



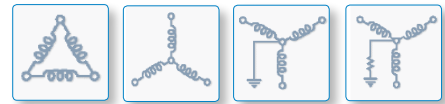
GARD

Unparalleled Protection

**2022 Food and Beverage
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.

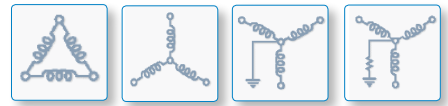
In the **IEEE 141-1993, Recommended Practice for Electrical Power Distribution for Industrial Plants section 7.2.4, it states that:**

“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”.



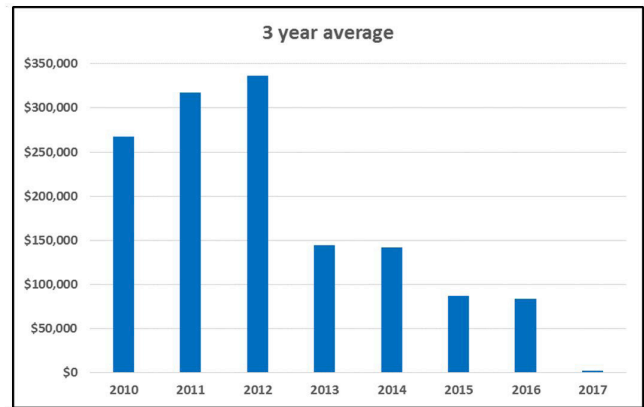
By choosing **HIGH RESISTANCE GROUNDING** on your electrical distribution system you control the ground fault magnitude to the point where the vast majority of arc flash accidents simply never occur.

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 requirement
- 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



Addressing Unplanned Outages in the Food Processing Sector

By: Robert Wetter and Tom Wasemiller

In recent years, high resistance grounding (HRG) technology has become more prevalent in a variety of process industries. Much of this awareness comes from changes in NFPA70E, which recognizes HRG as an arc flash reduction technology. Likewise, insurance companies also push for upgraded electrical systems in order to reduce equipment damages and process interruptions.

Our introduction to the application of HRG technology predates these more recent events by more than 20 years and stemmed from the desire to avoid uncontrolled, and unplanned outages while improving safety for our employees. As those of us who work in the food-processing sector can attest, it is critical to finish certain processes completely and without interruption or delay, or the batch is compromised and/or destroyed. Agitators, conveyors, fans, rotary airlocks, blowers etc., all contribute to a continuous product flow within a critical process. When a process is unexpectedly shutdown, radical changes occur resulting in deviations from manufacturing standards and guidelines; the respective changes include but are not limited to, temperature, absorption, tempering, emulsifying, homogenizing and roasting. Consequently, these undesired changes often result in damaged or destroyed product.

Similarly, if the stall results in solidified product, the equipment can clog, jam and break. As a result, removing the scrap materials and reinstating equipment to its proper state can result in hours of costly downtime. More consequently, when a heat process is involved, such as a trapped oven or roaster, the internal temperatures can quickly rise resulting in a variety of dangerous situations – such as a meltdown, or flash fire.

All of the above-mentioned threats to both product and equipment are actual situations that we have experienced first-hand while working in various food industries.

The cost of a shutdown can quickly rise to thousands of dollars, in addition to the secondary losses and damages derived from scrap, re-work, loss of production time, and the inconvenience posed to customers.

In the case of a serious meltdown or fire, the costs are immediately exponentially higher in addition to increased physical risk to personnel. However, accurately quantifying the expense of an unplanned shutdown due to a ground fault is difficult. The cost associated with a ground fault is largely dependent on a variety of factors: equipment type, severity of the incident, length of shutdown, injuries etc. For example, let us share our experience dealing with roaster failure due to a sudden shutdown because of a ground fault occurrence. The ground fault occurrence caused the roaster to immediately shutdown, trapping a full product batch inside. Internal temperatures quickly rose causing a meltdown. When a meltdown occurs, unique and valuable equipment is damaged and in certain incidents, destroyed. Due to the unique nature of this equipment, a replacement had to ship from overseas. The total losses for this specific case, including expedited delivery charges, labor with overtime, loss of production, loss of product, etc., surpassed \$100,000. Therefore, due to the variety of circumstances that can arise resulting from a ground fault occurrence, it is difficult to quantify the monetary value achieved by operating with HRG technology. However, it is safe to estimate that on average, HRG technology can save anywhere from \$1000 - \$5000 per critical process fault.



As a company with hundreds of locations across North America, we operated facilities with a variety of electrical systems; wye, delta, grounded, and many ungrounded. While not universal, the ungrounded electrical system is common in older food processing facilities as there is a strong desire for process continuity even under a single ground fault condition. However, as noted by IEEE and insurance companies such as FM Global, these systems are subject to over-voltages that result in equipment damage and the location of a ground fault is difficult to find. While changing to a solidly grounded system eliminates the issues of over-voltages, equipment damage and fault location, it results in unplanned equipment outages, which is the core problem to be addressed.

The smart business justifications for using HRG technology are:

- HRG allows the process to continue even in the event of ground fault occurrence
- HRG controls and limits the over-voltages, thereby avoiding equipment damage
- HRG provides an alarm to alert personnel who can consider an orderly and sequential shutdown of process equipment if need be
- HRG provides mechanisms for maintenance personnel to quickly locate the fault limiting shutdown time

More sophisticated HRG systems provide indication of which feeder has the fault, thus expediting the fault location process. Likewise, users also have the ability to preset the system in order to determine which critical processes require protection in the event of a second ground fault in order to promote continuity.

Changing the approach to electrical grounding across multiple divisions, in different countries, through a magnitude of personnel, has been anything but straightforward. In our experience, division management and project managers fight to maintain a certain level of autonomy, and the role of corporate engineering is to consult and advise, rather than dictate and direct.

The first step in effort to achieve the desired change and understanding was education. Educate stakeholders on HRG technology and the respective operational benefits.

Educating the food industry was complicated due to the skepticism surrounding the lack of food industry installations. This meant there was a lack of overall understanding of HRG technology and an unjust fear of the associated cost. The benefits and cost avoidances quickly and easily outweigh the initial investment. While HRG was relatively unknown in the food industry, it has been used for several years prior in mining and petro-chemical industries.

Likewise, I received some concern from plant personnel who had been conditioned to believe that any electrical fault in the system must be eliminated immediately. The concept of safely leaving an electrical fault on the system until a coordinated shutdown could be arranged was not trusted. The prevailing knowledge among electrical personnel was that any phase to ground fault was bad, likely to result in equipment damage and employee injury.

The compromise was to use HRG technology in green field sites where corporate engineering had a higher level of input and on larger brown-field sites for upgrades and retrofits for the same reasons.

Hazelton Cocoa plant was 1 of 7 high dollar value projects (\$100million+) that our company funded between 2006 and 2009. Fortunately, the project management team responsible for designing and implementing electrical protection and personnel safety were open to support from corporate engineering.

When implementing new technology from any vendor, it is imperative that proper support is provided. Unfortunately, our initial experience was poor, as we did not receive what is now known as critical training. This critical training includes installation guidance, commission and product training as well as trouble shooting tactics. Therefore, the product was not fully accepted or trusted as it did not provide the purported benefits. When the system indicated a fault situation or initiated a trip signal, electricians were frustrated as they were unable to calibrate or tune the system. Additional frustration stemmed from the inability to quickly locate the fault, which was one of the key expected benefits. As a result, until the situation could be resolved, a portion of the plant was shut down. The lack of technical support from the HRG vendor used in this case rendered the technology useless, thus providing a negative first impression of HRG technology in the food processing industry. Additionally, there were also minor compatibility issues with existing equipment and the ability to successfully operate in various facilities. Again, this HRG vendor failed to advise us of these potential complications. In order to resolve these issues, grounded transformers had their bonding conductor removed and variable frequency drives modified to ensure compatibility.

Lack of understanding from personnel within ADM was not the only issue when pioneering this technology shift, outside influences were also a problem. The most notable being utility companies that automatically grounded the secondary line coming off their services. This created a situation where the HRG system would constantly alarm and become inoperable. When discussing this issue with utility providers, the common response was that it was a worker safety issue and required union involvement and agreement.

At this time, we decided a change in our HRG technology supplier was in our best interest, and this is when we began using I-Gard products. The experience was immediately superior in terms of engineering and product support. Sergio Panetta, Vice President of Engineering at I-Gard, accompanied Tom and I on our next plant visit. While the utility refused to change their outdated approach, at least we had an ally with us in the fight.

Shortly thereafter, we installed an I-Gard HRG system in a rural grain location. The local electrical contractor claimed he was well versed in HRG technology and refused support. The moment we energized the system we were plagued with nuisance trips and plant personnel blamed the new equipment. Once again, Sergio intervened and personally offered remote technical support and an in-person troubleshooting visit. The visit was not needed as a series of voltage tests conducted at Sergio's request provided the answer. In this instance, the system was still grounded and once this was corrected, the technology worked as advertised.

From this real-world experience, I-Gard and our corporate Technical Services created a training presentation used by all company personnel as well as all approved contractors when installing and commissioning HRG technology.

Proper training on what HRG technology will provide, correct installation and commissioning of the technology, available expert technical support and validation that the process can operate without damaging equipment or injuring personnel were all vital to win over HRG skeptics.

Implementing new technology or changing the approach that has become accepted practice involves a certain amount of risk and the unknown technology is typically blamed for any installation or operational concerns. Successfully changing to HRG technology, which we knew would provide the expected benefits if implemented correctly, was dependent of realizing the saying, seeing is believing.

It was necessary for the electrical personnel and the operations personnel to keep production equipment running even when the system provided a ground fault alarm with no injuries and no equipment damage. Maintenance personnel could see the HRG system in operation and providing indication of the faulted feeders with a traceable pulse that assisted in locating the fault.

HRG technology avoids the issue of unplanned outages and the associated cost impact. HRG technology eliminates the issue of over-voltages and the associated equipment damage. HRG technology lowers the probability of an arc flash by more than 90%.

For these reasons, decision-making managers need to embrace HRG technology in their project justification discussions when considering upgrades, retrofits or new builds. However, a successful project isn't just about the product, it is about who you choose to partner with and ensuring they not only have the product you need, but also the commitment to customer service and application expertise.

Altogether, we installed approximately 50 HRG systems all over the world providing plants against unplanned outages, arc flash incidents, personnel injury and costly damage.

About the Authors

Tom Wasemiller

Tom has 40+ years of experience in electrical safety, much of this time spent working in electrical power distribution throughout several food plants. Tom is also an OSHA certified Electrical Safety Instructor. Prior to retirement, Tom was the Electrical Project Lead at ADM Electrical Technical Services supervising high value projects surpassing \$110million. Tom has lead teams of engineers supporting various corporate divisions in new plant construction, retrofitting and expansion projects while working to reduce arc flash and shock exposure.

Robert Wetter

Recently retired, Bob has 37 years experience working as a senior automation and electrical engineer for one of the largest food ingredient companies in the world. In recent years, Bob designed a variety of industrial power distribution, automation networks and industrial Cybersecurity systems for projects around the world ranging from 4 megawatts to over 150 megawatts. Through innovative designs, Bob has managed to improve safety by adding features such as High Resistance Grounding while actually reducing the overall electrical system cost.

FOOD AND BEVERAGE CUSTOMERS

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

Customer	Product	Location	Year
Cargill	Sleuth	Indiana, USA	2020
Archer Daniels Midland	Sentinel	Minnesota, USA	2020
Bunge	NGR	Ontario, Canada	2019
Coca Cola	DSP-OHMNI, NGR	Quebec, Canada	2019
Land O'Lakes	Sentinel	Texas, USA	2016, 2019
Cargill	DSP-OHMNI	Iowa, USA	2019
Cargill	DSP-OHMNI	British Columbia, Canada	2018
Lantic	VIA	Alberta, Canada	2018
Nestle	Sleuth	Missouri, USA	2018
Cargill	Sentinel	Colorado, USA	2015
Wesco Distribution	Sleuth	California, USA	2015
Rancho Lucero	Sleuth	Durango, Mexico	2015
Archer Daniel Midland	DSP-OHMNI	Iowa, USA	2012
Archer Daniel Midland	DSP-OHMNI	Nebraska, USA	2011
Cerveceria Cuauhtemoc Moctezuma	NTR	Valdivia, Chile	2006
Labatt	DSP MK III System	Ontario, Canada	2006
Nestle	DSP System	Ontario, Canada	2004



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.

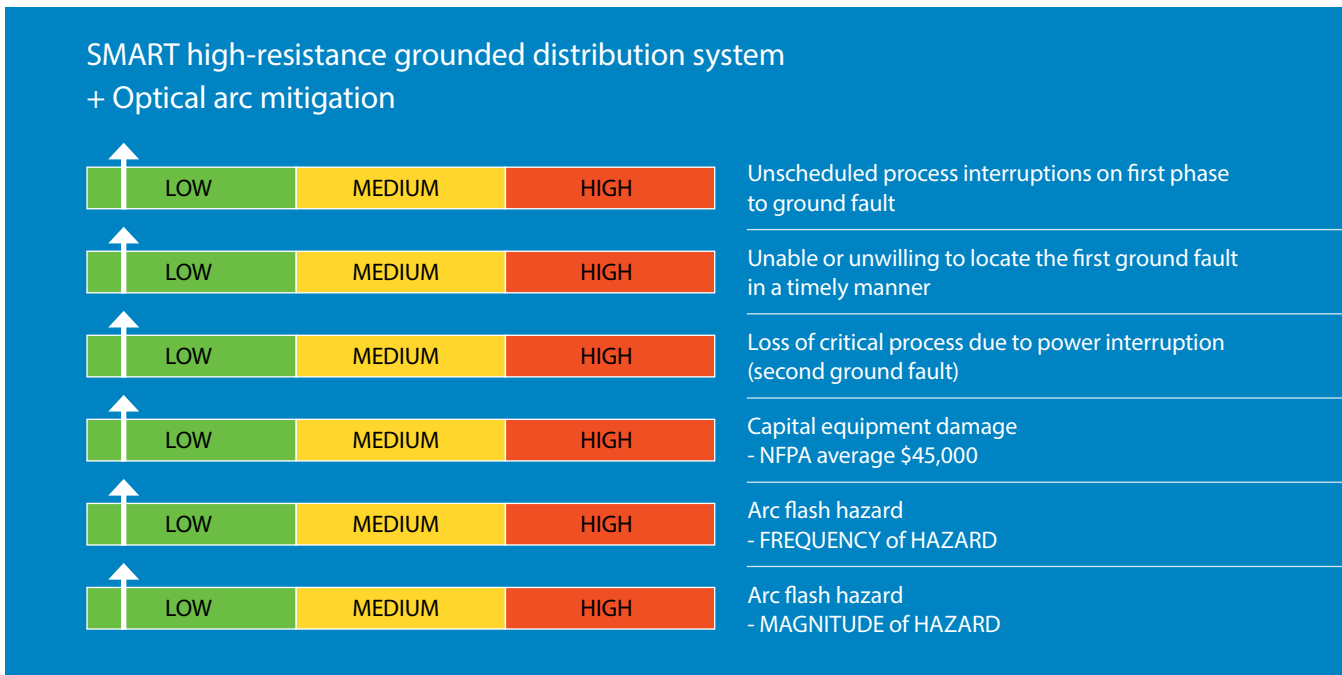
Feeder indication of a ground fault shortens the time needed to find a fault and removes personnel from the risk involved in starting the search at the main switchgear.

- 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.





Unparalleled Protection

2022 FOOD & BEVERAGE
SEGMENT BROCHURE

Phone: 905-673-1553
Toll Free: 1-888-737-4787

E-mail: support@i-gard.com
Fax: 905-673-8472



www.i-gard.com