Gas-insulated medium voltage switchgear ZX
ZX family general presentation

Agenda

Medium Voltage Switchgear
  ▪ Definition and application

ABB Calor Emag in Ratingen
  ▪ Location, experience and customers

Characteristics of ZX Technology
  ▪ Advantages of SF6 and ZX

ZX Family
  ▪ Family members

References

Conclusion
Medium Voltage Switchgear

Definition and application
Medium Voltage Switchgear
Definition of medium voltage

IEC definition

Low voltage
High voltage

Non-standard definition

Range ZX

ZX ≤ 40.5 kV

≤ 1kV
> 1kV
≤ 52kV
> 52kV

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Medium Voltage Switchgear
Further applications

Power supply utilities
- Power stations, transformer stations

Industry
- Steelworks, foundries, rolling mills
- Chemicals industry
- Automobile industry
- Petrochemicals, pipeline systems
- Mining

Marine
- Offshore facilities, oil rigs, ships

Transport
- Airports, harbours, railways

Services
- Shopping centres, hospitals
ABB Calor Emag Medium Voltage Products
Focused Feeder Factory – Location Ratingen
Experience:

Long experience in GIS:
- Introduced gas-insulated technology in 1965

2nd generation of GIS in MV range:
- first ZV2 now ZX-family

First ZX delivered in 1995

Product family:
- ZX0/ZX0.2, ZX1.2, ZX2
ABB Calor Emag Medium Voltage Products
Product Portfolio

Components
- Poles
- Vacuum interrupters

Apparatus
- VD4

Gas-insulated switchgear
- ZX2
- ZX0
- ZX1.2

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ZX Technology
Characteristics and advantages of SF6 and ZX
What do our customers want?

Deliver and distribute energy without interruptions
  → Highest availability of equipment

Minimise accidents and dangers to human life
  → Highest safety for employees

Reduce total cost of ownership
  → Cost effective solution with low overall lifetime costs

Technologically clever solution
  → Space savings and plug-in busbar connection
ZX Technology
Our offering – Highest availability of equipment

ZX gas-insulated switchgear means:

- Dust and salt
- Humidity and adverse atmosphere
- Small animals and vermin

Switchgear is protected from environmental conditions
Repair and maintenance work can be minimized

Availability and lifetime of equipment are maximized!
ZX Technology
Improved availability of GIS concept over AIS concept

AIS concept

- Insulation of Medium Voltage by Air
- Ambient conditions have influence on insulation (humidity, dust, altitude ...)
- Dimensions and ageing behavior depend on quality of insulation during lifetime of switchgear

GIS concept

- Medium voltage parts are inside of sealed tank
  Air is replaced by non-reactive insulating gas.
- Ambient conditions do not have influence on insulation
- Dimensions and ageing behaviour are determined through the design and remain constant during lifetime of the switchgear
ZX Technology
Our offering – Highest safety for employees

- In GIS all live parts are installed completely touch proof.

- Due to SF6 filled IP65 design of MV compartments the probability of internal faults is smaller than in any other Switchgear design.

- Even in the unlikely case of an internal arc personnel is completely safe as the resulting pressure is guided and reduced via an optional duct system. (ZX2: standard)
ZX Family
Shared features – Voltage indication

General
- Testing feeder for off-circuit condition
- Capacitive, low impedance voltage indication systems
  - IEC 61243-5
- High voltage side capacitance in the test sockets

Connections
- Rear wall of panel
  - Single phase LRM or KVDS system
- In the panel door
  - Optional three phase LRM, KVDS or CAVIN system (with switching contacts)
ZX-Technology: Clever Solutions
Plug-in components

- Dummy plug
- Test plug
- Surge arrestor
- Voltage transformer
- Cable plug
- BB plug-in system
ZX Technology
Our offering – Clever solutions

Reduced dimensions
Space saving (up to 60-70%) compared to conventional AIS solutions

Simple & safe installation
Plug-in technology for cable and busbar connections
→ No gas handling at site!

example: ZX1.2
ZX Technology
Our offering – Cost effective solution

Cost effectiveness due to:

• Increased availability and reduced maintenance or repair
• Reduced space requirements on civil works and transport
• Increased lifetime
• Reduced time for installation and testing at site

The moderately higher equipment costs are more than offset by lower overall lifetime costs!
ZX Technology
Advantages of ZX technology – Overview

- Space saving
- Simple and safe installation, no gas handling at site
- Not affected by ambient conditions
- Minimum maintenance, maintenance-free MV part
- Increased availability, less downtime of plant
- Increased safety for staff
- Reduced lifecycle cost and total cost of ownership
ZX Family
family members
### ZX Product range

<table>
<thead>
<tr>
<th>Voltage</th>
<th>BIL level</th>
<th>Single busbar</th>
<th>Single busbar</th>
<th>Single busbar</th>
<th>Single busbar</th>
<th>Double busbar</th>
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<tbody>
<tr>
<td>12 kV</td>
<td>75 kV</td>
<td>ZX0</td>
<td>Zx0.2</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>24 kV</td>
<td>125 kV</td>
<td></td>
<td></td>
<td>Zx1.2</td>
<td>Zx2</td>
<td>Zx0.2</td>
</tr>
<tr>
<td>36 kV</td>
<td>170 kV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 kV</td>
<td>185 kV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Zx2</td>
</tr>
</tbody>
</table>
Gas-insulated medium voltage switchgear
Type ZX0 Block Design

Compact medium voltage switchgear type ZX0
12 kV, …1250 A, …25 kA
24 kV, …1250 A, …25 kA
Gas-insulated medium voltage switchgear
Type ZX0

- Rated voltage: kV 12, 24
- Rated current of busbars: A, 1250, 1250
- Rated current of tee-offs:
  - with circuit-breaker: A, 1250, 1250
  - with switch-disconnector: A, 630, 630
- Rated short-circuit breaking current: kA, 25, 25
- Width: a mm, 400 / 600 1)
- Height: b mm, 2100 or 2250
- Depth:
  - wall installation: c mm, 950 / 1100 1)
  - free standing: c mm, 1185

1) For Feeder currents > 800 A; with voltage metering
Gas-insulated medium voltage switchgear
Circuit-breaker panel 630 A

1 Multifunctional control and protection unit
2 Measuring sockets for capacitive voltage indicator system
3 Three position disconnector mechanism
4 Circuit-breaker mechanism
5 Cable plug
6 Ring-type current transformer
7 Pressure relief plate
8 External cone
9 Vacuum circuit-breaker
10 Three-position disconnector
11 Busbars

SF₆
Gas-insulated medium voltage switchgear
Type ZX0.2 Separate Panel Design

Medium voltage switchgear type ZX0.2
Single busbar version
12 kV,…2500 A,…31.5 kA
24 kV,…2500 A,…31.5 kA
Gas-insulated switchgear
Type ZX0.2

With IAC classification
AFL 31.5 kA 1s
AFLR 31.5 kA 1s

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value 1</th>
<th>Value 2</th>
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</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>kV</td>
<td>12</td>
<td>24</td>
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<tr>
<td>Rated current of busbars</td>
<td>A</td>
<td>...2500</td>
<td>...2500</td>
</tr>
<tr>
<td>Rated current of tee-offs</td>
<td>A</td>
<td>...2500</td>
<td>...2500</td>
</tr>
<tr>
<td>with circuit-breaker</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with switch-disconnector/fuse combination</td>
<td>A</td>
<td>...80</td>
<td>...63</td>
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<tr>
<td>Rated short-circuit breaking current</td>
<td>kA</td>
<td>...31.5</td>
<td>...31.5</td>
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<tr>
<td>Width a</td>
<td>mm</td>
<td>600 / 1200</td>
<td>1)</td>
</tr>
<tr>
<td>Height b</td>
<td>mm</td>
<td>2250</td>
<td></td>
</tr>
<tr>
<td>Depth c</td>
<td>mm</td>
<td>1330</td>
<td></td>
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</tbody>
</table>

1) Dependent on current
Gas-insulated switchgear
Feeder ZX0.2

Circuit-breaker panel, 1250 A
1 Removable low voltage compartment
2 Three position disconnector operating mechanism
3 Mechanism bay with operator controls
4 Circuit-breaker operating mechanism
5 Cable connector
6 Window-type current transformer
7 Bushing with outer cone
8 Isolatable voltage transformer on the cable
9 Pressure relief disk
10 Vacuum circuit-breaker
11 Three position disconnector
12 Busbars
13 Plug-in busbar voltage transformers

SF₆
Gas-insulated medium voltage switchgear
Type ZX1.2

Medium voltage switchgear type ZX1.2
Single busbar version
12 kV, …2500 A, …31.5 kA
24 kV, …2500 A, …31.5 kA
36 kV, …2500 A, …31.5 kA
# Gas-insulated medium voltage switchgear

**Type ZX1.2**

With IAC classification
AFLR 31.5 kA 1s

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated voltage</strong> kV</td>
<td>12 24 36 1)</td>
</tr>
<tr>
<td><strong>Rated current of busbars</strong> A A A ...2500</td>
<td>...2500 ...2500 ...2500</td>
</tr>
<tr>
<td><strong>Rated current of tee-offs</strong> A A A ...2500</td>
<td>...2500 ...2500 ...2500</td>
</tr>
<tr>
<td><strong>Rated short-circuit breaking current</strong> kA</td>
<td>...31.5 ...31.5 ...31.5</td>
</tr>
<tr>
<td><strong>Rated short-circuit making current</strong> kA</td>
<td>80 80 80</td>
</tr>
<tr>
<td><strong>Insulation gas</strong> SF$_6$ 2) SF$_6$ 2) SF$_6$ 2)</td>
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</tr>
<tr>
<td><strong>Width a</strong> mm</td>
<td>600 / 800 3) 4) 600 / 800 4)</td>
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<tr>
<td><strong>Heigth b</strong> mm</td>
<td>2100</td>
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<tr>
<td><strong>Depth c</strong> mm</td>
<td>1300-1800 5)</td>
</tr>
<tr>
<td><strong>Heigth of cable fixing point</strong> mm</td>
<td>1250</td>
</tr>
</tbody>
</table>

1) Higher values as per international standards on request
2) Sulphur hexafluoride
3) Double feeder panel up to 25 kA, 2 x 630 A
4) Rated feeder current > 1250 A
5) Depending on quantity of cables per phase
Gas-insulated medium voltage switchgear

Feeder 1250 A

1. Density sensor
2. Circuit-breaker operating mechanism
3. Multifunctional protection and switchgear control unit
4. Three position disconnector operating mechanism
5. Three position disconnector
6. Busbar
7. Pressure relief disk
8. Pressure relief duct (optional)
9. Ring type current transformer
10. Cable plug
11. Cable socket
12. Measuring sockets for capacitive voltage indicator system
13. Test socket
14. Circuit-breaker

$SF_6$
Gas-insulated medium voltage switchgear
Type ZX2

Medium voltage switchgear type ZX2
12 kV, …2500 A, …40 kA
24 kV, …2500 A, …40 kA
36 kV, …2500 A, …40 kA
Gas-insulated medium voltage switchgear
Type ZX2

With IAC classification
AFLR 40 kA 1s

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>kV</th>
<th>12</th>
<th>24</th>
<th>36 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated current of busbars</td>
<td>A</td>
<td>...2500</td>
<td>...2500</td>
<td>...2500</td>
</tr>
<tr>
<td>Rated current of tee-offs</td>
<td>A</td>
<td>...2500</td>
<td>...2500</td>
<td>...2500</td>
</tr>
<tr>
<td>Rated short-circuit breaking current</td>
<td>kA</td>
<td>...40</td>
<td>...40 2)</td>
<td>...40 2)</td>
</tr>
<tr>
<td>Insulating gas</td>
<td></td>
<td>SF₆ 3)</td>
<td>SF₆ 3)</td>
<td>SF₆ 3)</td>
</tr>
<tr>
<td>Width a</td>
<td>mm</td>
<td>600 / 800 4) 5)</td>
<td>600 / 800 4)</td>
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<tr>
<td>Heigth b</td>
<td>mm</td>
<td>2300</td>
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<tr>
<td>Depth c</td>
<td>mm</td>
<td>1760</td>
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</tbody>
</table>

1) Higher values as per international standards on request
2) 600 mm panel width up to 31.5 kA rated short-circuit breaking current
3) Insulating gas: sulphur hexafluoride (SF₆)
4) Rated feeder current above 1250 A
5) Double feeder panel up to 25 kA, 2 x 630 A
Gas-insulated medium voltage switchgear
Double busbar panel for 1250 A

1. HMI of multifunctional protection and control unit
2. Three position disconnector operating mechanism
3. Three position disconnector
4. Pressure sensor (temperature-compensated)
5. Circuit-breaker operating mechanism
6. Cable socket
7. Cable plug
8. Electronic unit of multifunctional protection and control unit
9. Dummy plug
10. Combined current sensor with socket
11. Pressure relief disk
12. Pressure relief duct
13. Circuit-breaker
14. Measuring sockets for capacitive voltage indicator system
15. Busbars

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ZX Family | 33

SF₆
Gas-insulated medium voltage switchgear
Plug-in components
Medium Voltage Switchgear

Main Customers in Arab Countries: Power Utilities, Algeria, Tunisia, Libya, United Arab Emirates, Saudi Arabia, Qatar, Kuwait, Syria
Medium Voltage Switchgear
Main Customers in Arab Countries: Industry, Oil & Gas

United Arab Emirates
Dubai Aluminium

Algeria
SONELGAZ

Saudi Arabia
TAKREER

Qatar
Qatar Petroleum

Oman
Petroleum Development Oman

Jordan

Kuwait

Egypt

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ABB Medium Voltage GIS - ZX
Reference Projects: Abu Dhabi
ABB Medium Voltage GIS - ZX
Reference Projects: Abu Dhabi
ABB Medium Voltage GIS - ZX

At one glance

**Highest availability and safety**

All MV parts are protected from external influence.
No maintenance of parts inside gas tank

**Reduced dimensions**

Space saving compared to conventional solutions

**Simple & safe installation**

Plug-in technology for cable and busbar connections

Example: ZX1.2
Power and productivity for a better world™