VDH/GSMI™

Combined 34.5 kV Vacuum Circuit Breaker & Grounding Switch Mechanically Interlocked

U.S. Patent Pending

EMP ELECTRO MECANICA
VDH/GSMI™ Series

Combined Vacuum Circuit Breaker & Grounding Switch Mechanically Interlocked

- VDH/GSMI™ series is particularly suitable for application with wind farm collection circuits. This model combines a main breaker with a high speed, mechanically-interlocked grounding switch within the same outdoor enclosure, and totally replaces traditional use of grounding transformers in wind generation installations.

- Main breaker connects generator collection circuits to the transformer bus, while grounding switch connects collection circuits automatically to ground, immediately after the main breaker opens. The primary characteristic of the overall system is that the complete switching operation (time duration for opening main breaker through closing grounding switch) is accomplished in less than 1 cycle (between 12 to 16 milliseconds).

- When a conventional wind farm substation breaker opens and the wind turbines are still in operation the voltage will rise on the 34.5 kV collection system cables between the turbines and the substation. If the voltage is allowed to rise then the surge arresters at the substation and at the ends of the 34.5 kV cable runs will be subjected to an overvoltage. The turbine controllers can also be subjected to an overvoltage. It’s essential to keep the voltage down to the withstand limits of the surge arresters and the turbine controllers.

- Some wind generation installations traditionally use grounding transformers in order to limit that voltage rising. But VDH/GSMI™ series provides a very fast switching time to ground which holds transient voltage excursion to very low levels, thereby eliminating the need for grounding transformers, with very important advantages as follows:

  * Eliminates need for grounding transformer for each collection circuit, resulting in elimination of:
    * First cost for expensive grounding transformers, grounding transformers installation labor costs and grounding transformers installation materials costs.
    * Eliminates grounding transformers core losses, which amounts to a very large savings over project life.

- Enclosure is metal enclosed, self-supporting and free standing construction, with weatherproof design suitable for installation in an unprotected environment, equipped inside with the following main components:

  * Three-pole main vacuum breaker combined with a high speed, mechanically-interlocked three-pole vacuum grounding switch.
  * Commutation & operating mechanism, spring stored energy type.
  * Epoxy resin bushings including 4 hole flat pad stud connectors.
  * Epoxy insulated ring-core current transformers installed around the bushings (up to two current transformers per bushing)
  * Frontal & rear low voltage compartments including control push-buttons, indicating lamps, current transformers terminal blocks and auxiliary devices.

- All exterior parts fabricated from steel sheet with cataphoresis protection as anticorrosive process which provides longstanding performance in corrosive or contaminated environments. Roof assembly particularly fabricated in aluminium to prevent eddy currents around bushings.

- Manufactured and tested to meet ANSI C37 and IEC 62271-100 standards, this series provides easy installation and accessibility, minimal maintenance and long service life.
## Electrical Ratings

<table>
<thead>
<tr>
<th>   </th>
<th>Rated Voltage</th>
<th>Rated Maximum Voltage</th>
<th>Rated Continuous Current</th>
<th>Symmetrical Interrupting Capacity</th>
<th>Short Time Withstand Current</th>
<th>Making Capacity (peak value)</th>
<th>Dielectric Strength, Withstand 60 Hz 1 min</th>
<th>Impulse Full Wave (BIL)</th>
<th>Rated Frequency</th>
<th>Rated Opening Time</th>
<th>Rated Closing Time</th>
<th>Rated Mechanical Commutation Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>main breaker</td>
<td>34.5</td>
<td>38</td>
<td>630/2000</td>
<td>25</td>
<td>25</td>
<td>65</td>
<td>80</td>
<td>200</td>
<td>60</td>
<td>30</td>
<td>30</td>
<td>4 to 11</td>
</tr>
<tr>
<td>grounding switch</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>12.5</td>
<td>32.5</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<td>—</td>
<td>12 to 16</td>
</tr>
</tbody>
</table>

## Dimensions and Weights

Approximate weight: 4070 pounds / 1850 kg

1. MAIN VACUUM BREAKER
2. VACUUM GROUNDING SWITCH
3. OPERATING & COMMUTATION MECHANISM
4. MECHANICAL INTERLOCK
5. BUSHINGS (WIND FARM SIDE)
6. BUSHINGS (TRANSFORMER SIDE)
7. CURRENT TRANSFORMERS
8. MAIN BUSBARS
9. GROUNDING BAR
10. AUXILIARY & TERMINAL BLOCKS COMPARTMENT
11. CONTROL PUSH-BUTTONS & INDICATING LAMPS
Main breaker (upper vacuum interrupters) connects generator collection circuits to the transformer bus, while high speed, mechanically-interlocked grounding switch (lower vacuum interrupters) connects collection circuits automatically to ground, with a complete switching sequence lower than 1 cycle (between 12 to 16 msec). The transient voltage doesn’t rise enough in 1 cycle to be above the withstand of the arresters or the allowable rise at the wind turbine controllers.

Channel 1 is the analogical representation of the main breaker contact traveling, while channel 2 is the logical representation of the contacts position of both main breaker and grounding switch, connected in a parallel circuit.

This real oscillogram shows that complete switching sequence (time duration for opening main breaker through closing grounding switch) was accomplished in 14.76 msec, and the main breaker contact traveled more than 75% of its total stroke when the grounding switch closed.