DISTRIBUTION SOLUTIONS

ZX1.5-R
Gas-insulated medium voltage for railway application

- Safety and reliability
- 20% footprint saving
- Easy operation
- Complete solution
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Power engineering from ABB

Solutions for the future.
As a technology group with global operations, ABB supplies the solutions of the future for the core areas of our economy: public and industrial electricity, heat, gas and water supply. In that context, our clients benefit from a comprehensive product, system and service range in power engineering. With a combination of experience and innovative power, we offer them turnkey implementation of projects of all sizes, from planning to commissioning, from low voltage to high voltage and from process control to corporate management.

Our innovative and holistic concepts for modular structure systems enable you to make optimum, economical use of the equipment deployed and thus ensure the necessary security of investment in today’s markets.

Gas-insulated switchgear from ABB.
Flexible combination, reliability, availability and economy are the attributes that make it easy for our clients in industry and the public sector to decide in favor of this product series. The modular structure ensures that even unusual configurations can be economically implemented.

The use of digital protection and control technology, sensor systems and plug-in connections makes the products in the ZX family unrestrictedly fit for the future, and the primary function of reliable power distribution is fulfilled.

This is ensured by ABB’s uncompromising approach to quality, which leaves no customer’s wishes unfulfilled.
More than 3000 panels of the switchgear ZKLS-R have been in service in traction power supply systems in China high speed railway and all over the world.
Focus on the details

Design
• Special for railway traction system application
• Single busbar version, single/double pole
• Laser welded stainless steel enclosures
• Modular design
• Panels coupled by plug-in busbar connectors without SF₆ gas work
• High cable termination point of 1250 mm
• Inner cone cable plug system with sizes 3
• Bus duct connection solidly insulated

Advantages
Maximum safety
• Partitioning of functional compartments
• Encapsulation completely protected against access to hazardous parts
• HV parts totally independent of environmental influences
• No effect of site altitude on dielectric strength
• Minimum space required
• Minimum switchgear dimensions due to SF₆ insulation
• Savings in building space

Economy
• Maximum availability for the operator
• Maximum system service life as independent of the environment
• Minimum maintenance requirement means significant savings in operating costs

Metal-partitioned and gas-tight
• SF₆ gas-insulated
• Busbar compartment as hermetically sealed pressure system
• Circuit-breaker compartment as hermetically sealed pressure system
• 27.5 kV/2x27.5 kV
• Up to 2500 A and 31.5 kA

1 Busbar connection between the panels
2 Separate compartment for breaker and busbar compartment.
3 Plug in surge arrester
Plug-in technology at all ends.
Every enclosure is hermetically sealed. The factory-assembled, routine tested gas-insulated switchgear accommodates all the live components in a gas-tight stainless steel enclosure containing SF₆ gas. SF₆ stands for sulfur hexafluoride, an artificially manufactured gas molecule in which six fluorine atoms are arranged around one sulfur atom.

With its good chemical and physical properties (excellent insulating capacity) SF₆ provides optimum conditions for the handling of voltages over 1000 V.

Not only power cables, but also busbars and voltage transformers are connected to the panels at an installation-friendly height using our tested and proven plug-in technology. The result is a hermetically sealed panel which requires no work with SF₆ at site.

The advantages at a glance.
• Dielectrically safe, even at atmospheric pressure
• Sealed for life
• Space-saving

SF₆ is an inert, nonflammable, non-toxic and non-ozone depleting insulating medium.

SF₆ has three times the dielectric strength of air at atmospheric pressure. This can be further increased by increasing the pressure.

SF₆ consists of very large molecules and can be enclosed without notable losses for the complete service life of a switchgear installation (approx. 40 years).
Safety and Reliable

3-position switch
- Motor-operated rod-type switch with three functions
  - Connecting, isolating and earthing
  - Disconnected position at center
  - Limit positions: Disconnector ON or earthing switch ON
- Currentless preparation of any connection: Switching is performed exclusively by the circuit-breaker
- Only a few live switch components in the gas compartment
- Operating mechanism is located in front of panel and outside the gas compartment
- Emergency manual operation optional with mechanical interlocking
- Position detection by sensors or auxiliary switches
- Mechanical position indicators

Advantages
- Earthing by circuit breaker has advantages over earthing switch
- Higher number of switching cycles onto faults
- Causes no pollution of the SF6 during switching operations

By merging 2 devices in a 3-position switch, mutual interlocking of the functions is integrated as part of the system and requires no further work.

Circuit-breaker VD4 XR
- Horizontal arrangement of circuit-breaker poles
- Operating mechanism outside the gas compartment
- Poles and mechanism connected via gas-tight thrust bushing
- Additional earthing function in combination with 3-position switch

In gas-insulated switchgear, earthing of switchgear section is performed by a high quality vacuum circuit-breaker. The circuit-breaker can close onto a short-circuit significantly more frequently and reliably than a positively making earthing switch.
Since 1968, ABB has acquired outstanding expertise in the design and construction of gas-insulated switchgear. ZX panels have been launched and in service since 1995 with reliable quality.

Delivery
Complete panels
• Factory tested
• Individual panels as transport units
• With SF₆ at rated filling pressure
• Suitable for handling by crane or fork lift truck

Installation
• Easy and fast installation
• Suitable for room heights over 2.8 meters
• Erection on foundation frame or cable trench
• Simple connection of panels via plug-in connectors
• Cable termination compartments with plug-in technology

Commissioning
• By trained skilled personnel
• Direct access to the conductors through a separate test socket is available for current and voltage tests on site
  • without removing the cable connection
  • without gas work
• Test socket can be used for cable tests or maintenance earthing

Inspection and maintenance
• No refill required under normal conditions due to sealed pressure system
• Gas compartments are maintenance-free under normal conditions
• Inspection predominantly comprises visual inspection and functional testing
## Technical Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>U_r</td>
<td>kV</td>
<td>27.5 / 2x27.5</td>
<td></td>
</tr>
<tr>
<td>Rated power frequency withstand voltage</td>
<td>U_d</td>
<td>kV</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>Line-Line</td>
<td>U_d</td>
<td>kV</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td>Across isolated distance</td>
<td>U_d</td>
<td>kV</td>
<td>110</td>
<td></td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage</td>
<td>U_d</td>
<td>kV</td>
<td>200</td>
<td></td>
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<tr>
<td>Line-Line</td>
<td>U_d</td>
<td>kV</td>
<td>325</td>
<td></td>
</tr>
<tr>
<td>Across isolated distance</td>
<td>U_d</td>
<td>kV</td>
<td>220</td>
<td></td>
</tr>
<tr>
<td>Rated frequency</td>
<td>f</td>
<td>Hz</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Rated busbars current</td>
<td>I_p</td>
<td>A</td>
<td>...8500</td>
<td></td>
</tr>
<tr>
<td>Rated peak withstand current</td>
<td>I_p</td>
<td>kA</td>
<td>...80</td>
<td></td>
</tr>
<tr>
<td>Rated short-time current, 4 s</td>
<td>I_s</td>
<td>kA</td>
<td>...31.5</td>
<td></td>
</tr>
<tr>
<td>Rated short-circuit breaking current of circuit-breaker</td>
<td>I_sc</td>
<td>kA</td>
<td>...31.5</td>
<td></td>
</tr>
<tr>
<td>Rated short-circuit making current of circuit-breaker</td>
<td>I_mc</td>
<td>kA</td>
<td>...80</td>
<td></td>
</tr>
<tr>
<td>Rated operating sequence</td>
<td></td>
<td></td>
<td>O-0.3 s-CO-3 min-CO 3)</td>
<td></td>
</tr>
<tr>
<td>Total break-time (approx.)</td>
<td></td>
<td>ms</td>
<td>30-45</td>
<td></td>
</tr>
<tr>
<td>Make-time (approx.)</td>
<td></td>
<td>ms</td>
<td>55-70</td>
<td></td>
</tr>
<tr>
<td>Insulating gas</td>
<td></td>
<td></td>
<td>SF_6 ^4)</td>
<td></td>
</tr>
<tr>
<td>Rated filling level for insulation</td>
<td>P_m</td>
<td>kPa</td>
<td>130</td>
<td></td>
</tr>
<tr>
<td>Alarm level for insulation</td>
<td>P_m</td>
<td>kPa</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>Minimum functional level for insulation ^5)</td>
<td>P_m</td>
<td>kPa</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>Rated data</td>
<td></td>
<td></td>
<td>&lt;200</td>
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</tr>
<tr>
<td>Charging motor</td>
<td></td>
<td>VA(W)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closing coil</td>
<td></td>
<td>VA(W)</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Opening coil</td>
<td></td>
<td>VA(W)</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Auxiliary voltage</td>
<td></td>
<td>V</td>
<td>110,220 ^4)</td>
<td></td>
</tr>
<tr>
<td>Degree of protection</td>
<td></td>
<td></td>
<td>IP 65</td>
<td></td>
</tr>
<tr>
<td>Gas filled compartments</td>
<td></td>
<td></td>
<td>IP 4X ^7)</td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum value</td>
<td></td>
<td>°C</td>
<td>+40</td>
<td></td>
</tr>
<tr>
<td>Maximum value of 24 hour mean</td>
<td></td>
<td>°C</td>
<td>+35</td>
<td></td>
</tr>
<tr>
<td>Minimum value</td>
<td></td>
<td>°C</td>
<td>-15</td>
<td></td>
</tr>
<tr>
<td>Altitude for erection above sea level</td>
<td></td>
<td>m</td>
<td>...1000 ^8)</td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td></td>
<td>mm</td>
<td>2370 ^4)</td>
<td></td>
</tr>
<tr>
<td>Depth ^3) [10] [12]</td>
<td></td>
<td>mm</td>
<td>...1470</td>
<td></td>
</tr>
<tr>
<td>Width</td>
<td></td>
<td>mm</td>
<td>500/800 ^12)</td>
<td></td>
</tr>
<tr>
<td>Cable termination point</td>
<td></td>
<td>mm</td>
<td>1250</td>
<td></td>
</tr>
</tbody>
</table>

1) Other values on request based on insulation situation.  
2) Rated frequency 60 Hz on request.  
3) Other operating sequence on request.  
4) Insulating gas: Sulphur hexafluoride SF_6.  
5) 100 kPa=1 bar.  
6) Other voltage on request.  
7) Other specification on request.  
8) Higher altitude for erection on request.  
9) Dependent on the number of cables per line.  
10) Low voltage compartment depth 400 mm.  
11) If there are more second device, 500 mm low voltage compartment could be selected and the panel depth will be extended by 100 mm.  
12) Could have other dimension based on actual function.  
13) The width of 500 mm is for the single pole feeder panel.
Outgoing feeder

1. Density sensor
2. Circuit-breaker operating mechanism
3. Multifunctional Protection and Switchgear Control unit
4. Measuring sockets for capacitive voltage indicator system
5. 3-position switch operating mechanism
6. 3-position switch
7. Busbar
8. Pressure relief disk
9. Pressure relief duct
10. Cable plug
11. Cable socket
12. CT
13. Circuit-breaker

Cable termination compartment
The installation-friendly, 1.25 m high cable termination compartment accommodates the main earthing bar, the high voltage cables to be connected with their cable plugs fitted, cable mountings and, where appropriate, surge arresters.

1. Plug-in voltage transformer
2. Density sensor
3. Circuit-breaker operating mechanism
4. Multifunction Protection and Switchgear Control unit
5. Measuring sockets for capacitive voltage indicator system
6. 3-position switch operating mechanism
7. 3-position switch
8. Busbar
9. Pressure relief disk
10. Pressure relief duct
11. Cable plug
12. Cable socket
13. Circuit-breaker
14. CT
Implementing customers' wishes

With the ZX1.5-R, all the variants of electrical train traction power system can be implemented. ZX1.5-R always provides the right solution.

### Incoming and outgoing feeder panels

#### Single pole

<table>
<thead>
<tr>
<th>Panel width 500 mm</th>
<th>Ur: ...27.5 kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel depth 1470 mm</td>
<td>Ir: 1250 A</td>
</tr>
<tr>
<td>Panel depth 1470 mm</td>
<td>Ir: ...2500 A</td>
</tr>
</tbody>
</table>

#### Double pole

<table>
<thead>
<tr>
<th>Panel width 800 mm</th>
<th>Ur: ...2x27.5 kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel depth 1470 mm</td>
<td>Ir: ...1250 A</td>
</tr>
<tr>
<td>Panel depth 1470 mm</td>
<td>Ir: ...2500 A</td>
</tr>
</tbody>
</table>
Versatile and adaptable

<table>
<thead>
<tr>
<th></th>
<th>Feeder with busbar disconnection</th>
<th>Feeder with busbar PT or SA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Double pole</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panel width</td>
<td>800 mm</td>
<td>800 mm</td>
</tr>
<tr>
<td>Panel depth</td>
<td>1470 mm</td>
<td>1470 mm</td>
</tr>
<tr>
<td><strong>Ur</strong></td>
<td>$2 \times 27.5$ kV</td>
<td>$2 \times 27.5$ kV</td>
</tr>
<tr>
<td><strong>Ir</strong></td>
<td>$\ldots 2500$ A</td>
<td>$\ldots 2500$ A</td>
</tr>
</tbody>
</table>

Or