

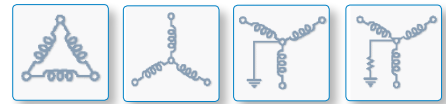


iGARD

Unparalleled Protection

2022 Pulp and Paper
Segment Brochure

WHY GROUNDING IS KEY?



When designing or selecting an electrical grounding system for industrial operation for voltages of 5kV and below there are three basic choices – **Ungrounded, Solidly Grounded or High Resistance Grounded.**

When deciding which type of grounding system to specify there is a need to consider:

- ▶ Reliability
- ▶ Electrical Risk
- ▶ Operating Costs

Under normal conditions any of the three grounding methods are reliable, free from electrical risks and have similar operating costs but ground faults are a reality in any electrical system and so the question becomes how does the grounding system decision affects reliability, risk and costs?



During a ground fault on an **UNGROUNDING SYSTEM**, the arcing nature ‘charges’ the system capacitance. When the arc extinguishes the charged system cannot dissipate the charge, so it holds it. When the arc re-strikes, more charge is added to the system. This continues until the insulation breaks down at the weakest point in the system.

The concern over the safety aspect of ungrounded systems when experiencing a ground fault is noted in the **IEEE 242-1986 Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems 7.2.5:**

“A second ground fault occurring before the first fault is cleared will result in a phase-to-ground-to-phase fault, usually arcing, with current magnitude large enough to do damage, but sometimes too small to activate overcurrent devices in time to prevent or minimize damage.

Ungrounded systems offer no advantage over high-resistance grounded systems in terms of continuity of service and have the disadvantages of transient overvoltages, difficulty in locating the first ground fault, and burndowns from a second ground fault”.

In effect, ungrounded systems have no advantages over high resistance grounded systems and have higher costs associated with equipment damage, loss of process continuity and risk of arcing flash.



Under normal operating conditions a **SOLIDLY GROUNDED SYSTEM** is safe and reliable, however both criteria are impacted when the system is subject to a ground fault. A ground fault of sufficient magnitude will trip the over-current protection and interrupt the process.

An arcing fault may not be of sufficient magnitude to be detected by and trip the over-current device until the arc fully develops and it becomes destructive and possible deadly.

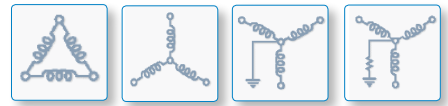
In the **IEEE 141-1993, Recommended Practice for Electrical Power Distribution for Industrial Plants section 7.2.4, it states that:**

“The solidly grounded system has the highest probability of escalating into a phase-to-phase or three-phase arcing fault, particularly for the 480 and 600V systems”.

“A safety hazard exists for solidly grounded systems from the severe flash, arc burning, and blast hazard from any phase-to-ground fault”.

The following table provides a summary of arc flash data over a 23 year period - not all arc flash incidents are effectively captured or reported. This data validates the occurrence of injuries and fatalities associated with arc flash incidents at different voltage levels.

Voltage	Burns	Smoke Inhalation	Shock	Fatalities
Under 400V	19	0	3	0
480V and 600V	283	18	5	33
1kV to 5kV	78	1	0	13
5kV to 15kV	100	3	13	10
Over 15kV	50	16	2	5



NFPA 70E states in Annex O *Safety-Related Design requirements*:

“A great majority of electrical faults are of the phase-to-ground type. High-resistance grounding will insert an impedance in the ground return path and will typically limit the fault current to 10 amperes and below (at 5 kV nominal or below), leaving insufficient fault energy and thereby helping reduce the arc flash hazard level”.

IEEE141-1993 Recommended Practice for Electric Power Distribution for Industrial Plants Section 7.2.2:

“There is no arc flash hazard, as there is with solidly grounded systems, since the fault current is limited to approximately 5A”.



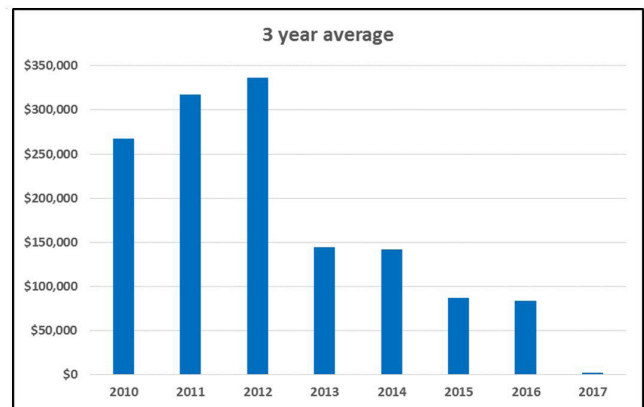
By choosing **HIGH RESISTANCE GROUNDING** on your electrical distribution system you control the ground fault magnitude to the point where the vast majority of arc flash accidents simply never occur.

Not only does HRG technology allow for process continuity during a single phase to ground fault thereby avoiding unnecessary process interruptions, there is evidence that converting to HRG will reduce equipment repair costs.

One leading industrial company made the decision to change their 3 phase 4 wire system to 3 phase 3 wire high resistance grounded on the basis of arc flash reduction. This company received the unexpected but welcomed benefit of reducing motor repair costs.

In solidly grounded systems, it is not unusual to have several hundred amps of fault current, insufficient to trip the over-current device but more than enough to damage motors.

The change to HRG where the ground fault is limited to 10 Amps or less, reduced the damage so significantly that this factor alone would have provided less than a 3-year return on investment.



The two limitations with standard HRG technology are that a second ground fault trips the entire system, and the arc flash energy levels are not reduced by HRG technology, both of these limitations are overcome through the application of **SMART (ADVANCED) HRG** technology.



SMART HRG with second fault protection ensures that your most critical process is operational at all times, providing an opportunity for increased revenue.

Feeder indication of a ground fault shortens the time needed to find a fault and removes personnel from the risk involved in starting the search at the main switchgear.

Detecting and interrupting an arc flash as quickly as possible reduces the incident energy levels and ensures workplace safety.

What does a **SMART (ADVANCED) HRG** offer in terms of features and benefits? It is described through SMART acronym, which stands for:

- S** - Selective Instantaneous Feeder Trip (SIFT) on 2nd ground fault
- M** - Mitigate 95-98% of arc flash incidents on 1st phase-to-ground fault
- A** - Assisted Fault location through pulsing system and indication/alarm of faulted phase and feeder
- R** - Resistor integrity monitoring. It continuously monitors neutral and resistor continuity to meet the new CSA code requirements
- T** - Time selective feeder isolation. Feeders can be programmed to trip on 1st fault, first fault with time delay, trip on 2nd fault. It allows the user to set priority levels

CASE STUDY



Converting Solidly Grounded Transformers to High Resistance Grounded Systems in a Pulp and Paper Mill

By: Todd Legette, Aaron McPhee, Sergio Panetta and Edmundo Perich

The first step in addressing arc flash is to reduce the probability of exposure at the inception of the arc fault. This can be accomplished utilizing High Resistance Grounding (HRG) systems.

It is well known that up to 70% of all electrical faults begin as single-phase-to-ground faults. Therefore, reducing the energy produced by this type of fault will reduce the likelihood of a single phase to ground fault to propagate to a phase-to-phase or three-phase fault.

High resistance grounding is the only method to date that will reduce the probability of exposure before a significant phase-to-ground fault arc flash occurs. Other methods will not reduce the probability of an arc flash occurring and begin mitigating the arc flash only after the fault has occurred. That is the reason why NFPA-70E (Z462 in Canada) recognizes high resistance grounding as a mitigation technique for arc flash.

In the studied facility, a significant decision making process was conducted to determine the best approach to give the facility the most protection for their employees. To do this, the owners chose to implement arc flash reduction in a two-pronged attack; first, limit the probability of an arc flash occurring and second, reduce the arc flash incident energy if more than a phase to ground fault occurs.

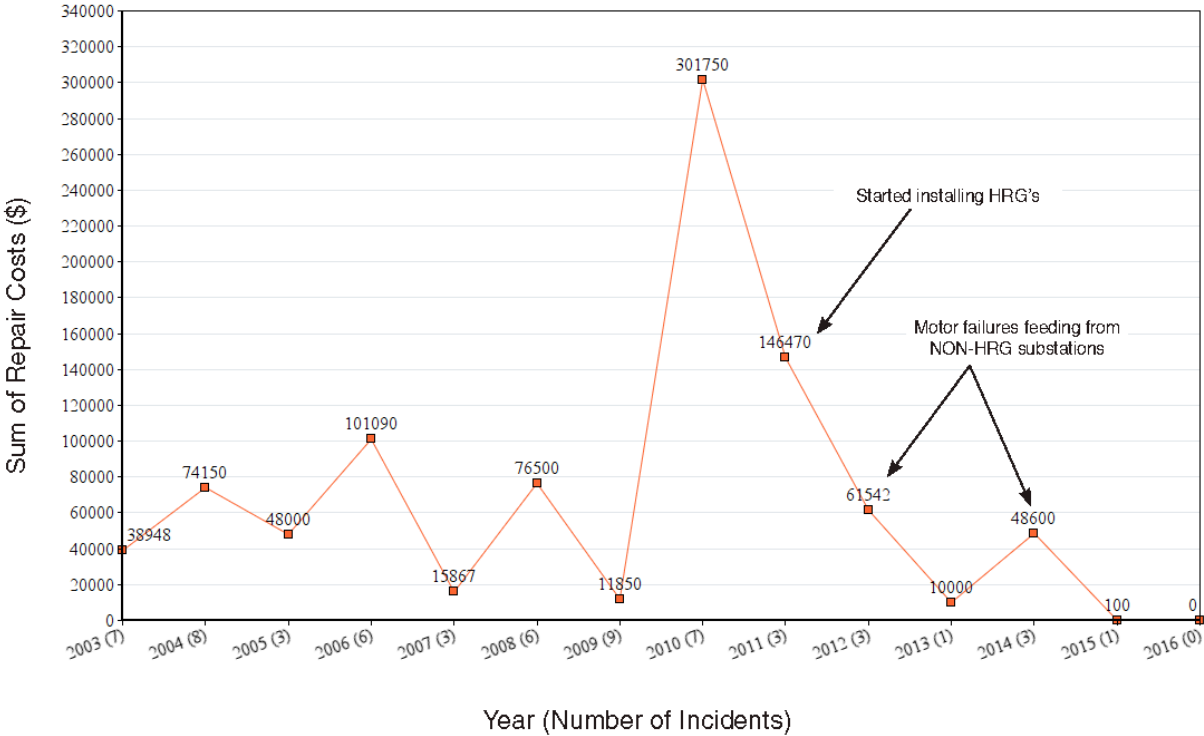
Arc flash mitigation was accomplished through a number of strategies:

1. Application of high resistance grounding on all the low voltage transformers to reduce the probability of occurrence;
2. Installation of low voltage power circuit breakers digital relays on most low voltage breakers for tighter tripping control;
3. Installation of electronic protection relays on low voltage substations which incorporated Maintenance Mode switches programmed into the relays; and
4. Installation of 15kV primary fuses which have faster trip curves.

The facility also recognized the disadvantage of not having the neutral available to service line-to-neutral loads. This necessitated the installation of isolation transformers to service these loads. This also made the system safer by exposing the single phase loads to much lower bolted fault current.

Even with the added cost to the project, there were overwhelming advantages observed by utilizing a high resistance grounding system and the facility felt it was well worth it since they wanted to not only reduce the probability of an arc flash occurrence, but also reduce the incident energy to protect their employees.

HRG Installation Impact: 480VAC Motor Failure Impact



PULP AND PAPER CUSTOMERS

I-Gard values its long standing relationships with hundreds of industry leaders and widely recognized institutions, many of which are in the Pulp and Paper industry. Discover which companies have used and continue to use I-Gard products. Please see a small portion of our Pulp and Paper clients outlined below.

Customer	Product	Location	Year
International Paper	Sleuth	Oregon, USA	2021
International Paper	DSP-OHMNI	Alberta, Canada	2021
Rhona	NGR	Santiago, Chile	2021
Georgia-Pacific Consumer Operations LLC	Sleuth	Oklahoma, USA	2018-2020
Western Forest Products - Saltair	DSP-223	British Columbia, Canada	2019
WestRock	DSP-OHMNI, NGR	Quebec, USA	2019
Foley Cellulose	DSP Upgrade	Georgia, USA	2019
Kruger Bromptonville	NGR, SIGMA	Quebec, Canada	2019
Verso Paper	Sentinel	Michigan	2019
Tolko	DSP-OHMNI	British Columbia, Canada	2019
Cascades Candiak	DSP-OHMNI, NGR	Quebec, Canada	2019
Tolko	DSP-OHMNI	Alberta, Canada	2019
Harmac Pacific	DSP-OHMNI	British Columbia, Canada	2019
Weyerhaeuser	DSP-223	British Columbia, Canada	2018
Weyerhaeuser	DSP-OHMNI	Montana, USA	2018
Georgia-Pacific Consumer Operations LLC	Sleuth	Oklahoma, USA	2018
Northland Forest Products	Sleuth + Zigzag	Alberta, Canada	2018
Vaagen Fibre	Sleuth + VIA	British Columbia, Canada	2018
International Paper	Sleuth + Zigzag	Mississippi, USA	2018
Canfor	DSP-OHMNI	British Columbia, Canada	2018
Graphic Packaging International	Sleuth + Zigzag	Georgia, USA	2018
Pinnacle Point	DSP-OHMNI	British Columbia, Canada	2017
Millport Lumber	DSP-OHMNI	Alabama, USA	2017
Interfor	DSP-OHMNI	British Columbia	2017
Alberta Pacific Forest Industries (ALPAC)	DSP-OHMNI	Alberta, Canada	2017
Weyerhaeuser	DSP-OHMNI	Georgia, USA	2015
Weyerhaeuser	DSP-OHMNI	Alberta, Canada	2015
Weyerhaeuser	DSP-OHMNI	North Carolina, USA	2015
CMPC	DSP-OHMNI	Concepción, Chile	2015
Mercer (Zellstoff Celgar)	DSP-OHMNI	British Columbia, Canada	2015
SFK	DSP MK III System	Quebec, Canada	2006
Arauco	DSP MK III System	Valdivia, Chile	2006
CMPC	DSP MK III System	Santiago, Chile	2006



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KEY BENEFITS OF SMART (ADVANCED) HRG



High-resistance grounding is a proven technology that provides process continuity even under a single ground fault condition.

The **SMART HRG** from I-Gard is the only HRG system that ensures process continuity of your most critical processes even under second ground fault conditions.

The **SMART HRG** system offers feeder indication and second fault protection which ensures that your most critical process is operational at all times, providing an opportunity for increased revenue.

The **SMART HRG** system can be configured with the time delay feeder trip.

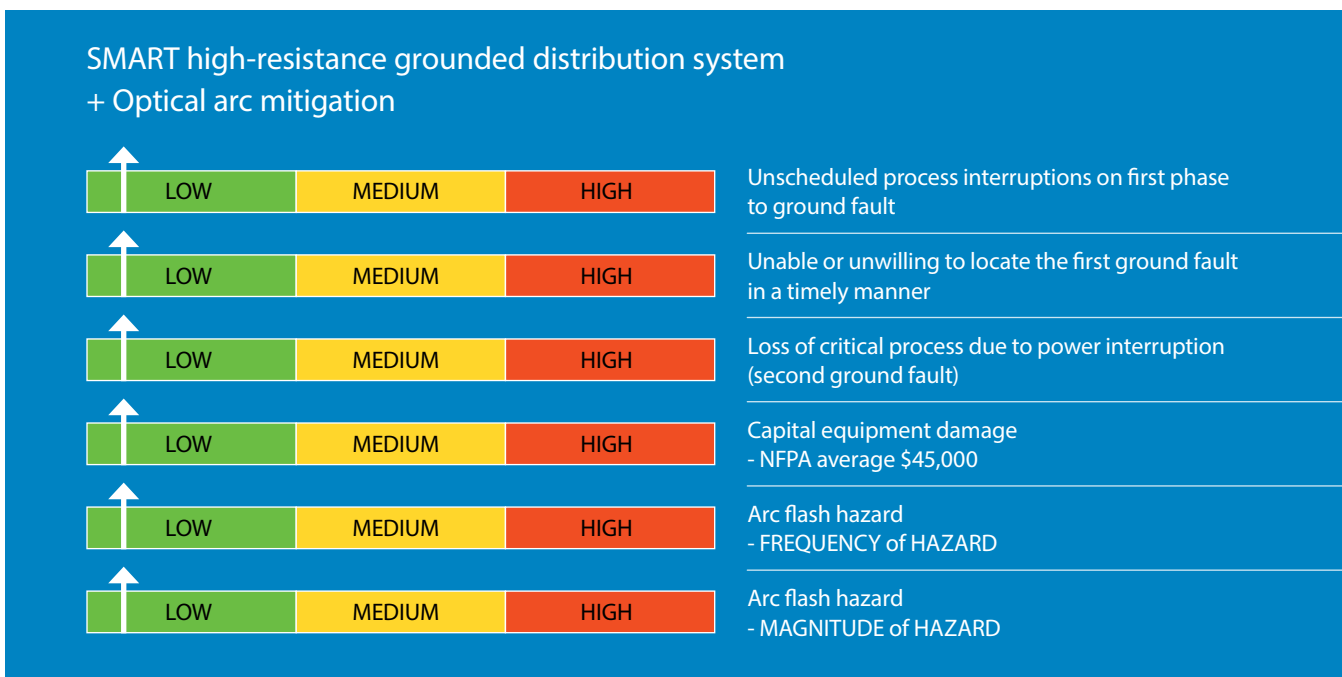
Feeder indication of a ground fault shortens the time needed to find a fault and removes personnel from the risk involved in starting the search at the main switchgear.

- Feeder identification feature provides information of where to start looking for a ground fault.
- With feeder time delay you control how long the ground fault is on the system and reduce the likelihood of a second ground fault.

The **SMART HRG** solution offers HRG and Arc Flash Mitigation functions in the same system.

- Once a certain level of light produced by an arc flash event is detected, the I-Gard sensors react in 1 milliseconds sending a trip signal to the relay.
- Detecting and interrupting an arc flash as quickly as possible reduces the incident energy levels and ensures workplace safety.

The figure below shows the Low Risk Level that the **SMART HRG + Optical Arc Mitigation** system provides by reducing the likelihood and magnitude of exposure of an arc flash, enabling achievement of an electrically safe work condition.



ABOUT I-GARD

I-Gard's commitment to electrical safety provides both industrial and commercial customers with the products needed to protect their electrical equipment and the people that operate them.

As the only electrical-safety focused company whose product portfolio includes neutral grounding resistors, high-resistance grounding systems and optical arc mitigation, we take pride in our technologies that reduce the frequency and impact of electrical hazards, such as arc flash and ground faults.

For those customers who have purchased from us over the last 30 years, you know us for the quality and robustness of our product, our focus on quality, customer service and technical leadership. We build on this foundation by investing in developing new products in electrical safety education – including the EFC scholarship program – by actively participating in the IEEE community programs on technical and electrical safety standards, and working with local universities at uncovering new technologies. We remain unrelenting in our goal of improving electrical safety in the workplace.

Our commitment to excellence is validated by our long-standing relationships with industry leaders in fields as diverse as oil and gas, hospitals, automotive, data centres, food processing, aerospace, water and waste water, and telecommunications.

We provide them with the product and application support required to ensure that their electrical distribution system is safe and reliable.

3 SOLUTIONS & FACTS ABOUT I-GARD

I-Gard offers more HRG products at more price points than any other competitor in the industry, with customized solutions for your specific application.

I-Gard is the exclusive supplier of FAIL-SAFE and ADVANCED HRG systems with 2nd ground fault protection to better match your need for electrical reliability and safety.

We are the only HRG supplier that also offers optical arc mitigation for Total Protection against ground faults and arc flash incidences.

- ▶ The first power resistor company in North America to be ISO 9001 certified.
- ▶ The only resistor manufacturer with a CSA-approved testing facility in-house under CSA SMTC program including CSA 295-15 and CSA 22.2 Part 1.
- ▶ The only resistor manufacturer with UL listing of our complete NGR product offering.
- ▶ Approved by the Government of Canada in its Controlled Goods Program for Defense applications.



- ▶ Visit: www.i-gard.com to get access to our technical documentation and certificates.





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