



How to reduce exposure to arc flash hazards

Multiple solutions for new and existing facilities



imagination at work

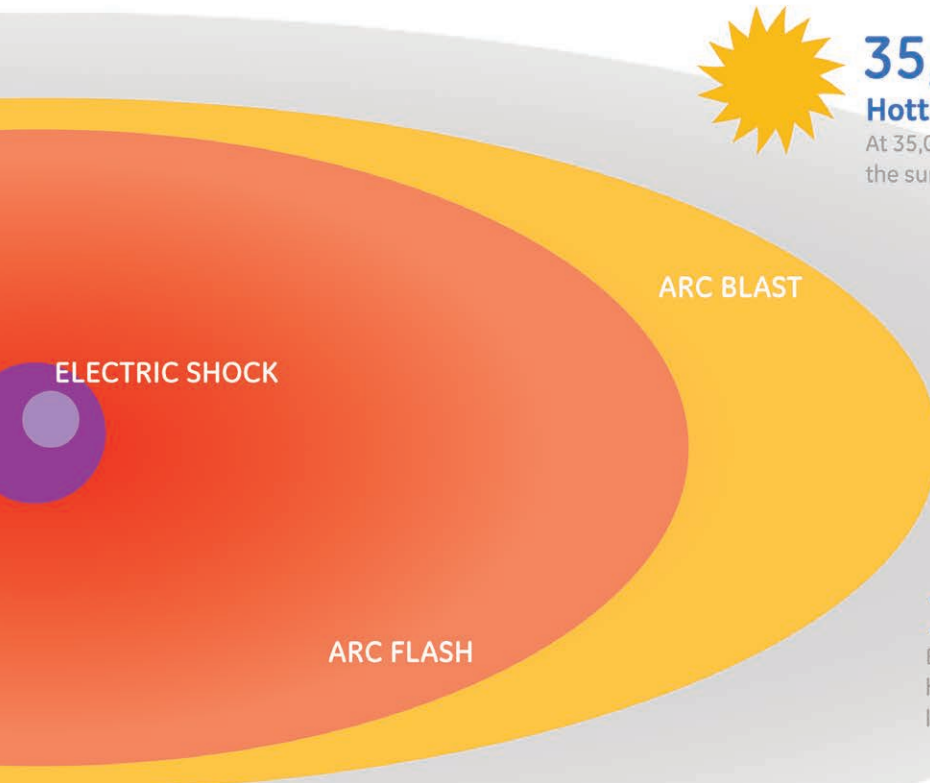
Arc Flash:

A Real Danger of Conducting Business

Arc Flash Happens at Least One Time Every Day.

Accidental contact between conductors creates Arc Flash.

The most common causes: human error, curious rodents, equipment underrated for the available short-circuit level of the system, contamination, deterioration, or corrosion of conductor insulation.



35,000° F

Hotter Than You Can Imagine

At 35,000° F, Arc Flash temperatures are hotter than the surface of the sun.



700 mph

Projectile-Producing Pressure

Vaporizing metals from an Arc Flash produce pressure and sound waves strong enough to throw workers across a room. Molten metal flies from flashpoint at 700 mph. Tools and equipment can become life-threatening shrapnel.

140 dB. An Assault on Your Senses

Extreme light and sound outbursts can cause vision and hearing loss. Inhaling gases from vaporized metals is a long- and short-term health risk.

10 ft.

Too Close for Comfort

Arc Flash can reach out 10 feet to take a life. Serious-injury zone is even larger. PPE reduces arc flash injury risk, but can make even simple procedures tedious.



2,000+ people

More Than One Way to Burn You

Arc Flash's extreme heat burns workers directly and ignites clothing. Each year more than 2,000 people seek treatment for serious Arc Flash burns.

\$15,000,000

It Burns Through Your Cash, too

One Arc Flash incident can cost up to \$15MM when you total healthcare, workers compensation, new equipment, increased insurance premiums, and lost production time.

100% of the time

Limit Exposure to Reduce Risk

Actively manage risk with fault diversion, advanced diagnostics, protective equipment, barriers, and remote operations.



Multiple Solutions

Arc flash hazard exposure is a function of fault clearing time at an arcing current and a worker's distance from the event. Multiple techniques can be employed to limit exposure.

GE delivers multiple products and services that reduce exposure in both new and existing facilities.



Approach	1 Reduce incident energy	2 Deploy preventative maintenance capability	3 Help minimize event equipment damage	4 Shield personnel/add distance
Arc Vault* Protection System				
ArcWatch*				
Entellisys*				
Arc Resistant Equipment				
Arc Flash Mitigation MCC Units				
Breakmaster* V				
RELT				
EntelliGuard* TU				
Current Limiting Circuit Breakers				
EntelliGuard Manager Gateway				
Meter in a Box (MIB)				
Remote Racking Devices				
envisage*				
Arc Flash Hazard Analysis				
Services Maintenance Program/ Scheduled Outage				



Arc Vault* protection system

Out of the box thinking, inside the box protection

The Arc Vault protection system consists of an activation switch, a protective trip unit and a containment dome, all working together to provide fast protection from arc flash hazards. With the activation switch enabled, the trip unit will look for a current spike, then trigger the containment dome and call for the main breaker to trip. A secondary arc fault is created within the containment dome, which can extinguish the arc flash within 8ms of the initial event. The secondary arc flash continues, protected in the containment dome, until the main breaker clears and de-energizes the entire system.

- Contains arc fault in less than 8ms, resulting in incident energy in accordance with IEEE 1584 at 18" from the arc event of less than 1.2 cal/cm², with the circuit breaker compartment doors open in a 480V 65kAIC system.
- Reduces building construction costs, when compared to traditional arc resistant switchgear, because it does not require exhaust chimneys or plenums to direct the arc flash energy outside of the building.
- If an arc flash incident occurs during maintenance, the low-voltage switchgear can be operational again within a working day.
- Reduces the energy released by 63% or more, compared to a bolted fault that would occur with a crowbar system.
- Can be retrofit onto existing GE or other manufacturers' low voltage equipment, including switchgear, switchboards and MCCs.
- Protects the transformer transition section and the low-voltage lineup in a system that contains an upstream controllable device. In a system where an upstream controllable device does not exist, the Arc Vault protection system will provide protection to the downstream low voltage equipment only.
- Can be retrofit without having to replace the existing low voltage equipment lineup.



ArcWatch Technology

Don't compromise protection for coordination

ArcWatch is a set of GE Technologies, WaveForm Recognition (WFR)¹ and Instantaneous Zone Selective Interlocking (I-ZSI) which, when used in combination with one another allow system design that does not require compromise between instantaneous protection from arcing faults and full (.01 Second) selective coordination. Using these technologies, ArcWatch can reduce incident energy to less than 8 cal/cm² in.

¹Limited to 480V

ArcWatch* technology is available in the following GE products:

- Evolution* Switchboard
- Entellisys* 5.5 Low-Voltage Switchgear
- AKD-20 Low-Voltage Switchgear
- Evolution Series E9000* Motor Control Center
- Entelliguard* G Circuit Breakers with EntelliGuard Trip Unit
- Record Plus* Circuit Breakers with PremEon* S Trip Unit
- Spectra* RMS Circuit Breakers with *micro*Entelliguard* Trip Unit
- WavePro Circuit Breakers with EntelliGuard Trip Unit
- Power Break II Circuit Breakers with EntelliGuard Trip Unit



Entellisys* 5.5 low-voltage switchgear

Entellisys represents a remarkable advance over traditional low-voltage switchgear. Applicable to a wide variety of industries, Entellisys takes a two-pronged approach to arc flash mitigation by reducing your activity risk while lowering incident energy.

- ArcWatch* compatible
- External HMI mounting options keep operators outside the arc flash boundary, where they can monitor, operate and troubleshoot away from live gear.
- Bus differential protection
- Integrated high-resistance ground fault (HRGF) protection
- When activated by the operator, Reduced Energy Let-Thru (RELT) enables pre-set overcurrent and ground fault settings for faster, more sensitive protection.
- Remote racking device to allow racking in or out of circuit breakers by operators well outside the arc flash boundary.
- Fully insulated and isolated bus to reduce potential bus faults.
- Fully compartmentalized circuit breakers help to minimize arc fault transmission within the equipment.



AKD-20 low-voltage switchgear

- Epoxy bus insulation, complete live bus and compartment isolation, compartmentalized control wiring and automatic shutter system minimize arcing fault generation.
- Non-vented front panels keep probability of arc effluent exiting towards operating personnel low.
- Infrared port access, hinged equipment panels, control circuitry drawers and remote communications improve maintenance results.
- Fast, ultrasensitive protection provided by EntelliGuard G circuit breakers and EntelliGuard TU trip units.
- Temporary extra-safe protection settings delivered by RELT (Reduced Energy Let-Through) with positive status indication.



AKD-20 Arc Resistant (AR)

Arc Resistant Enclosures

Arc resistant enclosures are available for Entellisys 5.5 and AKD-20 low-voltage switchgear, and offer the following features:

- Meets the IEEE C37.20.7 Type 2B AR standard
- Internal exhaust chimney
- Heavy-duty enclosure
- Same footprint as standard AKD-20 and Entellisys
- Insulated/isolated bus
- Bus compartment barriers
- Section barriers and shutters
- Push-to-latch circuit breaker cubicle doors
- Pressure activated rear vent flaps
- Reinforced circuit breaker escutcheon gasket
- Plenum flange
- Full height hinged and bolted rear doors
- Floor plates in cable compartment



E9000* low-voltage motor control centers

- Starters up to 600A protected by current limiting circuit breakers and motor circuit protectors reduce incident energy
- Fully insulated horizontal bus, fully compartmentalized horizontal bus, fully isolated vertical bus bars help minimize risk of arcing
- Advanced monitoring, diagnostics and communication capability, reducing the need for hands-on maintenance
- Visible blade disconnect option available
- IP20 and separable terminal blocks help minimize risk of shock during work in starter cubicles



Medium-voltage arc resistant switchgear

Arc-resistant switchgear channels the energy released during an internal arc fault in ways that reduce the potential for injury to personnel and damage to surrounding equipment.

- ANSI Type 1 or Type 2 construction available
- Footprint no larger than standard design
- Interlocked circuit breakers for added protection
- Closed door racking
- Optional plenum allows for indoor construction
- Top mounted plenum to direct the arc flash away from the equipment to a safe external atmosphere, and obtain true arc resistance rating.



Arc Flash Mitigation (AFM) Units

The E9000 AFM units are designed to reduce the likelihood of exposure to electrical shock and the potential of internal arcing faults from occurring during maintenance.

- Two-position closed-door retractable unit stabs
- Automatic operation vertical bus isolation shutter
- Stab and Shutter position indicators on unit doors
- Padlock for racking screw & stab-breaker interlock
- Compact NEMA contactor allows a minimum IP10 protection with optional IP20 safety features and incidental contact barriers
- Stab and Door Interlock: prevents opening the unit door when stab is energized.
- Stab and Unit Interlock: prevents user from taking the unit out when stab is energized or, inserting the unit into the bus when stab is extended.
- Racking Screw and Disconnect Interlock: prevents the user from racking the stab in/out of the unit with the disconnect in the "ON" position.



Limitamp* arc resistant medium-voltage motor control centers

GE's Arc-Res Limitamp is a great solution for applications where an extra margin of protection is essential. Limitamp AR is designed to contain and redirect the arc flash energy and exhaust gases up through special vent flaps at the top of the enclosure and away from the system through a plenum.

- Meets IEEE C37.20.7-2007-Type 2B Standard
- Heavy-duty enclosure for reliable safe operations and ease of maintenance
- Fully isolated low-voltage compartment in front door for relays, meter, lights and switches
- Internal construction to ensure the arc flash gases and products are directed to the upper section of the enclosure
- State-of-the-art vent/flap mechanism for arc mitigation
- Flexible design of plenum to meet customer requirements
- Visual disconnection safety feature via window in outer high voltage door



Breakmaster V

GE's Breakmaster V solution provides reduced Arc Flash incident energy levels for customers on their existing MV equipment. This new solution includes a fixed-mount IEC SecoVac* VB2 Plus vacuum circuit breaker (VCB) in the fused compartment of Load Interrupter Switch (LIS). Operating in three cycles, the fast-acting SecoVac VCB offers a new Arc Flash mitigating solution designed in response to Arc Flash Safety Standards.

The Breakmaster V solution reduces Arc Flash levels to help enhance safety and provides increased flexibility:

- Reduced Arc Flash levels from the transformer down to the LV system
- Use as a main or feeder device which can also be part of a line-up that includes the fused or unfused Breakmaster LIS
- Relay options that provide upstream and/or downstream communications
- Maintains the same footprint as the fusible Breakmaster LIS
- The added reliability and quality of an IEC-rated, fast-acting, 3-cycle Vacuum Circuit Breaker with embedded pole technology
- Protection provided via the latest relay technology including bus and transformer differential options



RELT (Reduced Energy Let-through)

RELT helps to minimize the risk of an arc flash event when approaching hot gear. When breakers and equipment temporarily change the instantaneous trip to lower levels, you dramatically lower incident energy potential.

- Less Fault Current = Lower Incident Energy
- With lower incident energy potential, workers may be able to wear less restrictive PPE.
- RELT only lowers incident energy when needed to work safely and then you can restore settings that minimize the likelihood of trips.



EntelliGuard* TU trip unit

Industry-leading capabilities improve selectivity and help to mitigate arc flash hazards.

- Temporary extra-safe protection settings delivered by RELT (Reduced Energy Let-Through) with positive status indication provide extra sensitive and fast protection
- Up to 44 different long time delay bands in two distinct shapes
- Up to 11 short time delays as fast as 1.5 cycles to commit
- Multiple short time I²t curves set selectively without sacrificing protection
- Four different ground fault curve shapes provide optimal selectivity when implementing ground fault protection in systems with circuit breakers or fuses
- Metering, waveform capture, protective relays, Modbus and Profibus communications
- Plug-and-play upgradeability for GE Legacy low voltage power circuit breakers
- Conversion kits available for competitor trip units



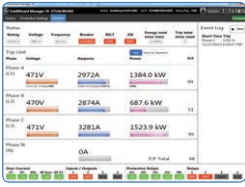
Current-limiting circuit breakers

Current-limiting circuit breakers are fast-acting and limit the amount of incident energy. GE offers the following circuit breakers with current-limiting technology:

Thermal-magnetic, Current Limiting¹:

- Record Plus: FB, FC, FD
- Q-Line: THQC/THHQC, THQB/THHQB, THQL / THHQL
- TEY Family: TEY, TEY (F, D, H, L)
 - Electronic, Current Limiting¹:
- Adjustable Instantaneous (LI or LIG):
 - Record Plus: FE, FG (with SMR1 or PremEon S Trip Unit)
 - Spectra: SE, SF, SG
- Fully Adjustable (LSI or LSIG)
 - Record Plus: FG (with SMR2 Trip Unit)
 - Spectra: SG (with *micro*EntelliGuard Trip Unit)

¹ Many MCCBs not labeled or UL Listed as current limiting may be current limiting under some fault conditions. It cannot be assumed that any circuit breaker not labeled current limiting always takes a certain amount of time to clear. Time-current curves may show clearing times in excess of ½ or 1 cycle, but the circuit breaker may clear in less than ½ cycle.



EntelliGuard* Manager Gateway

Designed for frequently monitored systems where safety is paramount, GE EntelliGuard Manager Gateway provides a wireless solution for monitoring circuit breakers outside the arc flash zone. It allows a user to view information from multiple EntelliGuard trip units via smartphone or tablet.



Remote racking

With our remote racking devices, maintenance personnel can rack low voltage breakers in and out remotely for greater arc flash protection. Our external remote racking device allows for remote racking up to 30 feet away. It connects easily to WavePro*, EntelliGuard and medium voltage PowerVac* circuit breakers. Our internal motorized draw-out mechanism for remote connect and test position allows for remote control from a central control room, removing personnel from the arc flash zone.



envisage*

envisage opens up a virtual window to analyze and control your facility's real-time energy usage remotely through a web browser or through a mobile device. This keeps personnel outside the arc flash zone. The complete envisage solution offers a choice of four customizable modules that include: monitoring, power analytics, energy tracker, and control and automation.



Meter in a Box (MIB)

GE's 480V Meter in a Box makes it easy for you to design an electrical distribution system that keeps personnel outside the arc flash zone whenever monitoring is necessary. Its small enclosure profile allows for increased flexibility when choosing a remote mounting location.



Arc flash hazard analysis

GE's comprehensive arc flash hazard study, designed to assist in addressing the recommendations of the National Fire Protection Association's (NFPA) Standard 70E, helps promote employee safety against dangers associated with the release of energy caused by an electrical arc. Key elements of an arc flash hazard safety program are:

- Calculating the NFPA based level of personal protective equipment (PPE)
- Communicating PPE and approach distance to exposed energized equipment through a warning label system

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