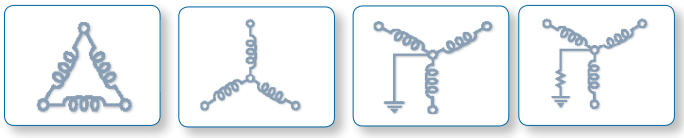
GARD

Unparalleled Protection

case study



ECONOMICS OF HIGH RESISTANCE GROUNDING

Any electrical system has the same preferred deliverables – process continuity, free from electrical hazards and no equipment damage. The decision on which grounding option to choose for the electrical system in an industrial facility is simple – ungrounded, solidly grounded or resistance grounded.

The most common option in North America for 480V and 600V distribution is solidly grounded despite the concern over interrupting processes during a ground fault and the unintended consequence of the arc flash hazard. 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 historical option for facilities where process continuity is key was to be ungrounded, however this is changing quickly given the long standing issues with this grounding choice. In the IEEE 242-1986 Recommended Practice for the Protection and Coordination of Industrial and Commercial Power Systems standard it states in 7.2.5. Ungrounded systems offer no advantage over high-resistance grounded systems in terms of continuity of service and have the disadvantages of transient over-voltages, locating the first fault and burn downs from a second ground fault. For these reasons, they are being used less frequently today than high-resistance grounded systems"

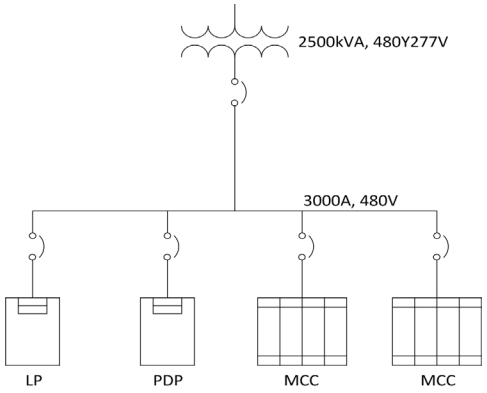
So if High Resistance Grounding is preferable to ungrounded given that it provides the same level of service continuity but without the risks associated with transient over-voltages and High Resistance Grounding is recognized as a technology that reduces the arc flash hazard, then why has this not become the default choice of consulting engineers and facility engineers?

The answer may reside in commonly held misconceptions about HRG Technology – that it is expensive.

To address this misconception we can review 3 different aspects of cost: *installation cost, operational cost and avoidance cost*.

Installation Cost: The basic sample system below comprises of a Lighting Panel, a Product Distribution Panel and 2 Motor Control Centres. We can list the added costs and the savings between solidly grounded and resistance grounded.

No Neutral from Source to Switchgear	saves $12,500
3 wire bus not 4 wire bus	saves $3,500
LSI breaker versus LSIG breakers	saves $5,000
Add HRG panel	costs $7,500
Add Isolation transformer	costs $1,000
Total Savings	**$12,500**



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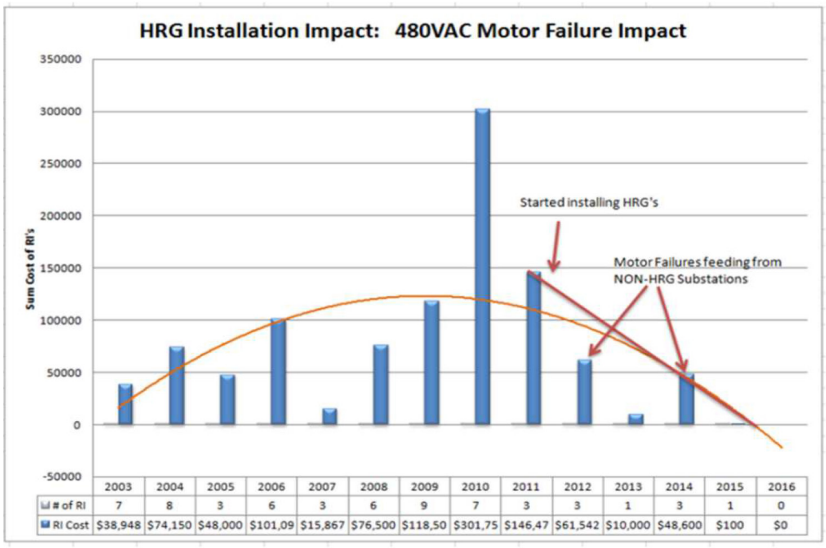
ECONOMICS OF HIGH RESISTANCE GROUNDING

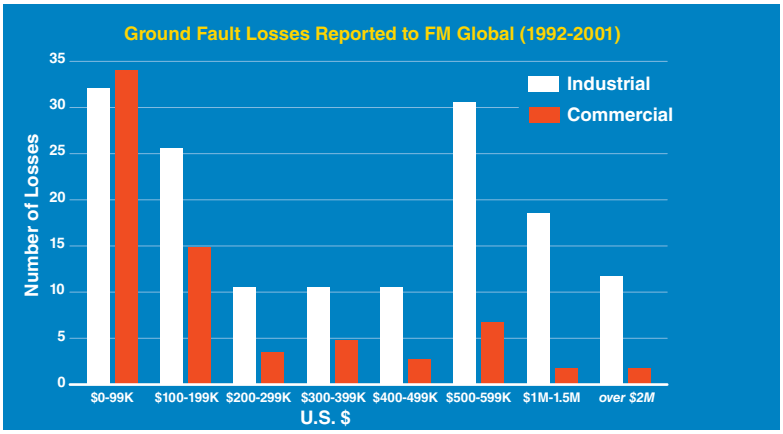
Operational Cost: Not only does HRG technology allow for process continuity during a single phase to ground fault, thereby avoiding unnecessary process interruptions, there is evidence that changing from a solidly grounded system, where ground fault levels are excessive and damaging to equipment such as motors to a HRG system where ground faults are controlled to a low level, reduces motor repair costs as per the figure below:



The second factor to consider when reviewing operational costs is the hourly cost of process interruptions which varies by industry:

Sector	Interruption Cost/ Hour
Automotive	$15,000
Food and Beverage	$16,420
Plastics and Moulding	$7,600
Pulp and Paper	$14,000
Ticket Reservations	$72,000
Data Centers	$474,000

Avoidance Cost: One insurance company reported 228 instances of ground faults leading to losses over a 7 year period. There were 156 losses involving industrial facilities with an average loss of $769,230. The losses including costs associated with equipment damage, process interruptions, spoiled product, employee retraining and medical costs.



- High Resistance Grounding ensures process continuity in the event of a single ground fault and advanced HRG technology available from I-Gard ensures continuity of your most critical process even if there is a second ground fault, avoiding the cost of interruptions and saving thousands per hour.
- High Resistance Grounding has a lower installation cost than solidly grounded systems.
- High Resistance Grounding lowers motor repair costs.
- High Resistance Grounding reduces the likelihood of an arc flash event by 95%, saving people and avoiding equipment damage.
- High Resistance Grounding is the safest option, the option that provides the highest level of reliability and the economical option.

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