



Industrial Shock-Block
Presented by Jeff Glenney, P.Eng.
And Ed Barnett bailed on me
May 31, 2013
WMEA, DENVER



Agenda

- Electrical Shock Statistics
- Industrial Shock Block Product
- Success Stories (Special Cameo Appearance you won't want to miss)



Quick Overview – SB6000 series



- **In-line Ground-Fault Circuit Interrupter (GFCI)**
- **208V / 240V / 480V / 600V, 100A, 1- or 3-phase applications**

Why Did Littelfuse Build it

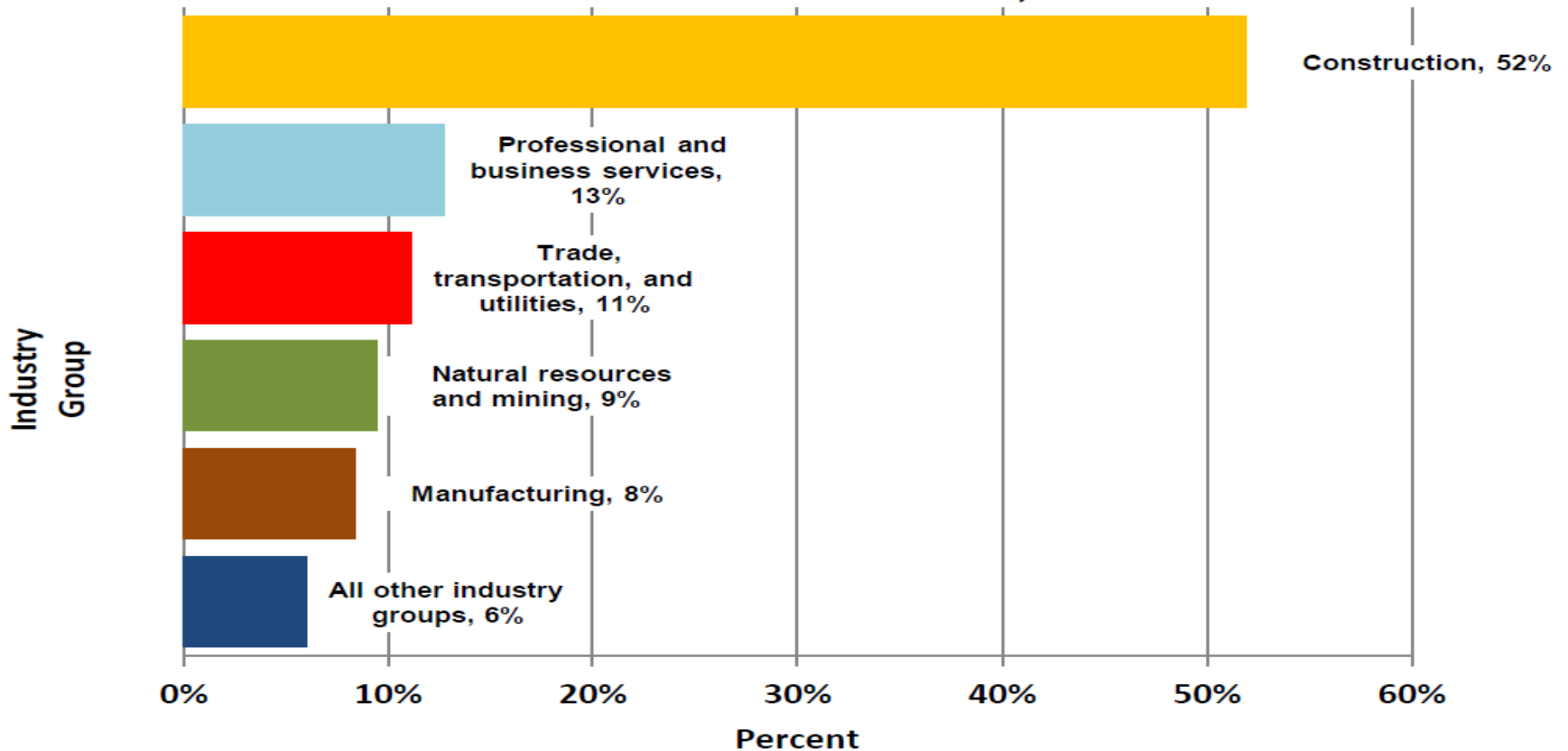
The Hazard – Electrocution & Implications (\$)

- **5th leading cause of death** from 1980 to 1992
 - 7% of all work fatalities (411 deaths per year) Source: NIOSH
- **3 killed every 4 days** from 1992 to 2010
 - 5% of all work fatalities (270 deaths per year) Source: BLS
- **17 other injuries** (non-fatal shock and burns) for every electrocution Source: Ontario Ministry of Labor
- **\$160.4 billion** was the cost of US workplace injuries in 2006*
- **Over \$30 million** per incident in fines, medical, litigation, lost business, and equipment costs*

*Source: National Safety Council

Electrical Fatalities – US

Electrical Fatalities by Industry Group as a Pct. of Total Electrical Fatalities, 2003-2010



Compiled by the Electrical Safety Foundation International using data from the U.S. Bureau of Labor Statistics, CFOI, 1992-2010

Source: Electrical Safety Foundation International



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Types of Electrical Injuries*

- Electrical Shock

- reflex response possibly involving trauma
- involves burns, abnormal heart rhythm and unconsciousness



- Electrocutation

- occurs when electrical current passes over or through a worker's body resulting in a fatality

*Source: Prevention Strategies for Electrical Hazards © 2008 National Safety Council

How Shock Occurs?*

■ Direct Contact

- Touching wires in an energized circuit
- Touching one wire of an energized circuit and a path to the ground



■ Indirect Contact

- Touching metallic part that has become “hot” by contact with an energized conductor due to an insulation fault



*Source: Prevention Strategies for Electrical Hazards © 2008 National Safety Council

Effect of Electric Shock

- Disagreeable sensation
- Involuntary muscular contraction
- Burns
- Ventricular fibrillation
 - Most serious cardiac rhythm disturbance
 - The Lower chambers quiver and the heart can't pump any blood, causing cardiac arrest*
 - AC current flow through the body generates periodic excitation



*Source: American Heart Association

Severity of Shock*

- The path of current through the body
- The amount of current flowing through the body
- The length of time the body is in the circuit

***LOW VOLTAGE DOES NOT
IMPLY LOW HAZARD!***

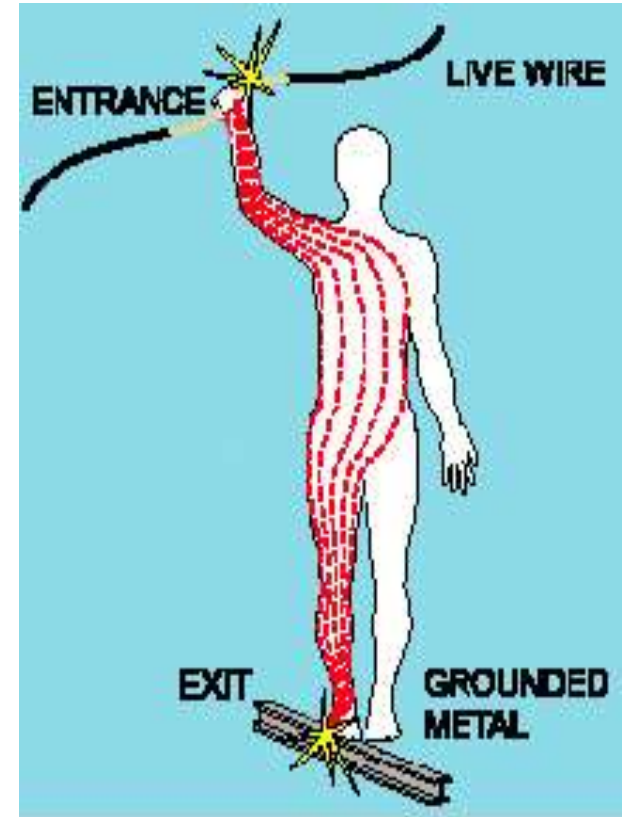


Image courtesy of Electrical Safety Foundation International

*Source: Prevention Strategies for Electrical Hazards © 2008 National Safety Council

Amount of Current

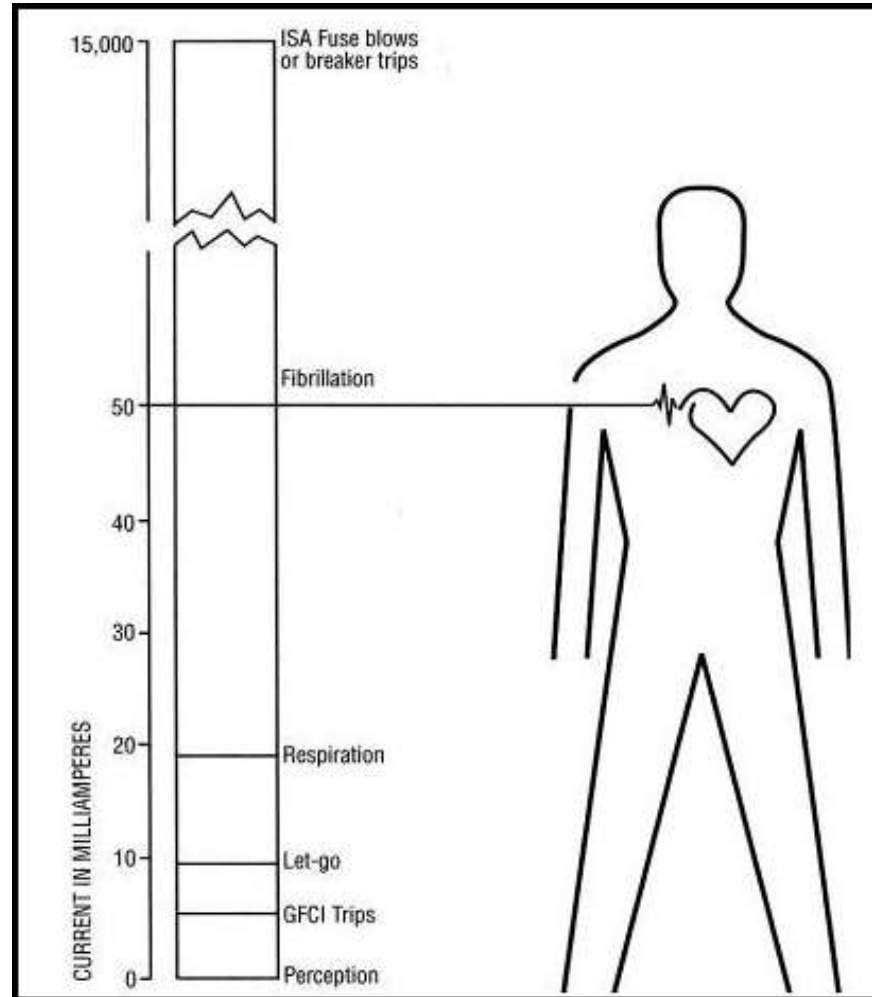


Image courtesy of Pass & Seymour

Agenda

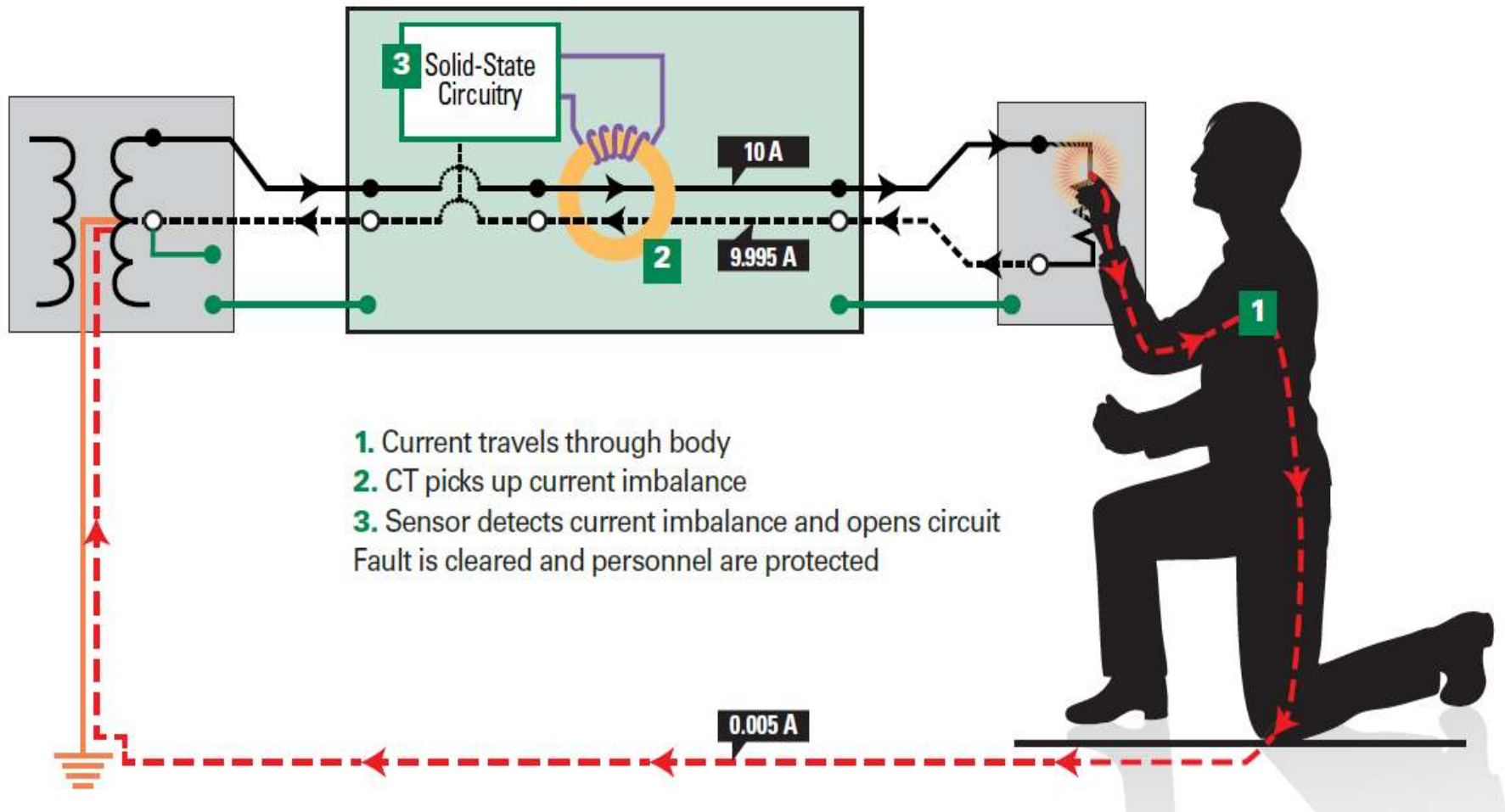
- Electrical Shock Statistics
- Industrial Shock Block
- Success Stories

The Solution – Personnel Protection

- Ground Fault Circuit Interrupter (GFCI)
 - Fast-acting circuit breaker
 - Very low pick-up current (6 mA)
- Types of GFCI
 - Permanently-connected
 - ❖ Receptacle, GFCI breaker
 - Portable
 - ❖ Cord-connected
- Mandated by NEC
- Defined by UL 943

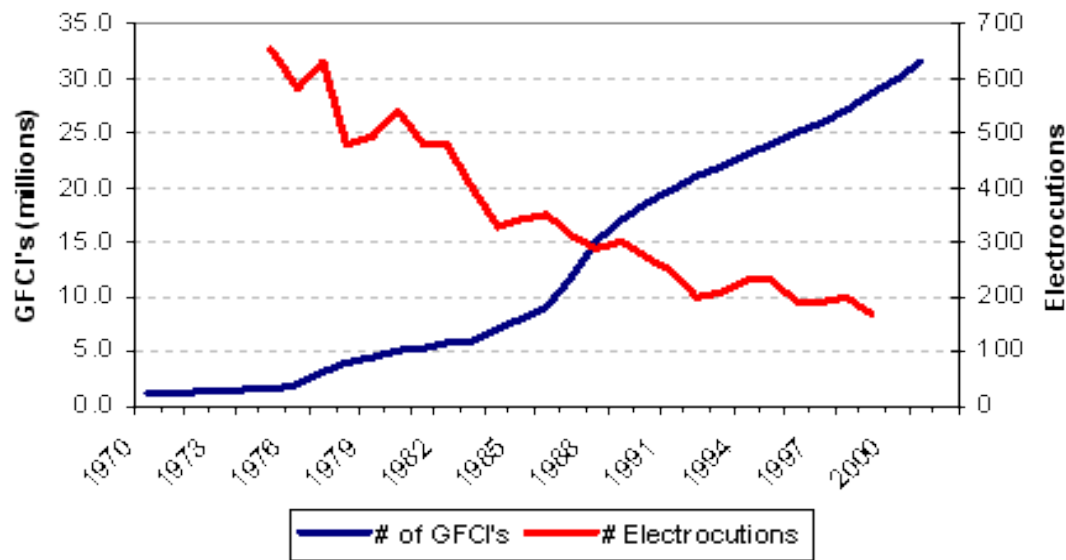


GFCI – Theory of Operation



GFCI – Facts

- Since mandated by NEC in 1973*:
 - **50% reduction in residential electrocutions** has been accredited to GFCIs
 - **280 lives could have been saved each year**, had each household been equipped with GFCIs



Source: NEMA

*Source: Electrical Safety Foundation International



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CIRCUIT PROTECTION SOLUTIONS



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Personnel Protection – The Gap

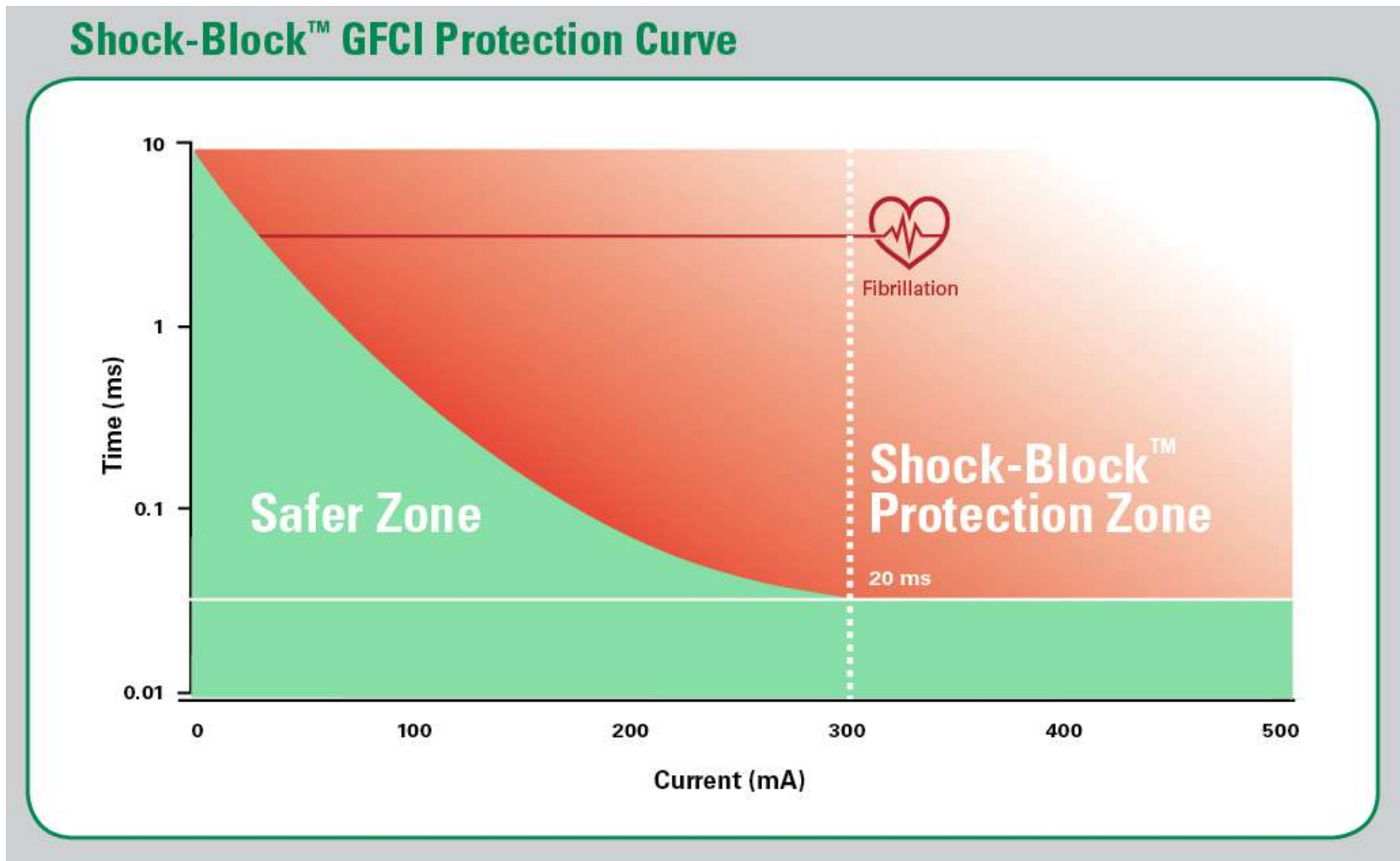
- UL 943 Class A GFCI:
 - 150 V line-to-ground max. (240 V systems)
 - 6 mA trip level (too low for industrial equipment)
 - Ground wire is not monitored
- Only appropriate for residential applications
- UL identified the need for new GFCI classes appropriate for industrial applications

*INDUSTRIAL PERSONNEL
PROTECTION IS STILL LACKING*

NEW UL 943C – Special Purpose GFCIs Usage

- **Line-to-ground voltage is greater than 150 volts** (i.e. 480 V & 600 V systems) and equipment grounding or double insulation is required by the National Electrical Code, ANSI/NFPA 70
- **Line-to-ground voltage is 150 volts or less** (i.e. 208 V & 240 V) and equipment grounding or double-insulation is provided, **but the use of a Class-A GFCI is not practical.**

UL 943C Trip Curve – Class C & Class D GFCIs



The SB6000 Series – Industrial Shock-Block*

- First & only UL 943C listed GFCI
- 208-600 V, 100 A
- Trip Level Options
 - Fixed 20 mA GFCI
 - Selectable 6, 10, 20, and 30 mA EGFPD
- Packaging Options
 - Enclosed model mounts like an electrical cabinet
 - Open-chassis model for mounting inside existing cabinets or OEM equipment

The SB6000 Series – UL 943C Listed

- Reliable performance
 - 85%, 100%, and 110% of the rated voltage
 - Full-load & no-load
 - 20 mA & 500 Ω ground faults
 - -35°C (-31°F) to $+66^{\circ}\text{C}$ ($+151^{\circ}\text{F}$)
- Leakage-current return path
- SCC rating of at least 5,000 A
 - ISB was tested at 50,000 A
- Environment Considerations
 - Humidity conditioning, ultraviolet, corrosion, & dust
 - RF immunity

The SB6000 Series – Connection Diagram



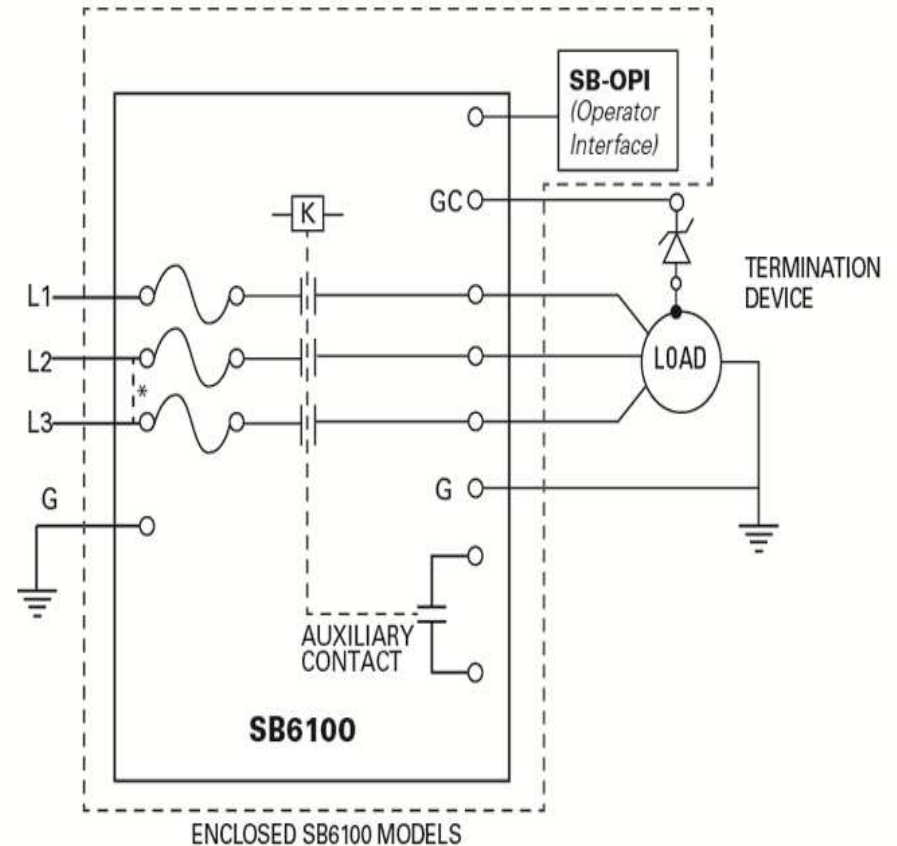
The SB6000 Series – Operator Interface (SB-OPI)

- Power (PWR) and Operation (EN)
- Ground Leakage Percentage
- Fault (FLT)
- Input Connection (INP)
- Ground Wire Connection (GC)
- Test & Reset



The SB6000 Series – Ground Wire Monitor (GFCI only, not EGFPD)

- An additional zener diode must be installed on the load equipment
- An additional pilot wire from SB6100 to termination
- DC signal from SB6100 to the termination, then load's chassis and back to the source through ground
- If monitored circuits opens, or if pilot wire shorts to ground, the supply will be de-energized



* For a single-phase load; Jumper L2 & L3 & use L1 & L2 as the input terminals

The SB6000 Series – Features and Benefits

Features & Benefits

UL 943 inverse time trip curve	Detects and interrupts to protect people and reduce the probability of nuisance tripping
Minimum trip time less than 20 msec	Reduces the risk of ventricular fibrillation for leakage current of 250 mA and above
UL 943C fixed trip level (GFCI 20 mA)	GFCI protection for systems with leakage current higher than the standard 6 mA required by UL 943 Class A
Selectable trip levels (EGFPD)	Provides extra safety when a customer is able to operate with a setting below 20 mA (GFCI) and the settings above 20 mA can reduce nuisance tripping on systems with high leakage current.
UL 943C ground monitor/interrupt	Protects from shock by tripping if continuity of ground wire between Industrial Shock-Block and load is broken.
Undervoltage, brownout, chatter detection	Ensures proper operation and prolongs the internal contactor lifetime
3 x Class T, 600 V incoming fuses	Provides overcurrent protection for the internal contactor
Conformal coating	Internal circuits are protected against corrosion and moisture, yet still repairable
Operator Interface	Shows unit status, alarm types, percentage of leakage current, and allows for Test and Reset capabilities

Success Story – Interstate Bricks

- Wet environment
- High leakage-current
- Personnel protection needed



Success Story – NA Coal

- Stud gun machine
- Move around the shop floor
- Welding outlets all around the shop



- 6-ft cable with a 60 A welding plug
- 200-ft cable to stud gun machine

Pictogram Definition of a STUD GUN



Rob Marnell

Office : 307-265-2310

Fax: 307-265-6019

Mobile: 903-530-5243

Home: 307-237-1902



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Success Story – NA Coal



SB-CART-00 (to be Released in August)

SB-CART-00 Two-wheeled Cart

Optional for mounting ISB to allow for moving the unit while power is off



Ordering Information - Accessories

ACCESSORIES	REQUIREMENT	PAGE*
SB-OPI	Included	N/A
1N5339B	Included	120
SB-TA6	Optional	120
SB-TA6-SM	Optional	120
SE-TA6ASF-WL	Optional	120
SB-CART-00	Optional	N/A



Applications – Manufacturing/Processing

- Mixers
- Heaters
- Fans
- Tile/concrete cutters
- Conveyors & Hoists
- Elevators & Escalators
- Fusion Splicers
- Paint booths
- Pressure washers
- Submersible pumps
- Arc welders
- Portable lighting
- Motors
- Compressors

Applications – Entertainment

- Aquariums
- Fountains
- Swimming pools
- Amusement parks
- Water slides
- Golf courses
- Fairs
- Zoos



Industrial Shock-Block™

For Customers:

- Datasheet
- Brochure
- Video
- Manual



Brochure PF137



Video



Datasheet

Contact Information – United States

- Questions about Protection Relays? *Please contact:*
 - **Jeff Glenney** – Sales Engineering Manager US/Mexico
306-657-1974 jglenney@littelfuse.com
 - **Bob Zweifel** – Relay Sales Territory Manager Central
636-236-5548 bzweifel@littelfuse.com
 - **Cory Anderson** – Sales Engineer South East
306-657-1975 canderson@littelfuse.com
 - **Justin Mahaffey** –Sales Engineer South Central
214-500-3511 jmahaffey@littelfuse.com
 - **Ajay Pathak** – Sales Engineer North East
302-898-8506 apathak@littelfuse.com
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Questions and Answers

Thank you.

Cash reward for photos of Ed Barnett

