HMC operating mechanisms
Designed for reliable switching
Introduction
HMC operating mechanisms for HV circuit-breakers
The successors of the HMB family

Overview:
- Applications
- Types of operating mechanisms
- Innovation and reliability
- Modular design
- Maintenance
- Adaptation
- Working principle
Applications

General examples – HMB and HMC

1 | Gas-Insulated Switchgear (GIS)
   52-1200 kV

2 | Dead Tank Breaker (DTB)
   52-800 kV

3 | Generator Circuit Breaker (GCB)
   Up to 300 kA

4 | Air Insulated Switchgear (AIS)
   52-800 kV
HMC is suitable

- for high-voltage circuit-breakers
- LTB
- DTB
- Hybrid
- GIS
- for generator circuit-breakers (GCB)
Types of operating mechanisms
HMC-1, HMC-2 and HMC-4

HMC-1 and HMC-2
- stored energy
  max. 2.2 kJ (open operation)
- suitable for circuit breakers
  up to 245 kV

HMC-4
- stored energy
  max. 5.1 kJ (open operation)
- suitable for circuit breakers
  from 245 up to 420 kV
## Types of operating mechanisms

### HMC versus ABB competitors

<table>
<thead>
<tr>
<th></th>
<th>Pneumatic Operating Mechanism</th>
<th>Hydraulic Operating Mechanism</th>
<th>Spring Operating Mechanism</th>
<th>HMC Operating Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minimum Number of Moving Parts</strong></td>
<td>Minimum number of moving parts</td>
<td>Minimum number of moving parts</td>
<td>Higher number of moving parts</td>
<td>Minimum number of moving parts</td>
</tr>
<tr>
<td><strong>Extensive Size</strong></td>
<td>Extensive size because of gas tank</td>
<td>Extensive size because of gas tank</td>
<td>Medium size due to mechanical gear</td>
<td>Very compact due to hydraulic gear</td>
</tr>
<tr>
<td><strong>Complex Adaptation</strong></td>
<td>Complex adaptation to breaker</td>
<td>Simple adaptation to breaker</td>
<td>Simple adaptation to breaker</td>
<td>Very simple adaptation to breaker</td>
</tr>
<tr>
<td><strong>Maintenance</strong></td>
<td>Intensive maintenance</td>
<td>Minimum maintenance</td>
<td>Minimum maintenance</td>
<td>No maintenance</td>
</tr>
</tbody>
</table>
Innovation and reliability

Experience

- Experience based on
  - 30 years of design and manufacturing
  - more than 110,000 delivered units
  - more than 100 different applications

- Experience consequently used for
  - innovative solutions
  - new, patented technologies

- Resulting in the HMC family
Modular Design
HMC-4

- Working module
- Monitoring module
- Control module
- Charging module
- Adapter with auxiliary switches
- Storage module

Modules are easily accessible around the central working cylinder.
Modular design HMC-4
360° view

click on picture to start animation
Modular design HMC-4
Working module (cylinder)

- Cylinder made from ferrous materials for longest life-time
- Adjustable speed and integrated damping
- Close-position interlocking pin with damage-free design
Modular design HMC-4
Storage module (energy)

- consisting of storage blocks and helical spring assembly
- spring assembly designed and tested for one million cycles
- protected sealing system for highest reliability
Modular design HMC-4
Charging module (pump)

- gearless pump unit for reliability and low noise
- high pressure filtering
- plug-in motor for easy exchange
Modular design HMC-4
Control module (valves)

- new robust valve technology
- slip-on coils – not interfering with the hydraulic system, for easy exchange
Modular design HMC-4
Monitoring module (spring travel switch)

- simplified robust design for longer life-time
- 9 poles – selectable for N/O or N/C
- pressure relief valve
Modular design HMC-4
Adaptor (interface)

- same mechanical interface as for HMB
- 2 auxiliary switches
Working principle HMC-4
Open operation
HMC-2
HMC-1 and HMC-2

Scope of delivery also includes adapter to circuit-breaker and auxiliary switch assembly.

HMC-1 and -2 differ only in number of springs.
Modular design
HMC-1 and HMC-2

- Working module
- Monitoring module
- Control module
- Charging module
- Adapter with auxiliary switches
- Storage module

Advantages
- easily accessible modules
- clear functional separation

Benefits of the modules features:
see section for HMC-4
HMC-1 and HMC-2 – one-fits-all
3 possible orientations with 1 design

<table>
<thead>
<tr>
<th>horizontal – min. width</th>
<th>horizontal – min. height</th>
<th>vertical</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Horizontal - Min. Width" /></td>
<td><img src="image2" alt="Horizontal - Min. Height" /></td>
<td><img src="image3" alt="Vertical" /></td>
</tr>
</tbody>
</table>
Adaptors: O-Type and L-Type
HMC-1 and HMC-2

<table>
<thead>
<tr>
<th></th>
<th>O-type</th>
<th>L-type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• designed for coupling to breakers using <strong>linear</strong> feedthrough</td>
<td>• designed for coupling to breakers using <strong>rotary</strong> feedthrough</td>
</tr>
<tr>
<td></td>
<td>• lateral force support included (for use in combination with rotary</td>
<td>• lateral force support included</td>
</tr>
<tr>
<td></td>
<td>feedthrough)</td>
<td>• designed and tested for 15 g</td>
</tr>
<tr>
<td></td>
<td>• designed and tested for 15 g</td>
<td></td>
</tr>
</tbody>
</table>
## Technical data

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>number of springs</td>
<td>4</td>
<td>4</td>
<td>7</td>
<td>7</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>piston rod diameter</td>
<td>16 mm</td>
<td>16 mm</td>
<td>16 mm</td>
<td>16 mm</td>
<td>18 mm</td>
<td>22 mm</td>
<td>18 mm</td>
<td>22 mm</td>
</tr>
<tr>
<td>stroke</td>
<td>90 mm</td>
<td>135 mm</td>
<td>90 mm</td>
<td>135 mm</td>
<td>205 mm</td>
<td>205 mm</td>
<td>230 mm</td>
<td>230 mm</td>
</tr>
<tr>
<td>stored energy open</td>
<td>0.9 kJ</td>
<td>1.2 kJ</td>
<td>1.6 kJ</td>
<td>2.2 kJ</td>
<td>4.7 kJ</td>
<td>4.0 kJ</td>
<td>5.2 kJ</td>
<td>4.2 kJ</td>
</tr>
<tr>
<td>stored energy close</td>
<td>0.4 kJ</td>
<td>0.6 kJ</td>
<td>0.7 kJ</td>
<td>1.1 kJ</td>
<td>2.1 kJ</td>
<td>3.2 kJ</td>
<td>2.3 kJ</td>
<td>3.3 kJ</td>
</tr>
<tr>
<td>operating sequence</td>
<td>O-CO - 15 s - CO</td>
<td></td>
<td></td>
<td></td>
<td>O-CO - 60 s - CO / CO - 15 s - CO / O-CO - 15 s - CO (optional)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mechanical endurance</td>
<td>M2 acc. to IEC 62271-100</td>
<td></td>
<td></td>
<td></td>
<td>M2 acc. to IEC 62271-100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>expansion stages</td>
<td>EP</td>
<td></td>
<td></td>
<td></td>
<td>EP, CM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dimensions Ø x h (EP)</td>
<td>350 mm x 580 mm x 770 mm</td>
<td></td>
<td></td>
<td></td>
<td>555 mm x 847 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>weight (EP)</td>
<td>approx. 195 kg</td>
<td></td>
<td></td>
<td></td>
<td>approx. 350 kg</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Basic technical data for the variants of HMC. Other data, defining secondary technology, are customer specific. We reserve the right to make technical changes without prior notice.
# Maintenance
## Definition and schedule

### Levels of maintenance

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level A</td>
<td>visual inspection at site with no preventive maintenance</td>
</tr>
<tr>
<td>Level B</td>
<td>visual inspection, preventive maintenance of wear parts (e.g. motor carbon brushes, etc.)</td>
</tr>
<tr>
<td>Level C</td>
<td>replace mechanism</td>
</tr>
</tbody>
</table>

### Schedule for maintenance

<table>
<thead>
<tr>
<th>Event</th>
<th>Indoor</th>
<th>Outdoor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every 5 years</td>
<td>n/a</td>
<td>Level A</td>
</tr>
<tr>
<td>Every 5,000 CO</td>
<td>Level A</td>
<td>Level A</td>
</tr>
<tr>
<td>After 10,000 CO</td>
<td>Level B</td>
<td>Level B</td>
</tr>
<tr>
<td>After 20,000 CO</td>
<td>Level C</td>
<td>Level C</td>
</tr>
</tbody>
</table>

Electrical parts can be easily changed by customer:
- heater
- slip-on coils
- motor

New compared to HMB:
- simple exchange of motor and pump module

Design with modules around working cylinder simplifies service.
Adaptation
Substitution and compatibility

Substitution for HMB
- same mechanical interface (HMC-4)
- nearly identical travel curve as HMB, allowing alternative operating mechanisms test according to IEC62271-100

Compatibility to circuit-breaker
- matching the linear motion of the interrupter – levers and gears are not necessary
- avoiding friction and wear, saving space and money
- well devised and proven adaptation process (Application Release Process)
Summary

HMC family

- Reliable spring mechanism with modular components for quick, safe maintenance
- Latest technology for a most compact system, allowing for most compact circuit-breakers
- New robust valve technology, protected sealing systems, gearless pump unit, simplified spring travel switch, close-position interlocking pin with damage-free design
- Simple and easy adaption to all circuit breaker types
- Low life-cycle cost
- Maintenance free for 10,000 CO-operations

- Learn more on abb.com/highvoltage
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