



Mike Holt's Illustrated Guide to

# Article 555

## MARINAS, BOATYARDS, AND DOCKING FACILITIES

Extracted from Understanding the National Electrical Code® Volume 2



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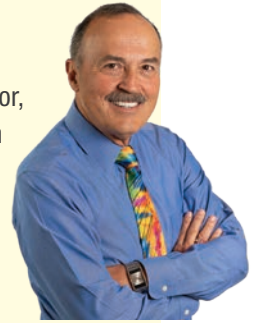
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## ABOUT THE AUTHOR

**Mike Holt** is an author, businessman, educator, speaker, publisher and *NEC*® expert. He's written hundreds of electrical training books and articles, founded three successful businesses, and has taught thousands of electrical *Code* seminars across the U.S. and internationally.



Mike's approach to electrical training is based on his own experience as an electrician, contractor, inspector and teacher. He's always felt a responsibility to his students and to the electrical industry to provide education beyond the scope of just passing an exam. This commitment, coupled with the lessons he learned at the University of Miami's MBA program, have helped him build one of the largest electrical training and publishing companies in the United States. His one-of-a-kind presentation style and his ability to simplify and clarify technical concepts explain his unique position as one of the premier educators and *Code* experts in the country. His passion for the electrical field drives his goal to increase electrical safety and improve lives.

Mike's commitment to pushing boundaries and setting high standards extends into his personal life. He's an eight-time Overall National Barefoot Waterski Champion with more than 20 gold medals, many national records, and he has competed in three World Barefoot Tournaments. In 2015, at the tender age of 64, he started a new adventure—competitive mountain bike racing. Every day he continues to find ways to motivate himself, both mentally and physically.

Mike and his wife, Linda, reside in New Mexico and Florida, and are the parents of seven children and six grandchildren. As his life has changed over the years, a few things have remained constant: his commitment to God, his love for his family, and doing what he can to change the lives of others through his products and seminars.

*I dedicate this book to the  
Lord Jesus Christ,  
my mentor and teacher.  
Proverbs 16:3*



# ARTICLE 555

## MARINAS, BOATYARDS, AND DOCKING FACILITIES

### Introduction to Article 555—Marinas, Boatyards, and Docking Facilities

This article covers the installation of wiring and equipment for fixed or floating piers, wharfs, docking facilities, marinas, and boatyards. Fluctuating water levels and the hazard of electric shock drowning (ESD) require special rules to protect the users of these facilities from the hazards that arise from the use of electricity. Many of these rules are outside of the scope of this material, however, some of the topics we cover include the following:

- ▶ Scope
- ▶ Electrical Datum Plane Distances
- ▶ Electric Shock Hazard Sign
- ▶ Equipment Grounding Conductor

Article 555 consists of three parts:

- ▶ Part I. General
- ▶ Part II. Marinas, Boatyards, and Docking Facilities
- ▶ Part III. Floating Buildings (not covered)

### Part I. General

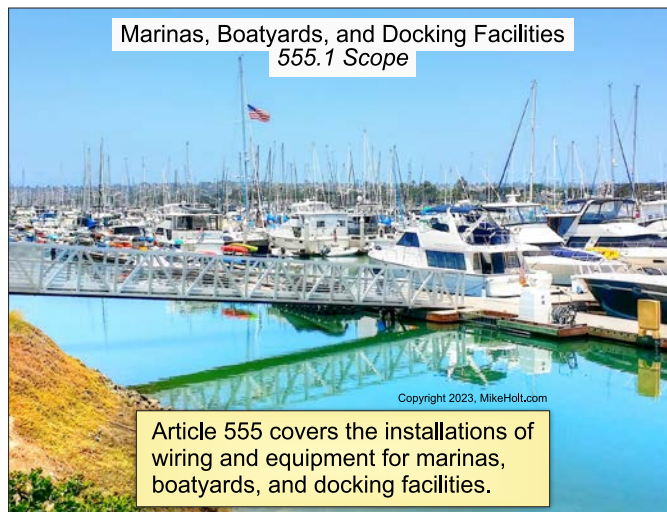
#### 555.1 Scope

Article 555 covers the installations of wiring and equipment for marinas, boatyards, and docking facilities. ▶Figure 555-1

**According to Article 100**, the definition of a “Marina” is a facility, generally on the waterfront, which stores and services boats in berths, on moorings, and in dry storage or dry stack storage. ▶Figure 555-2

A “Boatyard” is a facility used for constructing, repairing, servicing, hauling from the water, storing (on land and in water), and launching of boats (555). ▶Figure 555-3

A “Docking Facility” is a covered or open, fixed, or floating structure that provides access to the water and to which boats are secured. ▶Figure 555-4

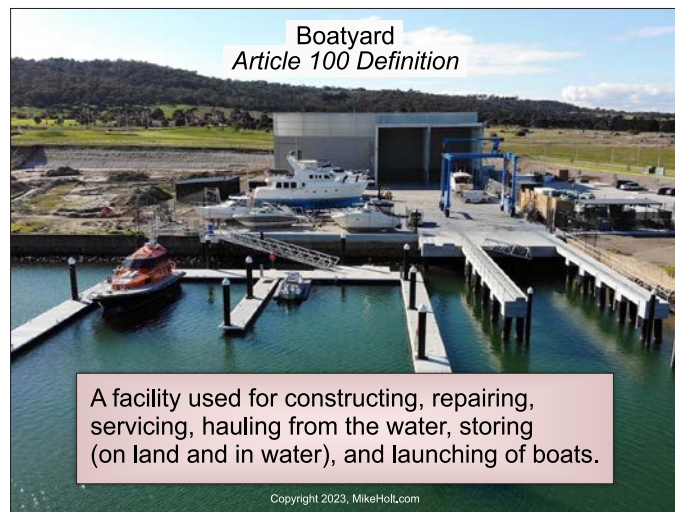


▶Figure 555-1





►Figure 555-2



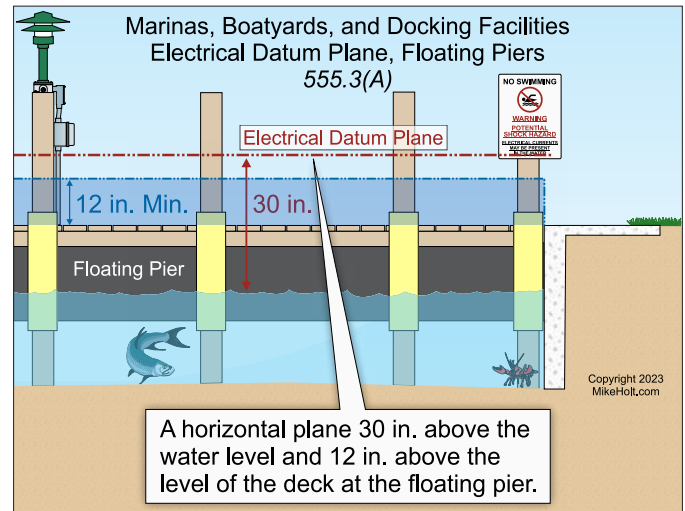
►Figure 555-3



►Figure 555-4

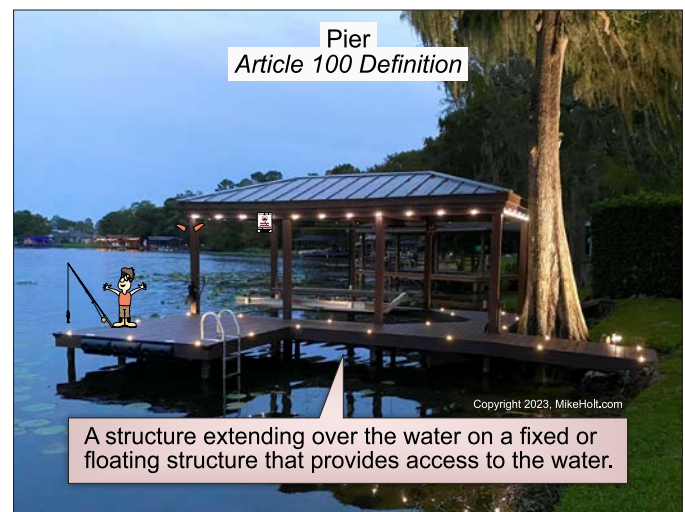
## 555.3 Electrical Datum Plane Distances

**(A) Floating Pier.** A horizontal plane 30 in. above the water level and 12 in. above the level of the deck at the floating pier. ►Figure 555-5



►Figure 555-5

According to Article 100, a 'Pier' is a structure extending over the water on a fixed or floating structure that provides access to the water. ►Figure 555-6



►Figure 555-6

## 555.4 Location of Service Equipment

The service equipment for a floating dock or marina must be on land no closer than 5 ft horizontally from the floating structure.

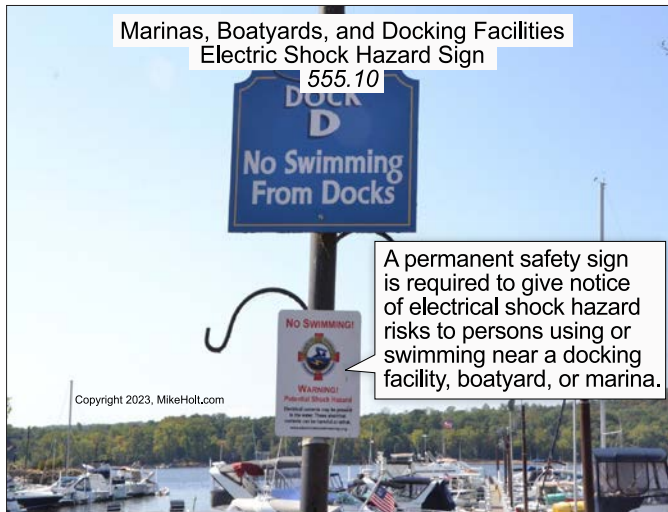
### 555.7 Transformers

**(A) General.** Transformers and enclosures must be identified for wet locations.

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

### 555.10 Electric Shock Hazard Sign

A permanent safety sign is required to give notice of electrical shock hazard risks to persons using or swimming near a docking facility, boatyard, or marina. The safety sign must meet all the following requirements: ▶Figure 555-7



▶Figure 555-7

- (1) The sign must warn of the hazards using effective words, colors, or symbols (or a combination of such) in accordance with 110.21(B)(1) and be of sufficient durability to withstand the environment.
- (2) The signs must be clearly visible from all approaches to a marina or boatyard facility.
- (3) The signs must state:

**WARNING—POTENTIAL SHOCK HAZARD—ELECTRICAL  
CURRENTS MAY BE PRESENT IN THE WATER.**

### 555.11 Motor Fuel Dispensing Stations— Hazardous (Classified) Locations

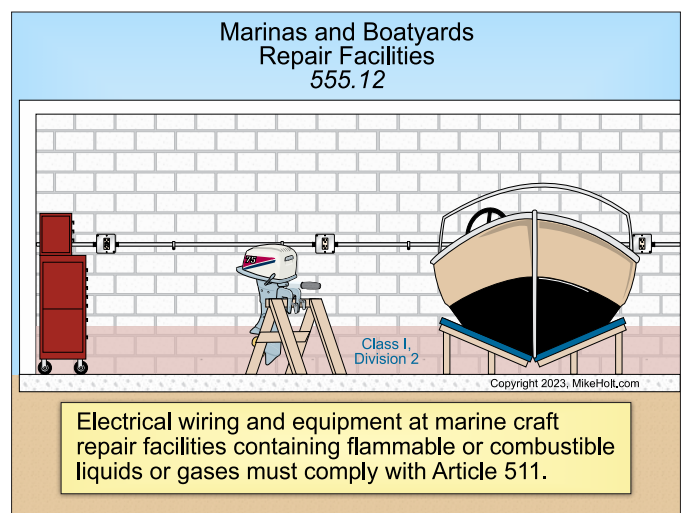
Electrical wiring and equipment serving motor fuel dispensing locations must comply with Article 514. ▶Figure 555-8



▶Figure 555-8

### 555.12 Repair Facilities—Hazardous (Classified) Locations

Electrical wiring and equipment at marine craft repair facilities containing flammable or combustible liquids or gases must comply with Article 511. ▶Figure 555-9



▶Figure 555-9



Author’s Comment:

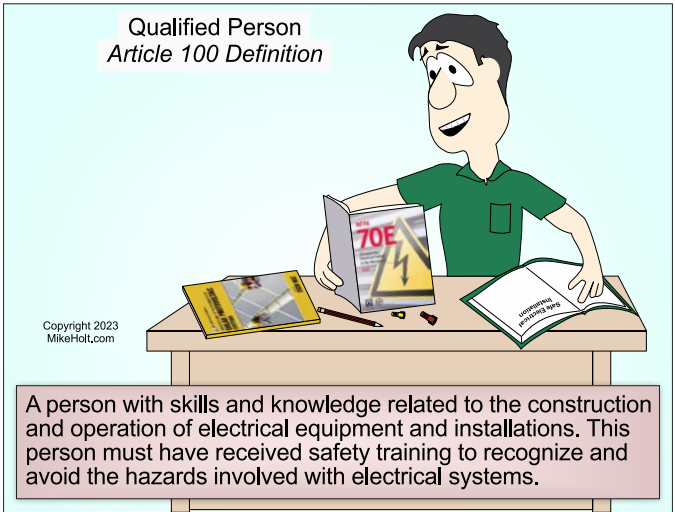
- ▶ Important rules in Article 511 to consider include:
  - ▶ 511.3—Classification of Hazardous Areas
  - ▶ 511.4—Wiring and Equipment in Hazardous (Classified) Locations
  - ▶ 511.7—Wiring and Equipment Above Hazardous (Classified) Locations
  - ▶ 511.9—Explosionproof Seals
  - ▶ 511.12—GFCI-Protected Receptacles

555.15 Replacement of Equipment

**Modifications and Replaced Equipment.** Modification or replacement of electrical enclosures, devices, or wiring on a docking facility must be in accordance with this *Code* and the installation requires an inspection of the entire circuit.

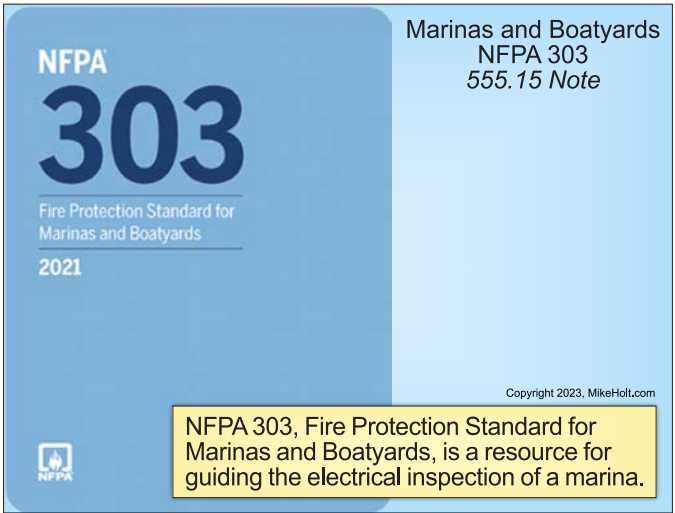
**Repairing Damaged Equipment.** Existing equipment that has been damaged must be identified, documented, and repaired by a qualified person to the minimum requirements of the edition of this *Code* to which it was originally installed.

According to Article 100, the definition of qualified persons is “a person with skills and knowledge related to the construction and operation of electrical equipment and installations. This person must have received safety training to recognize and avoid the hazards involved with electrical systems.” ▶Figure 555-10



▶Figure 555-10

**Note:** NFPA 303, *Fire Protection Standard for Marinas and Boatyards*, is a resource for guiding the electrical inspection of a marina. ▶Figure 555-11

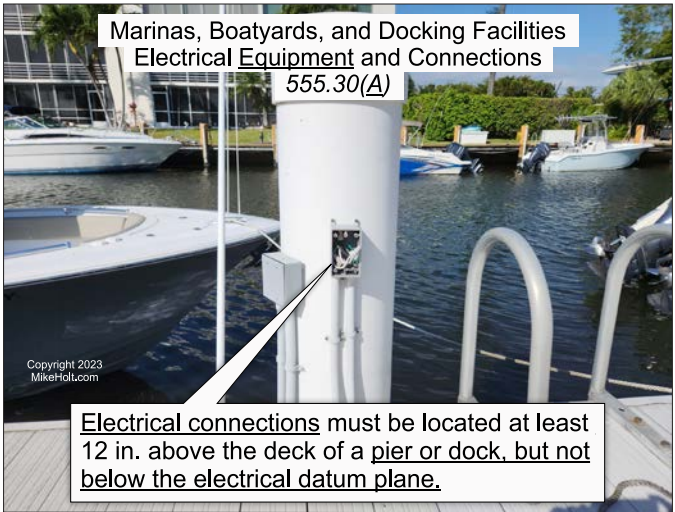


▶Figure 555-11

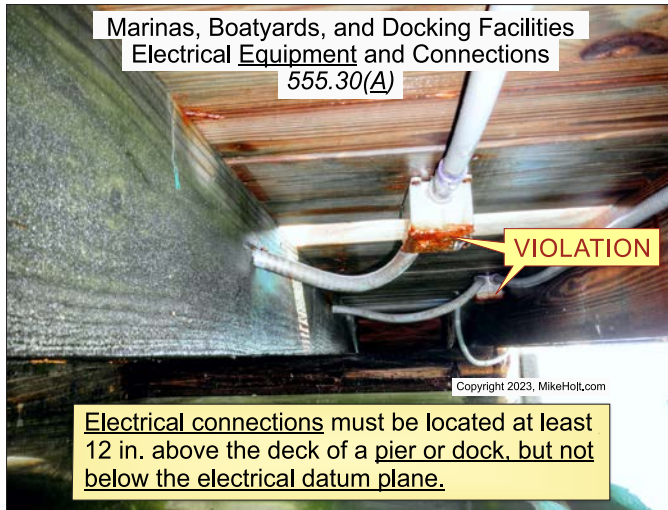
Part II. Marinas, Boatyards, and Docking Facilities

555.30 Electrical Equipment and Connections

**(A) New Installation.** Electrical equipment (excluding wiring methods) and connections (splices and terminations) not intended for operation while submerged must be located at least 12 in. above the deck of a pier or dock, but not below the electrical datum plane. ▶Figure 555-12 and ▶Figure 555-13



▶Figure 555-12



►Figure 555-13

**(B) Replacements.** Where equipment is replaced, electrical connections (splices and terminations) must be located at least 12 in. above the deck of a pier or dock but not below the electrical datum plane.

►Figure 555-14



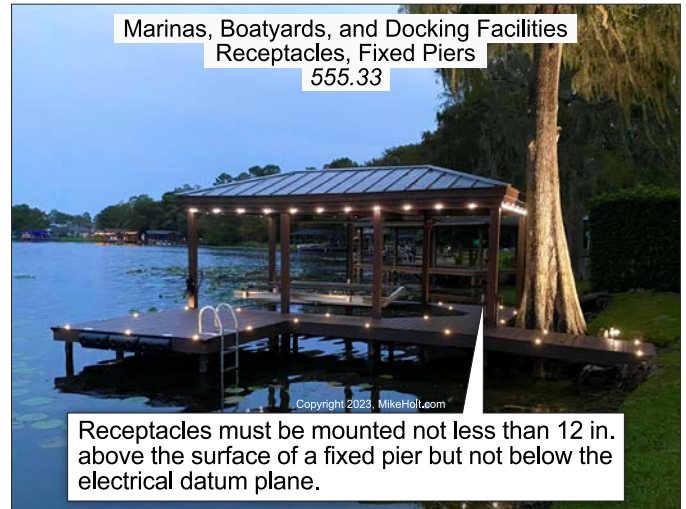
►Figure 555-14

#### Author's Comment:

- Sealed wire connector systems are limited to use with Types USE, RHW, XHHW, RW90 EP, RW90, XLPE, or TWU conductors, size 30 AWG through 2,000 kcmil copper or aluminum per the UL Guide Information Sheet for "Sealed Wire Connector Systems (ZMWQ)."

## 555.33 Receptacles

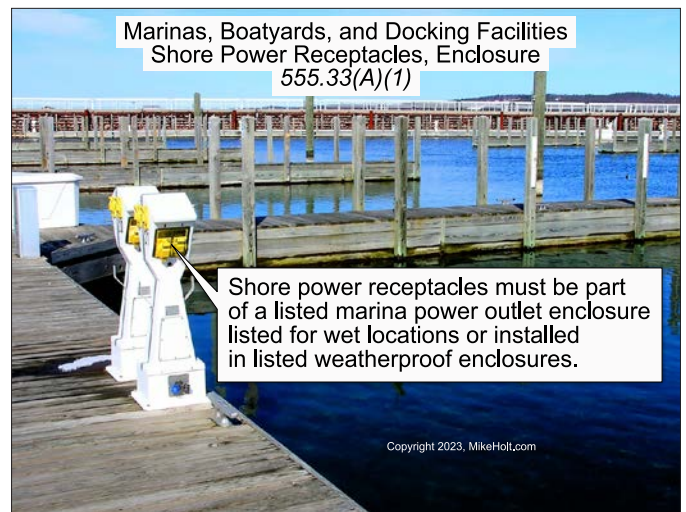
Receptacles must be mounted not less than 12 in. above the surface of a fixed pier but not below the electrical datum plane. ►Figure 555-15



►Figure 555-15

### (A) Shore Power Receptacles.

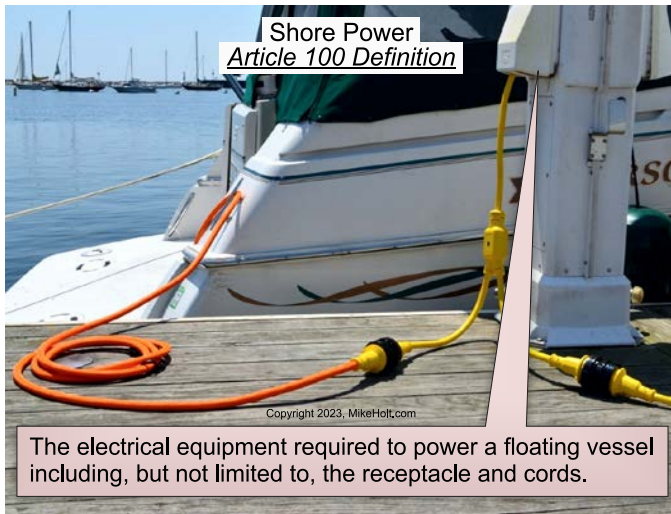
**(1) Enclosures.** Shore power receptacles must be part of a listed marina power outlet enclosure listed for wet locations or installed in listed weatherproof enclosures. ►Figure 555-16



►Figure 555-16

**According to Article 100,** the definition of "Shore Power" is the electrical equipment required to power a floating vessel including, but not limited to, the receptacle and cords. ►Figure 555-17





►Figure 555-17

According to Article 100, the definition of a “Power Outlet, Marina” is an enclosed assembly that can include equipment such as receptacles, circuit breakers, watt-hour meters, and panelboards. ►Figure 555-18



►Figure 555-18

**(4) Ratings.** Shore power receptacles must be rated at least 30A and must be of the pin and sleeve type if rated 60A or higher.

#### Author's Comment:

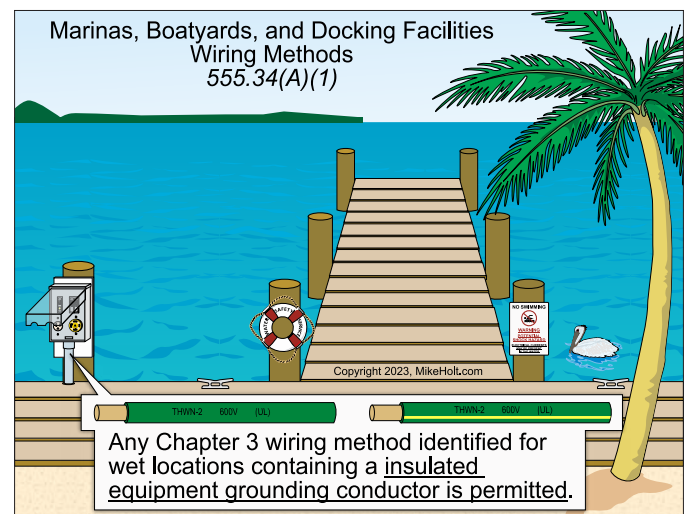
- The rating of the shore power receptacle does not depend on the length of the boat. The *Code* simply sets a minimum rating of 30A and leaves it up to the designer and/or owner to provide the receptacles they deem necessary based on the projected usage of the slips.

**(C) Replacement Receptacles.** Replacement receptacles must comply with 555.33.

## 555.34 Wiring Methods and Installation

### (A) Wiring Methods.

**(1) General.** Any Chapter 3 wiring method identified for wet locations containing an insulated equipment grounding conductor is permitted. ►Figure 555-19



►Figure 555-19

**(2) Portable Power Cables.** Sunlight resistant, extra-hard usage cord and extra-hard usage portable power cables listed for use in the environment within which they are installed, are 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.

### (B) Installation.

**(2) Outdoor Branch Circuits and Feeders.** Overhead branch-circuit and feeder wiring in locations of the boatyard other than those described in 555.34(B)(1) must be not less than 18 ft above grade. Multiple feeders and branch circuits are permitted for marina installations in accordance with only Part I of Article 225.

### (3) Portable Power Cables.

- (a) Portable power cables permitted by 555.13(A)(2) must be:
  - (1) Properly supported.
  - (2) Located on the underside of the pier.



- (3) Securely fastened by nonmetallic clips to structural members other than the deck planking.
  - (4) Not be subject to physical damage.
  - (5) Protected against chafing by a permanently installed, oversized sleeve of nonmetallic material when cables pass through structural members.
- (b) Where portable power cables are used, there must be a junction box of corrosion-resistant construction with permanently installed terminal blocks on each pier section to which the feeders are connected. A listed marina power outlet employing terminal blocks/bars is permitted in lieu of a junction box. Metal junction boxes and covers, and metal screws and parts that are exposed externally to the boxes, must be of corrosion-resistant materials or protected by material resistant to corrosion.

**Author's Comment:**

- ▶ Portable power cables are specifically listed in Table 400.4 with their usage applicability and this wiring method can be used for branch circuits and feeders.

**(4) Protection of Wiring Methods.** 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 must be used to protect wiring to a point at least 8 ft above the docks, decks of piers, and landing stages.

### 555.35 Ground-Fault Protection (GFPE and GFCI)

Ground-fault protection for docking facilities must be provided in accordance with the following:

**(A) GFPE Protection, Feeders.** Feeder conductors installed on docking facilities must be provided with GFPEs set to open at trip currents not exceeding 100 mA.

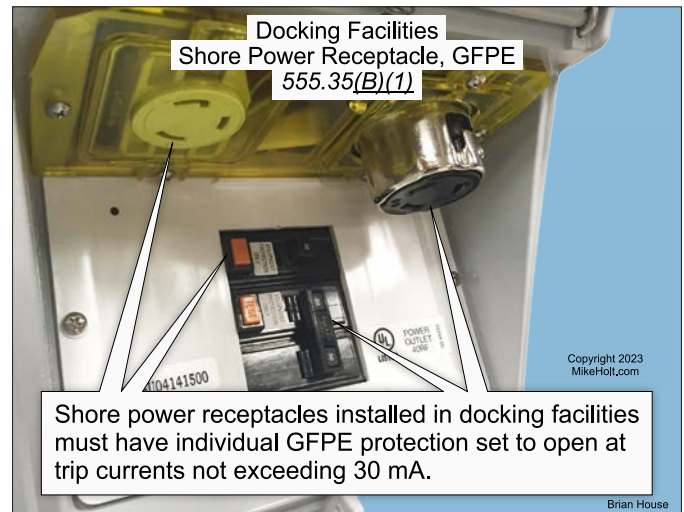
Coordination with the feeder GFPE overcurrent protective device is permitted.

*Ex: Transformer secondary conductors of a separately derived system that do not exceed 10 ft, and are installed in a raceway, are permitted to be installed without ground-fault protection. This exception also applies to the supply terminals of the equipment supplied by the transformer secondary conductors.*

**(B) GFPE and GFCI.**

**(1) Shore Power Receptacles, GFPE Protection.** Shore power receptacles installed in accordance with 555.33(A) must have individual GFPE protection set to open at trip currents not exceeding 30 mA.

▶ **Figure 555-20**



▶ **Figure 555-20**

**Author's Comment:**

- ▶ In accordance with the research study by the American Boat and Yacht Council Foundation, Inc., 30 mA represents an acceptable threshold level for GFPE protection to prevent most electrical shock drowning incidents while remaining practical enough to minimize nuisance tripping.
- ▶ If shore power receptacles are replaced, they are required to have GFPE protection [406.4(D)(8)].

**(2) Outlets Other than Shore Power, GFCI Protection.** GFCI protection is required for docking facility outlets rated 60A and less, single-phase, and 100A and less, three-phase for electrical systems not exceeding 150V to ground.

*Ex to (B): Circuits not requiring grounding, not exceeding the low-voltage contact limit, and supplied by listed transformers or power supplies complying with 680.23(A)(2) can be installed without GFCI protection.*

**(C) Boat Hoist.** Boat hoist outlets on docking facilities must be GFCI protected where the circuit voltage does not exceed 240V. ▶ **Figure 555-21**



►Figure 555-21

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

**Note 1:** Leakage current measurements 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 this test device will allow the facility operator to identify a boat that is creating an electrical hazard. In some cases, a single boat could cause an upstream GFPE device protecting a feeder to trip even though multiple boats are supplied from the same feeder. The use of this test device will help the facility operator prevent a particular boat from contributing to hazardous voltage and current in the marina area.

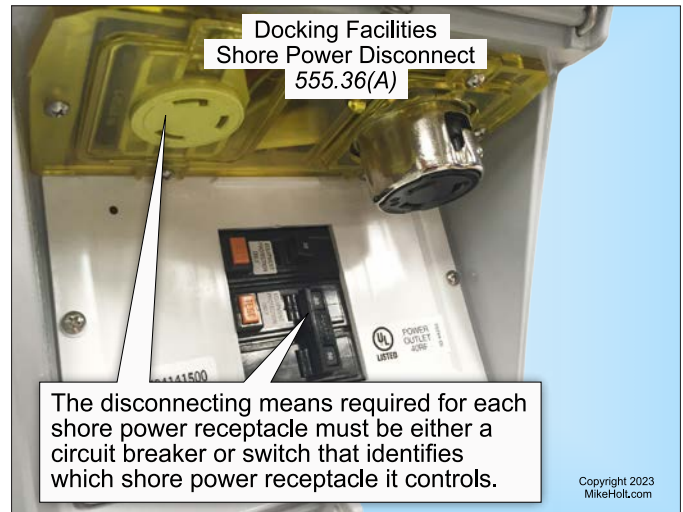
**Note 2:** An annual test of each boat with the leakage current measurement device is a prudent step toward determining if a boat has defective wiring that could be contributing hazardous voltage and current. Where the leakage current measurement device reveals that a boat is contributing hazardous voltage and current, repairs should be made to the boat before it is permitted to utilize shore power.

*Ex: Where the shore power equipment includes a leakage indicator and leakage alarm, a separate leakage test device is not required.*

### 555.36 Shore Power Receptacle Disconnecting Means

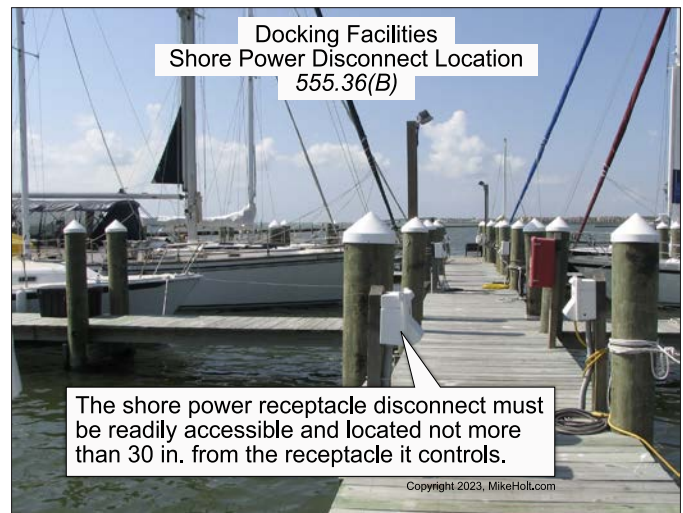
A disconnecting means must be provided for each shore power receptacle in accordance with the following:

**(A) Type of Disconnecting Means.** A circuit breaker or switch that identifies which shore power receptacle it controls. ►Figure 555-22



►Figure 555-22

**(B) Location.** The shore power receptacle disconnect must be readily accessible and not more than 30 in. from the receptacle it controls. ►Figure 555-23



►Figure 555-23

#### Author's Comment:

- This shore power receptacle disconnect is intended to eliminate the hazard of someone engaging or disengaging the boat's shore power attachment plug with wet, slippery hands and contacting energized blades.



**(C) Emergency Electrical Disconnect.** Each marina power outlet or enclosure that provides shore power to boats must have a listed emergency shutoff device or disconnect that is marked “Emergency Shutoff” in accordance with 110.22(A).

The emergency shutoff device or disconnect must be within sight of the marina power outlet, readily accessible, externally operable, and manually resettable. The emergency shutoff device or disconnect must de-energize the power supply to all circuits supplied by the marina power outlet(s). A circuit breaker handle is not permitted to be used for this purpose.

**Author’s Comment:**

- An emergency disconnect within sight of the marina power outlet will provide bystanders with the ability to shutoff power if a swimmer comes in contact with an energized metal boat, dock, or ladder and in cases where it appears that Electric Shock Drowning (ESD) is occurring.

### 555.37 Equipment Grounding Conductor

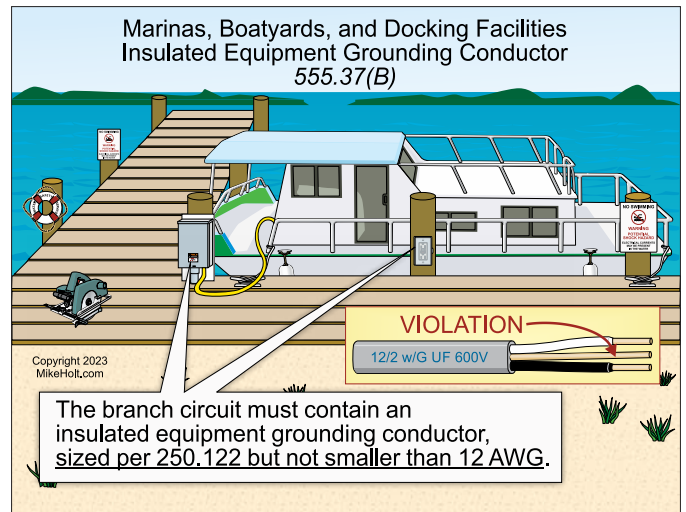
**(A) Equipment to be Connected to the Equipment Grounding Conductor.** The following items in a marina, boatyard, or docking facility must be connected to an equipment grounding conductor of the wire-type run with the circuit conductors:

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

**(B) Insulated Equipment Grounding Conductor.** An insulated equipment grounding conductor, sized in accordance with 250.122 but not smaller than 12 AWG, must be provided for all circuits in a marina, boatyard, or docking facility. ►Figure 555-24

**(C) Feeder Equipment Grounding Conductor.** A feeder to a panelboard or distribution equipment must have an insulated equipment grounding conductor [555.37(B)] run from the service to the panelboard or distribution equipment.

**(D) Branch-Circuit Equipment Grounding Conductor.** The required branch-circuit insulated equipment grounding conductor [555.37(B)] must terminate at a grounding terminal in a panelboard, distribution equipment, or service equipment.



►Figure 555-24

### 555.38 Luminaires

**(A) General.** All luminaires and retrofit kits must be listed and identified for use in their intended environment. Luminaires and their supply connections must be secured 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 must be limited to the following:

- (1) Identified as submersible
- (2) Operate below the low-voltage contact limit as defined in Article 100
- (3) Supplied by a swimming pool transformer in accordance with 680.23(A)(2)

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