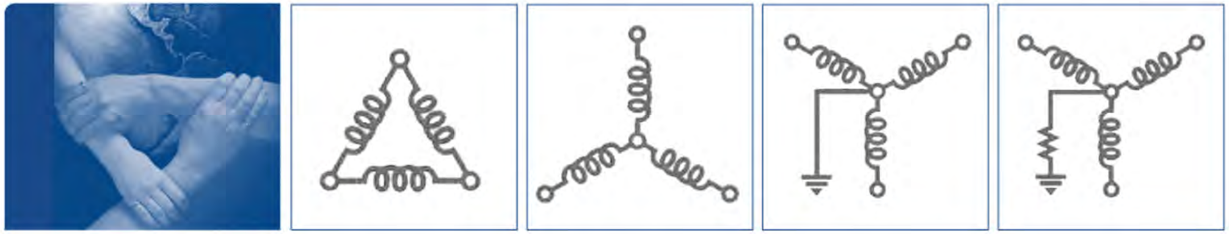
I GARD

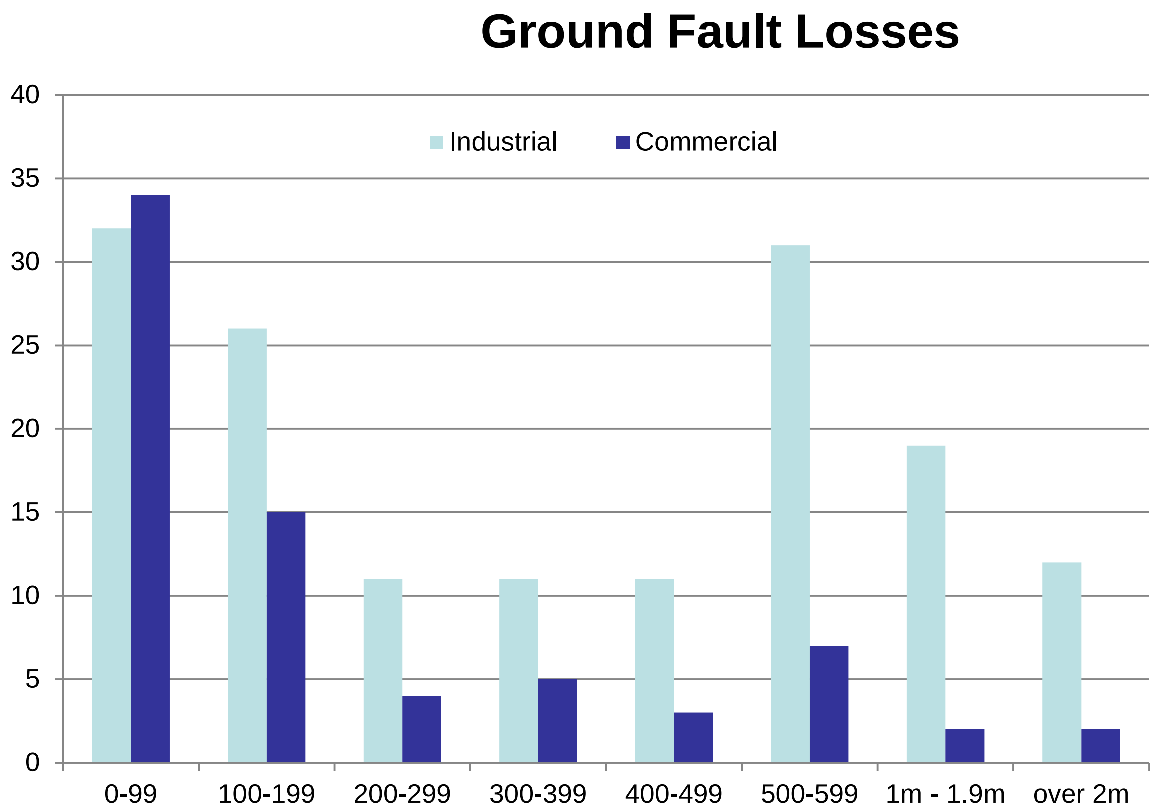
Unparalleled Protection

Smart Vs Standard HRG

> www.i-gard.com



Why the Concern over Ground Faults?



Industrial Losses

$120,000,000 total

$ 769,230 average

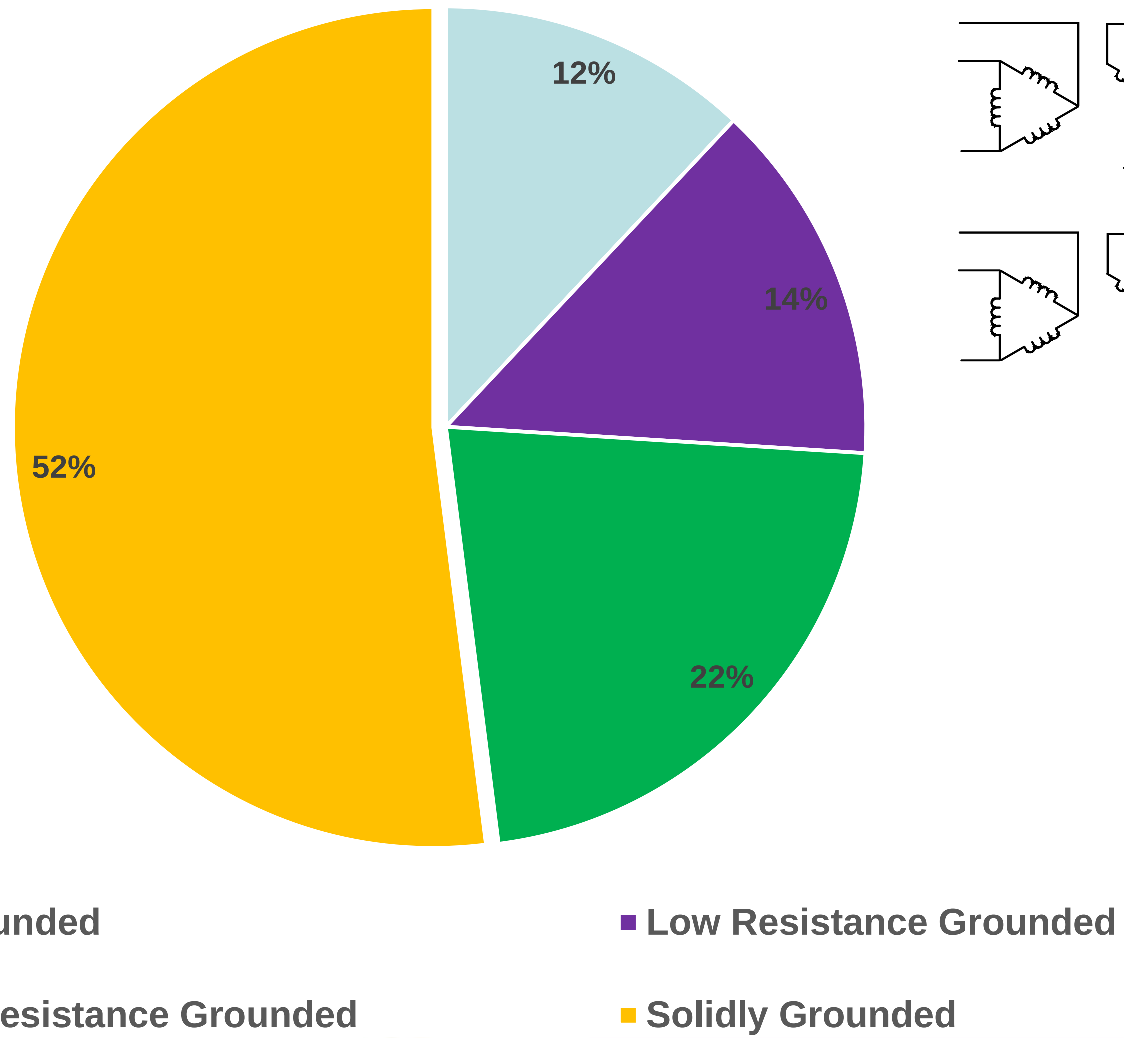
Commercial Losses

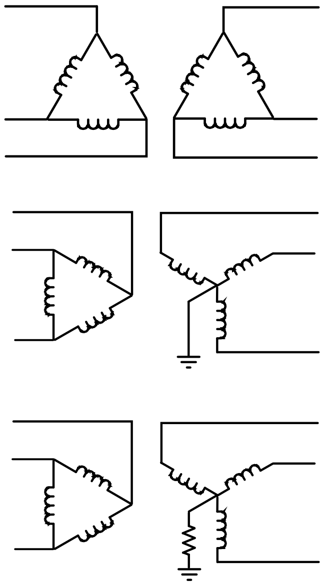
$ 60,000,000 total

$ 833,300 average

<u>One</u> leading insurance company reported 228 losses over a 7 year period related to ground faults, 72 in commercial locations such as hotels, universities and shopping malls and 156 losses at manufacturing locations.

Type of Grounding System





GARD

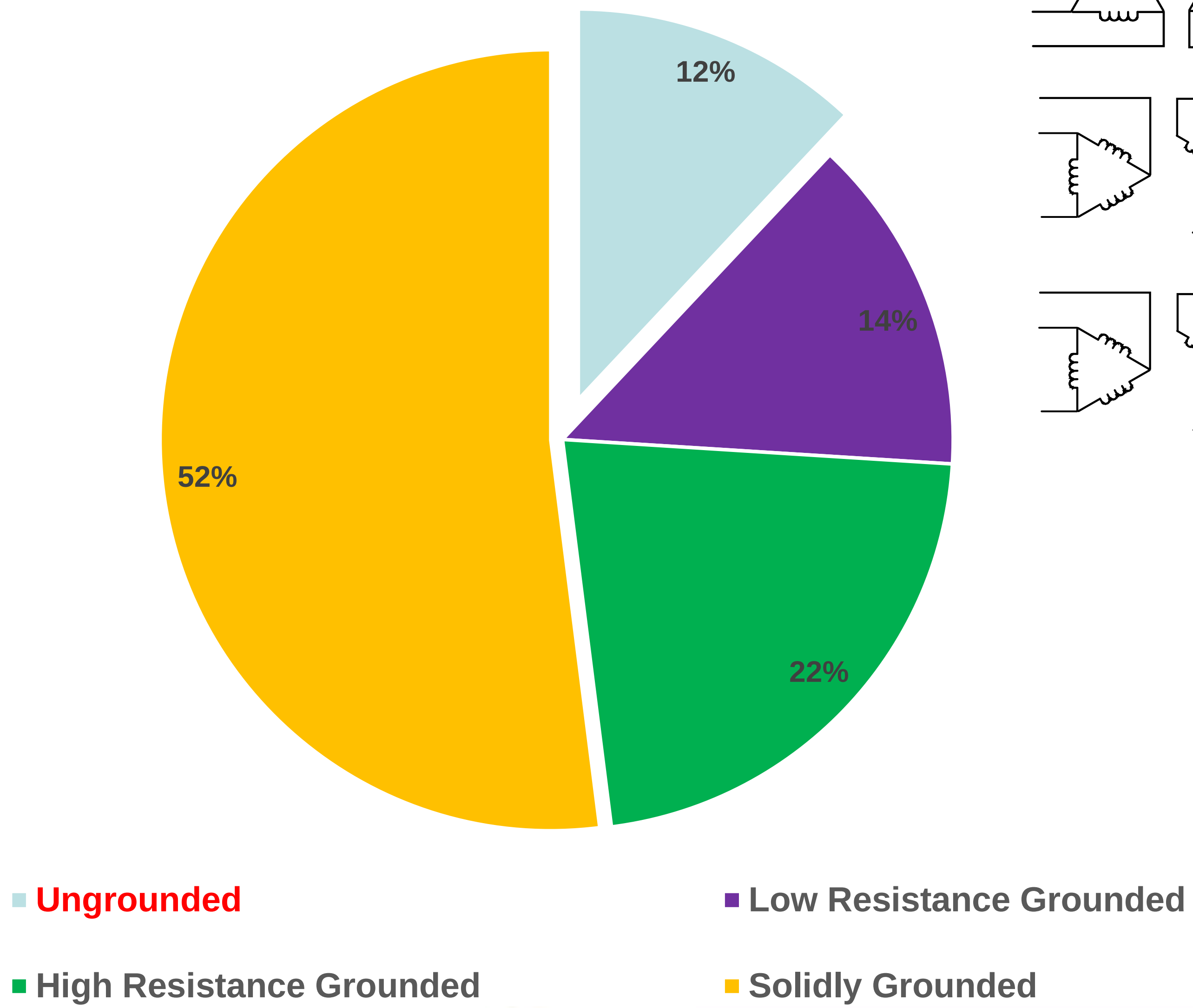
Electrical Safety Risk Meter

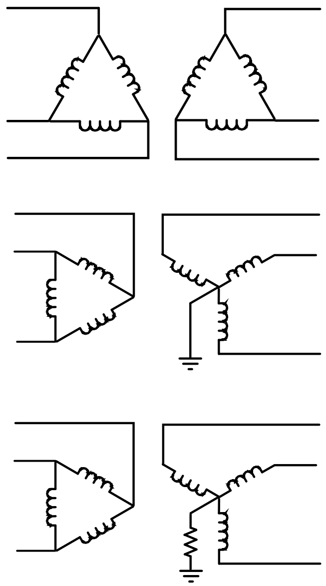
LOW	MEDIUM	HIGH	a	Unscheduled Process Interruptions on first ground fault. Typically $7,000 to $30,000 per hour
LOW	MEDIUM	HIGH	b	Unable to locate the first ground fault in a timely manner
LOW	MEDIUM	HIGH	c	Loss of Critical Process due to power interruption (second ground fault)
LOW	MEDIUM	HIGH	d	Capital Equipment Damage – NFPA Average $45,000.
LOW	MEDIUM	HIGH	e	Arc Flash Hazard – frequency / probability
LOW	MEDIUM	HIGH	f	Arc Flash Hazard – magnitude of destructive arc

1 2 3 4 5 6 →

a+b+c+d+e+f

Type of Grounding System

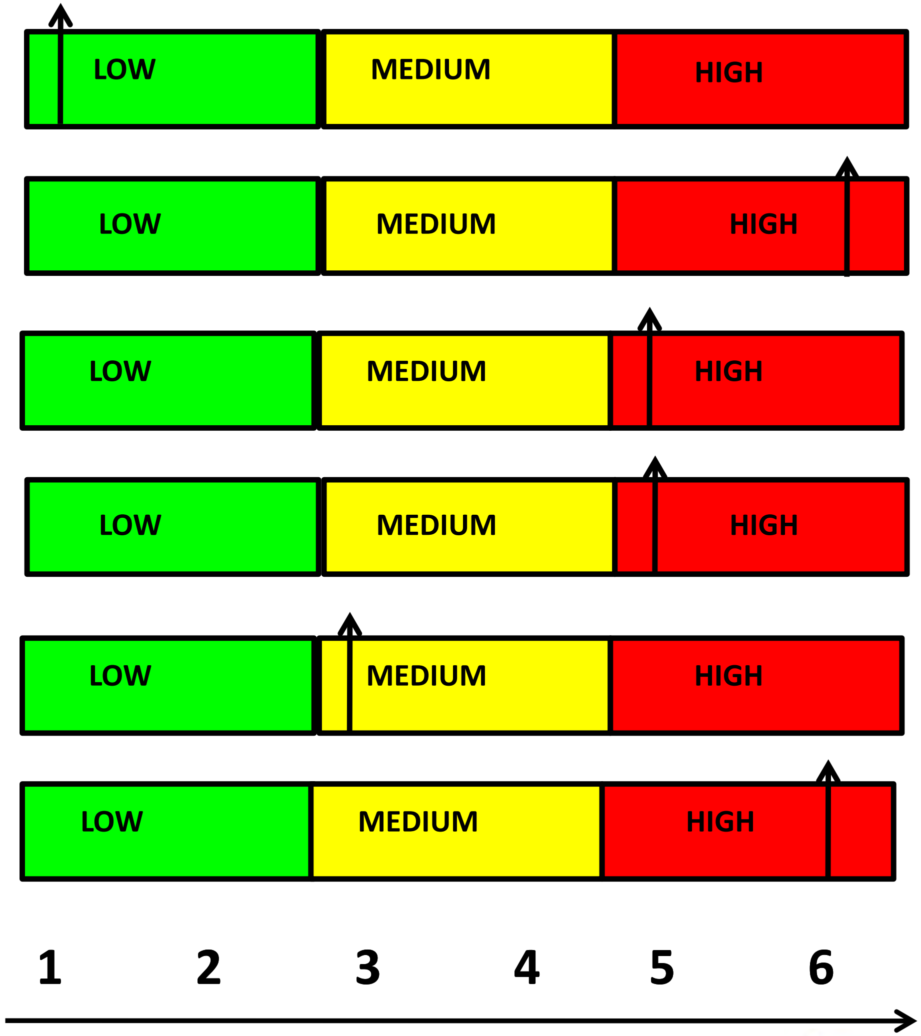




- **Ungrounded systems**
  - **No intentional ground connection to the system conductors.**
- **Ungrounded distribution systems are used in industrial installations**
  - **Ability to provide continuous service with a ground fault on one phase.**
- **Ungrounded system susceptible to a build-up of high voltages (up to six times the nominal voltage) when the first fault is intermittent**
  - **Can initiate a second fault at the weakest insulation point on the system and thus larger, more damaging fault currents can occur.**
- **Code Requirements**
  - **Code requires an ungrounded system to be equipped with a suitable ground detection device to indicate the presence of a ground fault.**

Ungrounded Distribution System

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. IEEE 242-1986 7.2.5



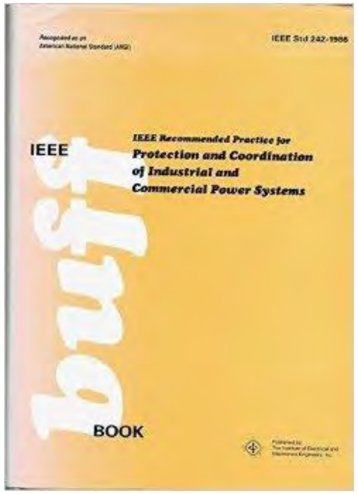
1	Unscheduled Process Interruptions on first ground fault. Typically $7,000 to $30,000 per hour
6	Unable to locate the first ground fault in a timely manner
5	Loss of Critical Process due to power interruption (second ground fault)
5	Capital Equipment Damage – NFPA Average $45,000.
3	Arc Flash Hazard – frequency / probability
6	Arc Flash Hazard – magnitude of destructive arc
26	

Ungrounded Systems

IEEE Standard 242-2001 (Buff Book)

Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems

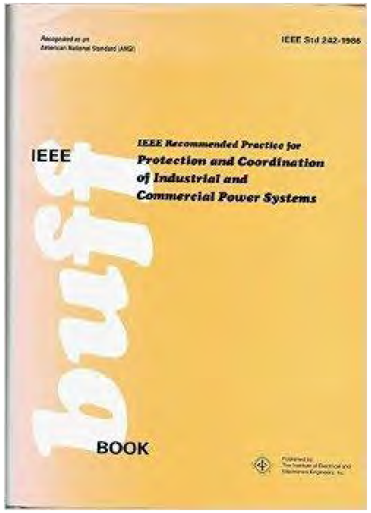
8.2.5 Ungrounded low-voltage systems employ ground detectors to indicate a ground fault. These detectors show the existence of a ground on the system and identify the faulted phase, but do not locate the ground, which can be anywhere on the entire system.



Ungrounded Systems

IEEE Standard 242-2001 (Buff Book)

Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems



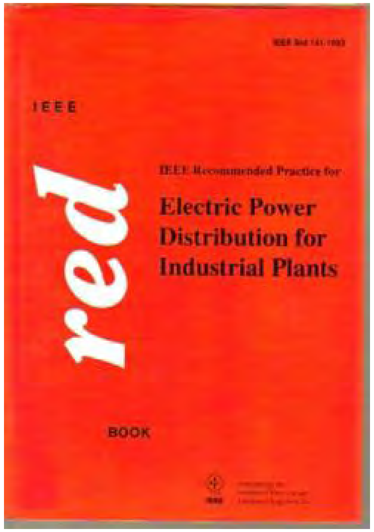
8.2.5 **If this ground fault is intermittent or allowed to continue, the system could be subjected to possible severe over-voltages to ground, which can be as high as six to eight times phase voltage.**

Such over-voltages can puncture insulation and result in additional ground faults. These over-voltages are caused by repetitive charging of the system capacitance or by resonance between the system capacitance and the inductance of equipment in the system.

Ungrounded Systems

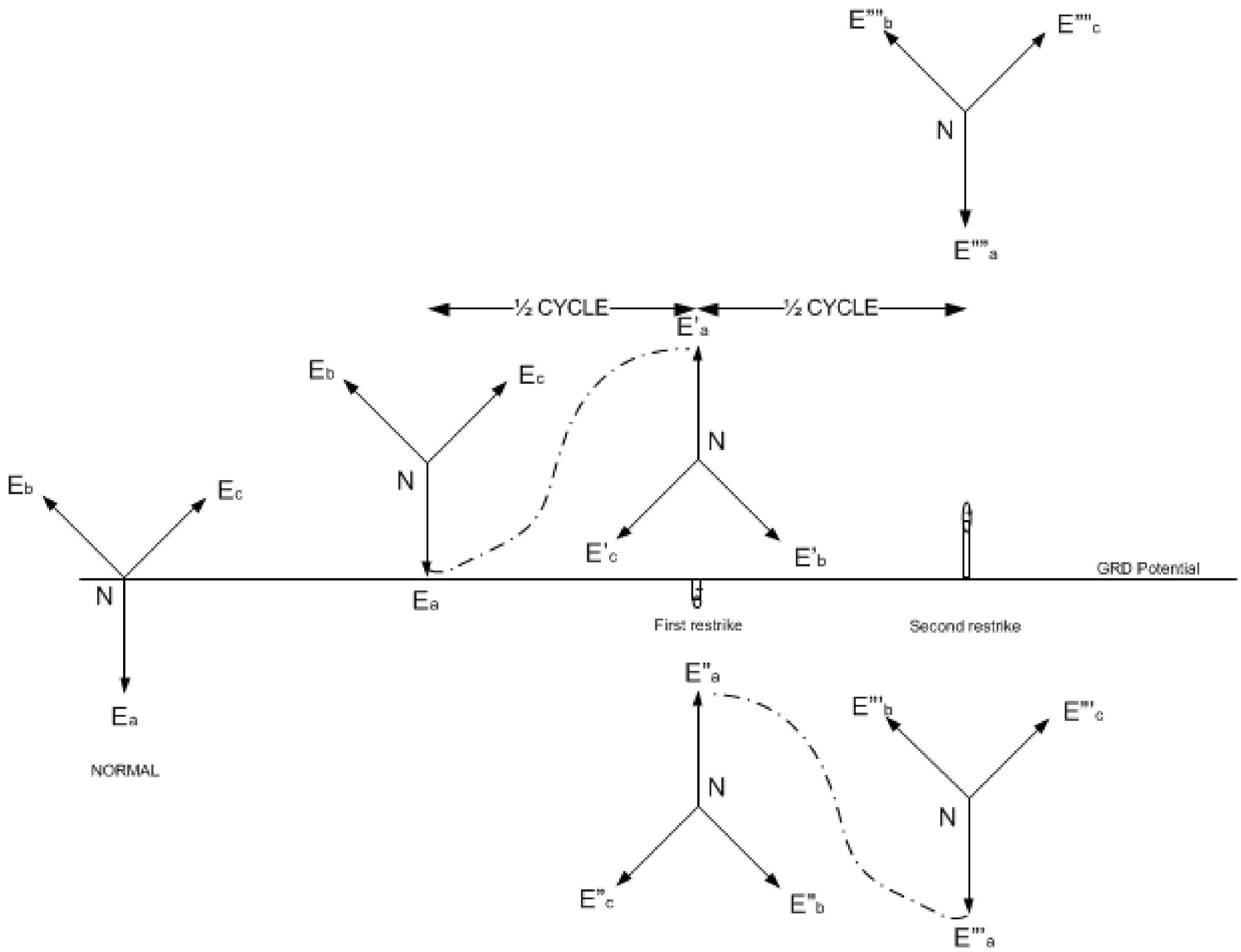
IEEE Std 141-1993 (Red Book)

Recommended Practice for Electric Power Distribution for Industrial Plants



7.2.1 Accumulated operating experience indicates that, in general purpose industrial power distribution systems, **the over-voltage incidents associated with ungrounded operation reduce the useful life of insulation** so that electric current and machine failures occur more frequently than they do on grounded power systems.

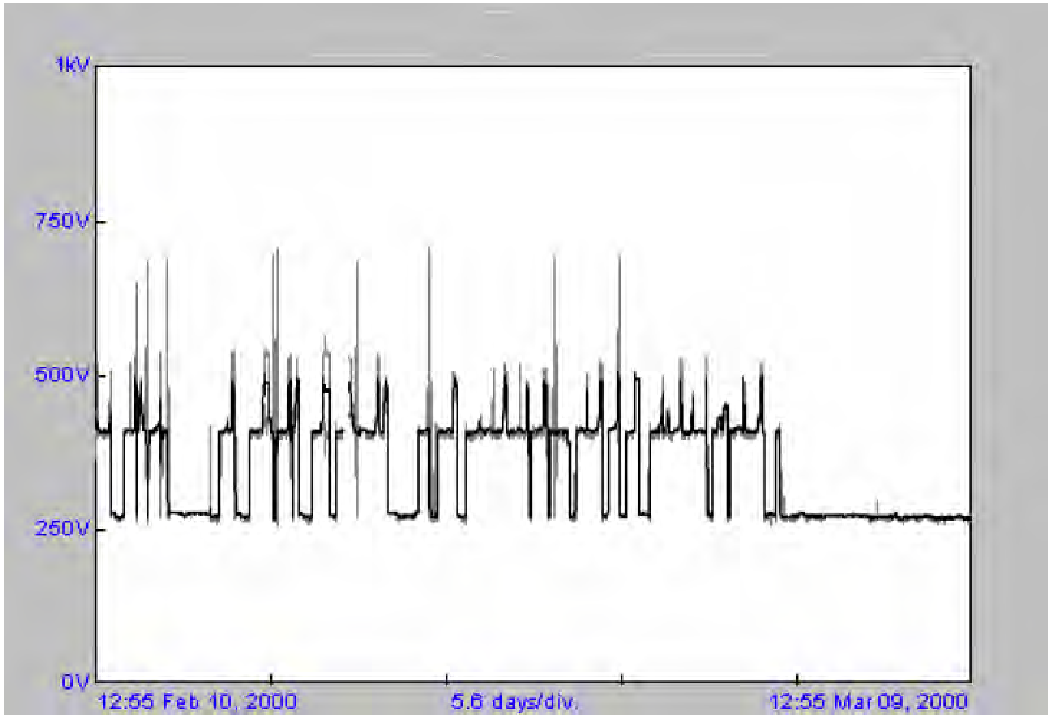
Ungrounded Systems



Case Study

Automotive Facility **Troy Michigan**

Phase to Ground voltage monitored for 4 weeks ungrounded and 4 weeks high resistance grounded.



485 events with peak voltage above 700 volts due to intermittent ground faults.

Peak voltage 1050 volts

Transients lead to insulation degradation.

Impact of Transient Over-voltages

Insulation failure resulting in phase to phase fault and equipment damage in excess of $200k.

Ungrounded Systems

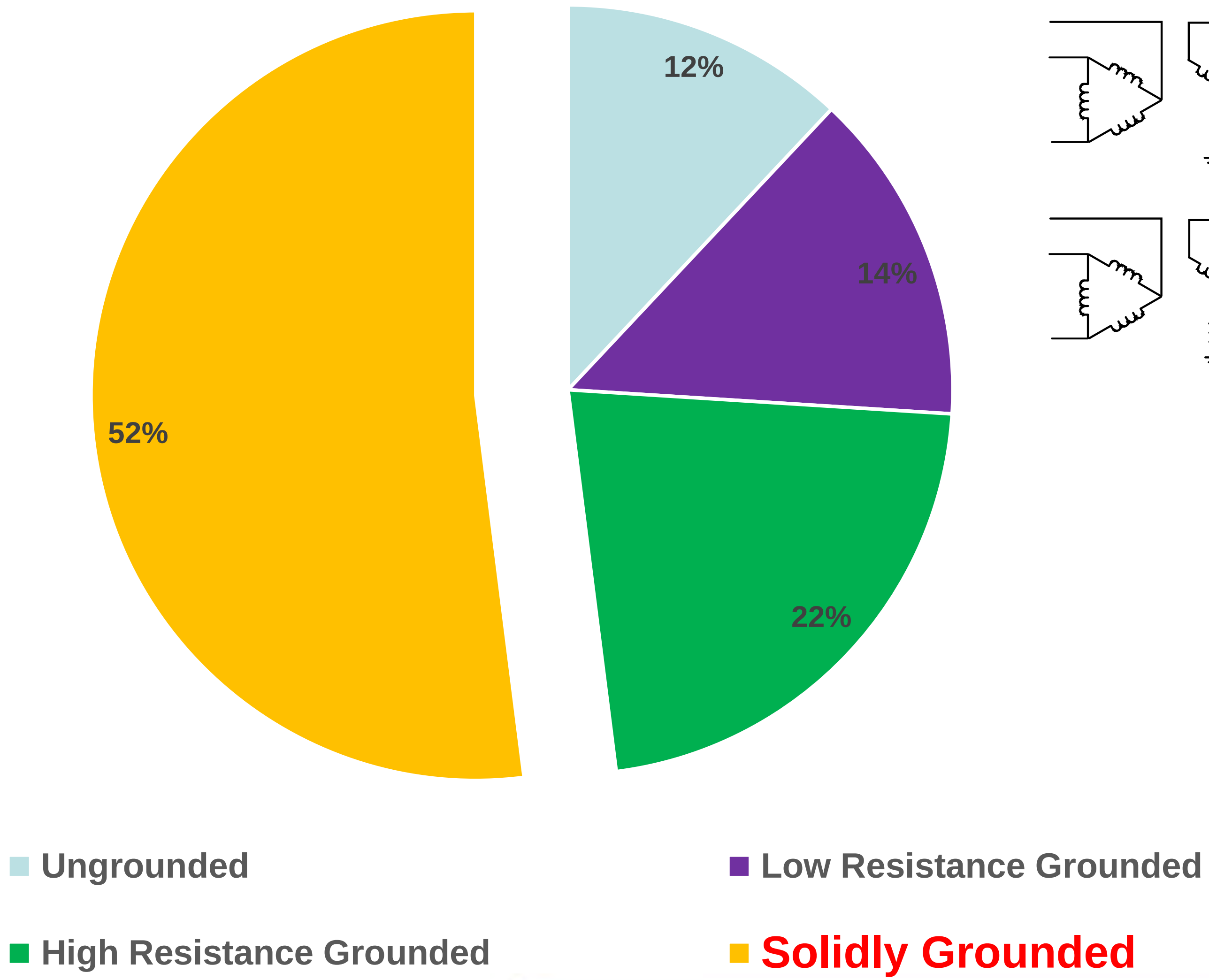
FM Global 5-18 Protection of Electrical Equipment Single Phase and Other Related Faults

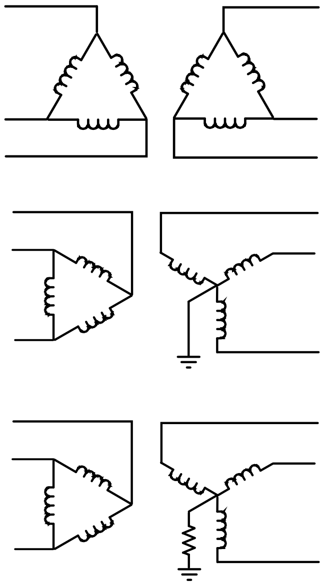
- **In ungrounded systems a phase to ground fault often produces dangerous overvoltage…**
- **Sustained arcing faults in low voltage apparatus are often initiated by a single-phase fault to ground which results in extensive damage to switchgear and motor control centers.**

FM Global 5-10 Protective Grounding for Electric Power Systems and Equipment

- **2.3.3.1 Unlike the ungrounded system the high resistance grounded system prevents transient overvoltage which can cause potential failure of insulation.**
- **2.3.4.1 Convert ungrounded systems to high resistance grounded systems.**

Type of Grounding System





Comments from NFPA 70E & Z462

Informative Annex O Safety-Related Design Requirements

This informative annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

O.1 Introduction. This informative annex addresses the responsibilities of the facility owner or manager or the employer having responsibility for facility ownership or operations management to perform a risk assessment during the design of electrical systems and installations.

(2) Differential relaying. The concept of this protection method is that current flowing into protected equipment must equal the current out of the equipment. If these two currents are not equal, a fault must exist within the equipment, and the relaying can be set to operate for a fast interruption. Differential relaying uses current transformers located on the line and load sides of the protected equipment and fast acting relay.

O.2 General Design Considerations.

O.2.1 Employers, facility owners, and managers who have responsibility for facilities and installations having electrical energy as a potential hazard to employees and other personnel should ensure that electrical hazards risk assessments are performed during the design of electrical systems and installations.

O.2.2 to eliminate hazards or reduce risk by doing the following:

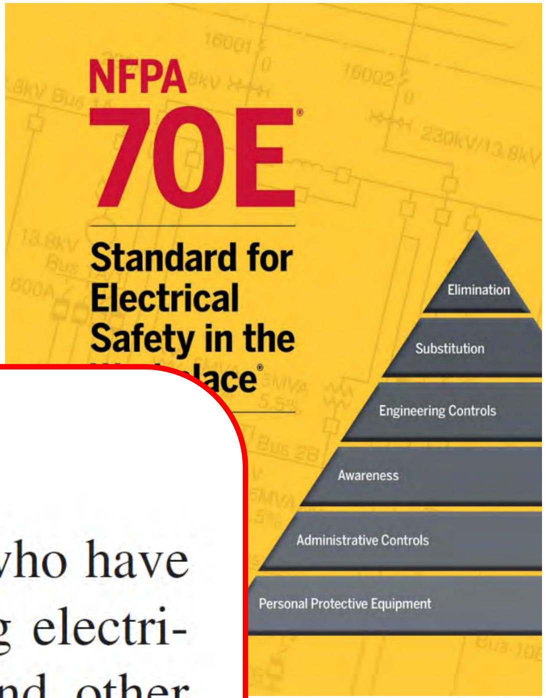
(1) Reducing the likelihood of exposure
(2) Reducing the magnitude or severity of exposure
(3) Enabling achievement of an electrically safe work condition

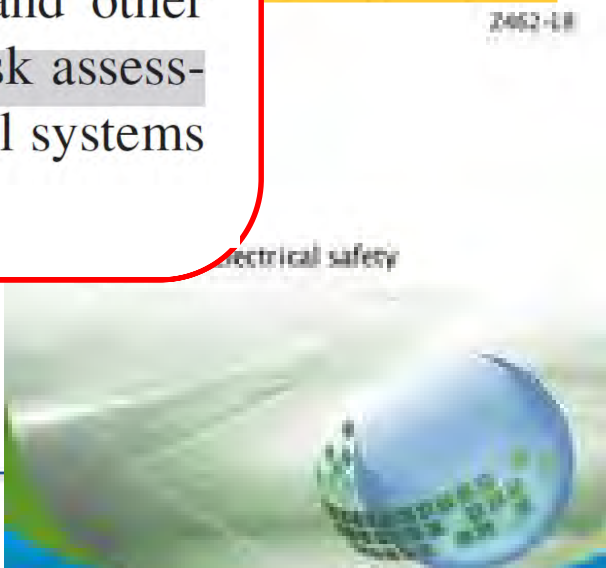
O.2.3 Incident Energy Reduction Methods. The following methods have proved to be effective in reducing incident energy:

(1) Zone-selective interlocking. A method that allows two

cal 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. High-resistance grounding will not affect arc flash energy for line-to-line or line-to-line-to-line arcs.

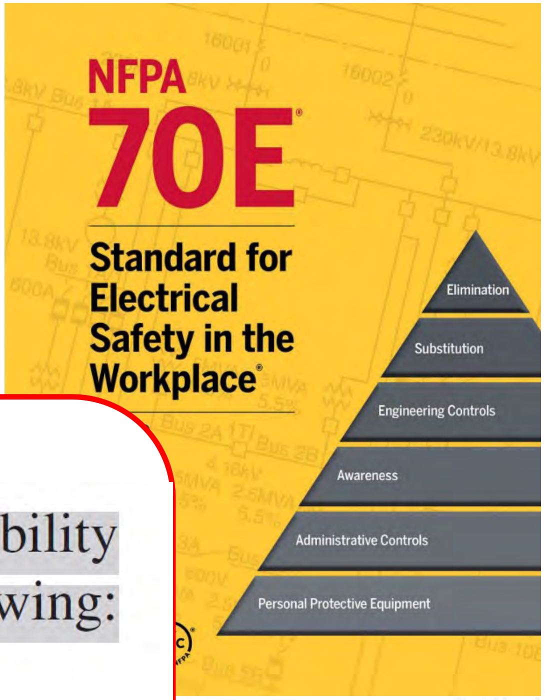
(4) Current-limiting devices. Current-limiting protective devices reduce incident energy by clearing the fault faster and by reducing the current seen at the arc





GARD

Comments from NFPA 70E & Z462



Informative Annex O Safety-Related Design Requirements

This informative annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

O.1 Introduction. This informative annex addresses the responsibilities of the facility owner or manager or the employer having responsibility for facility ownership or operations management to perform a risk assessment during the design of electrical systems and installations.

O.2.2 Design option decisions should facilitate the ability to eliminate hazards or reduce risk by doing the following:

(1) Reducing the likelihood of exposure

(2) Reducing the magnitude or severity of exposure

(3) Enabling achievement of an electrically safe work condition

(1) Reducing the likelihood of exposure
(2) Reducing the magnitude or severity of exposure
(3) Enabling achievement of an electrically safe work condition

O.2.3 Incident Energy Reduction Methods. The following methods have proved to be effective in reducing incident energy:

(1) Zone-selective interlocking. A method that allows two

(2) Differential relaying. The concept of this protection method is that current flowing into protected equipment must equal the current out of the equipment. If these two currents are not equal, a fault must exist within the equipment, and the relaying can be set to operate for a fast interruption. Differential relaying uses current transformers located on the line and load sides of the protected equipment and fast acting relay.

(3) Energy-reducing maintenance switching with a local status indicator. An energy-reducing maintenance

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. High-resistance grounding will not affect arc flash energy for line-to-line or line-to-line-to-line arcs.

(4) Current-limiting devices. Current-limiting protective devices reduce incident energy by clearing the fault faster and by reducing the current seen at the arc

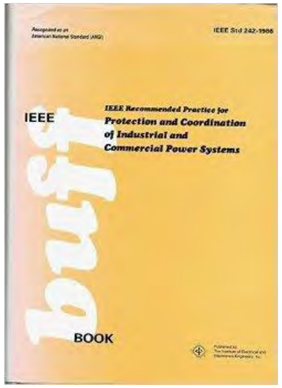
Z462-18

e electrical safety

IEEE Color Books – Arcing Faults

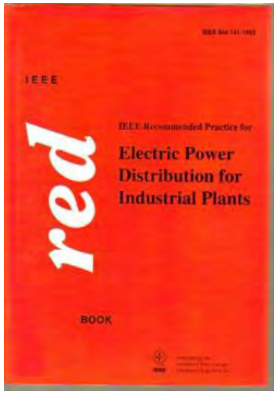
IEEE Std 242-2001 (Buff Book)

- **8.2.2. One disadvantage of the solidly grounded system involves the high magnitude of destructive, arcing ground-fault currents that can occur.**



IEEE Std 141-1993 (Red Book)

- **7.2.4. The solidly grounded system has the high probability of escalating into a phase-to-phase or three-phase arcing fault, particularly for the 480V and 600V systems. The danger of sustained arcing for phase-to-ground fault…is also high for the 480V and 600V systems, and low or near zero for the 208V system.**



Arc Faults on Solidly Grounded Systems

There was a recent electrical fire at a recreational facility that resulted in consequential damages of $400,000, mostly in business interruption costs

During the course of the investigation a simple question was raised.

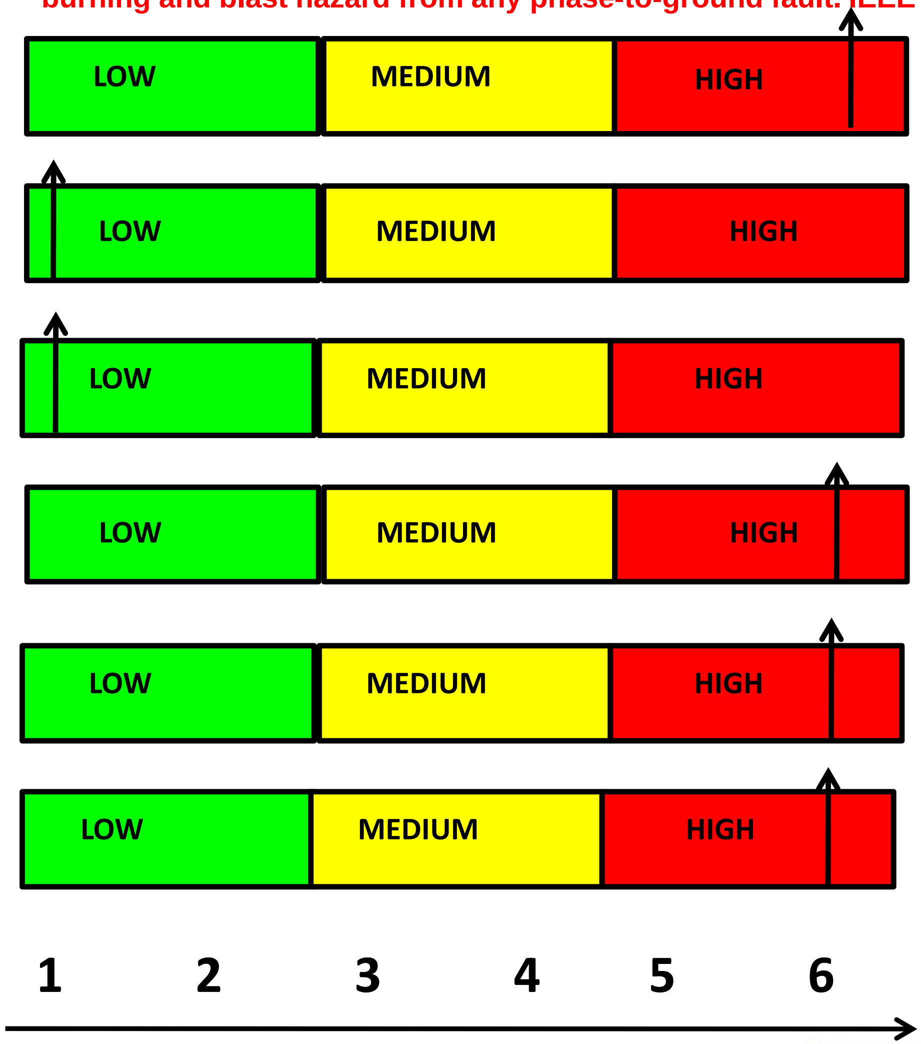
Was the grounding method chosen by the consulting engineer and the facility owner or operator a contributing factor?

The simple answer is YES – while solidly grounded systems are economical and simple they are known to be subject to arc flash hazards.

The fire and damage was not a result of IF but WHEN.

Solidly Grounded Distribution System

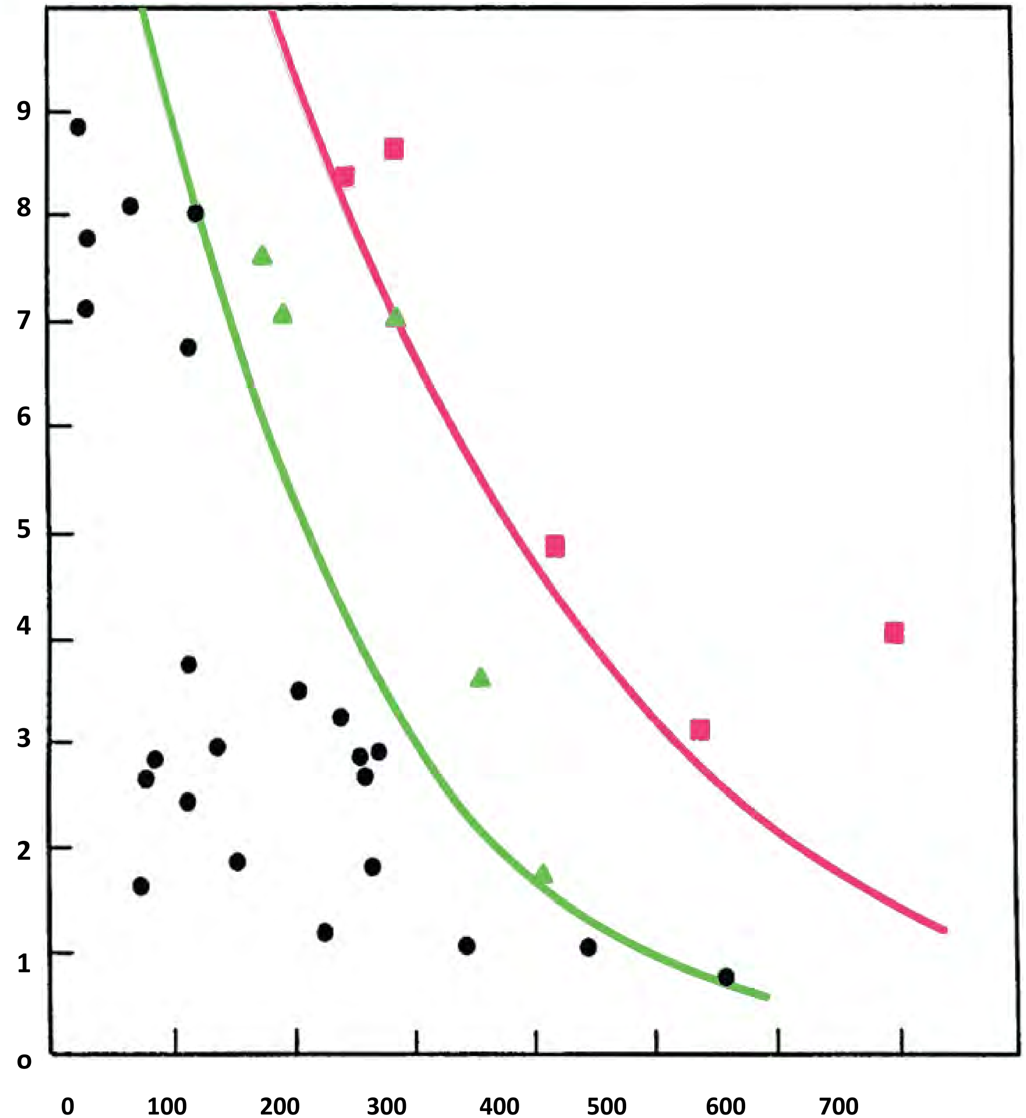
The solidly grounded system has the highest probability of escalating into a phase-to-phase or three-phase arcing fault, particularly for the 480 and 600V systems. A safety hazard exists for solidly grounded systems from the severe flash, arc burning and blast hazard from any phase-to-ground fault. IEEE Standard 141-1993



6	Unscheduled Process Interruptions on first ground fault. Typically $7,000 to $30,000 per hour
1	Unable to locate the first ground fault in a timely manner
1	Loss of Critical Process due to power interruption (second ground fault)
6	Capital Equipment Damage – NFPA Average $45,000.
6	Arc Flash Hazard – frequency / probability
6	Arc Flash Hazard – magnitude of destructive arc
26	

Arc Damage versus Arc Duration

Current kA



An arc is developed within milli-seconds and leads to the discharge of enormous amounts of destructive energy. The energy in the arc is directly proportional to the square of the short-circuit current and the time the arc takes to develop.

Reduce the Time,

Reduce the Damage,

Reduce the Incident Energy.

NFPA 70E 2015 Comments

(2) Arc flash relay. An arc flash relay typically uses light sensors to detect the light produced by an arc flash event. Once a certain level of light is detected the relay will issue a trip signal to an upstream overcurrent device.

Informative Annex O Safety-Related Design Requirements

This informative annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

O.1 Introduction. This informative annex addresses the responsibilities of the facility owner or manager or the em- …

employer should choose design options that eliminate hazards or reduce risk and enhance the effectiveness of safety-related work practices.

O.2 General Design Considerations.

O.2.1 Employers, facility owners, and managers who have responsibility for facilities and installations having electrical energy as a potential hazard to employees and other personnel should ensure that electrical hazards risk assessments are performed during the design of electrical systems and installations.

O.2.2 Design option decisions should facilitate the ability to eliminate hazards or reduce risk by doing the following:

(1) Reducing the likelihood of exposure

(2) Reducing the magnitude or severity of exposure

(3) Enabling achievement of an electrically safe work condition

O.2.3 Incident Energy Reduction Methods. The following methods have proved to be effective in reducing incident energy:

(1) Zone-selective interlocking. A method that allows two or more circuit breakers to communicate with each other so that a short circuit or ground fault will be

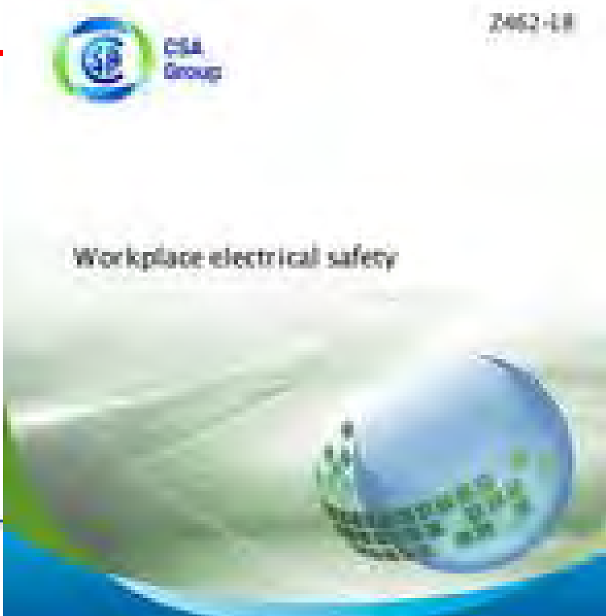
(2) Differential relaying. The concept of this protection method is that current flowing into protected equipment must equal the current out of the equipment. If these two currents are not equal, a fault must exist within the equipment, and the relaying can be set to operate for a fast interruption. Differential relaying uses current …

a low impedance current path, located within a controlled compartment, to cause the arcing fault to transfer to the new current path, while the upstream breaker clears the circuit. The system works without compromising existing selective coordination in the electrical distribution system.

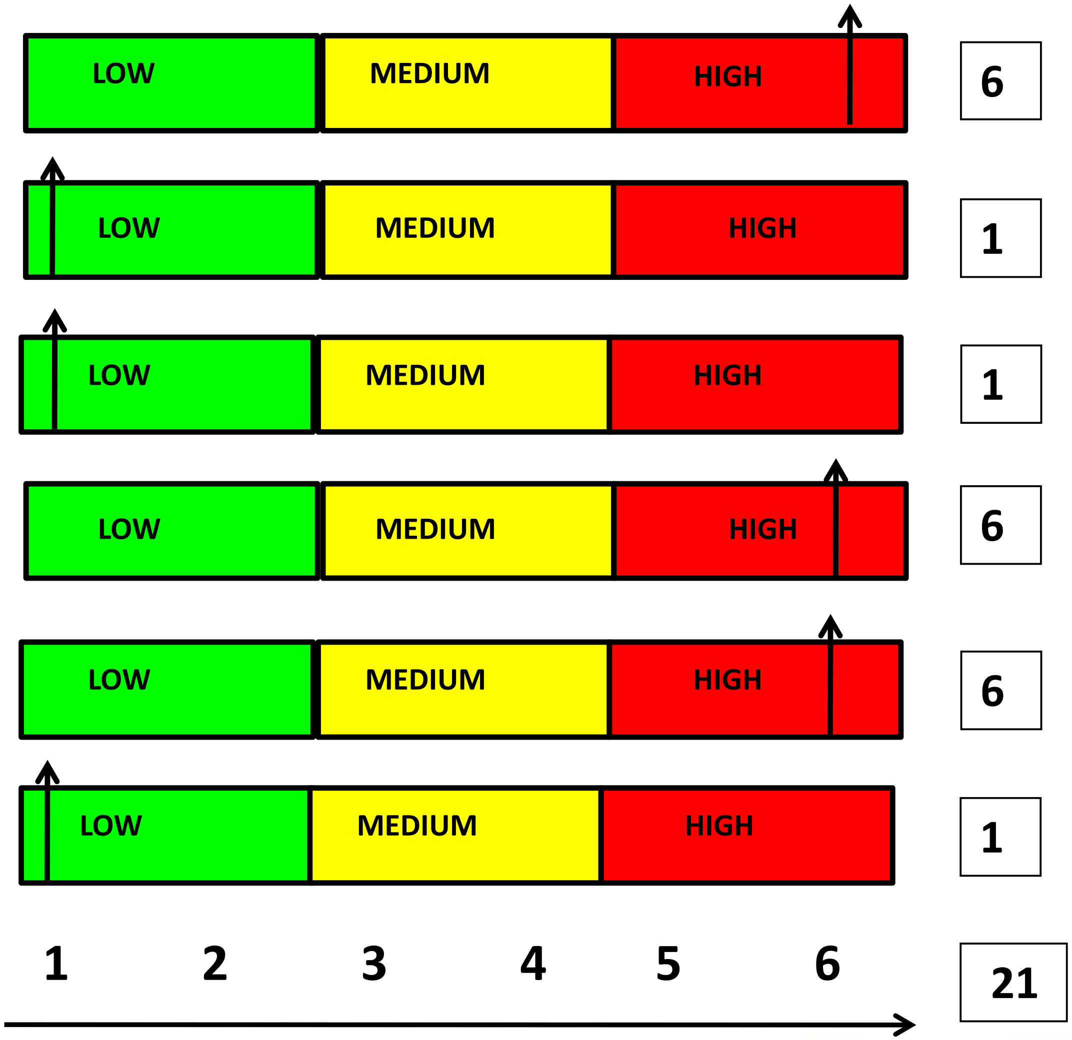
(2) Arc flash relay. An arc flash relay typically uses light sensors to detect the light produced by an arc flash event. Once a certain level of light is detected the relay will issue a trip signal to an upstream overcurrent device.

(3) High-resistance grounding. 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. High-resistance grounding will not affect arc flash energy for line-to-line or line-to-line-to-line arcs.

(4) Current-limiting devices. Current-limiting protective devices reduce incident energy by clearing the fault faster and by reducing the current seen at the arc source. The energy reduction becomes effective for current above the current-limiting threshold of the current-



Solidly Grounded Distribution System plus Arc Mitigation Device



Unscheduled Process Interruptions on first ground fault. Typically $7,000 to $30,000 per hour

Unable to locate the first ground fault in a timely manner

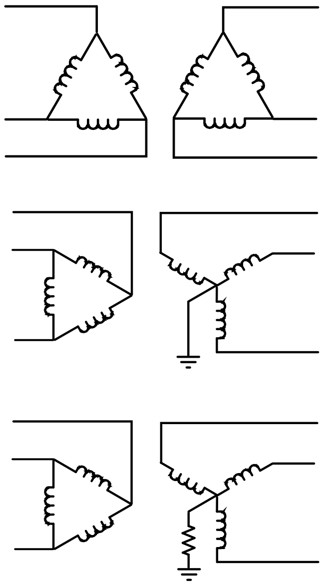
Loss of Critical Process due to power interruption (second ground fault)

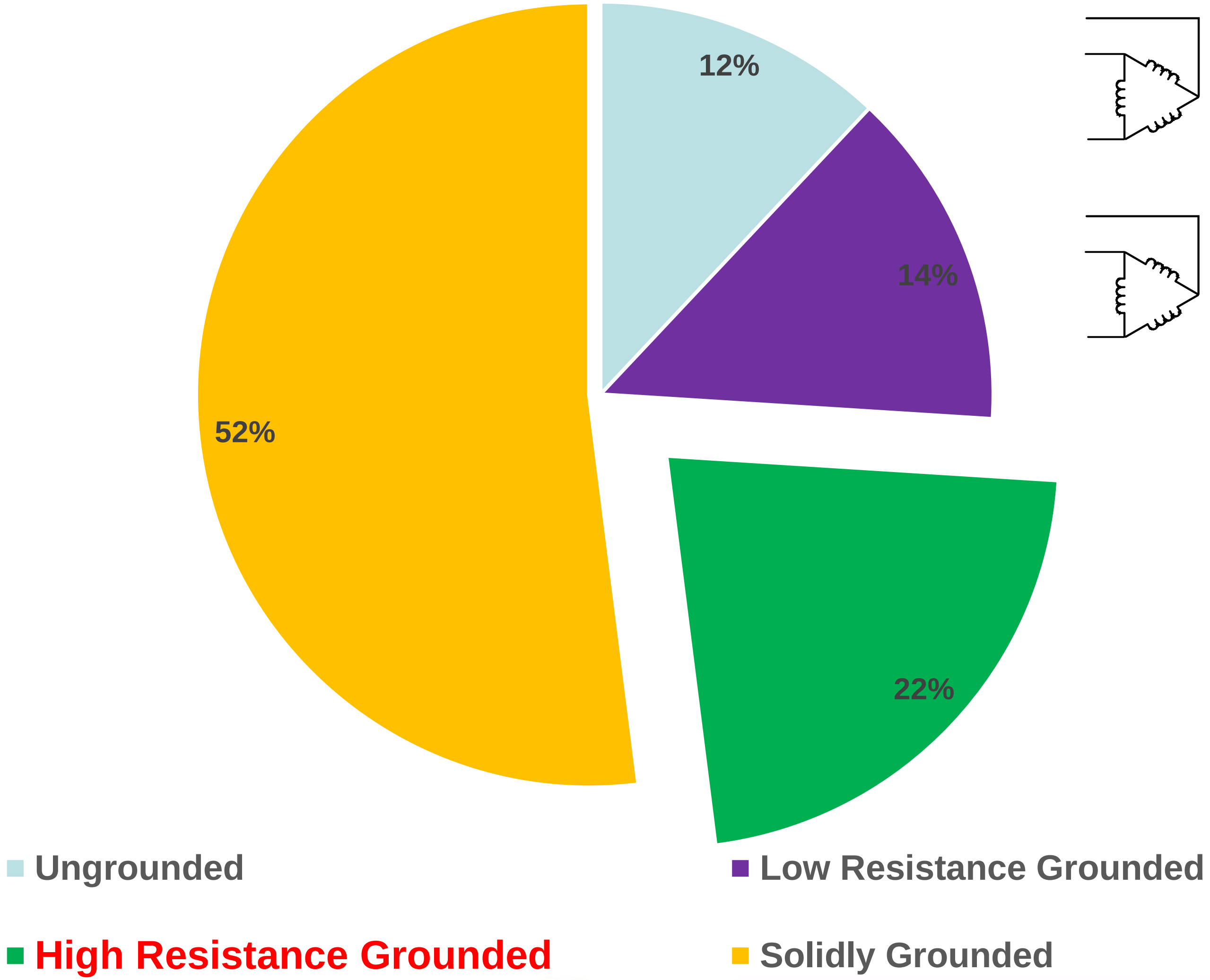
Capital Equipment Damage – NFPA Average $45,000.

Arc Flash Hazard – frequency / probability

Arc Flash Hazard – magnitude of destructive arc

Type of Grounding System

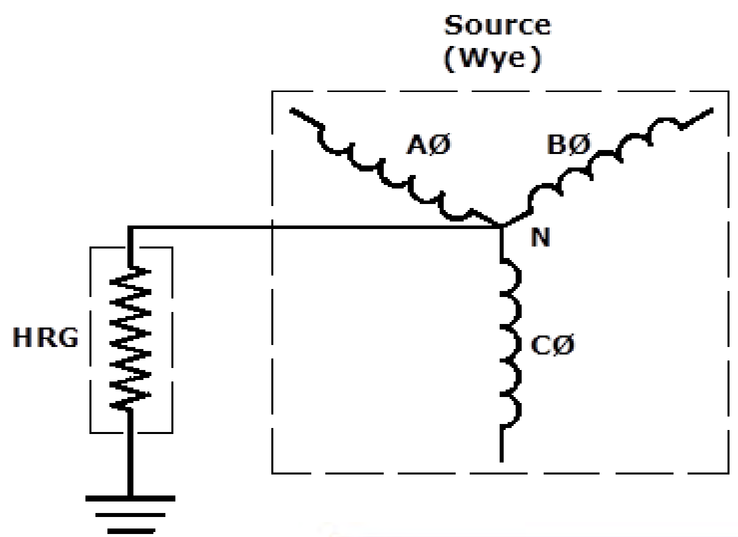




What is High Resistance Grounding?

High resistance grounding of the neutral limits the ground fault current to a very low level (typically from 1 to10 amps) and this is achieved by connecting a current limiting resistor between the neutral of the transformer secondary and the earth ground and is used on low voltage systems of 5000 volts or less, under 3000 amp.

By limiting the ground fault current, the fault can be tolerated on the system until it can be located, and then isolated or removed at a convenient time.



Elimination of Ground Faults and Arc Flash Hazards

How Does HRG reduce Arc Flash?

95% of all electrical faults are phase to ground faults.

By limiting the fault current to a low level, 10 amps or less, there is insufficient current for the arc to re-strike and it self-extinguishes.

High Resistance Grounding

IEEE Std 242-2001 (Buff Book)

- 8.2.4. High-resistance grounding helps ensure a ground-fault of known magnitude, helpful for relaying purposes. This makes it possible to identify the faulted feeder with sensitive ground-fault relays.

IEEE Std 141-1993 (Red Book)

- 7.2.2. High-resistance grounding provides the same advantages as ungrounded systems yet limits the steady state and severe transient over-voltages associated with ungrounded systems. There is no arc flash hazard *[for LV ground faults]*, as there is with a solidly grounded system, since the fault current is limited to approximately 5A.

IEE Std 242-1986 Recommended Practice for the Protection and Coordination of Industrial and Commercial Power Systems

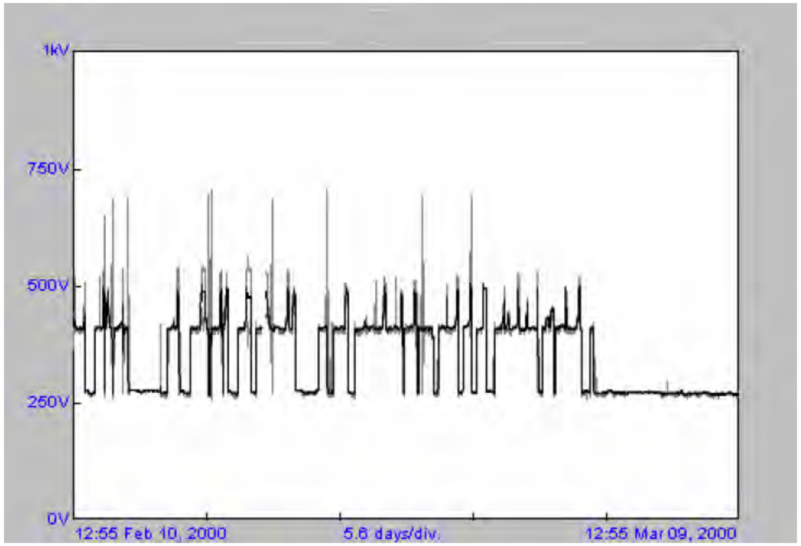
- 7.2.5. Ungrounded systems offer no advantage over high-resistance grounded systems in terms of continuity of service and have the disadvantages of transient overvoltage's, locating the first fault and burn downs from a second ground fault. For these reasons, they are being used less frequently today than high-resistance grounded systems"

High Resistance Grounding

Automotive Facility

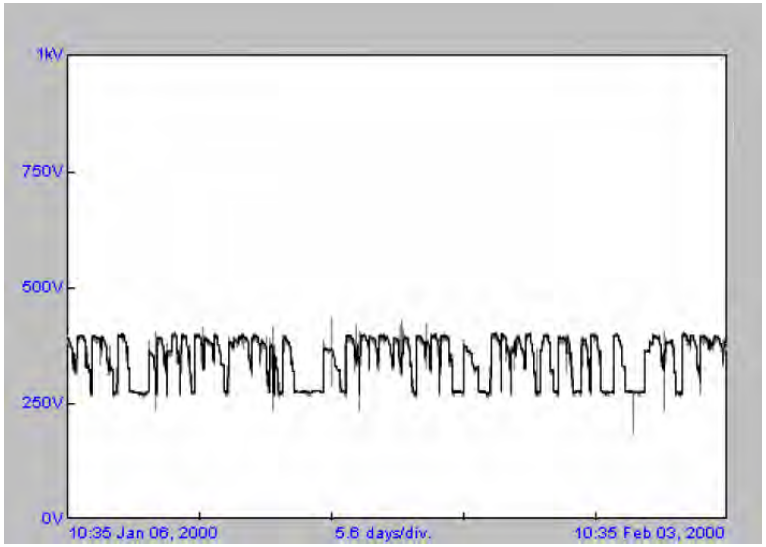
Troy Michigan

Phase voltage ungrounded



High level of transients
485 peak events over 700 volts
Peak voltage 1050 volts

Phase voltage HRG



Transients controlled
0 peak events over 700 volts
Peak voltage 660 volts

NFPA 70E 2018 & Z462 Comments

Informative Annex O Safety-Related Design Requirements

This informative annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

O.1 Introduction. This informative annex addresses the responsibilities of the facility owner or manager or the employer having responsibility for facility ownership or operations management to perform a risk assessment during the design of electrical systems and installations.

O.1.1 This informative annex covers employee safety-related design concepts for electrical equipment and installations in workplaces covered by the scope of this standard. This informative annex discusses design considerations that

(2) Differential relaying. The concept of this protection method is that current flowing into protected equipment must equal the current out of the equipment. If these two currents are not equal, a fault must exist within the equipment, and the relaying can be set to operate for a fast interruption. Differential relaying uses current transformers located on the line and load sides of the protected equipment and fast acting relay.

(3) Energy-reducing maintenance switching with a local status indicator. An energy-reducing maintenance switch allows a worker to set a circuit breaker trip unit to operate faster while the worker is working within an arc flash boundary, as defined in NFPA 70E, and then

(3) High-resistance grounding. 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. High-resistance grounding will not affect arc flash energy for line-to-line or line-to-line-to-line arcs.

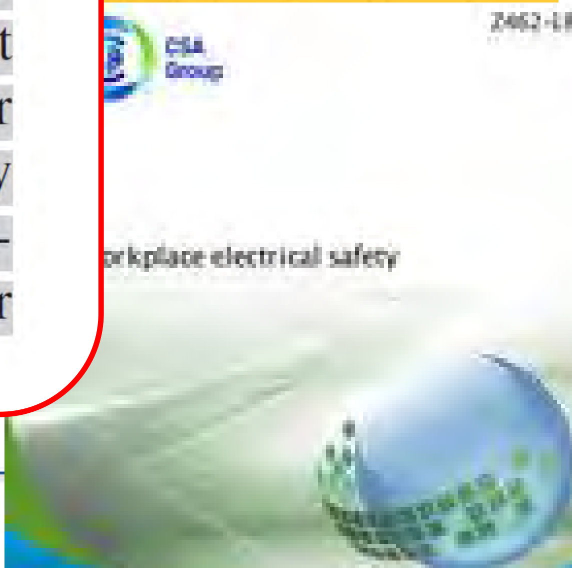
condition

O.2.3 Incident Energy Reduction Methods. The following methods have proved to be effective in reducing incident energy:

(1) Zone-selective interlocking. A method that allows two

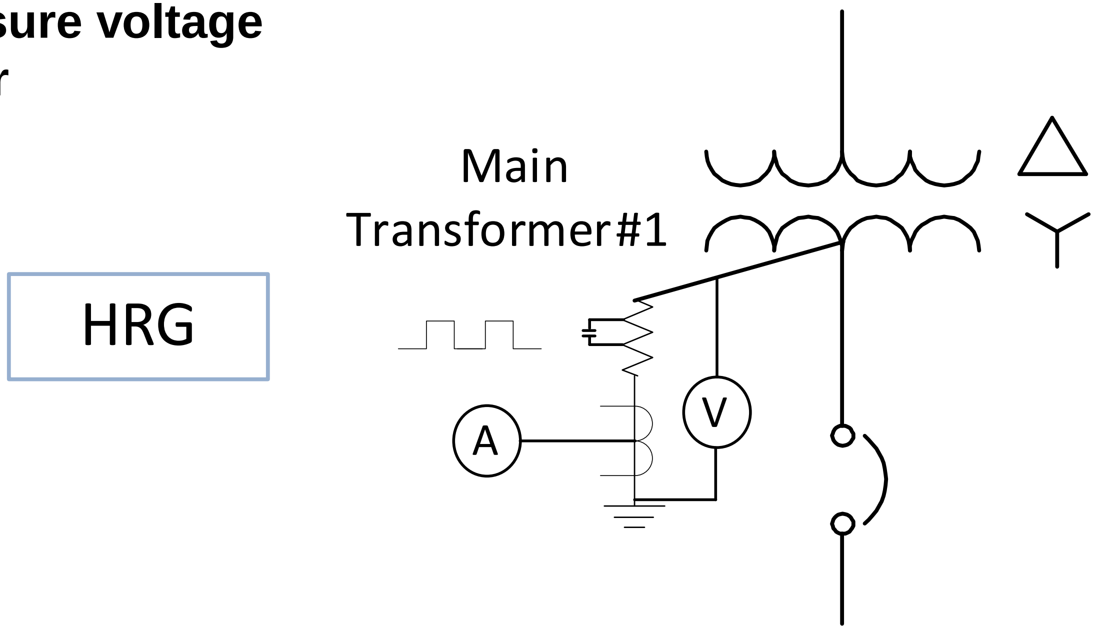
helping reduce the arc flash hazard level. High-resistance grounding will not affect arc flash energy for line-to-line or line-to-line-to-line arcs.

(4) Current-limiting devices. Current-limiting protective devices reduce incident energy by clearing the fault faster and by reducing the current seen at the arc



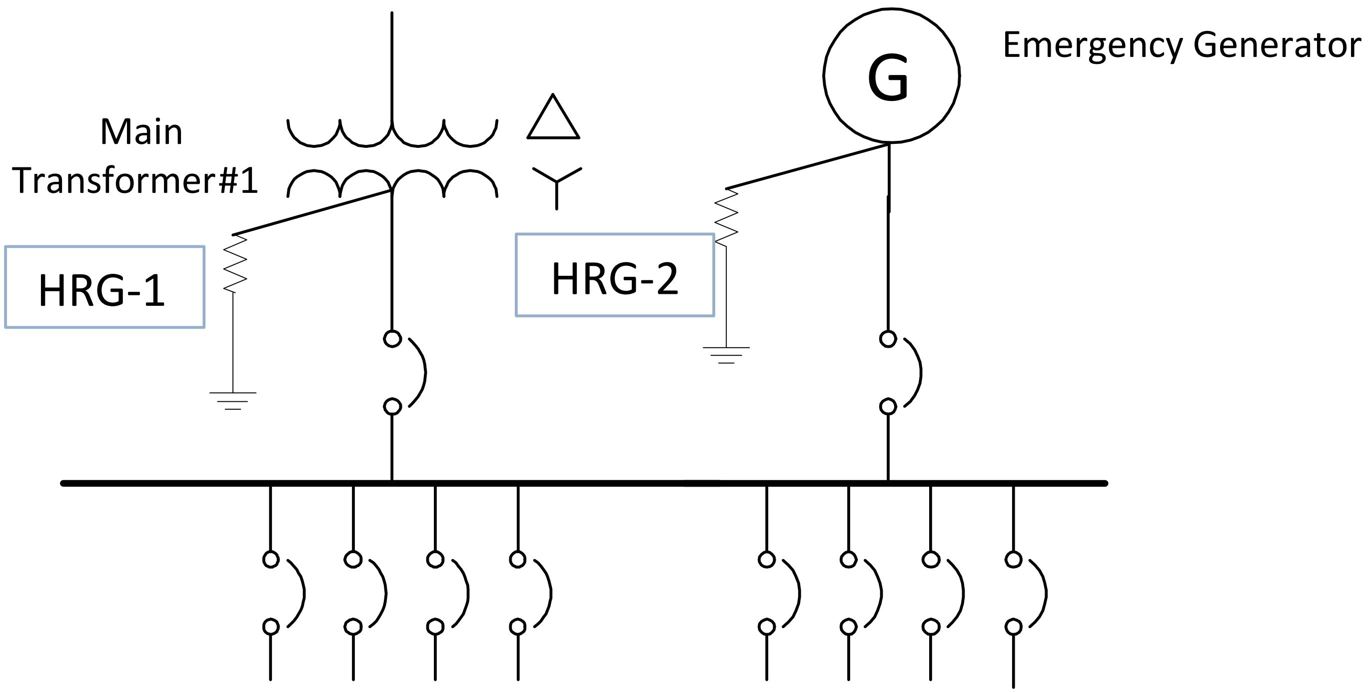
Standard HRG

- Minimum Requirements
- Resistor to limit Fault
- Ammeter to measure current
- Voltmeter to measure voltage
- Pulsing Contactor



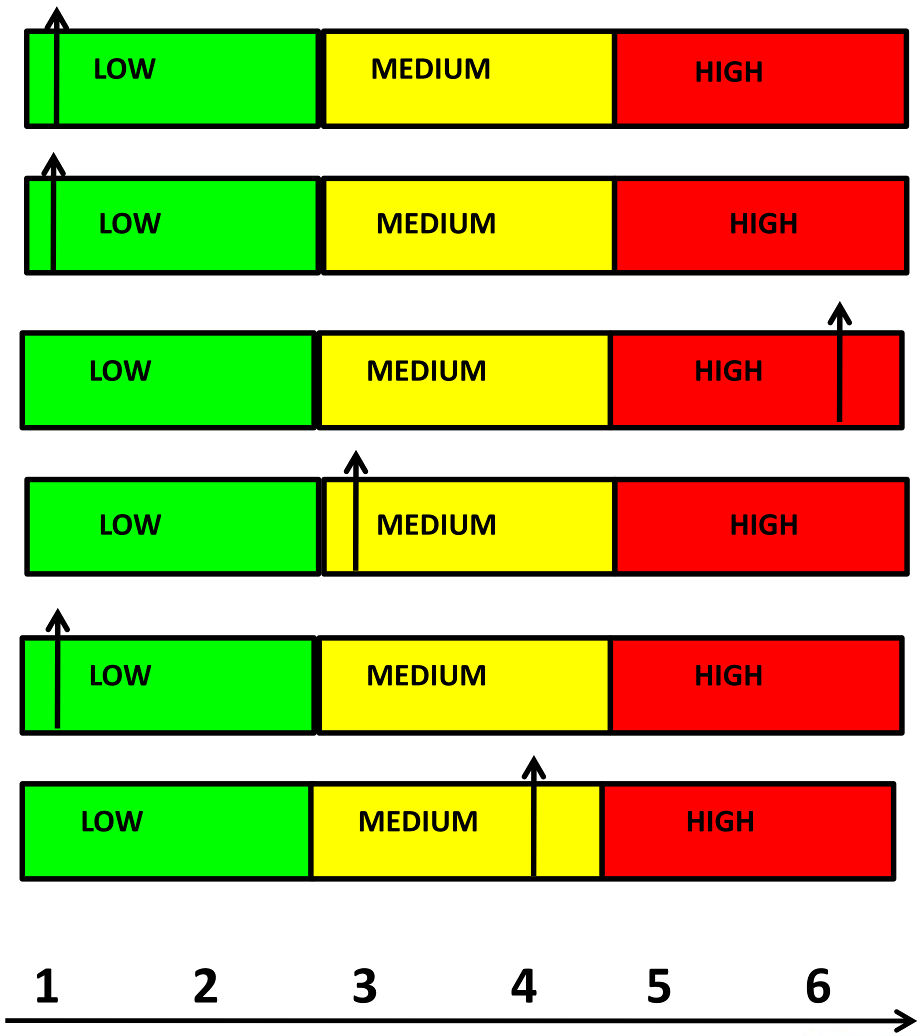
Data Centre

with standard HRG



Standard High Resistance Grounded Distribution System

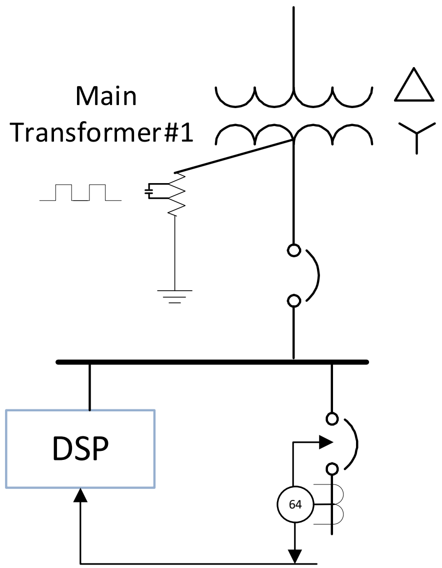
High-resistance grounding provides the same advantages as ungrounded systems yet limits the steady state and severe transient over-voltages associated with ungrounded systems. There is no arc flash hazard, as there is with a solidly grounded system, since the fault current is limited to approximately 5A. IEEE Std 141-1993 7.2.2



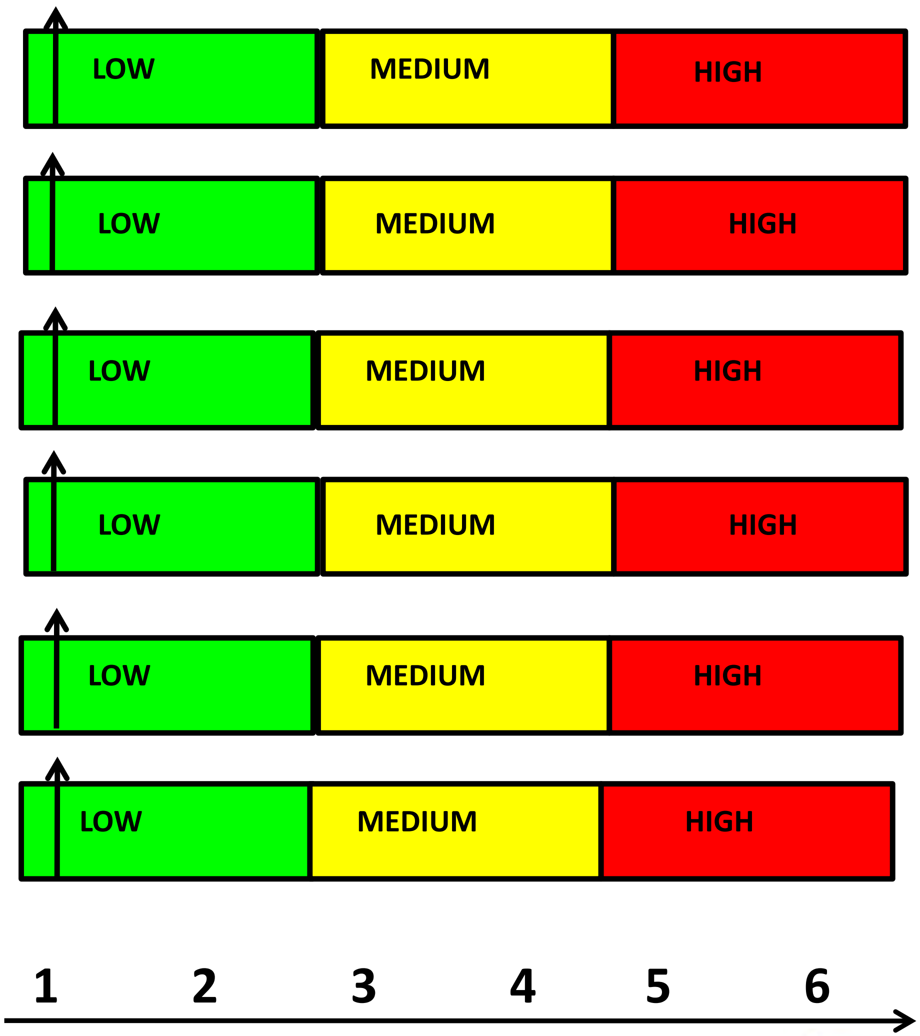
1	Unscheduled Process Interruptions on first ground fault. Typically $7,000 to $30,000 per hour
1	Unable to locate the first ground fault in a timely manner
6	Loss of Critical Process due to power interruption (second ground fault)
3	Capital Equipment Damage – NFPA Average $45,000.
1	Arc Flash Hazard – frequency / probability
4	Arc Flash Hazard – magnitude of destructive arc
16	

Smart HRG

- Minimum Requirements
- Resistor to limit Fault
- Pulsing Contactor
- Option for resistor monitoring
- Feeder Indication
- Easier fault location
- SIFT/ adjustable timer
- Arc Flash Monitor

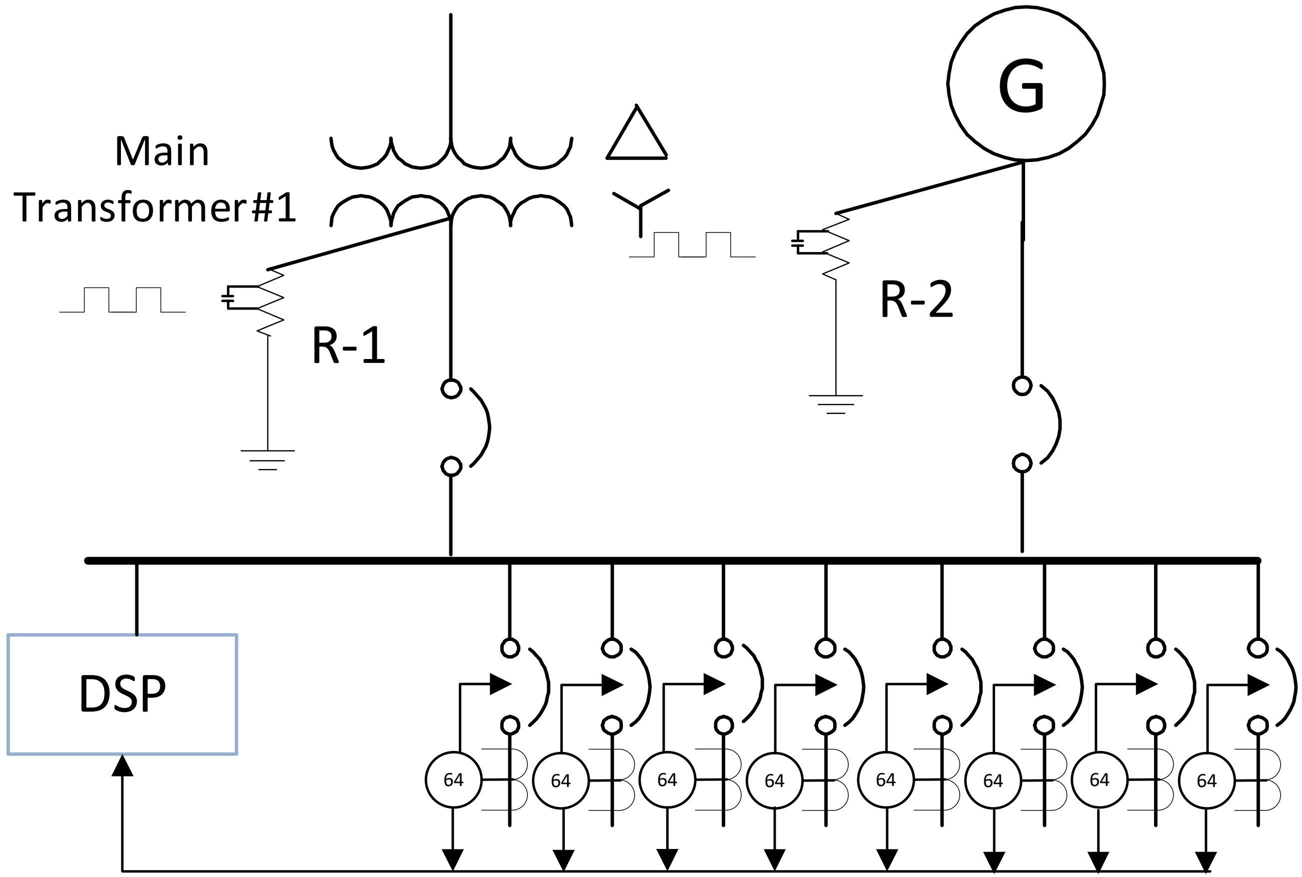


Upgrade to Sentinnel



1	Unscheduled Process Interruptions on first ground fault. Typically $7,000 to $30,000 per hour
1	Unable to locate the first ground fault in a timely manner
1	Loss of Critical Process due to power interruption (second ground fault)
1	Capital Equipment Damage – NFPA Average $45,000.
1	Arc Flash Hazard – frequency / probability
1	Arc Flash Hazard – magnitude of destructive arc
6	

Data Centre with SMART HRG



NFPA 70E & Z 462 2018 Comments

Informative Annex O Safety-Related Design Requirements

This informative annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

O.1 Introduction. This informative annex addresses the responsibilities of the facility owner or manager or the employer having responsibility for facility ownership or operations management to perform a risk assessment during the design of electrical systems and installations.

O.1.1 This informative annex covers employee safety-related design concepts for electrical equipment and installations in workplaces covered by the scope of this standard. This informative annex discusses design considerations that have impact on the application of the safety-related work practices only.

O.1.2 This informative annex does not discuss specific design requirements. The facility owner or manager or the employer should choose design options that eliminate hazards or reduce risk and enhance the effectiveness of safety-related work practices.

O.2 General Design Considerations.

O.2.1 Employers, facility owners, and managers who have responsibility for facilities and installations having electrical energy as a potential hazard to employees and other personnel should ensure that electrical hazards risk assessments are performed during the design of electrical systems and installations.

O.2.2 Design option decisions should facilitate the ability to eliminate hazards or reduce risk by doing the following:

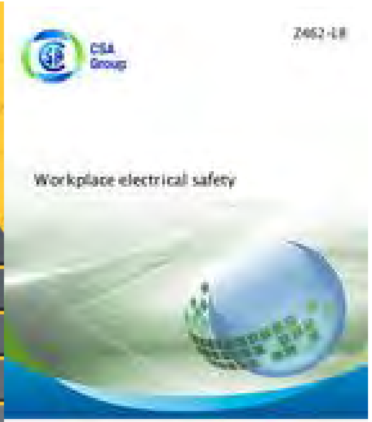
(1) Reducing the likelihood of exposure
(2) Reducing the magnitude or severity of exposure
(3) Enabling achievement of an electrically safe work condition

O.2.3 Incident Energy Reduction Methods. The following methods have proved to be effective in reducing incident energy:

(1) Zone-selective interlocking. A method that allows two or more circuit breakers to communicate with each other so that a short circuit or ground fault will be cleared by the breaker closest to the fault with no intentional delay. Clearing the fault in the shortest time aids in reducing the incident energy.
(2) Differential relaying. The concept of this protection method is that current flowing into protected equipment must equal the current out of the equipment. If these two currents are not equal, a fault must exist within the equipment, and the relaying can be set to operate for a fast interruption. Differential relaying uses current transformers located on the line and load sides of the protected equipment and fast acting relay.
(3) Energy-reducing maintenance switching with a local status indicator. An energy-reducing maintenance switch allows a worker to set a circuit breaker trip unit to operate faster while the worker is working within an arc flash boundary, as defined in NFPA 70E, and then to set the circuit breaker back to a normal setting after the work is complete.

O.2.4 Other Methods.

(1) Energy-reducing active arc flash mitigation system. This system can reduce the arcing duration by creating a low impedance current path, located within a controlled compartment, to cause the arcing fault to transfer to the new current path, while the upstream breaker clears the circuit. The system works without compromising existing selective coordination in the electrical distribution system.
(2) Arc flash relay. An arc flash relay typically uses light sensors to detect the light produced by an arc flash event. Once a certain level of light is detected the relay will issue a trip signal to an upstream overcurrent device.
(3) High-resistance grounding. 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. High-resistance grounding will not affect arc flash energy for line-to-line or line-to-line-to-line arcs.
(4) Current-limiting devices. Current-limiting protective devices reduce incident energy by clearing the fault faster and by reducing the current seen at the arc source. The energy reduction becomes effective for current above the current-limiting threshold of the current-limiting fuse or current limiting circuit breaker.



0.2.2 Design option decisions should facilitate the ability to eliminate hazards or reduce risk by doing the following:

(1)Reducing the likelihood of exposure
= High Resistance Grounding

(2) Reducing the magnitude or severity of exposure = arc flash relays or active arc mitigation.

A Product for Every Grounding System

What Type of Grounding System Do You Use?

Ungrounded

ViA
- Ground Fault Indication on Wye or Delta-connected, 3-phase, 3-wire
- No external hardware
- Protection Relay

Turbo Sleuth
- Portable HRG System
- Fault Limiting Resistor
- Pulsing Circuitry

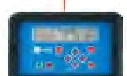
Insulation Monitoring
- Automatic Operation
- Early warning of insulation problems
- Usable with variable speed drives
- Integral Self-test capability

Resistance Grounded

High

Gemini
- Dual path current limiting resistor
- Redundant fail-safe resistor circuit
- Integral ground fault relay
- Integral ground monitoring relay
- Fault location through pulsing
- Harmonic filter and time / current adjustments to reduce false trips

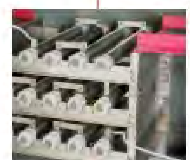
Sentinel
- Current limiting resistor
- Voltage and current sensing
- Integral ground fault relay
- Integral ground monitoring relay
- Fault location through pulsing
- Harmonic filter and time / current adjustments to reduce false trips
- Inrush detection restraint
- Multi-feeder protection
- Second fault protection
- MODBUS for remote monitoring



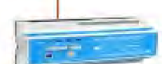
DSP-OHMNi
- Monitors and protects up to 50 feeders on one relay
- 1st Fault Alarm, 1st Fault Trip or 1st Fault Time Delay Trip
- Resistor Monitoring Module
- Selective Instantaneous Feeder Trip on 2nd ground fault

Gardian
- HRG reduces the frequency of arc flash incidents and optical detection reducing impact, all in one.

Low

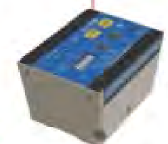


NGR
- Complete range of NGR from 480V to 69,000V
- Only NGR with integral ground fault relay (2400V + above)
- Designed with special element material with low temperature coefficient of resistivity for consistent fault current levels
- Edgewound element design eliminates hot-spots
- CSA certified and UL approved



Sigma
- Monitoring Relay

Solid Grounded



Sentri
- Arc Flash Mitigation
- ZSIP Selective Instantaneous Protection
- 40 trip levels from 100 mA up to 1200A

m-Gard (10;100;125,250)
- Microprocessor based ground fault relay
- Built-in zero sequence current sensor (ZSCS)
- MODBUS connection to external Network
- Monitors up to 50 devices
- Remote Data Collection
- Remote Relay Reset

ARC-i-TEC
- Fastest Arc Detection Technology
- Combines monitoring for abnormal current to avoid nuisance tripping
- 4 output relays for tripping and alarming

Pressure Arc Detector
- Fast detecting of the pressure wave generated by the arc
- Detection time in 10ms
- Easily integrates with other arc mitigation technology

Hybrid Grounding

Contact I-Gard for a system solution that works with your needs!

www.i-gard.com

Phone: 905-673-1553
Toll Free: 1-888-737-4787
Fax: 905-673-8472
sales@i-gard.com

Why Partner with I-Gard?

Product for every grounding system which means any industrial facility operating at 480V to 5kV is a potential customer.

The industry’s widest range of HRG products from the most economical to the most advanced.

The industry’s most advanced HRG which ensures the customer process reliability and arc flash hazard reduction.

Range of arc mitigation products from simple arc detection devices to active arc reduction systems.

Application experience and installation references.

System Grounding Comparison

Reliability and Safety Impact	Ungrounded	Solidly Grounded	High Resistance Grounded	Smart SENTINEL HRG	Smart SENTINEl HRG c/w ADM Module
Process continuity under ground fault condition	✓	✗	✓	✓	✓
Control transient over-voltages	✗	✓	✓	✓	✓
Ability to locate ground fault	✗	✓	✓	✓	✓
Process continuity of critical process with second ground fault	✗	✗	✗	✓	✓
Arc Flash Mitigation for safety	✗	✗	✗	✗	✓

Thank you

Support Support@i-gard.com