term *ground-fault circuit interrupter* in Article 100 for details on the operational current levels of GFCIs.

Outlets for other than shore power and outlets rated 240 volts or less for boat hoists are required to be provided with GFCI protection, as defined in Article 100. Ground-fault protection equipment (GFPE) is not a permitted protection method for these outlets per 555.35(C) and (D).

555.54 Grounding. Grounding at floating buildings shall comply with 555.54(A) through (D).

(A) Grounding of Electrical and Nonelectrical Parts. Grounding of both electrical and nonelectrical parts in a floating building shall be through connection to a grounding bus in the building panelboard.

(B) Installation and Connection of Equipment Grounding Conductor. The equipment grounding conductor shall be installed with the feeder conductors and connected to a grounding terminal in the service equipment.

(C) Identification of Equipment Grounding Conductor. The equipment grounding conductor shall be an insulated copper conductor with a continuous outer finish that is either green or green with one or more yellow stripes. For conductors larger than 6 AWG, or where multiconductor cables are used, re-identification of conductors allowed in 250.119(B)(2)b. and (B)(2)c. shall be permitted.

(D) Grounding Electrode Conductor Connection. The grounding terminal in the service equipment shall be grounded by connection through an insulated grounding electrode conductor to a grounding electrode on shore.

555.55 Insulated Neutral. The grounded circuit conductor (neutral) shall be an insulated conductor identified in compliance with 200.6. The neutral conductor shall be connected to the equipment grounding terminal in the service equipment, and, except for that connection, it shall be insulated from the equipment grounding conductors, equipment enclosures, and all other grounded parts. The neutral conductor terminals in the panelboard and in ranges, clothes dryers, counter-mounted cooking units, and the like shall be insulated from the enclosures.

555.56 Equipment Grounding.

(A) Electrical Systems. All enclosures and exposed metal parts of electrical systems shall be connected to the grounding bus.

(B) Cord-Connected Appliances. Where required to be grounded, cord-connected appliances shall be grounded by means of an equipment grounding conductor in the cord and a grounding-type attachment plug.

ARTICLE
590 Temporary Installations

590.1 Scope. The provisions of this article apply to temporary electric power and lighting installations.

Temporary installations are temporary as approved by the AHJ. Article 590 applies to any temporary installation whether it is at a transient or a permanent location. The installation could be at a construction site, a store parking lot, or a local craft fair in a field.

590.2 All Wiring Installations.

(A) Other Articles. Except as specifically modified in this article, all other requirements of this *Code* for permanent wiring shall apply to temporary wiring installations.

Temporary installations of electrical equipment must be installed in accordance with all applicable permanent installation requirements except as modified by the rules in this article. For example, the requirements of 300.15 specify that a box or other enclosure must be used where splices are made. This rule is amended by 590.4(G), which, for construction sites, permits splices to be made in multiconductor cords and cables without the use of a box.

Dismissing the need to comply with the requirements of the *NEC*® because the installation "is only temporary" reduces the level of safety for users of the temporary installation. For instance, contrary to what is believed by some to be acceptable, there is no permission in Article 590 allowing temporary services to be grounded any differently than a permanently installed service. Where used, rod-type electrodes must comply with all of the requirements of 250.53, including the need to install a supplemental electrode, unless the 25-ohm earth resistance condition can be met. Only under that condition can one ground rod be used.

Electrical accidents do not discriminate and can occur in any installation, permanent or temporary, if the requirements of the *NEC* are not followed. Due to the nature of work occurring at construction sites and the higher probability of wiring systems being damaged and compromised, following the requirements of Article 590 is essential to electrical safety. Bypassing GFCI protection because the device is "nuisance tripping" is another compromise of the safety system that occurs on construction sites. In the vast majority of these cases, the GFCI is doing what it is designed and intended to do — prevent electrical injuries and deaths.

(B) Approval. Temporary wiring methods shall be acceptable only if approved based on the conditions of use and any special requirements of the temporary installation.

Temporary wiring methods are approved based on criteria such as length of time in service, severity of physical abuse, exposure to weather, and other special requirements. Special requirements can range from tunnel construction projects to tent cities constructed after a natural disaster to flammable hazardous material reclamation projects.

590.3 Time Constraints.

(A) During the Period of Construction. Temporary electric power and lighting installations shall be permitted during the period of construction, remodeling, maintenance, repair, or demolition of buildings, structures, equipment, or similar activities.

(B) 90 Days. Temporary electric power and lighting installations shall be permitted for a period not to exceed 90 days for holiday decorative lighting and similar purposes.

The 90-day time limit applies only to temporary electrical installations associated with holiday displays. Other installations are not bound by this time limit, and, in fact, some construction projects extend over multiple years in which temporary power is necessary for the duration of the project.

(C) Emergencies and Tests. Temporary electric power and lighting installations shall be permitted during emergencies and for tests, experiments, and developmental work.

(D) Removal. Temporary wiring shall be removed immediately upon completion of construction or purpose for which the wiring was installed.

Because temporary wiring installations might not meet all the requirements for a permanent installation due to the modifications permitted by Article 590, all temporary wiring must not only be disconnected but must also be removed from the building, structure, or other location of installation.

See also

590.4(B) and (C) for the permission to use nonmetallic jacketed cables and flexible cords for temporary branch circuits and feeders

590.4 General.

(A) Services. Services shall be installed in conformance with Parts I through VIII of Article 230, as applicable.

(B) Feeders. Overcurrent protection shall be provided in accordance with 240.4, 240.5, 245.26, 445.12, and 445.13. Conductors shall be permitted within cable assemblies or within multiconductor cords or cables of a type identified in Table 400.4 for hard usage or extra-hard usage. For the purpose of this section, the following wiring methods shall be permitted:

(1) Type NM, Type NMC, and Type SE cables shall be permitted to be used in any dwelling, building, or structure without any height limitation or limitation by building construction type and without concealment within walls, floors, or ceilings.
(2) Type SE cable shall be permitted to be installed in a raceway in an underground installation.

Exception: Single insulated conductors shall be permitted where installed for the purpose(s) specified in 590.3(C) and accessible only to qualified persons.

(C) Branch Circuits. All branch circuits shall originate in an approved power outlet, switchgear, switchboard or panelboard, motor control center, or fused switch enclosure. Conductors shall be permitted within cable assemblies or within multiconductor cord or cable of a type identified in Table 400.4 for hard usage or extra-hard usage. Conductors shall be protected from overcurrent as provided in 240.4, 240.5, and 245.26. For the purposes of this section, the following wiring methods shall be permitted:

(1) Type NM, Type NMC, and Type SE cables shall be permitted to be used in any dwelling, building, or structure without any height limitation or limitation by building construction type and without concealment within walls, floors, or ceilings.
(2) Type SE cable shall be permitted to be installed in a raceway in an underground installation.

Types NM, NMC, and SE cable may be used in any building or structure regardless of building height and construction type.

Temporary feeders and branch circuits are permitted to be cable assemblies, multiconductor cords, or single-conductor cords. Cords must be identified for hard or extra-hard usage according to Table 400.4. Individual conductors, as described in Table 310.4(1), are not permitted as open conductors but can be part of a cable assembly or used in a raceway system. Open or individual conductor feeders are permitted only during emergencies or tests by the exception to 590.4(B).

The basic requirement is that temporary wiring be located and installed so that it will not be physically damaged. Note that hard-usage or extra-hard-usage extension cords are permitted to be laid on the floor.

Exception: Branch circuits installed for the purposes specified in 590.3(B) or 590.3(C) shall be permitted to be run as single insulated conductors. Where the wiring is installed in accordance with 590.3(B), the voltage to ground shall not exceed 150 volts, the wiring shall not be subject to physical damage, and the conductors shall be supported on insulators at intervals of not more than 3.0 m (10 ft); or, for festoon lighting, the conductors shall be so arranged that excessive strain is not transmitted to the lampholders.

(D) Receptacles.

(1) All Receptacles. All receptacles shall be of the grounding type. Unless installed in a continuous metal raceway that qualifies as an equipment grounding conductor in accordance with 250.118 or a continuous metal-covered cable that qualifies as an equipment grounding conductor in accordance with 250.118, all branch circuits shall include a separate equipment grounding conductor, and all receptacles shall be electrically connected to the equipment grounding conductor(s). Receptacles on construction sites shall not be installed on any branch circuit that supplies temporary lighting.

Conductors for lighting and receptacle loads are required to be separate so that the activation of an overcurrent device or GFCI

does not de-energize the lighting circuit. Metal cables or raceways must be continuous and qualify as an equipment grounding conductor (EGC). Temporary wiring is subject to frequent handling and relocation, and maintaining the continuity of EGCs needs to be a focus of those responsible for operation of a safe temporary electrical system.

(2) Receptacles in Wet Locations. All 15- and 20-ampere, 125- and 250-volt receptacles installed in a wet location shall comply with 406.9(B)(1).

(E) Disconnecting Means. Suitable disconnecting switches or plug connectors shall be installed to permit the disconnection of all ungrounded conductors of each temporary circuit. Multiwire branch circuits shall be provided with a means to disconnect simultaneously all ungrounded conductors at the power outlet or panelboard where the branch circuit originated. Identified handle ties shall be permitted.

(F) Lamp Protection. All lamps for general illumination shall be protected from accidental contact or breakage by a suitable luminaire or lampholder with a guard.

Metal guarded sockets shall not be used unless the metal guard is connected to the circuit equipment grounding conductor.

(G) Splices. A box, conduit body, or other enclosure, with a cover installed, shall be required for all splices.

Exception No. 1: On construction sites, a box, conduit body, or other enclosure shall not be required for either of the following conditions:

(1) The circuit conductors being spliced are all from nonmetallic multiconductor cord or cable assemblies, provided that the equipment grounding continuity is maintained with or without the box.
(2) The circuit conductors being spliced are all from metal-sheathed cable assemblies terminated in listed fittings that mechanically secure the cable sheath to maintain effective electrical continuity.

Exception No. 2: On construction sites, branch circuits that are permanently installed in framed walls and ceilings and are used to supply temporary power or lighting, and that are GFCI protected, the following shall be permitted:

(1) A box cover shall not be required for splices installed completely inside of junction boxes with plaster rings.
(2) Listed pigtail-type lampholders shall be permitted to be installed in ceiling-mounted junction boxes with plaster rings.
(3) Finger safe devices shall be permitted for supplying and connection of devices.

(H) Protection from Accidental Damage. Flexible cords and cables shall be protected from accidental damage. Sharp corners and projections shall be avoided. Where passing through doorways or other pinch points, protection shall be provided to avoid damage.

One of the modifications to a Chapter 4 requirement [i.e., 400.12(3)] is to permit flexible cords and cables to pass through doorways due to the need to provide power in areas that do not have permanent installed receptacles and other power outlets.

(I) Termination(s) at Devices. Flexible cords and cables entering enclosures containing devices requiring termination shall be secured to the box with fittings listed for connecting flexible cords and cables to boxes designed for the purpose.

(J) Support. Cable assemblies and flexible cords and cables shall be supported in place at intervals that ensure that they will be protected from physical damage. Support shall be in the form of staples, cable ties, straps, or similar type fittings installed so as not to cause damage. Cable assemblies and flexible cords and cables installed as branch circuits or feeders shall not be installed on the floor or on the ground. Extension cords shall not be required to comply with 590.4(J). Vegetation shall not be used for support of overhead spans of branch circuits or feeders.

Exception: For holiday lighting in accordance with 590.3(B), where the conductors or cables are arranged with strain relief devices, tension take-up devices, or other approved means to avoid damage from the movement of the live vegetation, trees shall be permitted to be used for support of overhead spans of branch-circuit conductors or cables.

Temporary wiring methods do not have to be supported in accordance with the permanent installation requirements (from Chapter 3) for the particular wiring method. Adequate support is needed only to minimize the possibility of damage to the wiring method during its temporary period of use. The use of vegetation as a support structure for overhead spans of branch-circuit and feeder conductors is not permitted.

The exception allows branch-circuit and feeder cables supplying holiday lighting to be installed and supported by trees for a period of not more than 90 days, provided the wiring is arranged with proper strain relief devices, tension take-up devices, or other means to prevent damage to the conductors from the tree swaying. All temporary wiring must be removed at the end of the temporary period or project.

590.5 Listing of Decorative Lighting. Decorative lighting used for holiday lighting and similar purposes, in accordance with 590.3(B), shall be listed and shall be labeled on the product.

590.6 Ground-Fault Protection for Personnel. Ground-fault protection for personnel for all temporary wiring installations shall be provided to comply with 590.6(A) and (B). This section shall apply only to temporary wiring installations used to supply temporary power to equipment used by personnel during construction, remodeling, maintenance, repair, or demolition of buildings, structures, equipment, or similar activities. This section shall apply to power derived from an electric utility company or from an on-site-generated power source.

(A) Receptacle Outlets. Temporary receptacle installations used to supply temporary power to equipment used by personnel during construction, remodeling, maintenance, repair, or demolition of buildings, structures, equipment, or similar activities shall comply with the requirements of 590.6(A)(1) through (A)(3), as applicable.

Exception: In industrial establishments only, where conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power were interrupted or having a design that is not compatible with GFCI protection.

A cord-and-plug-connected ventilation fan for personnel working in toxic environments is an example of where the loss of power poses a greater hazard to personnel. Some electrically operated testing equipment has proven to be incompatible with GFCI protection.

(1) Receptacle Outlets Not Part of Permanent Wiring. All 125-volt, single-phase, 15-, 20-, and 30-ampere receptacle outlets that are not a part of the permanent wiring of the building or structure and that are in use by personnel shall have ground-fault circuit-interrupter protection for personnel. In addition to this required ground-fault circuit-interrupter protection for personnel, listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use shall be permitted.

(2) Receptacle Outlets Existing or Installed as Permanent Wiring. Ground-fault circuit-interrupter protection for personnel shall be provided for all 125-volt, single-phase, 15-, 20-, and 30-ampere receptacle outlets installed or existing as part of the permanent wiring of the building or structure and used for temporary electric power. Listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use shall be permitted.

(3) Receptacles on 15-kW or less Portable Generators. All 125-volt and 125/250-volt, single-phase, 15-, 20-, and 30-ampere receptacle outlets that are a part of a 15-kW or smaller portable generator shall have listed ground-fault circuit-interrupter protection for personnel. All 15- and 20-ampere, 125- and 250-volt receptacles, including those that are part of a portable generator, used in a damp or wet location shall comply with 406.9(A) and (B). Listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use shall be permitted for use with 15-kW or less portable generators manufactured or remanufactured prior to January 1, 2015.

Requiring GFCI protection of all temporarily installed, 125-volt, single-phase, 15-, 20-, and 30-ampere receptacles is intended to protect personnel using these receptacles from shock hazards that could be encountered during construction and maintenance activities. Receptacles on a construction site provide power via the temporary wiring system or the permanent premises wiring system of the structure. The latter method can be used when the premises wiring is available prior to project completion. This requirement applies even where the final occupancy would not require GFCI protection for the receptacle being utilized.

Section 590.6(A)(3) specifically addresses GFCI protection for small generators that are common at construction sites. Generators manufactured prior to January 1, 2011, were not required to provide this protection. Therefore, listed cord sets or other devices are permitted to provide GFCI protection. Exhibits 590.1 and 590.2 show examples of ways to implement the GFCI requirements for temporary installations.

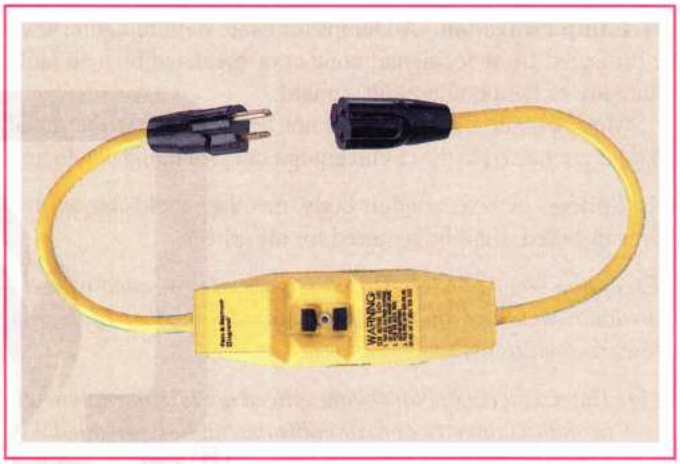

EXHIBIT 590.1 A raintight, portable GFCI with open neutral protection designed for use on the line end of a flexible cord. *(Courtesy of Legrand®)*

EXHIBIT 590.2 A temporary power outlet unit commonly used on construction sites with a variety of configurations, including GFCI protection. *(Courtesy of Hubbell Wiring Device—Kellems)*

(B) Other Receptacle Outlets. For temporary wiring installations, receptacles, other than those covered by 590.6(A)(1) through (A)(3) used to supply temporary power to equipment used by personnel during construction, remodeling, maintenance, repair, or demolition of buildings, structures, or equipment, or similar activities, shall have protection in accordance with 590.6(B)(1) or the assured equipment grounding conductor program in accordance with 590.6(B)(2).

(1) GFCI Protection. Ground-fault circuit-interrupter protection for personnel.

(2) Assured Equipment Grounding Conductor Program. A written assured equipment grounding conductor program continuously enforced at the site by one or more designated persons to ensure that equipment grounding conductors for all cord sets, receptacles that are not a part of the permanent wiring of the building or structure, and equipment connected by cord and plug are installed and maintained in accordance with the applicable requirements of 250.114, 250.138, 406.4(C), and 590.4(D).

(a) The following tests shall be performed on all cord sets, receptacles that are not part of the permanent wiring of the building or structure, and cord-and-plug-connected equipment required to be connected to an equipment grounding conductor:

(1) All equipment grounding conductors shall be tested for continuity and shall be electrically continuous.
(2) Each receptacle and attachment plug shall be tested for correct attachment of the equipment grounding conductor. The equipment grounding conductor shall be connected to its proper terminal.
(3) All required tests shall be performed as follows:
   a. Before first use on site
   b. When there is evidence of damage
   c. Before equipment is returned to service following any repairs
   d. At intervals not exceeding 3 months

(b) The tests required in 590.6(B)(2)(a) shall be recorded and made available to the authority having jurisdiction.

The assured equipment grounding conductor program shall be documented and made available to the authority having jurisdiction.

Informational Note: See OSHA 29 CFR 1910 and 1926 for requirements for assured equipment grounding conductor programs. See NFPA *70E*-2018, *Standard for Electrical Safety in the Workplace*, for additional information.

The environmental conditions encountered during construction or demolition could subject personnel to an increased exposure to electrical shock hazards. Receptacle configurations other than 125 volts, single phase, 15, 20, and 30 amperes supplying temporary power must also be GFCI protected or be installed and maintained in accordance with the documented assured EGC program specified in 590.6(B)(2).

The Occupational Safety and Health Administration (OSHA) test requirements are very similar to the *NEC* requirements for an assured grounding program. According to OSHA 29 CFR 1926.404(b)(1)(iii), those test requirements are as follows:

> The employer shall establish and implement an assured equipment grounding conductor program on construction sites covering all cord sets, receptacles which are not a part of the building or structure, and equipment connected by cord and plug which are available for use or used by employees. This program shall comply with the following minimum requirements:
>
> (A) A written description of the program, including the specific procedures adopted by the employer, shall be available at the jobsite for inspection and copying by the Assistant Secretary and any affected employee.
>
> (B) The employer shall designate one or more competent persons to implement the program.

590.7 Guarding. For wiring over 600 volts, nominal, suitable fencing, barriers, or other effective means shall be provided to limit access only to authorized and qualified personnel.

590.8 Overcurrent Protective Devices.

Δ **(A) Where Reused.** Overcurrent protective devices that have been previously used and are installed in a temporary installation shall be examined to ensure they have been properly installed and properly maintained, and there is no evidence of impending failure.

Informational Note: See the following standards for further information for properly maintained equipment:

(1) NEMA AB 4, *Guidelines for Inspection and Preventive Maintenance of Molded-Case Circuit Breakers Used in Commercial and Industrial Applications*
(2) NFPA 70B, *Recommended Practice for Electrical Equipment Maintenance*
(3) NEMA GD 1, *Evaluating Water-Damaged Electrical Equipment*
(4) IEEE 1458, *IEEE Recommended Practice for the Selection, Field Testing, and Life Expectancy of Molded-Case Circuit Breakers for Industrial Applications*

Δ **(B) Service Overcurrent Protective Devices.** Overcurrent protective devices for solidly grounded wye electrical services of more than 150 volts to ground but not exceeding 1000 volts phase-to-phase, available fault current greater than 10,000 amperes, shall be current limiting.

It is not uncommon for temporary electrical equipment to be used more than once. Temporary equipment is often subjected to conditions that permanently installed equipment is not. Weather, transportation, storage, and use can play a role in creating an unsafe condition within the temporary equipment. For that reason, equipment must be examined before being put back in use.

For equipment that poses a greater risk of causing an injury or death to workers, the overcurrent protective device (OCPD) at the temporary service must be current limiting. This reduces the amount of incident energy available in a temporary system, thereby potentially reducing the risk to employees. This requirement applies only to service overcurrent protective devices rated to interrupt fault currents exceeding 10,000 amperes, which is not uncommon in larger capacity temporary installations such as commercial and industrial construction projects and temporary services for large events such as a music festival or similar event.