

# VDH/GSMI®

Combined Vacuum  
Circuit Breaker & High  
Speed Mechanically  
Interlocked Grounding  
Switch



ISO 9001:2015

## 38kV - 1200A - 25 / 31.5 / 40kA

## Combined Vacuum Circuit Breaker & High Speed Mechanically Interlocked Grounding Switch

### The Switch

VDH/GSMI® is especially designed for application with **wind and solar collection circuits**. This model combines a vacuum circuit 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**.

Circuit breaker connects collection circuits to the substation bus, while the associated grounding switch automatically switches the collection circuits to ground immediately after the circuit breaker opens. The primary characteristic of the overall system is that the complete switching operation (time duration for opening circuit breaker through closing grounding switch) is mechanically accomplished in **less than 1 cycle** (between 12 to 16 milliseconds), with a maximum electrical switching of **12 milliseconds**.

### Grounding of wind and solar collection systems

34.5 kV radial feeders are used to collect the power output of the individual step-up transformer associated to each wind or solar generator, routing it to the substation collection bus. Usual connection on the 34.5 kV side of the step-up transformer is delta to prevent zero sequence current from a ground fault on the low voltage generator side from entering into the 34.5 kV system. Therefore, neither generators, nor their unit step-up transformers provide neutral grounding for the 34.5 kV collection system. The normal source of grounding for the collectors feeders is from the substation power transformer.

If a ground fault should occur, and a collector feeder is tripped but the generators continue to operate, the feeder becomes isolated without a ground source but with a ground fault. As a result, unfaulted phase voltages will rise greatly on the 34.5 kV collection system cables between the generators and the substation.

If the voltage is allowed to rise excessively then surge arresters at the substation and at the ends of the 34.5 kV cable runs may be subject to overvoltage failure. The generator controllers may also be subject to overvoltage failure. It's essential to keep the voltage down to the withstand limits of the surge arresters and the generator controllers.

Wind generation installations have typically used grounding transformers in order to limit that voltage rising. Now VDH/GSMI® provides a very fast switching time to ground which holds transient voltage excursion to very low levels, thereby **eliminating the need for grounding transformers**.

### Advantages, features and benefits

VDH/GSMI® is a unique and patented system, an innovative concept for switching and grounding of wind and solar collection circuits with very important advantages, features and benefits as follows:

- Appreciably less expensive compared to a grounding transformer + conventional substation circuit breaker, plus less labor required to install & lower materials costs required for installation, which amounts to a very large first cost savings.
- Eliminates grounding transformers core losses.
- Eliminates a potential source of oil spills / contamination / fire hazard from installations.
- Appreciably less energy absorbed by the arresters during the transient overvoltages compared to a grounding transformer.
- For some Wind Power Projects, it may be the only solution to avoid high transient voltages.
- Switching function is mechanically interlocked, simple & reliable - no switching timers with associated components / circuitry.



## Design characteristics

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

- Three-pole vacuum circuit breaker combined with a high speed, mechanically-interlocked three-pole vacuum grounding switch.
- Switching & operating mechanism, spring stored energy type.
- Porcelain bushings suitable to fit up to two bushing current transformers.
- Plastic cased bushing current transformers, with ratios and accuracies as per project requirements.
- Frontal control panel and rear low voltage compartment.

All exterior parts fabricated from sheet steel with an electro-chemical process as anticorrosive protection which provides longlasting performance in corrosive or contaminated environments.

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.

VDH/GSMI® has been particularly verified for:

- High Seismic Level as per guidelines of IEEE 693 standard.
- Wind Load of 150m/h (250km/h) as per guidelines of NEMA SG6 standard.
- Low Ambient Temperature -50°C as per guidelines of IEC 62271-100 standard.

**EMD VDH/GSMI®**

## Dimensions and Weight

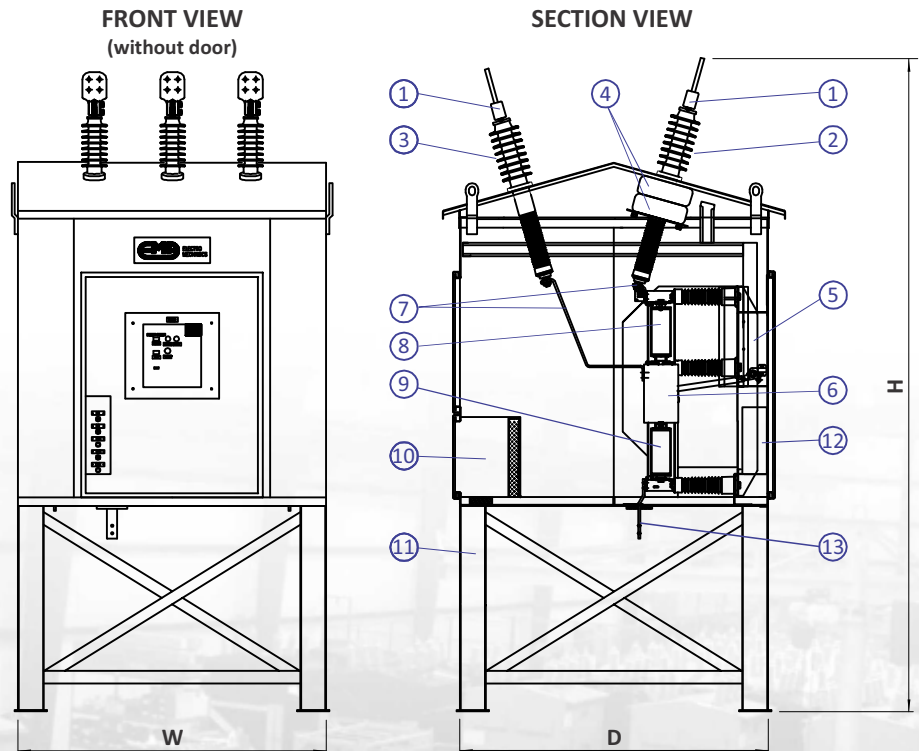
### REFERENCES

- ① 4-Hole Flat Pad Stud Connector
- ② Bushings 1 - 3 - 5
- ③ Bushings 2 - 4 - 6
- ④ Current Transformers
- ⑤ Spring-Stored Operating Mechanism
- ⑥ Switching and Interlock Mechanism
- ⑦ Bus Bars
- ⑧ Vacuum Interrupter (Circuit Breaker)
- ⑨ Vacuum Interrupter (Grounding Switch)
- ⑩ Low Voltage Compartment
- ⑪ Supporting Frame (Tall or Short)
- ⑫ Control Panel
- ⑬ Grounding Bar

**NOTE 1:** Stainless Steel enclosure optionally available for highly corrosive environments

**NOTE 2:** Extra Creep Bushings optionally available

**NOTE 3:** Integral Potential Transformers inside the enclosure optionally available



	DIMENSIONS in inches (mm)			AVERAGE WEIGHT in pounds (kg)
	W	D	H	
<b>VDH/GSMI®</b>	70.9 (1800)	70.9 (1800)	147.9 or 128.2 (3755) (3255)	3320 (1505)



## The Circuit Breaker & Grounding Switch Unit

Circuit breaker (upper vacuum interrupters) connects wind / solar collection circuits to the substation bus, while the associated high speed, mechanically-interlocked grounding switch (lower vacuum interrupters) connects collection circuits automatically to ground.

Complete switching sequence is mechanically accomplished in less than 1 cycle (between 12 to 16 milliseconds), with a maximum electrical switching of 12 milliseconds, thus the transient voltage doesn't rise enough to be above the withstand of the arresters or the allowable rise at the generator controllers.



## Electrical Ratings

	Rated Voltage	Rated Maximum Voltage	Rated Continuous Current	Rated Symmetrical Interrupting Capability	Rated Short-Time Current (RMS)	Rated Closing and Latching Current (peak)	Dielectric Strength Power Frequency	Dielectric Strength Impulse Full Wave (BIL)	Rated Frequency	Rated Closing Time	Rated Opening Time	Rated Arcing Time	Rated Mechanical Switching Time	Maximum Electrical Switching Time
	kV	kV	A	kA	kA (3 sec)	kA	kV	kV	Hz	msec	msec	msec	msec	msec
circuit breaker	34.5	38	1200	25	25	65	80	200	50/60	<45	≤30	4 to 11	12 to 16	12
			31.5	40	104									
grounding switch			—	—	12.5	33				—	—	—		



## Main Advantages for Wind and Solar Projects

**VDH/GSMI® provides Better Safety and Reliability for Wind and Solar Power Plants and their Personnel than Remote Transfer Trip.** Latency on the communication system of a transfer trip scheme does not guarantee generators and feeder breakers to trip both simultaneously.

**VDH/GSMI® provides Better Protection for Insulation Coordination than a Grounding Transformer.** During severe *islanding*, the grounding transformer on the separated collection circuit will not shunt the active power to ground and will not keep the voltage below the MCOV of the lightning arrestor.

Concerning NERC's PRC-024-1 and PRC-024-2 Reliability Standards and their LVRT and HVRT requirements, **VDH/GSMI® supports Differentiation between Internal and External faults**, where generators may be set to *trip* if the fault is inside the plant or *ride through* if the fault is outside the plant, thus providing a valuable discriminatory function that standard circuit breakers do not.

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