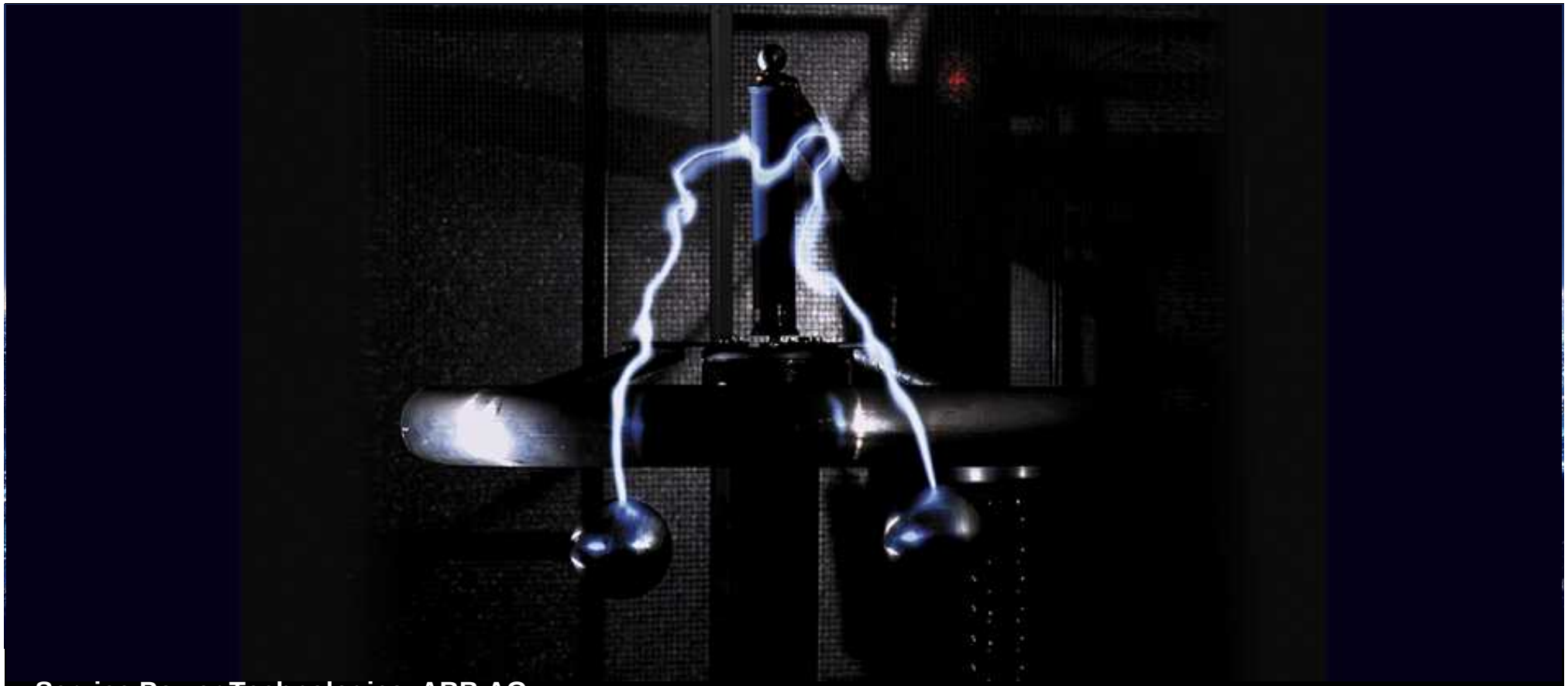

Service Power Technologies, ABB AG

Retrofit solutions
Circuit breaker retrofit

Power and productivity
for a better world™

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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
- Minimisation of further maintenance costs
- Warranty on the conversion work
- Spare parts availability for long time

Retrofit Concept
The Benefits

Technology

- **M**agnetic actuator that increases mechanical life time
- **B**us communication between breaker and control panel
- **I**ndividual pole release for a predictive switching
- **M**otorized rack-in rack-out operations

Quality of Supply

- **T**hrough advanced switching features.)
- **F**aster reclosing times
- **L**arge communication option to downstream and upstream

Reliability

- **L**ower maintenance requirements.
- **S**pare parts availability and delivery time for obsolete products can result in unexpected down time. (DOWN TIME)
- **M**odern breakers features:
- **A**ccumulated Switching Current Ctrl
- **N**umber of operations.
- **G**as Control interlock.
- **M**odern breaker mechanism are lighter and have longer mechanical life
- **O**pportunity to utilize spring or magnetic actuator

Safety

- **O**ffer opportunity of eliminating oil and airblast insulation through use of SF6 or vacuum interrupting technology
- **D**ramatically reduce fire risk. (people & plants)
- **R**educed insurance costs. (people & plants) Increa-sing making current capacity protects personnel and equipment from unexpected failures.
- **M**odern control circuits supports remote operations.
- **A**dditional safety standards embedded in modern breaker increases installation safety (i.e. internal/external interlocks)

Investment

- **W**here limited funds are available of capital investment
- **L**ets update equipment with lower investments
- **L**ets plan customer maintenance budget
- **R**eduction of insurance costs
- **B**y using new technology
- **R**eduction of fire risk from old oil breakers
- **R**elay on operation performance and lose of production/time

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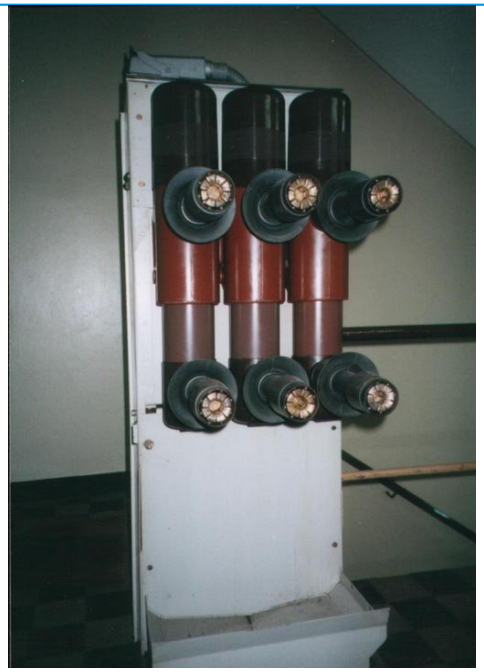
General Description
Retrofitting example



Minimum oil circuit breaker

- **Manufacturer:** Calor Emag
- **Used in panel:** ZP, ZE, ZW
- **Productname:** OD3

Retrofit solutions with vacuum circuit breaker

- **Productname: ZP-VD4-24-truck**
- **Same characteristics as original breaker type**

General Description
Retrofitting

- Based on the longtime service-experience and possible through the existing manufacturer know-how and access to the engineering drawings, ABB developed Retrofit solutions especially tailored to minimum oil circuit breakers
- As the only authorized provider for retrofit solutions on ABB circuit breakers, ABB offers the exchange of the existing, technical outdated circuit breaker by a switch-truck equipped with state-of-the-art components
- Due to the expertise and worldwide experience in retrofit, ABB can assure a smoothly run of your retrofit project

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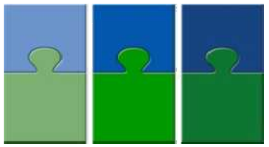


- Retrofit Concept
- General Description
- **Technical Specification**
- Necessary details for standard retrofit solutions
- Manufacture Process
- Certification
- Other retrofit solutions
- Contact and Support

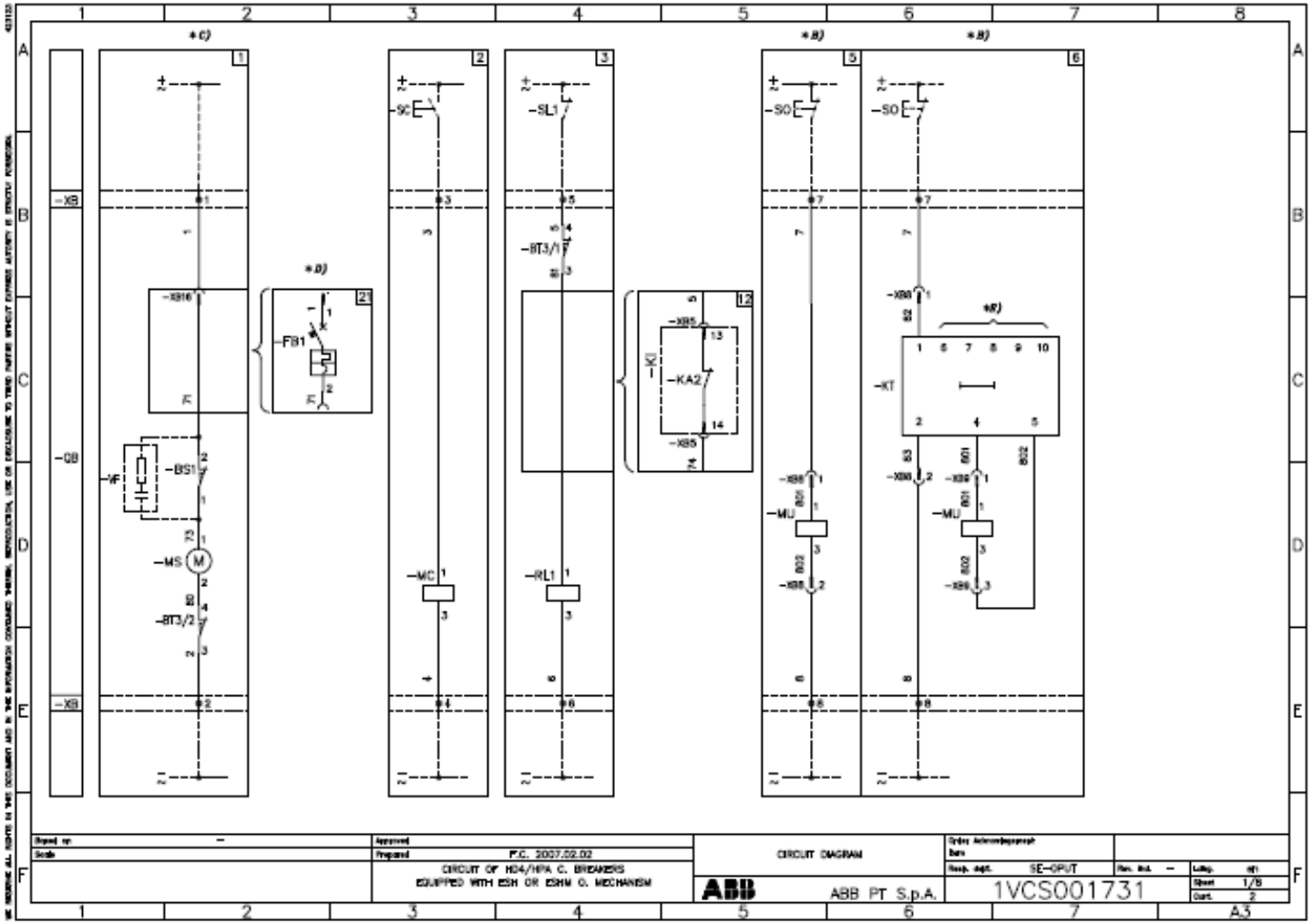
Technical Specification
VD4 Ratings

Standards		VDE 0670, part 10/IEC 60694 and VDE 0671, part 100/IEC62271-100 and IEC60068-2-30				
Operating sequence		O – 0,3 s – CO – 3 s – CO				
Rated frequency (HZ)		50 / 60				
Typ	Rated current Ir (A)	Rated voltage Ur (kV)	Impulse withstand Voltage Up (kV)	Rated breaking capacity ISC (kA)	Making capacity Ip (kA)	Rated short time current Ik (kA) 3 sec
VD4	630 … 2500	12	75	16 … 40	40 … 100	16 … 40
VD4	630 … 2500	17,5	95	16 … 40	40 … 100	16 … 40
VD4	630 … 2500	24	125	16 … 25	40 … 63	16 … 25

Technical Specification

VD4 New Schematic Diagram – Circuit breaker

Schematic Diagram Based on Standard VD4



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- Retrofit Concept
- General Description
- Technical Specification
- **Necessary details for standard retrofit solutions**
- Manufacture Process
- Certification
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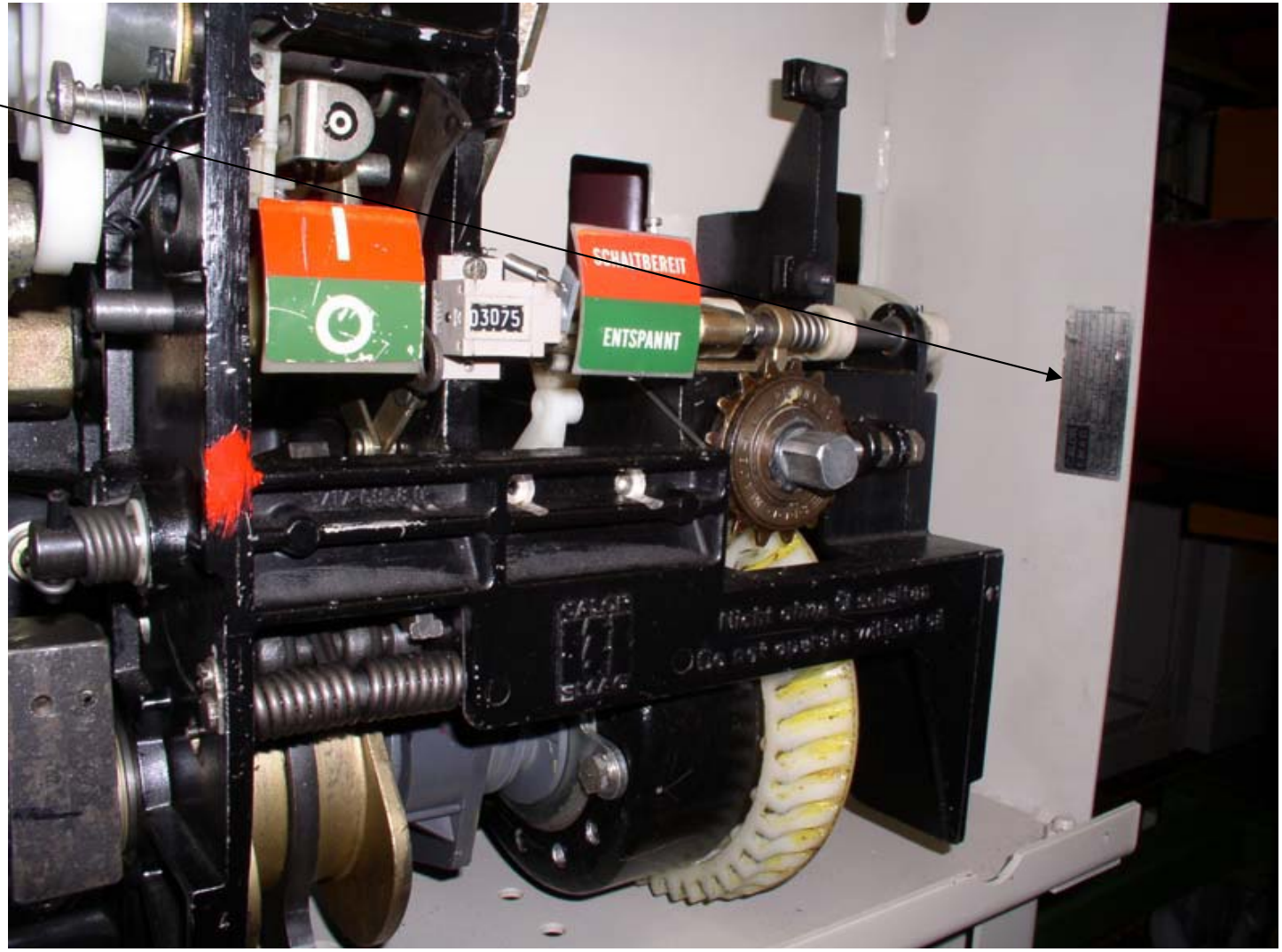
Necessary Details for Standard Solution
Retrofit Solution Development

In case of Generator CB, to be filled the relevant data sheet.

- Essential technical data
  - 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
- 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 Solution
Picture of Name Plate breaker

Positioned on the CB front for every breaker type.



Necessary Details for Standard Solution
Picture of Name Plate truck

Positioned on the truck front .

Necessary Details for Standard Solution
Picture of Name Plate panel

Name plate on the existing panel mounted inside the panel

Necessary Details for Standard Solution
Front, rear, side pictures of old breaker

Example:

Front and side details.

Necessary Details for Standard Solution
Internal panel view without breaker

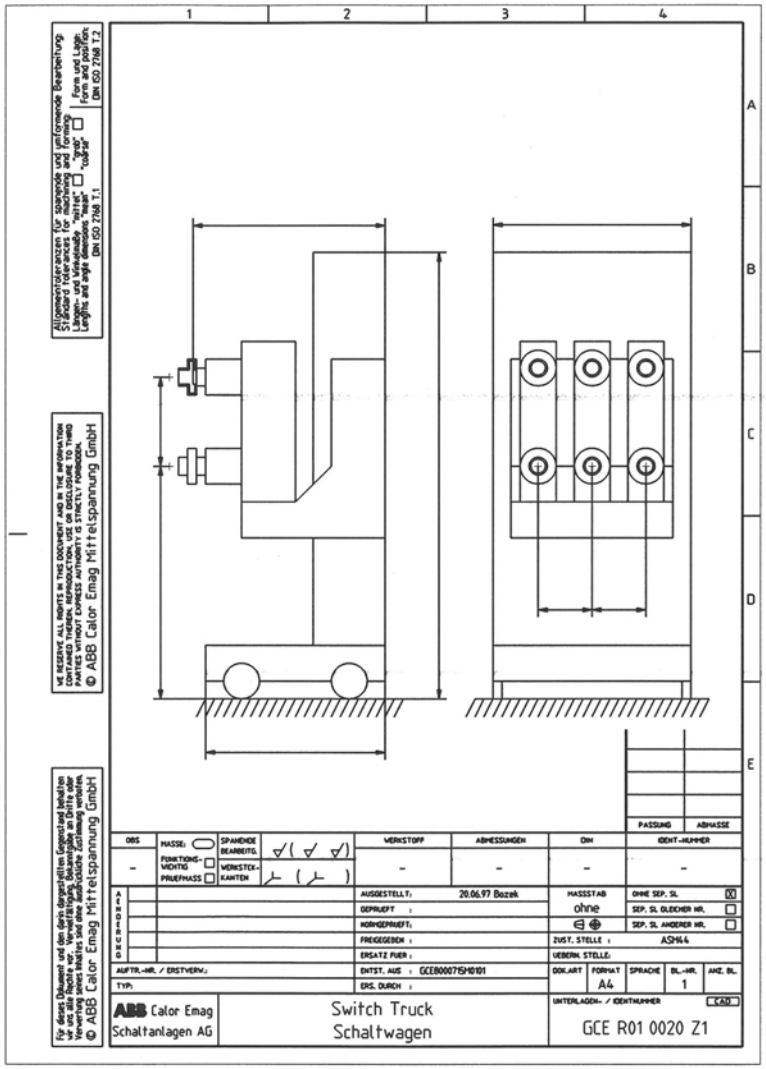
Necessary Details for Standard Solution
Internal panel view with breaker

Necessary Details for Standard Solution
Front view panel door closed

Existing panels interlocking system (panel internal right side) must be adjusted with some additional slots.

Necessary Details for Standard Solution
Switch truck dimension

Please fill sheet with relevant data



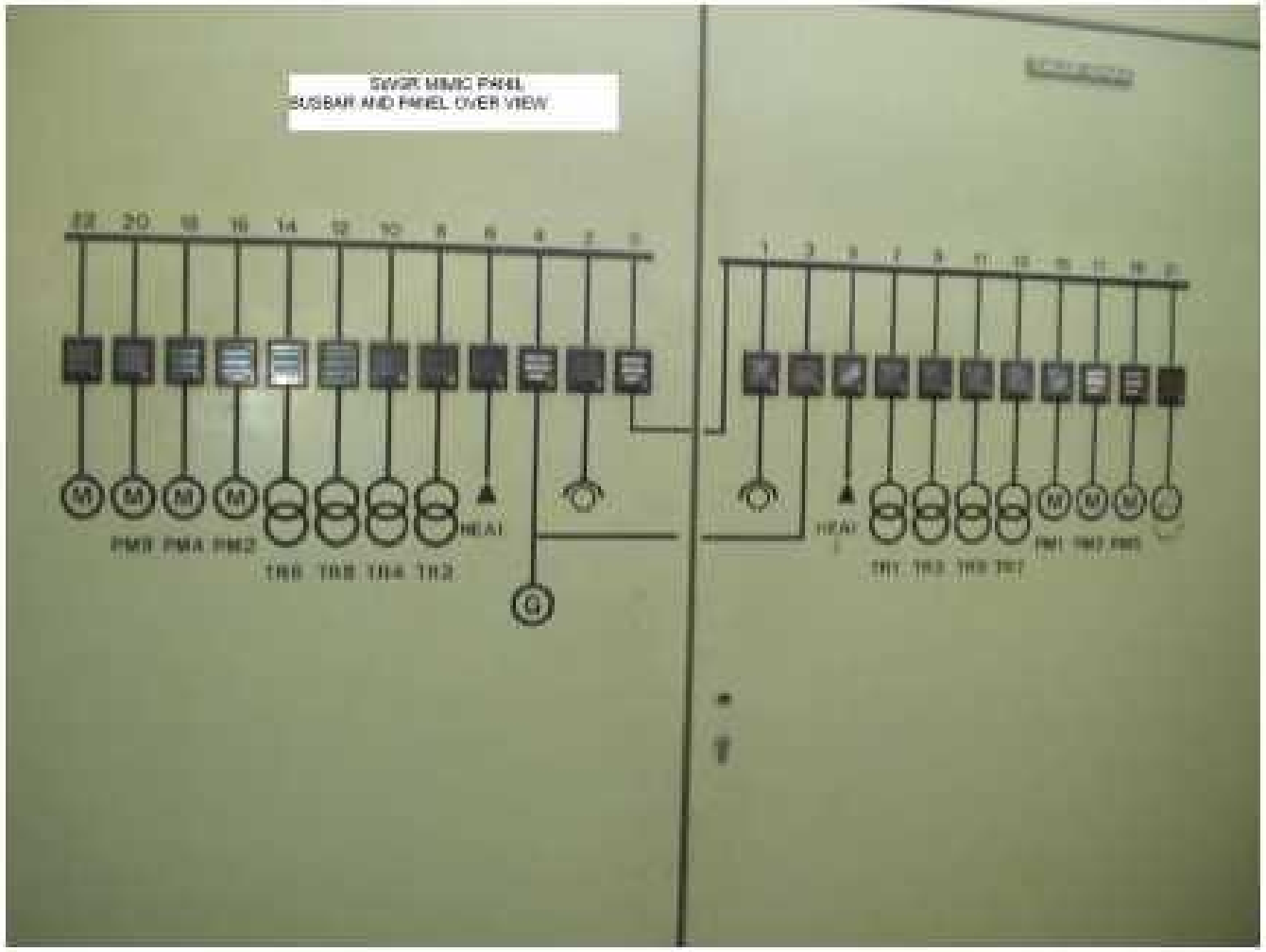
Necessary Details for Standard Solution
Secondary connection

Please take some pictures of the existing secondary plug so that we are able to count the pins. In the past we used two different types of secondary plugs – one type was equipped with 40 pins, the other one with 22 pins.

We have to know the existing type at site.

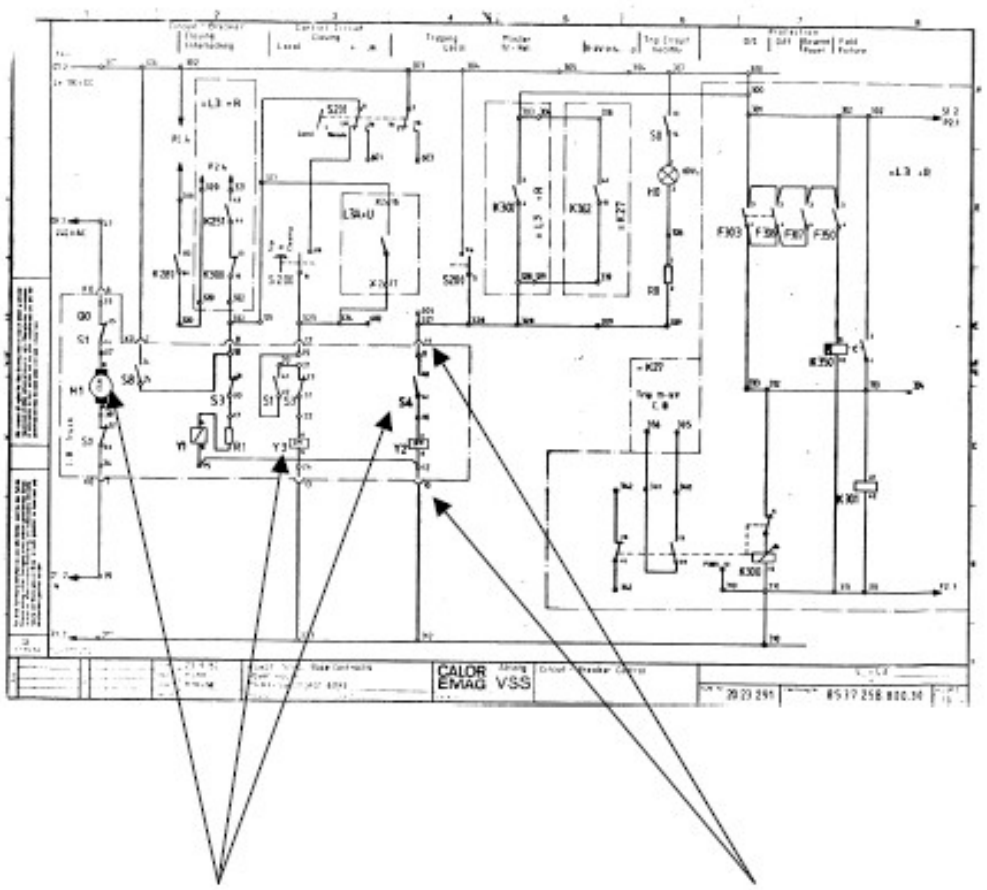
Necessary Details for Standard Solution
Control board

Control board (single line) to find out the connected equipment



Necessary Details for Standard Solution
Secondary wiring diagram

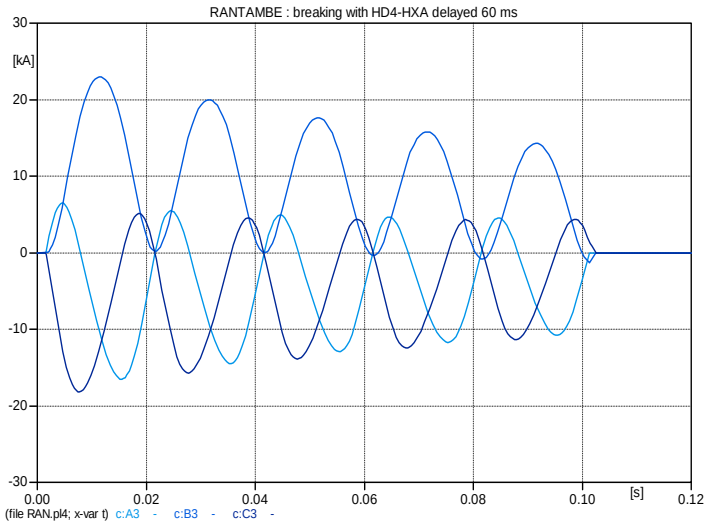
Secondary wiring diagram to be copied at site. Please copy all relevant pages!



Installed secondary equipment inside the old existing minimum oil type breaker like motor drive (MO), shunt release "ON" (Y3) and auxiliary switches (S4)

Very important !!
Secondary plug pin numbers for instance X0:10, X0:11 and so on

Necessary Details for Standard Solution
Generator Breaker Replacement



- In order to use a distribution breaker like 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 Solution
Generator Breaker Data sheet

2. Technical data of generator		
Rated voltage	U_r [kV]	Generator Information
Rated apparent power	S_r [MVA]	
Rated frequency	f_r [Hz]	
Subtransient direct axis reactance (saturated)	X_d'' [%]	
Transient direct axis reactance (saturated)	X_d' [%]	
Synchronous direct axis reactance (saturated)	X_d [%]	
Subtransient short-circuit time constant	T_d'' [ms]	
Transient short-circuit time constant	T_d' [ms]	
Armature short-circuit time constant	T_a [ms]	

3. Data of network		
Short circuit power of high voltage network	S_k'' [MVA]	Net Information
Rated power of main transformer	S_r [MVA]	
Impedance voltage of main transformer	U_k [%]	
Rated power of auxiliary transformer *)	S_r [MVA]	
Impedance voltage of auxiliary transformer *)	U_k [%]	
Rated power of connected medium voltage motor(s) *)	P_r [MW]	
Rated motor current related to motor starting current *)	I_r/I_a [p.u.]	
Single line diagram of network		

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Manufacture Process
Production site Ratingen

Manufacture Process
Retrofit Customization & Routine Tests

Retrofit Assembling

- Bushings
- Customized Truck

Routine test

- Voltage drop test
- Insulation auxiliary circuit 2kV
- Schematic dgr. Check
- SF_6 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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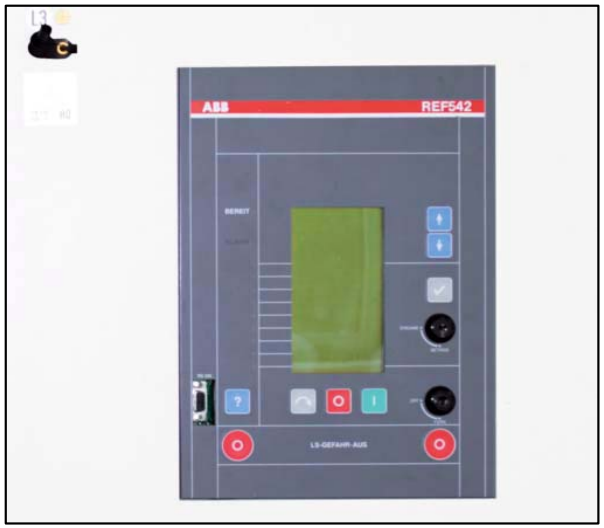
Other Solutions
Retrofit for protection and control

Human maschine interface of faced out SCU/REF542

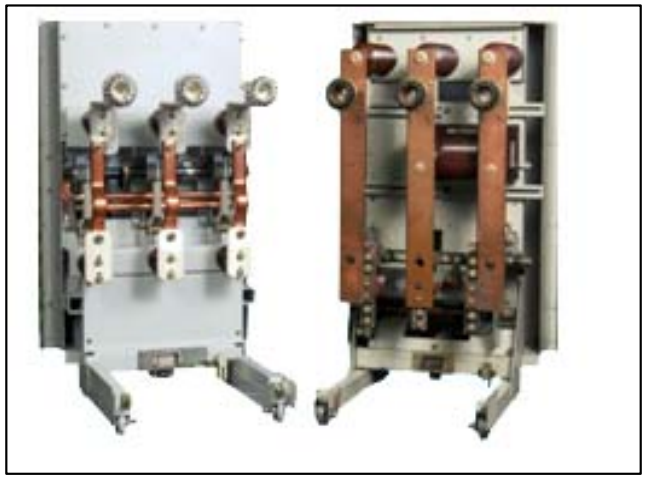


Human maschine interface of replacement solution with REF542plus

- Retrofit solution for exchange SCU / REF542plus
- Only minor changes are necessary (door and plugconnection)
- which results in short downtime
- To ensure optimum programming, only software update is required

Other Solutions
Retrofitting of earthing switches

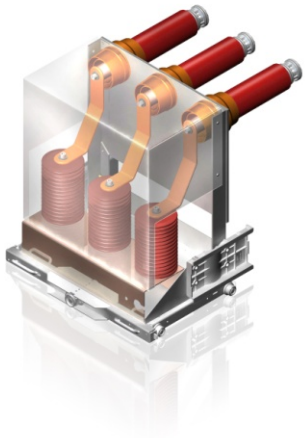
Rear view



Front view

- In case switchgear does not have attached earthing switch and conversion work shall be avoided.
- Panel earthing can not be demounted without a check
- Increases security in case of revision work. arthing truck is lockable. It can only be removed by person who is in charge of key.
- Earthing truck has an integrated voltage measurement. Earthing of outgoing cable can not take place in case of primary voltage. Advantage compared to a „regular“ earthing.

PPMV Service
Retrofit – ultra fast earthing switch UFES



- ABB has developed an extremely fast-acting earthing switch
- The goal: Achievement of the highest possible protection level for medium voltage switchgear in regard to destruction by internal arc faults.
- The fast-acting earthing switch UFES is an innovative combination of the ABB technologies vacuum interrupter and I_S-limiter.
- The reliable detection of current and light, in combination with the extreme short operation time, ensures immediate extinguishing of every internal arc within 4ms after detection.

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Service Support and Contacts
Medium Voltage Service Contacts for Retrofit

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

- Juergen Welling
  Manager MV Service
  Phone: +49 (0) 2102 -12 – 1645
  Email: Juergen.Welling@de.abb.com

- Arnd Ickenroth
  Manager MV Retrofit
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  Email: Arnd.Ickenroth@de.abb.com

- Quirin Hall
  Service Product Manager
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  Email: Quirin.Hall@de.abb.com

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