PR 20-85 6470247 0003558 1
A-14-03

National Electrical Manufacturers Association
2101 L Street, N.W. Suite 300
Washington, D.C. 20037 (202) 457-8400

PROPOSED, NEW AND REVISED STANDARDS

TO ALL REPRESENTATIVES OF MEMBER COMPANIES IN SECTIONS REPRESENTED IN THE PIN AND SLEEVE PLUG, RECEPTACLE AND CONNECTOR SECTION

Subject: NEMA Standards Publication No. **PR 20-1985**, *Digest of 1984 National Electrical Code (Relating to Pin and Sleeve Plugs, Receptacles, and Connectors)*

Dear Representative:

On October 16, 1985, the Codes and Standards Committee approved the subject publication, and we are pleased to enclose your complimentary copy with Editorial Revision 1—a new member company page.

Please replace the original member company page with this updated list and insert the new title page indicating Editorial Revision 1 in place of the old.

PR 20-1985 also revises and supersedes PR 20-1980 and the latter should be deleted from your records.

Additional copies of the PR 20-1985 may be purchased for $11.00. Please direct your order to the attention of the Sales Office.

Sincerely yours,

Krystyna Bagnato

Krystyna Bagnato
Standards Publications Editor

KAB:srt

Enclosure

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

PR 20-85 6470247 0003559 3
A-14-03

STANDARDS PUBLICATION / NO. PR 20

nema

Digest of 1984 National Electrical Code (Relating to Pin and Sleeve Plugs, Receptacles and Connectors)

NEMA

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION ■ 2101 L STREET, N.W., WASHINGTON, D.C. 20037

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

NEMA PR 20-1985

PR 20

DIGEST OF 1984 NATIONAL ELECTRICAL CODE (RELATING TO PIN AND SLEEVE PLUGS, RECEPTACLES AND CONNECTORS)

Editorial Revision 1—July 1986

Published by

National Electrical Manufacturers Association
2101 L Street, NW
Washington, DC 20037
(202) 457-8400

© 1986 by National Electrical Manufacturers Association

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

FOREWORD

This digest of the 1984 edition of the *National Electrical Code** covers those sections of the Code applying to plugs and receptacles. This NEMA Standards Publication has been prepared by the Pin and Sleeve Plug, Receptacle and Connector Section of NEMA.

The object of this digest is to identify those sections of the Code which apply to plugs and receptacles and to provide a brief description of the requirements found in these sections.

The digest applies to plugs, receptacles, and connectors and should not be construed in any way as a position or interpretation, formal or otherwise, of the National Fire Protection Association or any of its Committees.

Comments are welcomed and should be submitted to:

Manager, Engineering Department
National Electrical Manufacturers Association
2101 L Street, N.W.
Washington, D.C. 20037

*This Digest contains extracts from the 1984 *National Electrical Code,* Copyright © 1983, reprinted by permission of the National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

DIGEST OF THE NATIONAL ELECTRICAL CODE
(Relating to Pin and Sleeve Plugs, Receptacles and Connectors)

(Approved as Authorized Engineering Information)

NATIONAL ELECTRICAL CODE	COMMENT

Chapter 2. Wiring Design and Protection

ARTICLE 200—USE AND IDENTIFICATION OF GROUNDED CONDUCTORS

200-10. Identification of Terminals.

(b) Receptacles, Plugs, and Connectors. Receptacles, polarized attachment plugs and cord connectors for plugs and polarized plugs shall have the terminal intended for connection to the grounded (white) conductor identified.

Identification shall be by a metal or metal coating substantially white in color or the word "white" located adjacent to the identified terminal.

If the terminal is not visible, the conductor entrance hole for the connection shall be colored white or marked with the word "white."

The terminal for the connection of the equipment grounding conductor shall be identified by: (1) a green-colored, not readily removable terminal screw with a hexagonal head; (2) a green-colored, hexagonal, not readily removable terminal nut; or (3) a green-colored pressure wire connector. If the terminal for the grounding conductor is not visible, the conductor entrance hole shall be marked with the word "green" or otherwise identified by a distinctive green color.

Exception: Terminal identification shall not be required for 2-wire non-polarized attachment plugs.

(b) Requires that plugs, receptacles, and connectors have the grounded terminal identified by a white color. The grounding terminal may be identified in different ways utilizing a green color or the word "green."

ARTICLE 210—BRANCH CIRCUITS

210-3. Classifications. Branch circuits recognized by this article shall be classified in accordance with the maximum permitted ampere rating or setting of the overcurrent device. The classification for other than individual branch circuits shall be: 15, 20, 30, 40, and 50 amperes. Where conductors of higher ampacity are used for any reason, the ampere rating or setting of the specified overcurrent device shall determine the circuit classification.

Exception: Multioutlet branch circuits greater than 50 amperes shall be permitted on industrial premises where maintenance and supervision indicate that qualified persons will service equipment.

Exception: Recognizes the use of plugs and receptacles on multioutlet branch circuits in industrial premises with ampacity ratings greater than 50 amperes.

210-6. Maximum Voltage.

(a) Voltage to Ground. Branch circuits supplying lampholders, fixtures, or standard receptacles rated 15 amperes or less shall not exceed 150 volts to ground.

Exception No. 1: The voltage shall be permitted to exceed 150 volts to ground but shall not exceed 300 volts to ground on branch circuits within the confines of industrial premises where all of the following conditions are met:

a. The conditions of maintenance and supervision indicate that only qualified persons will service the system(s).

b. The branch circuits supply only lighting fixtures that are equipped with mogul-base screw-shell lampholders or with lampholders other than the screw shell type applied within their voltage rating.

c. Incandescent lamp fixtures, if used, shall be mounted not less than 8 feet (2.44 m) above the floor. Where conditions do not permit 8 feet (2.44 m), the incandescent fixtures shall be permitted at the available height.

(FPN): See Section 110-17.

d. Integral lighting switch, if used, shall not be readily accessible.

Exception No. 2: The voltage shall be permitted to exceed 150 volts to ground but shall not exceed 300 volts to ground on branch circuits on premises other than within dwelling units where all of the following are met:

a. The branch circuits only supply the ballasts for permanently installed electric-discharge lamp fixtures.

(a) Requires that standard receptacles rated 15 amperes or less not exceed 150 volts to ground, except that the branch circuits in industrial establishments that have competent maintenance and supervision personnel shall not exceed 300 volts to ground. The intent is that in industrial applications the highest voltage that can be used is a 480Y/277 volt distribution system.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

NATIONAL ELECTRICAL CODE

b. Integral lighting switch, if used, shall not be readily accessible.

c. Electric-discharge lampholders of the screw-shell type, if used, shall be mounted not less than 8 feet (2.44 m) from the floor.

Exception No. 3: For lampholders of infrared industrial heating appliances as provided in Section 422-15(c).

Exception No. 4: The railway properties as described in Section 110-19.

Exception No. 5: The voltage shall be permitted to exceed 300 volts to ground provided the conditions of Section 210-6(b) are met.

210-7. Receptacles and Cord Connectors.

(a) Grounding Type. Receptacles installed on 15- and 20-ampere branch circuits shall be of the grounding type. Grounding-type receptacles shall be installed only on circuits of the voltage class and current for which they are rated, except as provided in Table 210-21 (b)(2) and (b)(3).

Exception No. 1: Grounding-type receptacles of the type that reject nongrounding-type attachment plugs or which are of the locking type shall be permitted for specific purposes or in special locations. Receptacles required in Section 517-101(a)(3) and 517-101(c) shall be considered as meeting the requirements of this section.

Exception No. 2: Nongrounding-type receptacles installed in accordance with Section 210-7(d). Exception.

(b) To Be Grounded. Receptacles and cord connectors having grounding contacts shall have those contacts effectively grounded.

Exception No. 1: Receptacles mounted on portable and vehicle-mounted generators in accordance with Section 250-6.

Exception No. 2: Ground-fault circuit-interrupter replacement receptacles as permitted by Section 210-7(d), Exception.

(c) Methods of Grounding. The grounding contacts of receptacles and cord connectors shall be grounded by connection to the equipment grounding conductor of the circuit supplying the receptacle or cord connector.

(FPN): For installation requirements for the reduction of electrical noise, see Section 250-74, Exception No. 4.

The branch circuit or branch-circuit raceway shall include or provide a grounding conductor to which the grounding contacts of the receptacle or cord connector shall be connected.

(FPN): Section 250-91(b) describes acceptable grounding means.

(FPN): For extensions of existing branch circuits, see Section 250-50.

(d) Replacements. Grounding-type receptacles shall be used as replacements for existing nongrounding types and shall be connected to a grounding conductor installed in accordance with (c) above.

Exception: Where a grounding means does not exist in the receptacle enclosure either a nongrounding or a ground-fault circuit-interrupter type of receptacle shall be used, provided the ground-fault circuit-interrupter does not supply other receptacles.

(e) Cord- and Plug-Connected Equipment. The installation of grounding-type receptacles shall not be used as a requirement that all cord- and plug-connected equipment be of the grounded type.

(FPN): See Section 250-45 for type of cord- and plug-connected-equipment to be grounded.

(f) Noninterchangeable Types. Receptacles connected to circuits having different voltages, frequencies, or types of current (ac or dc) on the same premises shall be of such design that the attachment plugs used on these circuits are not interchangeable.

COMMENT

(a) Requires that 15- and 20-ampere receptacles shall be of the grounding type and shall be installed on circuits of the voltage, class, and current for which they are rated. The method of grounding is specified.

(f) States that receptacles connected to circuits having different voltages, frequencies, or types of current on the same premises shall be of such design that the plugs used on these circuits are not interchangeable. This section recognizes that configuration control is the responsibility of the installer or user to make sure there is no interchangeability between the voltage, frequency, or type of current.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

NATIONAL ELECTRICAL CODE

210-21. Outlet Devices. Outlet devices shall have an ampere rating not less than the load to be served and shall comply with (b) below.

(b) Receptacles.

(1) A single receptacle installed on an individual branch circuit shall have an ampere rating of not less than that of the branch circuit. **(FPN):** See definition of Receptacle in Article 100.

(2) Where connected to a branch circuit supplying two or more receptacles or outlets, a receptacle shall not supply a total cord- and plug-connected load in excess of the maximum specified in Table 210-21(b)(2).

(3) Where connected to a branch circuit supplying two or more receptacles or outlets, receptacle ratings shall conform to the values listed in Table 210-21(b)(3) or where larger than 50 amperes, the receptacle rating shall not be less than the branch-circuit rating.

Table 210-21(b)(2)
Maximum Cord- and Plug-Connected Load to Receptacle

Circuit Rating Amperes	Receptacle Rating Amperes	Maximum Load Amperes
15 or 20	15	12
20	20	16
30	30	24

Table 210-21(b)(3)
Receptacle Ratings for Various Size Circuits

Circuit Rating Amperes	Receptacle Rating Amperes
15	Not over 15
20	15 or 20
30	30
40	40 or 50
50	50

COMMENT

This section contains the requirements for matching receptacle ratings and maximum loads with circuit ratings.

ARTICLE 220—BRANCH CIRCUIT AND FEEDER CALCULATIONS

220-13. Receptacle Loads—Nondwelling Units. In other than dwelling units, the use of the the demand factors for lighting loads in Table 220-11 or those shown in Table 220-13 shall be permitted for receptacle loads computed at not more than 180 volt-amperes per outlet in accordance with Section 220-2 (c)(5).

Table 220-13
Demand Factors for Nondwelling Receptacle Loads

Portion of Receptacle Load to which demand factor applies (volt-amperes)	Demand Factor Percent
First 10 kVA or less	100
Remainder over 10 kVA at	50

This section states that the demand factors in Table 220-11 shall be permitted for receptacle loads computed at not more than 180 volt-amperes per outlet. The only type of occupancy which would normally be covered by pin and sleeve is the warehouse which requires that the first 12,500 square feet requires 100% demand factor while the balance of the area can be calculated on a 50% demand factor. Table 220-13 shows demand factors for nondwelling receptacle loads.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

NATIONAL ELECTRICAL CODE	COMMENT
ARTICLE 250—GROUNDING	
250-45. Equipment Connected by Cord and Plug. Under any of the conditions described in (a) through (d) below, exposed noncurrent-carrying metal parts of cord- and plug-connected equipment likely to become energized shall be grounded.	This section gives the grounding requirement for the exposed noncurrent-carrying metal parts that are likely to become energized of equipment connected by cord and plug.
(a) In Hazardous (Classified) Locations. In hazardous (classified) locations (see Articles 500 through 517).	(a) Requires cord- and plug-connected equipment used in hazardous loations as described in Article 500 through 517 to be grounded.
(b) Over 150 Volts to Ground. Where operated at over 150 volts to ground.	(b) Requires the exposed noncurrent-carrying metal parts of cord- and plug-connected equipment operating at more than 150 volts to be grounded.
Exception No. 1: Motors, where guarded.	*Exception No. 1: Excludes the exposed noncurrent-carryng metal parts of motors that are guarded and operating at more than 150 volts to ground from the grounding requirement.*
Exception No. 2: Metal frames of electrically heated appliances, exempted by special permission, in which case the frames shall be permanently and effectively insulated from ground.	*Exception No. 2: Exposed noncurrent-carrying metal parts of cord- and plug-connected appliances operating at more than 150 volts to ground are not required to be grounded when exempted by Section 422-16. Special permission is required for this exception.*
(d) In Other than Residential Occupancies. In other than residential occupancies: (1) refrigerators, freezers, and air conditioners; (2) clothes-washing, clothes-drying, dishwashing machines, sump pumps, electrical aquarium equipment; (3) hand-held motor operated tools; (4) motor-operated appliances of the following types: hedge clippers, lawn mowers, snow blowers, and wet scrubbers; (5) cord- and plug-connected appliances used in damp or wet locations or by persons standing on the ground or on metal floors or working inside of metal tanks or boilers; (6) tools likely to be used in wet and conductive locations; and (7) portable headlamps.	(d) Lists the equipment with exposed noncurrent-carrying metal parts of cord- and plug-connected equipment for other than residential occupancies that must be grounded.
Exception No. 1: Tools and portable handlamps likely to be used in wet and conductive locations shall not be required to be grounded where supplied through an isolating transformer with an ungrounded secondary of not over 50 volts.	*Exception No. 1: Removes the ground requirement for cord- and plug-connected tools and handlamps in other than residential occupancies if the tool is likely to be used in a wet and conductive location, provided the tool is supplied through an isolating transformer with an ungrounded secondary of not over 50 volts.*
Exception No. 2: Listed portable tools and listed appliances protected by an approved system of double insulation, or its equivalent, shall not be required to be grounded. Where such a system is employed, the equipment shall be distinctively marked.	*Exception No. 2: Removes the grounding requirement for listed portable tools and listed appliances that have an approved system of insulation or its equivalent and are distinctively marked to indicate the system being used.*
(FPN): With reference to (c) and (d), portable tools or appliances are not intended to be used in damp, wet, or conductive locations unless they are grounded, double insulated, or supplied through an isolating transformer.	
250-50. Equipment Grounding Conductor Connections. Equipment grounding conductor connections at the source of separately derived systems shall be made in accordance with Section 250-26(a). Equipment grounding conductor connections at service equipment shall be made as indicated in (a) or (b) below.	
(a) For Grounded System. The connection shall be made by bonding the equipment grounding conductor to the grounded service conductor and the grounding electrode conductor.	
(b) For Ungrounded System. The connection shall be made by bonding the equipment grounding conductor to the grounding electrode conductor.	
Exception for (a) and (b) above: For replacement of nongrounding-type receptacles with grounding-type receptacles and for branch-circuit extensions only in existing installations that do not have an equipment grounding conductor in the branch circuit, the grounding conductor of a grounding-type receptacle outlet shall be permitted to be grounded to a water pipe which is bonded in accordance with Section 250-80(a).	*Exception for (a) and (b): Permits the grounding conductor of the grounding-type receptacle outlet to be grounded to a grounded water pipe only in existing installations that do not have an equipment grounding conductor in the branch circuits, provided the water pipe is properly grounded.*

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

NATIONAL ELECTRICAL CODE

250-59. Cord- and Plug-Connected Equipment. Noncurrent-carrying metal parts of cord- and plug-connected equipment, where required to be grounded shall be grounded by one of the methods indicated in (a), (b), or (c) below.

(a) By Means of the Metal Enclosure. By means of the metal enclosure of the conductors supplying such equipment if a grounding-type attachment plug with one fixed grounding contact is used for grounding the metal enclosure, and if the metal enclosure of the conductors is secured to the attachment plug and to equipment by approved connectors.

Exception: A self-restoring grounding contact shall be permitted on grounding-type attachment plugs used on the power supply cord of portable hand-held, hand-guided, or hand-supported tools or appliances.

(b) By Means of a Grounding Conductor. By means of an equipment grounding conductor run with the power supply conductors in a cable assembly or flexible cord properly terminated in grounding-type attachment plug with one fixed grounding contact. An uninsulated equipment grounding conductor shall be permitted but, if individually covered, the covering shall have a continuous outer finish that is either green or green with one or more yellow stripes.

Exception: A self-restoring grounding contact shall be permitted on grounding-type attachment plugs used on the power supply cord of portable hand-held, hand-guided, or hand-supported tools or appliances.

(c) Separate Flexible Wire or Strap. By means of a separate flexible wire or strap, insulated or bare, protected as well as practicable against physical damage, where part of equipment.

250-74. Connecting Receptacle Grounding Terminal to Box. An equipment bonding jumper shall be used to connect the grounding terminal of a grounding-type receptacle to a grounded box.

Exception No. 1: Where the box is surface mounted, direct metal-to-metal contact between the device yoke and the box shall be permitted to ground the receptacle to the box. This exception shall not apply to cover-mounted receptacles unless the box and cover combination are listed as providing satisfactory ground continuity between the box and the receptacle.

Exception No. 2: Contact devices or yokes designed and listed for the purpose shall be permitted in conjunction with the supporting screws to establish the grounding circuit between the device yoke and flush-type boxes.

Exception No. 3: Floor boxes designed for and listed as providing satisfactory ground continuity between the box and the device.

Exception No. 4: Where required for the reduction of electrical noise (electromagnetic interference) on the grounding circuit, a receptacle in which the grounding terminal is purposely insulated from the receptacle mounting means shall be permitted. The receptacle grounding terminal shall be grounded by an insulated equipment grounding conductor run with the circuit conductors. This grounding conductor shall be permitted to pass through one or more panelboards without connection to the panelboard grounding terminal as permitted in Section 384-27, Exception No. 1, so as to terminate directly at an equipment grounding conductor terminal of the applicable derived system or service.

(FPN): Use of an isolated equipment grounding conductor does not relieve the requirement for grounding the raceway system and outlet box.

250-99. Equipment Grounding Conductor Continuity.

(a) Separable Connections. Separable connections such as those provided in drawout equipment or attachment plugs and mating connectors and receptacles shall provide for first-make last-break of the equipment grounding conductor.

Exception: Interlocked equipment, plugs, receptacles, and connectors which preclude energization without grounding continuity.

COMMENT

This section describes the methods of grounding the noncurrent-carrying metal parts of cord- and plug-connected equipment, where required to be grounded.

(a) For this method a grounding type attachment plug with one fixed grounding contact is used for grounding the metal enclosure and the metal enclosure of the conductors is secured to the attachment plug and to the equipment by connectors approved for the purpose.

Exception: Permits the use of self-restoring ground contacts on grounding-type attachment plugs used on the power supply cord of portable hand-held, hand-guided, or hand-supported tools or appliances.

(b) Permits a grounding conductor to be run with power supply cable assembly or flexible cord that is properly terminated in a grounding-type attachment plug that includes one fixed grounding contact. Uninsulated grounding conductors are permitted, but if individually covered, the covering must be green or green with yellow stripes.

Exception: Same as for (a) above.

(c) This method permits the use of a flexible wire or strap where it is part of the equipment or if special permission is obtained. The wire or strap can be insulated or bare and must be protected as well as practicable against physical damage.

This section requires an equipment bonding jumper be used between the grounding terminal of a grounding-type receptacle to a grounded box.

Exception No. 1: Permits the direct metal-to-metal contact between the device yoke and the box to provide the means of grounding the receptacle to the box, but not vice versa, in installations where the box is surface-mounted.

Exception No. 2: Permits contact devices or yokes that are designed and listed for the purpose in conjunction with supporting screws to provide the grounding circuit between the device yoke on a flush-type box.

Exception No. 3: Permits floor boxes designed for and listed as providing satisfactory ground continuity between the box and the device.

Exception No. 4: Permits a receptacle to be installed in which the grounding terminal is purposely insulated from the receptacle mounting means when: 1) it is required for the reduction of electrical noise (electromagnetic interference) on the grounding circuit and 2) the receptacle grounding terminal is grounded by an insulated equipment grounding conductor run with the circuit conductors. This grounding conductor is permitted to pass through one or more panelboards without connection to the panelboard grounding terminal as permitted in Section 384-27 Exception No. 1, so as to terminate directly at the applicable derived system or service grounding terminal.

(a) This section requires separable connections such as those provided in draw-out equipment or attachment plugs and mating connectors and receptacles to have first-make, last-break of the equipment grounding conductor.

Exception: Interlocked equipment with plugs, receptacles, and connectors which cannot be energized without grounding continuity are excluded from the requirements of (a).

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

NATIONAL ELECTRICAL CODE

(b) Switches. No automatic cutout or switch shall be placed in the equipment grounding conductor of a premises wiring system.
Exception: Where the opening of the cutout or switch disconnects all sources of energy.

250-114. Continuity and Attachment of Branch-Circuit Equipment Grounding Conductors to Boxes. Where more than one equipment grounding conductor enters a box all such conductors shall be spliced or joined within the box or to the box with devices suitable for the use. Connections depending on the solder shall not be used and the arrangement shall be such that the disconnection or the removal of a receptacle, fixture, or other device fed from the box will not interfere with or interrupt the grounding continuity.

(a) Metal Boxes. A connection shall be made between the one or more equipment grounding conductors and metal box by means of a grounding screw which shall be used for no other purpose, or an approved grounding device.

(b) Non-mettalic Boxes. One or more equipment grounding conductors brought into a non-metallic outlet box shall be so arranged that a connection can be made to any fitting or device in that box requiring grounding.

COMMENT

(b) This section does not allow automatic cutouts or switches to be placed in the grounding conductors of a premises wiring system.
Exception: A cut-out or switch that disconnects all sources of energy is permitted.
This section requires that when more than one equipment grounding conductor of a branch circuit enters a box, they must all be in good electrical contact with one another and must be arranged so that the grounding continuity must not be interfered with when disconnecting or removing a receptacle, fixture, or other device, fed from the box.

(a) This section requires a connection between the one or more equipment grounding conductors and a metal box by means of a grounding screw which is to be used for no other purpose or an approved grounding device.
(b) This section requires any fitting or device in a non-metallic box that requires grounding to be grounded.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

NATIONAL ELECTRICAL CODE | **COMMENT**

Chapter 3 Wiring Methods and Materials

ARTICLE 300—WIRING METHODS

300-13. Mechanical and Electrical Continuity-Conductors.

(b) Device Removal. In multiwire circuits the continuity of a grounded conductor shall not be dependent upon device connections, such as lampholders, receptacles, etc., where the removal of such devices would interrupt the continuity.

(b) Neutral conductors of multi-wire branch circuits supplying receptacles must not be dependent upon terminal connections for continuity. Opening the neutral could cause unbalance and considerably higher line voltages. For these circuits, either a splice must be made and a jumper connected to the terminal, or the neutral must be "looped." This requirement does not apply to individual 2-wire circuits or circuits without a grounded neutral conductor.

ARTICLE 305—TEMPORARY WIRING

305-2. General.

(d) Receptacles. All receptacles shall be of the grounding type. Unless installed in a complete metallic raceway all branch circuits shall contain a separate equipment grounding conductor and all receptacles shall be electrically connected to the grounding conductor. Receptacles on construction sites shall not be installed on branch circuits which supply temporary lighting. Receptacles shall not be connected to the same ungrounded conductor of multiwire circuits which supply temporary lighting.

(d) Requires all receptacles for temporary wiring to be of the grounding type. On construction sites, receptacles must not be installed on circuits which supply temporary lighting; otherwise the operation of overload protection, or ground-fault circuit interrupters could simultaneously de-energize the lighting circuits.

(e) Disconnecting Means. Suitable disconnecting switches or plug connectors shall be installed to permit the disconnection of all ungrounded conductors of each temporary circuit.

305-4. Ground-Fault Protection of Personnel. Ground-fault protection for personnel on construction sites shall be provided to comply with (a) or (b) below.

(a) Ground-Fault Circuit-Interrupters. All 125-volt, single-phase, 15- and 20-ampere receptacles outlets which are not a part of the permanent wiring of the building or structure and which are in use by employees shall have ground-fault circuit-interrupter protection for personnel.

(a) On construction sites, 125-volt, single-phase, 15- and 20-ampere receptacle outlets not part of the permanent wiring must have ground fault circuit interrupters for personnel protection.

Exception: Receptacles on a 2-wire, single-phase portable or vehicle-mounted generator rated not more than 5 kW, where the circuit conductors of the generator are insulated from the generator frame and all other grounded surfaces.

(b) Assured Equipment Grounding Conductor Program. A written procedure shall be continuously enforced at the construction site by one or more designated persons to assure that equipment grounding conductors for all cord sets, receptacles which 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 Section 210-7(c), 250-45, 250-59, and 305-2(d).

Paragraph (b) is an alternative to the requirements in (a) for GFCI protection.

(1) The following tests shall be performed on all cord sets, receptacles which are not part of the permanent wiring of the building or structure, and cord- and plug-connected equipment required to be grounded.

a. All equipment-grounding conductors shall be tested for continuity and shall be electrically continuous.

b. 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.

c. All required tests shall be performed:

1. Before first use on the construction site.
2. When there is evidence of damage.
3. Before equipment is returned to service following any repairs.
4. At intervals not exceeding 3 months.

(2) The tests required in (1) above shall be recorded and made available to the authority having jurisdiction.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

NATIONAL ELECTRICAL CODE	COMMENT

Chapter 4 Equipment for General Use

ARTICLE 400—FLEXIBLE CORDS AND CABLES

400-7. Uses Permitted.

(a) Uses. Flexible cords and cables shall be used only for (1) pendants; (2) wiring of fixtures; (3) connection of portable lamps or appliances; (4) elevator cables; (5) wiring of cranes and hoists; (6) connection of stationary equipment to facilitate their frequent interchange; (7) prevention of the transmission of noise or vibration; (8) appliances where the fastening means and mechanical connections are designed to permit removal for maintenance and repair; (9) data processing cables as permitted by Section 645-2; (10) connection of moving parts; or (11) temporary wiring as permitted in Sections 305-2(b) and 305-2(c).

(b) Attachment plugs. Where used as permitted in subsections (a)(3), (a)(6), and (a)(8) of this section, each flexible cord shall be equipped with an attachment plug and shall be energized from a receptacle outlet.

400-8. Uses Not Permitted. Unless specifically permitted in Section 400-7 flexible cords and cables shall not be used (1) as a substitute for the fixed wiring of a structure; (2) where run through holes in walls, ceilings, or floors; (3) where run through doorways, windows, or similar openings; (4) where attached to building surfaces; or (5) where concealed behind building walls, ceilings, or floors.

400-10. Pull at Joints and Terminals. Flexible cords shall be so connected to devices and to fittings that tension will not be transmitted to joints or terminals.

This section requires strain relief at joints and terminals when flexible cords are connected to devices and fittings.

(FPN): Some methods of preventing pull on a cord from being transmitted to joints or terminals are (1) knotting the cord, (2) winding with tape, and (3) fittings designed for the purpose.

400-24. Attachment Plugs. Where a flexible cord is provided with a grounding conductor and equipped with an attachment plug, the attachment plug shall comply with Section 250-59(a) and (b).

This section requires the noncurrent-carrying metal parts of the attachment plug of a flexible cord with grounding conductor to be grounded where required.

ARTICLE 410—LIGHTING FIXTURES, LAMPHOLDERS, LAMPS, RECEPTACLES AND ROSETTES

410-12. Outlet Boxes to be Covered. In a completed installation, each outlet box shall be provided with a cover unless covered by means of a fixture canopy, lampholder, receptacle, rosette, or similar device.

This section requires outlet boxes in a completed installation to be covered, unless a suitable device is mounted to them.

410-28. Protection of Conductors and Insulation.

(a) Properly Secured. Conductors shall be secured in a manner that will not tend to cut or abrade the insulation.

(b) Protection Through Metal. Conductor insulation shall be protected from abrasion where it passes through metal.

(a) Requires conductors to be secured to protect the insulation of the conductors.
(b) Requires the holes in metal used for wires to pass through not to cause damage to the insulation of the conductors.

410-56. Rating and Type.

(a) Receptacles. Receptacles installed for the attachment of portable cords shall be rated at not less than 15 amperes, 125 volts, or 15 amperes, 250 volts, and shall be of a type not suitable for use as lampholders.

Exception: The use of receptacles of 10-ampere, 250-volt rating used in nonresidential occupancies for the supply of equipment other than portable hand tools, portable handlamps, and extension cords shall be permitted.

(a) Establishes the minimum rating of 15 amperes, 125 volts, or 15 amperes, 250 volts, for receptacles for residential use.

Exception: 10 amperes, 250 volts, is permitted for nonresidential use.

(b) CO/ALR Receptacles. Receptacles rated 20 amperes or less directly connected to aluminum conductors shall be marked CO/ALR.

(b) Requires suitable terminations for use with aluminum conductors.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

NATIONAL ELECTRICAL CODE

(c) Faceplates. Metal faceplates shall be of ferrous metal not less than 0.030 inch (762 micrometers) in thickness or of nonferrous metal not less than 0.040 inch (1 mm) in thickness. Metal faceplates shall be grounded. Faceplates of insulating material shall be noncombustible and not less than 0.10 inch (2.54 mm) in thickness but shall be permitted to be less than 0.10 inch (2.54 mm) in thickness if formed or reinforced to provide adequate mechanical strength.

(d) Position of Receptacle Faces. After installation, receptacle faces shall be flush with or project from faceplates of insulating material and shall project a minimum of 0.015 inch (381 micrometers) from metal faceplates. Faceplates shall be installed so as to completely cover the opening and seat against the mounting surface. Boxes shall be installed in accordance with Section 370-10.

(e) Attachment Plugs. All 15- and 20-ampere attachment plugs and connectors shall be so constructed that there are no exposed current-carrying parts except the prongs, blades, or pins. The cover for wire terminations shall be a part, which is essential for the operation of an attachment plug or connector (dead-front construction).

(f) Attachment Plug Ejector Mechanisms. Attachment plug ejector mechanisms shall not adversely affect engagement of the blades of the attachment plug with the contacts of the receptacle.

(g) Noninterchangeability. Receptacles, cord connectors, and attachment plugs shall be constructed so that the receptacle or cord connectors will not accept an attachment plug with a different voltage or current rating than that for which the device is intended. Nongrounding-type receptacles and connectors shall not accept grounding-type attachment plugs.

Exception: A 20-ampere T-slot receptacle or cord connector shall be permitted to accept a 15-ampere attachment plug of the same voltage rating.

410-57. Receptacles in Damp or Wet Locations.

(a) Damp Locations. A receptacle installed outdoors in a location protected from the weather or in other damp locations shall have an enclosure for the receptacle that is weatherproof when the receptacle is covered (attachment plug cap not inserted and receptacle covers closed).

An installation suitable for wet locations shall also be considered suitable for damp locations.

A receptacle shall be considered to be in a location protected from the weather where located under roofed open porches, canopies, marquees, and the like, and will not be subjected to a beating rain or water run-off.

(b) Wet Locations. A receptacle installed outdoors where exposed to weather or in other wet locations shall be in a weather-proof enclosure, the integrity of which is not affected when the receptacle is in use (attachment plug cap inserted).

Exception: An enclosure that is weatherproof only when a self-closing receptacle cover is closed shall be permitted to be used for a receptacle installed outdoors where the receptacle is not to be used with other than portable tools or other portable equipment not left connected to the outlet indefinitely.

(c) Protection for Floor Receptacles. Standpipes of floor receptacles shall allow floor-cleaning equipment to be operated without damage to receptacles.

(d) Flush Mounting with Faceplate. The enclosure for a receptacle installed in an outlet box flush-mounted on a wall surface shall be made weatherproof by means of a weatherproof faceplate assembly that provides a watertight connection between the plate and the wall surface.

COMMENT

(c) Establishes minimum thicknesses for ferrous or nonferrous metal faceplates. Insulating, noncombustible faceplates are required to be a minimum thickness or have adequate mechanical strength.

(d) Specifies the location of the faceplates and receptacle faces after installation.

(e) Requires all 15- and 20-ampere attachment plugs to be of dead-front construction.

(g) Requires receptacles and cord connectors to accept only plugs for which they are intended.

(a) Establishes suitability criteria for receptacle enclosures mounted in damp locations.

(b) Receptacles installed in wet locations must maintain weatherproof integrity with or without the plug inserted.

Exception: The exception allows, under certain circumstances, the use of receptacles that are weatherproof only when a plug is not inserted.

(d) When flush mounting with faceplate, a watertight connection must be maintained between the plate and the wall surface.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

NATIONAL ELECTRICAL CODE	COMMENT
(e) Installation. A receptacle outlet installed outdoors shall be located so that water accumulation is not likely to touch the outlet cover or plate.	(e) Location of receptacles outdoors must be such that water accumulation cannot touch the outlet cover or plate.
410-58. Grounding-Type Receptacles, Adapters, Cord Connectors, and Attachment Plugs.	
(a) Grounding Poles. Grounding-type receptacles, cord connectors, and attachment plugs shall be provided with one fixed grounding pole in addition to the circuit poles.	(a) Requires grounding-type receptacles, adapters, cord connectors, and attachment plugs to have a grounding pole in addition to the circuit poles.
(b) Grounding-Pole Identification. Grounding-type receptacles, adapters, cord connections, and attachment plugs shall have a means for connection of a grounding conductor to the grounding pole.	(b) Requires a terminal for connecting the grounding conductor to the grounding pole.
A terminal for connection to the grounding pole shall be designated by:	
(1) A green-colored hexagonal headed or shaped terminal screw or nut, not readily removable; or	(1) Requires terminal screw or nut to be green and not readily removable.
(2) A green-colored pressure wire connector body (a wire barrel); or	(2) Allows green-colored pressure wire connectors.
(3) A similar green-colored connection device in the case of adapters. The grounding terminal of a grounding adapter shall be a green-colored rigid ear, lug, or similar device. The grounding connection shall be so designed that it cannot make contact with current-carrying parts of the receptacle, adapter, or attachment plug. The adapter shall be polarized.	(3) Specifies that adapters be polarized. Regulates the locations and design of grounding connections so they cannot make contact with current-carrying parts.
(4) If the terminal for the equipment grounding conductor is not visible, the conductor entrance hole shall be marked with the word "green" or otherwise identified by a distinctive green color.	(4) Allows the word "green" at locations where the teminal cannot be seen.
(c) Grounding Terminal Use. A grounding terminal or grounding-type device shall not be used for purposes other than grounding.	(c) Limits grounding terminal use for grounding purposes only.
(d) Grounding-Pole Requirements. Grounding-type attachment plugs and mating cord connectors and receptacles shall be so designed that the grounding connection is made before the current-carrying connections. Grounding-type devices shall be designed so grounding poles of attachment plugs cannot be brought into contact with current-carrying parts of receptacles or cord connectors.	(d) Requires ground connection to be made before current-carrying connections. Requires grounding poles of attachment plugs to be located so they cannot be brought into contact with current-carrying parts of receptacles or cord connectors.
(e) Use. Grounding-type attachment plugs shall be used only where an equipment ground is to be provided.	
ARTICLE 422—APPLIANCES	
422-22. Disconnection of Cord- and Plug-Connected Appliances.	
(a) Separable Connector or an Attachment Plug and Receptacle. For cord- and plug-connected appliances, a separable connector or an attachment plug and receptacle shall be permitted to serve as the disconnecting means.	(a) Permits a separable connector or an attachment plug and receptacle to serve as a disconnecting means for portable appliances. The devices must be rated for current interruption.
(c) Rating. The rating of a receptacle or of a separable connector shall not be less than the rating of any appliance connected thereto. *Exception: Demand factors authorized elsewhere in this Code shall be permitted to be applied.*	(c) The rating of a separable connector or receptacle must not be less than the rating of the appliance to which it is connected. *Exception: This exception permits the use of demand factors authorized elsewhere in the Code.*
(d) Requirements for Attachment Plugs and Connectors. Attachment plugs and connectors shall conform to the following:	(d) Lists the following requirements for attachment plugs and connectors:
(1) Live Parts. They shall be so constructed and installed as to guard against inadvertent contact with live parts.	(1) Must be constructed and installed to prevent inadvertent contact without hazard with live parts.
(2) Interrupting Capacity. They shall be capable of interrupting their rated current without hazard to the operator.	(2) Must be capable of interrupting their rated current without hazard to the operator.
(3) Interchangeability. They shall be so designed that they will not fit into receptacles of lesser rating.	(3) Must be designed so interchanging plugs and connectors with a receptacle of lesser rating is not possible.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

NATIONAL ELECTRICAL CODE	COMMENT

ARTICLE 430—MOTORS, MOTOR CIRCUITS AND CONTROLLERS

430-42. Motors on General-Purpose Branch Circuits. Overload protection for motors used on general-purpose branch circuits as permitted in Article 210 shall be provided as specified in (a), (b), (c), or (d) below.

(c) Cord- and Plug-Connected. Where a motor is connected to a branch circuit by means of an attachment plug and receptacle and individual overload protection is omitted as provided in (a) above, the rating of the attachment plug and receptacle shall not exceed 15 amperes at 125 volts or 10 amperes at 250 volts. Where individual overload protection is required as provided in (b) above for a motor or motor-operated appliance that is attached to the branch circuit through an attachment plug and receptacle, the overload device shall be an integral part of the motor or of the appliance. The rating of the attachment plug and receptacle shall determine the rating of the circuit to which the motor may be connected, as provided in Article 210.

(c) Specifies that the ratings of the attachment plug and receptacle shall not exceed 15 amperes at 125 volts or 10 amperes at 250 volts when a motor is connected to a branch circuit by an attachment plug and receptacle and the motor does not have individual overload protection. The overload device shall be an integral part of the motor or the motor-operated appliance when individual overload protection is required as in 430-42(b) for a motor or a motor-operated appliance that is attached to the branch circuit from an attachment plug and receptacle. The rating of the attachment plug and receptacle shall determine the rating of the circuit to which the motor may be connected as provided in Article 210—Branch Circuits.

430-81. Motor Controllers.

(c) Portable Motor of 1/3 Horsepower or Less. For a portable motor rated at 1/3 horsepower or less, the controller shall be permitted to be an attachment plug and receptacle.

(c) Permits an attachment plug and receptacle to function as the controller for a portable motor rated at ⅓ horsepower or less.

430-109. Type. The disconnecting means shall be a motor-circuit switch rated in horsepower, a circuit breaker, or a molded case switch (nonautomatic circuit interrupter).

This section deals with the type of disconnecting for motors. It requires the disconnecting means to be motor circuit switch rated in horsepower or a circuit breaker.

Exception No. 1: For stationary motors of 1/8 horsepower or less, the branch-circuit overcurrent device shall be permitted to serve as the disconnecting means.

Exception No. 2: For stationary motors rated at 2 horsepower or less and 300 volts or less, the disconnecting means shall be permitted to be a general-use switch having an ampere rating not less than twice the full-load current rating of the motor.

On ac circuits, general-use snap switches suitable only for use on ac (not general-use ac-dc snap switches) shall be permitted to disconnect a motor rated 2 horsepower or less and 300 volts or less having a full-load current rating not more than 80 percent of the ampere rating of the switch.

Exception No. 3: For motors of over 2 horsepower to and including 100 horsepower, the separate disconnecting means required for a motor with an autotransformer-type controller shall be permitted to be a general-use switch where all of the following provisions are met:

a. The motor drives a generator that is provided with overload protection.

b. The controller (1) is capable of interrupting the locked-rotor current of the motor; (2) is provided with a no-voltage release; and (3) is provided with running overload protection not exceeding 125 percent of the motor full-load current rating.

c. Separate fuses or an inverse time circuit breaker rated or set at not more than 150 percent of the motor full-load current are provided in the motor branch circuit.

Exception No. 4: For stationary motors rated at more than 40 horsepower direct-current or 100 horsepower alternating-current, the disconnecting means shall be permitted to be a general-use or isolating switch when plainly marked "Do not operate under load."

Exception No. 5: For a cord- and plug-connected motor, an attachment plug and receptacle having ratings no less than the motor ratings shall be permitted to serve as the disconnecting means. A horsepower rated attachment plug and receptacle shall not be required for a cord- and plug-connected appliance in accordance with Section 422-22 or a room air conditioner in accordance with Section 440-63.

Exception No. 5: Permits attachment plug and receptacles to serve as the disconnecting means for motors.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

NATIONAL ELECTRICAL CODE	COMMENT
Exception No 6: For torque motors the disconnecting means shall be permitted to be a general-use switch.	
430-110. Ampere Rating and Interrupting Capacity. **(a) General.** The disconnecting means for motor circuits rated 600 volts, nominal, or less, shall have an ampere rating of at least 115 percent of the full-load current rating of the motor. **(b) For Torque Motors.** Disconnecting means for a torque motor shall have an ampere rating of at least 115 percent of the motor nameplate current. **(c) For Combination Loads.** Where two or more motors are used together or where one or more motors are used in combination with other loads, such as resistance heaters, and where the combined load may be simultaneous on a single disconnecting means, the ampere and horsepower ratings of the combined load shall be determined as follows: (1) The rating of the disconnecting means shall be determined from the summation of all currents, including resistance loads, at the full-load condition and also at the locked-rotor condition. The combined full-load current and the combined locked-rotor current so obtained shall be considered as a single motor for the purpose of this requirement as follows: The full-load current equivalent to the horsepower rating of each motor shall be selected from Table 430-148, 430-149, or 430-150. These full-load currents shall be added to the rating in amperes of other loads to obtain an equivalent full-load current for the combined load. The locked-rotor current equivalent to the horsepower rating of each motor shall be selected from Table 430-151. The locked-rotor currents shall be added to the rating in amperes of other loads to obtain an equivalent locked-rotor current for the combined load. Where two or more motors and/or other loads cannot be started simultaneously, appropriate combinations of locked-rotor and full-load current shall be permitted to be used to determine the equivalent locked-rotor current for the simultaneous combined loads. *Exception: Where part of the concurrent load is resistance load, and where the disconnecting means is a switch rated in horsepower and amperes, the switch used shall be permitted to have a horsepower rating not less than the combined load of the motor(s), if the ampere rating of the switch is not less than the locked-rotor current of the motor(s) plus the resistance load.* (2) The ampere rating of the disconnecting means shall not be less than 115 percent of the summation of all currents at the full-load condition determined in accordance with (c)(1) above. (3) For small motors not covered by Tables 430-147, 430-148, 430-149, or 430-150, the locked-rotor current shall be assumed to be six times the full-load current.	(a) Requires that the disconnecting means (i.e., general use switch, circuit breaker, plug and receptacle, or fuse) must have an ampacity of not less than 115 percent of the full-load current of the motor for motors and circuits rated 600 volts nominal or less.

ARTICLE 440—AIR CONDITIONING AND REFRIGERATING EQUIPMENT

440-13. Cord-Connected Equipment. For cord-connected equipment such as room air conditioners, household refrigerators and freezers, drinking water coolers and beverage dispensers, a separable connector or an attachment plug and receptacle shall be permitted to serve as the disconnecting means. See also Section 440-63.	This section permits the use of a separable connector or attachment plug and receptacle to serve as the disconnecting means for cord connected equipment such as room air conditioners, household refrigerators and freezers, drinking water coolers, and beverage dispensers. The device must be rated for current interruption.
440-55. Cord-and-Attachment Plug-Connected Motor-Compressors and Equipment on 15- or 20-Ampere Branch Circuits. Overload protection for motor-compressors and equipment that are cord-and-attachment plug-connected and used on 15- or 20-ampere 208- or 240-volt single-phase branch circuits as permitted in Article 210 shall be permitted as indication in (a), (b), and (c) below.	

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

NATIONAL ELECTRICAL CODE

(a) Overload Protection. The motor-compressor shall be provided with overload protection as specified in Section 440-52(a). Both the controller and the motor overload protective device shall be approved for installation with the short-circuit and ground-fault protective device for the branch circuit to which the equipment is connected.

(b) Attachment Plug and Receptacle Rating. The rating of the attachment plug and receptacle shall not exceed 20 amperes at 125 volts or 15 amperes at 250 volts.

(c) Time Delay. The short-circuit and ground-fault protective device protecting the branch circuit shall have sufficient time delay to permit the motor-compressor and other motors to start and accelerate their loads.

COMMENT

(a), (b), and (c) of this section cover overload protection for motor compressors and equipment that are cor- and attachment-plug connected and used on 15- and 20-ampere 120-volt or 15-ampere 250-volt single-phase branch circuits as permitted be Article 210.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

NATIONAL ELECTRICAL CODE	COMMENT

Chapter 5. SPECIAL OCCUPANCIES

ARTICLE 501—HAZARDOUS LOCATIONS—CLASS I INSTALLATIONS

501-3. Meters, Instruments, and Relays.

(b) Class I, Division 2. In class I, Division 2 locations, meters, instruments, and relays shall comply with the following:

(6) Connections. To facilitate replacements, process control instruments shall be permitted to be connected through flexible cord, attachment plug, and receptacle, provided: (1) a switch complying with (b)(1) above is provided so that the attachment plug is not depended on to interrupt current; and (2) the current does not exceed 3 amperes at 120 volts nominal; and (3) the power-supply cord does not exceed 3 feet, (914 mm) is of a type approved for extra-hard usage or for hard usage if protected by location, and is supplied through an attachment plug and receptacle of the locking and grounding type; and (4) only necessary receptacles are provided; and (5) the receptacle carries a label warning against unplugging under load.

(6) Permits the use of locking-type plugs and receptacles at a maximum of 3 amperes; 120 volts nominal, in a Class I, Division 2 area for disconnect use only; so as to ease replacement of process control instruments under limited conditions.

501-11. Flexible Cords, Class I, Division 1 and 2. A flexible cord shall be permitted only for connection between a portable lamp or other portable utilization equipment and the fixed portion of its supply circuit; and where used shall; (1) be of a type approved for extra-hard usage; and (2) contain, in addition to the conductors of the circuit, a grounding conductor complying with Section 400-23; and (3) to be connected to terminals or to supply conductors in an approved manner; and (4) be supported by clamps or by other suitable means in such a manner that there will be no tension on the terminal connections; and (5) be provided with suitable seals where the flexible cord enters boxes, fittings, or enclosures of the explosion-proof type.
Exception: As provided in Sections 501-3(b)(6) and 501-4(b).
Electric submersible pumps with means for removal without entering the wet pit shall be considered portable utilization equipment.
(FPN): See Section 501-13 for flexible cords exposed to liqids having a deleterious effect on the conductor insulations.

This section permits the use of approved extra-hard usage cord with approved plugs. It should be noted that approval of equipment is not general but is specific to Class and temperature and is limited to the specific gases or vapors for which it is approved.

501-12. Receptacles and Attachment Plugs, Class I, Divisions 1 and 2. Receptacles and attachment plugs shall be of the type providing for connection to the grounding conductor of a flexible cord and shall be approved for Class I locations.
Exception: As provided in Section 501-3(b)(6).

ARTICLE 502—HAZARDOUS LOCATIONS—CLASS II INSTALLATIONS

502-13. Receptacles and Attachment Plugs.

(a) Class II, Division 1. In Class II, Division I locations, receptacles and attachment plugs shall be of the type providing for connection to the grounding conductor of the flexible cord and shall be approved for Class II locations.

(a) Permits the use of approved hard usage cord with approved plugs. It should be noted that approval of equipment is not general but is specific to Class and temperature, and is limited to the specific dusts for which it is approved.

(b) Class II, Division 2. In Class II, Division 2 locations, receptacles and attachment plugs shall be of the type providing for connection to the grounding conductor of the flexible cord and shall be so designed that connection to the supply circuit cannot be made or broken while live parts are exposed.

ARTICLE 503—HAZARDOUS LOCATIONS—CLASS III INSTALLATIONS

503-11. Receptacles and Attachment Plugs, Class III, Division 1 and 2. Receptacles and attachment plugs shall be of the grounding type and shall be so designed to minimize the accumulation or the entry of fibers or flyings, and shall prevent the escape of sparks or molten particles.
Exception: In locations where, in the judgment of the authority having jurisdiction, only moderate accumulations of lint of flyings will be

Exception: Permits the use of general purpose grounding type receptacles mounted to minimize the entry of fiber or flyings.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

NATIONAL ELECTRICAL CODE	COMMENT

likely to collect in the vicinity of a receptacle, and where such receptacle is readily accessible for routine cleaning, general-purpose grounding-type receptacles mounted so as to minimize the entry of fibers or flyings shall be permitted.

ARTICLE 511—COMMERCIAL GARAGES, REPAIR AND STORAGE

511-8. Electric Vehicle Charging.

(a) Connections. Flexible cords and connectors used for charging shall be suitable for the type of service and approved for extra-hard usage. Their ampacity shall be adequate for the charging current.

(a) Regulates the use of charging connections to vehicle near hazardous areas in garages. Connectors are no longer limited to 50 amperes minimum.

(b) Connector Design and Location. Connectors shall be so designed and installed that they will disconnect readily at any position of the charging cable, and live parts shall be guarded from accidental contact. No connector shall be located within a hazardous location as defined in Section 511-2.

(c) Plug Connections to Vehicles. Where plugs are provided for direct connection to vehicles, the point of connection shall not be within a Class I location as defined in Section 511-2, and where the cord is suspended from overhead, it shall be so arranged that the lowest point of sag is at least 6 inches (152 mm) above the floor. Where the vehicle is equipped with an approved plug that will disconnect readily, and where an automatic arrangement is provided to pull both cord and plug beyond the range of physical damage, no additional connector shall be required in the cable or at the outlet.

ARTICLE 513—AIRCRAFT HANGARS

513-1. Definition. An aircraft hangar is a location used for storage or servicing of aircraft in which gasoline, jet fuels, or other volatile flammable liquids or flammable gases are used. It shall not include locations used exclusively for aircraft that have never contained such liquids or gases, or that have been drained and properly purged.

Article 513 establishes the rules for wiring plug and receptacle connections within and near hazardous areas in aircraft hangars.

513-3. Wiring and Equipment in Class I Locations. All wiring and equipment that is or may be installed or operated within any of the Class I locations defined in Section 513-2 shall comply with the applicable provisions of Article 501. All wiring installed in or under the hangar floor shall comply with the requirements of Class I, Division 1 hazardous locations. Where such wiring is located in vaults, pits, or ducts, adequate drainage shall be provided; and the wiring shall not be placed within the same compartment with any service other than piped compressed air.

Attachment plugs and receptacles in Class I locations shall be approved for Class I locations or shall be so designed that they cannot be energized while the connections are being made or broken.

Establishes the use of approved receptacles and plugs or those designed so they cannot be energized while connections are made or broken.

513-4. Wiring Not Within Class I Locations

(a) Fixed Wiring. All fixed wiring in a hangar, but not within a Class I location as defined in Section 513-2, shall be installed in metallic raceways or shall be Type MI, TC, SNM or Type MC cable.
Exception: Wiring in nonhazardous locations as defined in Section 513-2(d) shall be of a type recognized in Chapter 3.

(b) Pendants. For pendants, flexible cord suitable for the type of service and approved for hard usage shall be used. Each such cord shall include a separate grounding conductor.

(c) Portable Equipment. For portable utilization equipment and lamps, flexible cord suitable for the type of service and approved for extra-hard usage shall be used. Each such cord shall include a separate grounding conductor.

(c) Requires the use of extra-hard usage cord and with a separate grounding conductor.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

NATIONAL ELECTRICAL CODE

COMMENT

(d) Grounded and Grounding Conductors. Where a circuit supplies portables or pendants and includes an identified gounded conductor as provided in Article 200, receptacles, attachment plugs, connectors, and similar devices shall be of the polarized type, and the grounded conductor of the flexible cord shall be connected to the screw-shell of any lampholder or to the grounded terminal of any utilization equipment supplied. Acceptable means shall be provided for maintaining continuity of the grounding conductor between the fixed raceway system and the noncurrent-carrying metal portions of pendant fixtures, portable lamps, and portable utilization equipment.

513-10. External Power Sources for Energizing Aircraft.

(a) Not Less Than 18 Inches (457 mm) Above Floor. Aircraft energizers shall be so designed and mounted that all electric equipment and fixed wiring will be at least 18 inches (457 mm) above floor level and shall not be operated in a Class I location as defined in Section 513-2(c).

(b) Marking for Mobil Units. Mobil energizers shall carry at least one permanently affixed warning sign to read: "WARNING—KEEP 5 FEET CLEAR OF AIRCRAFT ENGINES AND FUEL TANK AREAS."

(c) Cords. Flexible cords for aircraft energizers and ground support equipment shall be approved for the type of service and extra-hard usage and shall include an equipment grounding conductor.

(c) Cords shall be approved for extra hard usage and have a grounding conductor.

513-11. Mobile Servicing Equipment with Electric Components.

(a) General. Mobile servicing equipment (such as vacuum cleaners, air compressors, air movers, etc.) having electric wiring and equipment not suitable for Class I, Division 2 locations shall be so designed and mounted that all such fixed wiring and equipment will be at least 18 inches (457 mm) above the floor. Such mobile equipment shall not be operated within the Class I location defined in Section 513-2(c) and shall carry at least one permanently affixed warning sign to read: "WARNING—KEEP 5 FEET CLEAR OF AIRCRAFT ENGINES AND FUEL TANK AREAS."

(b) Cords and Connectors. Flexible cords for mobil equipment shall be suitable for the type of service and approved for extra-hard usage, and shall include an equipment grounding conductor. Attachment plugs and receptacles shall be approved for the location in which they are installed, and shall provide for connection of the gorunding conductor to the raceway system.

(c) Restricted Use. Equipment not suitable for Class I, Division 2 locations shall not be operated in locations where maintenance operations likely to release flammable liquids or vapors are in progress.

513-12. Grounding. All metal raceways and all noncurrent-carrying metal portions of fixed or portable equipment, regardless of voltage, shall be grounded as provided in Article 250.

ARTICLE 517—HEALTH CARE FACILITIES

517-11. Grounding of Receptacles and Fixed Electrical Equipment. In areas used for patient care, all receptacles and all non-current-carrying conductirve surfaces of fixed electrical equipment likely to become energized that are subject to personal contact, operating at over 100 volts, shall be grounded by an insulated copper conductor sized in accordance with Table 250-95 and installed with the branch-circuit conductors supplying these receptacles or fixed equipment.

This section states the grounding requirements for noncurrent-carrying exposed conductive parts. It excludes equipment operating at 100 volts or less and allows some exceptions.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

NATIONAL ELECTRICAL CODE	COMMENT
Exception No. 1: Metal faceplates shall be permitted to be grounded by means of a metal mounting screw(s) securing the faceplate to a grounded outlet box or grounded wiring device. *Exception No. 2: An equipment grounding conductor enclosed in the sheath of a nonmetallic-sheathed cable assembly installed in accordance with the limitations of Section 336-4 shall be permitted to be used in accordance with Parts C and D of this article.*	
517-13. Receptacles with Insulated Grounds. Receptacles with insulated grounds as permitted in Section 250-74, Exception No. 4 shall be identified; such identification shall be visible after installation. **(FPN):** Care is important in specifying such a system with receptacle insulated grounds since the grounding impedance is controlled only by the grounding wires and does not benefit functionally from any parallel grounding paths.	This section requires that where insulated ground receptacles are used, they must be identified.
517-84. Critical Care Areas. **(f) Special Purpose Receptacle Grounding.** The equipment grounding conductor for special purpose receptacles such as the operation of mobil X-ray equipment shall be extended to the reference grounding points for all locations likely to ber served from such receptacles. When such a circuit is served from an isolated ungrounded system, the grounding terminal of the special purpose receptacle shall be connected to the reference grounding point.	(f) Details the grounding requirements for special purpose receptacles used to supply power for moveable X-ray equipment and other similar equipment.
517-90. Additional Protective Techniques **(b) Pediatric and Psychiatric Locations.** Fifteen- and Twenty-ampere, 125-volt receptacles intended to supply areas designated by the governing body of the health care facilities as pediatric or psychiatric wards, rooms and/or areas shall be tamperproof.. For the prupose of this section, a tamperproof receptacle is a receptacle which by its construction limits improper access to its energized contacts.	(b) Requires that receptacles used in pediatric and psychiatric locations be of a design that limits access to energized contacts.
517-101. Wiring and Equipment. **(a) Within Hazardous Anesthetizing Locations.** **(1)** In hazardous (classified) loations(s) referred to in Section 517-100, all fixed wiring and equipment, and all portable equipment, including lamps and other utilization equipment, operating at more than 8 volts between conductors shall comply with the requirements of Section 501-1 through 501-15 and Section 501-16(a) and (b) for Class 1, Division 1 locations. All such equipment shall be specifically approved for the hazardous atmospheres involved. **(2)** Where a box fitting or enclosure is partially, but not entirely, within a hazardous (classified) location(s), the hazardous (classified) location(s) shall be considered to be extended to include the entire box, fitting, or enclosure. **(3)** Receptacle and attachment plugs in hazardous (classified) location(s) shall be listed for use in Class I, Group C hazardous (classified) locations, and shall have provision for the connection of a grounding conductor.	Sections 117-101(a)(1), (2), (3) require that wiring devices partially in a hazardous or anesthetizing location must be suitable for Class I Group C locations and must be the grounding type if they are operating at more than 8 volts between conductors.
(4) Flexible cords used in hazardous areas for connection to portable utilization equipment, including lamps operating at more than 8 volts between conductors, shall be of a type approved for extra-hard usage in accordance with Table 400-4, and shall include an additional conductor for grounding. **(5)** A storage device for the flexible cord shall be provided, and shall not subject the cord to bending at a radius of less than 3 inches (76 mm).	(4) & (5) state that flexible cords in hazardous areas must be approved for extra-hard usage with an additional conductor for grounding. The flexible cord must not be bent to a radius of less than three inches in storage.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

NATIONAL ELECTRICAL CODE	COMMENT
(b) Above Hazardous Anesthetizing Locations.	
(2) Installed equipment which may produce arcs, sparks, or particles of hot metal such as lamps and lampholders for fixed lighting cutouts, switches, generators, motors, or other equipment having make-and-break or sliding contacts shall be of the totally enclosed type or so constructed as to prevent escape of sparks or hot metal particles. *Exception: Wall-mounted receptacles installed above the hazardous area in flammable anesthetizing locations shall not be required to be totally enclosed or have openings guarded or screened to prevent dispersion of particles.*	*Exception: New in the 1984 Code and does not require a receptacle located above flammable anesthetizing locations to have guards to prevent hot particles from falling within the hazardous area.*
(5) Receptacles and attachment plugs located above hazardous anesthetizing locations shall be listed for hospital use for services of prescribed voltage, frequency, rating and number of conductors with provision for the connection of the grounding conductor. This requirement shall apply to attachment plugs and receptacles of the 2-pole, 3-wire grounding type for single-phase 120-volt, nominal ac service.	(5) Requires all 120-volt, 2-pole, 3-wire receptacles and attachment plugs be listed for hospital use when located above hazardous anesthetizing locations.
(6) Plugs and receptacles for connection of 250-volt, 50 ampere and 60-ampere ac medical equipment for use above hazardous (classified) locations shall be so arranged that the 60-ampere receptacle will accept either the 50-ampere or the 60-ampere plug. Fifty-ampere receptacles shall be designed so as not to accept the 60-ampere attachment plug. The plugs shall be of the 2-pole, 3-wire design with a third contact connecting to the insulated (green or green with yellow stripe) equipment grounding conductor of the the electrical system.	(6) Gives the interchangeability and grounding requirements for 250-volt, 50- and 60-ampere plugs and receptacles.
(c) Other-than-Hazardous Anesthetizing Locations.	
(2) Receptacles and attachment plugs installed and used in other-than-hazardous (classified) locations shall be listed for hospital use for services of prescribed voltage, frequency, rating, and number of conductors with provision for connection of the grounding conductor. This requirement shall apply to attachment plugs and receptacles of the 2-pole, 3-wire grounding type for single-phase 120-, 208-, or 240-volt nominal, ac service.	(2) Requires all 2-pole, 3-wire, 120; 208- or 240-volt receptacles and attachment plugs located in anesthetizing locations that are not hazardous be listed for hospital use.
(3) Plugs and receptacles for connection of 250-volt, 50-ampere, and 60-ampere ac medical equipment for use in other-than-hazardous (classified) locations shall be so arranged that the 60-ampere receptacle will accept either the 50-ampere or the 60-ampere plug. The 50-ampere receptacle shall be designed so as not to accept the 60-ampere attachment plug. The plug shall be of the 2-pole, 3-wire design with a third contact connecting to the insulated (green or green with yellow stripe) equipment grounding conductor of the electrical system.	(3) Gives the interchangeability and grounding requirements for 250-volt, 50- and 60-ampere plugs and receptacles.
517-105. Low-Voltage Equipment and Instruments.	
(f) Receptacles or Attachment Plugs. Any receptacle or attachment plug used on low-voltage circuits shall be of a type which does not permit interchangeable connection with circuits of higher voltage. **(FPN):** Any interruption of the circuit, even circuits as low as 8 volts, either by any wsitch or loose or defective connections anywhere in the circuit, may produce a spark sufficient to ignite flammable anesthetic agents [See Section 3-5.2 of Standard for the Use of Inhalation Anesthetics (Flammable and Nonflammable). NFPA 56A-1978.]	(f) Requires noninterchangeability between low voltage and high voltage circuit connections.
517-142. Disconnecting Means.	
(c) Portable Equipment. For equipment connected to a 120-volt branch circuit of 30 amperes or less, a grounding-type attachment plug and receptacle of proper rating shall be permitted to serve as a disconnecting means.	(c) Permits a plug and receptacle to serve as a disconnecting means for equipment connected on 120-volt circuits rated 30 amperes or less.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

NATIONAL ELECTRICAL CODE	COMMENT

ARTICLE 520—THEATERS AND SIMILAR LOCATIONS

520-23. Control and Overcurrent Protection of Receptacles Circuits. Means shall be provided at a stage lighting switchboard to which load circuits are connected for individual overcurrent protection of stage lighting branch circuits and stage and gallery receptacles used for cord- and plug-connected stage equipment. Where the stage switchboard contains dimmers to control non-stage lighting, the locating of the overcurrent protective devices for these branch circuits at the stage switchboard shall be permitted.

520-45. Receptacles. Receptacles for electrical equipment or fixtures on stages shall be rated in amperes.

(1) A continuous load shall not exceed 80 percent of the receptacle rating.

(2) A noncontinuous load shall not exceed 100 percent of the receptacle rating.

Conductors supplying receptacles shall be in accordance with Article 310.

520-46. Stage Pockets. Receptacles intended for the connection of portable stage lighting equipment shall be mounted in suitable pockets or enclosures and shall comply with Section 520-45.

520-62. Portable Plugging Boxes. Portable plugging boxes shall comply with (a) through (d) below.

(b) Receptacles and Overcurrent Protection. Each receptacle shall have a rating of not less than 30 amperes, and shall have overcurrent protection installed in an enclosure equipped with self-closing doors.

(b) Specifies overcurrent protection and minimum rating for portable plugging boxes.

520-67. Cable Connectors. Cable connectors, male and female, for flexible conductors shall be constructed so that tension on the cord or cable will not be transmitted to the connections. The female half shall be attached to the load end of the power supply cord or cable. The connector shall be rated in amperes and designed so that differently rated devices cannot be connected together.
(FPN): See Section 400-10 for pull at terminals.

This section states that adequate strain relief be provided for cable connectors and that female section be the "live" half. It also requires non-interchangeability of services with different ratings.

ARTICLE 530—MOTION PICTURE AND TELEVISION STUDIOS AND SIMILAR LOCATIONS

530-14. Plugging Boxes. Each receptacle of plugging boxes shall be rated at not less than 30 amperes.

This section requires that receptacles be rated at least 30 amperes.

530-18. Overcurrent Protection-Short-Time Rating*

General. Automatic overcurrent protective devices (circuit breakers or fuses) for motion picture studio stage set lighting and the stage cables for such stage set lighting shall be as given in (a) through (e) below.

Note: *Special consideration is given to motion-picture studios and similar locations because filming periods are of short duration.

This section concerns overcurrent protection of studio stage lighting cables.

(a) Stage Cables. Stage cables for stage set lighting shall be protected by means of overcurrent devices set at not more than 400 percent of the ampacity given in Table 310-16 through 310-19 and Table 400-5.

(b) Feeders. In buildings used primarily for motion-picture production, the feeders from the substations to the stages shall be protected by means of overcurrent devices (generally located in the substation) having suitable ampere rating. The overcurrent devices shall be permitted to be multiple or single-pole gang-operated. No pole or overcurrent device shall be required in the neutral conductor. The overcurrent device setting for each feeder shall not exceed 400 percent of the ampacity of the feeder, as given in Tables 310-16 and 310-18 for the kind of insulation used.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

NATIONAL ELECTRICAL CODE	COMMENT
(c) Location Boards. Overcurrent protection (fuses or circuit breakers) shall be provided at the "location boards." Fuses in the "location boards" shall have an ampere rating of not over 400 percent of the ampacity of the cables between the "location boards" and the plugging boxes.	
(d) Plugging Boxes. Cables and cords supplied through plugging boxes shall be of copper. Cables and cords smaller than No. 8 shall be attached to the plugging box by means of a plug containing two cartridge fused or a 2-pole circuit breaker. The rating of the fuses or the setting of the circuit breaker shall not be over 400 percent of the safe ampacity of the cables or cords as given in Table 210-5 for the kind of insulation used.	(d) Requires that any cable smaller than No. 8 supplied through a plugging box shall be attached by means of a plug containing two cartridge fuses or a circuit breaker.
(e) Lighting. Work lights, stand lamps, and fixtures shall be connected to plugging boxes by means of plugs containing two cartridge fuses not larger than 20 amperes, or they shall be permitted to be connected to special outlet on circuits protected by fuses or circuit breakers rated at not over 20 amperes. Plug fuses shall not be used unless they are on the load side of the fuse or circuit breakers on the "location boards."	(e) Stipulates that plug fuses not larger than 20 amperes may be used for individual light stands, but plug fuses are not allowed to be used unless they are on the load side of the "location boards."
530-21. Plugs and Receptacles. Plugs and receptacles shall be rated in amperes.	
ARTICLE 555—MARINAS AND BOATYARDS	
555-3. Receptacles. Receptacles that provide shore power for boats shall be rated not less than 20 amperes and shall be single and of the locking and grounding types. Fifteen- and 20-ampere, single-phase, 125-volt receptacles other than those supplying shore power to boats located at piers, wharfs, and other locations shall be protected by ground-fault circuit-interrupters. **(FPN):** For various configurations and ratings of locking- and grounding-type receptacles and caps, see Dimensions of Caps, Plugs, and Receptacles, ANSI C73-1972. **(FPN):** In locating receptacles consideration should be given to the maximum tide level and wave action.	This section limits receptacles to not less than 20 amperes and also requires the use of locking and grounding types.
555-5. Feeders and Services. The load for each ungrounded feeder and service conductor supplying receptacles that supply shore power for boats shall be calculated as follows:	This section gives method of calculating loading of conductors supplying groups of receptacles.

	Sum of the Rating of the Receptacle, %
For 1 to 4 receptacles	100
For 5 to 8	90
For 9 to 13	80
For 14 to 30	70
For 31 to 50	50
For 50 to 100	40
For over 100	30

Chapter 6. Special Equipment

ARTICLE 645—DATA PROCESSING SYSTEMS

645-2. Supply Circuits and Interconnecting Cables. **(a) Branch-Circuit Conductors.** The branch-circuit conductors	(a) Establishes circuit breaker sizing rules.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

NATIONAL ELECTRICAL CODE	COMMENT
to which one or more units of a data processing system are connected to a source of supply shall have an ampacity not less than 125 percent of the total connected load.	
(b) Connecting Cables. The data processing system shall be permitted to be connected by means of computer or data processing cable or flexible cord and an attachment plug cap or cord-set assembly specifically approved as a part of the data processing system. Separate units shall be permitted to be interconnected by means of flexible cords and cables specifically approved as part of the data processing system. When run on the surface of the floor, they shall be protected against physical damage.	(b) Requires that flexible cords and their attachment plug caps be specifically approved as part of the data processing system.
(c) Under Raised Floors. Power cables, communications cables, and interconnecting cables associated with the data processing equipment shall be permitted under a raised floor provided:	(c) Prescribes protection for these portable cables against physical damage and allows them to be run under raised floors under certain specified conditions.
(1) The raised floor is of suitable construction.	
(FPN): See Standard for Electronic Computer/Data Processing Equipment, NFPA 75-1981 (ANSI).	
(2) The branch-circuit supply conductors to receptacles are in rigid metal conduit, intermediate metal conduit, electrical metallic tubing, metal wireway, metal surface raceway with metal cover, flexible metal conduit, liquidtight flexible metal conduit, mineral-insulated, metal-sheathed cable, metal-clad cable, or Type AC cable.	(2) Lists permitted types of raceways for raised floor installations.
(3) Ventilation in the underfloor area is used for the data processing equipment and data processing area only.	
ARTICLE 660—X-RAY EQUIPMENT	
660-4. Connection to Supply Circuit.	
(a) Fixed and Stationery Equipment. Fixed and stationery X-ray equipment shall be connected to the power supply by means of a wiring method meeting the general requirements of this Code. *Exception: Equipment properly supplied by a branch circuit rated at not over 30 amperes shall be permitted to be supplied through a suitable attachment plug cap and hard-service cable or cord.*	(a) Requires fixed and stationary X-ray equipment to be connected to the power supply by means of a wiring method that meets the general requirements of the Code. *Exception: Permits attachment plug caps and hard-service cable or cord to be used with equipment properly supplied by a branch circuit rated at not over 30 amperes.*
(b) Portable, Mobile, and Transportable Equipment. Individual branch circuits shall not be required for portable, mobile, and transportable medical X-ray equipment requiring a capacity of not over 60 amperes. Portable and mobile types of X-ray equipment of any capacity shall be supplied through a suitable hard-service cable or cord. Transportable X-ray equipment of any capacity shall be permitted to be connected to its power supply by suitable connections and hard-service cable or cord.	(b) Allows portable, mobile and transportable medical X-ray equipment with a capacity of 60 amperes or less to be operated without an individual branch circuit. A suitable hard-service cable or cord must be used to supply portable and mobile types of X-ray equipment of any capacity. Suitable connections and hard-service cable or cord are permitted to be used to supply transportable X-ray equipment of any capacity.
(c) Over 600-Volt Supply. Circuits and equipment operated at more than 600 volts, nominal, shall comply with Article 710.	(c) Requires compliance with Article 710 for circuits and equipment operated on a supply of over 600 volts.
660-5. Disconnecting Means. A disconnecting means of adequate capacity for at least 50 percent of the input required for the momentary rating or 100 percent of the input required for the long-time rating of the X-ray equipment, whichever is greater, shall be provided in the supply circuit. The disconnecting means shall be operable from a location readily accessible from the X-ray control. For equipment connected to a 120-volt branch circuit of 30 amperes or less, a grounding-type attachment plug cap and receptacle of proper rating shall be permitted to serve as a disconnecting means.	This section permits the use of a grounding type attachment plug cap and receptacle of proper rating to be used as the disconnecting means for X-ray equipment connected to a 120-volt branch circuit of 30 amperes or less.
660-48. Grounding. Noncurrent-carrying metal parts of X-ray and associated equipment (controls, tables, X-ray tube supports, transformer tanks, shielded cables, X-ray tube heads, etc.), shall be grounded in the manner specified in Article 250. Portable and mobile equipment shall be provided with an approved grounding-type attachment plug cap. *Exception: Battery-operated equipment.*	This section requires the noncurrent-carrying metal parts of X-ray and associated equipment to be grounded as specified in Article 250. Portable and mobile equipment (except battery-operated) is required to be provided with an approved grounding-type attachment plug.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

NATIONAL ELECTRICAL CODE	COMMENT

Chapter 7 Special Conditions

ARTICLE 710—OVER 600 VOLTS, NOMINAL—GENERAL

710-2. Other Articles. Provisions applicable to specific types of installation are included in Article 225, Outside Branch Circuits and Feeders; Article 230, Services; Article 240, Overcurrent Protection; Article 250, Grounding; Article 300, Wiring Methods; Article 318, Cable Trays; Article 326, Medium Voltage Cable; Article 345, Intermediate Metal Conduit; Article 346, Rigid Metal Conduit; Article 347, Rigid Nonmetallic Conduit; Article 364, Busways; Article 365, Cablebus; Article 370, Outlet Device, Pull and Junction Boxes, Conduit Bodies and Fittings; Article 410, Lighting Fixtures, Lampholders, Lamps, Receptacles, and Rosettes; Article 427, Fixed Electric Heating Equipment for Pipelines and Vessels; Article 430, Motors, Motor Circuits, and Controllers; Article 450, Transformers and Transformer Vaults; Article 460, Capacitors; Article 600, Electric Signs and Outline Lighting; Article 660, X-Ray Equipment; Article 665, Induction and Dielectric Heating Equipment; and for construction and ampacities of high-voltage conductors, see Article 310.

This section lists Articles other than those in 710 that are applicable to specific types of installations.

ARTICLE 720—CIRCUITS AND EQUIPMENT OPERATING AT LESS THAN 50 VOLTS

720-6. Receptacle Rating. Receptacles shall have a rating of not less than 15 amperes.

720-7. Receptacles Required. Receptacle of not less than 20-ampere rating shall be provided in kitchens, laundries, and other locations where portable appliances are likely to be used.

This section requires that receptacles used on equipment operating at less than 50 volts ac or dc have a rating of not less than 15 amperes.

This section requires receptacles having a rating of not less than 20 amperes must be provided in any location where portable appliances are likely to be used.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

September 1984

NEMA STANDARDIZATION

The purpose of NEMA Standards, their classification and status are set forth in certain clauses of the NEMA Bylaws, which are quoted below:

Purpose of Standards

National Electrical Manufacturers Association Standards are adopted in the public interest and are designed to eliminate misunderstandings between the manufacturer and the purchaser and to assist the purchaser in selecting and obtaining the proper product for its particular need. Existence of a National Electrical Manufacturers Association Standard does not in any respect preclude any member or nonmember from manufacturing or selling products not conforming to the standard.

(Bylaw—Art. V, Sec. 1)

Definition of a Standard

A standard of the National Electrical Manufacturers Association defines a product, process or procedure with reference to one or more of the following: nomenclature, composition, construction, dimensions, tolerances, safety, operating characteristics, performance, rating, testing, and the service for which they are designed.

(Bylaw—Art. V, Sec. 2, Subsection A)

Dimensions

Where dimensions are given for interchangeability purposes, alternate dimensions satisfying the other provisions of the standards publication may be capable of otherwise equivalent performance.

(NEMA Policy Memorandum 84-2, dated June 7, 1984)

Classes of Standards

National Electrical Manufacturers Association Standards are of two classes:

1. NEMA Standard, which relates to a product commercially standardized and subject to repetitive manufacture, which standard has been approved by at least 90 percent of the members of the Subdivision eligible to vote thereon;
2. Suggested Standard for Future Design, which may not have been regularly applied to a commercial product, but which suggests a sound engineering approach to future development, which standard has been approved by at least two-thirds of the members of the Subdivision eligible to vote thereon.

(Bylaw—Art. V, Sec. 2, Subsection B)

Authorized Engineering Information

Authorized Engineering Information consists of explanatory data and other engineering information of an informative character not falling within the classification of NEMA Standard or Suggested Standard for Future Design.

(Bylaw—Art. V, Sec. 6, 1st Sentence)

Official Standards Proposal

An Official Standards Proposal is an official draft of a proposed standard which is formally recommended to an outside organization(s) for consideration, comment and/or approval.

(Bylaw—Art. V, Sec. 4, Subsection A)

Identification of Status

Standards in NEMA Standards Publications are identified in the foreword or following each standard as "NEMA Standard" or "Suggested Standard for Future Design." These indicate the status of the standard. These words are followed by a date which indicates when the standard was adopted in its present form by the Association.

The material identified as "Authorized Engineering Information" and "Official Standards Proposal" is designated similarly.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

PIN & SLEEVE PLUG, RECEPTACLE & CONNECTOR SECTION OF THE NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

MEMBER COMPANIES

Appleton Electric Company
Chicago, IL 60657

Crouse-Hinds Electrical Construction Materials
Division of Cooper Industries, Inc.
Syracuse, NY 13221

Hubbell, Inc.
Wiring Devices Division
Orange, CT 06477

Killark Electric Mfg. Company
Subsidiary of Harvey Hubbell, Inc.
St. Louis, MO 63115

Midland-Ross Corporation
Pittsburgh, PA 15230

Russellstoll Division
Livingston, NJ 07039

Thomas & Betts Corporation
Raritan, NJ 08869

Woodhead Industries, Inc.
Northbrook, IL 60062

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale