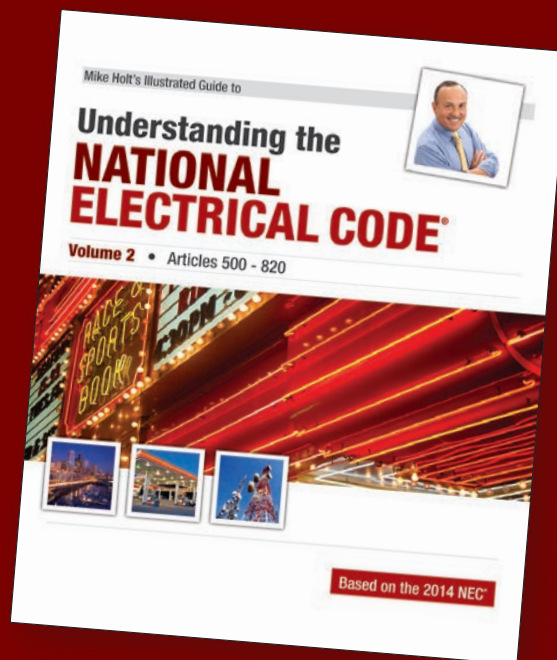


Mike Holt's Illustrated Guide to

ARTICLE 555— MARINAS AND BOATYARDS

Based on the 2014 NEC®

Extracted from Mike Holt's Illustrated Guide to Understanding
the National Electrical Code® • Volume 2



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Author: Mike Holt

Technical Illustrator: Mike Culbreath

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ABOUT THE AUTHOR

Mike Holt worked his way up through the electrical trade. He began as an apprentice electrician and became one of the most recognized experts in the world as it relates to electrical power installations. He's worked as a journeyman electrician, master electrician, and electrical contractor. Mike's experience in the real world gives him a unique understanding of how the *NEC* relates to electrical installations from a practical standpoint.



You'll find his writing style to be direct, nontechnical, and powerful.

Did you know Mike didn't finish high school? So if you struggled in high school or didn't finish at all, don't let it get you down. However, realizing that success depends on one's continuing pursuit of education, Mike immediately attained his GED, and ultimately attended the University of Miami's Graduate School for a Master's degree in Business Administration.

Mike resides in Central Florida, is the father of seven children, has five grandchildren, and enjoys many outside interests and activities. He's a nine-time National Barefoot Water-Ski Champion (1988, 1999, 2005–2009, 2012–2013). He's set many national records and continues to train year-round at a World competition level (www.barefootwaterskier.com).

What sets him apart from some is his commitment to living a balanced lifestyle; placing God first, family, career, then self.

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



ARTICLE 555

MARINAS AND BOATYARDS

Introduction to Article 555—Marinas and Boatyards

Water levels aren't constant. Ocean tides rise and fall, while lakes and rivers vary in depth in response to rain. To provide power to a marina or boatyard, you must allow for these variations in water level between the point of use and the power source. Article 555 addresses this issue.

This article begins with the concept of the electrical datum plane. You might think of it as the border of a “demilitarized zone” for electrical equipment. Or, you can think of it as a line that marks the beginning of a “no man’s land” where you simply don’t place electrical equipment. Once you determine where this plane is, don’t locate transformers, connections, or receptacles below that line.

555.1 Scope

Article 555 covers the installation of wiring and equipment for fixed or floating piers, wharfs, docks, and other areas in marinas, boatyards, boat basins, boathouses, and similar occupancies. This article doesn't apply to docking facilities or boathouses used for the owners of single-family dwellings. [Figure 555-1](#)

Author's Comment:

- GFCI protection is required for outdoor 15A and 20A, 125V receptacles [210.8].

555.2 Definitions

Electrical Datum Plane.

(1) Land Area Subject to Tidal Fluctuation. The horizontal plane 2 ft above the highest high tide that occurs under normal circumstances. [Figure 555-2](#)

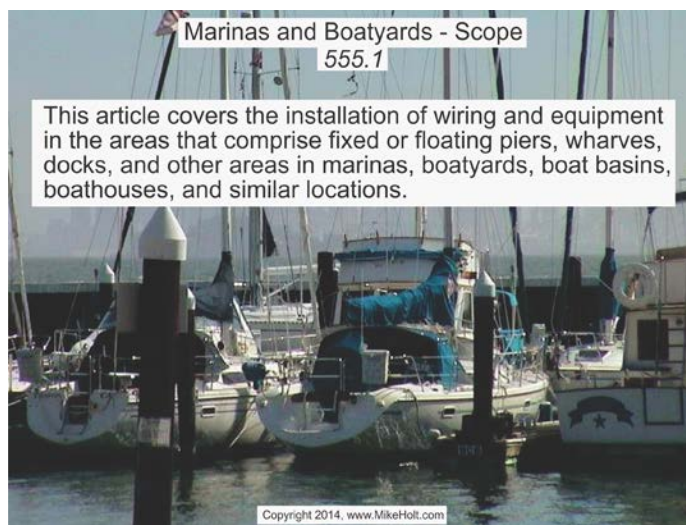


Figure 555-1

(2) Land Areas Not Subject to Tidal Fluctuation. The horizontal plane 2 ft above the highest water level that occurs under normal circumstances. [Figure 555-3](#)

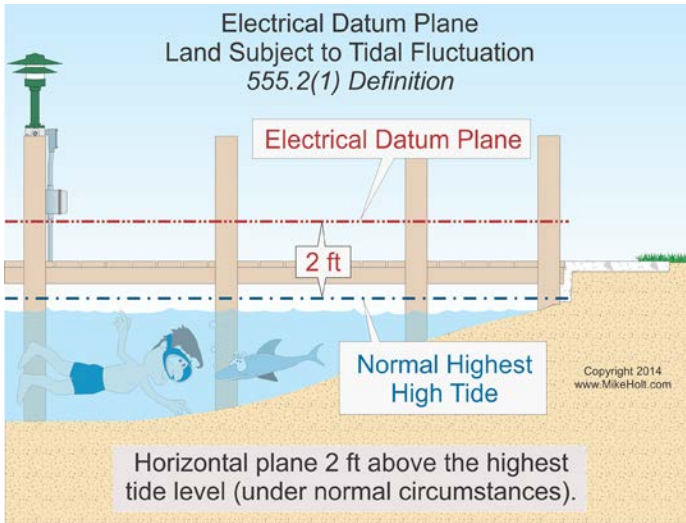


Figure 555-2

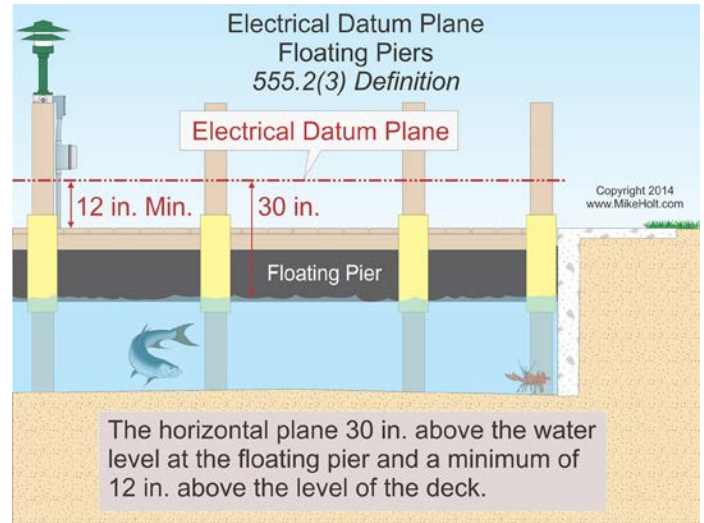


Figure 555-4

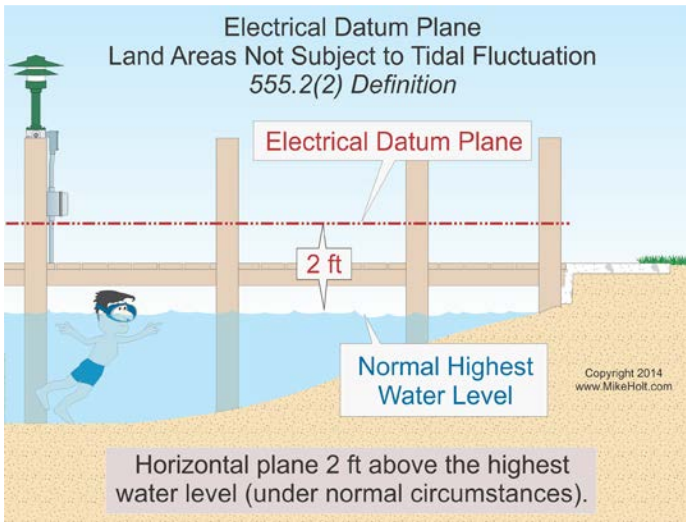


Figure 555-3

(3) Floating Piers. The horizontal plane 30 in. above the water level at the floating pier and a minimum of 12 in. above the level of the deck.

Figure 555-4

Author's Comment:

- This definition is necessary for the location of transformers [555.5], electrical connections [555.9], and receptacles [555.19] near water.

Marine Power Outlet. An enclosed assembly that can include equipment such as receptacles, circuit breakers, fused switches, fuses, watt-hour meters, panelboards, and monitoring means approved for marine use. Figure 555-5



Figure 555-5

Author's Comment:

- This definition is necessary for the application of shore power receptacles [555.19(A)(1)] and disconnecting means [555.17(B)].

555.3 Ground-Fault Protection

The overcurrent device for the main marina feeder conductors must have ground-fault protection not exceeding 100 mA. If ground-fault protection is provided for each individual marina branch or feeder circuit, ground-fault protection isn't required for the main marina feeder conductors. [Figure 555-6](#)

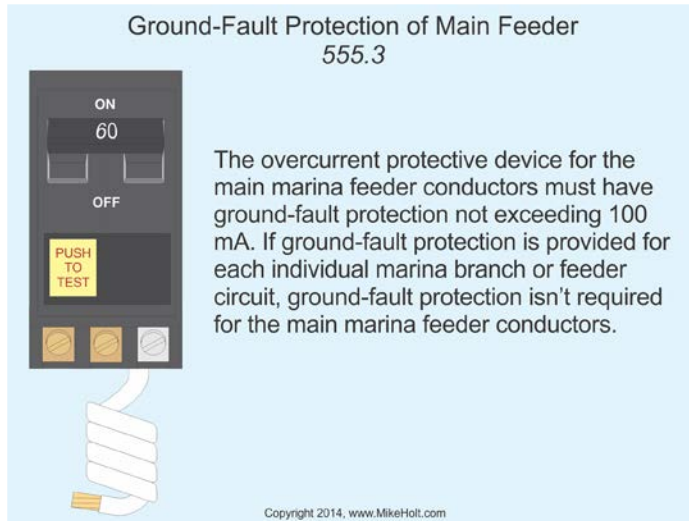


Figure 555-6

555.5 Transformers

Transformers must be approved by the authority having jurisdiction for the location, and the bottom must not be located below the electrical datum plane. [Figure 555-7](#)

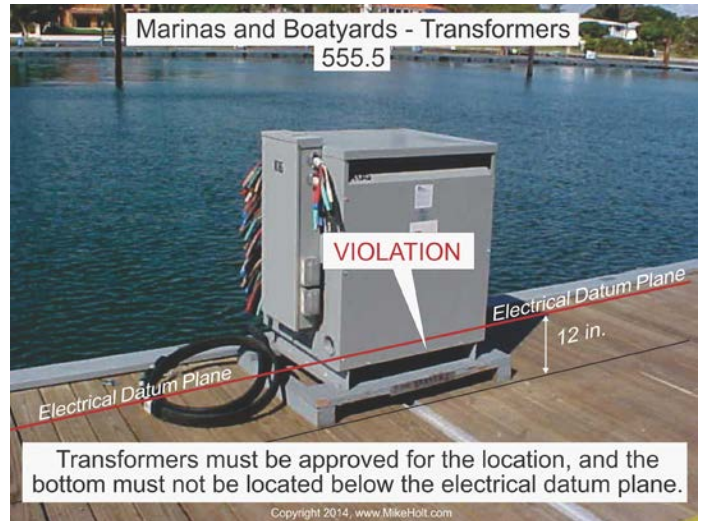


Figure 555-7

555.9 Electrical Connections

Floating Piers. Electrical connections must be located not less than 12 in. above the deck of a floating pier, unless the conductor splices are contained within approved junction boxes utilizing sealed wire connector systems listed and identified for submersion located above the waterline but below the electrical datum plane for floating piers. [Figure 555-8](#) and [Figure 555-9](#)

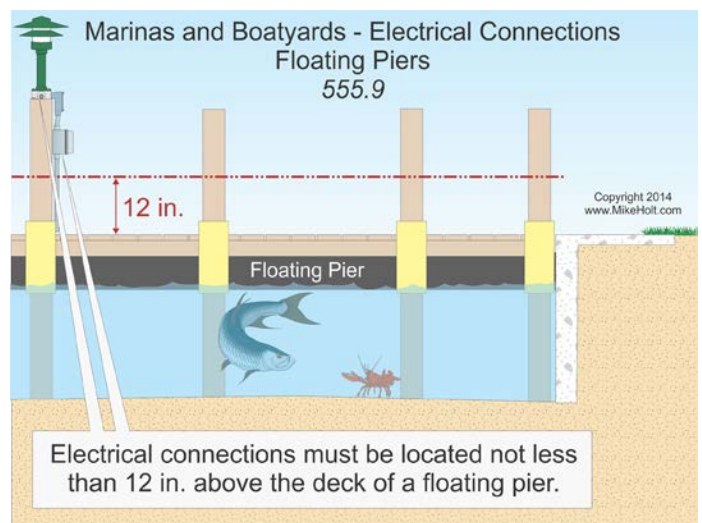


Figure 555-8

555.7 Location of Service Equipment

Service equipment for floating docks or marinas isn't permitted to be located on the floating structure.

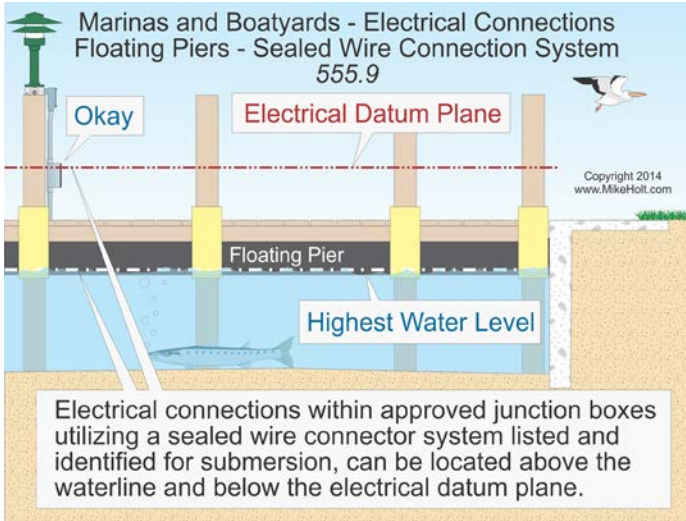


Figure 555-9

Fixed Piers. For a fixed pier, electrical connections must be located not less than 12 in. above the deck, and never below the electrical datum plane. **Figure 555-10**

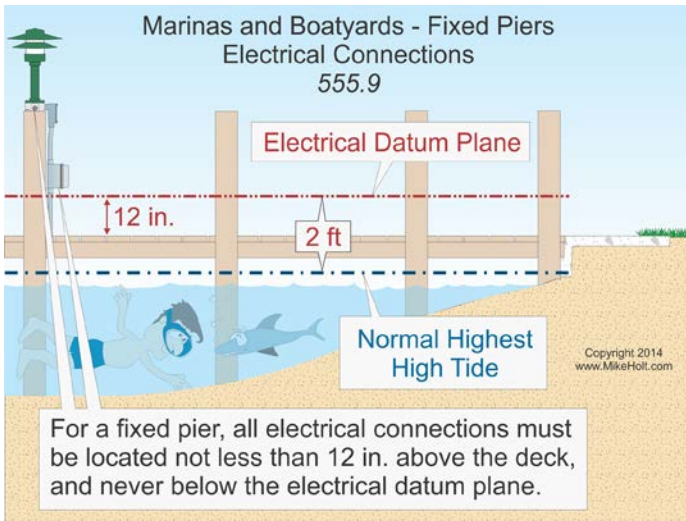


Figure 555-10

555.10 Electrical Equipment Enclosures

(A) Securing and Supporting. Electrical equipment enclosures must be securely and substantially supported by structural members, independent of any raceway connected to them.

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

555.12 Load Calculations for Service and Feeder Conductors

The calculated ungrounded and neutral service or feeder load for shore power receptacles can be calculated using the adjustment factors contained in Table 555.12.

Table 555.12 Adjustment Factors

Number of Receptacles	Sum of the Rating of the Receptacles
1-4	100%
5-8	90%
9-14	80%
15-30	70%
31-40	60%
41-50	50%
51-70	40%
Over 71	30%

Table Note 1. If shore power provides two receptacles having different voltages for an individual boat slip, only the receptacle with the larger kilowatt demand rating is required to be included in the calculation. **Figure 555-11**

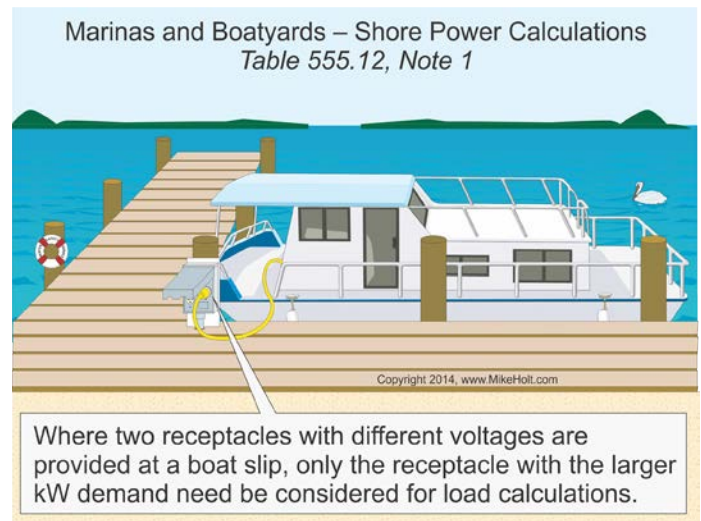


Figure 555-11

Question: What size 120/240V, single-phase service is required for a marina with twenty 20A, 125V receptacles, and twenty 30A, 250V receptacles? **Figure 555–12**

- (a) 200A (b) 400A (c) 600A (d) 800A

Answer: (c) 600A

Step 1: Determine the receptacle load per line.

	Line 1	Line 2
Twenty 20A, 125V	200A	200A (ten each line)
Twenty 30A, 250V	+ 600A	+ 600A (twenty each line)
	800A	800A

Step 2: The calculated load per line for the marina is based on the demand factors listed in Table 555.12 for 30 receptacles (per line). $800A \times 0.70 = 560A$

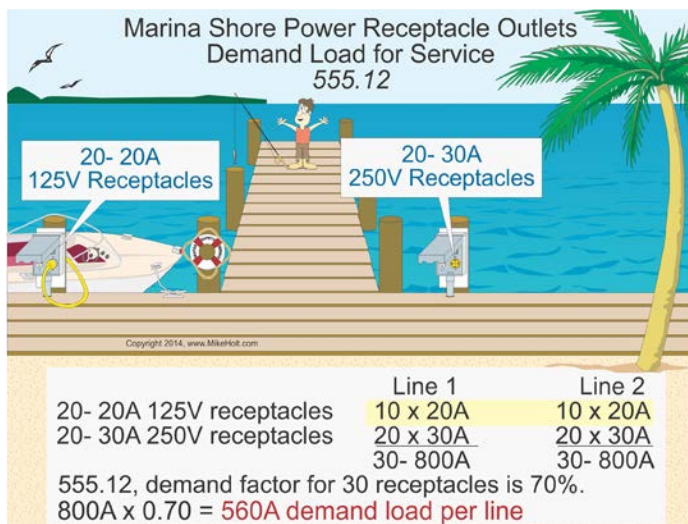


Figure 555–12

Author's Comment:

- There are 40 receptacles in this example but because the 125A are balanced between Line 1 and Line 2 the maximum receptacles connected to any one line after balancing is 30.

555.13 Wiring Methods and Installation

(A) Wiring Methods.

(1) General. Any Chapter 3 wiring method is permitted if identified for use in wet locations.

(2) Portable Power Cables. Sunlight resistant, extra-hard usage portable power cables listed for wet locations having an outer jacket resistant to temperature extremes, oil, gasoline, ozone, abrasion, acids, and chemicals.

(B) Installation.

(4) Portable Power Cables.

- (a) Portable power cables permitted by 555.13(A)(2) must be:
- Properly supported.
 - Located on the underside of the pier.
 - Securely fastened by nonmetallic clips to structural members other than the deck planking.
 - Not be subject to physical damage.
 - Protected against chafing by a permanently installed oversized sleeve of nonmetallic material when cables pass through structural members.
- (5) Protection.** Raceways must be used to protect wiring above decks of piers and landing stages.

555.15 Grounding

(B) Equipment Grounding Conductor. The equipment grounding conductor must be an [insulated conductor](#) with a continuous outer finish that's green or green with one or more yellow stripes. **Figure 555–13**

(C) Size of Equipment Grounding Conductor. The [insulated equipment](#) grounding conductor must be sized in accordance with 250.122, based on the rating of the overcurrent device, but not smaller than 12 AWG.



Figure 555-13

555.17 Boat Receptacle Disconnecting Means

A disconnecting means must isolate each boat from its shore power receptacle.

(A) Type of Disconnect. A circuit breaker or switch (or both) must be used to serve as the required shore power receptacle disconnecting means and it must be identified as to which receptacle it controls.

Figure 555-14

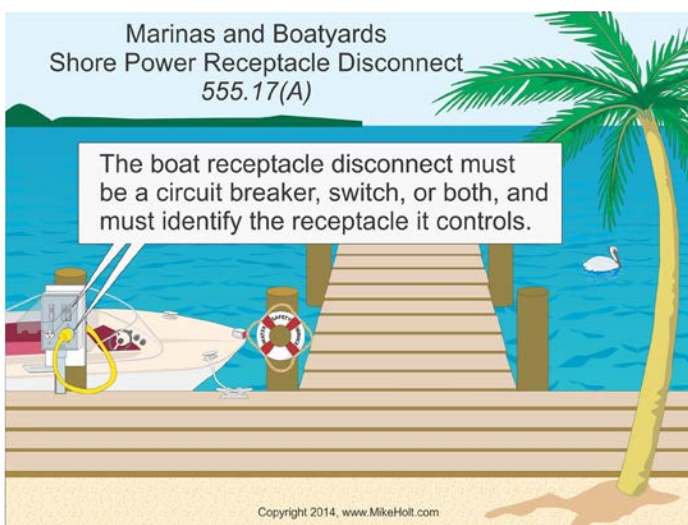


Figure 555-14

(B) Location. The disconnecting means for shore power receptacles must be readily accessible and located not more than 30 in. from the receptacle it controls. Circuit breakers or switches located in marine power outlets can be used for the boat receptacle disconnecting means. [Figure 555-15](#)

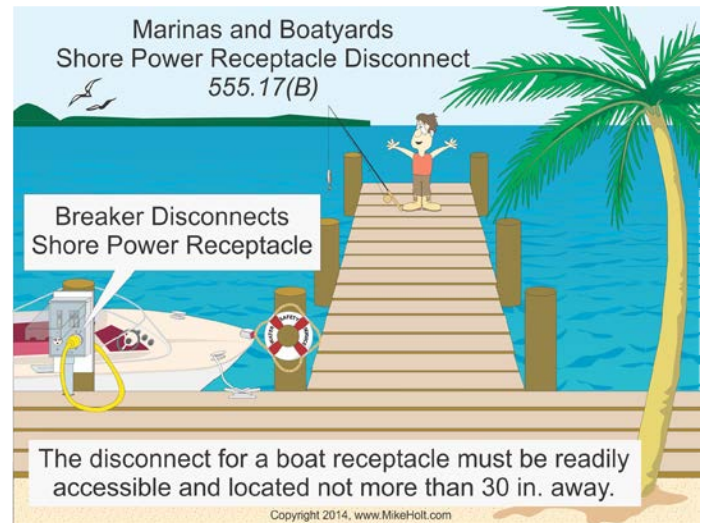


Figure 555-15

Author's Comment:

- This shore power receptacle disconnecting means is intended to eliminate the hazard of someone engaging or disengaging the boat's shore power attachment plug with wet, slippery hands, and possibly contacting energized blades. The "30-in. requirement" helps someone not familiar with the marina layout to quickly reach the disconnecting means in an emergency.

555.19 Receptacles

Receptacles must be mounted not less than 12 in. above the deck surface of the pier, and not below the electrical datum plane on a fixed pier. [Figure 555-16](#)

(A) Shore Power Receptacles.

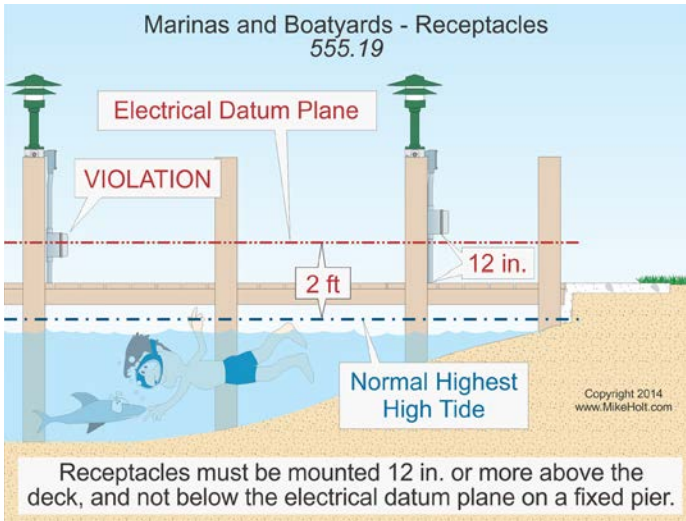


Figure 555-16

(1) Enclosures. Receptacles intended to supply shore power to boats must be part of a listed marina power outlet enclosure, be installed in listed enclosures protected from the weather, or in listed weather-proof enclosures. The integrity of the assembly must not be affected when the receptacles are in use with a booted or nonbooted attachment plug/cap inserted.

(3) Branch Circuits. An individual branch circuit of the voltage class and rating corresponding to the rating of the receptacle must supply each receptacle that supplies shore power to boats.

Note: Supplying 120/240V 3-wire receptacles from a 120/208V 3-wire supply may cause overheating or malfunctioning of connected equipment.

(4) Ratings. Single receptacles that provide shore power for boats must be rated not less than 30A.

- (a) Receptacles rated 30A and 50A must be of the locking and grounding type. [Figure 555-17](#)
- (b) Receptacles rated 60A or 100A must be of the pin and sleeve type.

Author's Comment:

- The rating of the shore power receptacle doesn't depend upon 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.



Figure 555-17

(B) Other Than Shore Power.

(1) GFCI Protection of Receptacles. 15A and 20A, 125V receptacles installed outdoors, in boathouses, buildings/structures used for storage, maintenance, or repair for portable electric hand tools, electrical diagnostic equipment, or portable lighting equipment must be GFCI protected. [Figure 555-18](#)

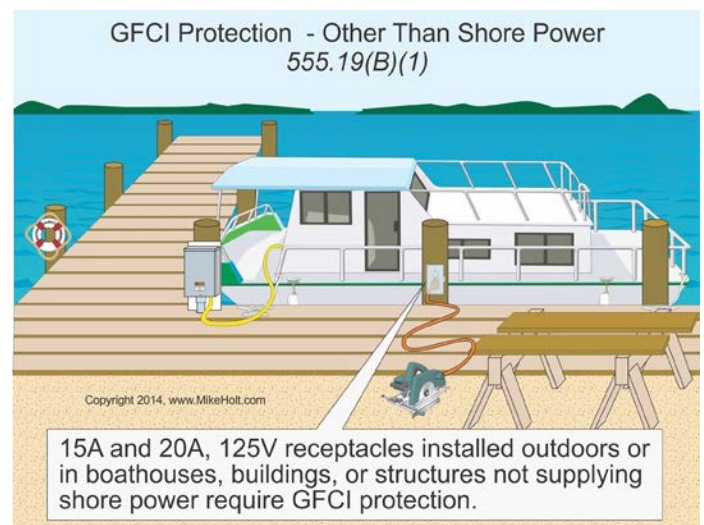


Figure 555-18

555.22 Repair Facilities

Electrical wiring and equipment at marine craft repair facilities containing flammable or combustible liquids or gases must comply with Article 511 in addition to the requirements of Article 555. **Figure 555–19**

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

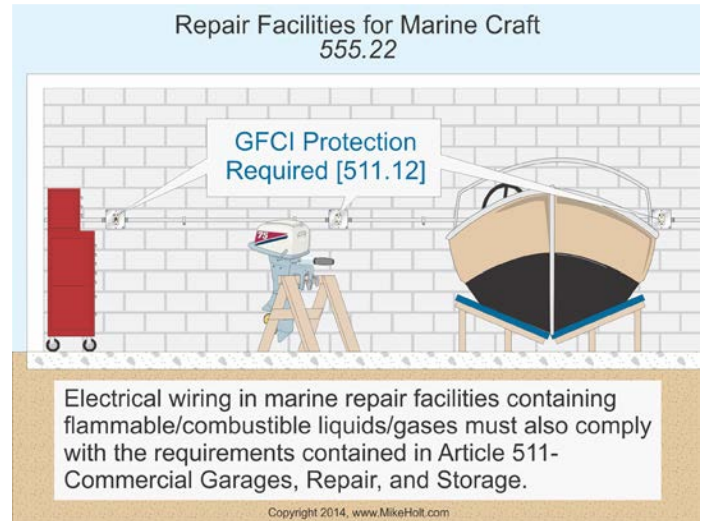
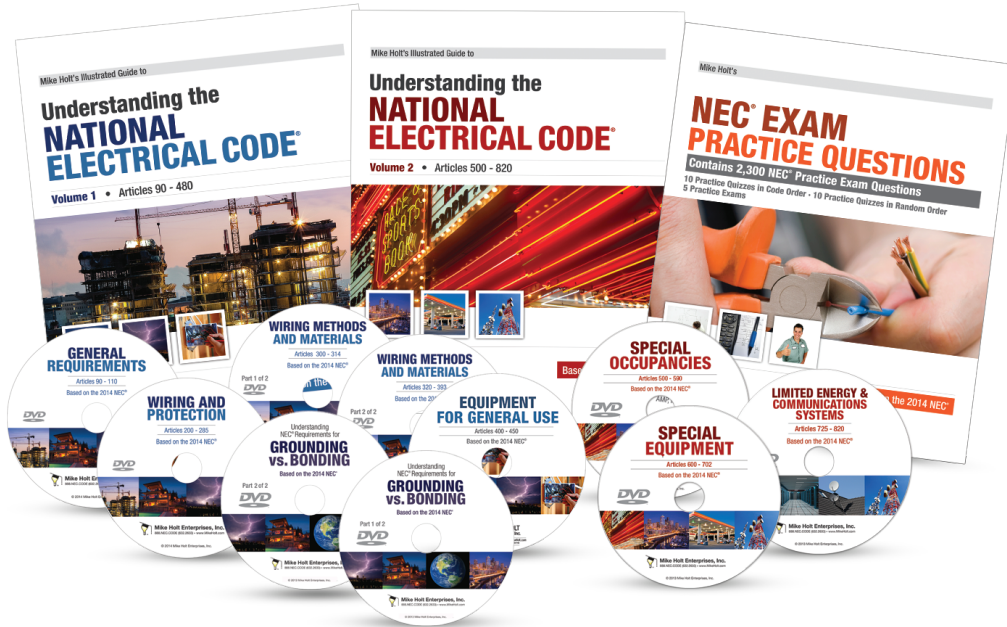


Figure 555–19

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