

## High Resistance Ground Systems promote these benefits

### Benefits promoted

1. Personnel safety and equipment protection
2. Continuity of service
3. Avoidance of large transient Voltage
4. Mitigates Arc Flash events, 1ph GF
5. Ground Fault location easier to find
6. Integrated Fault tracing, detection
7. Built-in alarm for advance warning

### High Resistance Ground

- Limit Fault Current < 10A
- Alarm & Shutdown
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- Some transient mitigation
- Limit Fault Current & alarm with Hand held ammeter
- Pulsing Ground Indicator
- Advance warning

### VSGR provides

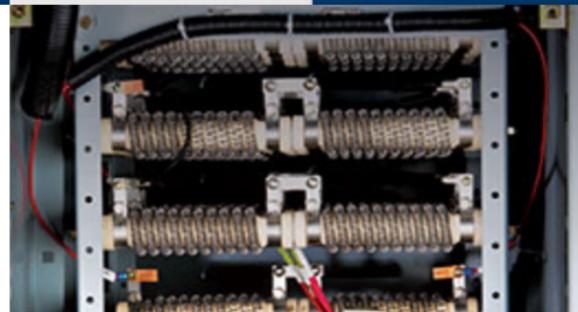
- Safe operation, Limit Fault Current to 1A, Alarm, Prevent V. Spikes & 1ph Flashover
- Continuous ride-through
- Prevents transient events
- Prevents 1ph Gr. Faults with Hand held ammeter
- Differential Ground Detection
- Adjustable remote detection of Ground forming

*To overcome the shortcomings of HRG & other Resistance Grounding Systems, simply install **VSGR**.*

*You will gain true Voltage Stabilization, Arc Flash Prevention, and all of the other benefits that only come from **Phaseback VSGR**.*

*With new construction, Resistance Grounding is not needed, with **VSGR**.*

- Products & Services
- Follow the Charge
- Experience Centers
- Your Business
- How to



### High Resistance Grounding

High-resistance grounding solutions allow for continuous operation and increased safety during fault conditions. Provides ground fault detection and control of transient overvoltages during a single-phase to ground fault on an ungrounded system, thus minimizing the possibility of insulation failure in motors, transformers, power cables and electronic equipment.

### Features

### Applications

### Documentation

1. Personnel safety and equipment protection
2. Service continuity: the ground return current is limited to a low magnitude value that does not require taking the system offline
3. Avoidance of large transient overvoltages that can result in restrikes and cause additional ground faults
4. Mitigates arc flash events
5. Ground fault location easier to find
6. Integrated fault tracing for easy detection
7. Built-in alarm for advanced warning
  - Integrated within switchgear or stand alone
  - Custom applications allow for greater flexibility

**Phaseback VSGR** (voltage stabilizing ground reference) Prevents problems!

**Correcting Voltages, phase to ground provides many benefits. They are:**

- 1) **Arc Flash Prevention** — Eliminate 1ph Ground Fault and Arcing Ground. Correct Phase Voltages to ground, so the event is prevented.
- 2) **Arcing ground-faults** — The 1ph events do not happen, whether grounded, arcing, or intermittent.
- 3) **Voltage spikes** — from internal or external sources— Prevented.
- 4) **Phase voltage imbalance** — Prevented.
- 5) **Phase Loss due to high impedance grounds** — Prevented.
- 6) **Phase angle differential** — Prevented.
- 7) **Phase voltage instability** — Prevented.
- 8) **Phase voltage harmonics** — Reduced by 85%, typically on 3 wire systems.
- 9) **Waveform distortion** — Prevented.
- 10) **Noisy ground reference and frequency instability** — Prevented.
- 11) **Operational efficiency** — Reduce energy used. Typically, 1.4% Energy reduction for every 1% of Voltage imbalance corrected.
- 12) **Limit Fault Current to 1A.**
- 13) **Adjustable Ground Current detector for remote notification of Ground forming & local indication of Ground Fault present.**

## Resistance Grounded Systems

1. **The purpose of Resistance Grounded Systems are to limit the ground fault current.** Tripping the upstream Circuit Breaker at a lower energy level will extend the life of the Circuit Breaker.
2. **All Resistance Grounded circuits do a poor job of Voltage Control.**
3. **With Resistance Grounded Systems, large amounts of energy will be drained to ground during a fault,** possibly causing damage to insulation systems and can mask the cause of control downtime. The fundamental problem, such as insulation breakdown can be masked so that arcing ground faults can escalate into a Flash-over or Arc Flash.
4. **Resistance Grounded Systems, can have a continuous drain of wattage to ground** during normal operation, depending on system capacitance ( based on the distribution size).
5. For example, **HRG draining 5A at 480V, could cost \$ 1,820 per year,** every year, at \$.05 /kWhr.
6. **The HRG will send noise back to the primary,** contaminating the System Voltage, which is another source of electrical noise.
7. To protect itself under certain conditions, the **HRG will take itself offline,** stopping any protection it was providing.

## *Resistance Grounded Electrical Systems are obsolete.*

***Cost justification for Phaseback VSGR over HRG or other Resistance Grounding Technologies are:***

1. **Safer operation** VSGR can Eliminate 85% of Arc Flash risks, by preventing 1ph/ Ground faults.
2. **Energy Reduction** will reduce operational costs, with less than 1 year pay-back!
3. **Uptime** is maximized!
4. **Longer life** of equipment & humans!



Today's control equipment is much more sensitive to Voltage anomalies, making Voltage control much more important.

The **Phaseback VSGR** circuit may look similar to the High Resistance Ground circuit, and the differences are all about performance!

1. **Fault Current is limited to 1A.**
2. **The Voltages are kept in balance phase to ground,** continuously, preventing a grounded phase from becoming a fault. In case of a lost phase, **VSGR** will hold the phase / ground Voltages within about 6% of each other. In both cases, the remaining phases do not go high.
3. **Phaseback VSGR uses the energy,** that would be drained to ground by the HRG, to stabilize the Voltages and correct Voltage imbalances, holding the phase angles in the proper position.
4. **Phaseback VSGR Alarm will not trip the main breaker, as it prevents the Ground Fault from forming,** unless the customer selects this feature. In most cases, Alarm allows corrective measures to be taken well before the Trip signal, which is optional. Many customers do not use a trip sensor.
5. **One sensor or two sensors** are provided, based on customer preference. Local indication of Ground Fault (pilot light) & remote notification of a ground forming from each.
6. **Energy Reduction:** Motors greatly benefit from balanced Voltage. 5000HP of motors can save \$ 33,000/year by having balanced Voltage. (at \$.05/kWhr 14.4hrs/day) Reduction in Energy drained to ground saves \$1700/year. Total Savings \$ 34,700/year.