Ground-fault circuit interrupters (GFCIs) have been in use for over 40 years, and have proven themselves to be invaluable in the protection of personnel from the hazard of electric shock. Other types of leakage current and ground fault protective devices have been introduced for various applications since the introduction of GFCIs. The use of some protective devices is specifically required in the National Electrical Code® (NEC®). Others are a component of an appliance, as required by the UL standard covering that appliance. This article will help to differentiate the various types of protective devices used today and clarify their intended uses.

**GFCIs**

The definition of a ground-fault circuit interrupter is located in Article 100 of the NEC and is as follows: “A device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds the values established for a Class A device.” Following this definition, a Fine Print Note provides additional information on what constitutes a Class A GFCI device. It states that a Class A GFCI trips when the current to ground has a value in the range of 4 milliamps to 6 milliamps, and references UL 943, the Standard for Safety for Ground-Fault Circuit-Interrupters.

Section 210.8 of the NEC covers specific applications where GFCI protection for personnel is required. In dwelling units, GFCIs are required in all 125-volt, single phase, 15- and 20-ampere receptacles installed in locations such as bathrooms, garages, outdoors, unfinished basements, and kitchens. Article 680 of the NEC covering swimming pools has additional GFCI requirements.

In almost every new edition of the NEC since 1968, new GFCI requirements were added. See the sidebar on page 2 for examples of when the NEC first required GFCIs for various applications. Please note that this list does not include all locations where GFCI protection is required.


**Other Types of Leakage Current and Ground Fault Protective Devices**

The following describes various types of leakage current or ground fault protective devices:

**AFCI (Arc-Fault Circuit Interrupter)** — Provides protection from the effects of arc faults that may pose a risk of fire, which in some cases may be ground faults. AFCIs are required in certain applications by the NEC, including Section 210.12 for many specific installations in dwelling units. AFCIs are not required to provide GFCI protection.

(continued on page 2)
GFPE (Ground-Fault Protection of Equipment) — Intended for the protection of equipment by disconnecting all ungrounded conductors of a circuit at current levels less than that of a supply circuit overcurrent protective device. This device operates to disconnect the electric circuit from the source of supply when the ground-fault current exceeds the ground-fault pick-up level marked on the device, typically 6 mA to 50 mA. UL Guide Information for Equipment Ground-fault Protective Devices (FTTE) can be found on page 137 of the 2008 UL White Book.

The following types of devices are UL Component Recognized, and not intended for general sale or use. They are intended for use as factory-assembled components of specific appliances where the suitability of the installation is determined by UL. They have not been investigated for installation in the field, and may or may not satisfy requirements in the NEC.

EGFPD (Equipment Ground-Fault Protective Device) — Intended for applications such as fixed electric deicing and snow melting equipment, as well as fixed electric heating equipment for pipelines and vessels, in accordance with Articles 426 and 427 in the NEC. This device operates to disconnect the electric circuit from the source of supply when the ground-fault current exceeds the ground-fault pick-up level marked on the device, typically 6 mA to 50 mA. UL Guide Information for Equipment Ground-fault Protective Devices (FTTE) can be found on page 137 of the 2008 UL White Book.

Proven Benefit of Leakage Current and Ground Fault Protection

To help mitigate electrical shock hazards, UL has been at the forefront of detector research, technology and standards development. Statistics have shown that devices described in this article have proven to be an effective means to improve safety in residential occupancies and other electrical installations. Proper application and use of these protective devices is critical to coordinating required protection for safe installations.

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NEC Edition Where GFCI Protection Was First Required

1968 — Swimming pool underwater lighting
1971 — Outdoor receptacles and near swimming pools
1975 — Bathroom receptacles and construction sites
1978 — Garage receptacles
1981 — Spas or hot tubs
1984 — Bathrooms of hotel or motel guest rooms
1987 — Basements, receptacles near kitchen sinks, and boathouses
1990 — Unfinished basements and crawl spaces
1993 — Wet bar sinks
1996 — All kitchen countertop receptacles, unfinished accessory buildings, rooftops
2005 — Near laundry and utility room sinks, outdoors in public spaces
2008 — All sinks (other than dwelling units), electric water drinking fountains