Gas-Insulated Switchgear

Type 8VN1 blue GIS up to 145 kV, 40 kA, 3150 A
8VN1 blue GIS up to 145 kV

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# 8VN1 blue GIS up to 145 kV

GIS Product Portfolio 72.5 kV – 550 kV

<table>
<thead>
<tr>
<th>Product line</th>
<th>8VM1</th>
<th>8VN1</th>
<th>8DN8</th>
<th>8DN9</th>
<th>8DQ1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Solution</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rated voltage</strong></td>
<td>72.5 kV</td>
<td>145 kV</td>
<td>145 kV</td>
<td>170 kV</td>
<td>245 kV</td>
</tr>
<tr>
<td><strong>Rated short circuit-breaking current</strong></td>
<td>25 kA</td>
<td>40 kA</td>
<td>40 kA</td>
<td>63 kA</td>
<td>50 kA</td>
</tr>
<tr>
<td><strong>Rated current busbar</strong></td>
<td>-</td>
<td>3150 A</td>
<td>3150 A</td>
<td>4000 A</td>
<td>4000 A</td>
</tr>
<tr>
<td><strong>Rated current feeder</strong></td>
<td>1250 A</td>
<td>3150 A</td>
<td>3150 A</td>
<td>4000 A</td>
<td>4000 A</td>
</tr>
<tr>
<td><strong>Interrupter technology</strong></td>
<td>Vacuum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Insulation medium</strong></td>
<td>Clean air</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8VN1 blue GIS up to 145 kV
Vacuum interrupter technology - Customer value

For more than 40 years successful operational experience in medium-voltage, since 2010 in high-voltage

- **High reliability**
  due to the hermetically tight vacuum interrupter, eliminating any influence of decomposition products

- **High performance**
  Perfect for frequent switching applications: High number of short-circuit interruptions with excellent interrupting performance at rated nominal current and rated short-circuit currents throughout life-time of the vacuum circuit-breaker

- **Perfect for low temperature**
  No liquefaction of switching medium

- **No maintenance**
  Maintenance free due to sealed for life technology; no spare part costs

- **No CO₂e emissions**
  Switching media (vacuum) with GWP=0; no CO₂e emissions during operation, maintenance or recycling
8VN1 blue GIS up to 145 kV
Vacuum interrupter Development of product / production technology

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Assembly under clean room conditions

- special clothing for the staff
- working documents only in digital form
- particle cleaning of all articles entering the clean room

Ensures a consistent high quality standard.
One-shot brazing technology under clean room conditions

The brazing furnace ensures that its complete volume is evacuated and the vacuum interrupters are exposed to a pre-defined temperature profile. Depending on loading, one cycle can require up to 20 hours.

The fully automatic system guarantees the vacuum interrupters to be “sealed for life”.
8VN1 blue GIS up to 145 kV
Production of vacuum interrupters

With help of x-ray based testing, positions and completeness of internal parts as well as brazed joints can be exactly ascertained.

This intermediate inspection grants for continuously high quality and longevity.
Clean air is a composition of 80% N2 and 20% O2, cleaned and free from humidity (Synthetic air)

- No Global Warming Potential: GWP = 0 (Potencial de calentamiento Global) (SF6 GWP 276)
- No Ozone Depletion Potential: ODP = 0 (Potencial de agotamiento de Ozono)
- Non-toxic (no known toxicological effects: LC50, TLV-TWA, CMR)
- Non-flammable
- High stability
- Low boiling point and no liquefaction of insulation medium
- Clean air with well-known and proven material compatibilities
- F-gas free insulation with lowest requirements on training, transport, installation, operation, reporting and recycling
- C-gas free with no risk of C-decomposition
- No documentation and reporting duties for clean air gas
- No CO₂ compensation costs or risk of future tax or compensation
- No gas recycling required
8VN1 blue GIS up to 145 kV
GIS with vacuum circuit-breaker and clean air technology

Values for customers and environmental sustainability

- 40 years of experience – 5.5 million vacuum interrupters delivered
- Perfect for frequent switching and low temperature applications
- Completely type-tested according to latest international standards
- Lowest operation and maintenance costs:
  Sealed for life interrupter unit; no gas handling during lifetime required
- No reporting or emission costs during operation and recycling:
  No SF$_6$- or F-gas tax or future risk, No CO$_2$e emission compensation or future risk
  No F-gas documentation or reporting costs; no risk of F-gas gas recycling costs
8VN1 blue GIS up to 145 kV
Technical data (with Conventional Instrument Transformer)

<table>
<thead>
<tr>
<th>Switchgear type</th>
<th>8VN1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>up to 145 kV</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>50 / 60 Hz</td>
</tr>
<tr>
<td>Rated short-duration power-frequency withstand voltage (1 min)</td>
<td>up to 275 kV</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage (1.2 / 50 µs)</td>
<td>up to 650 kV</td>
</tr>
<tr>
<td>Rated normal current – busbar</td>
<td>up to 3150 A</td>
</tr>
<tr>
<td>Rated normal current – feeder</td>
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</tr>
<tr>
<td>Rated short-circuit breaking current</td>
<td>up to 40 kA</td>
</tr>
<tr>
<td>Rated peak withstand current</td>
<td>up to 108 kA</td>
</tr>
<tr>
<td>Rated short-time withstand current (up to 3 s)</td>
<td>up to 40 kA</td>
</tr>
<tr>
<td>Leakage rate per year and gas compartment (type-tested)</td>
<td>&lt; 0.1 %</td>
</tr>
<tr>
<td>Driving mechanism of circuit-breaker</td>
<td>Stored energy spring</td>
</tr>
<tr>
<td>Rated operating sequence</td>
<td>O-0.3 s-CO-3 min-CO</td>
</tr>
<tr>
<td>Interrupter technology</td>
<td>Vacuum</td>
</tr>
<tr>
<td>Insulation medium</td>
<td>Clean air</td>
</tr>
<tr>
<td>Weight of SF6 or other fluorinated greenhouse gases</td>
<td>0 kg</td>
</tr>
<tr>
<td>GWP Global Warming Potential</td>
<td>0</td>
</tr>
<tr>
<td>CO2 equivalent</td>
<td>0 kg</td>
</tr>
<tr>
<td>Rated filling pressure</td>
<td>0.77 MPa abs</td>
</tr>
<tr>
<td>Bay width common pole drive</td>
<td>1000 mm</td>
</tr>
<tr>
<td>Bay height, depth (depending on bay arrangement)</td>
<td>3200 mm x 5500 mm</td>
</tr>
<tr>
<td>Bay weight (depending on bay arrangement)</td>
<td>4.7 t</td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>-50 ºC up to +55 ºC</td>
</tr>
<tr>
<td>Installation</td>
<td>Indoor / Outdoor</td>
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<tr>
<td>First major inspection</td>
<td>&gt; 25 years</td>
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<tr>
<td>Expected lifetime</td>
<td>&gt; 50 years</td>
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<td>Standards</td>
<td>IEC / IEEE</td>
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<td>Other values on request</td>
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- Insulation medium: clean air
- VT: Voltage Transformer
- CT: Current Transformer
- Vacuum circuit-breaker
8VN1 blue GIS up to 145 kV
Switchgear bay (with Conventional Instrument Transformer)

1 Integrated local control cubicle
2 Circuit-breaker with vacuum interrupter
3 Spring-stored-energy operating mechanism with circuit-breaker control unit (common drive)
4 Busbar I with disconnector and earthing switch
5 Busbar II with disconnector and earthing switch
6 Current transformer
7 Outgoing module with disconnector and earthing switch
8 Voltage transformer
9 Make-proof earthing switch (high speed)
10 Cable sealing end
### Switchgear type

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<th>8VN1 values</th>
<th>Details</th>
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8VN1 blue GIS up to 145 kV Switchgear bay (with Non-conventional Instrument Transformer)

1 Integrated local control cubicle
2 Circuit-breaker with vacuum interrupter
3 Spring-stored-energy operating mechanism with circuit-breaker control unit (common drive)
4 Busbar I with disconnector and earthing switch
5 Busbar II with disconnector and earthing switch
6 Non-Conventional Instrument Transformers (NCIT)
7 Outgoing module with disconnector and earthing switch
8 Make-proof earthing switch (high speed)
9 Cable sealing end
8VN1 blue GIS up to 145 kV
Modular structure

Switchgear Bay
- Vacuum Circuit Breaker
- Earthing Switch
- Disconnector / Earthing Switch (Cross Module)

Disconnector / Earthing Switch (Cross Module)
- Current Transformer
- Voltage Transformer
- (NCIT) Non-Conventional Instrument Transformers
- Surge Arrester

Cable Module
- Outdoor Bushing

Extension Modules
- three-phase
- Splitting Module 1/3-phase
8VN1 blue GIS up to 145 kV
Circuit-breaker module

1 Spring-stored-energy operating mechanism with circuit-breaker control unit (single or common drive)
2 Connection to current transformer
3 Connection to busbar II
4 Vacuum interrupter unit
5 Connection to busbar I
6 Insulating support
8VN1 blue GIS up to 145 kV
Spring operated mechanism

On

Off

“off” position
(Closing spring loaded)

1 Closing release
2 Cam plate
3 Coupling linkage
4 Operating rod
5 Closing spring connecting rod
6 Opening spring connecting rod
7 Closing spring
8 Hand-wound mechanism
9 Charging mechanism
10 Charging shaft
11 Roller lever
12 Closing damper
13 Operating shaft
14 Opening damper
15 Opening release
16 Mechanism housing
17 Opening spring
8VN1 blue GIS up to 145 kV
Conventional /Non-Conventional Instrument Transformer Technology

Conventional Instrument Transformer Technology

Inductive Voltage Transformer (VT) + Inductive Current Transformer (CT)

Non-conventional Instrument Transformer (NCIT) Technology

1 x Electric Field Probe for Voltage Measurement + 2 x Rogowski Coils for Current Measurement (redundant) = Cast resin partition with integrated voltage and current sensors
8VN1 blue GIS up to 145 kV
Non-Conventional Instrument Transformer (NCIT) - Technology

- Combined electronic Voltage and Current Sensor (eVT/eCT) according to IEC / IEEE
- Applied technologies: Rogowski Coil & Electric Field Probe
- One common measuring system für protection and metering

<table>
<thead>
<tr>
<th></th>
<th>realized</th>
<th>achievable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current range:</td>
<td>100 A up to 3.150A; 100kA</td>
<td>up to 6.000 A; 216 kA</td>
</tr>
<tr>
<td>Voltage range:</td>
<td>72.5 kV up to 145kV</td>
<td>up to 550 kV</td>
</tr>
</tbody>
</table>
8VN1 blue GIS up to 145 kV
Non-Conventional Instrument Transformer (NCIT) in GIS

Customer Benefits

- **Decreased size and weight**
  reduced weight of CT and VT (from approx. 1.500 kg to 85kg),
  lower dimensions of GIS bay and significantly less cabling

- **Simple network connections with improved safety**
  significantly reduced cabling, more thin cables, easier cable works, smaller cable ducts
  low signal levels for safe maintenance and operations

- **Reduced failure rate**
  because connection failures are less likely to occur

- **Contribution to environmental protection**
  no SF₆-Gas in NCIT → lower CO₂ footprint (if used with SF₆ GIS)

- **Simplified Engineering, Approval (“rating plate”) and Logistics**
  only one hardware variant for current and voltage measurements
  uniform configuration → no approval (at an early project status) needed

- **Improved measurement behaviour**
  with wide dynamic range due to no saturation effect in multi-purpose current sensor
  no magnetic losses, and no ferro-resonance effects
## 8VN1 blue GIS up to 145 kV

### Essentials at a glance

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental-friendly</td>
<td>The 8VN1 uses clean air as insulation medium. Clean air is a composition of 80% N\textsubscript{2} and 20% O\textsubscript{2}, cleaned and free from humidity (technical air). The clean air Global Warming Potential GWP is 0. Clean air is and will not be part of the EU-F-gas regulation.</td>
</tr>
<tr>
<td>Experience</td>
<td>The 8VN1 is based on vacuum interrupter technology with more than 40 years successful operational experience in the field of medium-voltage and since 2010 in high-voltage.</td>
</tr>
<tr>
<td>Robustness</td>
<td>The fixed bay concept of the 8VN1 leads to an improved seismic resistance of 0.5g (IEC 62271-207) without additional measures.</td>
</tr>
<tr>
<td>Indoor and outdoor application</td>
<td>The 8VN1 offers the well-known and proven modular design and can be used for indoor and outdoor applications from -50°C to +55°C at 50 / 60 Hz.</td>
</tr>
<tr>
<td>Highest quality and reliability</td>
<td>Compliance with the extended mechanical endurance class M2. 10,000 mechanical operations (CB, DS).</td>
</tr>
<tr>
<td>Adapter modules</td>
<td>8VN1 is compatible with all previously installed Siemens GIS of the same voltage level.</td>
</tr>
</tbody>
</table>
8VN1 blue GIS up to 145 kV

Contact

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