

ARTICLE

555

Marinas, Boatyards, Floating Buildings, and Commercial and Noncommercial Docking Facilities

Part I. General

555.1 Scope. This article covers the installation of wiring and equipment in the areas comprising fixed or floating piers, wharves, docks, floating buildings, and other areas in marinas, boatyards, boat basins, boathouses, yacht clubs, boat condominiums, docking facilities associated with one-family dwellings, two-family dwellings, multifamily dwellings, and residential condominiums; any multiple docking facility or similar occupancies; and facilities that are used, or intended for use, for the purpose of repair, berthing, launching, storage, or fueling of small craft and the moorage of floating buildings.

Informational Note No. 1: See NFPA 303-2016, *Fire Protection Standard for Marinas and Boatyards*, for additional information.

Informational Note No. 2: Where boats, floating buildings, docks, and similar structures are connected to an electrical source or a supply of electricity, hazardous voltages and currents may create serious safety concerns.

Informational Note No. 3: Text that is followed by a reference in brackets has been extracted from NFPA 303-2016, *Fire Protection Standard for Marinas and Boatyards*, and NFPA 307-2016, *Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves*. Only editorial changes were made to the extracted text to make it consistent with this Code.

The requirements of Article 555 apply to public and private docking, storage, repair, and fueling facilities for small craft. It also applies to floating buildings. The term *small craft* is not defined in the NEC®. Based on the scope of NFPA 303, *Fire Protection Standard for Marinas and Boatyards*, the term *small craft* includes recreational and commercial boats, yachts, and other craft that do not exceed 300 gross tons. For facilities that serve larger craft and ships, see NFPA 307, *Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves*. Requirements for floating buildings, including floating dwelling units, which previously were contained in Article 553 until the 2020 NEC, are covered in Article 555.

This article also applies to docking facilities associated with one-family dwellings, two-family dwellings, and multifamily dwellings.

555.3 Electrical Datum Plane Distances.

(A) Floating Piers. The electrical datum plane for floating piers and boat landing stages that is (1) installed to permit rise and fall response to water level and without lateral movement, and (2) that are so equipped that piers and landing stages can rise to the datum plane established for 555.3(B) or (C), shall be a horizontal plane 762 mm (30 in.) above the water level at the floating pier or boat landing stage and a minimum of 305 mm (12 in.) above the level of the deck.

(B) Areas Subject to Tidal Fluctuations. In land areas subject to tidal fluctuation, the electrical datum plane shall be a horizontal plane that is 606 mm (2 ft) above the highest tide level for the area occurring under normal circumstances, based on the highest high tide.

(C) Areas Not Subject to Tidal Fluctuations. In land areas not subject to tidal fluctuation, the electrical datum plane shall be a horizontal plane that is 606 mm (2 ft) above the highest water level for the area occurring under normal circumstances.

Throughout Article 555, the physical location of electrical equipment is referenced to the electrical datum plane, which is used as a horizontal benchmark on land and on floating piers. The definition of the term *electrical datum plane* encompasses areas subject to tidal movement and areas in which the water level is affected only by conditions such as climate (rain or snowfall) or by human intervention (the opening or closing of dams and floodgates). In either case, the term covers the normal highest water level, such as astronomical high tides. The term does not cover extremes due to natural or manmade disasters.

See also

Article 100 for the definition of *electrical datum plane*

555.4 Location of Service Equipment. The service equipment for a floating building, dock, or marina shall be located on land no closer than 1.5 m (5 ft) horizontally from and adjacent to the structure served, but not on or in the structure itself or any other floating structure. Service equipment shall be elevated a minimum of 300 mm (12 in.) above the electrical datum plane.

This requirement ensures that supply conductors to a floating building, dock, or pier can be disconnected in an emergency, such as during a storm, when the floating structure has to be moved quickly. Service equipment is not permitted to be installed on the floating building and any other floating structure, such as a pier, and is now subject to horizontal clearances from these structures. Additionally, minimum elevation requirements above the electrical datum plane provide clearances above normally experienced high-water levels, as covered by the definition of *electrical datum plane* in Article 100. This requirement applies only to equipment that is covered by the definition of *service equipment*. A minimum elevation requirement above docks and piers for other electrical equipment, not meeting the definition of *service equipment*, is covered by the requirements of 555.30(A).

555.5 Maximum Voltage. Pier power distribution systems shall not exceed 250 volts phase to phase. Pier power distribution systems, where qualified personnel service the equipment under engineering supervision, shall be permitted to exceed 250 volts but these systems shall not exceed 600 volts.

Δ 555.6 Load Calculations for Service and Feeder Conductors. General lighting and other loads shall be calculated in accordance with Part III of Article 220, and, in addition, the demand factors set forth in 220.120 shall be permitted for each service and/or

feeder circuit supplying receptacles that provide shore power for boats.

All load calculations for the types of facilities covered by Article 555 are located in Article 220. Part VII of Article 220 contains demand factors that are permitted to be applied to receptacles supplying shore power to watercraft.

555.7 Transformers.

(A) General. Transformers and enclosures shall be identified for wet locations. The bottom of transformer enclosures shall not be located below the electrical datum plane.

(B) Replacements. Transformers and enclosures shall be identified for wet locations where replacements are made.

555.8 Marine Hoists, Railways, Cranes, and Monorails.

Motors and controls for marine hoists, railways, cranes, and monorails shall not be located below the electrical datum plane. Where it is necessary to provide electric power to a mobile crane or hoist in the yard and a trailing cable is utilized, it shall be a listed portable power cable rated for the conditions of use and be provided with an outer jacket of distinctive color for safety.

555.10 Signage. Permanent safety signs shall be installed to give notice of electrical shock hazard risks to persons using or swimming near a docking facility, boatyard, or marina and shall comply with all of the following:

- (1) The signage shall comply with 110.21(B)(1) and be of sufficient durability to withstand the environment.
- (2) The signs shall be clearly visible from all approaches to a marina, docking facility, or boatyard facility.
- (3) The signs shall state “WARNING — POTENTIAL SHOCK HAZARD — ELECTRICAL CURRENTS MAY BE PRESENT IN THE WATER.”

Electrical shock drowning is only one of many hazards that exist in the water around marinas and boatyards. Part of an effective plan to reduce the number of incidents is a no swimming policy. Prohibiting recreational swimming in the immediate vicinity of boats and docks using ac electrical power will protect the public against the dangers associated with using electrical power in marinas and boatyards. The warnings provided by signage (see Exhibit 555.1), along with enforcement by marina and boatyard operators, can help promote changes in the behavior of those using facilities covered by Article 555 with the intended result being to save lives and prevent injuries that have occurred too frequently in bodies of water associated with public and private marinas and docking facilities.

555.11 Motor Fuel Dispensing Stations — Hazardous (Classified) Locations. Electrical wiring and equipment located at or serving motor fuel dispensing locations shall comply with Article 514 in addition to the requirements of this article.



EXHIBIT 555.1 An example of signage that includes the messaging required by 555.10.

See also

NFPA 303, *Fire Protection Standard for Marinas and Boatyards*

NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Repair Garages*

555.12 Repair Facilities — Hazardous (Classified) Locations.

Electrical wiring and equipment located at facilities for the repair of marine craft containing flammable or combustible liquids or gases shall comply with Article 511 in addition to the requirements of this article.

555.13 Bonding of Non-Current-Carrying Metal Parts.

All metal parts in contact with the water, all metal piping, and all non-current-carrying metal parts that are likely to become energized and that are not connected to a branch circuit or feeder equipment grounding conductor, shall be connected to the grounding bus in the panelboard using solid copper conductors; insulated, covered, or bare; not smaller than 8 AWG. Connections to bonded parts shall be made in accordance with 250.8.

N 555.14 Equipotential Planes and Bonding of Equipotential Planes.

An equipotential plane shall be installed where required in this section to mitigate step and touch voltages at electrical equipment. The parts specified in this section shall be bonded together and to the electrical grounding system. The bonding conductor shall be solid copper conductors; insulated, covered, or bare; not smaller than 8 AWG.

(A) Areas Requiring Equipotential Planes. Equipotential planes shall be installed adjacent to all outdoor service equipment or disconnecting means that control equipment in or on water where the following conditions exist:

- (1) Where the system voltage exceeds 250 volts to ground
- (2) Where the equipment is located within 3 m (10 ft) of the body of water

The equipotential plane shall include all metallic enclosures and controls that are likely to become energized and are accessible to personnel. The equipotential plane shall encompass the area around the equipment and shall extend from the area directly below the equipment out not less than 900 mm (36 in.) in all directions from which a person would be able to stand and come in contact with the equipment.

N (B) Areas Not Requiring Equipotential Planes. Equipotential planes shall not be required for the controlled utilization equipment on the docking facility or floating building supplied by the service equipment or disconnecting means.

Equipotential bonding of electrical equipment to mitigate the hazard of potential differences is a proven safety feature used in many settings where a shock hazard exists due to touch and step potentials between items of electrical equipment or between electrical equipment and ground. The increased likelihood of step and touch potentials due to wet or damp conditions resulting from the close proximity of electrical equipment to water is the hazard being addressed by this requirement. If outdoor service equipment or other disconnecting means is used to supply equipment in or on the water and the supply system voltage is rated over 250 volts to ground (i.e., a 277/480-volt wye system or a 240-volt delta system), all electrical equipment enclosures within 36 inches horizontally of the service equipment or disconnecting means must be connected together with an 8 AWG conductor. This connection equalizes the touch potential of all exposed conductive surfaces that are *likely to become energized*. Creating the equipotential plane is only required if the service equipment or disconnecting means is located within 10 feet of the body of water.

See also

Article 100 for the definition of *energized*, *likely to become energized*, and *likely to become energized*
682.33 for a parallel requirement covering electrical equipment installed in proximity to "natural and artificially made bodies of water"

N 555.15 Replacement of Equipment. When modifications or replacements of electrical enclosures, devices, or wiring methods are necessary on a docking facility, they shall be required to comply with the requirements of this *Code*, and the installation shall require an inspection of the circuit. Existing equipment that has been damaged shall be identified, documented, and repaired by a qualified person to the minimum requirements of the edition of this *Code* to which it was originally installed.

Informational Note: NFPA 303-2021, *Fire Protection Standard for Marinas and Boatyards*, is a resource for guiding the electrical inspection of a marina.

Newly installed electrical equipment that complies with the requirements of Article 555 is considered to be safe. Once the installation has been approved by the AHJ, the responsibility for ongoing safe operation of the electrical system is transferred to the owner/operator of the docking facility. An unsafe presumption by many is that if the equipment is functioning, it must be safe. Unfortunately, that is not always true. Electrical

equipment installed at docking facilities is subject to extreme environmental exposure and also to physical damage that is unintended in most cases but is inherent to the use of these types of facilities. While it may still be functioning, damaged electrical equipment can manifest into an unsafe condition, such as enclosures and pedestals that no longer prevent the entrance of moisture. Internal damage to electrical equipment can go unseen until it fails or an accident occurs.

Section 555.15 has the sole purpose of preventing electrical accidents due to the use of electrical equipment that no longer provides the requisite level of electrical safety. The NFPA standard cited in the Informational Note provides for yearly inspection of docking facilities, including a list of observations to make on docking facility electrical systems. Electricity and water are normally not a good mix, but *NEC* requirements such as those contained in Articles 555 and 680 provide for safe interface with electrical equipment while near or in water. However, this safe interface is only as good as how well the original level of safety provided by a compliant installation is maintained.

See also

90.2(B), in which the necessity of maintenance of electrical systems is discussed

Part II. Marinas, Boatyards, and Docking Facilities

555.30 Electrical Equipment and Connections.

Δ (A) General. All electrical components within electrical equipment (excluding wiring methods) and connections not intended for operation while submerged shall be located at least 305 mm (12 in.) above the deck of a fixed or floating structure, but not below the electrical datum plane. Conductor splices, within junction boxes identified for wet locations, utilizing sealed wire connector systems listed and identified for submersion shall be required for floating structures where located above the waterline but below the electrical datum plane.

Δ (B) Replacements. Replacement electrical connections shall be located at least 305 mm (12 in.) above the deck of a floating or fixed structure. Conductor splices, within junction boxes identified for wet locations, utilizing sealed wire connector systems listed and identified for submersion shall be required where located above the waterline but below the electrical datum plane.

Not all listed sealed wire-connector systems provide the same degree of protection from moisture ingress. Some sealed wire-connector systems are marked "Watertight" or "Submersible," as applicable.

555.31 Electrical Equipment Enclosures.

(A) Securing and Supporting. Electrical equipment enclosures installed on piers above deck level shall be securely and substantially supported by structural members, independent of

any conduit connected to them. If enclosures are not attached to mounting surfaces by means of external ears or lugs, the internal screw heads shall be sealed to prevent seepage of water through mounting holes.

(B) Location. Electrical equipment enclosures on piers shall be located so as not to interfere with mooring lines.

555.32 Circuit Breakers, Switches, Panelboards, and Marina Power Outlets. Circuit breakers and switches installed in gasketed enclosures shall be arranged to permit required manual operation without exposing the interior of the enclosure. All such enclosures shall be arranged with a weep hole to discharge condensation.

555.33 Receptacles. Receptacles shall be mounted not less than 305 mm (12 in.) above the deck surface of the pier and not below the electrical datum plane on a fixed pier.

The location of enclosures for receptacles on fixed and floating piers is based on the *electrical datum plane* as defined in Article 100. For floating piers, the datum plane is 12 inches above the deck of the pier. The purpose of this requirement is to prevent submersion of receptacle enclosures.

The requirements for enclosures in 555.33(A)(1) address their exposure to the severe weather (wind-driven rain) and environmental conditions (splashing from breaking waves or wakes) frequently encountered at marine locations.

(A) Shore Power Receptacles.

(1) Enclosures. Receptacles intended to supply shore power to boats shall be enclosed in listed marina power outlets, enclosures listed for wet locations, or shall be installed in listed enclosures protected from the weather. The integrity of the assembly shall not be affected when the receptacles are in use with any type of booted or nonbooted attachment plug/cap inserted.

(2) Strain Relief. Means shall be provided where necessary to reduce the strain on the plug and receptacle caused by the weight and catenary angle of the shore power cord.

(3) Branch Circuits. Each single receptacle that supplies shore power to boats shall be supplied from a marina power outlet or panelboard by an individual branch circuit of the voltage class and rating corresponding to the rating of the receptacle.

Informational Note: Supplying receptacles at voltages other than the voltages marked on the receptacle may cause overheating or malfunctioning of connected equipment, for example, supplying single-phase, 120/240-volt, 3-wire loads from a 208Y/120-volt, 3-wire source.

The requirement that each single receptacle that supplies shore power to boats be supplied from an individual branch circuit can be met through the use of multiwire branch circuits derived from single-phase, 3-wire systems or from 3-phase, 4-wire systems. Although the ungrounded conductors of a multiwire branch circuit share the same grounded (neutral) conductor, this configuration can be considered multiple branch circuits in accordance

with 210.4(A). If multiwire branch circuits are used, they must be provided with a disconnecting means that simultaneously opens all ungrounded circuit conductors at the point the circuit originates in accordance with 210.4(B). This requirement enhances the safety of those who have to work on a particular receptacle, but it could be inconvenient for boaters due to power to more receptacles being interrupted when the multiwire branch-circuit disconnecting means is opened.

See also

300.13(B) and its commentary regarding device removal for multiwire branch circuits

Δ (4) Ratings. Shore power for boats shall be provided by single receptacles rated not less than 30 amperes.

Informational Note: See NFPA 303-2016, *Fire Protection Standard for Marinas and Boatyards*, for locking- and grounding-type receptacles for auxiliary power to boats.

(a) Receptacles rated 30 amperes and 50 amperes shall be of the locking and grounding type.

Informational Note: See ANSI/NEMA WD 6-2016, *Wiring Devices — Dimensional Specifications*, for various configurations and ratings of locking- and grounding-type receptacles and caps.

(b) Receptacles rated 60 amperes or higher shall be of the pin and sleeve type.

Informational Note: See ANSI/UL 1686, *UL Standard for Safety Pin and Sleeve Configurations*, for various configurations and ratings of pin and sleeve receptacles.

Single locking- and grounding-type receptacles and attachment caps are required for providing shore power to boats. This facilitates proper connections and prevents unintentional disconnection of on-board equipment, such as bilge pumps, refrigerators, and so forth. Exhibit 555.2 illustrates a chart of grounding-type locking plug and receptacle configurations. Exhibit 555.3 shows pin-and-sleeve-type receptacle configurations.

(B) Other Than Shore Power. Receptacles other than those supplying shore power to boats shall be permitted to be enclosed in marina power outlets with the receptacles that provide shore power to boats, provided the receptacles are marked to clearly indicate that the receptacles are not to be used to supply power to boats.

All receptacle configurations and locations covered by 210.8, other than those supplying shore power to boats, are required to be GFCI protected.

(C) Replacement Receptacles. The requirements in 555.33 shall apply to the replacement of marina receptacles.

555.34 Wiring Methods and Installation.

(A) Wiring Methods.

(1) General. Wiring methods of Chapter 3 shall be permitted where identified for use in wet locations and shall contain a wire-type insulated equipment grounding conductor.

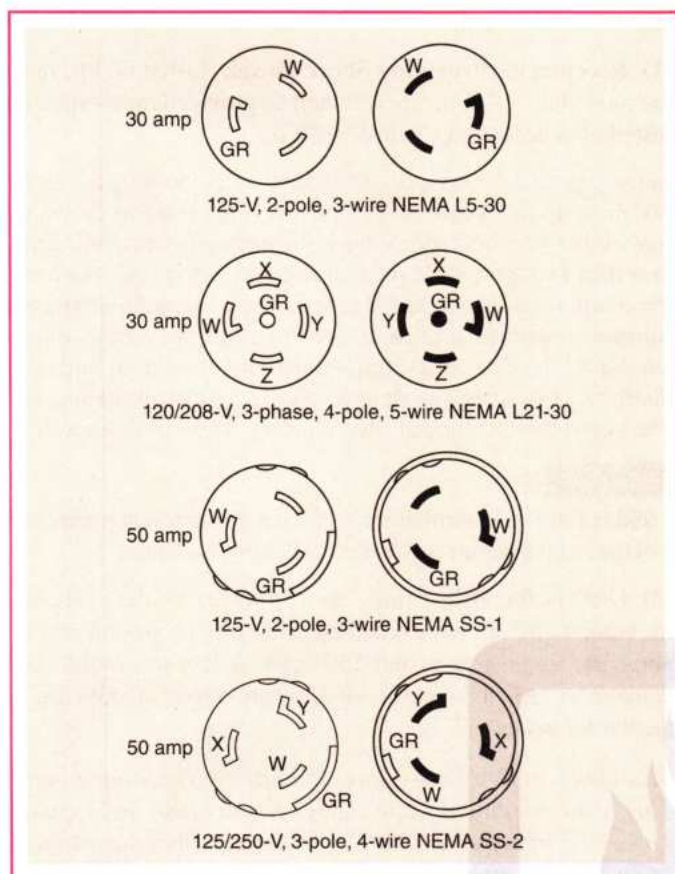


EXHIBIT 555.2 Typical configurations from 30 amperes to 50 amperes for single locking- and grounding-type receptacles and attachment plug caps used to provide shore power for boats in marinas and boatyards.

(2) **Portable Power Cables.** Extra-hard usage cord and extra-hard usage portable power cables rated not less than 75°C (167°F) and 600 volts, listed for use in the environment within which it is installed, shall be permitted as follows:

- (1) As permanent wiring on the underside of piers (floating or fixed)
- (2) Where flexibility is necessary as on piers composed of floating sections

The cable construction requirements are necessary due to the cables' exposure to extremes in weather conditions and to operational hazards such as oil and gasoline spills. Not all portable power cables are suitable for exposure to gasoline. A cable evaluated for oil and gasoline resistance at 75°C is marked "GASOLINE AND OIL RESISTANT II," or "GR2."

(B) Installation.

(1) **Overhead Wiring.** Overhead wiring shall be installed to avoid possible contact with masts and other parts of boats being moved in the yard.

Conductors and cables shall be routed to avoid wiring closer than 6.0 m (20 ft) from the outer edge or any portion of the yard

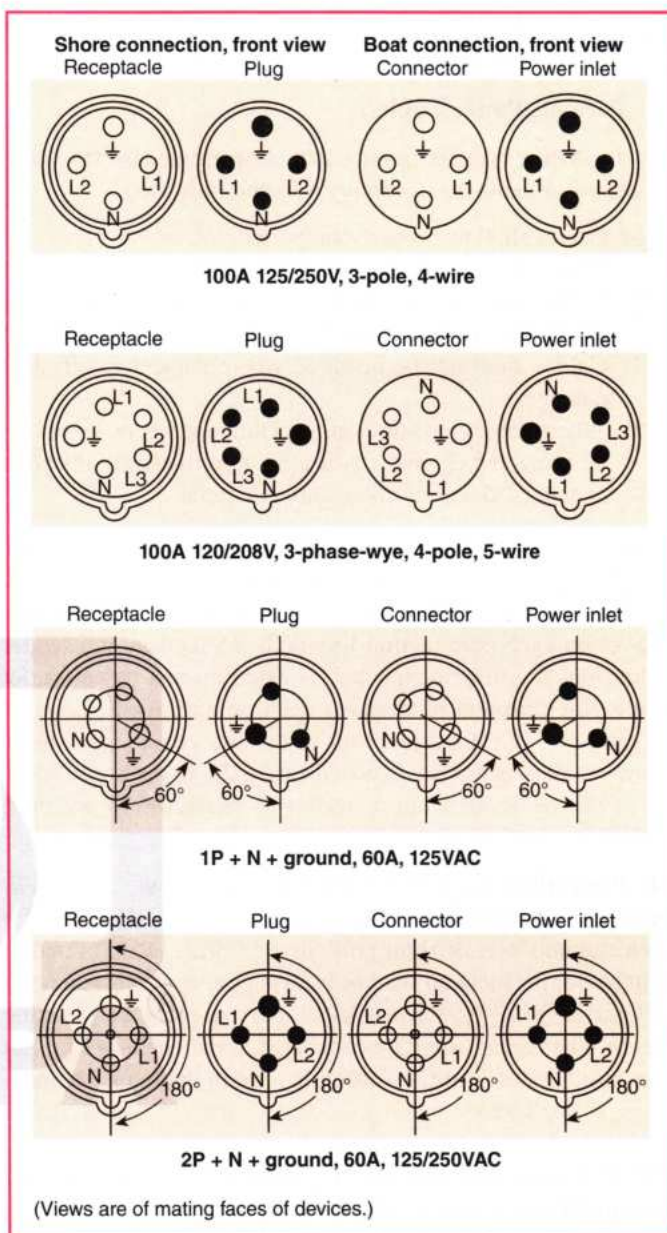


EXHIBIT 555.3 Typical configurations of 60 amperes or 100 amperes for safety pin-and-sleeve-type receptacles, plugs, connectors, and power inlets used to provide shore power for boats in marinas and boatyards.

that can be used for moving vessels or stepping or unstepping masts.

(2) **Outdoor Branch Circuits and Feeders.** Multiple feeders and branch circuits shall be permitted and clearances for overhead branch-circuit and feeder wiring in locations of the boatyard other than those described in 555.34(B)(1) shall be located not less than 5.49 m (18 ft) above grade. Only Part I of Article 225 shall apply to marina installations.

Approval for wiring over and under navigable water by the AHJ may include federal and local agencies, such as the Army Corps

of Engineers, the Coast Guard, or local harbor masters, that have specific authority over the waterways.

(3) Portable Power Cables.

(a) Where portable power cables are permitted by 555.34(A)(2), the installation shall comply with the following:

- (1) Cables shall be properly supported.
- (2) Cables shall be located on the underside of the pier.
- (3) Cables shall be securely fastened by nonmetallic clips to structural members other than the deck planking.
- (4) Cables shall not be installed where subject to physical damage.
- (5) Where cables pass through structural members, they shall be protected against chafing by a permanently installed oversized sleeve of nonmetallic material.

(b) Where portable power cables are used as permitted in 555.34(A)(2)(2), there shall be a junction box of corrosion-resistant construction with permanently installed terminal blocks on each pier section to which the feeders and feeder extensions are to be connected. A listed marina power outlet employing terminal blocks/bars shall be permitted in lieu of a junction box. Metal junction boxes and covers, and metal screws and parts that are exposed externally to the boxes, shall be of corrosion-resistant materials or protected by material resistant to corrosion.

Δ (4) **Protection.** Rigid metal conduit, intermediate metal conduit, reinforced thermosetting resin conduit (RTRC) listed for aboveground use, or rigid polyvinyl chloride (PVC) conduit suitable for the location shall be used to protect wiring to a point at least 2.5 m (8 ft) above docks, decks of piers, and landing stages. The conduit shall be connected to the enclosure by full standard threads or fittings listed for use in damp or wet locations, as applicable.

555.35 Ground-Fault Protection of Equipment (GFPE) and Ground-Fault Circuit Interrupter. For other than floating buildings, ground-fault protection for docking facilities shall be provided in accordance with 555.35(A) through (D).

N (A) **Feeder.** Listed GFPE, rated not more than 100 milliamperes, shall be provided for feeders installed on docking facilities. Coordination with downstream GFPE shall be permitted at the feeder overcurrent protective device.

Exception: Transformer secondary conductors of a separately derived system that do not exceed 3 m (10 ft) and are installed in a raceway shall be permitted to be installed without ground-fault protection.

This exception shall also apply to the supply terminals of the equipment supplied by the transformer secondary conductors.

N (B) Branch-Circuits

N (1) **Receptacles Providing Shore Power.** Listed GFPE, rated not more than 30 milliamperes, shall be provided for receptacles installed in accordance with 555.33(A).

According to U.S. Coast Guard studies and industry standards, 30 milliamperes represents an acceptable level to prevent a majority of electrical shock drowning incidents while remaining practical enough to minimize unnecessary tripping. For more information, see the report "Assessment of Hazardous Voltage/Current in Marinas, Boatyards and Floating Buildings," commissioned by the Fire Protection Research Foundation and conducted by the American Boat & Yacht Council Foundation, Inc. The report can be found at www.nfpa.org/news-and-research.

See also

555.53 and its commentary regarding ground-fault protection of the main overcurrent device for floating buildings

N (2) **Outlets for Other than Shore Power.** Outlets supplied by branch circuits not exceeding 150 volts to ground and 60 amperes, single phase, and 150 volts or less to ground, 100 amperes or less, three phase, shall be provided with GFCI protection for personnel.

Exception to (B): Low-voltage circuits not requiring grounding, not exceeding the low-voltage contact limit and supplied by listed transformers or power supplies that comply with 680.23(A)(2) shall be permitted to be installed without ground-fault protection.

The characteristics of the branch circuits covered by this requirement are similar to the parameters of 210.8(B) for GFCI protection of receptacles installed in or at other than dwelling units. An important distinction between this requirement and that of 210.8(B) is the use of the term *outlet*. An *outlet* includes a point in a wiring system at which a receptacle is installed and also includes locations in the wiring system where power is taken to supply utilization equipment using other than a cord-and-plug connection, such as "hard-wired" or "direct-wired" connections.

N (C) **Boat Hoists.** GFCI protection for personnel shall be provided for outlets not exceeding 240 volts that supply a boat hoist installed at docking facilities. GFCI protected receptacles for other than shore power shall be permitted to supply boat hoists.

Compliance with this GFCI requirement can be accomplished through the use of a device installed at the outlet or a device installed in the branch circuit supplying the outlet. Specifying GFCI protection "for outlets" that supply a boat hoist extends this requirement to direct- or hard-wired models as well as cord-and-plug-connected models.

(D) **Leakage Current Measurement Device.** Where more than three receptacles supply shore power to boats, a listed leakage current measurement device for use in marina applications shall be available and be used to determine leakage current from each

boat that will utilize shore power. The listing requirement for the leakage current measurement device for use in marina applications shall become effective January 1, 2026.

Informational Note No. 1: Leakage current measurement will provide the capability to determine when an individual boat has defective wiring or other problems contributing to hazardous voltage and current. The use of a test device will allow the facility operator to identify a boat that is creating problems. In some cases a single boat could cause an upstream GFPE device protecting a feeder to operate even though multiple boats are supplied from the same feeder. The use of a test device will help the facility operator prevent a particular boat from contributing to hazardous voltage and current in the marina area.

Informational Note No. 2: An annual test of each boat with the leakage current measurement device is a prudent step toward determining if a boat has defective wiring that could be contributing hazardous voltage and current. Where the leakage current measurement device reveals that a boat is contributing hazardous voltage and current, repairs should be made to the boat before it is permitted to utilize shore power.

Exception: Where the shore power equipment includes a leakage indicator and leakage alarm, a separate leakage test device shall not be required.

555.36 Disconnecting Means for Shore Power Connection(s). Disconnecting means shall be provided to isolate each boat from its supply connection(s).

(A) Type. The disconnecting means shall consist of a circuit breaker, switch, or both, and shall be properly identified as to which receptacle it controls.

Δ (B) Location. The disconnecting means shall be readily accessible, located not more than 762 mm (30 in.) from the receptacle it controls, and located in the supply circuit ahead of the receptacle. Circuit breakers or switches located in marina power outlets complying with this section shall be permitted as the disconnecting means.

N (C) Emergency Electrical Disconnect. Each marina power outlet or enclosure that provides shore power to boats shall be provided with a listed emergency shutoff device or electrical disconnect that is clearly marked "Emergency Shutoff" in accordance with 110.22(A). The emergency shutoff device or electrical disconnect shall be within sight of the marina power outlet or other enclosure that provides shore power to boats, readily accessible, externally operable, manually resettable, and listed for use in wet locations. The emergency shutoff device or electrical disconnect shall de-energize the power supply to all circuits supplied by the marina power outlet(s) or enclosure(s) that provide shore power to boats. A circuit breaker handle shall not be used for this purpose.

Requiring a readily accessible means to disconnect shore power connections to watercraft enables marina and boatyard users to respond to an emergency condition without increasing the

danger to themselves. The natural reaction of many is to enter the water if a disabled or distressed swimmer is observed and there is no marked or readily accessible means to shut the power off. Unfortunately, this only puts this person at peril of also becoming a victim of the current that exists in the water. A marked, local, and externally operable means of interrupting the power at the marina outlet is a far safer method of response to an incident involving a person fully or partially submerged in the water becoming disabled due to swimming or wading through a voltage gradient that results in electrical current through his or her body or by being in water and touching a surface that is exposed and conductive and at a different potential than the water.

555.37 Equipment Grounding Conductor.

(A) Equipment to Be Connected to Equipment Grounding Conductor. The following items shall be connected to an equipment grounding conductor run with the circuit conductors in the same raceway, cable, or trench:

- (1) Metal boxes, metal cabinets, and all other metal enclosures
- (2) Metal frames of utilization equipment
- (3) Grounding terminals of grounding-type receptacles

Δ (B) Type of Equipment Grounding Conductor. An equipment grounding conductor shall be of the wire-type, insulated, and sized in accordance with 250.122 but not smaller than 12 AWG.

The use of an insulated aluminum or copper wire-type equipment grounding conductor (EGC) ensures a high-integrity path for ground-fault current. Because of the corrosive conditions in marinas and boatyards, metal raceways are not permitted to serve as the sole EGC.

Δ (C) Feeder Equipment Grounding Conductor. Where a feeder supplies a remote panelboard or other distribution equipment, an insulated equipment grounding conductor shall extend from a grounding terminal in the service to a grounding terminal and busbar in the remote panelboard or other distribution equipment.

(D) Branch-Circuit Equipment Grounding Conductor. The insulated equipment grounding conductor for branch circuits shall terminate at a grounding terminal in a remote panelboard, in other distribution equipment, or in the main service equipment.

N (E) Cord-and-Plug-Connected Appliances. Unless double-insulated, cord-and-plug-connected appliances shall be grounded by means of an equipment grounding conductor in the cord and a grounding-type attachment plug.

Exception: An equipment grounding conductor shall be permitted to be uninsulated if a part of a listed cable assembly identified for the environment and not subject to atmospheres or environments such as, but not limited to, storm water basins, sewage treatment ponds, and natural bodies of water containing salt water.

N 555.38 Luminaires.

(A) General. All luminaires and retrofit kits shall be listed and identified for use in their intended environment. Luminaires and their supply connections shall be secured to structural elements of the marina to limit damage from watercraft and prevent entanglement of and interaction with sea life.

(B) Underwater Luminaires. Luminaires installed below the highest high tide level or electrical datum plane and likely to be periodically submersed shall be limited to those luminaires that comply with the following:

- (1) Identified as submersible
- (2) Operate below the low-voltage contact limit defined in Article 100
- (3) Supplied by an isolating transformer or power supply in accordance with 680.23(A)(2)

Limiting sources of electricity in the water due to equipment failure resulting from not being suitable for the harsh environment at marinas is the objective of this requirement for listed or certified luminaires and retrofit kits. Durability and resistance of the equipment to the harsh effects of outdoor conditions are considerations in evaluating products for the marina environment. Additionally, limiting voltage levels and using isolating transformers or power supplies — as is done with underwater luminaires for swimming pools and other bodies of water covered by Article 680 — is another protection technique for reducing electrical hazards associated with luminaires within marinas and boatyards that are intentionally or likely to be periodically submerged.

Part III. Floating Buildings

Although the *NEC* does not cover electrical installations on ships or watercraft, it does cover installations for floating buildings. Floating buildings are permanently moored in one location, for example, restaurants, aquariums, and dwelling units. All other applicable articles apply to these floating buildings.

See also

90.2(C)(1) for the scope statement on floating buildings covered by the *NEC*

90.2(D)(1) for the scope statement on ships and watercraft (other than floating buildings) not covered by the *NEC*

555.50 Service Conductors. One set of service conductors shall be permitted to serve more than one set of service equipment.

555.51 Feeder Conductors. Each floating building shall be supplied by a single set of feeder conductors from its service equipment.

Exception: Where the floating building has multiple occupancy, each occupant shall be permitted to be supplied by a single set of feeder conductors extended from the occupant's service equipment to the occupant's panelboard.

555.52 Installation of Services and Feeders.

(A) Flexibility. Flexibility of the wiring system shall be maintained between floating buildings and the supply conductors. All wiring shall be installed so that motion of the water surface and changes in the water level will not result in unsafe conditions.

(B) Wiring Methods. Liquidtight flexible metal conduit or liquidtight flexible nonmetallic conduit with approved fittings shall be permitted for feeders and where flexible connections are required for services. Extra-hard usage portable power cable listed for both wet locations and sunlight resistance shall be permitted for a feeder to a floating building where flexibility is required. Other raceways suitable for the location shall be permitted to be installed where flexibility is not required.

If a portable power cable is used as a feeder to a floating building, it is important to understand the differences between cable types. A cable designation with a "W" as the last letter is suitable for use in wet locations and is sunlight resistant. If "W" is the only letter, this indicates that the cable is a portable power cable. Where Type W cables from Table 400.4 are used to supply a floating building, they must be listed for use in wet locations and for sunlight resistance. Not all Type W cables are listed for wet location applications.

555.53 Ground-Fault Protection. The main overcurrent protective device that feeds the floating building shall have ground-fault protection not exceeding 100 mA. Ground-fault protection of each individual branch or feeder circuit shall be permitted as a suitable alternative. Outdoor outlets, shore power outlets, and boat hoists located at floating buildings shall comply with 555.35(B) and (C).

Overcurrent protection for supply conductors is provided by the service equipment. Since these conductors can develop leakage, ground-fault protection is required at the main device or, alternatively, for each feeder or branch circuit. Factors such as corrosion and equipment degradation or lack of maintenance can cause ground faults to the metal surfaces of floating buildings or shore-powered vessels. Persons in contact with those metal surfaces, in proximity to the water surrounding the metal surface, or attempting to exit the water via a metal swim platform or ladder could be subjected to an electric shock.

While branch-circuit GFCI devices, which may trip at as low as 4 milliamperes, are permitted to be used, this is not practical for all floating buildings due to normal leakage currents of appliances and other equipment in or on the floating building. Therefore, the ground-fault current level of the device is not permitted to exceed 100 milliamperes. Devices operating at current levels higher than those specified for a Class A GFCI in ANSI/UL 943, *Ground-Fault Circuit Interrupters*, do not provide GFCI protection of personnel, but they will open the circuit at much lower levels of ground-fault current than will a standard overcurrent protection device (OCPD). See the Informational Note for the

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.