FAQ

Shock Block
Three-Phase GFCI & SPGFCI

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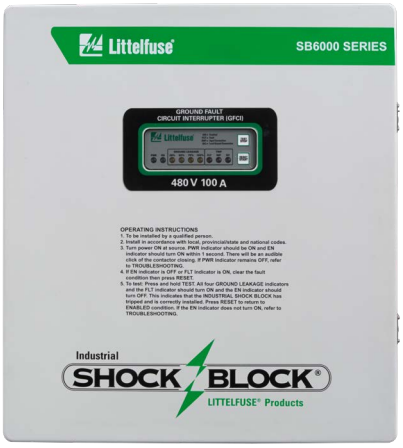

SB6000 Series

SB5000 Series

What is UL 943C and how does it differ from UL 943?

UL Standard 943 applies to Class A, single- and three-phase, Ground-Fault Circuit Interrupters (GFCI) intended for protection of personnel, for use only in grounded neutral systems in accordance with the National Electrical Code (NEC®), ANSI/NFPA 70, and the Canadian Electrical Code, C22.1 (CEC), These devices are intended for use on alternating current (AC) circuits of 120 V, 208Y/120 V, 120/240 V, 127 V, or 220Y/127 V, 60 Hz circuits.

UL 943C requirements cover ground-fault circuit-interrupters intended for use in one of the following applications:

1. On grounded-neutral systems where voltage to ground is above 150 Vac and equipment grounding or double insulation is required by the NEC, ANSI and NFPA 70.
2. On grounded-neutral systems where voltage to ground is 150 Vac or less and equipment grounding or double insulation is provided, but the use of a Class A ground-fault circuit interrupter is not practical.

Why did UL introduce UL 943C?

UL 943C, Special Purpose Ground-Fault Circuit-Interrupters (SPGFCIs), was introduced to address the two limitations of Class A GFCIs (defined by UL 943) that prohibited their use in many industrial applications. Namely, the system voltage limitation to a maximum of 240 V and a maximum allowed leakage current of 6 mA. UL 943C defines three GFCI Classes: Classes C, D, and E. These new Classes are rated up to 600 V, with a maximum trip level of 20 mA. In addition, UL 943C requires the device to monitor the continuity of the ground wire and interrupt power to the load if ground integrity is lost.

What are the different UL GFCI Classes?

Class A – A GFCI that will interrupt the circuit to the load when the ground-fault current is 6 mA or more but not when the ground-fault current is 4 mA or less and is intended to be used in circuits where the line-to-line voltage is 240 V or less.

Class B – A GFCI that will interrupt the circuit to the load when the ground-fault current exceeds 20 mA. Only used with swimming pool underwater lighting fixtures that were installed prior to local adoption of the 1965 edition of the NEC. Class B GFCI is obsolete.

Class C – A GFCI that will interrupt the circuit to the load when the ground-fault current is 20 mA or more and is intended to be used in circuits with no conductor over 300 V to ground (i.e. systems where line-to-line voltage is 480 V or less) where reliable equipment grounding or double insulation is provided.

Class D – A GFCI that will interrupt the circuit to the load when the ground-fault current is 20 mA or more and is intended to be used in circuits with one or more conductors over 300 V to ground (i.e. 600 V systems), and with specially sized, reliable grounding, to provide a low impedance path so that the voltage across the body during a fault does not exceed 150 V.

Class E – A GFCI that will interrupt the circuit to the load when the ground-fault current is 20 mA or more and is intended to be used in circuits with one or more conductors over 300 volts to ground (i.e. 600 V systems) but without conventional equipment grounding provided for the protected equipment in the system or double insulation. These GFCIs respond rapidly to open the circuit before the magnitude and duration of the current flowing through the person's body exceeds the limits for ventricular fibrillation.

What is the Littelfuse Shock Block?

The Shock Block is available as a Class A Ground-Fault Circuit-Interrupter, Class C and Class D Special-Purpose Ground-Fault Circuit-Interrupter (SPGFCI) and Equipment Ground-Fault Protection Device (EGFPD). The Class A Shock Block is tested and certified to UL 943, while the Class C and D Shock Block is tested and certified to UL 943C. The EGFPD is an equipment protection device that is tested to a combination of both UL 943 and UL 1053. The Littelfuse EGFPDs follow the same inverse time characteristics as GFCIs while also providing adjustability for applications where higher minimum trip levels may be required.

What does the Shock Block do?

The Shock Block detects leakage current and interrupts the circuit significantly reducing or eliminating the shock potential. One key part of the additional safety features mentioned earlier, is that the Shock Block also monitors the ground wire from the unit to the load for continuity. If the wire is broken or becomes loose, the Shock Block will signal an alarm and interrupt power.

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What are the differences between the GFCI, SPGFCI, and the EGFPD models?

The EGFPD Shock Block is exactly the same as the GFCI Shock Block and SPGFCI Shock Block models, except that it has variable setpoints (6, 10–100 mA in increments of 10 mA) to provide flexibility. It can provide "let-go" protection for settings below 20 mA and reduce nuisance tripping on systems with a high leakage current by selecting higher setpoints.

What are the voltage and current ratings of the Shock Block?

The SB5000 Series is available in the following voltages: 208 V, 480 V, and 600 V. The SB6000 Series is available in the following voltages: 208 V, 240 V, 480 V, and 600 V. The load must be either single phase or 3-phase (with no neutral). The power system can either be solidly grounded or high-resistance grounded.

Can the Shock Block be used on single-phase loads?

Yes, the Shock Block can be implemented for single-phase loads for the rated voltage (208 V, 240 V, 480 V, or 600 V). For the SB5000 series the phase conductors would be connected to the Shock Block Phase A and C inputs. For the SB6000 series the phase conductors would be connected to the Shock Block Phase A and B inputs.

What are the benefits of the built-in 3 x Class T 600 V incoming fuses on the SB6000 series?

The fuses provide the Shock Block with a high Short-Circuit Current Rating (SCCR).

Why does the SB6100 have 200 A Class T fuses when it is rated for a 100 A load?

The 200 A Class T fuses are not intended to protect the load; instead, they are for protection of the Shock Block's internal contactor as part of the 50 kA SCCR. The 200 A rating was specifically recommended by the manufacturer of the internal contactor as the official rating to protect it.

Do you need to fuse the input of the SB5000 series Shock Block?

No, you would only need to install fuses upstream of the input if you want to increase the Short-Circuit Current Rating.

What is the Short-Circuit Current Rating (SCCR) of the Shock Block?

SB6000 series has a SCCR of 50,000 A and the SB5000 series has a SCCR of 10,000 A. The SB5000 series can be extended to 50,000 A with the installation of current limiting fuses upstream of the input.

What are the enclosure options available for the Shock Block?

Two options for enclosures are available for the SB6000:
UL Recognized open-chassis models for installation in an existing electrical enclosure (for example, MCCs or switchgear) and UL Listed NEMA-4X enclosed models for stand-alone installations. The SB6000 can also be mounted to a portable cart, which is offered as an accessory for mobile applications.

The SB5000 is offered in an IP69K NEMA 4X enclosure.

What are the applications of the AC6000-CART-00?

The cart accessory can be used when it is required to roll the unit in and out (for example, construction, repair and maintenance work). Also it can be used with any portable equipment that is moved around frequently.

What is the importance of using a UL Listed GFCI?

There are several products on the market that either claim to act like a UL 943 or UL 943C device or have the GFCI designation but not the listing. With UL 943 and UL 943C and a clear definition of GFCIs and Special-Purpose GFCIs, this is no longer acceptable. For any product to be used for personnel protection, it must be UL listed. The UL 943C standard also has several additional safety features, such as:

- Monitor ground wire to ensure return path for leakage current (Class C and Class D)
- Performance requirements (trip curves) specific for the application
- A minimum short circuit current rating of 5,000 A (SB6000 series was tested up to 50,000 A short circuit)
- Guaranteed to operate at -35 °C (-31 °F) to +40 °C (104 °F) with a system voltage varying between 85% to 110% of the unit's rated voltage. At the rated system voltage and up to 110%, the SB6100 has a maximum operating temperature of +66 °C (151 °F)
- Self check within 5 seconds of power on and at least every 3 hours
- Only use microprocessors that comply with UL 1998 / CSA C22.2 No. 0.8 to avoid software problems

What about CSA?

All models of the Shock Block (GFCI and EGFPD) are certified to CSA C22.2 No. 144-M91 Ground-Fault Circuit Interrupters. However, many sensitive ground-fault protection devices such as ground-fault relays (for example, the Littelfuse EL731 AC/DC Sensitive Earth-Leakage Relay) are certified to this standard even though they do not directly interrupt the circuit and may not trip within a defined people protection time-current curve such as the curve defined by UL 943 and CSA C22.1, the Canadian Electrical Code.

In order to understand whether a device is capable of interrupting the circuit directly, Certificate of Compliance must be examined to determine the device class. Littelfuse SB5000 and SB6000 series GFCI models are certified as Class 1451-01 – Ground-Fault Devices – Circuit Interrupters. Littelfuse SB5000 and SB6000 series EGFPD models are certified as Class 4812-02 – Ground-Fault Devices – Signal Type Detectors. Unfortunately, CSA does not yet have an equivalent to Class C and Class D GFCIs as defined by UL 943C. Therefore, it is important to be aware that although the title of C22.2 No. 144 is "Ground-Fault Circuit Interrupters," this standard alone does not explicitly define people-protection products, nor does it explicitly define independent circuit-interrupting devices versus signaling devices.

The class of device must be reviewed to ascertain this information and furthermore it must be noted that the Canadian Electrical Code recognizes that new technologies can be introduced for which there is presently no CSA Standard, and allows the use of such items, either by recognition of non-CSA certification-agency certification, or by a provincial authority having jurisdiction.

How is the Shock Block reliability after repeated operation?

To meet UL 943C requirements, the Shock Block was tested for thousands of tripping cycles at various operating conditions. Therefore, the reliability of after repeated operation is guaranteed, which is another reason for the importance of using a UL listed Device.

Why does the Shock Block use a Zener-characteristic termination device?

The purpose of the Shock Block's ground-check circuit is to prove that the load is properly grounded back to the source to prevent hazardous touch potential on the frame of portable equipment. To do this, the Shock Block sends a small signal down a ground-check conductor (also referred to as a pilot wire) to the load, through a termination device, and back to the source on the ground conductor. Since it is critical that the entire length of the ground cable is monitored, we must ensure that the monitoring signal travels all the way from the Shock Block to the load. To do this, the Shock Block uses a Zener-characteristic 5.6 V termination device installed at the load. Since a Zener diode will block current up to its threshold voltage (in this case 5.6 V) and then clamp, it is not easily simulated by any type of cable damage or other phenomenon. In contrast, a termination resistor (or jumper) could be easily simulated by any resistive element, including the resistance of copper wire, the resistance of cable couplers, or the resistance of a damaged cable. This means that a resistor is not a good termination device. In addition, induced ac currents and fault currents can destroy both diode-type and resistor-type end-of-line devices because of the high current and voltage that can be present during a fault. Fault currents do not create a high voltage in a Zener termination device as it simply clamps the voltage.

What is an ELCI?

The term ELCI (Equipment Leakage Circuit Interrupter) is sometimes used to refer to an EGFPD, although ELCI is not a standard UL term.

Can the Shock Block be used to protect multiple loads?

Theoretically, yes a Class A Shock Block can be used to protect multiple loads as long as the total ampacity of the circuit falls within the Shock Block's current rating. However, this is not recommended, and the intended purpose of the Shock Block is to protect one load. If Shock Block was used to protect multiple loads a ground-fault would result in all downstream equipment being deenergized.

A Class C and Class D SPGFCI installation also requires the ground-cable continuity to be continuously monitored; this is not possible with parallel loads.

Can the Shock Block be used in hazardous locations?

Currently, the Shock Block is not available in a hazardous location rated enclosure (NEMA 7, 8 and 9). Yet, the open-chassis SB6000 series models can be installed in any hazardous rated switchgear. The operator interface is separately provided with a 10-foot cable so it can be installed in a separate enclosure (for example, a NEMA 4X with a glass door) attached to the hazardous rated enclosure. This allows full control of the unit without the need to get into the hazardous rated switchgear.

What are the typical applications for the Shock Block?

Any application that involves a wet environment including:

- Submersible pumps
- High pressure washers and paint booths
- Water and waste water treatment plants
- Dewatering applications
- Portable equipment (stud guns, heaters, fans, lighting, etc.)
- Temporary wiring (including welding receptacles) used for construction and maintenance
- Tile/concrete cutters
- Power plants
- Food processing plants
- Aquariums, fountains, and swimming pools
- Amusement parks, water slides, golf courses, and arenas
- High-amperage commercial kitchen equipment (including ovens, fryers, grills, refrigerators, dishwashers, etc.)
- Horticultural Lighting
- Marina shore-to-ship power

Does high-resistance grounding preclude the necessity for GFCI protection?

High-resistance grounding (HRG) can keep an electrical system operating despite a ground fault, and can help reduce the danger from arc flash, but does nothing for the shock hazard. The grounding resistor current is limited to (usually to 1 A or more), which can be fatal if a person touches a live conductor. In other words, HRG offers protection to equipment by limiting the ground fault current but it is not appropriate for personnel protection. Therefore, HRG does not preclude the necessity for GFCI protection.

Can the Shock Block be used with variable frequency drives?

Yes, the SB5000 series Shock Block provides excellent harmonic rejection filtering and can be used on the line-side of variable frequency drives.

Can the Shock Block replace an assured grounding program?

Yes! In fact, OSHA requires that if a GFCI is available for the load that GFCI be used instead of assured grounding. Using the Shock Block GFCI makes work sites safer and can save a lot of time and money for operations that frequently employ temporary wiring. The Shock Block not only interrupts the circuit when there is leakage current to ground that could be hazardous to a worker, but also continuously monitors the equipment being protected to ensure that it is grounded at all times. In cases where the leakage current due to harmonics and noise typically exceeds 20 mA, the Shock Block EGFPD also continuously monitors the ground and is capable of interrupting the circuit. This is clearly a better solution than having no fast circuit-interruption capability and an assured grounding program (which only checks ground continuity periodically), and most inspectors would likely agree. However, the OSHA wording currently does not make explicit allowances for using an EGFPD with ground continuity monitoring in place of a GFCI or assured grounding program when a GFCI is not practical. Check with your local authority having jurisdiction for their interpretation of this requirement.

Can I connect a motor or inductive load to the SB6000 series?

Yes, in fact all models of the SB6100 are certified as across-the-line motor starters; the buttons on the faceplate can be used to start and stop a motor and are labeled as such.

What size of motor can I connect to the SB6100? What about the inrush current?

The SB6100 specifications provide current ratings for both the AC-1 and AC-3 utilization categories. The AC-1 category applies to non-inductive or slightly inductive loads such as heating. The AC-3 category applies to inductive loads, including squirrel-cage motors. The SB6100 AC-1 rating is 100 A, while the AC-3 rating will vary based on the system voltage. The table below lists the inductive AC-3 current and power ratings for each SB6100 system voltage. As long as the nominal load is less than or equal to the ratings below, the SB6100 (including the internal fuses) will withstand the inrush current even if it exceeds 100 A. Refer to the SB6100 product manual for details.

SB6100 Voltage (AC)	Rated AC-3 Current (Ie)	Rated AC-3 Power (Pe)
208 V	75 A	25 hp
240 V	75 A	30 hp
480 V	66 A	60 hp
600 V	55 A	75 hp

Can the Shock Block be considered as a "disconnecting means"?

Yes, the Shock Block can be considered to be a disconnecting means, as it meets the definition of a device by which the conductors of a circuit can be disconnected from their source of supply.

Why would someone want a unit with adjustable trip levels vs. the fixed trip level? Under what conditions would that be beneficial or necessary?

A fixed trip-level unit must be specified and used for any and all applications that requires the use of a GFCI or a Special Purpose GFCI by code. When not required by code, the adjustable trip-level EGFPD can provide additional flexibility with settings below 20 mA for "let-go" trip levels and higher setpoints to reduce nuisance tripping on systems with a high leakage current.

What is the difference between NFPA 70 and NFPA 70E?

The purpose of both documents is to safeguard people and property from the hazards of electricity. One is a code, and the other is a standard. A code is a set of rules that knowledgeable people recommend for others to follow, is not law itself, but can be adopted into law. A standard tends be a more detailed elaboration that may provide guidance on how to meet a code.

NFPA 70 is the National Electrical Code (NEC). The NEC can be considered an electrical installation code designed to protect people under normal circumstances and is enforced by authorities with jurisdiction. The NFPA 70E is a standard intended to provide guidance or a starting point for employers to provide safe work practices around electricity.

For more information, visit
Littelfuse.com/ShockProtection

Additional technical information and application data for Littelfuse protection relays, fuses and other circuit protection and safety products can be found on **Littelfuse.com/protectionrelays**. For questions, contact our Technical Support Group **(800-832-3873)**.

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