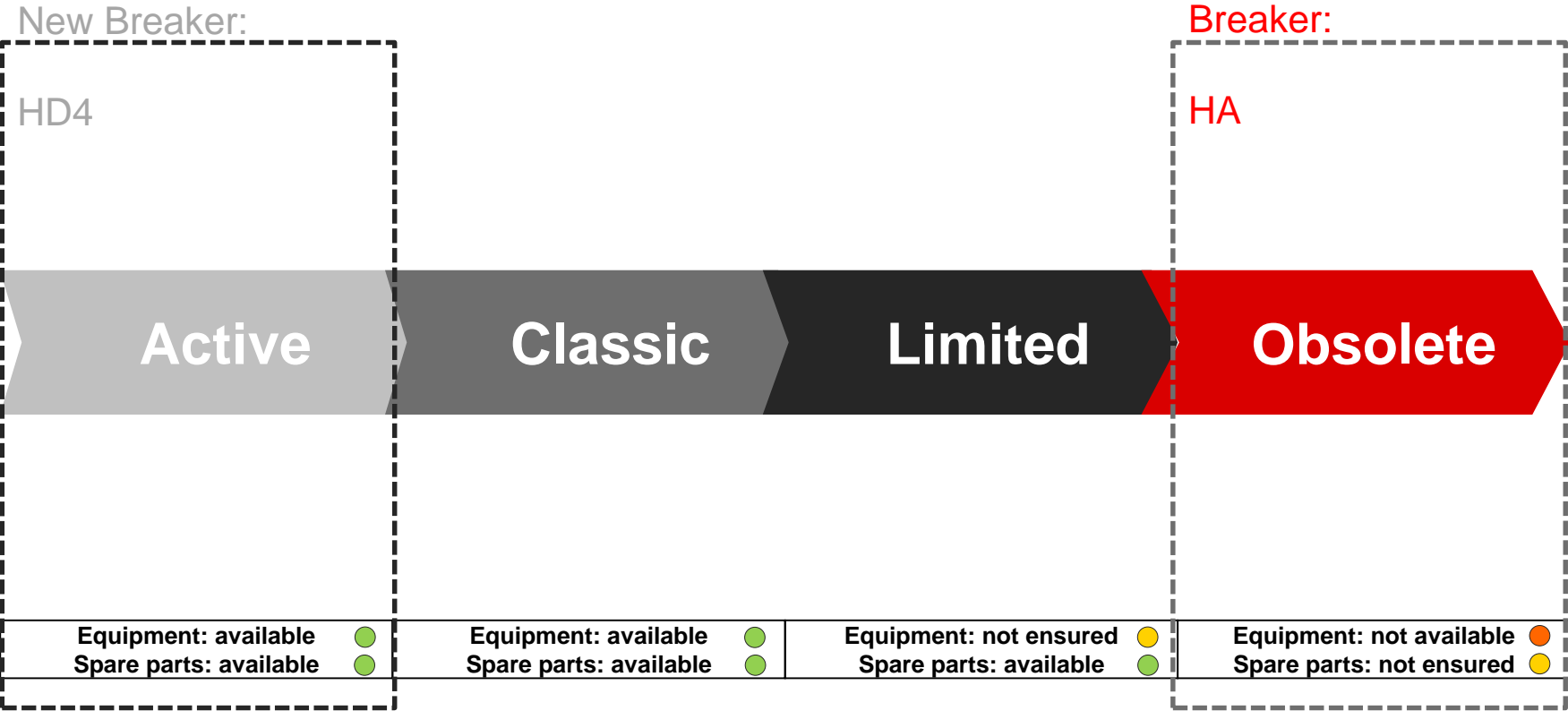
The maximum performances indicated are not available for some versions. Please consult the specific tables given further on.

Rated uninterrupted currents are defined in free air.

HA3/NFsg up to 3600° (4000° with forced ventilation)

Life cycle management

HA circuit breaker product status





Life cycle management

Spare parts availability for breakers

Obsolete products			Active products	Spare parts				
Name	Product	Type	Retrofit solution	Poles	Mechanism	Auxiliary equipment	Tulip contacts	Complete device
HA1-2-3	Circuit-breaker	SF6	HD4, VD4					

Not available

Not ensured

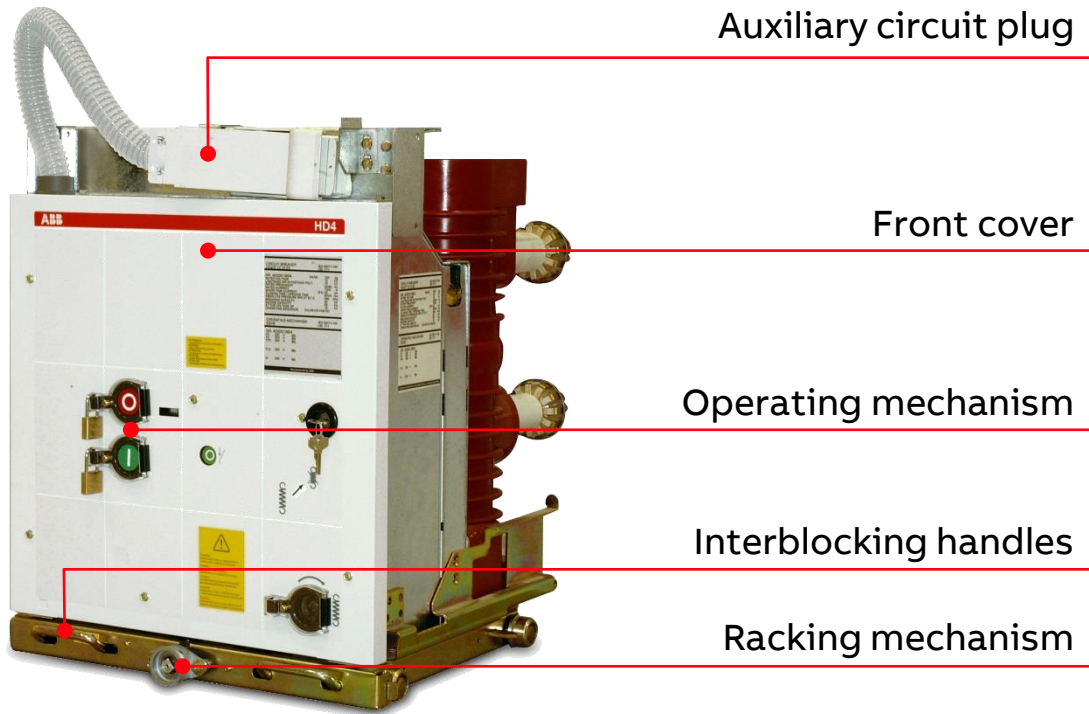
Available

Not applicable

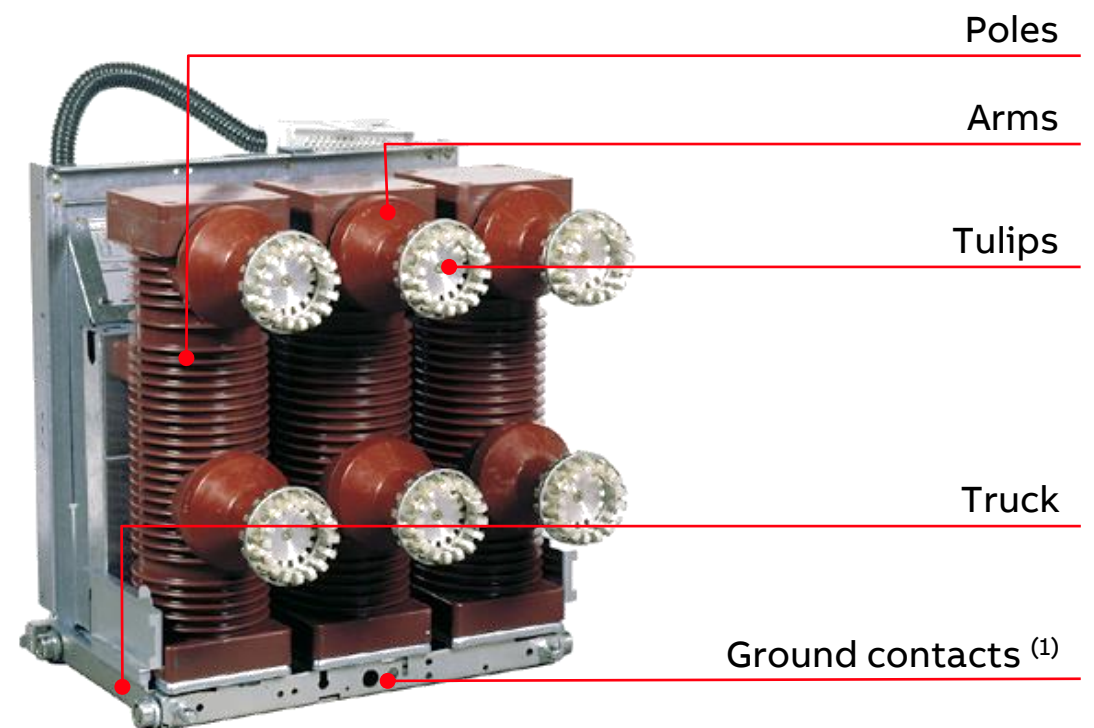
General description

HA retrofitting

HD4-HA front view



HD4-HA rear view



⁽¹⁾ For those apparatus type are fitted with

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Technical specification

VD4 and HD4-HA 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 to	125	100	100
Internal arc withstand current	kA 1s	Up to	50	40	40
Rated current	A	Up to	3,150	3,150	3,150

* Retrofit solution are available both in HD4 and in VD4 technology in the majority of cases.

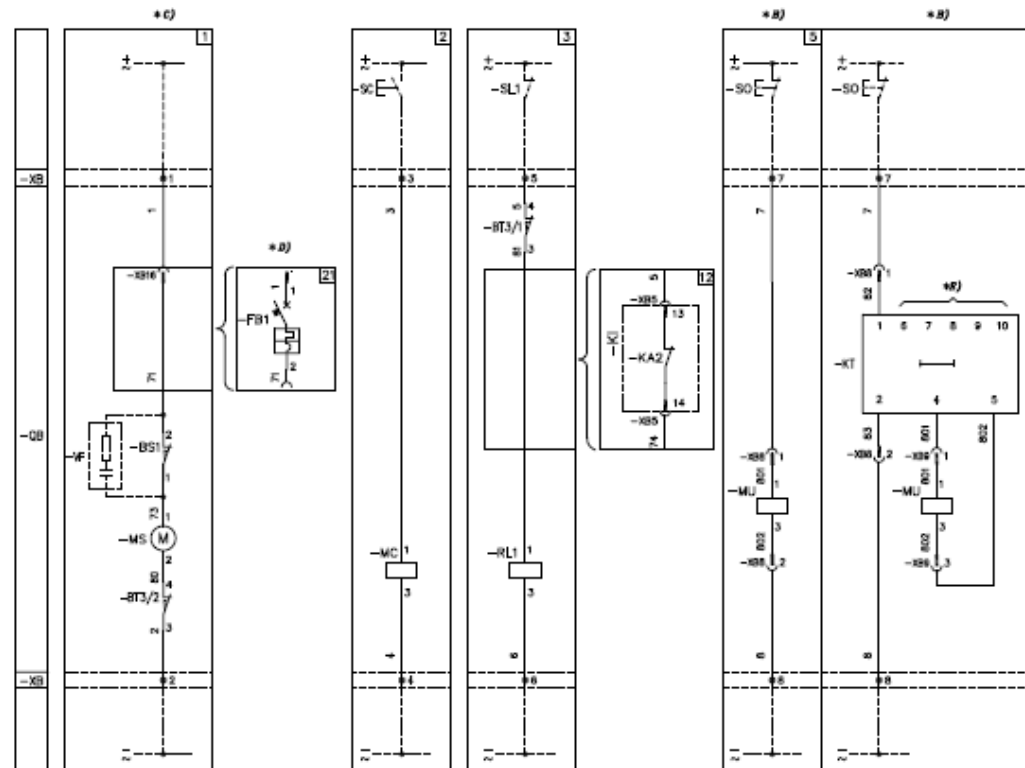


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Necessary details for standard retrofit solutions

VD4 and HD4-HA Retrofit solution development

Essential technical data ⁽¹⁾

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

⁽¹⁾ 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**



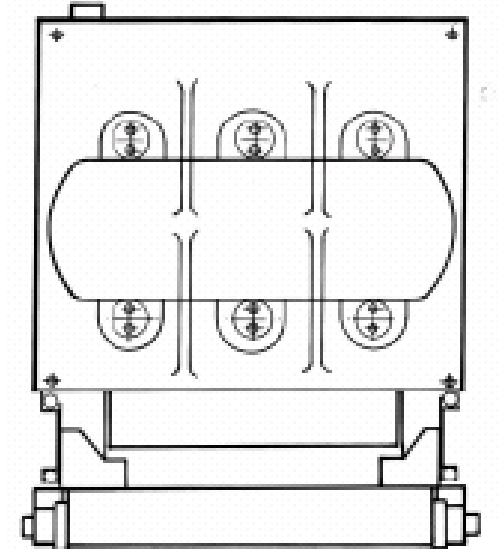
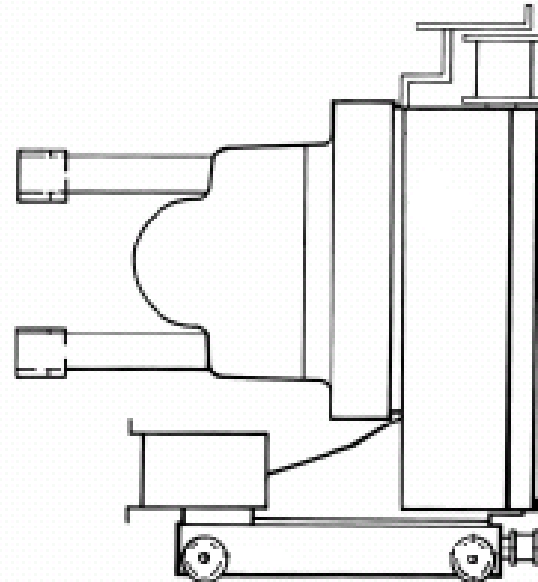
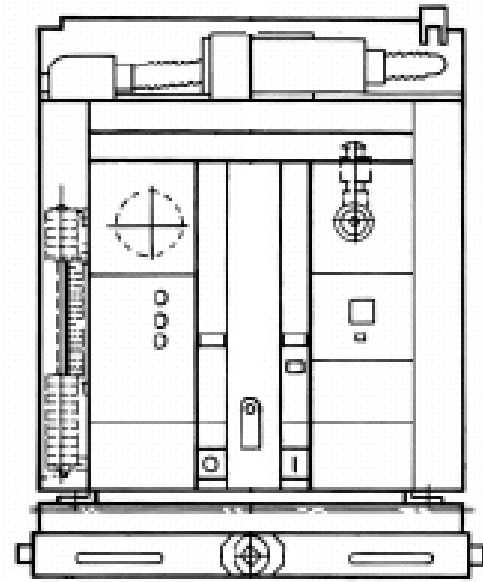
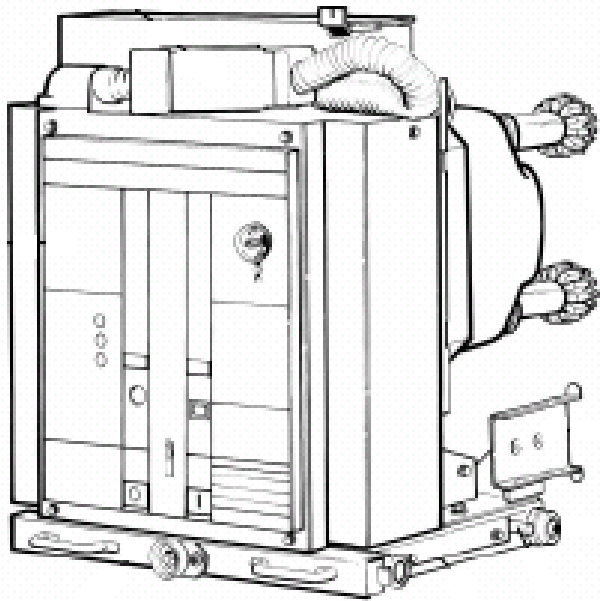
Necessary details for standard retrofit solutions

Name plate – positioned on the CB front for every breaker type

CIRCUIT-BREAKER				IEC 56
SACE HA				CEI 17-1
No. ...	MASS	...	kg	
RATED VOLTAGE		...	kV	
IMPULSE WITHSTAND VOLTAGE		...	kV	
RATED FREQUENCY		50/60	Hz	
RATED NORMAL CURRENT		...	A	
SHORT-TIME CURRENT (1 s)		...	kA	
CLOSING/OPENING TIME		...	ms	
ABSOLUTE SF6 PRESSURE AT 20 °C		...	kPa	
BREAKING CAPACITY		...	kA	
MAKING CAPACITY		...	kA	
AT VOLTAGE OF		...	kV	
OPERATION SEQUENCE		0-3MIN-CO-3MIN-CO		
OPERATING MECHANISM				IEC 56
SACE GV...				CEI 17-1
No. ...				
YC	...	V	—	
YU	...	V	—	
YO1	...	V	—	
H	...	V	—	
M	...	V	—	
Designed and manufactured by ABB SACE				

Necessary details for standard retrofit solutions

Front, rear, views



Necessary details for standard retrofit solutions

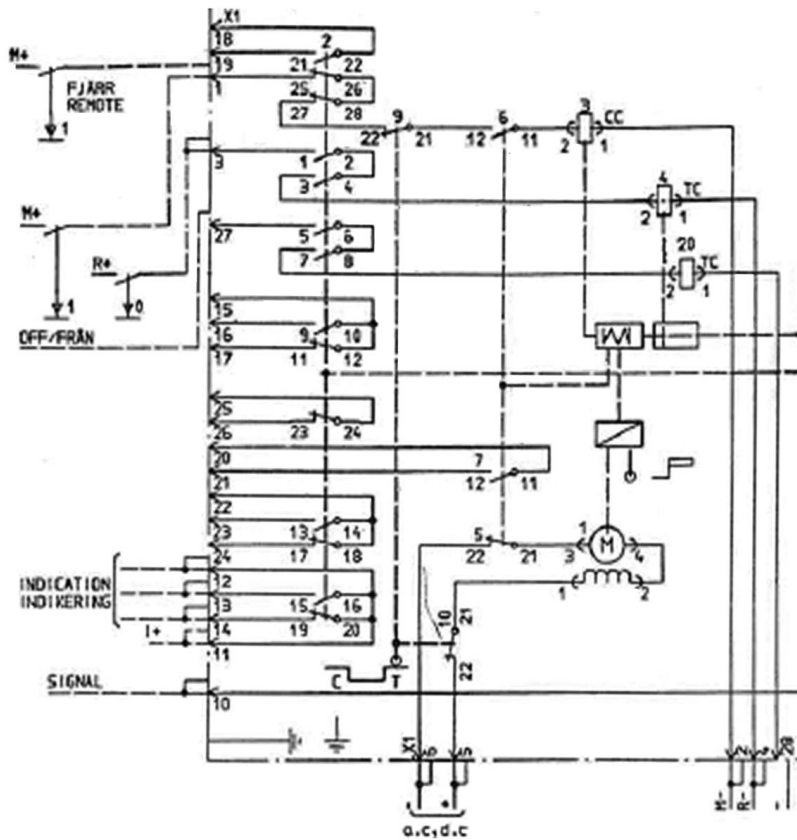
Enclosure view

Example for HA3 circuit breaker inside a UniVerG12 panel



Necessary details for standard retrofit solutions

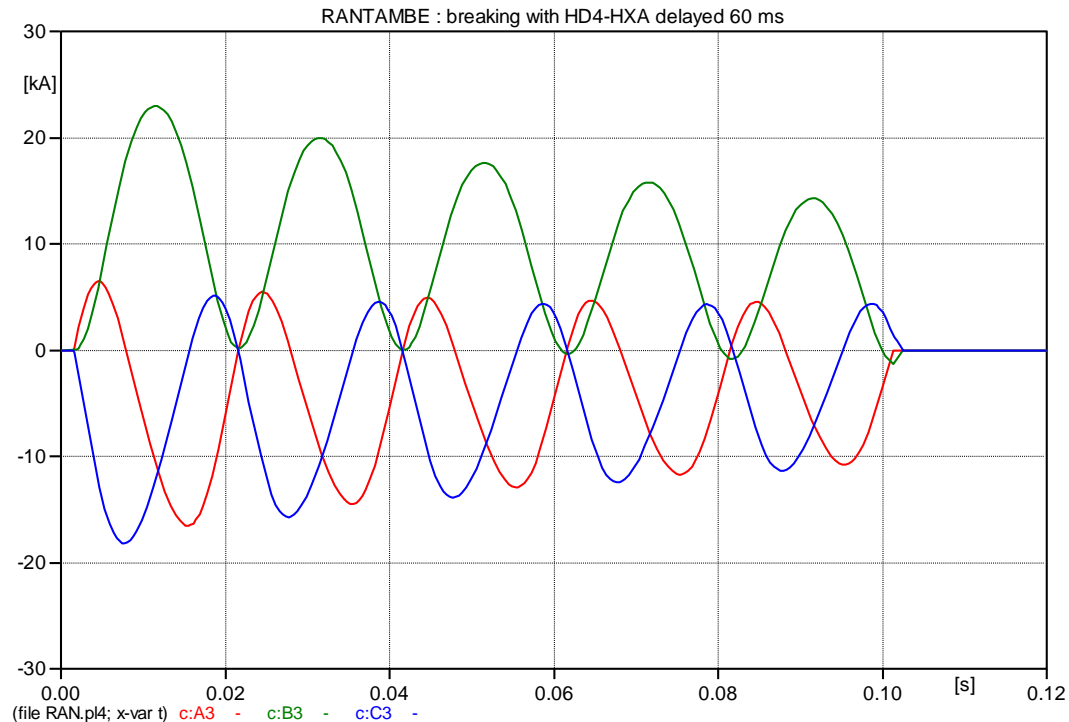
Existing panel schematic diagram



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

- 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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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).



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.



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SF6 handling

EC Regulations

The original design was based on SF6 self-blast technology.

Specific handling procedures shall be applied during maintenance

- They must be performed by certified operators according to EC Regulation 305/2008.
- SF6 gas has to be treated as per EC Regulation 842/2008.

We comply with the above to ensure the personnel safety and reduce the environmental impact.

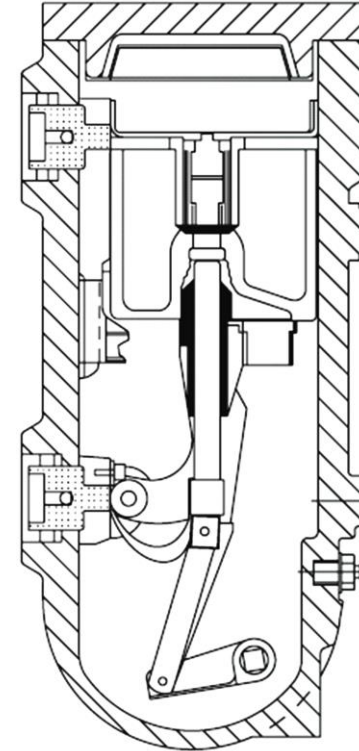


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TruckMaster CS

Remote racking solutions for enhanced personnel safety

Suitable for withdrawable circuit breakers with rotary racking systems

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



[Online video](#)



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](#)

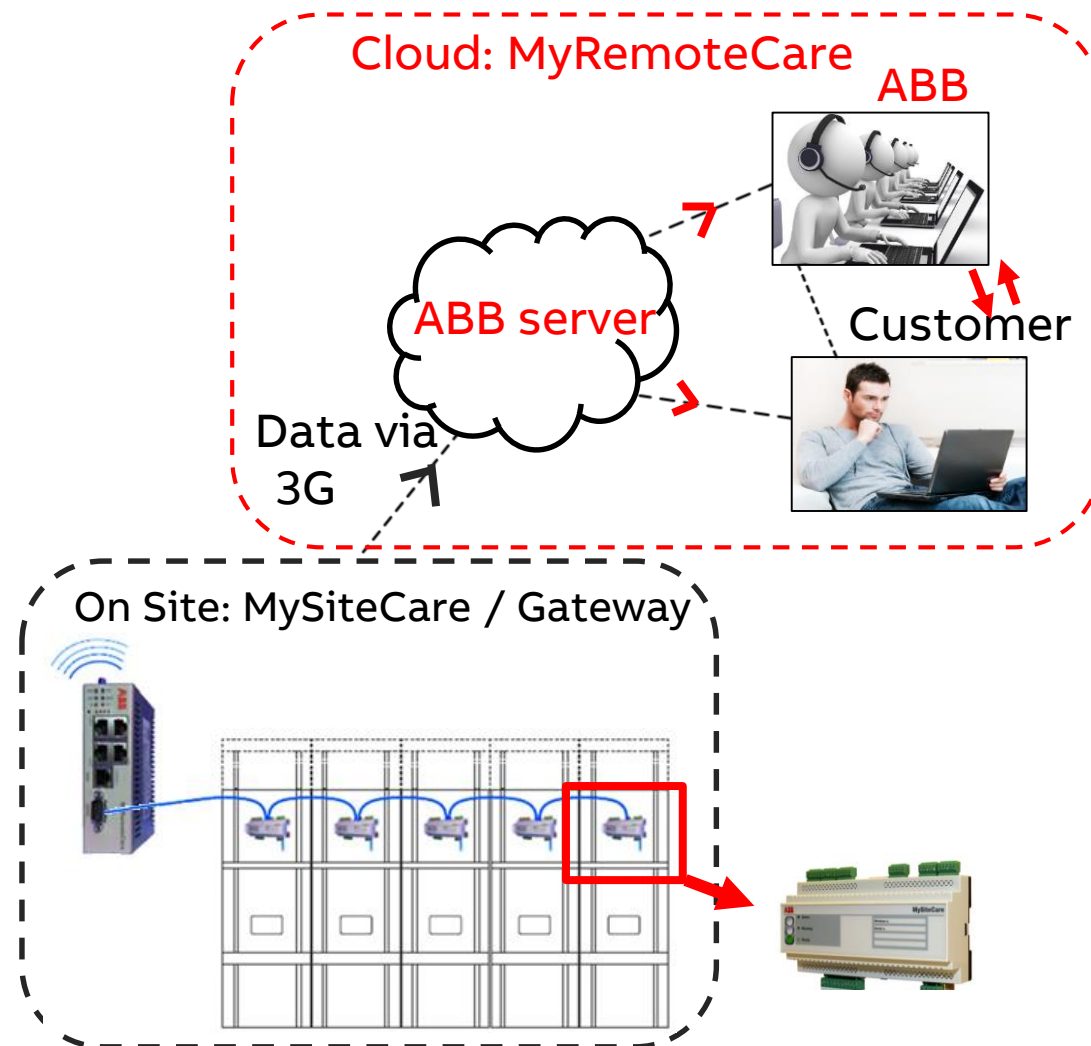


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Service support and contacts

Medium Voltage Service Contacts for HA 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
- Service Marketing and Sales Manager – Sebastiano Masper
Email: sebastiano.masper@it.abb.com
- Service Operation Manager – Giorgio Previtali
Email: giorgio.previtali@it.abb.com

[HA webpage:](#)



ABB