



Public Input No. 2120-NFPA 70-2020 [Article 100]

Article 100 Definitions

Scope. This article contains only those definitions essential to the application of this *Code*. It is not intended to include commonly defined general terms or commonly defined technical terms from related codes and standards. In general, only those terms that are used in two or more articles are defined in Article 100. Definitions are also found in XXX.2 sections of other articles.

Part I of this article contains definitions intended to apply wherever the terms are used throughout this *Code*. Part II contains definitions applicable to installations and equipment operating at over 1000 volts, nominal. Part III contains definitions applicable to Hazardous (Classified) Locations.

Part I. General

Accessible (as applied to equipment).

Capable of being reached for operation, renewal, and inspection. (CMP-1)

Accessible (as applied to wiring methods).

Capable of being removed or exposed without damaging the building structure or finish or not permanently closed in by the structure or finish of the building. (CMP-1)

Accessible, Readily (Readily Accessible).

Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom ready access is requisite to take actions such as to use tools (other than keys), to climb over or under, to remove obstacles, or to resort to portable ladders, and so forth. (CMP-1)

Informational Note: Use of keys is a common practice under controlled or supervised conditions and a common alternative to the ready access requirements under such supervised conditions as provided elsewhere in the NEC.

Adjustable Speed Drive.

Power conversion equipment that provides a means of adjusting the speed of an electric motor. (CMP-11)

Informational Note: A variable frequency drive is one type of electronic adjustable speed drive that controls the rotational speed of an ac electric motor by controlling the frequency and voltage of the electrical power supplied to the motor.

Adjustable Speed Drive System.

A combination of an adjustable speed drive, its associated motor(s), and auxiliary equipment. (CMP-11)

Ampacity.

The maximum current, in amperes, that a conductor can carry continuously under the conditions of use without exceeding its temperature rating. (CMP-6)

Appliance.

Utilization equipment, generally other than industrial, that is normally built in standardized sizes or types and is installed or connected as a unit to perform one or more functions such as clothes washing, air-conditioning, food mixing, deep frying, and so forth. (CMP-17)

Approved.

Acceptable to the authority having jurisdiction. (CMP-1)

Arc-Fault Circuit Interrupter (AFCI).

A device intended to provide protection from the effects of arc faults by recognizing characteristics unique to arcing and by functioning to de-energize the circuit when an arc fault is detected. (CMP-2)

Askarel.

A generic term for a group of nonflammable synthetic chlorinated hydrocarbons used as electrical insulating media. (CMP-9)

Informational Note: Askarels of various compositional types are used. Under arcing conditions, the gases produced, while consisting predominantly of noncombustible hydrogen chloride, can include varying amounts of combustible gases, depending on the askarel type.

Attachment Fitting.

A device that, by insertion into a locking support and mounting receptacle, establishes a connection between the conductors of the attached utilization equipment and the branch-circuit conductors connected to the locking support and mounting receptacle. (CMP-18)

Informational Note: An attachment fitting is different from an attachment plug because no cord is associated with the fitting. An attachment fitting in combination with a locking support and mounting receptacle secures the associated utilization equipment in place and supports its weight.

Attachment Plug (Plug Cap) (Plug).

A device that, by insertion in a receptacle, establishes a connection between the conductors of the attached flexible cord and the conductors connected permanently to the receptacle. (CMP-18)

Authority Having Jurisdiction (AHJ).

An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure. (CMP-1)

Informational Note: The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

Automatic.

Performing a function without the necessity of human intervention. (CMP-1)

Bathroom.

An area including a sink (basin) with one or more of the following: a toilet, a urinal, a tub, a shower, a bidet, or similar plumbing fixtures. (CMP-2)

Battery System.

Interconnected battery subsystems consisting of one or more storage batteries and battery chargers, and can include inverters, converters, and associated electrical equipment. (CMP-13)

Bonded (Bonding).

Connected to establish electrical continuity and conductivity. (CMP-5)

Bonding Conductor or Jumper.

A reliable conductor to ensure the required electrical conductivity between metal parts required to be electrically connected. (CMP-5)

Bonding Jumper, Equipment.

The connection between two or more portions of the equipment grounding conductor. (CMP-5)

Bonding Jumper, Main.

The connection between the grounded circuit conductor and the equipment grounding conductor, or the supply-side bonding jumper, or both, at the service. (CMP-5)

Bonding Jumper, Supply-Side.

A conductor installed on the supply side of a service or within a service equipment enclosure(s), or for a separately derived system, that ensures the required electrical conductivity between metal parts required to be electrically connected. (CMP-5)

Bonding Jumper, System.

The connection between the grounded circuit conductor and the supply-side bonding jumper, or the equipment grounding conductor, or both, at a separately derived system. (CMP-5)

Branch Circuit.

The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s). (CMP-2)

Branch Circuit, Appliance.

A branch circuit that supplies energy to one or more outlets to which appliances are to be connected and that has no permanently connected luminaires that are not a part of an appliance. (CMP-2)

Branch Circuit, General-Purpose.

A branch circuit that supplies two or more receptacles or outlets for lighting and appliances. (CMP-2)

Branch Circuit, Individual.

A branch circuit that supplies only one utilization equipment. (CMP-2)

Branch Circuit, Motor.

The circuit conductors between the motor branch-circuit short-circuit and ground-fault protective device, including the controller. (CMP-11)

Informational Note: See 430.2 for definition of controller.

Branch Circuit, Multiwire.

A branch circuit that consists of two or more ungrounded conductors that have a voltage between them, and a grounded conductor that has equal voltage between it and each ungrounded conductor of the circuit and that is connected to the neutral or grounded conductor of the system. (CMP-2)

Building.

A structure that stands alone or that is separated from adjoining structures by fire walls. (CMP-1)

Cabinet.

An enclosure that is designed for either surface mounting or flush mounting and is provided with a frame, mat, or trim in which a swinging door or doors are or can be hung. (CMP-9)

Cable, Coaxial.

A cylindrical assembly composed of a conductor centered inside a metallic tube or shield, separated by a dielectric material, and usually covered by an insulating jacket. (CMP-16)

Cable, Optical Fiber.

A factory assembly or field assembly of one or more optical fibers having an overall covering. (CMP-16)

Informational Note: A field-assembled optical fiber cable is an assembly of one or more optical fibers within a jacket. The jacket, without optical fibers, is installed in a manner similar to conduit or raceway. Once the jacket is installed, the optical fibers are inserted into the jacket, completing the cable assembly.

Cable, Optical Fiber, Composite.

A cable containing optical fibers and current-carrying electrical conductors. (CMP-16)

Cable, Optical Fiber, Conductive.

A factory assembly of one or more optical fibers having an overall covering and containing non-current-carrying conductive member(s) such as metallic strength member(s), metallic vapor barrier(s), metallic armor, or metallic sheath. (CMP-16)

Cable, Optical Fiber, Nonconductive.

A factory assembly of one or more optical fibers having an overall covering and containing no electrically conductive materials. (CMP-16)

Cable Routing Assembly.

A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support and route communications wires and cables, optical fiber cables, data cables associated with information technology and communications equipment, Class 2, Class 3, and Type PLTC cables, and power-limited fire alarm cables in plenum, riser, and general-purpose applications. (CMP-16)

Charge Controller.

Equipment that controls dc voltage or dc current, or both, and that is used to charge a battery or other energy storage device. (CMP-13)

Circuit Breaker.

A device designed to open and close a circuit by nonautomatic means and to open the circuit automatically on a predetermined overcurrent without damage to itself when properly applied within its rating. (CMP-10)

Informational Note: The automatic opening means can be integral, direct acting with the circuit breaker, or remote from the circuit breaker.

Adjustable (as applied to circuit breakers).

A qualifying term indicating that the circuit breaker can be set to trip at various values of current, time, or both, within a predetermined range.

Instantaneous Trip (as applied to circuit breakers).

A qualifying term indicating that no delay is purposely introduced in the tripping action of the circuit breaker.

Inverse Time (as applied to circuit breakers).

A qualifying term indicating that there is purposely introduced a delay in the tripping action of the circuit breaker, which delay decreases as the magnitude of the current increases.

Nonadjustable (as applied to circuit breakers).

A qualifying term indicating that the circuit breaker does not have any adjustment to alter the value of the current at which it will trip or the time required for its operation.

Setting (of circuit breakers).

The value of current, time, or both, at which an adjustable circuit breaker is set to trip.

Circuit Integrity (CI) Cable.

Cable(s) used for remote-control, signaling, or power-limited systems that supply critical circuits to ensure survivability for continued circuit operation for a specified time under fire conditions. (CMP-3)

Class 1 Circuit.

The portion of the wiring system between the load side of the overcurrent device or power-limited supply and the connected equipment. (CMP-3)

Informational Note: See 725.41 for voltage and power limitations of Class 1 circuits.

Class 2 Circuit.

The portion of the wiring system between the load side of a Class 2 power source and the connected equipment. Due to its power limitations, a Class 2 circuit considers safety from a fire initiation standpoint and provides acceptable protection from electric shock. (CMP-3)

Class 3 Circuit.

The portion of the wiring system between the load side of a Class 3 power source and the connected equipment. Due to its power limitations, a Class 3 circuit considers safety from a fire initiation standpoint. Since higher levels of voltage and current than for Class 2 are permitted, additional safeguards are specified to provide protection from an electric shock hazard that could be encountered. (CMP-3)

Clothes Closet.

A nonhabitable room or space intended primarily for storage of garments and apparel. (CMP-1)

Communications Equipment.

The electronic equipment that performs the telecommunications operations for the transmission of audio, video, and data, and includes power equipment (e.g., dc converters, inverters, and batteries), technical support equipment (e.g., computers), and conductors dedicated solely to the operation of the equipment. (CMP-16)

Informational Note: As the telecommunications network transitions to a more data-centric network, computers, routers, servers, and their powering equipment, are becoming essential to the transmission of audio, video, and data and are finding increasing application in communications equipment installations.

Concealed.

Rendered inaccessible by the structure or finish of the building. (CMP-1)

Informational Note: Wires in concealed raceways are considered concealed, even though they may become accessible by withdrawing them.

Conductor, Bare.

A conductor having no covering or electrical insulation whatsoever. (CMP-6)

Conductor, Covered.

A conductor encased within material of composition or thickness that is not recognized by this *Code* as electrical insulation. (CMP-6)

Conductor, Insulated.

A conductor encased within material of composition and thickness that is recognized by this *Code* as electrical insulation. (CMP-6)

Conduit Body.

A separate portion of a conduit or tubing system that provides access through a removable cover(s) to the interior of the system at a junction of two or more sections of the system or at a terminal point of the system.

Boxes such as FS and FD or larger cast or sheet metal boxes are not classified as conduit bodies. (CMP-9)

Connector, Pressure (Solderless).

A device that establishes a connection between two or more conductors or between one or more conductors and a terminal by means of mechanical pressure and without the use of solder. (CMP-1)

Continuous Load.

A load where the maximum current is expected to continue for 3 hours or more. (CMP-2)

Control Circuit.

The circuit of a control apparatus or system that carries the electric signals directing the performance of the controller but does not carry the main power current. (CMP-11)

Controller.

A device or group of devices that serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected. (CMP-1)

Cooking Unit, Counter-Mounted.

A cooking appliance designed for mounting in or on a counter and consisting of one or more heating elements, internal wiring, and built-in or mountable controls. (CMP-2)

Coordination, Selective (Selective Coordination).

Localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the selection and installation of overcurrent protective devices and their ratings or settings for the full range of available overcurrents, from overload to the available fault current, and for the full range of overcurrent protective device opening times associated with those overcurrents. (CMP-10)

Copper-Clad Aluminum Conductors.

Conductors drawn from a copper-clad aluminum rod, with the copper metallurgically bonded to an aluminum core, where the copper forms a minimum of 10 percent of the cross-sectional area of a solid conductor or each strand of a stranded conductor. (CMP-6)

Cutout Box.

An enclosure designed for surface mounting that has swinging doors or covers secured directly to and telescoping with the walls of the enclosure. (CMP-9)

DC-to-DC Converter.

A device that can provide an output dc voltage and current at a higher or lower value than the input dc voltage and current. (CMP-4)

Dead Front.

Without live parts exposed to a person on the operating side of the equipment. (CMP-9)

Demand Factor.

The ratio of the maximum demand of a system, or part of a system, to the total connected load of a system or the part of the system under consideration. (CMP-2)

Device.

A unit of an electrical system, other than a conductor, that carries or controls electric energy as its principal function. (CMP-1)

Disconnecting Means.

A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply. (CMP-1)

Dormitory Unit.

A building or a space in a building in which group sleeping accommodations are provided for more than 16 persons who are not members of the same family in one room, or a series of closely associated rooms, under joint occupancy and single management, with or without meals, but without individual cooking facilities. (CMP 2)

Duty, Continuous.

Operation at a substantially constant load for an indefinitely long time. (CMP-1)

Duty, Intermittent.

Operation for alternate intervals of (1) load and no load; or (2) load and rest; or (3) load, no load, and rest. (CMP-1)

Duty, Periodic.

Intermittent operation in which the load conditions are regularly recurrent. (CMP-1)

Duty, Short-Time.

Operation at a substantially constant load for a short and definite, specified time. (CMP-1)

Duty, Varying.

Operation at loads, and for intervals of time, both of which may be subject to wide variation. (CMP-1)

Dwelling, One-Family.

A building that consists solely of one dwelling unit. (CMP-1)

Dwelling, Two-Family.

A building that consists solely of two dwelling units. (CMP-1)

Dwelling, Multifamily.

A building that contains three or more dwelling units. (CMP-1)

Dwelling Unit.

A single unit, providing complete and independent living facilities for one or more persons, including permanent provisions for living, sleeping, cooking, and sanitation. (CMP-2)

Effective Ground-Fault Current Path.

An intentionally constructed, low-impedance electrically conductive path designed and intended to carry current under ground-fault conditions from the point of a ground fault on a wiring system to the electrical supply source and that facilitates the operation of the overcurrent protective device or ground-fault detectors. (CMP-5)

Electric Power Production and Distribution Network.

Power production, distribution, and utilization equipment and facilities, such as electric utility systems that are connected to premises wiring and are external to and not controlled by an interactive system. (CMP-13)

Electric Sign.

A fixed, stationary, or portable self-contained, electrically operated and/or electrically illuminated utilization equipment with words or symbols designed to convey information or attract attention. (CMP-18)

Electric Vehicle (EV).

An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, electric motorcycles, and the like, primarily powered by an electric motor that draws current from a rechargeable storage battery, fuel cell, photovoltaic array, or other source of electric current. Plug-in hybrid electric vehicles (PHEV) are electric vehicles having a second source of motive power. Off-road, self-propelled electric mobile equipment, such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, boats, and the like, are not considered electric vehicles. (CMP-12)

Electrical Circuit Protective System

A system consisting of components and materials intended for installation as protection for specific electrical wiring systems with respect to the disruption of electrical circuit integrity upon exterior fire exposure. (CMP-16)

Electrical Datum Plane.

A specified distance above a water level above which electrical equipment can be installed and electrical connections can be made. (CMP-7)

Electric-Discharge Lighting.

Systems of illumination utilizing fluorescent lamps, high-intensity discharge (HID) lamps, or neon tubing. (CMP-18)

Electronically Actuated Fuse.

An overcurrent protective device that generally consists of a control module that provides current-sensing, electronically derived time–current characteristics, energy to initiate tripping, and an interrupting module that interrupts current when an overcurrent occurs. Such fuses may or may not operate in a current-limiting fashion, depending on the type of control selected. (CMP-10)

Enclosed.

Surrounded by a case, housing, fence, or wall(s) that prevents persons from accidentally contacting energized parts. (CMP-1)

Enclosure.

The case or housing of apparatus, or the fence or walls surrounding an installation to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage. (CMP-1)

Informational Note: See Table 110.28 for examples of enclosure types.

Energized.

Electrically connected to, or is, a source of voltage. (CMP-1)

Equipment.

A general term, including fittings, devices, appliances, luminaires, apparatus, machinery, and the like used as a part of, or in connection with, an electrical installation. (CMP-1)

Equipotential Plane.

Accessible conductive parts bonded together to reduce voltage gradients in a designated area. (CMP-17)

Exposed (as applied to live parts).

Capable of being inadvertently touched or approached nearer than a safe distance by a person. (CMP-1)

Informational Note: This term applies to parts that are not suitably guarded, isolated, or insulated.

Exposed (as applied to wiring methods).

On or attached to the surface or behind panels designed to allow access. (CMP-1)

Externally Operable.

Capable of being operated without exposing the operator to contact with live parts. (CMP-1)

Fault Current.

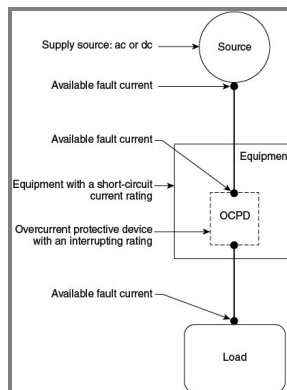
The current delivered at a point on the system during a short-circuit condition. (CMP-10)

Fault Current, Available (Available Fault Current).

The largest amount of current capable of being delivered at a point on the system during a short-circuit condition. (CMP-10)

Informational Note: A short-circuit can occur during abnormal conditions such as a fault between circuit conductors or a ground fault. See Informational Note Figure 100.1.

Figure Informational Note Figure 100.1 Available Fault Current.

**Feeder.**

All circuit conductors between the service equipment, the source of a separately derived system, or other power supply source and the final branch-circuit overcurrent device. (CMP-10)

Festoon Lighting.

A string of outdoor lights that is suspended between two points. (CMP-18)

Field Evaluation Body (FEB).

An organization or part of an organization that performs field evaluations of electrical or other equipment. [790, 2018] (CMP-1)

Informational Note: NFPA 790-2018, *Standard for Competency of Third-Party Field Evaluation Bodies*, provides guidelines for establishing the qualification and competency of a body performing field evaluations of electrical products and assemblies with electrical components.

Field Labeled (as applied to evaluated products).

Equipment or materials to which has been attached a label, symbol, or other identifying mark of an FEB indicating the equipment or materials were evaluated and found to comply with requirements as described in an accompanying field evaluation report. [790, 2018] (CMP-1)

Fitting.

An accessory such as a locknut, bushing, or other part of a wiring system that is intended primarily to perform a mechanical rather than an electrical function. (CMP-1)

Free Air (as applied to conductors).

Open or ventilated environment that allows for heat dissipation and air flow around an installed conductor. (CMP-6)

Fuel Cell.

An electrochemical system that consumes fuel to produce an electric current. In such cells, the main chemical reaction used for producing electric power is not combustion. However, there may be sources of combustion used within the overall cell system, such as reformers/fuel processors. (CMP-4)

Fuel Cell System.

The complete aggregate of equipment used to convert chemical fuel into usable electricity and typically consisting of a reformer, stack, power inverter, and auxiliary equipment. (CMP-4)

Garage.

A building or portion of a building in which one or more self-propelled vehicles can be kept for use, sale, storage, rental, repair, exhibition, or demonstration purposes. (CMP-1)

Informational Note: For commercial garages, repair and storage, see Article 511.

Generating Capacity, Inverter.

The sum of parallel-connected inverter maximum continuous output power at 40°C in watts or kilowatts. (CMP-4)

Ground.

The earth. (CMP-5)

Ground Fault.

An unintentional, electrically conductive connection between an ungrounded conductor of an electrical circuit and the normally non-current-carrying conductors, metallic enclosures, metallic raceways, metallic equipment, or earth. (CMP-5)

Grounded (Grounding).

Connected (connecting) to ground or to a conductive body that extends the ground connection. (CMP-5)

Grounded, Solidly.

Connected to ground without inserting any resistor or impedance device. (CMP-5)

Grounded Conductor.

A system or circuit conductor that is intentionally grounded. (CMP-5)

Informational Note: Although an equipment grounding conductor is grounded, it is not considered a grounded conductor.

Ground-Fault Circuit Interrupter (GFCI).

A device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a ground-fault current exceeds the values established for a Class A device. (CMP-2)

Informational Note: Class A ground-fault circuit interrupters trip when the ground-fault current is 6 mA or higher and do not trip when the ground-fault current is less than 4 mA. For further information, see UL 943, *Standard for Ground-Fault Circuit Interrupters*.

Ground-Fault Current Path.

An electrically conductive path from the point of a ground fault on a wiring system through normally non-current-carrying conductors, grounded conductors, equipment, or the earth to the electrical supply source. (CMP-5)

Informational Note: Examples of ground-fault current paths are any combination of equipment grounding conductors, metallic raceways, metallic cable sheaths, electrical equipment, and any other electrically conductive material such as metal, water, and gas piping; steel framing members; stucco mesh; metal ducting; reinforcing steel; shields of communications cables; grounded conductors; and the earth itself.

Ground-Fault Protection of Equipment.

A system intended to provide protection of equipment from damaging line-to-ground fault currents by operating to cause a disconnecting means to open all ungrounded conductors of the faulted circuit. This protection is provided at current levels less than those required to protect conductors from damage through the operation of a supply circuit overcurrent device. (CMP-5)

Grounding Conductor, Equipment (EGC).

A conductive path(s) that is part of an effective ground-fault current path and connects normally non-current-carrying metal parts of equipment together and to the system grounded conductor or to the grounding electrode conductor, or both. (CMP-5)

Informational Note No. 1: It is recognized that the equipment grounding conductor also performs bonding.

Informational Note No. 2: See 250.118 for a list of acceptable equipment grounding conductors.

Grounding Electrode.

A conducting object through which a direct connection to earth is established. (CMP-5)

Grounding Electrode Conductor.

A conductor used to connect the system grounded conductor or the equipment to a grounding electrode or to a point on the grounding electrode system. (CMP-5)

Guarded.

Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach or contact by persons or objects to a point of danger. (CMP-1)

Guest Room.

An accommodation combining living, sleeping, sanitary, and storage facilities within a compartment. (CMP-2)

Guest Suite.

An accommodation with two or more contiguous rooms comprising a compartment, with or without doors between such rooms, that provides living, sleeping, sanitary, and storage facilities. (CMP-2)

Habitable Room.

A room in a building for living, sleeping, eating, or cooking, but excluding bathrooms, toilet rooms, closets, hallways, storage or utility spaces, and similar areas. (CMP-2)

Handhole Enclosure.

An enclosure for use in underground systems, provided with an open or closed bottom, and sized to allow personnel to reach into, but not enter, for the purpose of installing, operating, or maintaining equipment or wiring or both. (CMP-9)

Hermetic Refrigerant Motor-Compressor.

A combination consisting of a compressor and motor, both of which are enclosed in the same housing, with no external shaft or shaft seals, with the motor operating in the refrigerant. (CMP-11)

Hoistway.

Any shaftway, hatchway, well hole, or other vertical opening or space in which an elevator or dumbwaiter is designed to operate. (CMP-12)

Hybrid System.

A system comprised of multiple power sources. These power sources could include photovoltaic, wind, micro-hydro generators, engine-driven generators, and others, but do not include electric power production and distribution network systems. Energy storage systems such as batteries, flywheels, or superconducting magnetic storage equipment do not constitute a power source for the purpose of this definition. The energy regenerated by an overhauling (descending) elevator does not constitute a power source for the purpose of this definition. (CMP-4)

Identified (as applied to equipment).

Recognizable as suitable for the specific purpose, function, use, environment, application, and so forth, where described in a particular *Code* requirement. (CMP-1)

Informational Note: Some examples of ways to determine suitability of equipment for a specific purpose, environment, or application include investigations by a qualified testing laboratory (listing and labeling), an inspection agency, or other organizations concerned with product evaluation.

In Sight From (Within Sight From, Within Sight).

Where this *Code* specifies that one equipment shall be “in sight from,” “within sight from,” or “within sight of,” and so forth, another equipment, the specified equipment is to be visible and not more than 15 m (50 ft) distant from the other. (CMP-1)

Industrial Control Panel.

An assembly of two or more components consisting of one of the following: (1) power circuit components only, such as motor controllers, overload relays, fused disconnect switches, and circuit breakers; (2) control circuit components only, such as push buttons, pilot lights, selector switches, timers, switches, and control relays; (3) a combination of power and control circuit components. These components, with associated wiring and terminals, are mounted on, or contained within, an enclosure or mounted on a subpanel.

The industrial control panel does not include the controlled equipment. (CMP-11)

Information Technology Equipment (ITE).

Equipment and systems rated 1000 volts or less, normally found in offices or other business establishments and similar environments classified as ordinary locations, that are used for creation and manipulation of data, voice, video, and similar signals that are not communications equipment as defined in Part I of Article 100 and do not process communications circuits as defined in 805.2. (CMP-12)

Informational Note: For information on listing requirements for both information technology equipment and communications equipment, see UL 60950-1-2014, *Information Technology Equipment — Safety — Part 1: General Requirements* or UL 62368-1-2014, *Audio/Video Information and Communication Technology Equipment Part 1: Safety Requirements*.

Information Technology Equipment Room.

A room within the information technology equipment area that contains the information technology equipment. [75:3.3.14] (CMP-12)

Innerduct.

A nonmetallic raceway placed within a larger raceway. (CMP-16)

Interactive Inverter.

An inverter intended for use in parallel with power source(s) such as an electric utility to supply common loads and capable of delivering power to the utility. (CMP-13)

Interactive System.

An electric power production system that is operating in parallel with and capable of delivering energy to an electric primary source supply system. (CMP-4)

Interrupting Rating.

The highest current at rated voltage that a device is identified to interrupt under standard test conditions. (CMP-10)

Informational Note: Equipment intended to interrupt current at other than fault levels may have its interrupting rating implied in other ratings, such as horsepower or locked rotor current.

Intersystem Bonding Termination.

A device that provides a means for connecting intersystem bonding conductors for communications systems to the grounding electrode system. (CMP-16)

Inverter.

Equipment that changes dc to ac. (CMP-4)

Inverter Input Circuit.

Conductors connected to the dc input of an inverter. (CMP-13)

Inverter Output Circuit.

Conductors connected to the ac output of an inverter. (CMP-13)

Inverter, Multimode.

Equipment having the capabilities of both the interactive inverter and the stand-alone inverter. (CMP-4)

Island Mode.

The operational mode for stand-alone power production equipment or an isolated microgrid, or for a multimode inverter or an interconnected microgrid that is disconnected from an electric power production and distribution network or other primary power source. (CMP-4)

Informational Note: Isolated microgrids are distinguished from interconnected microgrids, which are addressed in Article 705.

Isolated (as applied to location).

Not readily accessible to persons unless special means for access are used. (CMP-1)

Kitchen.

An area with a sink and permanent provisions for food preparation and cooking. (CMP-2)

Labeled.

Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner. (CMP-1)

Informational Note: If a listed product is of such a size, shape, material, or surface texture that it is not possible to apply legibly the complete label to the product, the complete label may appear on the smallest unit container in which the product is packaged.

Laundry Area.

An area containing or designed to contain a laundry tray, clothes washer, or clothes dryer. (CMP-2)

Lighting Outlet.

An outlet intended for the direct connection of a lampholder or luminaire. (CMP-18)

Lighting Track (Track Lighting).

A manufactured assembly designed to support and energize luminaires that are capable of being readily repositioned on the track. Its length can be altered by the addition or subtraction of sections of track. (CMP-18)

Listed.

Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose. (CMP-1)

Informational Note: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. Use of the system employed by the listing organization allows the authority having jurisdiction to identify a listed product.

Live Parts.

Energized conductive components. (CMP-1)

Location, Damp.

Locations protected from weather and not subject to saturation with water or other liquids but subject to moderate degrees of moisture. (CMP-1)

Informational Note: Examples of such locations include partially protected locations under canopies, marquees, roofed open porches, and like locations, and interior locations subject to moderate degrees of moisture, such as some basements, some barns, and some cold-storage warehouses.

Location, Dry.

A location not normally subject to dampness or wetness. A location classified as dry may be temporarily subject to dampness or wetness, as in the case of a building under construction. (CMP-1)

Location, Wet.

Installations underground or in concrete slabs or masonry in direct contact with the earth; in locations subject to saturation with water or other liquids, such as vehicle washing areas; and in unprotected locations exposed to weather. (CMP-1)

Luminaire.

A complete lighting unit consisting of a light source such as a lamp or lamps, together with the parts designed to position the light source and connect it to the power supply. It may also include parts to protect the light source or the ballast or to distribute the light. A lampholder itself is not a luminaire. (CMP-18)

Messenger or Messenger Wire.

A wire that is run along with or integral with a cable or conductor to provide mechanical support for the cable or conductor. (CMP-6)

Motor Control Center.

An assembly of one or more enclosed sections having a common power bus and principally containing motor control units. (CMP-11)

Multioutlet Assembly.

A type of surface, flush, or freestanding raceway designed to hold conductors and receptacles, assembled in the field or at the factory. (CMP-18)

Neutral Conductor.

The conductor connected to the neutral point of a system that is intended to carry current under normal conditions. (CMP-5)

Neutral Point.

The common point on a wye-connection in a polyphase system or midpoint on a single-phase, 3-wire system, or midpoint of a single-phase portion of a 3-phase delta system, or a midpoint of a 3-wire, direct-current system. (CMP-5)

Informational Note: At the neutral point of the system, the vectorial sum of the nominal voltages from all other phases within the system that utilize the neutral, with respect to the neutral point, is zero potential.

Nonautomatic.

Requiring human intervention to perform a function. (CMP-1)

Nonlinear Load.

A load where the wave shape of the steady-state current does not follow the wave shape of the applied voltage. (CMP-1)

Informational Note: Electronic equipment, electronic/electric-discharge lighting, adjustable-speed drive systems, and similar equipment may be nonlinear loads.

Outlet.

A point on the wiring system at which current is taken to supply utilization equipment. (CMP-1)

Outline Lighting.

An arrangement of incandescent lamps, electric-discharge lighting, or other electrically powered light sources to outline or call attention to certain features such as the shape of a building or the decoration of a window. (CMP-18)

Overcurrent.

Any current in excess of the rated current of equipment or the ampacity of a conductor. It may result from overload, short circuit, or ground fault. (CMP-10)

Informational Note: A current in excess of rating may be accommodated by certain equipment and conductors for a given set of conditions. Therefore, the rules for overcurrent protection are specific for particular situations.

Overcurrent Protective Device, Branch-Circuit.

A device capable of providing protection for service, feeder, and branch circuits and equipment over the full range of overcurrents between its rated current and its interrupting rating. Such devices are provided with interrupting ratings appropriate for the intended use but no less than 5000 amperes. (CMP-10)

Overcurrent Protective Device, Supplementary.

A device intended to provide limited overcurrent protection for specific applications and utilization equipment such as luminaires and appliances. This limited protection is in addition to the protection provided in the required branch circuit by the branch-circuit overcurrent protective device. (CMP-10)

Overload.

Operation of equipment in excess of normal, full-load rating, or of a conductor in excess of its ampacity that, when it persists for a sufficient length of time, would cause damage or dangerous overheating. A fault, such as a short circuit or ground fault, is not an overload. (CMP-10)

Panelboard.

A single panel or group of panel units designed for assembly in the form of a single panel, including buses and automatic overcurrent devices, and equipped with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet or cutout box placed in or against a wall, partition, or other support; and accessible only from the front. (CMP-9)

Photovoltaic (PV) System.

The total components, circuits, and equipment up to and including the PV system disconnecting means that, in combination, convert solar energy into electric energy. (CMP-4)

Pier.

A structure extending over the water and supported on a fixed foundation (fixed pier), or on flotation (floating pier), that provides access to the water. [303:3.3.17] (CMP-7)

Pier, Fixed.

Pier constructed on a permanent, fixed foundation, such as on piles, that permanently establishes the elevation of the structure deck with respect to land. [303:3.3.17.2] (CMP-7)

Pier, Floating.

Pier designed with inherent flotation capability that allows the structure to float on the water surface and rise and fall with water level changes. [303:3.3.17.3] (CMP-7)

Plenum.

A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system. (CMP-3)

Power Outlet.

An enclosed assembly that may include receptacles, circuit breakers, fuseholders, fused switches, buses, and watt-hour meter mounting means; intended to supply and control power to mobile homes, recreational vehicles, park trailers, or boats or to serve as a means for distributing power required to operate mobile or temporarily installed equipment.(CMP-7)

Power Production Equipment.

Electrical generating equipment supplied by any source other than a utility service, up to the source system disconnecting means. (CMP-4)

Informational Note: Examples of power production equipment include such items as generators, solar photovoltaic systems, and fuel cell systems.

Power-Limited Tray Cable (PLTC).

A factory assembly of two or more insulated conductors rated at 300 volts, with or without associated bare or insulated equipment grounding conductors, under a nonmetallic jacket. (CMP-3)

Premises Wiring (System).

Interior and exterior wiring, including power, lighting, control, and signal circuit wiring together with all their associated hardware, fittings, and wiring devices, both permanently and temporarily installed. This includes (a) wiring from the service point or power source to the outlets or (b) wiring from and including the power source to the outlets where there is no service point.

Such wiring does not include wiring internal to appliances, luminaires, motors, controllers, motor control centers, and similar equipment. (CMP-1)

Informational Note: Power sources include, but are not limited to, interconnected or stand-alone batteries, solar photovoltaic systems, other distributed generation systems, or generators.

Prime Mover.

The machine that supplies the mechanical horsepower to a generator. (CMP-13)

Qualified Person.

One who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved. (CMP-1)

Informational Note: Refer to *NFPA 70E-2018, Standard for Electrical Safety in the Workplace*, for electrical safety training requirements.

Raceway.

An enclosed channel designed expressly for holding wires, cables, or busbars, with additional functions as permitted in this *Code*. (CMP-8)

Informational Note: A raceway is identified within specific article definitions.

Raceway, Communications.

An enclosed channel of nonmetallic materials designed expressly for holding communications wires and cables; optical fiber cables; data cables associated with information technology and communications equipment; Class 2, Class 3, and Type PLTC cables; and power-limited fire alarm cables in plenum, riser, and general-purpose applications. (CMP-16)

Rainproof.

Constructed, protected, or treated so as to prevent rain from interfering with the successful operation of the apparatus under specified test conditions. (CMP-1)

Raintight.

Constructed or protected so that exposure to a beating rain will not result in the entrance of water under specified test conditions. (CMP-1)

Receptacle.

A contact device installed at the outlet for the connection of an attachment plug, or for the direct connection of electrical utilization equipment designed to mate with the corresponding contact device. A single receptacle is a single contact device with no other contact device on the same yoke or strap. A multiple receptacle is two or more contact devices on the same yoke or strap. (CMP-18)

Informational Note: A duplex receptacle is an example of a multiple receptacle that has two receptacles on the same yoke or strap.

Receptacle Outlet.

An outlet where one or more receptacles are installed. (CMP-18)

Reconditioned.

Electromechanical systems, equipment, apparatus, or components that are restored to operating conditions. This process differs from normal servicing of equipment that remains within a facility, or replacement of listed equipment on a one-to-one basis. (CMP-10)

Informational Note: The term *reconditioned* is frequently referred to as *rebuilt*, *refurbished*, or *remanufactured*.

Remote-Control Circuit.

Any electrical circuit that controls any other circuit through a relay or an equivalent device. (CMP-3)

Retrofit Kit.

A general term for a complete subassembly of parts and devices for field conversion of utilization equipment. (CMP-18)

Sealable Equipment.

Equipment enclosed in a case or cabinet that is provided with a means of sealing or locking so that live parts cannot be made accessible without opening the enclosure. (CMP-1)

Informational Note: The equipment may or may not be operable without opening the enclosure.

Separately Derived System.

An electrical source, other than a service, having no direct connection(s) to circuit conductors of any other electrical source other than those established by grounding and bonding connections. (CMP-5)

Service.

The conductors and equipment connecting the serving utility to the wiring system of the premises served. (CMP-10)

Service Cable.

Service conductors made up in the form of a cable. (CMP-10)

Service Conductors.

The conductors from the service point to the service disconnecting means. (CMP-10)

Service Conductors, Overhead.

The overhead conductors between the service point and the first point of connection to the service-entrance conductors at the building or other structure. (CMP-10)

Service Conductors, Underground.

The underground conductors between the service point and the first point of connection to the service-entrance conductors in a terminal box, meter, or other enclosure, inside or outside the building wall. (CMP-10)

Informational Note: Where there is no terminal box, meter, or other enclosure, the point of connection is considered to be the point of entrance of the service conductors into the building.

Service Drop.

The overhead conductors between the serving utility and the service point. (CMP-10)

Service-Entrance Conductors, Overhead System.

The service conductors between the terminals of the service equipment and a point usually outside the building, clear of building walls, where joined by tap or splice to the service drop or overhead service conductors. (CMP-10)

Service-Entrance Conductors, Underground System.

The service conductors between the terminals of the service equipment and the point of connection to the service lateral or underground service conductors. (CMP-10)

Informational Note: Where service equipment is located outside the building walls, there may be no service-entrance conductors or they may be entirely outside the building.

Service Equipment.

The necessary equipment, consisting of a circuit breaker(s) or switch(es) and fuse(s) and their accessories, connected to the serving utility and intended to constitute the main control and disconnect of the serving utility. (CMP-10)

Service Lateral.

The underground conductors between the utility electric supply system and the service point. (CMP-10)

Service Point.

The point of connection between the facilities of the serving utility and the premises wiring. (CMP-10)

Informational Note: The service point can be described as the point of demarcation between where the serving utility ends and the premises wiring begins. The serving utility generally specifies the location of the service point based on the conditions of service.

Short-Circuit Current Rating.

The prospective symmetrical fault current at a nominal voltage to which an apparatus or system is able to be connected without sustaining damage exceeding defined acceptance criteria. (CMP-10)

Show Window.

Any window, including windows above doors, used or designed to be used for the display of goods or advertising material, whether it is fully or partly enclosed or entirely open at the rear and whether or not it has a platform raised higher than the street floor level. (CMP-2)

Signaling Circuit.

Any electrical circuit that energizes signaling equipment. (CMP-3)

Single-Pole Separable Connector.

A device that is installed at the ends of portable, flexible, single-conductor cable that is used to establish connection or disconnection between two cables or one cable and a single-pole, panel-mounted separable connector. (CMP-18)

Special Permission.

The written consent of the authority having jurisdiction. (CMP-1)

Stand-Alone System.

A system that is capable of supplying power independent of an electric power production and distribution network. (CMP-4)

Structure.

That which is built or constructed, other than equipment. (CMP-1)

Surge Arrester.

A protective device for limiting surge voltages by discharging or bypassing surge current; it also prevents continued flow of follow current while remaining capable of repeating these functions. (CMP-10)

Surge-Protective Device (SPD).

A protective device for limiting transient voltages by diverting or limiting surge current; it also prevents continued flow of follow current while remaining capable of repeating these functions and is designated as follows:

Type 1: Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service disconnect overcurrent device.

Type 2: Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device, including SPDs located at the branch panel.

Type 3: Point of utilization SPDs.

Type 4: Component SPDs, including discrete components, as well as assemblies. (CMP-10)

Informational Note: For further information on Type 1, Type 2, Type 3, and Type 4 SPDs, see UL 1449, *Standard for Surge Protective Devices*.

Switch, Bypass Isolation.

A manual, nonautomatic, or automatic operated device used in conjunction with a transfer switch to provide a means of directly connecting load conductors to a power source and of disconnecting the transfer switch. (CMP-13)

Switch, General-Use.

A switch intended for use in general distribution and branch circuits. It is rated in amperes, and it is capable of interrupting its rated current at its rated voltage. (CMP-9)

Switch, General-Use Snap.

A form of general-use switch constructed so that it can be installed in device boxes or on box covers, or otherwise used in conjunction with wiring systems recognized by this *Code*. (CMP-9)

Switch, Isolating.

A switch intended for isolating an electrical circuit from the source of power. It has no interrupting rating, and it is intended to be operated only after the circuit has been opened by some other means. (CMP-9)

Switch, Motor-Circuit.

A switch rated in horsepower that is capable of interrupting the maximum operating overload current of a motor of the same horsepower rating as the switch at the rated voltage. (CMP-11)

Switch, Transfer.

An automatic or nonautomatic device for transferring one or more load conductor connections from one power source to another. (CMP-13)

Switchboard.

A large single panel, frame, or assembly of panels on which are mounted on the face, back, or both, switches, overcurrent and other protective devices, buses, and usually instruments. These assemblies are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets. (CMP-9)

Switchgear.

An assembly completely enclosed on all sides and top with sheet metal (except for ventilating openings and inspection windows) and containing primary power circuit switching, interrupting devices, or both, with buses and connections. The assembly may include control and auxiliary devices. Access to the interior of the enclosure is provided by doors, removable covers, or both. (CMP-9)

Informational Note: All switchgear subject to *NEC* requirements is metal enclosed. Switchgear rated below 1000 V or less may be identified as “low-voltage power circuit breaker switchgear.” Switchgear rated over 1000 V may be identified as “metal-enclosed switchgear” or “metal-clad switchgear.” Switchgear is available in non–arc-resistant or arc-resistant constructions.

Thermal Protector (as applied to motors).

A protective device for assembly as an integral part of a motor or motor-compressor that, when properly applied, protects the motor against dangerous overheating due to overload and failure to start. (CMP-11)

Informational Note: The thermal protector may consist of one or more sensing elements integral with the motor or motor-compressor and an external control device.

Thermally Protected (as applied to motors).

A motor or motor-compressor that is provided with a thermal protector. (CMP-11)

Ungrounded.

Not connected to ground or to a conductive body that extends the ground connection. (CMP-5)

Uninterruptible Power Supply.

A power supply used to provide alternating current power to a load for some period of time in the event of a power failure. (CMP-13)

Informational Note: In addition, it may provide a more constant voltage and frequency supply to the load, reducing the effects of voltage and frequency variations.

Utilization Equipment.

Equipment that utilizes electric energy for electronic, electromechanical, chemical, heating, lighting, or similar purposes. (CMP-1)

Voltage (of a circuit).

The greatest root-mean-square (rms) (effective) difference of potential between any two conductors of the circuit concerned. (CMP-1)

Informational Note: Some systems, such as 3-phase 4-wire, single-phase 3-wire, and 3-wire direct current, may have various circuits of various voltages.

Voltage, Nominal.

A nominal value assigned to a circuit or system for the purpose of conveniently designating its voltage class (e.g., 120/240 volts, 480Y/277 volts, 600 volts). (CMP-1)

Informational Note No. 1: The actual voltage at which a circuit operates can vary from the nominal within a range that permits satisfactory operation of equipment.

Informational Note No. 2: See ANSI C84.1-2011, *Voltage Ratings for Electric Power Systems and Equipment (60 Hz)*.

Informational Note No. 3: Certain battery units may be considered to be rated at nominal 48 volts dc, but may have a charging float voltage up to 58 volts. In dc applications, 60 volts is used to cover the entire range of float voltages.

Voltage to Ground.

For grounded circuits, the voltage between the given conductor and that point or conductor of the circuit that is grounded; for ungrounded circuits, the greatest voltage between the given conductor and any other conductor of the circuit. (CMP-1)

Watertight.

Constructed so that moisture will not enter the enclosure under specified test conditions. (CMP-1)

Weatherproof.

Constructed or protected so that exposure to the weather will not interfere with successful operation. (CMP-1)

Informational Note: Rainproof, raintight, or watertight equipment can fulfill the requirements for weatherproof where varying weather conditions other than wetness, such as snow, ice, dust, or temperature extremes, are not a factor.

Part II. Over 1000 Volts, Nominal

Electronically Actuated Fuse.

An overcurrent protective device that generally consists of a control module that provides current sensing, electronically derived time–current characteristics, energy to initiate tripping, and an interrupting module that interrupts current when an overcurrent occurs. Electronically actuated fuses may or may not operate in a current-limiting fashion, depending on the type of control selected. (CMP-10)

Fuse.

An overcurrent protective device with a circuit-opening fusible part that is heated and severed by the passage of overcurrent through it. (CMP-10)

Informational Note: A fuse comprises all the parts that form a unit capable of performing the prescribed functions. It may or may not be the complete device necessary to connect it into an electrical circuit.

Controlled Vented Power Fuse.

A fuse with provision for controlling discharge circuit interruption such that no solid material may be exhausted into the surrounding atmosphere.

Informational Note: The fuse is designed so that discharged gases will not ignite or damage insulation in the path of the discharge or propagate a flashover to or between grounded members or conduction members in the path of the discharge where the distance between the vent and such insulation or conduction members conforms to manufacturer's recommendations.

Expulsion Fuse Unit (Expulsion Fuse).

A vented fuse unit in which the expulsion effect of gases produced by the arc and lining of the fuseholder, either alone or aided by a spring, extinguishes the arc.

Nonvented Power Fuse.

A fuse without intentional provision for the escape of arc gases, liquids, or solid particles to the atmosphere during circuit interruption.

Power Fuse Unit.

A vented, nonvented, or controlled vented fuse unit in which the arc is extinguished by being drawn through solid material, granular material, or liquid, either alone or aided by a spring.

Vented Power Fuse.

A fuse with provision for the escape of arc gases, liquids, or solid particles to the surrounding atmosphere during circuit interruption.

Multiple Fuse.

An assembly of two or more single-pole fuses. (CMP-10)

Substation.

An assemblage of equipment (e.g., switches, interrupting devices, circuit breakers, buses, and transformers) through which electric energy is passed for the purpose of distribution, switching, or modifying its characteristics. (CMP-9)

Switching Device.

A device designed to close, open, or both, one or more electrical circuits. (CMP-1)

Circuit Breaker.

A switching device capable of making, carrying, and interrupting currents under normal circuit conditions, and also of making, carrying for a specified time, and interrupting currents under specified abnormal circuit conditions, such as those of short circuit.

Cutout.

An assembly of a fuse support with either a fuseholder, fuse carrier, or disconnecting blade. The fuseholder or fuse carrier may include a conducting element (fuse link) or may act as the disconnecting blade by the inclusion of a nonfusible member.

Disconnecting Means.

A device, group of devices, or other means whereby the conductors of a circuit can be disconnected from their source of supply.

Disconnecting (or Isolating) Switch (Disconnecter, Isolator).

A mechanical switching device used for isolating a circuit or equipment from a source of power.

Interrupter Switch.

A switch capable of making, carrying, and interrupting specified currents.

Oil Cutout (Oil-Filled Cutout).

A cutout in which all or part of the fuse support and its fuse link or disconnecting blade is mounted in oil with complete immersion of the contacts and the fusible portion of the conducting element (fuse link) so that arc interruption by severing of the fuse link or by opening of the contacts will occur under oil.

Oil Switch.

A switch having contacts that operate under oil (or askarel or other suitable liquid).

Regulator Bypass Switch.

A specific device or combination of devices designed to bypass a regulator.

Part III. Hazardous (Classified) Locations (CMP-14).**Aircraft Painting Hangar.**

An aircraft hangar constructed for the express purpose of spray/coating/dipping applications and provided with dedicated ventilation supply and exhaust.

Associated Apparatus.

Apparatus in which the circuits are not necessarily intrinsically safe themselves but that affects the energy in the intrinsically safe circuits and is relied on to maintain intrinsic safety. Such apparatus is one of the following:

- (1) Electrical apparatus that has an alternative type of protection for use in the appropriate hazardous (classified) location
- (2) Electrical apparatus not so protected that shall not be used within a hazardous (classified) location

Informational Note No. 1: Associated apparatus has identified intrinsically safe connections for intrinsically safe apparatus and also may have connections for nonintrinsically safe apparatus.

Informational Note No. 2: An example of associated apparatus is an intrinsic safety barrier, which is a network designed to limit the energy (voltage and current) available to the protected circuit in the hazardous (classified) location, under specified fault conditions.

Associated Nonincendive Field Wiring Apparatus.

Apparatus in which the circuits are not necessarily nonincendive themselves but that affect the energy in nonincendive field wiring circuits and are relied upon to maintain nonincendive energy levels. Such apparatus are one of the following:

- (1) Electrical apparatus that has an alternative type of protection for use in the appropriate hazardous (classified) location
- (2) Electrical apparatus not so protected that shall not be used in a hazardous (classified) location

Informational Note: Associated nonincendive field wiring apparatus has designated associated nonincendive field wiring apparatus connections for nonincendive field wiring apparatus and may also have connections for other electrical apparatus.

Combustible Dust.

Dust particles that are 500 microns or smaller (i.e., material passing a U.S. No. 35 Standard Sieve as defined in ASTM E11-2015, *Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves*), and present a fire or explosion hazard when dispersed and ignited in air.

Informational Note: See ASTM E1226-2012a, *Standard Test Method for Explosibility of Dust Clouds*, or ISO 6184-1, *Explosion protection systems — Part 1: Determination of explosion indices of combustible dusts in air*, for procedures for determining the explosibility of dusts.

Combustible Gas Detection System.

A protection technique utilizing stationary gas detectors in industrial establishments.

Control Drawing.

A drawing or other document provided by the manufacturer of the intrinsically safe or associated apparatus, or of the nonincendive field wiring apparatus or associated nonincendive field wiring apparatus, that details the allowed interconnections between the intrinsically safe and associated apparatus or between the nonincendive field wiring apparatus or associated nonincendive field wiring apparatus.

Cord Connector.

A fitting intended to terminate a cord to a box or similar device and reduce the strain at points of termination and may include an explosionproof, a dust-ignitionproof, or a flameproof seal.

Different Intrinsically Safe Circuits.

Intrinsically safe circuits in which the possible interconnections have not been evaluated and identified as intrinsically safe.

Dust-Ignitionproof.

Equipment enclosed in a manner that excludes dusts and does not permit arcs, sparks, or heat otherwise generated or liberated inside of the enclosure to cause ignition of exterior accumulations or atmospheric suspensions of a specified dust on or in the vicinity of the enclosure.

Informational Note No. 1: For further information on dust-ignitionproof enclosures, see ANSI/UL 1203-2015, *Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Hazardous (Classified) Locations*.

Informational Note No. 2: Dust-ignitionproof enclosures are sometimes additionally marked Type 9 per NEMA 250-2014, *Enclosures for Electrical Equipment*.

Dusttight.

Enclosures constructed so that dust will not enter under specified test conditions.

Informational Note No. 1: For further information, see ANSI/UL 121201-2017, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*.

Informational Note No. 2: Enclosure Types 3, 3X, 3S, 3SX, 4, 4X, 5, 6, 6P, 12, 12K, and 13, per NEMA 250-2014, *Enclosures for Electrical Equipment* and ANSI/UL 50E-2015, *Enclosures for Electrical Equipment, Environmental Considerations*, are considered dusttight.

Electrical Resistance Trace Heating “60079-30-1”.

Type of protection for the purpose of producing heat on the principle of electrical resistance and typically composed of one or more metallic conductors and/or an electrically conductive material, suitably electrically insulated and protected.

Informational Note: See ANSI/UL 60079-30-1-2017, *Explosive Atmospheres — Part 30-1: Electrical Resistance Trace Heating — General and Testing Requirements*.

Encapsulation “m”.

Type of protection where electrical parts that could ignite an explosive atmosphere by either sparking or heating are enclosed in a compound in such a way that this explosive atmosphere cannot be ignited.

Informational Note: See ANSI/UL 60079-18-2015, *Explosive atmospheres — Part 18: Equipment protection by encapsulation “m”*.

Explosionproof Equipment.

Equipment enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor that may occur within it and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes, or explosion of the gas or vapor within, and that operates at such an external temperature that a surrounding flammable atmosphere will not be ignited thereby. (CMP-14)

Informational Note No. 1: For further information, see ANSI/UL 1203-2015, *Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations*.

Informational Note No. 2: Explosionproof enclosures are sometimes additionally marked Type 7 per NEMA 250-2014, *Enclosures for Electrical Equipment*.

Flameproof “d”.

Type of protection where the enclosure will withstand an internal explosion of a flammable mixture that has penetrated into the interior, without suffering damage and without causing ignition, through any joints or structural openings in the enclosure of an external explosive gas atmosphere consisting of one or more of the gases or vapors for which it is designed.

Informational Note: See ANSI/UL 60079-1-2015, *Explosive Atmospheres — Part 1: Equipment Protection by Flameproof Enclosures “d”*.

Hermetically Sealed.

Equipment sealed against the entrance of an external atmosphere where the seal is made by fusion, for example, soldering, brazing, welding, or the fusion of glass to metal.

Informational Note: For further information, see ANSI/ISA-12.12.01-2013, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*.

Increased Safety “e”.

Type of protection applied to electrical equipment that does not produce arcs or sparks in normal service and under specified abnormal conditions, in which additional measures are applied so as to give increased security against the possibility of excessive temperatures and of the occurrence of arcs and sparks.

Informational Note: See ANSI/UL 60079-7-2017, *Explosive Atmospheres — Part 7: Equipment Protection by Increased Safety “e”*.

Inherently Safe Optical Radiation “op is”.

Type of protection to minimize the risk of ignition in explosive atmospheres from optical radiation where visible or infrared radiation is incapable of producing sufficient energy under normal or specified fault conditions to ignite a specific explosive atmosphere.

Informational Note: See ANSI/UL 60079-28-2017, *Explosive Atmospheres — Part 28: Protection of Equipment and Transmission Systems Using Optical Radiation*.

Intrinsic Safety “i”.

Type of protection where any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under prescribed test conditions.

Informational Note: See UL 913-2015, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1 Hazardous (Classified) Locations*; and ANSI/UL 60079-11-2013, *Explosive Atmospheres — Part 11: Equipment protection by intrinsic safety “i”*.

Intrinsically Safe Apparatus.

Apparatus in which all the circuits are intrinsically safe.

Intrinsically Safe Circuit.

A circuit in which any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under prescribed test conditions.

Informational Note: Test conditions are described in ANSI/UL 913-2013, *Standard for Safety, Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations*.

Intrinsically Safe System.

An assembly of interconnected intrinsically safe apparatus, associated apparatus, and interconnecting cables, in that those parts of the system that may be used in hazardous (classified) locations are intrinsically safe circuits.

Informational Note: An intrinsically safe system may include more than one intrinsically safe circuit.

Limited Finishing Workstation.

An apparatus that is capable of confining the vapors, mists, residues, dusts, or deposits that are generated by a spray application process but does not meet the requirements of a spray booth or spray room, as herein defined. [33:3.3.18.1]

Informational Note: See Section 14.3 of NFPA 33, *Standard for Spray Application Using Flammable or Combustible Materials*, for limited finishing workstations.

Liquid Immersion “o”.

Type of protection where electrical equipment is immersed in a protective liquid in such a way that an explosive atmosphere that may be above the liquid or outside the enclosure cannot be ignited.

Informational Note: See ANSI/UL 60079-6-2016, *Explosive Atmospheres — Part 6: Equipment protection by liquid immersion “o”*.

Major Repair Garage.

A building or portions of a building where major repairs, such as engine overhauls, painting, body and fender work, and repairs that require draining of the motor vehicle fuel tank are performed on motor vehicles, including associated floor space used for offices, parking, or showrooms. [30A:3.3.12.1]

Membrane Enclosure.

A temporary enclosure used for the spraying of workpieces that cannot be moved into a spray booth where open spraying is not practical due to the proximity to other operations, finish quality, or concerns such as the collection of overspray.

Informational Note: See Chapter 18 of NFPA 33-2016, *Standard for Spray Application Using Flammable or Combustible Materials*, for information on the construction and use of membrane enclosures.

Minor Repair Garage.

A building or portions of a building used for lubrication, inspection, and minor automotive maintenance work, such as engine tune-ups, replacement of parts, fluid changes (e.g., oil, antifreeze, transmission fluid, brake fluid, air-conditioning refrigerants), brake system repairs, tire rotation, and similar routine maintenance work, including associated floor space used for offices, parking, or showrooms. [30A:3.3.12.2]

Mobile Equipment.

Equipment with electrical components suitable to be moved only with mechanical aids or is provided with wheels for movement by person(s) or powered devices.

Motor Fuel Dispensing Facility.

That portion of a property where motor fuels are stored and dispensed from fixed equipment into the fuel tanks of motor vehicles or marine craft or into approved containers, including all equipment used in connection therewith. [30A:3.3.11]

Informational Note: Refer to Articles 510 and 511 with respect to electrical wiring and equipment for other areas used as lubricatoriums, service rooms, repair rooms, offices, salesrooms, compressor rooms, and similar locations.

Nonincendive Circuit.

A circuit, other than field wiring, in which any arc or thermal effect produced under intended operating conditions of the equipment, is not capable, under specified test conditions, of igniting the flammable gas–air, vapor–air, or dust–air mixture.

Informational Note: Conditions are described in ANSI/ISA-12.12.01-2013, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*.

Nonincendive Component.

A component having contacts for making or breaking an incendive circuit and the contacting mechanism is constructed so that the component is incapable of igniting the specified flammable gas–air or vapor–air mixture. The housing of a nonincendive component is not intended to exclude the flammable atmosphere or contain an explosion.

Informational Note: For further information, see ANSI/ISA-12.12.01-2013, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*.

Nonincendive Equipment.

Equipment having electrical/electronic circuitry that is incapable, under normal operating conditions, of causing ignition of a specified flammable gas–air, vapor–air, or dust–air mixture due to arcing or thermal means.

Informational Note: For further information, see ANSI/ISA-12.12.01-2013, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*.

Nonincendive Field Wiring.

Wiring that enters or leaves an equipment enclosure and, under normal operating conditions of the equipment, is not capable, due to arcing or thermal effects, of igniting the flammable gas–air, vapor–air, or dust–air mixture. Normal operation includes opening, shorting, or grounding the field wiring.

Nonincendive Field Wiring Apparatus.

Apparatus intended to be connected to nonincendive field wiring.

Informational Note: For further information, see ANSI/ISA-12.12.01-2013, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*.

Oil Immersion.

Electrical equipment immersed in a protective liquid in such a way that an explosive atmosphere that may be above the liquid or outside the enclosure cannot be ignited.

Optical Radiation.

Electromagnetic radiation at wavelengths in vacuum between the region of transition to X-rays and the region of transition to radio waves, that is approximately between 1 nm and 1000 μm .

Informational Note: For additional information on types of protection that can be applied to minimize the risk of ignition in explosive atmospheres from optical radiation in the wavelength range from 380 nm to 10 μm , see ANSI/UL 60079-28-2017, *Explosive Atmospheres — Part 28: Protection of Equipment and Transmission Systems Using Optical Radiation*.

Optical System With Interlock “op sh”.

Type of protection to minimize the risk of ignition in explosive atmospheres from optical radiation where visible or infrared radiation is confined inside optical fiber or other transmission medium with interlock cut-off provided to reliably reduce the unconfined beam strength to safe levels within a specified time in case the confinement fails and the radiation becomes unconfined.

Informational Note: See ANSI/UL 60079-28-2017, *Explosive Atmospheres — Part 28: Protection of Equipment and Transmission Systems Using Optical Radiation*.

Outdoor Spray Area.

A spray area that is outside the confines of a building or that has a canopy or roof that does not limit the dissipation of the heat of a fire or dispersion of flammable vapors and does not restrict fire-fighting access and control. For the purpose of this standard, an outdoor spray area can be treated as an unenclosed spray area. [33:3.3.2.3.1]

Portable Equipment.

Equipment with electrical components suitable to be moved by a single person without mechanical aids.

Powder Filling “q”.

Type of protection where electrical parts capable of igniting an explosive atmosphere are fixed in position and completely surrounded by filling material (glass or quartz powder) to prevent the ignition of an external explosive atmosphere.

Informational Note: See ANSI/UL 60079-5-2016, *Explosive Atmospheres — Part 5: Equipment protection by powder filling “q”*.

Pressurized.

The process of supplying an enclosure with a protective gas with or without continuous flow, at sufficient pressure to prevent the entrance of combustible dust or ignitable fibers/flyings.

Pressurized Enclosure “p”.

Type of protection for electrical equipment that uses the technique of guarding against the ingress of the external atmosphere, which may be explosive, into an enclosure by maintaining a protective gas therein at a pressure above that of the external atmosphere.

Informational Note: See ANSI/UL-60079-2-2017, *Explosive Atmospheres — Part 2: Equipment protection by pressurized enclosures “p”*.

Process Seal.

A seal between electrical systems and flammable or combustible process fluids where a failure could allow the migration of process fluids into the premises’ wiring system.

Protected Optical Fiber Cable.

Optical fiber cable protected from releasing optical radiation into the atmosphere during normal operating conditions and foreseeable malfunctions by additional armoring, conduit, cable tray, or raceway.

Informational Note: See ANSI/UL 60079-28-2017, *Explosive Atmospheres — Part 28: Protection of Equipment and Transmission Systems Using Optical Radiation*.

Protected Optical Radiation “op pr”.

Type of protection to minimize the risk of ignition in explosive atmospheres from optical radiation where visible or infrared radiation is confined inside optical fiber or other transmission medium under normal constructions or constructions with additional mechanical protection based on the assumption that there is no escape of radiation from the confinement.

Informational Note: See ANSI/UL 60079-28-2017, *Explosive Atmospheres — Part 28: Protection of Equipment and Transmission Systems Using Optical Radiation*.

Protection by Enclosure “t”.

Type of protection for explosive dust atmospheres where electrical equipment is provided with an enclosure providing dust ingress protection and a means to limit surface temperatures.

Informational Note: For additional information, see ANSI/UL 60079-31-2015, *Explosive Atmospheres — Part 31: Equipment Dust Ignition Protection by Enclosure “t”*.

Purged and Pressurized.

The process of (1) purging, supplying an enclosure with a protective gas at a sufficient flow and positive pressure to reduce the concentration of any flammable gas or vapor initially present to an acceptable level; and (2) pressurization, supplying an enclosure with a protective gas with or without continuous flow at sufficient pressure to prevent the entrance of a flammable gas or vapor, a combustible dust, or an ignitable fiber.

Informational Note: For further information, see ANSI/NFPA 496-2013, *Purged and Pressurized Enclosures for Electrical Equipment*.

Simple Apparatus.

An electrical component or combination of components of simple construction with well-defined electrical parameters that does not generate more than 1.5 volts, 100 mA, and 25 mW, or a passive component that does not dissipate more than 1.3 watts and is compatible with the intrinsic safety of the circuit in which it is used.

Informational Note No. 1: The following apparatus are examples of simple apparatus:

- (1) Passive components; for example, switches, instrument connectors, plugs and sockets, junction boxes, resistance temperature devices, and simple semiconductor devices such as LEDs
- (2) Sources of stored energy consisting of single components in simple circuits with well-defined parameters; for example, capacitors or inductors, whose values are considered when determining the overall safety of the system
- (3) Sources of generated energy; for example, thermocouples and photocells, that do not generate more than 1.5 volts, 100 mA, and 25 mW

Informational Note No. 2: For further information, refer to ANSI/UL 913-2013, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations*; and ANSI/UL 60079-11-2013, *Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety “i.”*

Spray Area.

Any fully enclosed, partly enclosed, or unenclosed area in which dangerous quantities of flammable or combustible vapors, mists, residues, dusts, or deposits are present due to the operation of spray processes, including (1) any area in the direct path of a spray application process; (2) the interior of a spray booth, spray room, or limited finishing workstation, as herein defined; (3) the interior of any exhaust plenum, eliminator section, or scrubber section; (4) the interior of any exhaust duct or exhaust stack leading from a spray application process; (5) the interior of any air recirculation path up to and including recirculation particulate filters; (6) any solvent concentrator (pollution abatement) unit or solvent recovery (distillation) unit; and (7) the inside of a membrane enclosure. The following are not part of the spray area: (1) fresh air make-up units; (2) air supply ducts and air supply plenums; (3) recirculation air supply ducts downstream of recirculation particulate filters; and (4) exhaust ducts from solvent concentrator (pollution abatement) units. [33:3.3.2.3]

Informational Note: Unenclosed spray areas are locations outside of buildings or are localized operations within a larger room or space. Such are normally provided with some local vapor extraction/ventilation system. In automated operations, the area limits are the maximum area in the direct path of spray operations. In manual operations, the area limits are the maximum area of spray when aimed at 90 degrees to the application surface.

Spray Booth.

A power-ventilated enclosure for a spray application operation or process that confines and limits the escape of the material being sprayed, including vapors, mists, dusts, and residues that are produced by the spraying operation and conducts or directs these materials to an exhaust system. [33:3.3.15]

Informational Note: A spray booth is an enclosure or insert within a larger room used for spray/coating/dipping applications. A spray booth can be fully enclosed or have open front or face and can include separate conveyor entrance and exit. The spray booth is provided with a dedicated ventilation exhaust with supply air from the larger room or from a dedicated air supply.

Spray Room.

A power-ventilated fully enclosed room used exclusively for open spraying of flammable or combustible materials. [33:3.3.16]

Type of Protection “n”.

Type of protection where electrical equipment, in normal operation, is not capable of igniting a surrounding explosive gas atmosphere and a fault capable of causing ignition is not likely to occur.

Informational Note: See ANSI/UL 60079-15-2013, *Explosive Atmospheres — Part 15: Equipment Protection by Type of Protection “n”*.

Unclassified Locations.

Locations determined to be neither Class I, Division 1; Class I, Division 2; Zone 0; Zone 1; Zone 2; Class II, Division 1; Class II, Division 2; Class III, Division 1; Class III, Division 2; Zone 20; Zone 21; Zone 22; nor any combination thereof.

Unenclosed Spray Area.

Any spray area that is not confined by a limited finishing workstation, spray booth, or spray room, as herein defined. [33:3.3.2.3.2]

Ventilated.

Provided with a means to permit circulation of air sufficient to remove an excess of heat, fumes, or vapors.

Volatile Flammable Liquid.

A flammable liquid having a flash point below 38°C (100°F), or a flammable liquid whose temperature is above its flash point, or a Class II combustible liquid that has a vapor pressure not exceeding 276 kPa (40 psia) at 38°C (100°F) and whose temperature is above its flash point.

Statement of Problem and Substantiation for Public Input

Unlike a normal branch circuit that originates at the terminals of the last overcurrent device, a motor branch circuit includes the controller, such as a motor starter (contactor with thermal overloads), or a separately derived system such as an adjustable speed drive. In the case of a variable frequency drive, the drive has circuit protection components which a regular branch circuit does not have.

This is a companion proposal to one that revises the term "controller" in 430.2

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 2121-NFPA 70-2020 [Definition: Controller.]</u>	Motor branch circuits

Submitter Information Verification

Submitter Full Name: Paul Guidry
Organization: Fluor Enterprises, Inc.
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Submittal Date: Sun Aug 02 05:48:08 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: [FR-7980-NFPA 70-2020](#)

Statement: The committee creates a definition to differentiate between a branch circuit and a motor branch circuit.



Public Input No. 2450-NFPA 70-2020 [New Definition after Definition: Branch Circuit, Individual.]

Branch Circuit, Motor.

The circuit conductors, including equipment such as a motor controller, with or without an overload device, between the motor branch-circuit short-circuit ground-fault protective device, or motor overload and fault-current protection relay that supplies energy to an individual motor.

Statement of Problem and Substantiation for Public Input

The term "motor branch circuit" is used throughout the NEC, especially in Art. 430, yet it is not defined. As a member of CMP 11 for the 2020 cycle, it was brought to light that a controller (motor starter or ASD), is considered to be part of the motor branch circuit per ANSI product standards. There is a difference between an individual branch circuit and a motor branch circuit as it includes the motor controller. The motor controller may be a simple snap switch or an adjustable speed drive.

In addition, it is a common misconception that motor branch circuits are "motor feeders" probably due to years of incorrect use of the term in the industry. Adding this term to the definitions would clarify that 1) a motor starter or ASD is part of the motor branch circuit even though in the case of an ASD it is actually a separately derived system and, 2) clarify for users of the Code that there is a distinct difference between a motor "feeder" and a motor "branch circuit".

This is a companion proposal to a proposed revision of the definition for "controller".

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 2123-NFPA 70-2020 [Section No. 430.1]	Addition of a motor branch circuit to the Diagram.
Public Input No. 2118-NFPA 70-2020 [Section No. 430.224]	Addition of requirements for motor branch circuits and feeders

Submitter Information Verification

Submitter Full Name: Paul Guidry
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Submittal Date: Sat Aug 22 23:35:20 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: [FR-7980-NFPA 70-2020](#)

Statement: The committee creates a definition to differentiate between a branch circuit and a motor branch circuit.



Public Input No. 3297-NFPA 70-2020 [Section No. 409.1]

409.1 Scope.

This article covers industrial control panels intended for general use and operating at 1000 volts or less.

Informational Note 1 : ANSI/UL 508A, *Standard for Industrial Control Panels*, is a safety standard for industrial control panels.

Informational Note 2: See IEEE 3001.11 *Recommended Practice for Application of Controllers and Automation to Industrial and Commercial Power Systems*

Statement of Problem and Substantiation for Public Input

This is another slice of updated content from the legacy "Red Book" IEEE 141 and "Gray Book: IEEE 241 into the new IEEE 3000 Standards Collection. From the project prospectus:

"The selection and application of controllers and automation to industrial and commercial power systems is covered by this recommended practice. It is likely to be of greatest value to the power-oriented engineer with limited experience with this equipment. It can also be an aid to all engineers responsible for the electrical design of industrial and commercial power systems."

https://standards.ieee.org/standard/3001_11-2017.html

Submitter Information Verification

Submitter Full Name: Michael Anthony
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Affiliation: IEEE Education & Healthcare Facility Electrotechnology Committee
Street Address:
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Submittal Date: Mon Sep 07 15:53:25 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: The proposed informational note does not improve the usability of the NEC.



Public Input No. 4215-NFPA 70-2020 [Section No. 409.3]

409.3 Other Articles.

In addition to the requirements of ~~Article 409~~ this article, industrial control panels that contain branch circuits for specific loads or components, or are for control of specific types of equipment addressed in other articles of this *Code*, shall be constructed and installed in accordance with the applicable requirements from the specific articles in Table 409.3.

Table 409.3 Other Articles

<u>Equipment/Occupancy</u>	<u>Article</u>	<u>Section</u>
Branch circuits	210	-
Luminaires	410	-
Motors, motor circuits, and controllers	430	-
Air-conditioning and refrigerating equipment	440	-
Capacitors	-	460.8, 460.9
Hazardous (classified) locations	500, 501, 502, 503, 504, 505	-
Commercial garages; aircraft hangars; motor fuel dispensing facilities; bulk storage plants; spray application, dipping, and coating processes; and inhalation anesthetizing locations	511, 513, 514, 515, 516, and 517 Part IV	-
Cranes and hoists	610	-
Electrically driven or controlled irrigation machines	675	-
Elevators, dumbwaiters, escalators, moving walks, wheelchair lifts, and stairway chair lifts	620	-
Industrial machinery	670	-
Resistors and reactors	470	-
Transformers	450	-
Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits	725	-

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(r) Style Manual prohibits references to an entire article, other than Article 100. As such, it is recommended that we change the reference here to "this article" to comply with the Style Manual.

Submitter Information Verification

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Submittal Date: Thu Sep 10 06:34:19 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8052-NFPA 70-2020](#)

Statement: The reference to Article 409 is revised to comply with section 4.1.4 of the NEC Style Manual.



Public Input No. 4297-NFPA 70-2020 [Section No. 409.21(B)]

(B) Location.

This protection shall be provided for each incoming supply circuit ~~by either of the following: An overcurrent by an overcurrent protective device located in a separate enclosure, located ahead of the industrial control panel. A single main overcurrent protective device located within the industrial control panel. Where overcurrent protection is provided as part of the industrial control panel, the supply conductors shall~~ The supply conductors to the separate enclosure shall be considered as either feeders or taps as covered by 240.21 .

Statement of Problem and Substantiation for Public Input

Worker safety can be improved by locating the overcurrent protection and disconnecting means outside of the industrial control panel. Once the external disconnecting means is turned off, and an electrically safe work condition is attained, the chances of contacting an energized part within the industrial control panel are greatly reduced. This reduces the chances of both shock and arc-flash.

Submitter Information Verification

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Submittal Date: Thu Sep 10 09:40:47 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: The current language of Part I allows for the overcurrent protective device to be installed remotely. The location of the overcurrent protective device is a design decision. The shock and arc flash hazard at the point of installation of the control panel will vary from location to location in the installation.



Public Input No. 1114-NFPA 70-2020 [New Section after 409.22(B)]

TITLE OF NEW CONTENT 409.26 Coarse Thread Screws.

Type your content here ...

Coarse thread screws shall not enter industrial control panel enclosures.

Statement of Problem and Substantiation for Public Input

Whether coarse thread screws are added before or after conductors or electrical components are installed or added to an existing installation, they are a recipe for disaster. Coarse thread screws are very convenient and are used this way and should be a violation. The closest the NEC comes to addressing this is 314.23(B)(1) which doesn't provide the same message as this public input.

The way the new entry is worded allows coarse thread screws to exit enclosures. For instance an electrical component could be mounted in an industrial control panel with coarse thread self-tapper screws zipped from the inside to the outside of the enclosure.

Submitter Information Verification

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Submittal Date: Sat May 16 18:27:02 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: The substantiation doesn't clearly define the hazard this is attempting to avoid.



Public Input No. 3386-NFPA 70-2020 [New Section after 409.60]

409.70 Surge Protection

Industrial Control Panels with safety circuits shall have surge protection installed in accordance with Part II of Article 242.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Surge_Protection_Details.pdf	Surge Protection Information	

Statement of Problem and Substantiation for Public Input

The study, "Data Assessment for Electrical Surge Protective Devices" commissioned by the Fire Protection Research Foundation, 1 Batterymarch Park, Quincy, MA 02169-7471, provides results of a 2013 and 2014 survey of facility managers concerning surge damage. It shows that 26% had damage to safety interlocking systems on machines due to surges. These safety-interlocking systems are in place to protect workers from interactions with the machinery. There were 50% of the respondents had issues related to surge damage in other areas where industrial control panels may be used for Security, Fire, and other systems. Injuries were stated in 11% of the responses. This report lead to a number of proposals that were rejected at the time, but many have been accepted since as the continued voltage surge damages

"Surge Protection More than Accessory" Survey & report conducted by the Electrical Safety Foundation, Inc. (ESFI) in December 2017 provided the following information for industrial facilities. There is additional data found in the full report that expands on these results.

- Industrial facilities experienced voltage surges significant enough to cause equipment damage:
 - o 23.6% Daily
 - o 29.1% Weekly
 - o 23.6% Monthly
 - o 20.9% Annually
 - o 2.7% Less than once a year
- Industrial facilities experience voltage surges significant enough to cause injury or death:
 - o 17.3% Daily
 - o 18.2% Weekly
 - o 12.7% Monthly
 - o 27.3% Annually
 - o 24.5% Less than once a year
- What causes surge protection to be installed in a specific building?
 - o Surge protection required by code 28.9%
 - o Customer Specified Surge Protection 25.7%
 - o Protect expensive equipment from damage 28.9%
 - o Reduced downtime 16.2%
 - o Other 0.2%
- Conditions that lead to voltage surges:
 - o Faulty/damaged wiring 24.4%
 - o Electrical equipment turning on/off 16.1%
 - o Magnetic coupling 11.9%
 - o Lightning strike 21.5%
 - o Static electricity discharge 15.0%
 - o Grid anomalies 11.9%

The conditions list shows that 40% of the conditions which cause surges within an Industrial facility occur within the facility.

“safety circuits” are used in this PI in order to coordinate with the proposed definition in the NEMA Public Input for 670.2.

Submitter Information Verification

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Submittal Date: Tue Sep 08 13:25:07 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: FR-8053-NFPA 70-2020

Statement: This first revision to require surge protective devices addresses a documented safety issue that has been reported by the Electrical Safety Foundation. This language provides consistency with requirements for industrial machinery in Article 670.



Public Input No. 1357-NFPA 70-2020 [Section No. 409.60]

409.60 Equipment Grounding Conductor .

Multisection industrial control panels shall be bonded together with an equipment grounding conductor or an equivalent equipment grounding bus sized in accordance with Table 250.122. Equipment grounding conductors shall be connected to this equipment grounding bus or to an equipment grounding termination point provided in a single-section industrial control panel.

Statement of Problem and Substantiation for Public Input

According to the NFPA Style Manual, the Section Title needs to reflect the content of the rule. The rule is about the equipment grounding conductor, not about 'Grounding.'

Submitter Information Verification

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Submittal Date: Mon Jun 01 17:42:29 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8056-NFPA 70-2020](#)

Statement: Section 409.60 (including the title) is revised to reflect the intent that sections of industrial control panels be bonded together.

**Public Input No. 4622-NFPA 70-2020 [Section No. 409.102]****409.102 Busbars- and Conductors.**

Industrial control panels utilizing busbars shall comply with 409.102(A) and (B).

(A) Support and Arrangement.

Busbars shall be protected from physical damage and be held firmly in place.

(B) Phase Arrangement.

The phase arrangement on 3-phase horizontal common power and vertical buses shall be A, B, C from front to back, top to bottom, or left to right, as viewed from the front of the industrial control panel. The B phase shall be that phase having the higher voltage to ground on 3-phase, 4-wire, delta-connected systems. Other busbar arrangements shall be permitted for additions to existing installations, and the phases shall be permanently marked.

Statement of Problem and Substantiation for Public Input

The title of the section can be shortened to just "Busbars" since busbars are the only thing addressed. There are no requirements for other conductors in this section. This will provide clarity to this section.

Submitter Information Verification

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Submittal Date: Thu Sep 10 15:54:26 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8057-NFPA 70-2020](#)

Statement: The title of the section is shortened to "Busbars" because busbars are the only topic being addressed.

There are no requirements for other conductors in this section. This will provide clarity to this section.



Public Input No. 3934-NFPA 70-2020 [New Section after 409.110]

Absence of Voltage Test & Indication

A means shall be provided to verify the absence of voltage in accordance with an acceptable industry practice that does not expose personnel to shock or arc flash hazards or live parts at the test point for the disconnecting means for any voltage supplies or stored energy sources that present a shock or arc flash hazard up to and including 10000 V that are likely to require examination, adjustment, servicing, or maintenance.

Informational Note: NFPA 70E-2021 Standard for Electrical Safety in the Workplace provides guidance for safely verifying the absence of voltage including the use of devices like a permanently mounted absence of voltage tester.

Statement of Problem and Substantiation for Public Input

Testing for absence of voltage is an important step that helps increase safety by detecting several conditions that could lead to an electrical incident:

- Power remains on if the wrong disconnecting means is utilized or the source is mislabeled (see examples from OSHA Summaries)
- Presence of stored electrical energy from a capacitor, present after the disconnect is opened and locked out (see examples from OSHA Summaries)
- Power remains present when the disconnect handle is in the off position if the disconnect experiences a mechanical failure (see Recall Notices below)

An easily accessible means to test for and visually convey the status of presence and absence of voltage that is part of the equipment installation at the point of work before accessing industrial control panels would prevent this type of incident (several examples are included below) and further the purpose of the code in practical safeguarding of persons and property by leveraging safety by design principles. Absence of Voltage Testers (AVT) listed to UL 1436 are permanently mounted testers that visually indicate when all voltages are less than 3 V (ac and dc) at the test point. This test is initiated before doors and covers are removed preventing accidental contact with energized parts. AVTs listed to UL 1436 have been recognized as an acceptable method to test for the absence of voltage in NFPA 70E since 2018 (120.5 (7) Exception 1).

Permanently mounted AVTs installed on or near the equipment increase the likelihood that the test for absence of voltage test occurs before the equipment is accessed when compared to portable voltage test instruments. Additionally, AVTs often have a feature to visually indicate when ac or dc voltage that would cause a shock hazard is present. In each of the incidents described below, the voltage presence indicators (for AC and DC) would have provided a visual warning that voltage was still present.

OSHA Fatality and Catastrophe Investigation Summaries

A keyword search of the OSHA Fatality and Catastrophe Investigation Summaries (<https://www.osha.gov/pls/imis/accidentsearch.html>) reveals several incidents resulting in severe injury or death that are attributed to failure to test for absence of voltage after de-energizing the disconnecting means. Some examples:

1. Report ID: 0728900

Employee #1 was on the roof of a customer's building, changing filters for the customer's air conditioning units. The employee had shut off the unit, but he did not lock out the unit or check its power supply for stored energy. As he reached into the unit, he came into contact with a capacitor charged to 280 volts and received an electric shock.

2. Report ID: 0420600

An employee turned off the known energy source to an air conditioning and heat unit at the panel box in a private residence. He pulled the disconnect switch in a box adjacent to the fan or blower assembly in the attic and was attempting to remove the air handler inside the blower housing. The heavy gold chain that the employee was wearing around his neck came in contact with or came in close proximity to a 10 microfarad, mfd, capacitor which can store 370 or more volts of alternating current. The chain burned an arc in his neck and carried sufficient current to his heart via the vascular tract to cause his death.

3. Report ID: 0316300

Employee #1 and his helper were installing a fan on a HVAC chiller unit. Employee asked his helper to open

the circuit breaker to deenergize the unit, but Employee #1 never tested the fan circuit to ensure it was deenergized. Employee #1's helper opened the wrong breaker and when Employee #1 touched the conductors for the fan, he was electrocuted.

4. Report ID: 0452110

Employee #1 turned off breaker #22 in a panel box so that he could make a connection in a junction box. He was using a wire stripper to cut into the insulation around a conductor when he was electrocuted. The breakers in the panel box were not labeled, and breaker #22 did not control the current in the circuit on which Employee #1 was preparing to work. He also did not use a voltmeter or another type of instrument to test the circuit and confirm that the power was off.

5. Report ID 0522300

Employee #1 was working on an HVAC air handling unit that had not been cooling adequately. The "lockout" procedure did not include de-energization at the power supply or application of locks. Therefore, although the unit was shut off, it was still energized. Employee #1 was killed.

6. Report ID 0950632

Employee #1, an electrician, was wiring an electrical room to test for continuity at a construction site. Employee #1 and two coworkers, Coworker #1 and Coworker #2, were testing the continuity at the main panel outside. Coworker #1 went inside the building and had the tester inside the electrical room. Employee #1 and Coworker #2 went outside and opened up the main panel. Coworker #2 had a walkie-talkie and was standing behind Employee #1, relaying instructions from Coworker #1. Employee #1 thought that the power was down, and he did not check it prior to working on the panel. Employee #1 connected a length of wire from a grounded location on the frame to a connector that was hot, and there was an immediate flash arc. Employee #1 sustained second degree burns to his right arm, hand, and fingers, with a small area of third degree burns on his wrist. Employee #1 was transported to UCSD Burn Center, where he was hospitalized for eight days. The worksite where the accident occurred was a construction site where an existing building was undergoing remodeling into a medical facility.

7. Report ID 0213600

Employee #1, employed by an electrical contractor, was working at a building jobsite. He was testing wires with a voltage meter to verify voltage. Employee #1 hit a live wire with his hand and sustained an electrical shock. Emergency services were called, and Employee #1 was transported to the hospital. He was admitted and treated for a thermal burn to his index finger. Subsequent investigation determined that Employee #1 was not wearing gloves when he came into contact with the bare electrical wire.

Disconnect Recall Notices

Several brands of disconnects that are commonly used in industrial and commercial applications have experienced recalls due to defects that allow power to remain present when the disconnect handle is in the off position, posing a shock hazard. This failure mode is an example of why testing for absence of voltage is critical in all applications.

Recalls (<https://www.cpsc.gov/Recalls>)

1. Example 1

Company A recalled more than a million safety switches manufactured between January 1, 2014 and January 18, 2018 because the power can stay on when the safety switch handle is in the off position, posing an electric shock or electrocution hazard. The switches may be installed in or around commercial buildings, outbuildings, apartments and homes with air conditioning units.

2. Example 2

Company B issued a safety recall of 26 models of safety switches that may not disconnect power when the handle is in the "off" position. The affected devices cover certain models of 30A and 60A heavy-duty safety switches manufactured between Nov. 19, 2015, and Jan. 23, 2018.

3. Example 3

Company C recalled 19,000 toggle and rotary switches. When switched OFF, one electrical pole may remain energized, posing a risk of electrical shock hazard. The switches are typically used with HVAC units, electric distribution and control panels and industrial uses. Primarily the switches are used commercially, however they may also be found in residential applications.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 3835-NFPA 70-2020 [New Section after 110.25]	
Public Input No. 3908-NFPA 70-2020 [New Part after I.]	

Submitter Information Verification

Submitter Full Name: Rachel Bugaris

Organization: Panduit Corp
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 15:47:12 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: The panel does not agree that AVT's should be required for all industrial control panels. Industrial control panels are commonly supplied by multiple circuits with the panel being subject to constant re-configuration. The AVT may not be connected to circuits added after installation. Additionally, the variety of energized topologies and the associated hazards needs to be addressed by the submitter, for example 480 Vac vs. 120 Vdc. It may be possible that some industrial control panels will not need the tester. Note that the proposal may contain a typo, 10000 V should probably be 1000 V.



Public Input No. 2347-NFPA 70-2020 [Section No. 409.110]

409.110 Marking.

An industrial control panel shall be marked with the following information that is plainly visible after installation:

- (1) Manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified.
- (2) Supply voltage, number of phases, frequency, and ~~full-load current~~ designed current capacity for each incoming supply circuit.
- (3) Industrial control panels supplied by more than one electrical source where more than one disconnecting means is required to disconnect all circuits 50-volts or more within the control panel shall be marked to indicate that more than one disconnecting means is required to de-energize the equipment. The location of the means necessary to disconnect all circuits 50-volts or more shall be documented and available.
- (4) Short-circuit current rating of the industrial control panel based on one of the following:
 - (5) Short-circuit current rating of a listed and labeled assembly
 - (6) Short-circuit current rating established utilizing an approved method

Informational Note: ANSI/UL 508A, *Standard for Industrial Control Panels*, Supplement SB, is an example of an approved method.

Exception to (4): Short-circuit current rating markings are not required for industrial control panels containing only control circuit components.

- (7) If the industrial control panel is intended as service equipment, it shall be marked to identify it as being suitable for use as service equipment.
- (8) Electrical wiring diagram or the identification number of a separate electrical wiring diagram or a designation referenced in a separate wiring diagram.
- (9) An enclosure type number shall be marked on the industrial control panel enclosure.

Statement of Problem and Substantiation for Public Input

The term "full-load current" for an incoming source supply circuit would or could vary with time and may warrant being accompanied by a calculation date if this is the intent of code. Because there are multiple power sources (aka supply circuits) referenced, it would appear that the intent is to include criterion for each separate circuit. If code intent is to denote the design intent for current capacity, then perhaps a different choice of terminology is warranted so as not to be confused with industry accepted definitions for full-load current. Or, if the intent is to list a singular full-load current for the industrial panel and label this value onto each supply circuit, the verbiage appears to warrant clarification to this purpose.

Submitter Information Verification

Submitter Full Name: John Blissett

Organization: Bernhard TME

Street Address:

City:

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Zip:

Submittal Date: Mon Aug 17 13:05:19 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: The wording change does not improve clarity or usability of this marking requirement, and is not consistent with other Articles in the code.

**Public Input No. 2390-NFPA 70-2020 [Section No. 409.110]****409.110 Marking.**

An industrial control panel shall be marked with ~~the following information~~ a permanent nameplate attached to the outside of the enclosure that is ~~plainly~~ visible after installation. The nameplate shall include the following information :

- (1) Manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified.
- (2) Supply voltage, number of phases, frequency, and full-load current for each incoming supply circuit.
- (3) Industrial control panels supplied by more than one electrical source where more than one disconnecting means is required to disconnect all circuits 50-volts or more within the control panel shall be marked to indicate that more than one disconnecting means is required to de-energize the equipment. The location of the means necessary to disconnect all circuits 50-volts or more shall be documented and available.
- (4) Short-circuit current rating of the industrial control panel based on one of the following:
 - (5) Short-circuit current rating of a listed and labeled assembly
 - (6) Short-circuit current rating established utilizing an approved method

Informational Note: ANSI/UL 508A, *Standard for Industrial Control Panels*, Supplement SB, is an example of an approved method.

Exception to (4): Short-circuit current rating markings are not required for industrial control panels containing only control circuit components.

- (7) If the industrial control panel is intended as service equipment, it shall be marked to identify it as being suitable for use as service equipment.
- (8) Electrical wiring diagram or the identification number of a separate electrical wiring diagram or a designation referenced in a separate wiring diagram.
- (9) An enclosure type number shall be marked on the industrial control panel enclosure.

Statement of Problem and Substantiation for Public Input

The term "plainly visible" is not defined and creates confusion as to the location of the nameplate marking. Industrial machinery is required to have this marking located on the outside of the control equipment enclosure or on the machine immediately adjacent to the enclosure per NFPA 79 16.4.1. There is no reason why industrial control panels should require the nameplate marking location to be different than industrial machinery, since it contains critical application information. Additionally, this will support ease of inspection for the critical safety related equipment ratings, such as short-circuit current ratings.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 2394-NFPA 70-2020 [Section No. 670.3(A)]	

Submitter Information Verification

Submitter Full Name: Barry Freiner

Organization: Rogers Schmidt Engineering CO., P.C.

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 18 15:26:03 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8058-NFPA 70-2020](#)

Statement: The requirements in 409.110 are being revised such that the marking be done with a permanent nameplate of sufficient durability for the environment and not be hand written, to be consistent with other areas of the code.

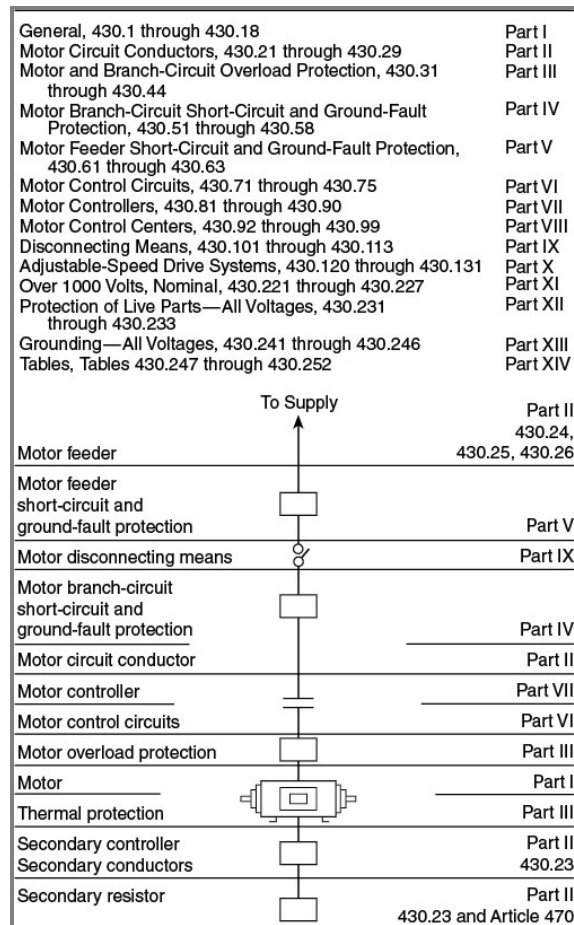


Public Input No. 167-NFPA 70-2019 [Section No. 430.1]

430.1 Scope.

This article covers motors, motor branch-circuit and feeder conductors and their protection, motor overload protection, motor control circuits, motor controllers, and motor control centers.

Figure 430.1 Article 430 Contents.



Informational Note No. 1: Installation requirements for motor control centers are covered in 110.26(E). Air-conditioning and refrigerating equipment are covered in Article 440.

Informational Note No. 2: Figure 430.1 is for information only.

Statement of Problem and Substantiation for Public Input

In 'Figure 430.1' there is essentially a 1-line diagram for a motor circuit. This diagram should say "From Supply" with the 'arrow' pointing toward the End Use Equipment. Everywhere else in the NEC the source of a circuit is the OCPD or separately derived system. In a logic diagram you go 'FROM the Supply Source' out 'TO End use equipment and devices'. In this case, the end use equipment happens to be a MOTOR, not a circuit originating from the motor.

Submitter Information Verification

Submitter Full Name: CORY LINKHART

Organization: [Not Specified]

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City:

State:

Zip:

Submittal Date: Tue Dec 03 17:40:16 EST 2019

Committee: NEC-P11

Committee Statement

Resolution: Submitter did not provide a statement on how this PI will improves safety or usability. The change would not improve clarity or readability. The arrow is shown to indicate the location of the power supply not the direction of power flow.

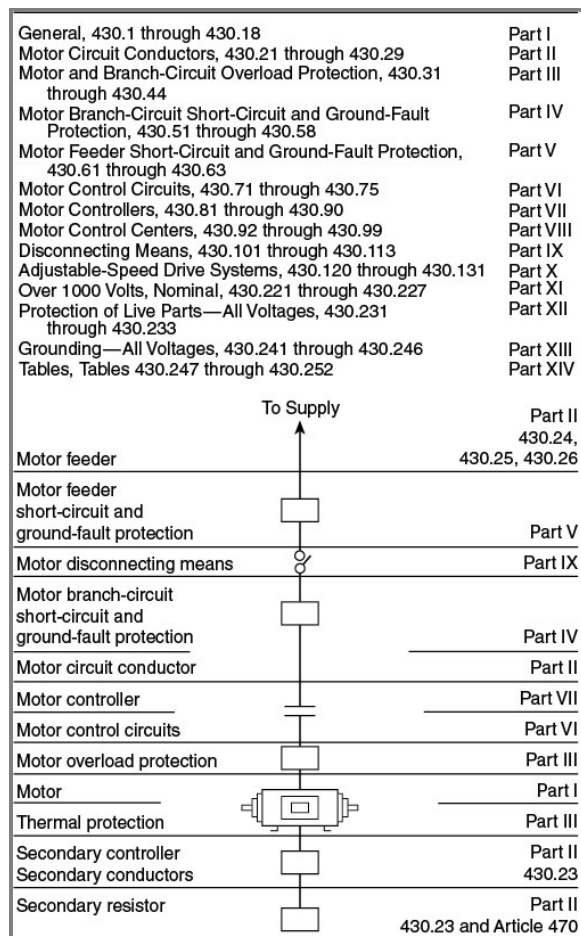


Public Input No. 2123-NFPA 70-2020 [Section No. 430.1]

430.1 Scope.

This article covers motors, motor branch-circuit and feeder conductors and their protection, motor overload protection, motor control circuits, motor controllers, and motor control centers.

Figure 430.1 Article 430 Contents.



Delete existing Figure 430.1 and insert revised Figure 430.1 here. (see attached PDF file)

Informational Note No. 1: Installation requirements for motor control centers are covered in 110.26(E). Air-conditioning and refrigerating equipment are covered in Article 440.

Informational Note No. 2: Figure 430.1 is for information only.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u> <u>Approved</u>
2023_NEC_Public_Input_Guidry_Paul_Fig_430.1.pdf	Figure 430.1

Statement of Problem and Substantiation for Public Input

Existing Figure 430.1 single line diagram has several issues that are corrected with the proposed diagram.

1. It doesn't include applicable references for motors more than 1000 Volts

2. The motor disconnecting means is in the wrong place in the circuit
3. Revised motor circuit conductors to motor branch circuit conductors
4. Added reference for motor grounding to diagram

Remainder of Figure 430.1 to remain the same

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 2120-NFPA 70-2020 [Article 100]	Definition for motor branch circuit
Public Input No. 2450-NFPA 70-2020 [New Definition after Definition: Branch Circuit, Individual.]	

Submitter Information Verification

Submitter Full Name: Paul Guidry
Organization: Fluor Enterprises, Inc.
Affiliation: Associated Builders and Contractors
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 02 09:19:09 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: [FR-8030-NFPA 70-2020](#)
Statement: Figure is revised for usability and clarity. The figure was revised to include references to grounding, MV applications, adjustable-speed drive systems, as well as other motor circuit information.

General, 430.1 through 430.18	Part I
Motor Circuit Conductors, 430.21 through 430.29	Part II
Motor and Branch-Circuit Overload Protection, 430.31 through 430.44	Part III
Motor Branch-Circuit Short-Circuit and Ground-Fault Protection, 430.51 through 430.58	Part IV
Motor Feeder Short-Circuit and Ground-Fault Protection, 430.61 through 430.63	Part V
Motor Control Circuits, 430.71 through 430.75	Part VI
Motor Controllers, 430.81 through 430.90	Part VII
Motor Control Centers, 430.92 through 430.99	Part VIII
Disconnecting Means 430.101 through 430.113	Part IX
Adjustable-Speed Drive Systems, 430.120 through 430.131	Part X
Over 1000 Volts, Nominal, 432.221 through 430.227	Part XI
Protection of Live Parts - All Voltages, 430.231 through 430.233	Part XII
Grounding - All Voltages, 430.241 through 430.246	Part XIII
Tables, Tables 430.247 through 430.252	Part XIV

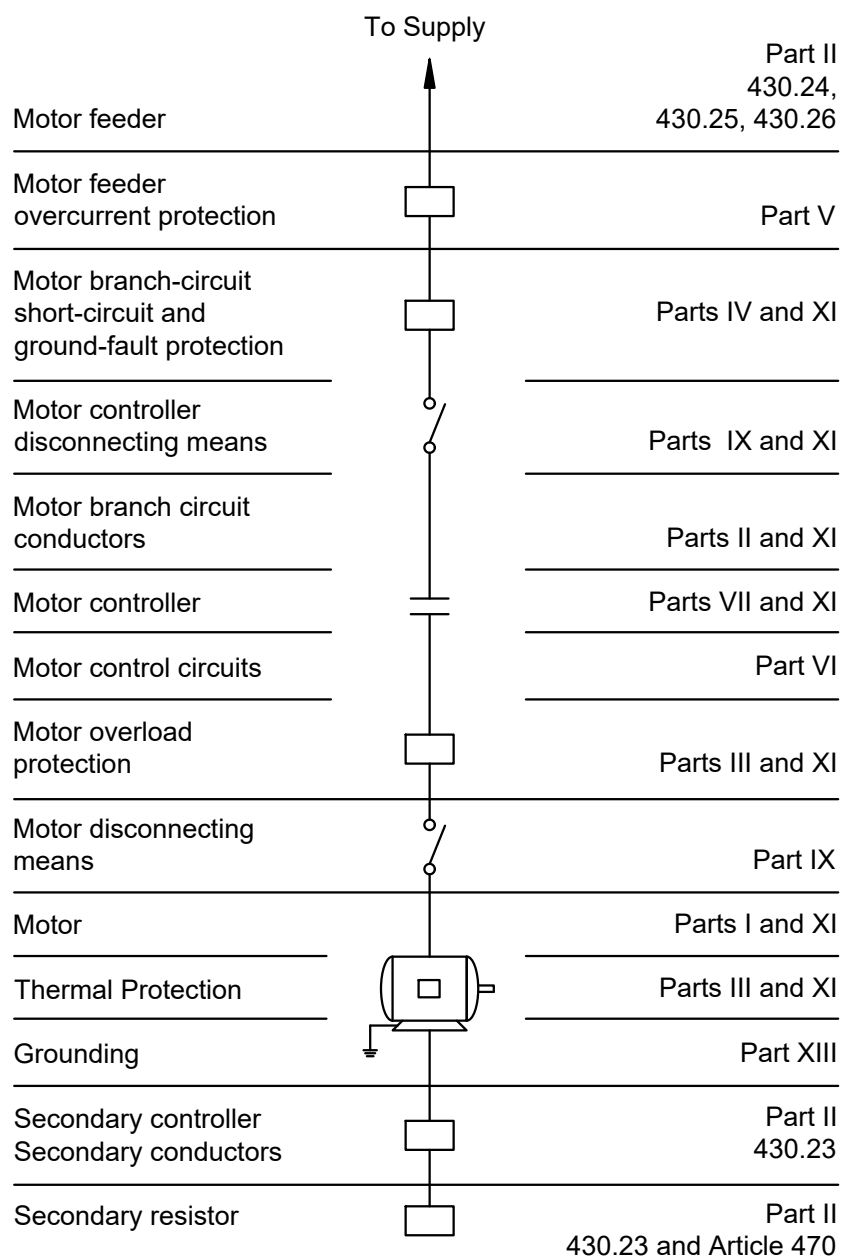


FIGURE 430.1 Article 430 Contents for Motors

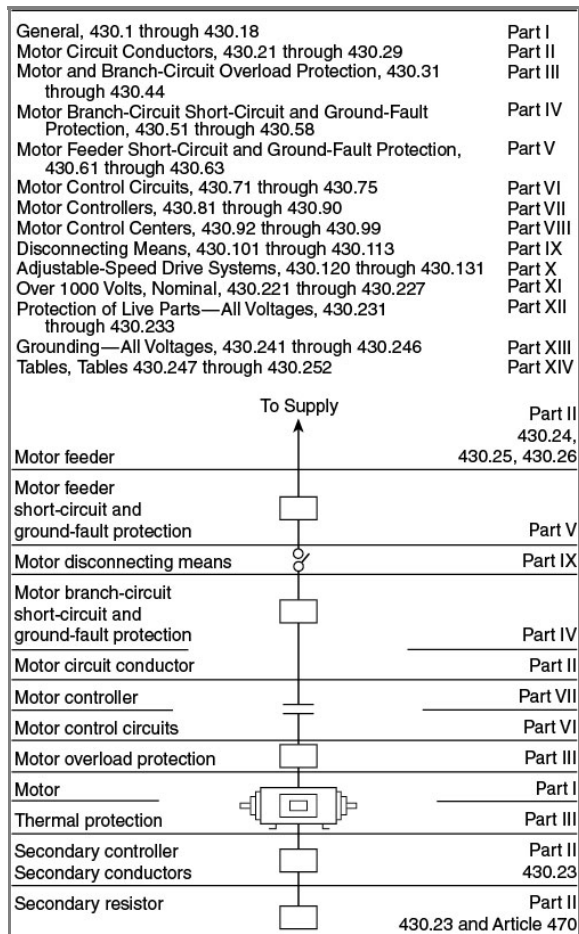


Public Input No. 3146-NFPA 70-2020 [Section No. 430.1]

430.1 Scope.

This article covers motors, motor branch-circuit and feeder conductors and their protection, motor overload protection, motor control circuits, motor controllers, and motor control centers.

Figure 430.1 Article 430 Contents.



Informational Note No. 1: Installation requirements for motor control centers are covered in 110.26(E). Air-conditioning and refrigerating equipment are covered in Article 440.

Informational Note No. 2: Figure 430.1 is for information only.

Informational Note No. 3: Additional guidance on motor supply circuits may be found in [IEEE 3004.8-2016 - Recommended Practice for Motor Protection in Industrial and Commercial Power Systems](#)

Statement of Problem and Substantiation for Public Input

This is another slice of updated content from the legacy "Red Book" IEEE 141 mapped into the new IEEE 3000 Standards Collection. From the project prospectus:

"The protection of motors used in industrial and commercial power systems is covered. It is likely to be of greatest value to the power-oriented engineer with limited experience in the area of protection and control. It can also be an aid to all engineers responsible for the electrical design of industrial and commercial power systems."

https://standards.ieee.org/standard/3004_8-2016.html

This content might also be appropriately located at the head of Part III Motor and Branch Circuit Overload Protection

Submitter Information Verification

Submitter Full Name: Michael Anthony

Organization: Standards Michigan

Affiliation: IEEE Education & Healthcare Facilities Committee

Street Address:

City:

State:

Zip:

Submittal Date: Sat Sep 05 16:24:18 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: The proposed informational note does not improve the usability of the NEC.

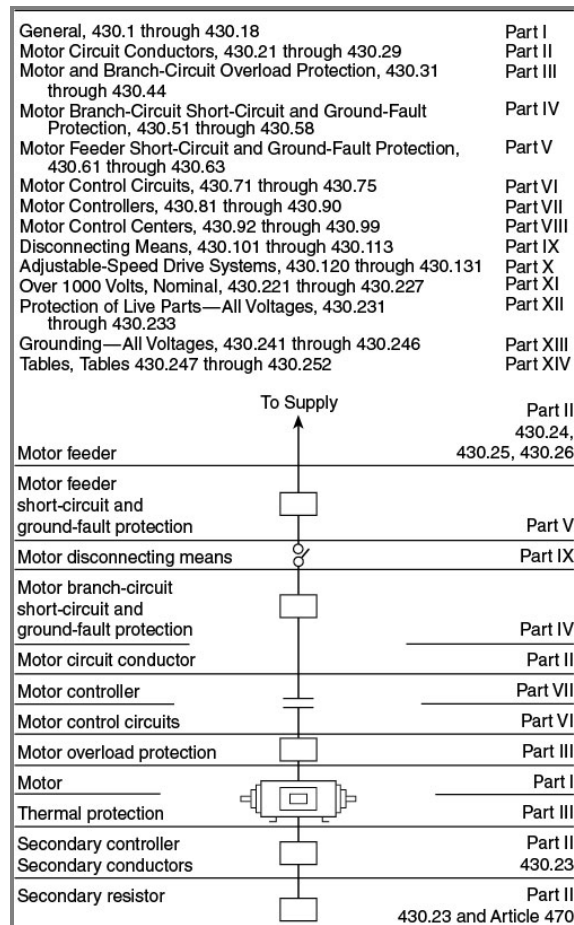


Public Input No. 3735-NFPA 70-2020 [Section No. 430.1]

430.1 Scope.

This article covers motors, motor branch-circuit and feeder conductors and their protection, motor overload protection, motor control circuits, motor controllers, and motor control centers.

Figure 430.1 Article 430 Contents.



Informational Note No. 1: Installation requirements for motor control centers are covered in 110.26(E). Air-conditioning and refrigerating equipment are covered in Article 440.

Informational Note No. 2: Figure 430.1 is for information only.

Statement of Problem and Substantiation for Public Input

This PI seeks to change the title of Article 430 to "Motors, Motor Circuits, and MOTOR Controllers." The capitalized text is my version of underlined text, because changing the title of Article 430 through Terraview would require selecting the entire article to add one word, which I assume the CMP would not appreciate. The reason for the PI is because the Code uses the term "controller" in both Article 100 and 430.2.

Submitter Information Verification

Submitter Full Name: Ryan Jackson

Organization: Ryan Jackson

Street Address:

City:

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Submittal Date: Wed Sep 09 11:32:58 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-7980-NFPA 70-2020](#)

Statement: The committee creates a definition to differentiate between a branch circuit and a motor branch circuit.

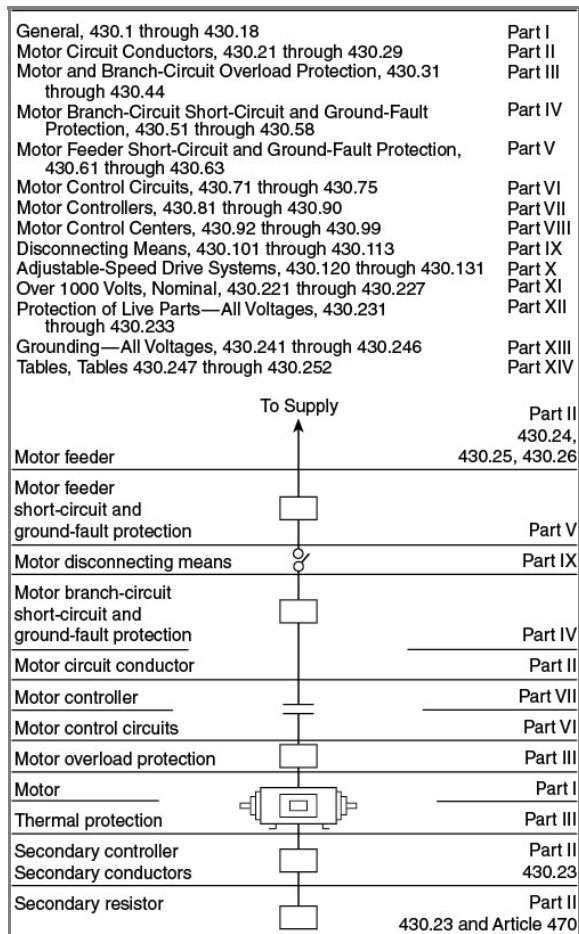


Public Input No. 4254-NFPA 70-2020 [Section No. 430.1]

430.1 Scope.

This article covers motors, motor branch-circuit and feeder conductors and their protection, motor overload protection, motor control circuits, motor controllers, and motor control centers.

Figure 430.1 Article 430 Contents.



Informational Note No. 1: - See 110.26(E) for _ Installation requirements for motor control centers- are covered in- 110.26(E) - .

Informational Note No. 2: See 440.1 for Air-conditioning and refrigerating- Refrigerating equipment- are covered in Article- 440 .

Informational Note No. -2 3 : Figure 430.1 is for information only.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(R) Style Manual prohibits references to an entire article, with the exception of Article 100. As such, it is recommended to point to the Scope Statement of the other article as shown and separate the Informational Note #1 into two informational notes, since they are separate items. In addition, the informational notes were re-ordered to comply with Section 4.1.3 of the 2020 NEC(r) Style Manual.

Submitter Information Verification

Submitter Full Name: Richard Holub

Organization: The DuPont Company, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 08:37:45 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: [FR-8030-NFPA 70-2020](#)

Statement: Figure is revised for usability and clarity. The figure was revised to include references to grounding, MV applications, adjustable-speed drive systems, as well as other motor circuit information.



Public Input No. 2627-NFPA 70-2020 [New Section after 430.2]

TITLE OF NEW CONTENT

Type your content here ...

430.3 Reconditioning of Motors. The reconditioning and marking of motors shall be performed in accordance with instructions provided by a motor manufacturer and/or in accordance with a nationally recognized standard. Motors are reconditioned when they are rebuilt or serviced and then placed in commerce. Motors are not considered reconditioned when they are repaired or rewound and not placed in commerce.

Exception: Classified (Hazardous) Motors identified for use in Class I, Division 1 (or Zone 0 or 1) locations shall not be reconditioned. Classified Motors Class I, Division 1 (Zone 0 or 1) shall be permitted to repaired or rewound in accordance with instructions provided by a motor manufacturer and in accordance with a nationally recognized standard.

Informational Note: For information pertaining to the reconditioning, repair and rewinding of motors see ANSI/EASA AR100-2020, *Recommended Practice for the Repair of Rotating Electrical Apparatus*.

Statement of Problem and Substantiation for Public Input

It is a normal practice for motors to be repaired and rewound by established refurbishing companies in accordance to a nationally recognized standard (ANSI/EASA AR100). Reconditioned motors are necessary to keep facilities running without long downtimes. Reconditioned motors are also reconditioned by established refurbishing companies in accordance to the same nationally recognized standard (ANSI/EASA AR100). The nameplate information supplied on a motor is required to ensure the proper application and should not be removed unless the original ratings or characteristics are modified. This program has been successfully in place for many years.

It is not acceptable to recondition motors Classified for Class 1, Division 1, Zone 0 and Zone 1 locations.

The proposed language is similar to the language found in 408.8 and 490.49 for Switchgear.

Free download of ANSI/EASA AR100-2020, Recommended Practice for the Repair of Rotating Electrical Apparatus is available at the following link:
<https://easa.com/DesktopModules/DnnSharp/SearchBoost/FileDownload.ashx?file=2125&sb-bhvr=1>

This Public input was developed by EASA, ABB Inc., and Nidec Motors.

Submitter Information Verification

Submitter Full Name: Thomas Bishop
Organization: Electrical Apparatus Service A
Affiliation: Electrical Apparatus Service Association
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 26 09:03:29 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: The term repair is not defined well enough to differentiate from reconditioned.



Public Input No. 3213-NFPA 70-2020 [New Section after 430.2]

430.3 Reconditioned Motors. The reconditioning of motors shall be in accordance with instructions provided by a motor manufacturer. The motor nameplate shall not be required to be removed.

Reconditioned, rewound or repaired Classified (Hazardous) Motors identified for use in Class I, Division 1 (or Zone 0 or 1) locations shall be listed as reconditioned (or certified as reconditioned).

Rewound or repaired motors shall not be defined as reconditioned and any listing mark shall not be required to be removed or made permanently illegible.

Informational Note: For information pertaining to the rewinding and repair of motors see ANSI/EASA AR100-2015, Recommended Practice for the Repair of Rotating Electrical Apparatus.

Statement of Problem and Substantiation for Public Input

This public input is submitted on behalf of the task group formed in accordance with the direction of the NFPA Standards Council in Decision D#19-11. This task group was appointed to identify potential proposed changes to the 2020 edition of the NEC in the form of proposed Tentative Interim Amendments (TIAs) or to the 2023 edition of the NEC in the form of Public Inputs (PIs) that are within the Task Group's scope of activity as specified by the Standards Council.

These proposed Public Inputs relate to requirements covering the use of reconditioned electrical equipment throughout the NEC as a coordinated set of new or revised requirements. These Public Inputs should not be misconstrued by the CMPs as precluding equal consideration of other Public Inputs, with supporting information, submitted now or in the future by individuals.

The task group members are: G. Scott Harding (Chair), Tom Bishop, Casey Blevins, John Catlett, Dave Dagenais, James Dollard, Robert Fahey, Paul Grein, Howard Herndon, David Hittinger, Christel Hunter, Bob Jordan, David Kendall, Dave King, Jack Lyons, Ryan McClarnon, Robert Osborne, Chris Paxton, David Rosenfield, Michael Savage, Bill Schofield and Ron Widup. This task group of balanced interests provided the expertise to develop these public inputs. Multiple sub task groups were set up during the process with the results of the sub task group work shared with and voted on by the full task group.

Public Inputs are being submitted as follows:

- Revised to Article 100 definition of Reconditioned
- Revisions to Sections 110.21(A)(2), 240.88 and 210.15(3)
- New requirements/Sections 110.17, 110.20, 430.3 and 445.3

New Section 430.3

It is a normal practice for motors to be repaired and rewound by established service centers. Said repairs are accomplished in accordance with manufacturer's instructions and/or to the nationally recognized standard (ANSI/EASA AR100). Rewound or repaired motors are necessary to keep facilities running without long downtimes. The original nameplate information supplied on a motor is required to ensure the proper application and should not be removed unless the original ratings or characteristics are modified. This process for repairs has been successfully in place for many years.

Classified motors used in Class I, Division 1 (Zone 0 and Zone 1) locations are permitted to be reconditioned when recertified.

A free download of ANSI/EASA AR100-2015, Recommended Practice for the Repair of Rotating Electrical Apparatus is available to the public at the following link:
<https://easa.com/Resources/Resource-library/ansieasa-standard-ar100-2015-recommended-practice-for-the-repair-of-rotating-electrical-apparatus-1>

Note to NFPA Staff: ANSI/EASA AR100-2015 is the current edition of this standard. EASA is finalizing the

ANSI procedure for AR100 and it will be published as ANSI/EASA AR100-2020 in 2020, prior to the publication of the 2023 NEC and will be confirmed in the comment period.

Submitter Information Verification

Submitter Full Name: G. Scott Harding

Organization: F. B. Harding, Inc.

Affiliation: Independent Electrical Contractors

Street Address:

City:

State:

Zip:

Submittal Date: Sun Sep 06 18:43:08 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: The term repair is not defined well enough to differentiate from reconditioned.



Public Input No. 3631-NFPA 70-2020 [Section No. 430.2]

(Relocate all definitions in the 430.2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

430.2 Definitions.

The definitions in this section shall apply only within this article.

Controller.

Any switch or device that is normally used to start and stop a motor by making and breaking the motor circuit current.

Electronically Protected (as applied to motors).

A motor that is provided with electronic control that is an integral part of the motor and protects the motor against dangerous overheating due to failure of the electronic control, overload and failure to start.

Part-Winding Motors.

A part-winding start induction or synchronous motor is one that is arranged for starting by first energizing part of its primary (armature) winding and, subsequently, energizing the remainder of this winding in one or more steps. A standard part-winding start induction motor is arranged so that one-half of its primary winding can be energized initially, and, subsequently, the remaining half can be energized, both halves then carrying equal current.

Informational Note: A hermetic refrigerant motor-compressor is not considered a standard part-winding start induction motor.

System Isolation Equipment.

A redundantly monitored, remotely operated contactor-isolating system, packaged to provide the disconnection/isolation function, capable of verifiable operation from multiple remote locations by means of lockout switches, each having the capability of being padlocked in the "off" (open) position.

Valve Actuator Motor (VAM) Assemblies.

A manufactured assembly, used to operate a valve, consisting of an actuator motor and other components such as controllers, torque switches, limit switches, and overload protection.

Informational Note: VAMs typically have short-time duty and high-torque characteristics.

Statement of Problem and Substantiation for Public Input

"The National Electrical Code has definitions in multiple parts in Article 100 and many definitions scattered through out the code many of them in the .2 section of the articles.

Most of the other standards under NFPA have their definitions in one location and this will allow the NEC the same requirement. The revisions to the NEC Style Manual require all the definitions to be relocated to Article 100.

Submitter Information Verification

Submitter Full Name: David Williams

Organization: Delta Charter Township

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 09 09:52:52 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-7978-NFPA 70-2020](#)

Statement: Relocating definitions in accordance with the manual of style.



Public Input No. 2121-NFPA 70-2020 [Definition: Controller.]

Controller, Motor .

~~Any switch-~~ A switch or other device(s) that is normally used to control the speed, or start and stop a motor by making and breaking opening and closing the motor branch circuit. Motor controllers are part of the motor circuit-current, branch circuit and may include a motor overload protection device.

Informational Note No. 1: See definition of Motor Branch Circuit in Article 100.

Informational Note. No. 2: Motor controllers may be a separately derived system, such as an adjustable speed drive with integral overcurrent and overload protection.

Statement of Problem and Substantiation for Public Input

During the 2020 cycle, it was brought to light that the motor branch circuit includes the controller, even in cases where the controller is an adjustable speed drive.

The addition of the term "Motor" to "Controller" will differentiate the term "Controller" in Art. 100.

This is a companion proposal to a proposed new definition for a "motor branch circuit" in Art. 100.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 2120-NFPA 70-2020 [Article 100]</u>	Motor Branch Circuit
<u>Public Input No. 2120-NFPA 70-2020 [Article 100]</u>	

Submitter Information Verification

Submitter Full Name: Paul Guidry
Organization: Fluor Enterprises, Inc.
Affiliation: Associated Builders and Contractors
Street Address:
City:
State:
Zip:
Submission Date: Sun Aug 02 06:12:47 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: FR-7980-NFPA 70-2020

Statement: The committee creates a definition to differentiate between a branch circuit and a motor branch circuit.



Public Input No. 2991-NFPA 70-2020 [Section No. 430.5]

430.5 Other Articles.

Motors and controllers shall also comply with the applicable provisions of Table 430.5.

Table 430.5 Other Articles

<u>Equipment/Occupancy</u>	<u>Article</u>	<u>Section</u>
Air-conditioning and refrigerating equipment	440	-
Capacitors	-	460.8, 460.9
Commercial garages; aircraft hangars; motor fuel dispensing facilities; bulk storage plants; spray application, dipping, and coating processes; and inhalation anesthetizing locations	511, 513, 514, 515, 516, and 517 Part IV	-
Cranes and hoists	610	-
Electrically driven or controlled irrigation machines	675	-
Elevators, dumbwaiters, escalators, moving walks, wheelchair lifts, and stairway chair lifts	620	-
Fire pumps	695 <u>703</u>	-
Hazardous (classified) locations	500–503, 505, and 506	-
Industrial machinery	670	-
Motion picture projectors	-	540.11 and 540.20
Motion picture and television studios and similar locations	530	-
Resistors and reactors	470	-
Theaters, audience areas of motion picture and television studios, and similar locations	-	520.48
Transformers and transformer vaults	450	-

Statement of Problem and Substantiation for Public Input

This public input was prepared by the correlating committee task group focused on alternative energy requirements. This task group consisted of the following members: Derrick Atkins (CMP 5), Greg Ball (CMP 13) Ken Boyce (CMP 1), Bill Brooks (CMP 4), Bruce Campbell, Thomas Domitrovich (CMP 2, CMP 10), Jason Fisher (CMP 4), Scott Harding (CMP 5), Pete Jackson (CMP 8), David Kendall (CMP 8, CC), Chad Kennedy (CMP 13), Christine Porter (CMP 5, CC), Timothy Windey (CMP 13). This change aligns with an effort to re-organize the alternative energy sources NEC Articles into a series of articles closely located together. This reorganization places all sources alternate sources as follows: 689 On-Site Energy Sources 690 Solar Photovoltaic (PV) Systems 691 Large-Scale Photovoltaic (PV) Systems 692 Fuel Cell Systems 693 Generators 694 Wind Electric Systems 695 Energy Storage Systems 696 Storage Batteries This public input aligns with changes that move 695 to 703. This input supports this effort and to better align with the fact that this Article is closely related to emergency systems. The requirements of this new 703 focus on more than just a fire pump and arguably more so focuses on fire pump systems which is closely aligned with Chapter 7 of the NEC. This move makes way for alignment of alternative energy sources article arrangement. These articles are closely related to each other and this change is in alignment with the direction by the correlating committee to review alternative energy sources for conflicts and usability. This new alignment will create a similar structure as that found for hazardous locations. The new Article 689 is the a combination of Articles 705, 710 and 712 and will act to be the new general requirements for this series of alternative energy sources.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 2987-NFPA 70-2020 [Article 695]</u>	Moving 695 to 703

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich

Organization: Eaton Corporation

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 03 19:44:15 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: Article 703 does not exist so the move cannot be made. CMP 11 would revisit this change if Article 695 is moved to Article 703.



Public Input No. 4668-NFPA 70-2020 [Section No. 430.6(A)]

(A) General Motor Applications.

For general motor applications, current ratings shall be determined based on 430.6(A)(1) and (A)(2).

(1) Table Values.

Other than for motors built for low speeds (less than 1200 RPM) or high torques, and for multispeed motors, the values given in Table 430.247, Table 430.248, Table 430.249, and Table 430.250 shall be used instead of the actual current rating marked on the motor nameplate to determine the ampacity of conductors or ampere ratings of switches, following:

(1) Ampacity of conductors

(2) Ampere ratings of switches

(3) Ampere ratings of branch-circuit short-circuit and ground-fault protection, instead of the actual current rating marked on the motor nameplate.

Where a motor is marked in amperes, but not horsepower, the horsepower rating shall be assumed to be that corresponding to the value given in Table 430.247, Table 430.248, Table 430.249, and Table 430.250, interpolated if necessary. ~~Motors built for low speeds (less than 1200 RPM) or high torques may have higher full-load currents, and multispeed motors will have full-load current varying with speed, in which case the nameplate current ratings shall be used.~~

Exception No. 1: Multispeed motors shall be in accordance with 430.22(B) and 430.52.

Exception No. 2: For equipment that employs a shaded-pole or permanent-split capacitor-type fan or blower motor that is marked with the motor type, the full load current for such motor marked on the nameplate of the equipment in which the fan or blower motor is employed shall be used instead of the horsepower rating to determine the ampacity or rating of the disconnecting means, the branch-circuit conductors, the controller, the branch-circuit short-circuit and ground-fault protection, and the separate overload protection. This marking on the equipment nameplate shall not be less than the current marked on the fan or blower motor nameplate.

Exception No. 3: For a listed motor-operated appliance that is marked with both motor horsepower and full-load current, the motor full-load current marked on the nameplate of the appliance shall be used instead of the horsepower rating on the appliance nameplate to determine the ampacity or rating of the disconnecting means, the branch-circuit conductors, the controller, the branch-circuit short-circuit and ground-fault protection, and any separate overload protection.

(2) Nameplate Values. The motor nameplate current ratings shall be used to determine the values for (2)(a) and (2)(b).

(a) Separate motor overload protection

~~shall be based on the motor nameplate current rating.~~

:

(b) For motors built for low speeds (less than 1200 RPM), high torques, or multispeed motors:

(1) Ampacity of conductors

(2) Ampere ratings of switches

(3) Ampere ratings of branch-circuit short-circuit and ground-fault protection.

Statement of Problem and Substantiation for Public Input

The existing language has some grammatical errors making it difficult to read. Also, (A)(1) is titled Table Values, but then spends a fair amount of time instructing the reader to use the nameplate values for high torque and low speed motors. Since (A)(2) addresses nameplate values that information is relocated there. This PI also re-configures this material into a list format for improved readability and clarity.

Submitter Information Verification

Submitter Full Name: Jebediah Novak

Organization: Cedar Rapids Electrical JATC

Affiliation: IBEW Local #405

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 10 16:36:18 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-7986-NFPA 70-2020](#)

Statement: The committee revised the section into a list format to improve the clarity and usability.

The Panel has added an additional section (2)(C) to include information on motors of such size that their ampacities are outside what is included in the tables found in Part XIV. Changes were made from “controller” to “motor controller” and revised the informational notes to align with the global PI request to make complete sentences.

**Public Input No. 99-NFPA 70-2019 [Section No. 430.6(A)(1)]****(1)_ Table Values.**

Other than for motors built for low speeds (less than 1200 RPM) or high torques, and for multispeed motors, the values given in Table 430.247, Table 430.248, Table 430.249, and Table 430.250 shall be used to determine the ampacity of conductors or ampere ratings of switches, branch-circuit short-circuit and ground-fault protection, instead of the actual current rating marked on the motor nameplate. Where a motor is marked in amperes, but not horsepower, the horsepower rating shall be assumed to be that corresponding to the value given in Table 430.247, Table 430.248, Table 430.249, and Table 430.250, interpolated if necessary. Motors- Motor nameplate kilowatt ratings shall not be used to determine conductor ampacity. Motors built for low speeds (less than 1200 RPM) or high torques may have higher full-load currents, and multispeed motors will have full-load current varying with speed, in which case the nameplate current ratings shall be used.

Exception No. 1: Multispeed motors shall be in accordance with 430.22(B) and 430.52.

Exception No. 2: For equipment that employs a shaded-pole or permanent-split capacitor-type fan or blower motor that is marked with the motor type, the full load current for such motor marked on the nameplate of the equipment in which the fan or blower motor is employed shall be used instead of the horsepower rating to determine the ampacity or rating of the disconnecting means, the branch-circuit conductors, the controller, the branch-circuit short-circuit and ground-fault protection, and the separate overload protection. This marking on the equipment nameplate shall not be less than the current marked on the fan or blower motor nameplate.

Exception No. 3: For a listed motor-operated appliance that is marked with both motor horsepower and full-load current, the motor full-load current marked on the nameplate of the appliance shall be used instead of the horsepower rating on the appliance nameplate to determine the ampacity or rating of the disconnecting means, the branch-circuit conductors, the controller, the branch-circuit short-circuit and ground-fault protection, and any separate overload protection.

Statement of Problem and Substantiation for Public Input

Foreign equipment manufactured outside the U.S., not compliant with U.S. product standards, and purchased to be used in the U.S., continues to become a source of conflict. Some ANSI/NEMA induction motors rated in kW, such as those found in VAMs, are covered by 430.6(D) with specific criteria which must be complied with. Art. 430 is based on ANSI/NEMA horsepower ratings and the Table ampacities for disconnecting means, switches, contactors, starters, motor branch-circuit short-circuit and ground-fault protective devices, etc.

In lieu of accepting this proposal, I recommend the NFPA Standards Council and the NEC Correlating Committee assign a task group to undertake a Code-wide change to address this issue. As ANSI/NEMA and foreign made equipment and standards continue to merge, it will be necessary at some point to address this issue with Art. 430 and 440 on a much larger scale as it makes sense to standardize globally on motor equipment ratings.

Submitter Information Verification

Submitter Full Name: Paul Guidry

Organization: Fluor Enterprises, Inc.

Affiliation: Associated Builders and Contractors

Street Address:

City:

State:

Zip:

Submittal Date: Tue Nov 12 16:20:28 EST 2019

Committee: NEC-P11

Committee Statement

Resolution: This wording will not fix the issue being addressed. It does not have requirements to solve the identified problem or add clarity to the sentence.



Public Input No. 4259-NFPA 70-2020 [Section No. 430.6 [Excluding any Sub-Sections]]

The size of conductors supplying equipment covered by ~~Article 430 - this article~~ shall be selected from the ampacity tables in accordance with 310.15 or shall be calculated in accordance with 310.14(B). Where flexible cord is used, the size of the conductor shall be selected in accordance with 400.5. The required ampacity and motor ratings shall be determined as specified in 430.6(A), (B), (C), and (D).

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(R) Style Manual prohibits references to an entire article, with the exception of Article 100. As such, it is recommended to revise the test to "this article" to comply.

Submitter Information Verification

Submitter Full Name: Richard Holub
Organization: The DuPont Company, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 08:43:45 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: [FR-7986-NFPA 70-2020](#)

Statement: The committee revised the section into a list format to improve the clarity and usability.

The Panel has added an additional section (2)(C) to include information on motors of such size that their ampacities are outside what is included in the tables found in Part XIV. Changes were made from "controller" to "motor controller" and revised the informational notes to align with the global PI request to make complete sentences.

**Public Input No. 3096-NFPA 70-2020 [Section No. 430.7]****430.7 Marking on Motors and Multimotor Equipment.****(A) Usual Motor Applications.**

A motor shall be marked with the following information:

- (1) Manufacturer's name.
- (2) Rated volts and full-load current. For a multispeed motor, full-load current for each speed, except shaded-pole and permanent-split capacitor motors where amperes are required only for maximum speed.
- (3) Rated frequency and number of phases if an ac motor.
- (4) Rated full-load speed.
- (5) Rated temperature rise or the insulation system class and rated ambient temperature.
- (6) Time rating. The time rating shall be 5, 15, 30, or 60 minutes, or continuous.
- (7) Rated horsepower if $\frac{1}{8}$ hp or more. For a multispeed motor $\frac{1}{8}$ hp or more, rated horsepower for each speed, except shaded-pole and permanent-split capacitor motors $\frac{1}{8}$ hp or more where rated horsepower is required only for maximum speed. Motors of arc welders are not required to be marked with the horsepower rating.
- (8) Code letter or locked-rotor amperes if an alternating-current motor rated $\frac{1}{2}$ hp or more. On polyphase wound-rotor motors, the code letter shall be omitted.

Informational Note: See 430.7(B).

- (9) Design letter for design A, B, C, or D motors.

Informational Note: Motor design letter definitions are found in ANSI/NEMA MG 1-1993 2016 , *Motors and Generators, Part 1, Definitions*, and in IEEE 100-1996, *Standard Dictionary of Electrical and Electronic Terms* .

- (10) Secondary volts and full-load current if a wound-rotor induction motor.
- (11) Field current and voltage for dc excited synchronous motors.
- (12) Winding — straight shunt, stabilized shunt, compound, or series, if a dc motor. Fractional horsepower dc motors 175 mm (7 in.) or less in diameter shall not be required to be marked.
- (13) A motor provided with a thermal protector complying with 430.32(A)(2) or (B)(2) shall be marked "thermally protected." Thermally protected motors rated 100 watts or less and complying with 430.32(B)(2) shall be permitted to use the abbreviated marking "T.P."
- (14) A motor complying with 430.32(B)(4) shall be marked "impedance protected." Impedance-protected motors rated 100 watts or less and complying with 430.32(B)(4) shall be permitted to use the abbreviated marking "Z.P."
- (15) Motors equipped with electrically powered condensation prevention heaters shall be marked with the rated heater voltage, number of phases, and the rated power in watts.
- (16) Motors that are electronically protected from overloads in accordance with 430.32(A)(2) and (B)(2) shall be marked "electronically protected" or "E.P."

(B) Locked-Rotor Indicating Code Letters.

Code letters marked on motor nameplates to show motor input with locked rotor shall be in accordance with Table 430.7(B).

The code letter indicating motor input with locked rotor shall be in an individual block on the nameplate, properly designated.

Table 430.7(B) Locked-Rotor Indicating Code Letters

<u>Code Letter</u>	<u>Kilovolt-Amperes per Horsepower with Locked Rotor</u>
A	0–3.14
B	3.15–3.54
C	3.55–3.99
D	4.0–4.49
E	4.5–4.99
F	5.0–5.59
G	5.6–6.29
H	6.3–7.09
J	7.1–7.99
K	8.0–8.99
L	9.0–9.99
M	10.0–11.19
N	11.2–12.49
P	12.5–13.99
R	14.0–15.99
S	16.0–17.99
T	18.0–19.99
U	20.0–22.39
V	22.4 and up

(1) Multispeed Motors.

Multispeed motors shall be marked with the code letter designating the locked-rotor kilovolt-ampere (kVA) per horsepower (hp) for the highest speed at which the motor can be started.

Exception: Constant horsepower multispeed motors shall be marked with the code letter giving the highest locked-rotor kilovolt-ampere (kVA) per horsepower (hp).

(2) Single-Speed Motors.

Single-speed motors starting on wye connection and running on delta connections shall be marked with a code letter corresponding to the locked-rotor kilovolt-ampere (kVA) per horsepower (hp) for the wye connection.

(3) Dual-Voltage Motors.

Dual-voltage motors that have a different locked-rotor kilovolt-ampere (kVA) per horsepower (hp) on the two voltages shall be marked with the code letter for the voltage giving the highest locked-rotor kilovolt-ampere (kVA) per horsepower (hp).

(4) 50/60 Hz Motors.

Motors with 50- and 60-Hz ratings shall be marked with a code letter designating the locked-rotor kilovolt-ampere (kVA) per horsepower (hp) on 60 Hz.

(5) Part-Winding Motors.

Part-winding start motors shall be marked with a code letter designating the locked-rotor kilovolt-ampere (kVA) per horsepower (hp) that is based on the locked-rotor current for the full winding of the motor.

(C) Torque Motors.

Torque motors are rated for operation at standstill and shall be marked in accordance with 430.7(A), except that locked-rotor torque shall replace horsepower.

(D) Multimotor and Combination-Load Equipment.**(1) Factory-Wired.**

Multimotor and combination-load equipment shall be provided with a visible nameplate marked with the manufacturer's name, the rating in volts, frequency, number of phases, minimum supply circuit conductor ampacity, and the maximum ampere rating of the circuit short-circuit and ground-fault protective device. The conductor ampacity shall be calculated in accordance with 430.24 and counting all of the motors and other loads that will be operated at the same time. The short-circuit and ground-fault protective device rating shall not exceed the value calculated in accordance with 430.53. Multimotor equipment for use on two or more circuits shall be marked with the preceding information for each circuit.

(2) Not Factory-Wired.

Where the equipment is not factory-wired and the individual nameplates of motors and other loads are visible after assembly of the equipment, the individual nameplates shall be permitted to serve as the required marking.

Statement of Problem and Substantiation for Public Input

This proposal harmonizes with the marking requirements in ANSI/NEMA MG 1-2016. The design A marking communicates that, among other things, there is no maximum value of locked-rotor current specified in ANSI/NEMA MG 1-2016 and that this maximum value must instead be determined from the manufacturer supplied marking of code letter or locked-rotor amperes that is required by 430.7(A)(8). IEEE 100-1996 is proposed to be removed from the Informational Note since that standard has been withdrawn.

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Fri Sep 04 15:17:04 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: FR-8031-NFPA 70-2020

Statement: Revisions made to add motor design letter A to the nameplate to increase the information to the user. Informational note revised to reference the most current revision of NEMA MG1 and the withdrawal of IEEE 100 since it is no longer active.



Public Input No. 3020-NFPA 70-2020 [Section No. 430.7(A)]

(A) Usual Motor Applications.

A motor shall be marked with the following information:

- (1) Manufacturer's name.
- (2) Rated volts and full-load current. For a multispeed motor, full-load current for each speed, except shaded-pole and permanent-split capacitor motors where amperes are required only for maximum speed.
- (3) Rated frequency and number of phases if an ac motor.
- (4) Rated full-load speed.
- (5) Rated temperature rise or the insulation system class and rated ambient temperature.
- (6) Time rating. The time rating shall be 5, 15, 30, or 60 minutes, or continuous.
- (7) ~~Rated horsepower if~~ Power rating in horsepower or kilowatts if $\frac{1}{8}$ hp or more. For a multispeed motor $\frac{1}{8}$ hp or more, ~~rated horsepower~~ power for each speed, except shaded-pole and permanent-split capacitor motors $\frac{1}{8}$ hp or more where rated horsepower or kilowatts is required only for maximum speed. Motors of arc welders are not required to be marked with the ~~horsepower~~ a power rating.
- (8) Code letter or locked-rotor amperes if an alternating-current motor rated $\frac{1}{2}$ hp or more. On polyphase wound-rotor motors, the code letter shall be omitted.

Informational Note: See 430.7(B).

- (9) Design letter for design B, C, or D motors.

Informational Note: Motor design letter definitions are found in ANSI/NEMA MG 1-1993, *Motors and Generators, Part 1, Definitions*, and in IEEE 100-1996, *Standard Dictionary of Electrical and Electronic Terms*.

- (10) Secondary volts and full-load current if a wound-rotor induction motor.
- (11) Field current and voltage for dc excited synchronous motors.
- (12) Winding — straight shunt, stabilized shunt, compound, or series, if a dc motor. Fractional horsepower dc motors 175 mm (7 in.) or less in diameter shall not be required to be marked.
- (13) A motor provided with a thermal protector complying with 430.32(A)(2) or (B)(2) shall be marked "thermally protected." Thermally protected motors rated 100 watts or less and complying with 430.32(B)(2) shall be permitted to use the abbreviated marking "T.P."
- (14) A motor complying with 430.32(B)(4) shall be marked "impedance protected." Impedance-protected motors rated 100 watts or less and complying with 430.32(B)(4) shall be permitted to use the abbreviated marking "Z.P."
- (15) Motors equipped with electrically powered condensation prevention heaters shall be marked with the rated heater voltage, number of phases, and the rated power in watts.
- (16) Motors that are electronically protected from overloads in accordance with 430.32(A)(2) and (B)(2) shall be marked "electronically protected" or "E.P."

Statement of Problem and Substantiation for Public Input

Some motors and motor controllers are rated in kilowatts. Allow equipment to be marked in horsepower or kilowatts or both. Some product standards allow the motor to be rated in kilowatts.

Submitter Information Verification

Submitter Full Name: Jeffrey Blain

Organization: Edgett Williams Consulting Group

Affiliation: National Elevator Industry Inc.

Street Address:

City:

State:

Zip:

Submittal Date: Fri Sep 04 08:45:26 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: The submitter does not provide specific information on where KW is supplied in marking for a product safety standard. Several product groups require HP ratings not KW ratings. The code addresses with the interpolation as necessary in 430.6(A)(1).



Public Input No. 393-NFPA 70-2020 [Section No. 430.8]

430.8 Marking on Controllers.

A controller shall be marked with the manufacturer's name or identification, the voltage, the current or horsepower rating, the short-circuit current rating, and other necessary data to properly indicate the applications for which it is suitable. A controller shall not be installed where the available fault current exceeds its marked short-circuit current rating.

Exception No. 1: The short-circuit current rating is not required for controllers applied in accordance with 430.81(A) or (B).

Exception No. 2: The short-circuit current rating is not required to be marked on the controller when the short-circuit current rating of the controller is marked elsewhere on the assembly.

Exception No. 3: The short-circuit current rating is not required to be marked on the controller when the assembly into which it is installed has a marked short-circuit current rating.

Exception No. 4: Short-circuit current ratings are not required for controllers rated less than 2 hp at 300 V or less and listed exclusively for general-purpose branch circuits.

A controller that includes motor overload protection suitable for group motor application shall be marked with the motor overload protection and the maximum branch-circuit short-circuit and ground-fault protection for such applications.

Combination controllers that employ adjustable instantaneous trip circuit breakers shall be clearly marked to indicate the ampere settings of the adjustable trip element.

Where a controller is built in as an integral part of a motor or of a motor-generator set, individual marking of the controller shall not be required if the necessary data are on the nameplate. For controllers that are an integral part of equipment approved as a unit, the above marking shall be permitted on the equipment nameplate.

Informational Note: See 110.10 for information on circuit impedance and other characteristics.

Statement of Problem and Substantiation for Public Input

The proposed revision adds the term "current" so that the term "short-circuit current rating" is used consistently.

In addition, text has been added to require the controller short-circuit current rating to be adequate for the available fault current similar to requirements for other types of equipment.

Submitter Information Verification

Submitter Full Name: Daniel Neeser

Organization: Eaton's Bussmann Division

Street Address:

City:

State:

Zip:

Submission Date: Fri Jan 31 17:00:38 EST 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-7988-NFPA 70-2020](#)

Statement: The change proposed for the marking is an installation comment and does not belong in this section. The addition of “current” to the exceptions correlates with the defined term in Article 100.



Public Input No. 4069-NFPA 70-2020 [Section No. 430.10(B)]

(B) Wire-Bending Space in Enclosures.

Minimum wire-bending space within the enclosures for motor controllers shall be in accordance with Table 430.10(B) where measured in a straight line from the end of the lug or wire connector (in the direction the wire leaves the terminal) to the wall or barrier. Where alternate wire termination means are substituted for that supplied by the manufacturer of the controller, they shall be of a type identified by the manufacturer for use with the controller and shall not reduce the minimum wire-bending space.

Table 430.10(B) Minimum Wire-Bending Space at the Terminals of Enclosed Motor Controllers

<u>Size of Wire (AWG or kcmil)</u>	<u>Wires per Terminal</u> *				
	<u>1</u>		-	<u>2</u>	
	<u>mm</u>	<u>in.</u>		<u>mm</u>	<u>in.</u>
10 and smaller	Not specified		-	—	—
8–6	38	1½	-	—	—
4–3	50	2	-	—	—
2	65	2½	-	—	—
1	75	3	-	—	—
1/0	125	5	-	125	5
2/0	150	6	-	150	6
3/0–4/0	175	7	-	175	7
250	200	8	-	200	8
300	250	10	-	250	10
350–500	300	12	-	300	12
600–700	350	14	-	400	16
750–900	450	18	-	475	19

*Where provision for three or more wires per terminal exists, the minimum wire-bending space shall be in accordance ~~with the requirements of~~ with Article 312.

Statement of Problem and Substantiation for Public Input

Deleting the words "the requirements of" does not change the meaning of the section.

Submitter Information Verification

Submitter Full Name: David Williams

Organization: Delta Charter Township

Street Address:

City:

State:

Zip:

Submission Date: Wed Sep 09 19:51:23 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: The changes proposed does not identify a problem or provide adequate substantiation for the change.



Public Input No. 4262-NFPA 70-2020 [Section No. 430.10(B)]

(B) Wire-Bending Space in Enclosures.

Minimum wire-bending space within the enclosures for motor controllers shall be in accordance with Table 430.10(B) where measured in a straight line from the end of the lug or wire connector (in the direction the wire leaves the terminal) to the wall or barrier. Where alternate wire termination means are substituted for that supplied by the manufacturer of the controller, they shall be of a type identified by the manufacturer for use with the controller and shall not reduce the minimum wire-bending space.

Table 430.10(B) Minimum Wire-Bending Space at the Terminals of Enclosed Motor Controllers

<u>Size of Wire (AWG or kcmil)</u>	<u>Wires per Terminal</u> *				
	<u>1</u>		-	<u>2</u>	
	<u>mm</u>	<u>in.</u>		<u>mm</u>	<u>in.</u>
10 and smaller	Not specified		-	—	—
8–6	38	1½	-	—	—
4–3	50	2	-	—	—
2	65	2½	-	—	—
1	75	3	-	—	—
1/0	125	5	-	125	5
2/0	150	6	-	150	6
3/0–4/0	175	7	-	175	7
250	200	8	-	200	8
300	250	10	-	250	10
350–500	300	12	-	300	12
600–700	350	14	-	400	16
750–900	450	18	-	475	19

*Where provision for three or more wires per terminal exists, the minimum wire-bending space shall be in accordance with the requirements of ~~Article~~ 312.6(B).

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(R) Style Manual prohibits references to an entire article, with the exception of Article 100. As the wire-bending space requirements are found in 312.6(B), it is recommended to point to the specific section to comply.

Submitter Information Verification

Submitter Full Name: Richard Holub

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Submittal Date: Thu Sep 10 08:45:20 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-7991-NFPA 70-2020](#)

Statement: Revisions are made for compliance with Section 4.1.4 of the NEC Style Manual. The controller definition has been updated changing "controller" to "motor controller".



Public Input No. 3398-NFPA 70-2020 [New Section after 430.18]

430.19 Reconditioning of Equipment.

Reconditioning of equipment within the scope of this article shall be limited as described in 430.19(A) and (B). The reconditioning process shall use design qualified parts verified under applicable standards and be performed in accordance with any instructions provided by the manufacturer. If equipment has been damaged by fire, products of combustion, or water, it shall be specifically evaluated by its manufacturer or a qualified testing laboratory prior to being returned to service.

430.19(A) Shall not be permitted to be reconditioned. Replacement of listed components or accessories are not considered reconditioning.

- Adjustable Speed Drives
- Relays (Overload, Electronic, and Digital)

430.19 (B) Shall be permitted to be reconditioned. Reconditioned equipment shall be field labeled as *reconditioned* , and previously applied listing marks, if any, within the portions reconditioned shall be removed.

- Motor Control Centers

Additional Proposed Changes

<u>File Name</u>	<u>Description</u> <u>Approved</u>
NEMA_Position_on_Refurbishing_Electrical_Equipment.pdf	NEMA Paper

Statement of Problem and Substantiation for Public Input

The addition of a section into article 430 covering reconditioning is essential to the inclusion of what should and should not be reconditioned in this article. The NEC CC task group on reconditioning is submitting several PI's to clarify definitions and general requirements. The Article 430 products detailed in this PI are based on the NEMA white paper on reconditioning. I have included a copy of this white paper for CMP-11's review.

Submitter Information Verification

Submitter Full Name: Donald Iverson
Organization: Schneider Electric
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Zip:
Submittal Date: Tue Sep 08 13:40:53 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: The panel understands the desire to consider reconditioned equipment for this section. However, the proposal was very limited and did not provide enough detail on the items presented as to why they should be considered. Also, the PI did not address medium voltage

equipment.



Public Input No. 774-NFPA 70-2020 [New Section after 430.18]

TITLE OF NEW CONTENT

Type your content here ...

430.19 Electromagnetic Pulse (EMP) Protection. Where motors, motor circuits, and controllers are utilized for the manufacturing, production, transportation, distribution, sales and business systems in facilities that are required to be EMP-protected, EMP protection for motors, motor circuits, and controllers against the effects of electromagnetic pulses shall be provided. See 709.7 for levels of electromagnetic pulse protection. This requirement shall become effective January 1, 2026.

Statement of Problem and Substantiation for Public Input

A devastating electromagnetic pulse (EMP), caused by a sun-spot or a nuclear bomb exploded high in the atmosphere, can impress 50,000 volts per meter on unprotected electrical and electronic equipment. It is similar to a radio wave impressing a very small voltage on a radio antenna, only orders of magnitude larger. The problem is that a significant EMP will fry every electrical/electronic component or piece of equipment that is not protected.

The EMP won't directly harm or injure people, but because there is no longer a working electrical infrastructure, which may take years to repair/rebuild, people will die from the lack of clean water, medicine, food, fuel, and eventual rioting due to the breakdown of society. Unclassified studies, referenced at the end of this substantiation, have estimated from 66% to 90% of the US population will die within one year if a significant sun spot were to occur or if a nuclear explosion were to occur 25 to 250 miles over the Midwest.

Our US military already "hardens" systems/buildings so that our country's critical defensive capabilities are not completely destroyed. There are two major methods of protecting electrical/electronic systems. The first is that surge protective devices are installed on all "incoming" power and communications cables, shunting overvoltages to ground. The second is that Faraday cages are installed around equipment/rooms, preventing the EMP from reaching critical equipment/components.

The NEC® needs to address EMP protection for equipment, systems and special occupancies that are critical to our survival. Electrical and electronic equipment can and must be protected, as has been achieved by our military. Unfortunately, there are no requirements to protect civilian electrical and electronic equipment/systems from EMPs.

The NEC Correlating Committee has informally advised that an EMP Protection Article, if passed and adopted into the NEC®, would be most appropriately located after Article 708 (COPS). Thus, Public Input 756 has suggested a new Article 709 under jurisdiction of CMP 13, which already has purview over Emergency Systems (Article 700), Legally Required Standby Systems (Article 701), Optional Standby Systems (Article 702), and Critical Operations Power Systems (Article 708).

Levels of protection and associated protection requirements listed in the Public Input(s) are based upon the unclassified National Cybersecurity and Communications Integration Center report "Electromagnetic Pulse (EMP) Protection and Resilience Guidelines for Critical Infrastructure and Equipment". This study explains electromagnetic pulses and provides the necessary protective measures. It also contains estimates of the costs associated with properly protecting our electrical infrastructure.

The following table contains critical infrastructure components/special occupancies and the maximum time for outages caused by an EMP. Electrical components/infrastructure that is not functioning for periods longer than shown in this table may begin to cause injury or death to people and harm to society/economy.

Critical Infrastructure Component/Special Occupancy Permitted Outage Time

Branch banking facilities 10 hours

Critical Operations Power Systems 10 minutes

Data centers 10 minutes

Direct current microgrids 10 hours

Drug stores/distribution centers 10 hours

Electrically driven or controlled irrigation machines 1 week

Elevators, dumbwaiters, escalators, moving walks, platform lifts, and stairway chairlifts See facility

requirements
 Emergency systems 10 hours
 Energy storage systems 10 hours
 Fire alarm systems 1 week
 Fire houses/stations 10 hours
 Fire pumps 10 hours
 Food processing and storage facilities 10 hours
 Fuel cell systems 10 hours
 Generators 10 hours
 Grocery stores 10 hours
 Hardware stores/home centers 10 hours
 Healthcare facilities See NFPA 99
 Information technology equipment 10 minutes
 Interconnected electric power production sources 10 minutes
 Jails and prisons 10 minutes
 Large-scale photovoltaic (PV) electric supply stations 10 hours
 Legally required standby systems 10 hours
 Modular data centers 10 minutes
 Motor fuel dispensing facilities 1 week
 Motors, motor circuits, and controllers See facility requirements
 Nuclear reactors 10 seconds
 Optional standby systems 1 week
 Petrochemical plants/facilities 10 hours
 Pharmaceutical plants/facilities 10 hours
 Police stations 10 minutes
 Solar photovoltaic (PV) systems 10 hours
 Stand-alone systems 10 hours
 Storage batteries See facility requirements
 Transformers See facility requirements
 Waste water treatment facilities 10 minutes
 Water supply facilities 10 hours
 Wind electric systems 10 hours

An effectivity date of January 1, 2026 is chosen to allow time for engineering and industry to adequately plan and prepare for the required changes.

Opponents of EMP protection requirements will likely charge that it is too costly to protect our critical infrastructure, and that the NEC® is not a war-time document. A close reading of 90.1 reveals that there is no mention of the “cost” of safeguarding persons and property. Neither does 90.1 mention that safeguarding persons and property is only required during peacetime. Additionally, a significant EMP event, caused by a sunspot, would be an act of God, not an act of war.

The novel, “One Second After”, provides an understanding of what happens when the majority of all unprotected electrical and electronic equipment/systems is destroyed during an EMP event. An audio version of this book is available in two parts, for free, on YouTube.

This link provides the unclassified report “Electromagnetic Pulse (EMP) Protection and Resilience Guidelines for Critical Infrastructure and Equipment”

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&ved=2ahUKEwjQhp2-77DoAhXBHM0KHboOB2QQFjACegQIBRAC&url=https%3A%2F%2Fwww.cisa.gov%2Fsites%2Fdefault%2Ffiles%2Fpublications%2F19_0307_CISA_EMP-Protection-Resilience-Guidelines.pdf&usg=AOvVaw2n7jLtJAUJtOJKHPMqWsTE

This link provides the study predicting up to 90% of our population could die from an EMP event

http://www.firstempcommission.org/uploads/1/1/9/5/119571849/nuclear_emp_attack_scenarios_and_combined-arms_cyber_warfare_by_peter_pry_july_2017.pdf

This link provides unclassified guidelines for facility EMP protection

<https://info.publicintelligence.net/DHS-FacilitiesGuidelinesEMP.pdf>

These links provide Parts 1 and 2 of a national plan for EMP protection.

<https://interferencetechnology.com/a-national-plan-for-emp-protection-part-1/>

<https://interferencetechnology.com/national-plan-emp-protection-part-2-protection-buildings/>

We have all just witnessed the chaos and pain caused by not having the “protections” in place to quickly defeat the Covid-19 virus. As unfortunate, costly, painful, and deadly as Covid-19 was, it would be child's play when compared to a significant EMP event if our critical electrical/electronic infrastructure remains unprotected. Quite simply, NEC® requirements to protect electrical and electronic equipment from an EMP event, could literally save millions of American lives.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 756-NFPA 70-2020 [New Section after 708.64]	
Public Input No. 756-NFPA 70-2020 [New Section after 708.64]	

Submitter Information Verification

Submitter Full Name: Vincent Saporita
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Affiliation: Saporita Consulting
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State:
Zip:
Submittal Date: Mon Mar 23 14:26:50 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: The NEC is the minimum installation requirements and EMP would be beyond the minimum for addition to the code. There are currently no product safety standard requirements to address EMP. No article currently addresses EMP.

**Public Input No. 4267-NFPA 70-2020 [Section No. 430.21]****430.21 General.**

Part II specifies ampacities of conductors that are capable of carrying the motor current without overheating under the conditions specified.

Part II shall not apply to motor circuits rated over 1000 volts, nominal.

Informational Note No 1 : For over 1000 volts, nominal, see Part XI.

~~Articles 250 , 300 , and 310 -~~ Chapter 2 and Chapter 3 requirements shall not apply to conductors that form an integral part of equipment, such as motors, motor controllers, motor control centers, or other factory-assembled control equipment.

Informational Note No 2 : See 110.14(C) and 430.9(B) for equipment device terminal requirements.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(R) Style Manual prohibits references to an entire article, with the exception of Article 100. The reference to Articles 250, 300 and 310 was revised to the more generic "Chapter 2 and Chapter 3 requirements" to comply. In addition, the informational notes were numbered to comply with the new requirements in 2.4.3 of the NEC(r) Style Manual.

Submitter Information Verification

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Submittal Date: Thu Sep 10 08:49:17 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: FR-7998-NFPA 70-2020

Statement: Revisions are made for compliance with Section 4.1.4 of the NEC Style Manual. The informational notes will be updated to meet section 2.4.3.

**Public Input No. 2150-NFPA 70-2020 [Section No. 430.24]****430.24 Several Motors or a Motor(s) and Other Load(s).**

Conductors supplying several motors, or a motor(s) and other load(s), shall have an ampacity not less than the sum of each of the following:

- (1) 125 percent of the full-load current rating of the highest rated motor, as determined by 430.6(A)
- (2) Sum of the full-load current ratings of all the other motors in the group, as determined by 430.6(A)
- (3) 100 percent of the noncontinuous non-motor load
- (4) 125 percent of the continuous non-motor load

Where two or more motors have the same full-load current, only one of the motor currents shall be considered the highest rated for the above calculations .

Informational Note: See Informative Annex D, Example No. D8.

Exception No. 1: Where one or more of the motors of the group are used for short-time, intermittent, periodic, or varying duty, the ampere rating of such motors to be used in the summation shall be determined in accordance with 430.22(E). For the highest rated motor, the greater of either the ampere rating from 430.22(E) or the largest continuous duty motor full-load current multiplied by 1.25 shall be used in the summation.

Exception No. 2: The ampacity of conductors supplying motor-operated fixed electric space-heating equipment shall comply with 424.4(B).

Exception No. 3: Where the circuitry is interlocked so as to prevent simultaneous operation of selected motors or other loads, the conductor ampacity shall be permitted to be based on the summation of the currents of the motors and other loads to be operated simultaneously that results in the highest total current.

Statement of Problem and Substantiation for Public Input

This revision is necessary to clarify the calculation process when 2 or more motors have the same current rating. For example: A feeder with three 22-amp motors. Should ALL of them be considered the "highest rated"? (22A X 3 X 125%); Should NONE of them be considered "highest rated"? (22A X 3); I believe the intent is to only consider ONE of them as the the "highest rated". [(22A X 125%) + 22A + 22A).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 2151-NFPA 70-2020 [Section No. 440.33]	

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
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Zip:
Submittal Date: Tue Aug 04 06:48:35 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: The proposed wording is not needed as the current language in 430.24(1) addresses this public input.



Public Input No. 1307-NFPA 70-2020 [Section No. 430.31]

Part III. Motor and Branch Circuit Protection

430.31 General .

Part III

Part III specifies overload devices intended to protect motors, motor-control apparatus, and motor branch-circuit conductors against excessive heating due to motor overloads and failure to start.

Informational Note No. 1: See Informative Annex D, Example No. D8.

Informational Note No. 2: See the definition of *Overload* in Article 100.

(A) Where Hazards Exist . These provisions shall not require overload protection where a power loss would cause a hazard, such as in the case of fire pumps.

Informational Note: For protection of fire pump supply conductors, see 695.7.

Part III- (B) Not over 1000 Volts . Part III shall not apply to motor circuits rated over 1000 volts, nominal.

Informational Note: For over 1000 volts, nominal, see Part XI.

Statement of Problem and Substantiation for Public Input

Revising the section into parts will comply with the NEC Style Manual and clarify where the informational notes apply.

Submitter Information Verification

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Submittal Date: Fri May 29 11:53:12 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: FR-8000-NFPA 70-2020

Statement: Revisions are made for compliance with Section 4.1.4 of the NEC Style Manual. The informational note numbering was updated to meet section 2.4.3.

**Public Input No. 2992-NFPA 70-2020 [Section No. 430.31]****430.31 General.**

Part III specifies overload devices intended to protect motors, motor-control apparatus, and motor branch-circuit conductors against excessive heating due to motor overloads and failure to start.

Informational Note No. 1: See Informative Annex D, Example No. D8.

Informational Note No. 2: See the definition of *Overload* in Article 100.

These provisions shall not require overload protection where a power loss would cause a hazard, such as in the case of fire pumps.

Informational Note: For protection of fire pump supply conductors, see 695 703 .7.

Part III shall not apply to motor circuits rated over 1000 volts, nominal.

Informational Note: For over 1000 volts, nominal, see Part XI.

Statement of Problem and Substantiation for Public Input

This public input was prepared by the correlating committee task group focused on alternative energy requirements. This task group consisted of the following members: Derrick Atkins (CMP 5), Greg Ball (CMP 13) Ken Boyce (CMP 1), Bill Brooks (CMP 4), Bruce Campbell, Thomas Domitrovich (CMP 2, CMP 10), Jason Fisher (CMP 4), Scott Harding (CMP 5), Pete Jackson (CMP 8), David Kendall (CMP 8, CC), Chad Kennedy (CMP 13), Christine Porter (CMP 5, CC), Timothy Windey (CMP 13). This change aligns with an effort to re-organize the alternative energy sources NEC Articles into a series of articles closely located together. This reorganization places all sources alternate sources as follows: 689 On-Site Energy Sources 690 Solar Photovoltaic (PV) Systems 691 Large-Scale Photovoltaic (PV) Systems 692 Fuel Cell Systems 693 Generators 694 Wind Electric Systems 695 Energy Storage Systems 696 Storage Batteries This public input aligns with changes that move 695 to 703. This input supports this effort and to better align with the fact that this Article is closely related to emergency systems. The requirements of this new 703 focus on more than just a fire pump and arguably more so focuses on fire pump systems which is closely aligned with Chapter 7 of the NEC. This move makes way for alignment of alternative energy sources article arrangement. These articles are closely related to each other and this change is in alignment with the direction by the correlating committee to review alternative energy sources for conflicts and usability. This new alignment will create a similar structure as that found for hazardous locations. The new Article 689 is the a combination of Articles 705, 710 and 712 and will act to be the new general requirements for this series of alternative energy sources.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 2987-NFPA 70-2020 [Article 695]	moving 695 to 703

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich

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Submittal Date: Thu Sep 03 19:47:20 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: Article 703 does not exist so the move cannot be made. CMP 11 would revisit this change if Article 695 is moved to Article 703.

**Public Input No. 3446-NFPA 70-2020 [Section No. 430.31]****430.31 General.**

Part III specifies overload devices intended to protect motors, motor-control apparatus, and motor branch-circuit conductors against excessive heating due to motor overloads and failure to start.

Informational Note No. 1: See Informative Annex D, Example No. D8.

Informational Note No. 2: See Article 100, for the definition of Overload in Article 100.

These provisions shall not require overload protection where a power loss would cause a hazard, such as in the case of fire pumps.

Informational Note ~~÷ For~~ No. 3: See 695.7, f or protection of fire pump supply conductors, ~~see 695.7.~~

Part III shall not apply to motor circuits rated over 1000 volts, nominal.

Informational Note ~~÷ For~~ No. 4: See Part XI, f or over 1000 volts, nominal, ~~see Part XI.~~

Statement of Problem and Substantiation for Public Input

The 3rd and 4th Informational Notes were numbered to comply with the Revised NEC Style Manual per 2.4.3.

Informational Notes 2, 3 and 4 were revised to comply with the Revised NEC Style Manual for the structure of Information Notes per 4.1.3.

Submitter Information Verification

Submitter Full Name: David Williams

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Submittal Date: Tue Sep 08 15:09:54 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: FR-8000-NFPA 70-2020

Statement: Revisions are made for compliance with Section 4.1.4 of the NEC Style Manual. The informational note numbering was updated to meet section 2.4.3.



Public Input No. 4272-NFPA 70-2020 [Section No. 430.42 [Excluding any Sub-Sections]]

Overload protection for motors used on general-purpose branch circuits as permitted in [Part II of Article 210](#) shall be provided as specified in 430.42(A), (B), (C), or (D).

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(R) Style Manual prohibits references to an entire article, with the exception of Article 100. It is suggested that the CMP point to the specific part of the article they intend to, here, which is thought to be Part II of Article 210 as shown.

Submitter Information Verification

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Submittal Date: Thu Sep 10 08:58:03 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8006-NFPA 70-2020](#)

Statement: Section 430.42 was revised to comply with the Style manual, 4.1.4.



Public Input No. 2721-NFPA 70-2020 [Section No. 430.51]

430.51 General.

Part IV specifies devices intended to protect the motor branch-circuit conductors, the motor control apparatus, and the motors against overcurrent due to short circuits or ground faults. These rules add to or amend Article 240. The devices specified in Part IV do not include the types of devices required by 210.8, 230.95, and 590.6.

Informational Note 1: See Informative Annex D, Example D8.

Informational Note 2: See IEEE 3004.8 Recommended Practice for Motor Protection in Industrial and Commercial Power Systems

Informational Note 3: See IEEE 3002.7 Recommended Practice for Conducting Motor-Starting Studies and Analysis of Industrial and Commercial Power Systems

Part IV shall not apply to motor circuits rated over 1000 volts, nominal.

Informational Note: For over 1000 volts, nominal, see Part XI.

Statement of Problem and Substantiation for Public Input

Content that formerly existed in the legacy Color Books (Red Book Std. 141 and Gray Book Std. 241) have been mapped into smaller titles such as these two. IEEE Color Books have been in the process of this transformation for at least two NEC cycles now. The transformation into smaller blocks of content is similar to the IEC best practice titles and aligns with the scope of this section of the NEC.

From the prospectus of these titles:

3004.8-2016: The protection of motors used in industrial and commercial power systems is covered. It is likely to be of greatest value to the power-oriented engineer with limited experience in the area of protection and control. It can also be an aid to all engineers responsible for the electrical design of industrial and commercial power systems.

https://standards.ieee.org/standard/3004_8-2016.html

3002.7 2018: Activities related to motor-starting studies including design considerations for new systems, analytical studies for existing systems, as well as operational and model-validation considerations for industrial and commercial power systems are described. Motor-starting analysis includes evaluation of motor-starting current and voltage drop. Accuracy of calculation results primarily relies on system modeling assumptions and methods used. The use of computer-aided analysis software, with a list of desirable capabilities recommended to conduct a modern motor-starting study, is emphasized. Examples of system data requirements and result-analysis techniques are presented. Benefits obtained from motor-starting studies are discussed, and various types of computer-aided motor-starting studies are examined. Data or information required for these studies, as well as the expected results of a motor-starting study effort, are also reviewed.

https://standards.ieee.org/standard/3002_7-2018.html

This proposal is intended to align IEEE and NFPA electrical safety standards.

Submitter Information Verification

Submitter Full Name: Michael Anthony

Organization: Standards Michigan

Affiliation: IEEE Education & Healthcare Facilities Committee

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Submittal Date: Sat Aug 29 15:11:22 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: While the reference documents may be useful, the substantiation does not provide details on how they would be useful in the code.



Public Input No. 4274-NFPA 70-2020 [Section No. 430.51]

430.51 General.

Part IV specifies devices intended to protect the motor branch-circuit conductors, the motor control apparatus, and the motors against overcurrent due to short circuits or ground faults. These rules add to or amend ~~Article 240~~ the overcurrent protection requirements found elsewhere in the Code . The devices specified in Part IV do not include the types of devices required by 210.8, 230.95, and 590.6.

Informational Note No. 1 : See Informative Annex D, Example D8.

Part IV shall not apply to motor circuits rated over 1000 volts, nominal.

Informational Note No. 2 : For over 1000 volts, nominal, see Part XI.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(R) Style Manual prohibits references to an entire article, with the exception of Article 100. As such, it is recommended to change the reference to Article 240 to "the overcurrent protection requirements found elsewhere in the Code" to comply. In addition, the informational notes were numbered to comply with the new requirements in Section 2.4.3 of the 2020 NEC(r) Style Manual.

Submitter Information Verification

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Submittal Date: Thu Sep 10 09:01:37 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8008-NFPA 70-2020](#)

Statement: Revisions are made for compliance with Section 4.1.4 of the NEC Style Manual. The informational note numbering was updated to meet section 2.4.3.



Public Input No. 3097-NFPA 70-2020 [Section No. 430.52(C)]

(C) Rating or Setting.

(1) In Accordance with Table 430.52.

A protective device that has a rating or setting not exceeding the value calculated according to the values given in Table 430.52 shall be used.

Table 430.52 Maximum Rating or Setting of Motor Branch-Circuit Short-Circuit and Ground-Fault Protective Devices

<u>Type of Motor</u>	<u>Percentage of Full-Load Current</u>			
	<u>Nontime</u>	<u>Dual Element</u>	<u>Instantaneous</u>	<u>Inverse</u>
	<u>Delay</u>	<u>(Time-Delay)</u>	<u>Trip</u>	<u>Time</u>
	<u>Fuse¹</u>	<u>Fuse¹</u>	<u>Breaker</u>	<u>Breaker²</u>
Single-phase motors	300	175	800	250
AC polyphase motors other than wound-rotor	300	175	800	250
Squirrel cage — other than Design B energy-efficient	300	175	800	250
efficient				
and Design B premium efficiency				
Design B energy-efficient	300	175	1100	250
or Design B premium efficiency				
Synchronous ³	300	175	800	250
Wound-rotor	150	150	800	150
DC (constant voltage)	150	150	250	150

Note: For certain exceptions to the values specified, see 430.54.

¹The values in the Nontime Delay Fuse column apply to time-delay Class CC fuses.

²The values given in the last column also cover the ratings of nonadjustable inverse time types of circuit breakers that may be modified as in 430.52(C)(1), Exceptions No. 1 and No. 2.

³Synchronous motors of the low-torque, low-speed type (usually 450 rpm or lower), such as are used to drive reciprocating compressors, pumps, and so forth, that start unloaded, do not require a fuse rating or circuit-breaker setting in excess of 200 percent of full-load current.

Exception No. 1: Where the values for branch-circuit short-circuit and ground-fault protective devices determined by Table 430.52 do not correspond to the standard sizes or ratings of fuses, nonadjustable circuit breakers, thermal protective devices, or possible settings of adjustable circuit breakers, a higher size, rating, or possible setting that does not exceed the next higher standard ampere rating shall be permitted.

Exception No. 2: Where the rating specified in Table 430.52, or the rating modified by Exception No. 1, is not sufficient for the starting current of the motor:

- (1) *The rating of a nontime-delay fuse not exceeding 600 amperes or a time-delay Class CC fuse shall be permitted to be increased but shall in no case exceed 400 percent of the full-load current.*
- (2) *The rating of a time-delay (dual-element) fuse shall be permitted to be increased but shall in no case exceed 225 percent of the full-load current.*
- (3) *The rating of an inverse time circuit breaker shall be permitted to be increased but shall in no case exceed 400 percent for full-load currents of 100 amperes or less or 300 percent for full-load currents greater than 100 amperes.*
- (4) *The rating of a fuse of 601–6000 ampere classification shall be permitted to be increased but shall in no case exceed 300 percent of the full-load current.*

Informational Note: See Informative Annex D, Example D8, and Figure 430.1.

(2) Overload Relay Table.

Where maximum branch-circuit short-circuit and ground-fault protective device ratings are shown in the manufacturer's overload relay table for use with a motor controller or are otherwise marked on the equipment, they shall not be exceeded even if higher values are allowed as shown above.

(3) Instantaneous Trip Circuit Breaker.

An instantaneous trip circuit breaker shall be used only if adjustable and if part of a listed combination motor controller having coordinated motor overload and short-circuit and ground-fault protection in each conductor, and the setting is adjusted to no more than the value specified in Table 430.52.

Informational Note No. 1: Instantaneous trip circuit breakers are also known as motor-circuit protectors (MCPs).

Informational Note No. 2: For the purpose of this article, instantaneous trip circuit breakers may include a damping means to accommodate a transient motor inrush current without nuisance tripping of the circuit breaker.

Exception No. 1: Where the setting specified in Table 430.52 is not sufficient for the starting current of the motor, the setting of an instantaneous trip circuit breaker shall be permitted to be increased but shall in no case exceed 1300 percent of the motor full-load current for other than Design B energy-efficient and Design B premium efficiency motors and no more than 1700 percent of motor full-load current for Design B energy-efficient or Design B premium efficiency motors. Trip settings above 800 percent for other than Design B energy-efficient and Design B premium efficiency motors and above 1100 percent for Design B energy-efficient or Design B premium efficiency motors shall be permitted where the need has been demonstrated by engineering evaluation. In such cases, it shall not be necessary to first apply an instantaneous-trip circuit breaker at 800 percent or 1100 percent.

Informational Note No.1 : For additional information on the requirements for a motor to be classified "energy efficient," see NEMA MG 1-2016, Supplements-2018, Motors and Generators, Part 12.59.

Informational Note No.2: For additional information on the requirements for a motor to be classified "premium efficiency" see NEMA MG1-2016, Supplements-2018, Motors and Generators, Part 12.60.

Exception No. 2: Where the motor full-load current is 8 amperes or less, the setting of the instantaneous-trip circuit breaker with a continuous current rating of 15 amperes or less in a listed combination motor controller that provides coordinated motor branch-circuit overload and short-circuit and ground-fault protection shall be permitted to be increased to the value marked on the controller.

(4) Multispeed Motor.

For a multispeed motor, a single short-circuit and ground-fault protective device shall be permitted for two or more windings of the motor, provided the rating of the protective device does not exceed the above applicable percentage of the nameplate rating of the smallest winding protected.

Exception: For a multispeed motor, a single short-circuit and ground-fault protective device shall be permitted to be used and sized according to the full-load current of the highest current winding, where all of the following conditions are met:

- (1) Each winding is equipped with individual overload protection sized according to its full-load current.*
- (2) The branch-circuit conductors supplying each winding are sized according to the full-load current of the highest full-load current winding.*
- (3) The controller for each winding has a horsepower rating not less than that required for the winding having the highest horsepower rating.*

(5) Power Electronic Devices.

Semiconductor fuses intended for the protection of electronic devices shall be permitted in lieu of devices listed in Table 430.52 for power electronic devices, associated electromechanical devices (such as bypass contactors and isolation contactors), and conductors in a solid-state motor controller system, provided that the marking for replacement fuses is provided adjacent to the fuses.

(6) Self-Protected Combination Controller.

A listed self-protected combination controller shall be permitted in lieu of the devices specified in Table 430.52. Adjustable instantaneous-trip settings shall not exceed 1300 percent of full-load motor current for other than Design B energy-efficient and Design B premium efficiency motors and not more than 1700 percent of full-load motor current for Design B energy-efficient or Design B premium efficiency motors.

Informational Note: Proper application of self-protected combination controllers on 3-phase systems, other than solidly grounded wye, particularly on corner grounded delta systems, considers the self-protected combination controllers' individual pole-interrupting capability.

(7) Motor Short-Circuit Protector.

A motor short-circuit protector shall be permitted in lieu of devices listed in Table 430.52 if the motor short-circuit protector is part of a listed combination motor controller having coordinated motor overload protection and short-circuit and ground-fault protection in each conductor and it will open the circuit at currents exceeding 1300 percent of motor full-load current for other than Design B energy-efficient and Design B premium efficiency motors and 1700 percent of motor full-load motor current for Design B energy-efficient or Design B premium efficiency motors.

Informational Note: A motor short-circuit protector, as used in this section, is a fused device and is not an instantaneous trip circuit breaker.

Statement of Problem and Substantiation for Public Input

Premium efficiency motors (which are energy-efficient motors with a higher level of efficiency) have largely replaced energy-efficient motors in installations in the US since they have been mandated for many applications from 1 – 200 Hp since December 19, 2010 and for the vast majority of applications from 1 – 500 Hp since June 1, 2016 by the energy conservation standards in 431.25 of Title 10, Chapter II Subchapter D of

the US CFR. Design B premium efficiency motors have a higher efficiency than Design B energy-efficient motors and, therefore, tend to have a starting current that is equal to or greater than that of Design B energy-efficient motors. It follows that the exception which allows the setting of an instantaneous trip circuit breaker to be increased for Design B energy-efficient motors should also apply to Design B premium efficiency motors. It also follows that the adjustable instantaneous-trip settings for self-protected combination controllers, which apply to Design B energy-efficient motors, should also apply to Design B premium efficiency motors. It also follows that the motor short-circuit protectors that are applicable to Design B energy-efficient motors should also be applicable to Design B premium efficiency motors. There are no anticipated safety concerns associated with this PI and additionally, it is anticipated that this proposed expansion of the highest allowable instantaneous trip settings will reduce nuisance tripping occurrences on the large, already-existing base of applications incorporating Design B premium efficiency motors. In Informational Note No. 1, the reference to NEMA MG 1 Part 12.59 has been updated to the most recent version.

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Fri Sep 04 15:23:42 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8009-NFPA 70-2020](#)

Statement: Updating the language of this section to include Design B premium efficiency motors will improve usability since these motors are being installed today per government regulations. The change provided improves usability of the code. The controller definition has been updated changing "controller" to "motor controller."



Public Input No. 1585-NFPA 70-2020 [Section No. 430.52(C)(1)]

(1) In Accordance with Table 430.52.

A protective device that has a rating or setting not exceeding the value calculated according to the values given in Table 430.52 shall be used.

Table 430.52 Maximum Rating or Setting of Motor Branch-Circuit Short-Circuit and Ground-Fault Protective Devices

<u>Type of Motor</u>	<u>Percentage of Full-Load Current</u>			
	<u>Nontime</u>	<u>Dual</u>	<u>Instantaneous</u>	<u>Inverse</u>
	<u>Delay</u>	<u>Element</u>	<u>Trip</u>	<u>Time</u>
	<u>Fuse¹</u>	<u>Fuse¹</u>	<u>Breaker</u>	<u>Breaker²</u>
Single-phase motors	300	175	800	250
AC polyphase motors other than wound-rotor	300	175	800	250
Squirrel cage — other than Design B energy-efficient	300	175	800	250
Design B energy-efficient	300	175	1100	250
Synchronous ³	300	175	800	250
Wound-rotor	150	150	800	150
DC (constant voltage)	150	150	250	150

Note: For certain exceptions to the values specified, see 430.54.

¹The values in the Nontime Delay Fuse column apply to time-delay Class CC fuses.

²The values given in the last column also cover the ratings of nonadjustable inverse time types of circuit breakers that may be modified as in 430.52(C)(1), Exceptions No. 1 and No. 2.

³Synchronous motors of the low-torque, low-speed type (usually 450 rpm or lower), such as are used to drive reciprocating compressors, pumps, and so forth, that start unloaded, do not require a fuse rating or circuit-breaker setting in excess of 200 percent of full-load current.

Exception No. 1: Where the values for branch-circuit short-circuit and ground-fault protective devices determined by Table 430.52 do not correspond to the standard sizes or ratings of fuses, nonadjustable circuit breakers, thermal protective devices, or possible settings of adjustable circuit breakers, a higher size, rating, or possible setting that does not exceed the next higher standard ampere rating, according to 240.6, shall be permitted.

Exception No. 2: Where the rating specified in Table 430.52, or the rating modified by Exception No. 1, is not sufficient for the starting current of the motor:

- (1) *The rating of a nontime-delay fuse not exceeding 600 amperes or a time-delay Class CC fuse shall be permitted to be increased but shall in no case exceed 400 percent of the full-load current.*
- (2) *The rating of a time-delay (dual-element) fuse shall be permitted to be increased but shall in no case exceed 225 percent of the full-load current.*
- (3) *The rating of an inverse time circuit breaker shall be permitted to be increased but shall in no case exceed 400 percent for full-load currents of 100 amperes or less or 300 percent for full-load currents greater than 100 amperes.*
- (4) *The rating of a fuse of 601–6000 ampere classification shall be permitted to be increased but shall in no case exceed 300 percent of the full-load current.*

Informational Note: See Informative Annex D, Example D8, and Figure 430.1.

Statement of Problem and Substantiation for Public Input

The exception allows upsizing to the next standard size fuse or circuit breaker, by adding the reference to

240.6 which lists the standard size fuses and circuit breakers, the user is directed to the list of standard size fuses and circuit breakers so that an accurate selection can be made to ensure safe installation.

Submitter Information Verification

Submitter Full Name: Ted Smith

Organization: E Light Electric Service

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 22 12:01:51 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: FR-8009-NFPA 70-2020

Statement: Updating the language of this section to include Design B premium efficiency motors will improve usability since these motors are being installed today per government regulations. The change provided improves usability of the code. The controller definition has been updated changing "controller" to "motor controller."



Public Input No. 413-NFPA 70-2020 [Section No. 430.52(C)(1)]

(1)_ In Accordance with Table 430.52.

A protective device that has a rating or setting not exceeding the value calculated according to the values given in Table 430.52 shall be used.

Table 430.52 Maximum Rating or Setting of Motor Branch-Circuit Short-Circuit and Ground-Fault Protective Devices

<u>Type of Motor</u>	<u>Percentage of Full-Load Current</u>			
	<u>Nontime</u>	<u>Dual Element</u>	<u>Instantaneous</u>	<u>Inverse</u>
	<u>Delay</u>	<u>(Time-Delay)</u>	<u>Trip</u>	<u>Time</u>
	<u>Fuse ¹</u>	<u>Fuse ¹</u>	<u>Breaker</u>	<u>Breaker ²</u>
Single-phase motors	300	175		
800				
1300				250
AC polyphase motors other than wound-rotor				300 175
800				
1300				250
Squirrel cage — other than Design B energy-efficient				300 175
800				
1300			250	
Design B energy-efficient			300	175
1100				
1700			250	
Synchronous ³			300	175
800				
1300		250		
Wound-rotor		150	150	
800				
1300		150		
DC (constant voltage)		150	150	250 150

Note: For certain exceptions to the values specified, see 430.54.

¹The values in the Nontime Delay Fuse column apply to time-delay Class CC fuses.

²The values given in the last column also cover the ratings of nonadjustable inverse time types of circuit breakers that may be modified as in 430.52(C)(1), Exceptions No. 1 and No. 2.

³Synchronous motors of the low-torque, low-speed type (usually 450 rpm or lower), such as are used to drive reciprocating compressors, pumps, and so forth, that start unloaded, do not require a fuse rating or circuit-breaker setting in excess of 200 percent of full-load current.

Exception No. 1: Where the values for branch-circuit short-circuit and ground-fault protective devices determined by Table 430.52 do not correspond to the standard sizes or ratings of fuses, nonadjustable circuit breakers, thermal protective devices, or possible settings of adjustable circuit breakers, a higher size, rating, or possible setting that does not exceed the next higher standard ampere rating shall be permitted.

Exception No. 2: Where the rating specified in Table 430.52, or the rating modified by Exception No. 1, is not sufficient for the starting current of the motor:

(1) *The rating of a nontime-delay fuse not exceeding 600 amperes or a time-delay Class CC fuse shall be permitted to be increased but shall in no case exceed 400 percent of the full-load current.*

- (2) *The rating of a time-delay (dual-element) fuse shall be permitted to be increased but shall in no case exceed 225 percent of the full-load current.*
- (3) *The rating of an inverse time circuit breaker shall be permitted to be increased but shall in no case exceed 400 percent for full-load currents of 100 amperes or less or 300 percent for full-load currents greater than 100 amperes.*
- (4) *The rating of a fuse of 601–6000 ampere classification shall be permitted to be increased but shall in no case exceed 300 percent of the full-load current.*

Informational Note: See Informative Annex D, Example D8, and Figure 430.1.

Statement of Problem and Substantiation for Public Input

Standard industrial motors have peak inrush currents which commonly exceed 800% of full load current (1100% for Design B Energy Efficient). In addition, many imported pieces of equipment include European motors which have even higher peak inrush currents. The Code should recognize this and just state the maximum setting for instantaneous only trip circuit breakers. The text of Article 430.52(C)(3) and exceptions should be similarly revised.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 414-NFPA 70-2020 [Section No. 430.52(C)(3)]</u>	should be changed together
<u>Public Input No. 414-NFPA 70-2020 [Section No. 430.52(C)(3)]</u>	

Submitter Information Verification

Submitter Full Name: Todd Sauve
Organization: Rockwell Automation
Street Address:
City:
State:
Zip:
Submittal Date: Tue Feb 04 05:59:16 EST 2020
Committee: NEC-P11

Committee Statement

Resolution: The code is a minimum standard and already permits the use of the higher ratings as exceptions. The proposed change does not provide information on how this would improve safety.

**Public Input No. 414-NFPA 70-2020 [Section No. 430.52(C)(3)]****(3)_ Instantaneous Trip Circuit Breaker.**

An instantaneous trip circuit breaker shall be used only if adjustable and if part of a listed combination motor controller having coordinated motor overload and short-circuit and ground-fault protection in each conductor, and the setting is adjusted to no more than the value specified in Table 430.52.

Informational Note No. 1: Instantaneous trip circuit breakers are also known as motor-circuit protectors (MCPs).

Informational Note No. 2: For the purpose of this article, instantaneous trip circuit breakers may include a damping means to accommodate a transient motor inrush current without nuisance tripping of the circuit breaker.

~~Exception No. 1: Where the setting specified in Table 430.52 is not sufficient for the starting current of the motor, the setting of an instantaneous trip circuit breaker shall be permitted to be increased but shall in no case exceed 1300 percent of the motor full-load current for other than Design-B energy-efficient motors and no more than 1700 percent of motor full-load current for Design-B energy-efficient motors. Trip settings above 800 percent for other than Design-B energy-efficient motors and above 1100 percent for Design-B energy-efficient motors shall be permitted where the need has been demonstrated by engineering evaluation. In such cases, it shall not be necessary to first apply an instantaneous trip circuit breaker at 800 percent or 1100 percent.~~

Informational Note Informational Note No. 3 : For additional information on the requirements for a motor to be classified "energy efficient," see NEMA MG 1-2016, *Motors and Generators*, Part 12.59.

~~Exception No. 2 1 : Where the motor full-load current is 8 amperes or less, the setting of the instantaneous-trip circuit breaker with a continuous current rating of 15 amperes or less in a listed combination motor controller that provides coordinated motor branch-circuit overload and short-circuit and ground-fault protection shall be permitted to be increased to the continuous current rating value marked on the controller.~~

Statement of Problem and Substantiation for Public Input

see related comment for proposed change in Table 430.52 With motor peak inrush values commonly exceeding 800% or 1100%, Exception 1 of the current 430.52(C)(3) is typically always used. I've heard many anecdotal stories of users simply turning the setting to the maximum value, regardless of whether or not it exceeds 1300% or 1700%. If there is no safety issue with permitting a maximum setting of 1300% or 1700% by exception, then there is little value in attempting to start the motor with a setting of 800% or 1100%. Since peak inrush current can be affected by the angle of the voltage at the time of the contactor closure or the system voltage level, a successful start at 800% or 1100% during the initial set-up, may result in a nuisance trip in the future. A future trip of the circuit breaker would require the cause of the trip to be investigated and the condition of the controller to be assessed prior to an attempt to restart. The act of investigation the condition of the controller (likely in an energized motor control center) could result a greater safety issue than just allowing a setting up to 1300% or 1700% in the first place. If there is a concern in regard to the motor overload opening a contactor at high currents, then perhaps the initial setting of an instantaneous trip circuit breaker could be increased to 1000% from 800% since contactors are subjected to a 1000% current withstand test, with the contactor ultimately being opened by the overload relay.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 413-NFPA 70-2020 [Section No. 430.52(C)(1)]	needs to be changed together
Public Input No. 413-NFPA 70-2020 [Section No. 430.52(C)(1)]	

Submitter Information Verification

Submitter Full Name: Todd Sauve

Organization: Rockwell Automation

Street Address:

City:

State:

Zip:

Submittal Date: Tue Feb 04 06:03:56 EST 2020

Committee: NEC-P11

Committee Statement

Resolution: The code is a minimum standard and already permits the use of the higher ratings as exceptions. The proposed change does not provide information on how this would improve safety.



Public Input No. 2587-NFPA 70-2020 [Section No. 430.61]

430.61 General.

Part V specifies protective devices intended to protect feeder conductors supplying motors against overcurrents due to short circuits or ~~grounds~~ ground-faults .

Informational Note: See Informative Annex D, Example D8.

Statement of Problem and Substantiation for Public Input

The correct term is ground-fault and not grounds.

Submitter Information Verification

Submitter Full Name: Don Ganiere

Organization: [Not Specified]

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City:

State:

Zip:

Submittal Date: Mon Aug 24 20:59:12 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8013-NFPA 70-2020](#)

Statement: This FR corrects the terminology used to make it correctly state “ground-faults”. Revisions are made for compliance with Section 4.1.4 of the NEC Style Manual.

**Public Input No. 2251-NFPA 70-2020 [Section No. 430.62(A)]****(A) Specific Load.**

A feeder supplying a specific fixed motor load(s) and consisting of conductor sizes based on 430.24 shall be provided with a protective device having a rating or setting not greater than the largest rating or setting of the branch-circuit short-circuit and ground-fault protective device for any motor supplied by the feeder [based on the maximum permitted value for the specific type of a protective feeder protective device employed in accordance with 430.52, or 440.22(A) for hermetic refrigerant motor-compressors], plus the sum of the full-load currents of the other motors of the group.

Where the same rating or setting of the branch-circuit short-circuit and ground-fault protective device is used on two or more of the branch circuits supplied by the feeder, one of the protective devices shall be considered the largest for the above calculations.

Exception No. 1: Where ~~one or more instantaneous trip circuit breakers or motor short-circuit protectors are used for motor branch-circuit short-circuit and ground-fault protection as permitted in 430.52(C)~~, the procedure provided above for determining the maximum rating of the feeder protective device shall apply with the following provision: For the purpose of the calculation, each instantaneous trip circuit breaker or motor short-circuit protector shall be assumed to have a rating not exceeding the maximum percentage of motor full-load current permitted by Table 430.52 for the type of feeder protective device employed. Exception No. 2: Where the feeder overcurrent protective device also provides overcurrent protection for a motor control center, the provisions of 430.94 shall apply.

Informational Note: See Informative Annex D, Example D8.

Statement of Problem and Substantiation for Public Input

The feeder OCPD should be calculated with the multiplier from Table 430.52 for the type of OCPD protecting the feeder, and exception No 1 should be deleted for the following reasons:

1. Due to the differing trip curves of OCPD's, when a different type of OCPD is used for the feeder than for some or all of the branch circuits, the feeder OCPD may trip on an inrush current that can be tolerated by the branch OCPD, if the multiplier for the type of OCPD used for the branch is used in the feeder OCPD calculation. This creates the possibility of opening the feeder and all of the motors connected when no fault has occurred, or the fault has occurred in only one of the derived branch circuits. This change clarifies what I believe is the intent of the article, and is already common installation practice.
2. The exception proposed to be removed explains the appropriate procedure for sizing the feeder OCPD, but gives the impression that this method is only to be used if ITCB's are used to protect the branch circuits. This further confuses the intent of the article.

Submitter Information Verification

Submitter Full Name: David Hittinger

Organization: IEC

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City:

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Zip:

Submittal Date: Wed Aug 12 12:59:58 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: The submitter did not provide substantiation of a problem that has been seen. The language in this section has been well established and no evidence of any issues have been provided.

**Public Input No. 4279-NFPA 70-2020 [Section No. 430.72(C)(1)]****(1) ~~Compliance with Article 725 Class 1 Power-Limited, Class 2, or Class 3 Circuits~~ .**

Where the transformer supplies a Class 1 power-limited circuit, Class 2, or Class 3 remote-control circuit complying with the requirements of ~~Article 725.35~~ , protection shall comply with Part II of Article 725.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(R) Style Manual prohibits references to an entire article, with the exception of Article 100. As such, it is recommended to change the section heading to "Class I Power-Limited, Class 2, or Class 3 Circuits" and point the user to 725.35 and Part II of Article 725 to comply while keeping the requirement unchanged.

Submitter Information Verification

Submitter Full Name: Richard Holub

Organization: The DuPont Company, Inc.

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 10 09:09:22 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: FR-8015-NFPA 70-2020

Statement: Revisions are made for compliance with Section 4.1.4 of the NEC Style Manual.

**Public Input No. 4284-NFPA 70-2020 [Section No. 430.72(C)(2)]**

~~(2)– Compliance with Article 450 __ Transformers .~~

Protection shall be permitted to be provided in accordance with 450.3.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(R) Style Manual prohibits references to an entire article, with the exception of Article 100. As such, it is recommended to change the heading of this section to "Transformers" to comply.

Submitter Information Verification

Submitter Full Name: Richard Holub

Organization: The DuPont Company, Inc.

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 10 09:22:54 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8015-NFPA 70-2020](#)

Statement: Revisions are made for compliance with Section 4.1.4 of the NEC Style Manual.



Public Input No. 3615-NFPA 70-2020 [Section No. 430.95]

430.95 Bonding of Service Equipment.

~~Where used as service equipment, each motor control center shall be provided with a single main disconnecting means to disconnect all ungrounded service conductors .~~

~~*Exception: A second service disconnect shall be permitted to supply additional equipment.*~~

Where a grounded conductor is provided, the motor control center shall be provided with a main bonding jumper, sized in accordance with 250.28(D), within one of the sections for connecting the grounded conductor, on its supply side, to the motor control center equipment ground bus.

Exception: High-impedance grounded neutral systems shall be permitted to be connected as provided in 250.36.

Statement of Problem and Substantiation for Public Input

Article 230 includes general requirements for service equipment, including the number of service disconnects allowed for various pieces of equipment (Section 230.71). The first portion of Section 430.95 should be removed and instead the topic should be addressed in Article 230. See Related PI to revise 230.71.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 3619-NFPA 70-2020 [Section No. 230.71(B)]	
Public Input No. 3619-NFPA 70-2020 [Section No. 230.71(B)]	

Submitter Information Verification

Submitter Full Name: Danish Zia

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 09 09:17:58 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: The panel agrees that the service entrance requirements should be part of Article 230. However, the proposed change is contingent on acceptance of another PI 3619. CMP11 would be willing to revisit this proposal if those changes are added to 230.



Public Input No. 1360-NFPA 70-2020 [Section No. 430.96]

430.96 Equipment Grounding Conductor .

Multisection motor control centers shall be connected together with an equipment grounding conductor or an equivalent equipment grounding bus sized in accordance with Table 250.122. Equipment grounding conductors shall be connected to this equipment grounding bus or to a grounding termination point provided in a single-section motor control center.

Statement of Problem and Substantiation for Public Input

According to the NFPA Style Manual, the Section Title needs to reflect the content of the rule. The rule is about the equipment grounding conductor, not about 'Grounding.'

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 01 19:41:08 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: The proposed change does not address equipment grounding bus sizing as indicated in the section.

**Public Input No. 4285-NFPA 70-2020 [Section No. 430.97(C)]****(C) Minimum Wire-Bending Space.**

The minimum wire-bending space at the motor control center terminals and minimum gutter space shall be as required in ~~Article~~ 312. 6(B) .

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(R) Style Manual prohibits references to an entire article, with the exception of Article 100. As such, it is recommended to change to point the user to the specific section in 312 that applies, in this 312.6(B).

Submitter Information Verification

Submitter Full Name: Richard Holub

Organization: The DuPont Company, Inc.

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 10 09:24:36 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8036-NFPA 70-2020](#)

Statement: Revisions are made for compliance with Section 4.1.4 of the NEC Style Manual.



Public Input No. 3941-NFPA 70-2020 [New Section after 430.99]

Absence of Voltage Test & Indication

A means shall be provided to verify the absence of voltage in accordance with an acceptable industry practice that does not expose personnel to shock or arc flash hazards or live parts at the disconnecting means for any voltage supplies or stored energy sources that present an shock or arc flash hazard up to and including 1000V.

Informational Note: NFPA 70E-2021 Standard for Electrical Safety in the Workplace provides guidance for safely verifying the absence of voltage including the use of devices like a permanently mounted absence of voltage tester.

Statement of Problem and Substantiation for Public Input

Testing for absence of voltage is an important step that helps increase safety by detecting several conditions that could lead to an electrical incident:

- Power remains on if the wrong disconnecting means is utilized or the source is mislabeled (see examples from OSHA Summaries)
- Presence of stored electrical energy from a capacitor, present after the disconnect is opened and locked out (see examples from OSHA Summaries)
- Power remains present when the disconnect handle is in the off position if the disconnect experiences a mechanical failure (see Recall Notices below)

An easily accessible means to test for and visually convey the status of presence and absence of voltage that is part of the equipment installation at the point of work before accessing motor control center mains, bus, and units would prevent this type of incident (several examples are included below) and further the purpose of the code in practical safeguarding of persons and property by leveraging safety by design principles. Absence of Voltage Testers (AVT) listed to UL 1436 are permanently mounted testers that visually indicate when all voltages are less than 3 V (ac and dc) at the test point. This test is initiated before doors and covers are removed preventing accidental contact with energized parts. AVTs listed to UL 1436 have been recognized as an acceptable method to test for the absence of voltage in NFPA 70E since 2018 (120.5 (7) Exception 1).

Permanently mounted AVTs installed on or near the equipment increase the likelihood that the test for absence of voltage test occurs before the equipment is accessed when compared to portable voltage test instruments. Additionally, AVTs often have a feature to visually indicate when ac or dc voltage that would cause a shock hazard is present. In each of the incidents described below, the voltage presence indicators (for AC and DC) would have provided a visual warning that voltage was still present.

OSHA Fatality and Catastrophe Investigation Summaries

A keyword search of the OSHA Fatality and Catastrophe Investigation Summaries (<https://www.osha.gov/pls/imis/accidentsearch.html>) reveals several incidents resulting in severe injury or death that are attributed to failure to test for absence of voltage after de-energizing the disconnecting means. An example from a motor control center:

Report ID 0729700

An employee was repairing the head switch of the primary motor control center at an oil pumping site. The oil pump motor control center and the saltwater motor control center were not labeled as to what circuits were either controlled by them and/or passed through them. The motor control center was secured in anticipation of replacing the head switch. The employee opened a nearby junction box to perform the initial disconnection of wiring to the switch. The employee came into contact with a 480 volt unused circuit that passed through the motor control center. This 480 volt circuit was not de-energized by the cutout used to secure the motor control center and the employee did not test the circuits within the junction box to ensure they were all de-energized and sustained extensive electrical burns to the right hand and less serious burns to the left.

Note: there are other examples with similar incidents from components in other equipment that are sometimes located within a motor control center.

Disconnect Recall Notices

Several brands of disconnects that are commonly used in industrial and commercial applications have experienced recalls due to defects that allow power to remain present when the disconnect handle is in the off position, posing a shock hazard. This failure mode is an example of why testing for absence of voltage is critical in all applications.

Recalls (<https://www.cpsc.gov/Recalls>)

1. Example 1

Company A recalled more than a million safety switches manufactured between January 1, 2014 and January 18, 2018 because the power can stay on when the safety switch handle is in the off position, posing an electric shock or electrocution hazard. The switches may be installed in or around commercial buildings, outbuildings, apartments and homes with air conditioning units.

2. Example 2

Company B issued a safety recall of 26 models of safety switches that may not disconnect power when the handle is in the "off" position. The affected devices cover certain models of 30A and 60A heavy-duty safety switches manufactured between Nov. 19, 2015, and Jan. 23, 2018.

3. Example 3

Company C recalled 19,000 toggle and rotary switches. When switched OFF, one electrical pole may remain energized, posing a risk of electrical shock hazard. The switches are typically used with HVAC units, electric distribution and control panels and industrial uses. Primarily the switches are used commercially, however they may also be found in residential applications.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 3835-NFPA 70-2020 [New Section after 110.25]	
Public Input No. 3908-NFPA 70-2020 [New Part after I.]	

Submitter Information Verification

Submitter Full Name: Rachel Bugaris
Organization: Panduit Corp
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 15:58:21 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: The code does not prohibit the use of AVT's to determine the absence of voltage, however there are other acceptable methods to do so. The panel does not agree that AVT's should be required for all motor control centers. The variety of energized topologies and the associated hazards needs to be addressed by the submitter, for example 480 Vac vs. 120 Vdc.



Public Input No. 2356-NFPA 70-2020 [Section No. 430.102(A)]

(A) Controller.

An individual disconnecting means shall be provided for each controller and shall disconnect the controller. The disconnecting means shall be located in sight from the controller location.

Exception No. 1: For motor circuits over 1000 volts, nominal, a controller disconnecting means lockable in accordance with 110.25 shall be permitted to be out of sight of the controller, provided that the controller is marked with a warning label giving the location of the disconnecting means.

Exception No. 2: A single disconnecting means shall be permitted for a group of coordinated controllers that drive several parts of a single machine or piece of apparatus. The disconnecting means shall be located in sight from the controllers, and both the disconnecting means and the controllers shall be located in sight from the machine or apparatus.

Exception No. 3: The disconnecting means shall not be required to be in sight from valve actuator motor (VAM) assemblies containing the controller where such a location introduces additional or increased hazards to persons or property and conditions (1) and (2) are met.

- (1) *The valve actuator motor assembly is marked with ~~a warning label~~ a label giving the location of the disconnecting means.*
- (2) *The disconnecting means is lockable in accordance with 110.25.*

Statement of Problem and Substantiation for Public Input

The NEC invokes, by informational note, an abiding by the ANSI standard Z535.4 Sign and Label Requirements as in 110.16(B), 110.21(B). This standard reserves the use of the term "warning" to indicate a potentially hazardous situation which, if not avoided, could result in death or serious injury. Similarly, other terms in this standard have specific boundaries for use; danger, caution, notice, instruction. For consistency of code text, the word "warning" should be deleted.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 2341-NFPA 70-2020 [Section No. 430.113]	related topic
Public Input No. 2400-NFPA 70-2020 [Section No. 600.6(A)(2)]	related topic
Public Input No. 2401-NFPA 70-2020 [Section No. 110.21(B)]	related topic
Public Input No. 2400-NFPA 70-2020 [Section No. 600.6(A)(2)]	
Public Input No. 2401-NFPA 70-2020 [Section No. 110.21(B)]	

Submitter Information Verification

Submitter Full Name: John Blissett
Organization: Bernhard TME
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 17 16:25:22 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: FR-8037-NFPA 70-2020

Statement: The panel changes the term “warning label” to “label” to provide location and not to indicate a hazardous situation. The panel also changes the “warning label” in exception No. 1 to “label”. The controller definition has been updated changing “controller” to “motor controller.” Revisions are made for compliance with Section 4.1.4 and 2.4.3 of the NEC Style Manual.



Public Input No. 3099-NFPA 70-2020 [Section No. 430.110(C)(1)]

(1) Horsepower Rating.

The rating of the disconnecting means shall be determined from the sum 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 430.247, Table 430.248, Table 430.249, or Table 430.250. 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 430.251(A) or Table 430.251(B). 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 or other loads cannot be started simultaneously, the largest sum of locked-rotor currents of a motor or group of motors that can be started simultaneously and the full-load currents of other concurrent loads shall be permitted to be used to determine the equivalent locked-rotor current for the simultaneous combined loads. In cases where different current ratings are obtained when applying these tables, the largest value obtained shall be used.

Exception No. 1 : The locked-rotor current equivalent to the horsepower rating of each polyphase motor with design letter A shall be the motor's marked value of locked-rotor amperes or in absence of these marking, determined by obtaining the maximum value within the range of kilvolt-amperes per horsepower with locked rotor in Table 430.7(B) associated with the motor's marked value of code letter and then multiplying this maximum value this range by the product $(577.35 \times \text{motor's marked value of rated horsepower})$ and then dividing this resulting value by the motor's marked value of rated volts.

Exception No. 2: 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 that is 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.

Statement of Problem and Substantiation for Public Input

As the footnote for Table 430.251(B) states, Design A motors are not limited by any code or standard to a maximum value of locked-rotor current. Typically, Design A motors have a value of locked-rotor current that is significantly higher than their Design B, C, and D counterparts. 430.110(C) presently does not address how to determine the locked-rotor current equivalent to the horsepower rating for Design A motors that are a part of combination loads and this omission could result in the selection of undersized disconnecting means. While the locked-rotor current of Design A motors is not limited by any code or standard, it is limited by the manufacturer-selected value of locked-rotor amperes or code letter that appears on the motor's markings as required by 430.7(A)(8). It is proposed to utilize in 430.110(C)(1) this marking to determine the locked-rotor current equivalent to the horsepower rating for Design A motors that are a part of combination loads.

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Fri Sep 04 15:49:01 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8039-NFPA 70-2020](#)

Statement: Improving the information available to properly apply Design A motors will improve the usability of the code. Information on the calculation proposed needs more detail and substantiation to be accepted. The controller definition has been updated changing “controller” to “motor controller.” Revisions are made for compliance with Section 2.4.3 of the NEC Style Manual.



Public Input No. 2341-NFPA 70-2020 [Section No. 430.113]

430.113 Energy from More Than One Source.

Motor and motor-operated equipment receiving electric energy from more than one source shall be provided with disconnecting means from each source of electric energy immediately adjacent to the equipment served. Each source shall be permitted to have a separate disconnecting means. Where multiple disconnecting means are provided, a permanent ~~warning~~ sign shall be provided on or adjacent to each disconnecting means indicating that multiple sources must be shut off to remove all power to the equipment . The sign at each disconnect shall identify the other specific circuits..

Exception No. 1: Where a motor receives electric energy from more than one source, the disconnecting means for the main power supply to the motor shall not be required to be immediately adjacent to the motor, provided that the controller disconnecting means is lockable in accordance with 110.25.

Exception No. 2: A separate disconnecting means shall not be required for a Class 2 remote-control circuit conforming with Article 725, rated not more than 30 volts, and isolated and ungrounded.

Statement of Problem and Substantiation for Public Input

1) remove the word "warning"; the NEC invokes, by informational note, an abiding by the ANSI standard Z535.4 Sign and Label Requirements as in 110.16(B), 110.21(B). This standard reserves the use of the term "warning" to indicate a potentially hazardous situation which, if not avoided, could result in death or serious injury. Similarly, other terms in this standard have boundaries for use; danger, caution, notice, instruction. Other code text, that advocates signage to indicate multiple sources of power, does not characteristically invoke the term "warning"; 225.37, 225.52(F), 409.110(3), 422.30, 424.19, 520.54(C), 547.9(D), 620.52, 620.55, 690.4(D), 705.10, 706.21(A).

2) Also, whenever any of these five label/sign header terms of ANSI standard Z535.4 are used, the standard advocates consistency in text color and background color. So whenever code text uses these terms to describe a label or sign requirement, the ANSI standard Z535.4 should be referenced in an informational note to further the consistency within NEC code text. It may be prudent to formalize a single consistent label header for this category of signage that applies to multiple source of power, whether or not one of the five ANSI standard Z535.4 terms are used.

Informational Note: ANSI Z535.4-2011, Product Safety Signs and Labels, provides guidelines for the design and durability of safety signs and labels for application to electrical equipment.

3) Include clarification that the signage required should reference the identification of the source of the other circuits involved, similar to what is typically done among other similar requirements of; 225.37, 225.52(F), 409.110(3), 422.30, 424.19, 520.54(C), 547.9(D), 620.52, 620.55, 690.4(D), 705.10, 706.21(A).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 2356-NFPA 70-2020 [Section No. 430.102(A)]	
Public Input No. 2400-NFPA 70-2020 [Section No. 600.6(A)(2)]	
Public Input No. 2401-NFPA 70-2020 [Section No. 110.21(B)]	

Submitter Information Verification

Submitter Full Name: John Blissett
Organization: Bernhard TME
Street Address:
City:

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Submittal Date: Mon Aug 17 10:13:18 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8040-NFPA 70-2020](#)

Statement: The changes will improve safety by indicating on the warning sign specifically where the different energy sources are located. Revisions are made for compliance with Section 4.1.4 of the NEC Style Manual. The controller definition has been updated changing “controller” to “motor controller.”

**Public Input No. 4288-NFPA 70-2020 [Section No. 430.113]****430.113** Energy from More Than One Source.

Motor and motor-operated equipment receiving electric energy from more than one source shall be provided with disconnecting means from each source of electric energy immediately adjacent to the equipment served. Each source shall be permitted to have a separate disconnecting means. Where multiple disconnecting means are provided, a permanent warning sign shall be provided on or adjacent to each disconnecting means.

Exception No. 1: Where a motor receives electric energy from more than one source, the disconnecting means for the main power supply to the motor shall not be required to be immediately adjacent to the motor, provided that the controller disconnecting means is lockable in accordance with 110.25.

Exception No. 2: A separate disconnecting means shall not be required for a Class 2 remote-control circuit conforming with Parts I and III of Article 725, rated not more than 30 volts, and isolated and ungrounded.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(R) Style Manual prohibits references to an entire article, with the exception of Article 100. As such, it is recommended to change the reference to Parts I and III of Article 725 as 725.35 requires compliance with those specific parts for Class II circuits.

Submitter Information Verification

Submitter Full Name: Richard Holub

Organization: The DuPont Company, Inc.

Street Address:

City:

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Zip:

Submittal Date: Thu Sep 10 09:28:50 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8040-NFPA 70-2020](#)

Statement: The changes will improve safety by indicating on the warning sign specifically where the different energy sources are located. Revisions are made for compliance with Section 4.1.4 of the NEC Style Manual. The controller definition has been updated changing “controller” to “motor controller.”



Public Input No. 2059-NFPA 70-2020 [Section No. 430.120]

430.120 General.

The installation provisions of Part I through Part IX are applicable unless modified or supplemented by Part X.

Power conversion equipment used in adjustable-speed drive systems with input ratings of 1000 V or lower, and output ratings of over 1000 V, or vice versa, shall comply with Part X for circuits rated 1000 V or lower, and Part XI for circuits rated over 1000 V .

Statement of Problem and Substantiation for Public Input

Substantiation:

Variable speed drive systems may use power conversion equipment that includes internal transformers, such that the output voltage does not match the input voltage. When only one of these voltages is over 1000 V, the requirements of Part XI are only applicable to the higher voltage circuits. This proposal makes it clear which portions of Part X and Part XI need to be considered for the circuits of different voltages.

NOTE TO CMP: For some reason, TerraView shows the first sentence in this PI underlined as if it were new text, but it is the existing text in section 430.120. This PI is only intended to add the new text shown in the second paragraph (starting with "Power conversion...") The original text (starting with "The installation...") should remain as the first sentence in section 430.120.

Submitter Information Verification

Submitter Full Name: Paul Barnhart

Organization: UL LLC

Street Address:

City:

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Submittal Date: Mon Jul 27 08:22:05 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8122-NFPA 70-2020](#)

Statement: This FR will include MV VFD's in a section where information is not provided for this product.



Public Input No. 524-NFPA 70-2020 [Section No. 430.122]

430.122 Conductors — Minimum Size, Properties, and Ampacity.

(A) Branch/Feeder Circuit Conductors.

Circuit conductors supplying power conversion equipment included as part of an adjustable-speed drive system shall have an ampacity not less than 125 percent of the rated input current to the power conversion equipment.

~~Informational Note No. 1 : Power conversion equipment can have multiple power ratings and corresponding input currents.~~

~~Informational Note No. 2: Circuit conductors on the output of an adjustable-speed drive system are susceptible to breakdown under certain conditions due to the characteristics of the output waveform of the drive. Factors affecting the conductors include but are not limited to the output voltage, frequency, and current, the length of the conductors, the spacing between the conductors, and the dielectric strength of the conductor insulation. Methods to mitigate breakdown include consideration of one or more of these factors.~~

(B) ~~Output Conductors~~ Conductor Properties and Ampacity .

The conductors between the power conversion equipment and the motor shall have an ampacity equal to or larger than 125 percent of the motor full-load current as determined by 430.6(A) or (B). The conductors shall be listed as suitable for use as adjustable speed drive output conductors, and shall have a voltage rating greater than or equal to the larger of:

(1) The peak value of the motor nameplate RMS voltage rating

(2) The peak value, as determined by multiplying the ratio of the RMS voltage to frequency, according to the motor nameplate ratings, by the maximum frequency the motor is expected to be operated at, where applications require a frequency above the motor nameplate rating, and the motor is listed for use in this manner

Exception: If the power conversion equipment is listed and marked as "Suitable for Output Motor Conductor Protection," the conductor between the power conversion equipment and the motor shall have an ampacity equal to or greater than the larger of:

(1) 125 percent of the motor full load current as determined by 430.6(A) or (B)

(2) The ampacity of the minimum conductor size marked on the power conversion equipment

~~Informational Note No. 1 : The minimum ampacity required of output conductors is often different than that of the conductors supplying the power conversion equipment. See 430.130 and 430.131 for branch circuit protection requirements.~~

~~Informational Note No. 2: Circuit conductors on the output of an adjustable-speed drive system are susceptible to breakdown under certain conditions due to the characteristics of the output waveform of the drive. Factors affecting the conductors include but are not limited to the output voltage, frequency, and current, the length of the conductors, the spacing between the conductors, and the dielectric strength of the conductor insulation. Methods to mitigate breakdown include consideration of one or more of these factors.~~

(C) Bypass Device.

For an adjustable-speed drive system that utilizes a bypass device, the conductor ampacity shall not be less than required by 430.6. The ampacity of circuit conductors supplying power conversion equipment included as part of an adjustable-speed drive system that utilizes a bypass device shall be the larger of either of the following:

(1) 125 percent of the rated input current to the power conversion equipment

(2) 125 percent of the motor full-load current rating as determined by 430.6

(D) Several Motors or a Motor and Other Loads.

Conductors supplying several motors or a motor and other loads, including power conversion equipment, shall have ampacity in accordance with 430.24, using the rated input current of the power conversion equipment for purposes of calculating ampacity.

Statement of Problem and Substantiation for Public Input

As stated by the IN No. 2, added to 430.122(A) in the 2020 NEC, increasing studies have shown premature failure in the output conductors on an adjustable speed drive, correlating with the type of conductor used. For example, in a 480-volt-rated, 60Hz drive application, the PWM voltage at 60Hz is transmitted at the peak voltage, or 684V of a 480-volt, 60Hz waveform. The use of THHN conductors, for example, in this application, would not be acceptable, as the voltage rating of 600V is already exceeded. Furthermore, the high-capacitance, low-resistance properties of THHN can create voltage spikes in the conductors in excess of 1200V. XHHW-2 insulation is rated at 1000V, and its conductor properties are better suited to handle the PWM output from an adjustable speed drive. A cable assembly that is listed as suitable for use as output conductors for an adjustable speed drive, or conductors that are listed for this purpose, would cut down on the premature failure rates of these installations. The titles of 430.122 and 430.122(B) is changed to reflect the requirement for the properties of the output conductors as a whole to be considered, and 430.122(A), IN No. 2 is moved to 430.122(B), to align with the proper subdivision.

Submitter Information Verification

Submitter Full Name: Steven Worsley
Organization: NECA IBEW Electrical JATC
Street Address:
City:
State:
Zip:
Submittal Date: Mon Feb 24 12:49:52 EST 2020
Committee: NEC-P11

Committee Statement

Resolution: The use of XHHW-2 is a design consideration for motor applications using VFD's. The NEC is an installation code not a design manual.

**Public Input No. 2086-NFPA 70-2020 [Sections 430.122(A), 430.122(B)]****Sections 430.122(A), 430.122(B)****(A) Branch/Feeder Circuit Conductors.**

Circuit conductors supplying power conversion equipment included as part of an adjustable-speed drive system shall have an ampacity not less than 125 percent of the rated input current to the power conversion equipment.

Informational Note No. 1: Power conversion equipment can have multiple power ratings and corresponding input currents.

~~Informational Note No. 2: Circuit conductors on the output of an adjustable-speed drive system are susceptible to breakdown under certain conditions due to the characteristics of the output waveform of the drive. Factors affecting the conductors include but are not limited to the output voltage, frequency, and current, the length of the conductors, the spacing between the conductors, and the dielectric strength of the conductor insulation. Methods to mitigate breakdown include consideration of one or more of these factors.~~

(B) Output Conductors.

The conductors between the power conversion equipment and the motor shall have an ampacity equal to or larger than 125 percent of the motor full-load current as determined by 430.6(A) or (B).

Exception: If the power conversion equipment is listed and marked as "Suitable for Output Motor Conductor Protection," the conductor between the power conversion equipment and the motor shall have an ampacity equal to or greater than the larger of:

- (1) 125 percent of the motor full load current as determined by 430.6(A) or (B)
- (2) The ampacity of the minimum conductor size marked on the power conversion equipment

Informational Note: The minimum ampacity required of output conductors is often different than that of the conductors supplying the power conversion equipment. See 430.130 and 430.131 for branch circuit protection requirements.

Informational Note No. 2: Circuit conductors on the output of an adjustable-speed drive system are susceptible to breakdown under certain conditions due to the characteristics of the output waveform of the drive. Factors affecting the conductors include but are not limited to the output voltage, frequency, and current, the length of the conductors, the spacing between the conductors, and the dielectric strength of the conductor insulation. Methods to mitigate breakdown include consideration of one or more of these factors.

Statement of Problem and Substantiation for Public Input

During the 2020 code cycle, 430.122(A) informational note no. 2 and section 430.122(B) Output Conductors were added. Informational note no. 2 to 430.122(A) pertains to output conductors of an adjustable-speed drive system and was proposed to be added to 430.122(A) because at the time, 430.122(B) did not exist. Now that 430.122(B) has been added with requirements related to conductors on the output of an adjustable-speed drive system, information note no. 2 of 430.122(A) would be more appropriate as an informational note to 430.122(B). This public input is to move informational note no. 2 from 430.122(A) to 430.122(B).

Submitter Information Verification

Submitter Full Name: Seth Carlton

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Wed Jul 29 16:23:55 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8124-NFPA 70-2020](#)

Statement: Moving the informational note from (A) to (B) will improve readability and usability of this section. Deletion of IN numbering will be in line with NEC style manual. Revisions are made for compliance with Section 4.1.4 of the NEC Style Manual.

**Public Input No. 2543-NFPA 70-2020 [Section No. 430.122(B)]****(B) Output Conductors.**

The conductors between the power conversion equipment and the motor shall have an ampacity equal to or larger than 125 percent of the motor full-load current as determined by 430.6(A) or (B).

Exception: If the power conversion equipment is listed and marked as "Suitable for Output Motor Conductor Protection," the conductor between the power conversion equipment and the motor shall have an ampacity equal to or greater than the larger of:

- (1) 125 percent of the motor full load current as determined by 430.6(A) or (B)
- (2) The ampacity of the minimum conductor size marked on the power conversion equipment

Informational Note No. 1 : The minimum ampacity required of output conductors is often different than that of the conductors supplying the power conversion equipment. See 430.130 and 430.131 for branch circuit protection requirements.

Informational Note No. 2: Circuit conductors on the output of an adjustable-speed drive system are susceptible to breakdown under certain conditions due to the characteristics of the output waveform of the drive. Factors affecting the conductors include but are not limited to the output voltage, frequency, and current, the length of the conductors, the spacing between the conductors, and the dielectric strength of the conductor insulation. Methods to mitigate breakdown include consideration of one or more of these factors. One method of mitigating the aforementioned issues is to use output conductor cables, constructed of thermoset insulated conductors, that have been evaluated for use with adjustable speed drive systems.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
VFD_Cable_PI_Rev_2_.docx	Word Document of the Proposed PI with supporting substantiation for the proposal.	

Statement of Problem and Substantiation for Public Input

This Public Input is intended to be reviewed in two parts. Rationale for each part of the public input is provided below.

- 1) During the 2020 code cycle, 430.122(A) informational note no. 2 and section 430.122(B) Output Conductors were added. Informational note no. 2 to 430.122(A) pertains to output conductors of an adjustable-speed drive system and was proposed to be added to 430.122(A) because at the time, 430.122(B) did not exist. Now that 430.122(B) has been added with requirements related to conductors on the output of an adjustable-speed drive system, information note no. 2 of 430.122(A) would be more appropriate as an informational note to 430.122(B). This public input is to delete informational note no. 2 from 430.122(A) and add it to 430.122(B).
- 2) The addition to the informational note starting at the sentence "one method" serves to further clarify a method of mitigation for cables when used with adjustable speed drives. The inclusion of thermoset insulated conductors is supported by NEMA ICS 7.2-2015 "Application Guide for AC Adjustable Speed Drive Systems" section 5.4.4.2.1, which highlights differences in Partial Discharge Inception voltages between thermoplastic and thermoset insulated wires when used in adjustable speed drive applications.

Submitter Information Verification

Submitter Full Name: Paul Knapp

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 24 13:40:03 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: There are several methods that can be used to mitigate the issue presented. Only listing one possible solution leaves out the others possible mitigation techniques. The relocation of the IN from (A) to (B) was processed.

VFD Cable PI

ARTICLE 430- MOTORS, MOTOR CIRCUITS, AND CONTROLLERS

430.122(B) Output Conductors.

The conductors between the power conversion equipment and the motor shall have an ampacity equal to or larger than 125 percent of the motor full-load current as determined by 430.6(A) or (B).

Exception: If the power conversion equipment is listed and marked as "Suitable for Output Motor Conductor Protection," the conductor between the power conversion equipment and the motor shall have an ampacity equal to or greater than the larger of:

(1) 125 percent of the motor full load current as determined by 430.6(A) or (B)

(2) The ampacity of the minimum conductor size marked on the power conversion equipment

Informational Note No. 1: The minimum ampacity required of output conductors is often different than that of the conductors supplying the power conversion equipment. See 430.130 and 430.131 for branch circuit protection requirements.

Informational Note No. 2: Circuit conductors on the output of an adjustable-speed drive system are susceptible to breakdown under certain conditions due to the characteristics of the output waveform of the drive. Factors affecting the conductors include but are not limited to the output voltage, frequency, and current, the length of the conductors, the spacing between the conductors, and the dielectric strength of the conductor insulation. Methods to mitigate breakdown include consideration of one or more of these factors. One method of mitigating the aforementioned issues is to use output conductor cables, constructed of thermoset insulated conductors, that have been evaluated for use with adjustable speed drive systems.

Substantiation for the proposal:

This Public Input is intended to be reviewed in two parts. Rationale for each part of the public input is provided below.

- 1) During the 2020 code cycle, 430.122(A) informational note no. 2 and section 430.122(B) Output Conductors were added. Informational note no. 2 to 430.122(A) pertains to output conductors of an adjustable-speed drive system and was proposed to be added to 430.122(A) because at the time, 430.122(B) did not exist. Now that 430.122(B) has been added with requirements related to conductors on the output of an adjustable-speed drive system, informational note no. 2 of 430.122(A) would be more appropriate as an informational note to 430.122(B). This public input is to delete informational note no. 2 from 430.122(A) and add it to 430.122(B).
- 2) The addition to the informational note starting at the sentence "one method" serves to further clarify a method of mitigation for cables when used with adjustable speed drives. The inclusion of thermoset insulated conductors is supported by NEMA ICS 7.2-2015 "Application Guide for AC Adjustable Speed Drive Systems" section 5.4.4.2.1, which highlights differences in Partial Discharge Inception voltages between thermoplastic and thermoset insulated wires when used in adjustable speed drive applications.



Public Input No. 1094-NFPA 70-2020 [Section No. 430.122(C)]

(C) Bypass Device.

For an adjustable-speed drive system that utilizes a bypass device, the conductor ampacity shall not be less than required by 430.6. The ampacity of circuit conductors supplying power conversion equipment included as part of an adjustable-speed drive system that utilizes a bypass device shall be the larger of either of the following:

- (1) 125 percent of the rated input current to the power conversion equipment
- (2) 125 percent of the motor full-load current rating as determined by 430.6
- (3)

The ampacity of the minimum conductor size marked on the power conversion equipment as determined in 430.122(B)(2).

Informational Note: The minimum ampacity required of output conductors is often different from that of the conductors supplying the power conversion equipment. See 430.130 and 430.131 for branch circuit protection requirements.

Statement of Problem and Substantiation for Public Input

The minimum ampacity required of output conductors is often different from that of the conductors supplying the power conversion equipment. Depending on the configuration for the system's power wiring, conformance will be assured by all components of the system.

Submitter Information Verification

Submitter Full Name: David Bredhold
Organization: DB Technical Services
Street Address:
City:
State:
Zip:
Submittal Date: Sat May 16 09:58:48 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: When a VFD is in bypass the power conversion is no longer part of the circuit. The Bypass device will be required to be sized as a motor circuit without power conversion.



Public Input No. 1588-NFPA 70-2020 [Section No. 430.122(C)]

(C) Bypass Device.

~~For an adjustable-speed drive system that utilizes a bypass device, the conductor ampacity shall not be less than required by 430.6 –~~ The ampacity of circuit conductors supplying power conversion equipment included as part of an adjustable-speed drive system that utilizes a bypass device shall be the larger of either of the following:

- (1) 125 percent of the rated input current to the power conversion equipment
- (2) 125 percent of the motor full-load current rating as determined by 430.6

Statement of Problem and Substantiation for Public Input

The current wording for 430.122(C) indicates that 430.6 would provide the conductor ampacity. Article 430.6 only provides direction on what FLC should be used to do the calculation. Removing the first sentence would clarify the requirement.

Submitter Information Verification

Submitter Full Name: David Hittinger

Organization: IEC

Affiliation: IEC

Street Address:

City:

State:

Zip:

Submission Date: Mon Jun 22 17:30:06 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8126-NFPA 70-2020](#)

Statement: The deletion of the first sentence does not change the remaining requirements within the section. It will improve clarity of the requirement.



Public Input No. 2060-NFPA 70-2020 [New Section after 430.224]

430.XX Wire-Bending Space in Enclosures

Motor controllers rated over 1000 V shall provide space within the enclosure to comply with 300.34.

Statement of Problem and Substantiation for Public Input

Substantiation:

As currently written, 430.10(B) applies to all motor controllers, regardless of voltage rating. The wire bending space in Table 430.10(B) is only for low voltage cables, and is not appropriate for medium voltage cables. Adding the new section in Part XI as proposed clarifies how bending space is to be determined for other than low voltage motor controllers.

NOTE TO CMP: Although it makes sense to place this before section 430.224 to keep the order similar to other parts of this Article, but this would require the rest of Part XI to be renumbered, so it could be added at the end of Part XI if that is preferable.

Submitter Information Verification

Submitter Full Name: Paul Barnhart

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jul 27 08:29:54 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: FR-8044-NFPA 70-2020

Statement: The FR adds requirements for minimum bending space of conductors for enclosures of equipment operating over 1000V



Public Input No. 2058-NFPA 70-2020 [Section No. 430.224]

430.224 Size of Conductors.

The ampacities of conductors supplying equipment rated over 1000 V, nominal, shall be determined based on 311.60, and 430.224(A) and (B):

(A) Conductors supplying motors shall have an ampacity not less than the current at which the motor overload protective device(s) is selected to trip.

(B) For an adjustable speed drive system, the ampacity of the conductors supplying the power conversion equipment shall have an ampacity not less than 125 percent of the rated input current to the power conversion equipment.

Statement of Problem and Substantiation for Public Input

Substantiation:

Section 430.224 provides guidance for sizing conductors supplying motors, but does not provide further guidance for determining ampacity of medium voltage conductors. Since there is no other guidance in Part XI of Article 430, the user would default to the general requirements in Part I, but 430.6 only provides guidance for low voltage conductors. The references to Article 310 are not appropriate for medium voltage cables. Furthermore, 430.224 only addresses conductors supplying motors. When an adjustable speed drive is used, guidance for sizing of the input conductors to the drive is needed. This public input provides the necessary references to determine the correct ampacity for conductors in medium voltage motor circuits.

NOTE TO CMP - the text that now appears in item (A) is NOT new text, but for some reason, TerraView marks it as new next. This text was the original (and only) text in 430.224, and this PI simply moves it to a new item (A) under the new "lead-in" text that is being proposed, along with new text that appears in item (B)

Submitter Information Verification

Submitter Full Name: Paul Barnhart

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jul 27 08:11:14 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: FR-8045-NFPA 70-2020

Statement: The panel is providing the addition of MV VFD information and is an important update to the code. The addition of requirements on sizing conductors for the input of MV VFD's is needed.



Public Input No. 2118-NFPA 70-2020 [Section No. 430.224]

430.

224-

224 Minimum Size of Motor Circuit Conductors.

(A) Motor Branch Circuit Conductors

supplying motors shall have

. Motor branch circuit conductors supplying a single motor shall have an ampacity not less than the current at which the motor overload protective device(s) is selected to trip.

and fault-current device(s) are selected to trip, and if continuous duty, shall also comply with either (a) or (b):

(1) Continuous Duty.

(a) For an induction-type squirrel cage or wound rotor motor, the branch circuit conductors shall have an ampacity not less than 125% of the motor nameplate full-load current rating.

(b) For synchronous motors, the branch circuit conductors shall have an ampacity not less than 125% of the motor nameplate full-load current rating at unity power factor. Field excitation conductors shall be protected against overcurrent according to the exciter device manufacturer instructions.

(B) Feeder Circuit Conductors. Feeder circuit conductors supplying equipment from which more than one motor or other non-motor loads over 1000 volts, nominal are supplied, shall have an ampacity not less than the current at which the overload protection device(s) and fault-current device(s) are selected to trip and shall comply with the following where applicable:

(1) Continuous Duty Motors and Other Loads.

Feeder conductors supplying equipment from which at least one continuous duty motor is supplied in addition to other motors or non-motor loads, shall have an ampacity not less than 125% of the largest full-load motor nameplate current rating, plus 100% of the current ratings of the other loads. Where the continuous duty motor is a synchronous motor, the unity power factor current nameplate rating shall be used.

(C) Engineering Supervision. Overload and fault-current device(s) settings for each feeder or motor branch circuit shall be determined under the supervision of a qualified licensed professional engineer.

Statement of Problem and Substantiation for Public Input

This proposal is a companion proposal for a new definition for motor branch circuit in Art. 100. In addition, it revises the current language to include the "fault-current device(s)" which are required by 430.225(C).

One of the principles of the NEC is where there is a continuous load, a factor of 125% must be used for calculating the minimum conductor size. It is not clear in Art. 430 in the 2020 edition that this principle applies to motors over 1000 volts as it does for motors less than 1000 volts. Adding this text would clarify that in addition to being protected by the overload and fault-current device (usually a protection relay), there is a minimum requirement of 125% of the continuous motor load which must be considered.

Calculating conductor sizes of circuits over 1000 volts, nominal and performing relay coordination requires special skills, and sometimes software, that an electrician, inspector, or designer alone may not possess. Adding this requirement would clarify the level of engineering supervision required. The proposed

terminology for the level of engineering supervision is already used in 490.48 for substations.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 2120-NFPA 70-2020 [Article 100]	motor branch circuit and feeder circuits
Public Input No. 2450-NFPA 70-2020 [New Definition after Definition: Branch Circuit, Individual.]	
Public Input No. 2452-NFPA 70-2020 [Section No. 430.225(B)(1)]	

Submitter Information Verification

Submitter Full Name: Paul Guidry
Organization: Fluor Enterprises, Inc.
Affiliation: Associated Builders and Contractors
Street Address:
City:
State:
Zip:
Submittal Date: Sat Aug 01 21:30:20 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: The proposal does not add clarity to the code. The requested changes do not account for the amount of complexity involved in these applications.



Public Input No. 2057-NFPA 70-2020 [Section No. 430.225(A)]

(A) General.

Each motor circuit shall include coordinated protection to automatically interrupt overload and fault currents in the motor, the motor-circuit conductors, and the motor control apparatus. Adjustable speed drive systems with input or output voltage ratings over 1000 V nominal shall comply with 430.124 and 430.126. All other motor circuits shall comply with 430.225(B) through (C).

Exception: Where a motor is critical to an operation and the motor should operate to failure if necessary to prevent a greater hazard to persons, the sensing device(s) shall be permitted to be connected to a supervised annunciator or alarm instead of interrupting the motor circuit.

Statement of Problem and Substantiation for Public Input

Substantiation:

Section 430.225 provides requirements for motor-circuit overcurrent protection, but does not provide sufficient information for protection of motor circuits in adjustable speed drive systems. Including the reference to the appropriate clauses in Part X make it clear that section 430.225 does not amend the requirements for protection in adjustable speed drive systems, including motor overtemperature requirements.

Submitter Information Verification

Submitter Full Name: Paul Barnhart

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jul 27 08:05:59 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: FR-8046-NFPA 70-2020

Statement: The panel is providing the addition of MV VFD information, it is an important update to the code. The addition will improve usability of this section.



Public Input No. 2451-NFPA 70-2020 [Section No. 430.225(A)]

(A) General.

Each motor circuit shall include coordinated protection to automatically interrupt overload and fault currents in the motor, the motor-circuit conductors, and the motor control apparatus. Overload and fault-current device(s) settings for each motor feeder or branch circuit shall be determined under the supervision of a qualified licensed professional engineer.

Exception: Where a motor is critical to an operation and the motor should operate to failure if necessary to prevent a greater hazard to persons, the sensing device(s) shall be permitted to be connected to a supervised annunciator or alarm instead of interrupting the motor circuit.

Statement of Problem and Substantiation for Public Input

The overload protective device(s) along with the fault-current devices settings should both be determined under engineering supervision.

The proposed language for the level of engineering supervision required is already used in Section 490.48 for substations.

This is a companion proposal for two others for the revision of 430.224 and 430.225(B)(1).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 2452-NFPA 70-2020 [Section No. 430.225(B)(1)]</u>	

Submitter Information Verification

Submitter Full Name: Paul Guidry
Organization: Fluor Enterprises, Inc.
Affiliation: Associated Builders and Contractors
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 23 00:49:25 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: The panel is providing the addition of MV VFD information and is an important update to the code. The addition of requirements on sizing conductors for the input of MV VFD's is needed.



Public Input No. 2452-NFPA 70-2020 [Section No. 430.225(B)(1)]

(1) Type of Overload Device.

Each motor shall be protected against ~~dangerous heating- overheating~~ due to motor overloads and an overload and a subsequent failure to start by- . Protection shall be provided by a thermal protector integral with the motor- ~~or external~~ , external current-sensing devices ~~device(s)~~ , or both. ~~Protective device settings for each motor circuit shall be determined under engineering supervision.~~

Statement of Problem and Substantiation for Public Input

This is a companion proposal to two others for Sections 430.224 and 430.225(A).

It also removes the adjective "dangerous" from the description of the level of overheating that may occur. Just because a motor may catch fire or has a fault due to overheating which results in a fire doesn't mean that it would necessarily be dangerous. All motors should be protected against overloads regardless if the result is dangerous or not.

This proposal also relocates and modifies the existing language for the required engineering supervision when determining the settings of the overload device.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 2118-NFPA 70-2020 [Section No. 430.224]	Protection of the motor circuit conductors
Public Input No. 2451-NFPA 70-2020 [Section No. 430.225(A)]	Engineering supervision requirements for both overload and fault-current protection.

Submitter Information Verification

Submitter Full Name: Paul Guidry
Organization: Fluor Enterprises, Inc.
Street Address:
City:
State:
Zip:
Submission Date: Sun Aug 23 00:56:42 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: This proposal to make editorial changes does not improve clarity and readability of the provisions of this section.



Public Input No. 2056-NFPA 70-2020 [Section No. 430.227]

430.227 Disconnecting Means.

The controller disconnecting means shall be a switch or circuit breaker having a voltage rating no less than that of the circuit involved, and shall be lockable in accordance with 110.25. The disconnecting means shall have an ampere rating not less than 115 percent of the full-load current rating of the motor. For adjustable speed drive systems, the disconnecting means shall have an ampere rating not less than 115 percent of the rated input current of the power conversion equipment.

Statement of Problem and Substantiation for Public Input

Substantiation:

The single sentence in 430.227 is insufficient to describe the requirements for the disconnect switch in circuits over 1000 V, nominal. Without additional text, the user might assume that 430.109 and 430.110 are applicable to equipment over 1000 V, which is not correct. The disconnect types identified in 430.109 are specifically low voltage type devices, and are not suitable for medium voltage circuits. In addition to specifying the type of device and the required current rating, the text regarding adjustable speed drive systems was added, since it might be assumed that 430.227 contains all the requirements and replaces 430.128 entirely.

Submitter Information Verification

Submitter Full Name: Paul Barnhart

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jul 27 07:59:06 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: FR-8047-NFPA 70-2020

Statement: This FR will improve the usability by providing the proper voltage and current ratings for MV disconnecting means.



Public Input No. 1087-NFPA 70-2020 [Section No. 430.241]

430.241 General.

Part XIII specifies the grounding of exposed non-current-carrying metal parts, likely to become energized, of motor and controller frames to prevent a voltage ~~aboveground~~ above ground in the event of accidental contact between energized parts and frames. Insulation, isolation, or guarding are suitable alternatives to grounding of motors under certain conditions.

Statement of Problem and Substantiation for Public Input

Aboveground is an adjective denoting position relative to the surface of the surrounding earth, e.g., aboveground pool. Above ground specifies voltage level relative to ground potential.

Submitter Information Verification

Submitter Full Name: David Bredhold

Organization: DB Technical Services

Street Address:

City:

State:

Zip:

Submittal Date: Sat May 16 09:09:34 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8049-NFPA 70-2020](#)

Statement: The editorial correction will correct the reference to ground potential in this section.

**Public Input No. 4582-NFPA 70-2020 [Section No. 430.245(B)]****(B) Separation of Junction Box from Motor.**

The junction box required by 430.245(A) shall be permitted to be separated from the motor by not more than 1.8 m (6 ft), provided the leads to the motor are stranded conductors within Type AC cable, interlocked metal tape Type MC cable where listed and identified in accordance with 250.118(10)(a), or armored cord or are stranded leads enclosed in liquidtight flexible metal conduit, flexible metal conduit, intermediate metal conduit, rigid metal conduit, or electrical metallic tubing not smaller than metric designator 12 (trade size $\frac{3}{8}$), the armor or raceway being connected both to the motor and to the box.

Liquidtight flexible nonmetallic conduit and rigid ~~nonmetallic conduit~~ polyvinyl chloride conduit shall be permitted to enclose the leads to the motor, provided the leads are stranded and the required equipment grounding conductor is connected to both the motor and to the box.

Where stranded leads are used, protected as specified above, each strand within the conductor shall be not larger than 10 AWG and shall comply with other requirements of this *Code* for conductors to be used in raceways.

Statement of Problem and Substantiation for Public Input

The 2008 NEC first referenced Reinforced Thermosetting Resin Conduit (RTRC) as a wiring method (Article 355). High Density Polyethylene Conduit (HDPE) first appeared in the 2005 NEC as Article 353. When Article 352 first changed (2008 NEC) to be titled "Rigid Polyvinyl Chloride Conduit" there were many changes throughout the Code to pick up this change and accordingly change text from "rigid nonmetallic conduit" to "rigid polyvinyl chloride conduit."

In the 2002 NEC, this section referenced "rigid nonmetallic conduit" (as it still does in the 2020 NEC) before RTRC and HDPE appeared in the Code. This makes it clear that this section intended to permit only the use of rigid polyvinyl chloride conduit identified as "rigid nonmetallic conduit" as the other raceway types were not recognized by the NEC at the time. This term should be changed to rigid polyvinyl chloride and if the cmp wishes to add other types of nonmetallic raceways they should be listed separately as the metal raceways are.

Submitter Information Verification

Submitter Full Name: David Humphrey

Organization: County of Henrico, Virginia

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 10 15:24:31 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: The panel's intent is to provide the user with the option to utilize any rigid nonmetallic conduit suitable in accordance with the respective wiring method article.



Public Input No. 3633-NFPA 70-2020 [Section No. 440.2]

(Relocate all definitions in the 440.2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

440.2 Definitions.

The definitions in this section shall apply only within this article.

Branch-Circuit Selection Current.

The value in amperes to be used instead of the rated-load current in determining the ratings of motor branch-circuit conductors, disconnecting means, controllers, and branch-circuit short-circuit and ground-fault protective devices wherever the running overload protective device permits a sustained current greater than the specified percentage of the rated-load current. The value of branch-circuit selection current will always be equal to or greater than the marked rated-load current.

Leakage-Current Detector-Interrupter (LCDI).

A device provided in a power supply cord or cord set that senses leakage current flowing between or from the cord conductors and interrupts the circuit at a predetermined level of leakage current.

Rated-Load Current.

The current of a hermetic refrigerant motor-compressor resulting when it is operated at the rated load, rated voltage, and rated frequency of the equipment it serves.

Statement of Problem and Substantiation for Public Input

"The National Electrical Code has definitions in multiple parts in Article 100 and many definitions scattered through out the code many of them in the .2 section of the articles.

Most of the other standards under NFPA have their definitions in one location and this will allow the NEC the same requirement. The revisions to the NEC Style Manual require all the definitions to be relocated to Article 100.

Submitter Information Verification

Submitter Full Name: David Williams

Organization: Delta Charter Township

Street Address:

City:

State:

Zip:

Submission Date: Wed Sep 09 09:53:41 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-7978-NFPA 70-2020](#)

Statement: Relocating definitions in accordance with the manual of style.



Public Input No. 4292-NFPA 70-2020 [Section No. 440.3]

440.3 Other Articles.

(A) ~~Article 430~~ Motors.

See Table 440.3. These provisions are in addition to, or amendatory of, ~~the provisions of Article 430 and other articles in this Code,~~ which apply except as modified in this article.

(B) ~~Articles 422, 424, or 430.~~

~~The rules of Articles 422, 424, or 430, as applicable, shall apply to air-conditioning and refrigerating equipment~~

Air-Conditioning and Refrigerating Equipment that does not incorporate a hermetic refrigerant motor-compressor.

See Table 440.3. This equipment includes devices that employ refrigeration compressors driven by conventional motors, furnaces with air-conditioning evaporator coils installed, fan-coil units, remote forced air-cooled condensers, remote commercial refrigerators, and so forth.

(C) ~~Article 422.~~

~~Equipment such as room air conditioners, household refrigerators and freezers, drinking water coolers, and beverage dispensers shall be considered appliances, and Article 422 shall also apply~~

Room Air Conditioners, Household Refrigerators and Freezers, Drinking Water Coolers, and Beverage Dispensers.

See Table 440.3. This equipment be considered as appliances and the rules of the applicable article shall apply unless modified in this article.

(D) Other Applicable Articles.

Hermetic refrigerant motor-compressors, circuits, controllers, and equipment shall also comply with the applicable provisions of Table 440.3(D).

Table 440.3(D) Other Articles

<u>Equipment/Occupancy</u>	<u>Article</u>	<u>Section</u>
<u>Motors</u>	-	
<u>Appliances</u>	<u>430</u>	<u>460.9</u>
<u>Fixed Electric Space-Heating Equipment</u>	<u>422</u>	
<u>Capacitors</u>	<u>424</u>	
Commercial garages, aircraft hangars, motor fuel dispensing facilities, bulk storage plants, spray application, dipping, and coating processes, and inhalation anesthetizing locations	511, 513, 514, 515, 516, and 517 Part IV	-
Hazardous (classified) locations	500–503, 505, and 506	-
Motion picture and television studios and similar locations	530	-
Resistors and reactors	470	-

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(R) Style Manual prohibits references to an entire article, with the exception of Article 100. In addition, references to other articles are to be listed in a table in accordance with Sections 2.5 and 2.3 of the NEC(r) Style Manual. As such, it is recommended that the CMP change the language as shown and incorporate a table making reference to other articles. The intent, here, is to comply with the style manual but not to change the requirements formerly stated in this section so careful review by the CMP is encouraged to make sure this has been done.

Submitter Information Verification

Submitter Full Name: Richard Holub

Organization: The DuPont Company, Inc.

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 10 09:33:43 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8059-NFPA 70-2020](#)

Statement: General references to other Articles within the code are being revised to meet the requirements of 4.1.4 within the new 2020 NEC Style Manual.



Public Input No. 837-NFPA 70-2020 [New Section after 440.3(B)]

AC & Refrigeration Equipment Feeders

Feeders supplying 1 or more overcurrent protection devices for AC or refrigeration equipment shall be sized in accordance with article 430 Part V.

Statement of Problem and Substantiation for Public Input

Article 440 only addresses the sizing for OCPDs and conductors of branch circuits feeding equipment. In the event that an ocpd is installed at the equipment for any purpose, those conductors that are ahead of the equipment disconnect become feeders and are no longer addressed by article 440. This change would give a reference to size these feeders.

Submitter Information Verification

Submitter Full Name: JEREMY ROLAND

Organization: West End Services

Street Address:

City:

State:

Zip:

Submittal Date: Tue Apr 07 21:11:03 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: The proposed language does not add clarity or usability to the code.



Public Input No. 2624-NFPA 70-2020 [Section No. 440.8]

440.8 Single Machine and location .

An air-conditioning or refrigerating system shall be considered to be a single machine under the provisions of 430.87, Exception No. 1, and 430.112, Exception. The motors shall be permitted to be located remotely from each other. Air Conditioning and refrigeration equipment shall not be installed in the bathtub and shower space.

Statement of Problem and Substantiation for Public Input

This input is being submitted on behalf of the Minnesota Department of Labor and Industry. The Department's 15 office/field staff, and 65 plus contract electrical inspectors complete over 150,000 electrical inspections annually and are involved in the daily enforcement and interpretation of the National Electrical Code.

In older homes with smaller bathrooms this is becoming a problem. With the lack of wall space in these bathrooms, and the fact that the bathtub is generally installed on an outside wall. This wall becomes a prime location for installing the utilization equipment such as a split-mini HVAC evaporator unit. This requirement would be similar to other electrical equipment that is prohibited to be installed in a bathtub or shower space such as switches, receptacles and ceiling suspended luminaires.

Submitter Information Verification

Submitter Full Name: Dean Hunter

Organization: Minnesota Department of Labor

Street Address:

City:

State:

Zip:

Submittal Date: Wed Aug 26 08:40:56 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: FR-8130-NFPA 70-2020

Statement: As split-mini units become more prevalent in installation, they are being installed in bathtub and shower spaces due to lack of wall space. This can present a hazard. This first revision revises 440.8 to include location and prohibits installation of these units in the zone around bathtub and shower spaces. The dimensions of the zone around these areas are consistent with other Articles in the Code.



Public Input No. 1361-NFPA 70-2020 [Section No. 440.9]

440.9 Equipment Grounding and Bonding Conductor .

Where equipment is installed outdoors on a roof, an equipment grounding conductor of the wire type shall be installed in outdoor portions of metallic raceway systems that use compression or set -screw type fittings.

Statement of Problem and Substantiation for Public Input

According to the NFPA Style Manual, the Section Title needs to reflect the content of the rule. The rule is about the equipment grounding conductor, not about 'Grounding.' Add 'set-screw' to the fitting list, since there are some 'set-screw' fitting listed for wet locations. In addition, set-screw fitting are permitted in wet locations, except where the raceway terminates to enclosures.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 01 19:42:52 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: The equipment grounding conductor's purpose is for bonding the equipment through the raceway, therefore the title of 440.9 is accurate. The committee is not aware of any set-screw fittings that are suitable for wet locations, thus making the need for the proposed change not necessary.



Public Input No. 4071-NFPA 70-2020 [Section No. 440.11]

440.11 General.

The disconnecting means shall be located at a readily accessible location. If the disconnecting means installed in dwellings exposes any terminals or wiring when physically open the enclosure shall be locked or require a tool to open.

Part II is intended to require disconnecting means capable of disconnecting air-conditioning and refrigerating equipment, including motor-compressors and controllers from the circuit conductors.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u> <u>Approved</u>
_1_Square_D_WP_switch_with_no_latch_no_interlock_and_no_guards_just_lift_the_cover.jpg	Disconnect switch with no latch and no guard shields just lift up the cover and it conforms to UL98 safety standards
_2_Toddler_height_and_any_disconnect_switch_60_amps_or_less_have_no_guards.jpg	Toddler height and any disconnect switch 60 amps or less have no guard shields
SW4.jpg	Toddler height

Statement of Problem and Substantiation for Public Input

The placement of disconnect switches in dwellings, in locations that are accessible by other than qualified personnel, particularly by children, is a potential hazard. Knife blade disconnect switches are the ONLY widely used piece of electrical equipment that does not require a tool to access the live components inside, thus they have no child safeguards. The disconnect enclosures can often be easily opened exposing potentially life-threatening voltages and current levels if contacted by personnel. The disconnect equipment often is being installed on accessible external and internal surfaces of dwellings, in garages, and in almost any room except bathrooms in dwellings. An opened disconnect enclosure contains wiring and terminals that can be touched with tools, probes or hands. There is a need to require, that they be locked, or require a tool to physically open these enclosures.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 3738-NFPA 70-2020 [Section No. 110.25]	knife blade disconnect switches installed in dwellings
Public Input No. 4057-NFPA 70-2020 [Section No. 404.8(A)]	knife blade disconnect switches installed in dwellings

Public Input No. 4080-NFPA 70-2020 [Section No. 680.13]

Submitter Information Verification

Submitter Full Name: Tommy Davis

Organization: Master Electrician, Retired IBEW member, Retired electrical inspector

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 09 19:57:24 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8063-NFPA 70-2020](#)

Statement: The first revision will enhance the protection of unqualified persons in the vicinity of this equipment. Section 440.14 already addresses location.



Public Input No. 512-NFPA 70-2020 [Section No. 440.11]

~~440.11~~ General.

~~Part II is intended to require disconnecting means capable of disconnecting air-conditioning and refrigerating equipment, including motor compressors and controllers from the circuit conductors.~~

Statement of Problem and Substantiation for Public Input

There is no reason for this section to exist. If the intent of the Article Part is not already clear there should be an informational note. The intent of the disconnecting means required in this article is not any different than any other article's disconnecting means, so there is no reason to need to explain it.

Submitter Information Verification

Submitter Full Name: Ryan Jackson

Organization: Ryan Jackson

Street Address:

City:

State:

Zip:

Submittal Date: Fri Feb 21 12:09:01 EST 2020

Committee: NEC-P11

Committee Statement

Resolution: Clause 440.11 provides clarity with respect to the requirements for a disconnect specific to air conditioning and refrigerating equipment. It should not be deleted.



Public Input No. 3912-NFPA 70-2020 [New Section after 440.14]

Absence of Voltage Test & Indication

A means shall be provided to verify the absence of voltage in accordance with an acceptable industry practice that does not expose personnel to shock or arc flash hazards or live parts at the test point for the disconnecting means for any voltage supplies or stored energy sources that present a shock or arc flash hazard up to and including 10000 V that are likely to require examination, adjustment, servicing, or maintenance in equipment located other than in dwelling units.

Informational Note: NFPA 70E-2021 Standard for Electrical Safety in the Workplace provides guidance for safely verifying the absence of voltage including the use of devices like a permanently mounted absence of voltage tester.

Statement of Problem and Substantiation for Public Input

Testing for absence of voltage is an important step that helps increase safety by detecting several conditions that could lead to an electrical incident:

- Power remains on if the wrong disconnecting means is utilized or the source is mislabeled (see examples from OSHA Summaries)
- Presence of stored electrical energy from a capacitor, present after the disconnect is opened and locked out (see examples from OSHA Summaries)
- Power remains present when the disconnect handle is in the off position if the disconnect experiences a mechanical failure (see Recall Notices below)

An easily accessible means to test for and visually convey the status of presence and absence of voltage that is part of the equipment installation at the point of work before accessing air conditioning and refrigeration units would prevent this type of incident (several examples are included below) and further the purpose of the code in practical safeguarding of persons and property by leveraging safety by design principles. Absence of Voltage Testers (AVT) listed to UL 1436 are permanently mounted testers that visually indicate when all voltages are less than 3 V (ac and dc) at the test point. This test is initiated before doors and covers are removed preventing accidental contact with energized parts. AVTs listed to UL 1436 have been recognized as an acceptable method to test for the absence of voltage in NFPA 70E since 2018 (120.5 (7) Exception 1).

Permanently mounted AVTs installed on or near the equipment increase the likelihood that the test for absence of voltage test occurs before the equipment is accessed when compared to portable voltage test instruments. Additionally, AVTs often have a feature to visually indicate when ac or dc voltage that would cause a shock hazard is present. In each of the incidents described below, the voltage presence indicators (for AC and DC) would have provided a visual warning that voltage was still present.

OSHA Fatality and Catastrophe Investigation Summaries

Air conditioning and refrigeration equipment often contains capacitors that can store lethal amounts of energy, even after the disconnect has been shut off. For this reason, it is especially important to test for absence of AC and DC voltage after turning off and locking out the electrical supply to the unit before making contact with electrical parts or circuit conductors. A keyword search of the OSHA Fatality and Catastrophe Investigation Summaries (<https://www.osha.gov/pls/imis/accidentsearch.html>) reveals several incidents resulting in severe injury or death that are attributed to failure to test for absence of voltage after de-energizing the disconnecting means. Some examples:

1. Report ID: 0728900

Employee #1 was on the roof of a customer's building, changing filters for the customer's air conditioning units. The employee had shut off the unit, but he did not lock out the unit or check its power supply for stored energy. As he reached into the unit, he came into contact with a capacitor charged to 280 volts and received an electric shock.

2. Report ID: 0420600

An employee turned off the known energy source to an air conditioning and heat unit at the panel box in a private residence. He pulled the disconnect switch in a box adjacent to the fan or blower assembly in the attic and was attempting to remove the air handler inside the blower housing. The heavy gold chain that the employee was wearing around his neck came in contact with or came in close proximity to a 10 microfarad, mfd, capacitor which can store 370 or more volts of alternating current. The chain burned an arc in his neck and carried sufficient current to his heart via the vascular tract to cause his death.

3. Report ID: 0316300

Employee #1 and his helper were installing a fan on a HVAC chiller unit. Employee asked his helper to open the circuit breaker to deenergize the unit, but Employee #1 never tested the fan circuit to ensure it was deenergized. Employee #1's helper opened the wrong breaker and when Employee #1 touched the conductors for the fan, he was electrocuted.

4. Report ID: 0452110

Employee #1 turned off breaker #22 in a panel box so that he could make a connection in a junction box. He was using a wire stripper to cut into the insulation around a conductor when he was electrocuted. The breakers in the panel box were not labeled, and breaker #22 did not control the current in the circuit on which Employee #1 was preparing to work. He also did not use a voltmeter or another type of instrument to test the circuit and confirm that the power was off.

5. Report ID 0522300

Employee #1 was working on an HVAC air handling unit that had not been cooling adequately. The "lockout" procedure did not include de-energization at the power supply or application of locks. Therefore, although the unit was shut off, it was still energized. Employee #1 was killed.

Disconnect Recall Notices

Several brands of disconnects that are commonly used in HVAC industrial and commercial applications have experienced recalls due to defects that allow power to remain present when the disconnect handle is in the off position, posing a shock hazard. This failure mode is an example of why testing for absence of voltage is critical in all applications, especially HVAC where mechanical technicians and non-electrical workers may be exposed to electrical hazards.

Recalls (<https://www.cpsc.gov/Recalls>)

1. Example 1

Company A recalled more than a million safety switches manufactured between January 1, 2014 and January 18, 2018 because the power can stay on when the safety switch handle is in the off position, posing an electric shock or electrocution hazard. The switches may be installed in or around commercial buildings, outbuildings, apartments and homes with air conditioning units.

2. Example 2

Company B issued a safety recall of 26 models of safety switches that may not disconnect power when the handle is in the "off" position. The affected devices cover certain models of 30A and 60A heavy-duty safety switches manufactured between Nov. 19, 2015, and Jan. 23, 2018.

3. Example 3

Company C recalled 19,000 toggle and rotary switches. When switched OFF, one electrical pole may remain energized, posing a risk of electrical shock hazard. The switches are typically used with HVAC units, electric distribution and control panels and industrial uses. Primarily the switches are used commercially, however they may also be found in residential applications.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 3835-NFPA 70-2020 [New Section after 110.25]	
Public Input No. 3908-NFPA 70-2020 [New Part after I.]	

Submitter Information Verification

Submitter Full Name: Rachel Bugaris

Organization: Panduit Corp

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 09 15:24:04 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: The code does not prohibit the use of AVT's to determine the absence of voltage, however there are other acceptable methods to do so. The panel does not agree that AVT's should be required for all air-conditioning and refrigerating equipment. The variety of energized topologies and the associated hazards needs to be addressed by the submitter, for example 480 Vac vs. 120 Vdc. Also, substantiation for not requiring AVT's in dwelling units should be provided. Note that the proposal may contain a typo, 10000 V should probably be 1000 V.



Public Input No. 2852-NFPA 70-2020 [Section No. 440.14]

440.14 Location.

Disconnecting means shall be located within sight from, and readily accessible from the air-conditioning or refrigerating equipment. ~~The Disconnecting means shall meet the working space requirements of 110.26 (A)(1) through (A)(3).~~ The disconnecting means shall be permitted to be installed on or within the air-conditioning or refrigerating equipment.

The disconnecting means shall not be located on panels that are designed to allow access to the air-conditioning or refrigeration equipment or to obscure the equipment nameplate(s).

Exception No. 1: Where the disconnecting means provided in accordance with 430.102(A) is lockable in accordance with 110.25 and the refrigerating or air-conditioning equipment is essential to an industrial process in a facility with written safety procedures, and where the conditions of maintenance and supervision ensure that only qualified persons service the equipment, a disconnecting means within sight from the equipment shall not be required.

Exception No. 2: Where an attachment plug and receptacle serve as the disconnecting means in accordance with 440.13, their location shall be accessible but shall not be required to be readily accessible.

Informational Note No. 1: See Parts VII and IX of Article 430 for additional requirements.

Informational Note No. 2: See 110.26.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
AC_Disconnect_clearance.jpg	AC disconnect clearance requirements clarified by IAEI	

Statement of Problem and Substantiation for Public Input

For many years there have been some confusion among Electrical and HVAC contractors, as well as Inspectors. I am proposing to add verbiage to article 440-14 to include "Disconnecting means shall meet the working space requirements of 110.26(A)(1) through (A)(3)" for clarification purposes. Thank you for your consideration.

Submitter Information Verification

Submitter Full Name: Dan Jenkins

Organization: County of York

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 02 15:13:57 EDT 2020

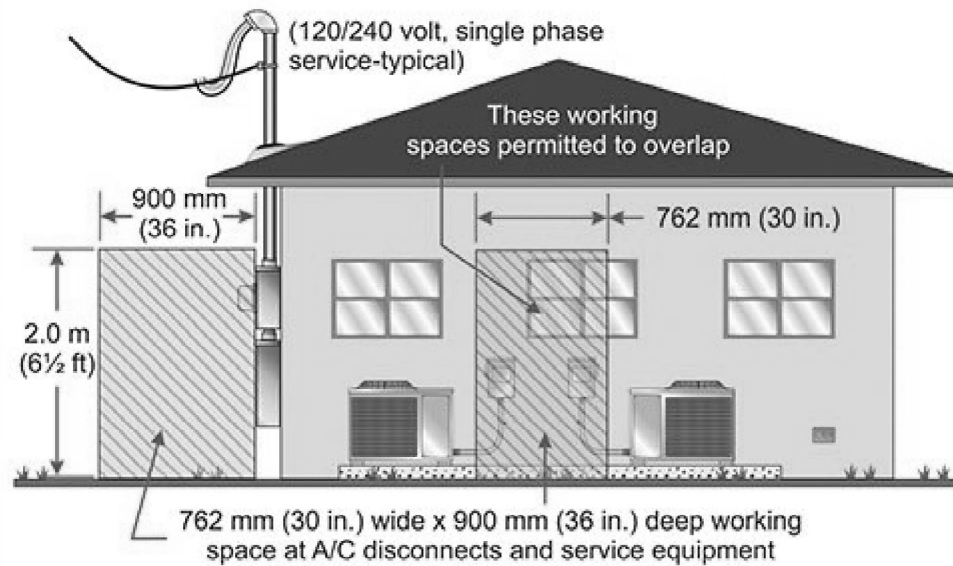
Committee: NEC-P11

Committee Statement

Resolution: FR-8078-NFPA 70-2020

Statement: A reference to 110.26(A) is being added to the normative text of 440.14 to emphasize the importance of complying with 110.26(A) when locating HVAC disconnecting means. This subsequently will eliminate the need for informative note 2.

Working space required at A/C disconnects and other electrical equipment





Public Input No. 4298-NFPA 70-2020 [Section No. 440.21]

440.21 General.

Part III specifies devices intended to protect the branch-circuit conductors, control apparatus, and motors in circuits supplying hermetic refrigerant motor-compressors against overcurrent due to short circuits and ground faults. They are in addition to or amendatory of ~~Article 240~~ the overcurrent requirements found elsewhere in the Code .

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(R) Style Manual prohibits references to an entire article, with the exception of Article 100. As such, it is recommended to change to the more generic text "overcurrent requirements found elsewhere in the Code" to comply, without changing the meaning of this section.

Submitter Information Verification

Submitter Full Name: Richard Holub

Organization: The DuPont Company, Inc.

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 10 09:44:28 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: FR-8080-NFPA 70-2020

Statement: General references to other Articles within the code are being revised to meet the requirements of 4.1.4 within the new 2020 NEC Style Manual.



Public Input No. 4432-NFPA 70-2020 [Section No. 440.22(A)]

(A) Rating or Setting for Individual Motor-Compressor.

The motor-compressor branch-circuit short-circuit and ground-fault protective device shall be capable of carrying the starting current of the motor. A protective device having a rating or setting not exceeding 175 percent of the motor-compressor rated-load current or branch-circuit selection current, whichever is greater, shall be permitted, ~~provided that, where the protection specified is~~ .

Exception No. 1: Where the values for branch-circuit short-circuit and ground-fault protection determined by 440.22(A) do not correspond to the standard sizes or ratings of fuses, nonadjustable circuit breakers, thermal protective devices, or possible settings of adjustable circuit breakers, a higher size, rating, or possible setting that does not exceed the next higher standard ampere rating shall be permitted.

Exception No. 2: Where the values for branch-circuit short-circuit and ground-fault protection determined by 440.22(A) or the rating modified by Exception No. 1 is not sufficient for the starting current of the motor, the rating or setting shall be permitted to be increased but shall not exceed 225 percent of the motor rated-load current or branch-circuit selection current, whichever is greater.

Exception No. 3: The rating of the branch-circuit short-circuit and ground-fault protective device shall not be required to be less than 15 amperes.

Statement of Problem and Substantiation for Public Input

As written, the current Section 440.22(A) is a long, run-on sentence. This PI is trying to break-up the section while also providing some clarity regarding the calculation required.

New Exception No. 1 is trying to clarify what action may be taken when performing the calculation based on 175%. If a calculation resulted in a device of 53-amperes, the current language does not state if the value may be rounded up to a standard rating or if it must be rounded down instead. This clarifies the value can be rounded up to but not exceed the next higher rating. This is similar to how the committee handles this calculation for motors in 430.52(C).

New Exception #2 is relocated language from the existing Section. If 175% isn't enough to start the motor, we can go up to but not exceed 225% of the RLC or BCSC.

New Exception #3 is the existing exception.

These changes will increase the readability and clarity of the Code for the user.

Submitter Information Verification

Submitter Full Name: Jebediah Novak

Organization: Cedar Rapids Electrical JATC

Affiliation: IBEW Local #405

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 10 12:59:07 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: FR-8081-NFPA 70-2020

Statement: The current wording of 440.22(A) is a run-on sentence which contains a rule and an exception to that rule. For clarity and proper sentence structure, the exception to the rule is moved out of the sentence and made an exception (exception 2) to the rule. Exception 1 is added for clarity of the situation where the calculation in the original clause leads to a non-standard size of overcurrent protection. This new exception 1 is consistent with the sizing requirements of 430.42(C) for motor branch-circuits.



Public Input No. 4299-NFPA 70-2020 [Section No. 440.31]

440.31 General.

Part IV and adjustments made according to Part III of Article 310 specify ampacities of conductors required to carry the motor current without overheating under the conditions specified, except as modified in 440.6(A), Exception No. 1.

These articles shall not apply to integral conductors of motors, to motor controllers and the like, or to conductors that form an integral part of approved equipment.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(R) Style Manual prohibits references to an entire article, with the exception of Article 100. As such, it is recommended that the CMP change the language as shown to describe clearly here the intent, without referencing the entire article.

Submitter Information Verification

Submitter Full Name: Richard Holub

Organization: The DuPont Company, Inc.

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 10 09:48:11 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: FR-8082-NFPA 70-2020

Statement: General references to other Articles within the code are being revised to meet the requirements of 4.1.4 within the new 2020 NEC Style Manual.

**Public Input No. 2151-NFPA 70-2020 [Section No. 440.33]****440.33 Motor-Compressor(s) With or Without Additional Motor Loads.**

Conductors supplying one or more motor-compressor(s) with or without an additional motor load(s) shall have an ampacity not less than the sum of each of the following:

- (1) The sum of the rated-load or branch-circuit selection current, whichever is greater, of all motor-compressor(s)
- (2) The sum of the full-load current rating of all other motors
- (3) 25 percent of the highest motor-compressor ~~or~~ or motor full load current in the group

Where two or more motors or motor-compressors have the same current rating, only one of the motor or motor-compressor currents shall be considered the highest rated for the above calculations.

Exception No. 1: Where the circuitry is interlocked so as to prevent the starting and running of a second motor-compressor or group of motor-compressors, the conductor size shall be determined from the largest motor-compressor or group of motor-compressors that is to be operated at a given time.

Exception No. 2: The branch-circuit conductors for room air conditioners shall be in accordance with Part VII of Article 440.

Statement of Problem and Substantiation for Public Input

This revision is necessary to clarify the calculation process when 2 or more motors or compressors have the same current rating. For example: A feeder with three 22-amp motor-compressors. Should ALL of them be considered the "highest rated"? ($22A \times 3 \times 125\%$); Should NONE of them be considered "highest rated"? ($22A \times 3$); I believe the intent is to only consider ONE of them as the the "highest rated". [$(22A \times 125\%) + 22A + 22A$].

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 2150-NFPA 70-2020 [Section No. 430.24]</u>	Clarification of "highest rated".

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 04 07:02:32 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: The proposed wording is not needed as the current language in 440.33(1) addresses this public input.

**Public Input No. 4305-NFPA 70-2020 [Section No. 440.34]****440.34** Combination Load.

Conductors supplying a motor-compressor load in addition to other load(s) as calculated from Article 220 and branch-circuit, feeder, and service load calculations and other applicable articles shall have an ampacity sufficient for the other load(s) plus the required ampacity for the motor-compressor load determined in accordance with 440.33 or, for a single motor-compressor, in accordance with 440.32.

Exception: Where the circuitry is interlocked so as to prevent simultaneous operation of the motor-compressor(s) and all other loads connected, the conductor size shall be determined from the largest size required for the motor-compressor(s) and other loads to be operated at a given time.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(R) Style Manual prohibits references to an entire article, with the exception of Article 100. As such, it is recommended that the CMP change the language as shown making reference to the more generic title of the article previously referenced without changing the intent of the section..

Submitter Information Verification

Submitter Full Name: Richard Holub

Organization: The DuPont Company, Inc.

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 10 09:51:54 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8084-NFPA 70-2020](#)

Statement: General references to other Articles within the code are being revised to meet the requirements of 4.1.4 within the new 2020 NEC Style Manual.



Public Input No. 4309-NFPA 70-2020 [Section No. 440.54 [Excluding any Sub-Sections]]

Overload protection for motor-compressors and equipment used on 15- or 20-ampere 120-volt, or 15-ampere 208- or 240-volt single-phase branch circuits as permitted elsewhere in ~~Article 240~~ - the Code shall be permitted as indicated in 440.54(A) and 440.54(B).

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(R) Style Manual prohibits references to an entire article, with the exception of Article 100. As such, it is recommended that the CMP change the language as shown making reference to the more generic "as permitted elsewhere in the Code" without changing the intent of the section.

Submitter Information Verification

Submitter Full Name: Richard Holub
Organization: The DuPont Company, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 09:55:51 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: [FR-8085-NFPA 70-2020](#)
Statement: General references to other Articles within the code are being revised to meet the requirements of 4.1.4 within the new 2020 NEC Style Manual.



Public Input No. 4310-NFPA 70-2020 [Section No. 440.55 [Excluding any Sub-Sections]]

Overload protection for motor-compressors and equipment that are cord- and attachment-plug-connected and used on 15- or 20-ampere 120-volt, or 15-ampere 208- or 240-volt, single-phase branch circuits as permitted elsewhere in Article 240 - the Code shall be permitted as indicated in 440.55(A), (B), and (C).

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(R) Style Manual prohibits references to an entire article, with the exception of Article 100. As such, it is recommended that the CMP change the language as shown making reference to the more generic "as permitted elsewhere in the Code" without changing the intent of the section.

Submitter Information Verification

Submitter Full Name: Richard Holub
Organization: The DuPont Company, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 09:58:14 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: [FR-8086-NFPA 70-2020](#)
Statement: General references to other Articles within the code are being revised to meet the requirements of 4.1.4 within the new 2020 NEC Style Manual.



Public Input No. 1362-NFPA 70-2020 [Section No. 440.61]

440.61 Equipment Grounding Conductor .

The enclosures of room air conditioners shall be connected to the equipment grounding conductor in accordance with 250.110, 250.112, and 250.114.

Statement of Problem and Substantiation for Public Input

According to the NFPA Style Manual, the Section Title needs to reflect the content of the rule. The rule is about the equipment grounding conductor, not about 'Grounding.'

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 01 19:44:12 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: The intent of the section is the grounding of the equipment enclosures which is being achieved with the equipment grounding conductor. The title "Grounding" is accurate.



Public Input No. 2358-NFPA 70-2020 [Section No. 440.62(B)]

(B) Where No Other Loads Are Supplied.

The total marked amp rating of a cord- and attachment-plug-connected room air conditioner shall not exceed 80 percent of the amp rating of a branch circuit where no other loads are supplied.

Statement of Problem and Substantiation for Public Input

Clarify that though "rating" can mean several things (volts, MOCP, etc), the intent here is that only "amp rating" is meant.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 2359-NFPA 70-2020 [Section No. 440.62(C)]	similar change for similar reason
Public Input No. 2359-NFPA 70-2020 [Section No. 440.62(C)]	

Submitter Information Verification

Submitter Full Name: John Blissett
Organization: Bernhard TME
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 17 16:54:21 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: [FR-8088-NFPA 70-2020](#)

Statement: The term "current" is being added before "rating" to clarify that the rating is the current rating.

**Public Input No. 2359-NFPA 70-2020 [Section No. 440.62(C)]****(C) Where Lighting Units or Other Appliances Are Also Supplied.**

The total marked amp rating of a cord- and attachment-plug-connected room air conditioner shall not exceed 50 percent of the amp rating of a branch circuit where lighting outlets, other appliances, or general-use receptacles are also supplied. Where the circuitry is interlocked to prevent simultaneous operation of the room air conditioner and energization of other outlets on the same branch circuit, a cord- and attachment-plug-connected room air conditioner shall not exceed 80 percent of the branch-circuit amp rating.

Statement of Problem and Substantiation for Public Input

Clarify that though "rating" can mean several things (volts, MOCP, etc), the intent here is that only "amp rating" is meant.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 2358-NFPA 70-2020 [Section No. 440.62(B)]</u>	Similar change for similar reason
<u>Public Input No. 2358-NFPA 70-2020 [Section No. 440.62(B)]</u>	

Submitter Information Verification

Submitter Full Name: John Blissett
Organization: Bernhard TME
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 17 17:00:38 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: FR-8088-NFPA 70-2020

Statement: The term "current" is being added before "rating" to clarify that the rating is the current rating.



Public Input No. 1919-NFPA 70-2020 [Section No. 440.65]

440.

65- Protection Devices:

65 leakage-Current Detector Interrupter (LCDI) and Arc-Fault Circuit Interrupter (AFCI) from the NEC Code

Single-phase cord- and plug-connected room air conditioners shall be provided with

one of the following

factory installed

devices:

- (1) Leakage-current detector interrupter (LCDI)**
- (2) Arc-fault circuit interrupter (AFCI)**
- (3) Heat detecting circuit interrupter (HDCI)**

The protection device

LCDI or AFCI protection. The LCDI or AFCI protection shall be an integral part of the attachment plug or be located in the power supply cord within

300 mm

300 mm {

12 in

12 in .) of the attachment plug.

Proposal is to Remove the requirements of 440.65 leakage-Current Detector-Interrupter (LCDI) and Arc-Fault Circuit Interrupter (AFCI) from the NEC Code

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
NEC_Proposal_LCDI_-_07_2020_00095776_.docx	NEC Proposal - Removal of 440.65	

Statement of Problem and Substantiation for Public Input

Recent changes adopted by the 2017 NEC code have made the requirements within 440.65 redundant & unnecessary. Section 210.12 of the 2017 NEC code requires that for dwelling units, "All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling unit kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas, or similar rooms or areas shall be protected"... by AFCIs.

The requirements of 210.12 provide additional protection of not only the room air conditioner cord, in the case of the LCDI, but protect the entire air conditioner & branch circuit. Section 440.65 is no longer necessary and unduly burdensome when a superior protection method (or "safety requirement") is already provided by the code.

The redundant LCDI adds to the complexity of the entire system. It provides additional failure points that may reduce the reliability of the product.

Additionally, the LCDI on the plug adds weight to the plug and strains the connection between the prongs and the receptacle resulting in loosening of the connection which can cause the outlet to fail.

Submitter Information Verification

Submitter Full Name: Matt Williams

Organization: Association Of Home Appliance Manufacturers

Street Address:

City:

State:

Zip:

Submittal Date: Thu Jul 16 11:44:15 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: Room air conditioners are commonly used within older existing dwelling units which may not have AFCI/LCDI/HDCI protection in accordance with 210.12. These devices are necessary to ensure the protection of the occupants. Room air conditioners may also be used in installations other than dwelling units which may not be required to have AFCI protection.

Proposal:

Remove the requirements of 440.65 leakage-Current Detector-Interrupter (LCDI) and Arc-Fault Circuit Interrupter (AFCI) from the NEC Code

Current Text:

440.65 leakage-Current Detector-Interrupter (LCDI) and Arc-Fault Circuit Interrupter (AFCI) from the NEC Code

Single-phase cord- and plug-connected room air conditioners shall be provided with factory-installed LCDI or AFCI protection. The LCDI or AFCI protection shall be an integral part of the attachment plug or be located in the power supply cord within 300 mm (12 in.) of the attachment plug.

Rational:

Recent changes adopted by the 2017 NEC code have made the requirements within 440.65 redundant & unnecessary. Section 210.12 of the 2017 NEC code requires that for dwelling units, "All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling unit kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas, or similar rooms or areas shall be protected" ... by AFCIs.

The requirements of 210.12 provide additional protection of not only the room air conditioner cord, in the case of the LCDI, but protect the entire air conditioner & branch circuit. Section 440.65 is no longer necessary and unduly burdensome when a superior protection method (or "safety requirement") is already provided by the code.

The redundant LCDI adds to the complexity of the entire system. It provides additional failure points that may reduce the reliability of the product.

Additionally, the LCDI on the plug adds weight to the plug and strains the connection between the prongs and the receptacle resulting in loosening of the connection which can cause the outlet to fail.

Proposed Revision:

~~440.65 leakage-Current Detector-Interrupter (LCDI) and Arc-Fault Circuit Interrupter (AFCI) from the NEC Code~~

~~Single phase cord and plug-connected room air conditioners shall be provided with factory installed LCDI or AFCI protection. The LCDI or AFCI protection shall be an integral part of the attachment plug or be located in the power supply cord within 300 mm (12 in.) of the attachment plug.~~



Public Input No. 4345-NFPA 70-2020 [Section No. 460.1]

460.1 Scope.

This article covers the installation of capacitors on electrical circuits.

Surge capacitors or capacitors included as a component part of other apparatus and conforming with the requirements of such apparatus are excluded from these requirements.

This article also covers the installation of capacitors in hazardous (classified) locations as modified by ~~Articles 501 through 503~~ the hazardous location requirements .

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(R) Style Manual prohibits references to an entire article, with the exception of Article 100. As such, it is recommended that the CMP change the language as shown making reference to the more generic "as modified by the hazardous location requirements" without changing the intent of the section. It is noted that the previous language was not inclusive of all the hazardous location requirements found generally in Articles 500 through 517, so the more generic language corrects this. It is recommended that this PI also be submitted to CMP14 for information and/or comment.

Submitter Information Verification

Submitter Full Name: Richard Holub

Organization: The DuPont Company, Inc.

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 10 10:51:50 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: FR-8131-NFPA 70-2020

Statement: In order to comply with 2.1.4 of the NEC Style Manual, Part I General is being added with existing clauses that preceded current Part I. This first revision is created to meet the requirements of 4.1.4 within the new 2020 NEC Style Manual.



Public Input No. 3636-NFPA 70-2020 [Section No. 460.2]

(Relocate all definitions in the 460.2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

460.2 Definitions.

The definition in this section shall apply only within this article.

Safe Zone.

Low probability of damage other than a slight swelling of the capacitor case, as identified by the case rupture curve of the capacitor.

Statement of Problem and Substantiation for Public Input

"The National Electrical Code has definitions in multiple parts in Article 100 and many definitions scattered through out the code many of them in the .2 section of the articles.

Most of the other standards under NFPA have their definitions in one location and this will allow the NEC the same requirement. The revisions to the NEC Style Manual require all the definitions to be relocated to Article 100.

Submitter Information Verification

Submitter Full Name: David Williams

Organization: Delta Charter Township

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 09 09:56:33 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-7978-NFPA 70-2020](#)

Statement: Relocating definitions in accordance with the manual of style.



Public Input No. 2055-NFPA 70-2020 [Section No. 460.8(C)]

(C) Disconnecting Means.

A disconnecting means shall be provided in each ungrounded conductor for each capacitor bank and shall meet the following requirements:

- (1) The disconnecting means shall open all ungrounded conductors simultaneously.
- (2) The disconnecting means shall be permitted to disconnect the capacitor from the line as a regular operating procedure.
- (3) The rating of the disconnecting means shall not be less than 135 percent of the rated current of the capacitor.
- (4) The disconnecting means shall be specifically rated for switching of capacitive loads.

Exception: A separate disconnecting means shall not be required where a capacitor is connected on the load side of a motor controller.

Statement of Problem and Substantiation for Public Input

Many switching devices have current ratings based on switching inductive loads, but have not been investigated for switching capacitive type loads. When used to switch a capacitive load, it is important that the switching device be suitably rated. Switching of capacitor banks can generate recovery voltages of two to three times the rated system voltage and can lead to restrikes and continued flow, which can result in ruptured capacitors, external equipment flashovers, failure of overvoltage device, and damage to the switching device contacts. Additionally, switching of capacitor banks may result in very large inrush currents for which a general purpose type switching device may not have been designed or tested for. Using properly rated switching devices that have specifically been designed and testing for switching of capacitive loads will alleviate these concerns.

Submitter Information Verification

Submitter Full Name: Paul Barnhart
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jul 27 07:54:46 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: UL 98 Standard for Disconnects and UL 489 Standard for circuit breakers have no provisions for testing the devices for switching the capacitive loads. The submitter to provide more clarity to switching capacitive loads and consider incorporating this requirement in UL 98 for disconnects and UL 489 for circuit breakers proposal. There was not substantiation of incidents to support a change.



Public Input No. 1364-NFPA 70-2020 [Section No. 460.10]

460.10 Equipment Grounding Conductor .

Capacitor cases shall be connected to the equipment grounding conductor.

Exception: Capacitor cases shall not be connected to the equipment grounding conductor where the capacitor units are supported on a structure designed to operate at other than ground potential.

Statement of Problem and Substantiation for Public Input

According to the NFPA Style Manual, the Section Title needs to reflect the content of the rule. The rule is about the equipment grounding conductor, not about 'Grounding.'

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 01 19:48:12 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: The intent of the section is the grounding of capacitor cases which is being achieved with the equipment grounding conductor. The title "Grounding" is accurate.

**Public Input No. 2063-NFPA 70-2020 [Section No. 460.24(A)]****(A) Load Current.**

Group-operated switches shall be used for capacitor switching, shall be specifically rated for switching of capacitive loads, and shall be capable of the following:

- (1) Carrying continuously not less than 135 percent of the rated current of the capacitor installation
- (2) Interrupting the maximum continuous load current of each capacitor, capacitor bank, or capacitor installation that will be switched as a unit
- (3) Withstanding the maximum inrush current, including contributions from adjacent capacitor installations
- (4) Carrying currents due to faults on capacitor side of switch

Statement of Problem and Substantiation for Public Input**Substantiation:**

Many switching devices have current ratings based on switching inductive loads, but have not been investigated for switching capacitive type loads. When used to switch a capacitive load, it is important that the switching device be suitably rated. Switching of capacitor banks can generate recovery voltages of two to three times the rated system voltage and can lead to restrikes and continued flow, which can result in ruptured capacitors, external equipment flashovers, failure of overvoltage device, and damage to the switching device contacts. Additionally, switching of capacitor banks may result in very large inrush currents for which a general purpose type switching device may not have been designed or tested for. Using properly rated switching devices that have specifically been designed and testing for switching of capacitive loads will alleviate these concerns.

Submitter Information Verification

Submitter Full Name: Paul Barnhart

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submission Date: Mon Jul 27 09:35:44 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: FR-8111-NFPA 70-2020

Statement: It is being clarified that group-operated switches be evaluated for switching a capacitive load because switching of capacitor banks can generate recovery voltages of two to three times the rated system voltage and can lead to restrikes and continued flow, which can result in ruptured capacitors, external equipment flashovers, failure of overvoltage device, and damage to the switching device contacts. Also switching of capacitor banks may result in very large inrush currents for which a general purpose type switching device may not have been designed or tested for.

“Group-operated switches shall be used for capacitor switching” is replaced with “Capacitor switch operation shall open all ungrounded conductors and the switch” to clarify the intent of the section that group-operated switches are not the sole means for switching the load current.



Public Input No. 1365-NFPA 70-2020 [Section No. 460.27]

460.27 Equipment Grounding Conductor .

Capacitor cases shall be connected to the equipment grounding conductor. If the capacitor neutral point is connected to a grounding electrode conductor, the connection shall be made in accordance with Part III of Article 250.

Exception: Capacitor cases shall not be connected to the equipment grounding conductor where the capacitor units are supported on a structure designed to operate at other than ground potential.

Statement of Problem and Substantiation for Public Input

According to the NFPA Style Manual, the Section Title needs to reflect the content of the rule. The rule is about the equipment grounding conductor, not about 'Grounding.'

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 01 19:49:25 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: The intent of the section is the grounding of capacitor cases which is being achieved with the equipment grounding conductor. The title "Grounding" is accurate.



Public Input No. 4350-NFPA 70-2020 [Section No. 470.1]

470.1 Scope.

This article covers the installation of separate resistors and reactors on electrical circuits.

~~Exception: Resistors and reactors that are component parts of other apparatus.~~

This article also covers the installation of resistors and reactors in hazardous (classified) locations as modified by ~~Articles 501 through 504~~ the hazardous location requirements. This article does not cover resistors and reactors that are component parts of other apparatus.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(R) Style Manual prohibits references to an entire article, with the exception of Article 100. As such, it is recommended that the CMP change the language as shown making reference to the more generic "as modified by the hazardous location requirements" without changing the intent of the section. It is noted that the previous language was not inclusive of all the hazardous location requirements found generally in Articles 500 through 517, so the more generic language corrects this. It is recommended that this PI also be submitted to CMP14 for information and/or comment. Finally, this PI also rewrites the former "exception" as a specific sentence covering what this article does not cover as the previous exception was not written in a complete sentence as required by Section 3.1.4.1 of the Style Manual.

Submitter Information Verification

Submitter Full Name: Richard Holub

Organization: The DuPont Company, Inc.

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 10 10:55:31 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: FR-8137-NFPA 70-2020

Statement: After reviewing the Article for compliance to section 2.1.4 of the NEC Style Manual, it was found that 470.1, Scope, is placed under requirements for 1000 volts and less, however the scope is independent of voltage and should not be in this location. This proposed revision moves 470.1 out of Part I so that it is applicable to the entire Article.

This first revision to modify the general references to Articles 501 through 504 is created to meet the requirements of 4.1.4 within the new 2020 NEC Style Manual

**Public Input No. 3624-NFPA 70-2020 [New Section after 470.4]****470.5 Reconditioning of Equipment**

Reconditioning of resistors shall not be permitted. Reconditioning of reactors shall be determined by the manufacturer.

Statement of Problem and Substantiation for Public Input

Power resistors are typically manufactured using steel plates, wire strips wrapped around ceramic cores and resistance wire helically wrapped around ceramic cores. The construction of grid resistor banks includes welds, ceramic spacers and other components. To repair a grid resistor, all the welds would need to be broken to replace any quantity of plates. Additionally, the ceramic spacers and other components would need to be inspected by a qualified individual. For resistors using ceramic cores, the strip or wire needs to be inspected to verify that it still provides the nominal resistance as delivered by the manufacturer. Additionally, the ceramic cores require inspection. The expertise to perform these tests and inspections resides with the manufacturer. In many cases, the materials, designs and other engineered products may no longer be available from the manufacturer and a new bank meeting the same requirements but with different technology may be provided as a replacement.

Submitter Information Verification

Submitter Full Name: Paul Rylatt

Organization: Post Glover Resistor

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 09 09:43:46 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8136-NFPA 70-2020](#)

Statement: New section 470.5 is being added to address reconditioning of resistor and reactors. Resistors are not permitted to be reconditioned because the reconditioning requires welds to be broken and replaced and ceramic spacers (and other components) to be inspected by a qualified individual. Reconditioning of reactors may be done but only at the discretion of the manufacturer.



Public Input No. 1366-NFPA 70-2020 [Section No. 470.19]

470.19 Equipment Grounding Conductor .

Resistor and reactor cases or enclosures shall be connected to the equipment grounding conductor.

Exception: Resistor or reactor cases or enclosures supported on a structure designed to operate at other than ground potential shall not be connected to the equipment grounding conductor.

Statement of Problem and Substantiation for Public Input

According to the NFPA Style Manual, the Section Title needs to reflect the content of the rule. The rule is about the equipment grounding conductor, not about 'Grounding.'

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 01 19:50:47 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: The intent of the section is the grounding of resistor and reactor cases or enclosures which is being achieved with the equipment grounding conductor. The title "Grounding" is accurate.

**Public Input No. 3683-NFPA 70-2020 [New Section after 470.20]****470.21 Reconditioning of Equipment**

Reconditioning of resistors shall not be permitted. Reconditioning of reactors shall be determined by the manufacturer.

Statement of Problem and Substantiation for Public Input

Power resistors are typically manufactured using steel plates, wire strips wrapped around ceramic cores and resistance wire helically wrapped around ceramic cores. The construction of grid resistor banks includes welds, ceramic spacers and other components. To repair a grid resistor, all the welds would need to be broken to replace any quantity of plates. Additionally, the ceramic spacers and other components would need to be inspected by a qualified individual. For resistors using ceramic cores, the strip or wire needs to be inspected to verify that it still provides the nominal resistance as delivered by the manufacturer. Additionally, the ceramic cores require inspection. The expertise to perform these tests and inspections resides with the manufacturer. In many cases, the materials, designs and other engineered products may no longer be available from the manufacturer and a new bank meeting the same requirements but with different technology may be provided as a replacement.

Submitter Information Verification

Submitter Full Name: Paul Rylatt

Organization: Post Glover Resistor

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 09 10:45:43 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8138-NFPA 70-2020](#)

Statement: New section 470.21 is being added to address reconditioning of resistor and reactors. Resistors are not permitted to be reconditioned because the reconditioning requires welds to be broken and replaced and ceramic spacers (and other components) to be inspected by a qualified individuals. Reconditioning of reactors may be done but only at the discretion of the manufacturer.

**Public Input No. 4355-NFPA 70-2020 [Section No. 470.20]****470.20 Oil-Filled Reactors.**

Installation of oil-filled reactors, in addition to the above requirements, shall comply with applicable requirements- Part II of Article 450.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(R) Style Manual prohibits references to an entire article, with the exception of Article 100. The current oil-filled installation requirements for transformers and reactors is found in Part II of Article 450 and it is proposed to instead point to that part to comply with the style manual requirements.

Submitter Information Verification

Submitter Full Name: Richard Holub

Organization: The DuPont Company, Inc.

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 10 11:08:18 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8139-NFPA 70-2020](#)

Statement: This first revision is created to meet the requirements of 4.1.4 within the new 2020 NEC Style Manual.



Public Input No. 4376-NFPA 70-2020 [Part I.]

~~(Relocate Part I. – 1000 Volts, Nominal, and Under General to directly under the title and prior to the scope in 460.1)~~

Part I. General

Statement of Problem and Substantiation for Public Input

Relocate Part I. General to directly after the title of Article 460 and prior to Section 460.1 Scope. Article 460 is subdivided into multiple parts and needs to comply with the revised NEC Style Manual on Parts 2.1.4 Part titles shall be descriptive and as concise as possible.
2.4.2.1 ...Where an article has multiple parts, Part I. shall be titled "General".

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 11:28:43 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: FR-8131-NFPA 70-2020

Statement: In order to comply with 2.1.4 of the NEC Style Manual, Part I General is being added with existing clauses that preceded current Part I. This first revision is created to meet the requirements of 4.1.4 within the new 2020 NEC Style Manual.



Public Input No. 4381-NFPA 70-2020 [Part I.]

Part I. – 1000 Volts, Nominal, and Under General

Statement of Problem and Substantiation for Public Input

"Article 470 is subdivided into multiple parts and needs to comply with the revised NEC Style Manual on Parts 2.1.4 Part titles shall be descriptive and as concise as possible.

2.4.2.1 ...Where an article has multiple parts, Part I. shall be titled "General". "

Submitter Information Verification

Submitter Full Name: David Williams

Organization: Delta Charter Township

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 10 11:33:51 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8137-NFPA 70-2020](#)

Statement: After reviewing the Article for compliance to section 2.1.4 of the NEC Style Manual, it was found that 470.1, Scope, is placed under requirements for 1000 volts and less, however the scope is independent of voltage and should not be in this location. This proposed revision moves 470.1 out of Part I so that it is applicable to the entire Article.

This first revision to modify the general references to Articles 501 through 504 is created to meet the requirements of 4.1.4 within the new 2020 NEC Style Manual



Public Input No. 1420-NFPA 70-2020 [Part IV.]

Part IV. ~~Branch-~~ Circuit Conductors

Statement of Problem and Substantiation for Public Input

Change the title to the scope so that the rules in this part also apply to feeder and service conductors, particularly when there are multiple a/c units on a feeder or service. Currently there are not rules addressing feeder conductor sizing because of the Title name.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Jun 02 13:55:22 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8091-NFPA 70-2020](#)

Statement: The term "branch" is being removed from the title to more accurately reflect that the Part addresses service, feeder, and branch-circuit conductors.



Public Input No. 976-NFPA 70-2020 [Part VII.]

Part VII. ~~Provisions for Room~~ Room Air Conditioners

Statement of Problem and Substantiation for Public Input

The words "Provisions for" are unnecessary and redundant.

Submitter Information Verification

Submitter Full Name: Agnieszka Golriz

Organization: NECA

Street Address:

City:

State:

Zip:

Submittal Date: Wed May 06 11:43:31 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: [FR-8092-NFPA 70-2020](#)

Statement: The words "provisions for" are being removed from the title because they are unnecessary and redundant.



Public Input No. 4550-NFPA 70-2020 [Part VIII.]

Part VIII. Motor Control Centers

430.XXX Reconditioning of Motor Control Centers

(A) Motor Control Centers

Motor control centers shall not be permitted to be reconditioned.

(B) Motor Control Center Unit

Motor control center units shall meet the requirements of 430.XXX(B)(1) through (B)(2)

- (1) Motor control enter units shall not be permitted to be reconditioned.
- (2) Replacement of a motor control center unit within an enclosure shall be permitted provided it has been listed and labeled for the use.

Additional Proposed Changes

<u>File Name</u>	<u>Description Approved</u>
MCC_Article_430_-_Part_VIII_Reconditioned_Final.docx	

Statement of Problem and Substantiation for Public Input

Motor control centers are comprised of a series of component items that evaluated as part of type tested 3rd party agency approval to industry standard. Many of these components, when evaluated individually by various CMPs in the NEC do not support reconditioning. When these devices are arranged within a motor control center they are part of a combination of specifically designed bus, connectors, cabling and panel volumes which are evaluated to support short-circuit current ratings and not exceed temperature limits so as not to incur thermal runaway which may lead to nuisance operation or electrical fire. This results in specific listing for motor control center sections and each motor control center cubicle. Reconditioning activities for this equipment does not consider these factors and create heightened safety risk.

This should not prevent activities such as replacement of OEM hardware, doors, covers maintenance, cleaning of components or equipment, or other items which would otherwise be considered under normal servicing of equipment.

Submitter Information Verification

Submitter Full Name: Matt Hussey
Organization: Eaton Corporation
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 14:59:57 EDT 2020
Committee: NEC-P11

Committee Statement

Resolution: The panel understands the desire to consider reconditioned equipment for this section. However, the proposal did not provide information that addresses the broad applications and installed base. Also, the PI did not address medium voltage equipment.

Article 430 Motors, Motor Circuits, and Controllers
Part VIII. Motor Control Centers

430.XXX Reconditioning of Motor Control Centers

(A) Motor Control Centers

Motor control centers shall not be permitted to be reconditioned.

(B) Motor Control Center Unit

Motor control center units shall meet the requirements of 430.XXX(B)(1) through (B)(2)

(1) Motor control center units shall not be permitted to be reconditioned.

(2) Replacement of a motor control center unit within an enclosure shall be permitted provided it has been listed and labeled for the use.

Statement of problem

Motor control centers are comprised of a series of component items that evaluated as part of type tested 3rd party agency approval to industry standard. Many of these components, when evaluated individually by various CMPs in the NEC do not support reconditioning. When these devices are arranged within a motor control center they are part of a combination of specifically designed bus, connectors, cabling and panel volumes which are evaluated to support short-circuit current ratings and not exceed temperature limits so as not to incur thermal runaway which may lead to nuisance operation or electrical fire. This results in specific listing for motor control center sections and each motor control center cubicle. Reconditioning activities for this equipment does not consider these factors and create heightened safety risk.

This should not prevent activities such as replacement of OEM hardware, doors, covers maintenance, cleaning of components or equipment, or other items which would otherwise be considered under normal servicing of equipment.

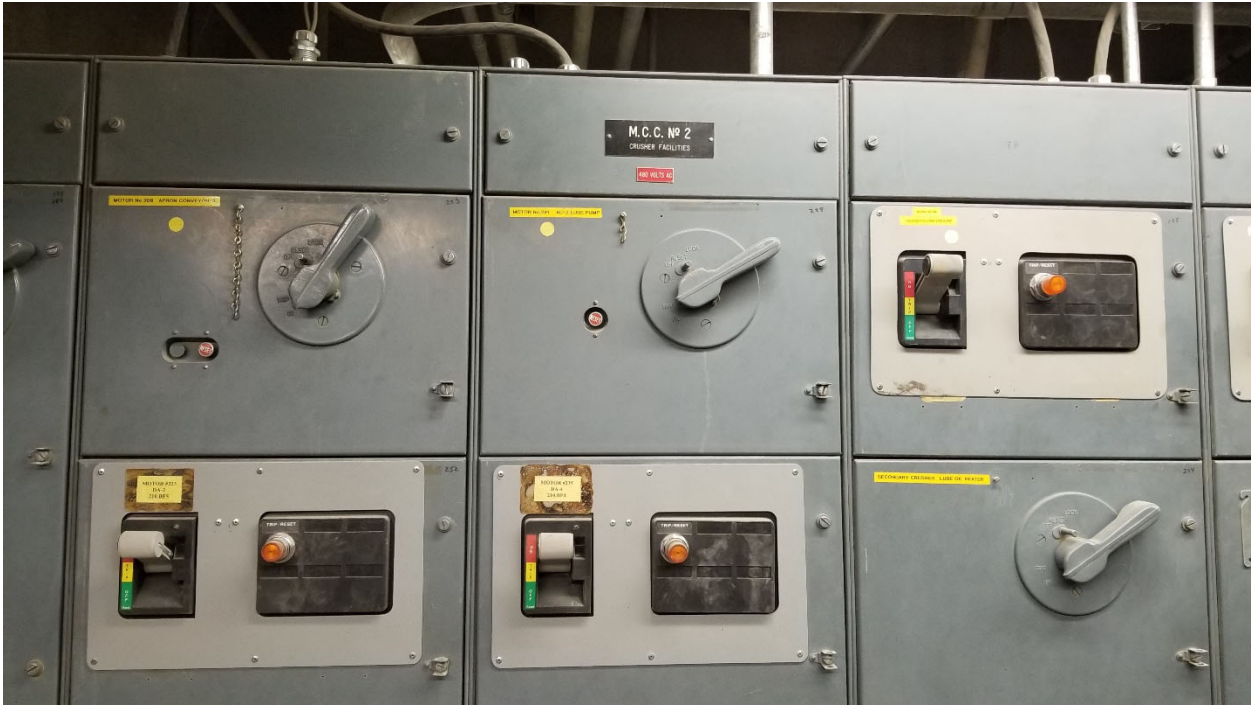
Examples

- MCC lineup has been installed for ___ # of years. Facility decides to perform maintenance on MCC. This process could result in a few different routes:
 - Cleaning, normal servicing done. Not considered reconditioning
 - MCC doors, handles, latches, etc... are damaged in a facility and need to be replaced. OEM parts can be sourced and installed without modifying design (i.e. handles are not obsolete). This is not reconditioning as it is normal servicing of the equipment since no modification is required.
 - MCC unit has breaker/starter/drive/etc to be replaced in a “like-for-like” scenario. Not considered reconditioning as replacement parts are matched with same components.
 - MCC unit has breaker/starter/drive/etc to be replaced in an upgrade or change of style scenario (mentioned in the Word document). This should not be allowed as it could invalidate listing (combination SCCR, temperature rise, etc..) and the original listing mark is no longer applicable
- MCC lineup has been installed for ___ # of years. Facility decides to procure a motor control center bucket to either replace existing or introduce new load to the MCC. This process could result in a few different routes:
 - MCC unit is procured from reseller (re-purposed from another facility/company) and installed into equipment. This should not be allowed as it is a transfer of ownership and does not involve any steps to validate the equipment has not been changed from its original listing.
 - MCC unit is procured from authorized channel for the OEM. This should be allowed (not sure it’s considered reconditioning) provided:
 - OEM manufactures new, UL listed (or UL Classified if vintage is no longer being actively produced) unit with new components. OEM maintains follow up testing to ensure new equipment meets short-circuit and other essential testing records are up to date, even with new component technologies if they weren’t present at time.
 - Insertion of new/replacement unit does not require structural modification to the extent that would invalidate the listing of the vertical section. Examples:
 - Unit support shelves can be relocated to accommodate new units via simple locating features hardware
 - Doors can be removed/installed to meet installation needs and any remaining openings can be covered with additional doors if necessary
- MCC lineup has been installed for ___ # of years. Facility decides to expand lineup by adding another vertical section’s worth of loads. This process could result in a few different routes:
 - MCC structure is procured from reseller (re-purposed from another site) and installed into equipment. This should not be allowed as it is a transfer of ownership and does not involve any steps to validate the equipment has not been changed from its original listing.
 - MCC structure is procured from authorized channel for the OEM. This should be allowed (not sure it’s considered reconditioning) provided:
 - OEM manufactures new, UL listed (or UL Classified if vintage is no longer being actively produced) structure which is designed to be connected to

existing bus. OEM maintains follow up testing to ensure new equipment meets short-circuit and other essential testing records are up to date, even with new component technologies if they weren't present at time.

- Insertion of new/replacement unit does not require structural modification to the extent that would invalidate the listing of the vertical section. Examples:
 - Bus splices are designed to be connected between existing and new sections and are procedurally identified
 - Doors can be removed/installed to meet installation needs and any remaining openings can be covered with additional doors if necessary







Public Input No. 10-NFPA 70-2019 [New Part after XIV.]

Large Motors.

when a motor is larger then the tables indicate, the nameplate rating shall be allowed to be used for the conductor sizing.

Statement of Problem and Substantiation for Public Input

the code users need to know how to size conductors for larger motors then what is indicated in the tables, and although it is true that those types of jobs are typically under the control of a design professional, they should still be able to rely on the NEC to size the conductors, and this will also require the design professionals and also electricians to size the conductors properly for large motors.

Submitter Information Verification

Submitter Full Name: Joel Sandel

Organization: JRS Consulting Inc.

Street Address:

City:

State:

Zip:

Submittal Date: Fri Nov 01 15:52:47 EDT 2019

Committee: NEC-P11

Committee Statement

Resolution: [FR-7986-NFPA 70-2020](#)

Statement: The committee revised the section into a list format to improve the clarity and usability.

The Panel has added an additional section (2)(C) to include information on motors of such size that their ampacities are outside what is included in the tables found in Part XIV. Changes were made from “controller” to “motor controller” and revised the informational notes to align with the global PI request to make complete sentences.



Public Input No. 100-NFPA 70-2019 [Part XIV.]

Part XIV. Tables

Table 430.247 Full-Load Current in Amperes, Direct-Current Motors

The following values of full-load currents* are for motors running at base speed.

<u>Horsepower</u>	<u>Armature Voltage Rating*</u>					
	<u>90 Volts</u>	<u>120 Volts</u>	<u>180 Volts</u>	<u>240 Volts</u>	<u>500 Volts</u>	<u>550 Volts</u>
<u>1/4</u>	<u>4.0</u>	<u>3.1</u>	<u>2.0</u>	<u>1.6</u>	—	—
<u>1/3</u>	<u>5.2</u>	<u>4.1</u>	<u>2.6</u>	<u>2.0</u>	—	—
<u>1/2</u>	<u>6.8</u>	<u>5.4</u>	<u>3.4</u>	<u>2.7</u>	—	—
<u>3/4</u>	<u>9.6</u>	<u>7.6</u>	<u>4.8</u>	<u>3.8</u>	—	—
<u>1</u>	<u>12.2</u>	<u>9.5</u>	<u>6.1</u>	<u>4.7</u>	—	—
<u>1 1/2</u>	—	<u>13.2</u>	<u>8.3</u>	<u>6.6</u>	—	—
<u>2</u>	—	<u>17</u>	<u>10.8</u>	<u>8.5</u>	—	—
<u>3</u>	—	<u>25</u>	<u>16</u>	<u>12.2</u>	—	—
<u>5</u>	—	<u>40</u>	<u>27</u>	<u>20</u>	—	—
<u>7 1/2</u>	—	<u>58</u>	—	<u>29</u>	<u>13.6</u>	<u>12.2</u>
<u>10</u>	—	<u>76</u>	—	<u>38</u>	<u>18</u>	<u>16</u>
<u>15</u>	—	—	—	<u>55</u>	<u>27</u>	<u>24</u>
<u>20</u>	—	—	—	<u>72</u>	<u>34</u>	<u>31</u>
<u>25</u>	—	—	—	<u>89</u>	<u>43</u>	<u>38</u>
<u>30</u>	—	—	—	<u>106</u>	<u>51</u>	<u>46</u>
<u>40</u>	—	—	—	<u>140</u>	<u>67</u>	<u>61</u>
<u>50</u>	—	—	—	<u>173</u>	<u>83</u>	<u>75</u>
<u>60</u>	—	—	—	<u>206</u>	<u>99</u>	<u>90</u>
<u>75</u>	—	—	—	<u>255</u>	<u>123</u>	<u>111</u>
<u>100</u>	—	—	—	<u>341</u>	<u>164</u>	<u>148</u>
<u>125</u>	—	—	—	<u>425</u>	<u>205</u>	<u>185</u>
<u>150</u>	—	—	—	<u>506</u>	<u>246</u>	<u>222</u>
<u>200</u>	—	—	—	<u>675</u>	<u>330</u>	<u>294</u>

*These are average dc quantities.

Table 430.248 Full-Load Currents in Amperes, Single-Phase Alternating-Current Motors

The following values of full-load currents are for motors running at usual speeds and motors with normal torque characteristics. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120 and 220 to 240 volts.

<u>Horsepower</u>	<u>115</u>	<u>200</u>	<u>208</u>	<u>230</u>
	<u>Volts</u>	<u>Volts</u>	<u>Volts</u>	<u>Volts</u>
<u>1/6</u>	<u>4.4</u>	<u>2.5</u>	<u>2.4</u>	<u>2.2</u>
<u>1/4</u>	<u>5.8</u>	<u>3.3</u>	<u>3.2</u>	<u>2.9</u>
<u>1/3</u>	<u>7.2</u>	<u>4.1</u>	<u>4.0</u>	<u>3.6</u>
<u>1/2</u>	<u>9.8</u>	<u>5.6</u>	<u>5.4</u>	<u>4.9</u>
<u>3/4</u>	<u>13.8</u>	<u>7.9</u>	<u>7.6</u>	<u>6.9</u>
<u>1</u>	<u>16</u>	<u>9.2</u>	<u>8.8</u>	<u>8.0</u>

	<u>115</u>	<u>200</u>	<u>208</u>	<u>230</u>
<u>Horsepower</u>				
	<u>Volts</u>	<u>Volts</u>	<u>Volts</u>	<u>Volts</u>
<u>1 1/2</u>	<u>20</u>	<u>11.5</u>	<u>11.0</u>	<u>10</u>
<u>2</u>	<u>24</u>	<u>13.8</u>	<u>13.2</u>	<u>12</u>
<u>3</u>	<u>34</u>	<u>19.6</u>	<u>18.7</u>	<u>17</u>
<u>5</u>	<u>56</u>	<u>32.2</u>	<u>30.8</u>	<u>28</u>
<u>7 1/2</u>	<u>80</u>	<u>46.0</u>	<u>44.0</u>	<u>40</u>
<u>10</u>	<u>100</u>	<u>57.5</u>	<u>55.0</u>	<u>50</u>

Table 430.249 Full-Load Current, Two-Phase Alternating-Current Motors (4-Wire)

The following values of full-load current are for motors running at speeds usual for belted motors and motors with normal torque characteristics. Current in the common conductor of a 2-phase, 3-wire system will be 1.41 times the value given. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120, 220 to 240, 440 to 480, and 550 to 600 volts.

<u>Induction-Type Squirrel Cage and</u>				
<u>Horsepower</u>	<u>Wound Rotor (Amperes)</u>			
	<u>115</u>	<u>230</u>	<u>460</u>	<u>575</u>
	<u>Volts</u>	<u>Volts</u>	<u>Volts</u>	
<u>1/2</u>	<u>4.0</u>	<u>2.0</u>	<u>1.0</u>	<u>0.8</u>
<u>3/4</u>	<u>4.8</u>	<u>2.4</u>	<u>1.2</u>	<u>1.0</u>
<u>1</u>	<u>6.4</u>	<u>3.2</u>	<u>1.6</u>	<u>1.3</u>
<u>1 1/2</u>	<u>9.0</u>	<u>4.5</u>	<u>2.3</u>	<u>1.8</u>
<u>2</u>	<u>11.8</u>	<u>5.9</u>	<u>3.0</u>	<u>2.4</u>
<u>3</u>	<u>—</u>	<u>8.3</u>	<u>4.2</u>	<u>3.3</u>
<u>5</u>	<u>—</u>	<u>13.2</u>	<u>6.6</u>	<u>5.3</u>
<u>7 1/2</u>	<u>—</u>	<u>19</u>	<u>9.0</u>	<u>8.0</u>

<u>10</u>	<u>—</u>	<u>24</u>	<u>12</u>	<u>10</u>
<u>—</u>				
<u>15</u>	<u>—</u>	<u>36</u>	<u>18</u>	<u>14</u>
<u>—</u>				
<u>20</u>	<u>—</u>	<u>47</u>	<u>23</u>	<u>19</u>
<u>—</u>				
<u>25</u>	<u>—</u>	<u>59</u>	<u>29</u>	<u>24</u>
<u>—</u>				
<u>30</u>	<u>—</u>	<u>69</u>	<u>35</u>	<u>28</u>
<u>—</u>				
<u>40</u>	<u>—</u>	<u>90</u>	<u>45</u>	<u>36</u>
<u>—</u>				
<u>50</u>	<u>—</u>	<u>113</u>	<u>56</u>	<u>45</u>
<u>—</u>				
<u>60</u>	<u>—</u>	<u>133</u>	<u>67</u>	<u>53</u>
<u>14</u>				
<u>75</u>	<u>—</u>	<u>166</u>	<u>83</u>	<u>66</u>
<u>18</u>				
<u>100</u>	<u>—</u>	<u>218</u>	<u>109</u>	<u>87</u>
<u>23</u>				
<u>125</u>	<u>—</u>	<u>270</u>	<u>135</u>	<u>108</u>
<u>28</u>				
<u>150</u>	<u>—</u>	<u>312</u>	<u>156</u>	<u>125</u>
<u>32</u>				
<u>200</u>	<u>—</u>	<u>416</u>	<u>208</u>	<u>167</u>
<u>43</u>				

Table 430.250 Full-Load Current, Three-Phase Alternating-Current Motors

The following values of full-load currents are typical for motors running at speeds usual for belted motors and motors with normal torque characteristics. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120, 220 to 240, 440 to 480, and 550 to 600 volts.

<u>Horsepower</u>	<u>Induction-Type Squirrel Cage and Wound Rotor (Amperes)</u>				
—					
	<u>Synchronous-Type Unity Power</u>				
	<u>Factor* (Amperes)</u>				
<u>115 Volts</u>	<u>200 Volts</u>	<u>208 Volts</u>	<u>230 Volts</u>	<u>460 Volts</u>	<u>575 Volts</u>
<u>2300 Volts -</u>					
	<u>230 Volts</u>	<u>460 Volts</u>	<u>575 Volts</u>		
<u>2300 Volts</u>					

<u>1/2</u>	<u>4.4</u>	<u>2.5</u>	<u>2.4</u>	<u>2.2</u>	<u>1.1</u>	<u>0.9</u>	<u>=</u>
-							
		<u>=</u>				<u>=</u>	
<u>3/4</u>	<u>6.4</u>	<u>3.7</u>	<u>3.5</u>	<u>3.2</u>	<u>1.6</u>	<u>1.3</u>	<u>=</u>
-							
		<u>=</u>				<u>=</u>	
<u>1</u>	<u>8.4</u>	<u>4.8</u>	<u>4.6</u>	<u>4.2</u>	<u>2.1</u>	<u>1.7</u>	<u>=</u>
-							
		<u>=</u>				<u>=</u>	
<u>1 1/2</u>	<u>12.0</u>	<u>6.9</u>	<u>6.6</u>	<u>6.0</u>	<u>3.0</u>	<u>2.4</u>	<u>=</u>
-							
		<u>=</u>				<u>=</u>	
<u>2</u>	<u>13.6</u>	<u>7.8</u>	<u>7.5</u>	<u>6.8</u>	<u>3.4</u>	<u>2.7</u>	<u>=</u>
-							
		<u>=</u>				<u>=</u>	
<u>3</u>	<u>=</u>	<u>11.0</u>	<u>10.6</u>	<u>9.6</u>	<u>4.8</u>	<u>3.9</u>	<u>=</u>
-							
		<u>=</u>				<u>=</u>	
<u>5</u>	<u>=</u>	<u>17.5</u>	<u>16.7</u>	<u>15.2</u>	<u>7.6</u>	<u>6.1</u>	<u>=</u>
-							
		<u>=</u>				<u>=</u>	
<u>7 1/2</u>	<u>=</u>	<u>25.3</u>	<u>24.2</u>	<u>22</u>	<u>11</u>	<u>9</u>	<u>=</u>
-							
		<u>=</u>				<u>=</u>	
<u>10</u>	<u>=</u>	<u>32.2</u>	<u>30.8</u>	<u>28</u>	<u>14</u>	<u>11</u>	<u>=</u>
-							
		<u>=</u>				<u>=</u>	
<u>15</u>	<u>=</u>	<u>48.3</u>	<u>46.2</u>	<u>42</u>	<u>21</u>	<u>17</u>	<u>=</u>
-							
		<u>=</u>				<u>=</u>	
<u>20</u>	<u>=</u>	<u>62.1</u>	<u>59.4</u>	<u>54</u>	<u>27</u>	<u>22</u>	<u>=</u>
-							

25		78.2	74.8	68	34	27
		53	26	21		
30		92	88	80	40	32
		63	32	26		
40		120	114	104	52	41
		83	41	33		
50		150	143	130	65	52
		104	52	42		
60		177	169	154	77	62
16						
		123	61	49		
12						
75		221	211	192	96	77
20						
		155	78	62		
15						
100		285	273	248	124	99
26						
		202	101	81		
20						
125		359	343	312	156	125
31						
		253	126	101		
25						
150		414	396	360	180	144
37						
		302	151	121		
30						
200						
		552	528	480	240	192
49						
		400	201	161		

40						
250	=	=	=	=	302	242
60 -						
	=			=		=
—						
300	=	=	=	=	361	289
72 -						
	=			=		=
—						
350	=	=	=	=	414	336
83 -						
	=			=		=
—						
400	=	=	=	=	477	382
95 -						
	=			=		=
—						
450	=	=	=	=	515	412
103 -						
	=			=		=
—						
500	=	=	=	=	590	472
118 -						
	=			=		=
—						

*For 90 and 80 percent power factor, the figures shall be multiplied by 1.1 and 1.25, respectively.

Table 430.251(A) Conversion Table of Single-Phase Locked-Rotor Currents for Selection of Disconnecting Means and Controllers as Determined from Horsepower and Voltage Rating

For use only with 430.110, 440.12, 440.41, and 455.8(C).

<u>Rated</u>	<u>Maximum Locked-Rotor Current in</u>		
	<u>Amperes, Single Phase</u>		
	<u>115 Volts</u>	<u>208 Volts</u>	<u>230 Volts</u>
<u>1/2</u>	<u>58.8</u>	<u>32.5</u>	<u>29.4</u>
<u>3/4</u>	<u>82.8</u>	<u>45.8</u>	<u>41.4</u>
<u>1</u>	<u>96</u>	<u>53</u>	<u>48</u>
<u>1 1/2</u>	<u>120</u>	<u>66</u>	<u>60</u>
<u>2</u>	<u>144</u>	<u>80</u>	<u>72</u>
<u>3</u>	<u>204</u>	<u>113</u>	<u>102</u>
<u>5</u>	<u>336</u>	<u>186</u>	<u>168</u>
<u>7 1/2</u>	<u>480</u>	<u>265</u>	<u>240</u>
<u>10</u>	<u>1000</u>	<u>332</u>	<u>300</u>

		<u>27.6</u>	
-			
		<u>25</u>	
-			
		<u>12.5</u>	
-			
			<u>10</u>
<u>1</u>	<u>60</u>		
-			
		<u>34.5</u>	
-			
		<u>33</u>	
-			
		<u>30</u>	
-			
		<u>15</u>	
-			
			<u>12</u>
<u>1 1/2</u>			<u>80</u>
-			
		<u>46</u>	
-			
		<u>44</u>	
-			
		<u>40</u>	
-			
		<u>20</u>	
-			
			<u>16</u>
<u>2</u>	<u>100</u>		
-			
		<u>57.5</u>	
-			
		<u>55</u>	
-			
		<u>50</u>	
-			
		<u>25</u>	
-			
			<u>20</u>
<u>3</u>			<u>=</u>
-			
		<u>73.6</u>	
-			
		<u>71</u>	
-			

-	
	<u>64</u>
-	
	<u>32</u>
-	
	<u>25.6</u>
<u>5</u>	<u>=</u>
-	
	<u>105.8</u>
-	
	<u>102</u>
-	
	<u>92</u>
-	
	<u>46</u>
-	
	<u>36.8</u>
<u>7 1/2</u>	<u>=</u>
-	
	<u>146</u>
-	
	<u>140</u>
-	
	<u>127</u>
-	
	<u>63.5</u>
-	
	<u>50.8</u>
<u>10</u>	<u>=</u>
-	
	<u>186.3</u>
-	
	<u>179</u>
-	
	<u>162</u>
-	
	<u>81</u>
-	
	<u>64.8</u>
<u>15</u>	<u>=</u>
-	
	<u>267</u>
-	
	<u>257</u>
-	

	<u>232</u>	
-		
	<u>116</u>	
-		
		<u>93</u>
<u>20</u>		<u>=</u>
-		
	<u>334</u>	
-		
	<u>321</u>	
-		
	<u>290</u>	
-		
	<u>145</u>	
-		
		<u>116</u>
<u>25</u>		<u>=</u>
-		
	<u>420</u>	
-		
	<u>404</u>	
-		
	<u>365</u>	
-		
	<u>183</u>	
-		
		<u>146</u>
<u>30</u>		<u>=</u>
-		
	<u>500</u>	
-		
	<u>481</u>	
-		
	<u>435</u>	
-		
	<u>218</u>	
-		
		<u>174</u>
<u>40</u>		<u>=</u>
-		
	<u>667</u>	
-		
	<u>641</u>	
-		
	<u>580</u>	
-		

	<u>290</u>
-	
	<u>232</u>
<u>50</u>	<u>=</u>
-	
	<u>834</u>
-	
	<u>802</u>
-	
	<u>725</u>
-	
	<u>363</u>
-	
	<u>290</u>
<u>60</u>	<u>=</u>
-	
	<u>1001</u>
-	
	<u>962</u>
-	
	<u>870</u>
-	
	<u>435</u>
-	
	<u>348</u>
<u>75</u>	<u>=</u>
-	
	<u>1248</u>
-	
	<u>1200</u>
-	
	<u>1085</u>
-	
	<u>543</u>
-	
	<u>434</u>
<u>100</u>	<u>=</u>
-	
	<u>1668</u>
-	
	<u>1603</u>
-	
	<u>1450</u>
-	
	<u>725</u>
-	

	<u>580</u>
<u>125</u>	<u>=</u>
-	
	<u>2087</u>
-	
	<u>2007</u>
-	
	<u>1815</u>
-	
	<u>908</u>
-	
	<u>726</u>
<u>150</u>	<u>=</u>
-	
	<u>2496</u>
-	
	<u>2400</u>
-	
	<u>2170</u>
-	
	<u>1085</u>
-	
	<u>868</u>
<u>200</u>	<u>=</u>
-	
	<u>3335</u>
-	
	<u>3207</u>
-	
	<u>2900</u>
-	
	<u>1450</u>
-	
	<u>1160</u>
<u>250</u>	<u>=</u>
-	
	<u>=</u>
-	
	<u>=</u>
-	
	<u>=</u>
-	
	<u>1825</u>
-	
	<u>1460</u>

300

==

-

==

-

==

-

==

-

2200

-

1760

350

==

-

==

-

==

-

==

-

2550

-

2040

400

==

-

==

-

==

-

==

-

2900

-

2320

450

==

-

==

-

==

-

==

-

==

-

3250

-

2600

500

==

-

-	
-	
-	
-	
	3625
-	
	2900

*Design A motors are not limited to a maximum starting current or locked rotor current.

Statement of Problem and Substantiation for Public Input

Article 430 Part XI, Section 430.225(B)(1) addresses the need for protection schemes to be performed under engineering supervision. There is no need to indicate FLC amperage for 2300V motors in Table 430.250. 430.6(A) currently refers the user to the tables to size all cables, fuses, breakers, disconnecting means, etc. Table 430.250 should not contain motors rated larger than 1000V as these motors and their protection schemes and equipment should not be designed without engineering supervision. Eliminating these values would align 430 Part XI with 430.6 and the Tables.

Submitter Information Verification

Submitter Full Name: Paul Guidry

Organization: Fluor Enterprises, Inc.

Affiliation: Associated Builders and Contractors

Street Address:

City:

State:

Zip:

Submittal Date: Tue Nov 12 16:52:55 EST 2019

Committee: NEC-P11

Committee Statement

Resolution: The submitter's substantiation needs more details as to why the 2300V column should be removed versus addition of further medium voltage columns.



Public Input No. 1250-NFPA 70-2020 [Part XIV.]

Part XIV. Tables

Table 430.247 Full-Load Current in Amperes, Direct-Current Motors

The following values of full-load currents* are for motors running at base speed.

<u>Horsepower</u>	<u>Armature Voltage Rating*</u>					
	<u>90 Volts</u>	<u>120 Volts</u>	<u>180 Volts</u>	<u>240 Volts</u>	<u>500 Volts</u>	<u>550 Volts</u>
¼	4.0	3.1	2.0	1.6	—	—
⅓	5.2	4.1	2.6	2.0	—	—
½	6.8	5.4	3.4	2.7	—	—
¾	9.6	7.6	4.8	3.8	—	—
1	12.2	9.5	6.1	4.7	—	—
1½	—	13.2	8.3	6.6	—	—
2	—	17	10.8	8.5	—	—
3	—	25	16	12.2	—	—
5	—	40	27	20	—	—
7½	—	58	—	29	13.6	12.2
10	—	76	—	38	18	16
15	—	—	—	55	27	24
20	—	—	—	72	34	31
25	—	—	—	89	43	38
30	—	—	—	106	51	46
40	—	—	—	140	67	61
50	—	—	—	173	83	75
60	—	—	—	206	99	90
75	—	—	—	255	123	111
100	—	—	—	341	164	148
125	—	—	—	425	205	185
150	—	—	—	506	246	222
200	—	—	—	675	330	294

*These are average dc quantities.

Table 430.248 Full-Load Currents in Amperes, Single-Phase Alternating-Current Motors

The following values of full-load currents are for motors running at usual speeds and motors with normal torque characteristics. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120 and 220 to 240 volts.

<u>Horsepower</u>	<u>115 Volts</u>	<u>200 Volts</u>	<u>208 Volts</u>	<u>230 Volts</u>
⅙	4.4	2.5	2.4	2.2
¼	5.8	3.3	3.2	2.9
⅓	7.2	4.1	4.0	3.6
½	9.8	5.6	5.4	4.9
¾	13.8	7.9	7.6	6.9
1	16	9.2	8.8	8.0
1½	20	11.5	11.0	10
2	24	13.8	13.2	12
3	34	19.6	18.7	17
5	56	32.2	30.8	28

<u>Horsepower</u>	<u>115</u> <u>Volts</u>	<u>200</u> <u>Volts</u>	<u>208</u> <u>Volts</u>	<u>230</u> <u>Volts</u>
7½	80	46.0	44.0	40
10	100	57.5	55.0	50

Table 430.249 Full-Load Current, Two-Phase Alternating-Current Motors (4-Wire)

The following values of full-load current are for motors running at speeds usual for belted motors and motors with normal torque characteristics. Current in the common conductor of a 2-phase, 3-wire system will be 1.41 times the value given. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120, 220 to 240, 440 to 480, and 550 to 600 volts.

<u>Horsepower</u>	<u>Induction-Type Squirrel Cage and</u> <u>Wound Rotor (Amperes)</u>				
	<u>115</u> <u>Volts</u>	<u>230</u> <u>Volts</u>	<u>460</u> <u>Volts</u>	<u>575</u> <u>Volts</u>	<u>2300</u> <u>Volts</u>
½	4.0	2.0	1.0	0.8	—
¾	4.8	2.4	1.2	1.0	—
1	6.4	3.2	1.6	1.3	—
1½	9.0	4.5	2.3	1.8	—
2	11.8	5.9	3.0	2.4	—
3	—	8.3	4.2	3.3	—
5	—	13.2	6.6	5.3	—
7½	—	19	9.0	8.0	—
10	—	24	12	10	—
15	—	36	18	14	—
20	—	47	23	19	—
25	—	59	29	24	—
30	—	69	35	28	—
40	—	90	45	36	—
50	—	113	56	45	—
60	—	133	67	53	14
75	—	166	83	66	18
100	—	218	109	87	23
125	—	270	135	108	28
150	—	312	156	125	32
200	—	416	208	167	43

Table 430.250 Full-Load Current, Three-Phase Alternating-Current Motors

The following values of full-load currents are typical for motors running at speeds usual for belted motors and motors with normal torque characteristics. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120, 220 to 240, 440 to 480, and 550 to 600 volts.

<u>Horsepower</u>	<u>Induction-Type Squirrel Cage and Wound Rotor (Amperes)</u>							<u>Syn</u>
	<u>115 Volts</u>	<u>200 Volts</u>	<u>208 Volts</u>	<u>230 Volts</u>	<u>460 Volts</u>	<u>575 Volts</u>	<u>2300 Volts</u>	<u>230 Volts</u>
½	4.4	2.5	2.4	2.2	1.1	0.9	—	—
¾	6.4	3.7	3.5	3.2	1.6	1.3	—	—
1	8.4	4.8	4.6	4.2	2.1	1.7	—	—

<u>Horsepower</u>	<u>Induction-Type Squirrel Cage and Wound Rotor (Amperes)</u>							<u>Syn</u>
	<u>115 Volts</u>	<u>200 Volts</u>	<u>208 Volts</u>	<u>230 Volts</u>	<u>460 Volts</u>	<u>575 Volts</u>	<u>2300 Volts</u>	<u>230 Volts</u>
1½	12.0	6.9	6.6	6.0	3.0	2.4	—	—
2	13.6	7.8	7.5	6.8	3.4	2.7	—	—
3	—	11.0	10.6	9.6	4.8	3.9	—	—
5	—	17.5	16.7	15.2	7.6	6.1	—	—
7½	—	25.3	24.2	22	11	9	—	—
10	—	32.2	30.8	28	14	11	—	—
15	—	48.3	46.2	42	21	17	—	—
20	—	62.1	59.4	54	27	22	—	—
25	—	78.2	74.8	68	34	27	—	53
30	—	92	88	80	40	32	—	63
40	—	120	114	104	52	41	—	83
50	—	150	143	130	65	52	—	104
60	—	177	169	154	77	62	16	123
75	—	221	211	192	96	77	20	155
100	—	285	273	248	124	99	26	202
125	—	359	343	312	156	125	31	253
150	—	414	396	360	180	144	37	302
200	—	552	528	480	240	192	49	400
250	—	—	—	—	302	242	60	—
300	—	—	—	—	361	289	72	—
350	—	—	—	—	414	336	83	—
400	—	—	—	—	477	382	95	—
450	—	—	—	—	515	412	103	—
500	—	—	—	—	590	472	118	—

*For 90 and 80 percent power factor, the figures shall be multiplied by 1.1 and 1.25, respectively.

Table 430.251(A) Conversion Table of Single-Phase Locked-Rotor Currents for Selection of Disconnecting Means and Controllers as Determined from Horsepower and Voltage Rating

For use only with 430.110, 440.12, 440.41, and 455.8(C).

<u>Rated Horsepower</u>	<u>Maximum Locked-Rotor Current in Amperes, Single Phase</u>		
	<u>115 Volts</u>	<u>208 Volts</u>	<u>230 Volts</u>
½	58.8	32.5	29.4
¾	82.8	45.8	41.4
1	96	53	48
1½	120	66	60
2	144	80	72
3	204	113	102
5	336	186	168
7½	480	265	240
10	1000	332	300

Table 430.251(B) Conversion Table of Polyphase Design B, C, and D Maximum Locked-Rotor Currents for Selection of Disconnecting Means and Controllers as Determined from Horsepower and Voltage Rating and Design Letter

For use only with 430.110, 440.12, 440.41, and 455.8(C).

<u>Rated</u> <u>Horsepower</u>	<u>Maximum Motor Locked-Rotor Current in Amperes, Two- and Three-Phase,</u> <u>Design B, C, and D*</u>					
	<u>115 Volts</u>	<u>200 Volts</u>	<u>208 Volts</u>	<u>230 Volts</u>	<u>460 Volts</u>	<u>575 Volts</u>
	<u>B, C, D</u>	<u>B, C, D</u>	<u>B, C, D</u>	<u>B, C, D</u>	<u>B, C, D</u>	<u>B, C, D</u>
½	40	23	22.1	20	10	8
¾	50	28.8	27.6	25	12.5	10
1	60	34.5	33	30	15	12
1½	80	46	44	40	20	16
2	100	57.5	55	50	25	20
3	—	73.6	71	64	32	25.6
5	—	105.8	102	92	46	36.8
7½	—	146	140	127	63.5	50.8
10	—	186.3	179	162	81	64.8
15	—	267	257	232	116	93
20	—	334	321	290	145	116
25	—	420	404	365	183	146
30	—	500	481	435	218	174
40	—	667	641	580	290	232
50	—	834	802	725	363	290
60	—	1001	962	870	435	348
75	—	1248	1200	1085	543	434
100	—	1668	1603	1450	725	580
125	—	2087	2007	1815	908	726
150	—	2496	2400	2170	1085	868
200	—	3335	3207	2900	1450	1160
250	—	—	—	—	1825	1460
300	—	—	—	—	2200	1760
350	—	—	—	—	2550	2040
400	—	—	—	—	2900	2320
450	—	—	—	—	3250	2600
500	—	—	—	—	3625	2900

*Design A motors are not limited to a maximum starting current or locked rotor current.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
2023_NEC_PI_Table_430.248_Guidry.docx	Revised Table 430.248	

Statement of Problem and Substantiation for Public Input

460V single phase ac motors are common. Since 430.6 requires the use of the full-load currents from the tables for sizing wire, fuses and breakers for motors less than 600V, the full-load current values for 460V single phase motors should be included. The values are based on the currently shown 230V motors full-load current divided by 2, and rounded up to the nearest single decimal.

Submitter Information Verification

Submitter Full Name: Paul Guidry

Organization: Fluor Enterprises, Inc.

Affiliation: Associated Builders and Contractors

Street Address:

City:

State:

Zip:

Submittal Date: Sun May 24 16:50:32 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: The substantiation on the development of the proposed table values needs better technical background and comparison with manufacturer's published tables.

Table 430.248 Full-Load Currents in Amperes, Single-Phase Alternating-Current Motors

The following values of full-load currents are for motors running at usual speeds and motors with normal torque characteristics. The voltages listed are rated motor voltages. †The currents listed shall be permitted for system voltage ranges of 110 to 120 and 220 to 240 and 440 to 480 volts.

Horsepower	<u>†115</u> Volts	200 Volts	208 Volts	<u>†230</u> Volts	<u>†460</u> Volts
1/6	4.4	2.5	2.4	2.2	<u>1.1</u>
1/4	5.8	3.3	3.2	2.9	<u>1.5</u>
1/3	7.2	4.1	4	3.6	<u>1.8</u>
1/2	9.8	5.6	5.4	4.9	<u>2.5</u>
3/4	13.8	7.9	7.6	6.9	<u>3.5</u>
1	16	9.2	8.8	8	<u>4</u>
1 1/2	20	11.5	11	10	<u>5</u>
2	24	13.8	13.2	12	<u>6</u>
3	34	19.6	18.7	17	<u>8.5</u>
5	56	32.2	30.8	28	<u>14</u>
7 1/2	80	46	44	40	<u>20</u>
10	100	57.5	55	50	<u>25</u>



Public Input No. 2350-NFPA 70-2020 [Part XIV.]

Part XIV. Tables

Table 430.247 Full-Load Current in Amperes, Direct-Current Motors

The following values of full-load currents* are for motors running at base speed.

<u>Horsepower</u>	<u>Armature Voltage Rating*</u>					
	<u>90 Volts</u>	<u>120 Volts</u>	<u>180 Volts</u>	<u>240 Volts</u>	<u>500 Volts</u>	<u>550 Volts</u>
$\frac{1}{4}$	4.0	3.1	2.0	1.6	—	—
$\frac{1}{3}$	5.2	4.1	2.6	2.0	—	—
$\frac{1}{2}$	6.8	5.4	3.4	2.7	—	—
$\frac{3}{4}$	9.6	7.6	4.8	3.8	—	—
1	12.2	9.5	6.1	4.7	—	—
$1\frac{1}{2}$	—	13.2	8.3	6.6	—	—
2	—	17	10.8	8.5	—	—
3	—	25	16	12.2	—	—
5	—	40	27	20	—	—
$7\frac{1}{2}$	—	58	—	29	13.6	12.2
10	—	76	—	38	18	16
15	—	—	—	55	27	24
20	—	—	—	72	34	31
25	—	—	—	89	43	38
30	—	—	—	106	51	46
40	—	—	—	140	67	61
50	—	—	—	173	83	75
60	—	—	—	206	99	90
75	—	—	—	255	123	111
100	—	—	—	341	164	148
125	—	—	—	425	205	185
150	—	—	—	506	246	222
200	—	—	—	675	330	294

*These are average dc quantities.

Table 430.248 Full-Load Currents in Amperes, Single-Phase Alternating-Current Motors

The following values of full-load currents are for motors running at usual speeds and motors with normal torque characteristics. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120 and 220 to 240 volts.

<u>Horsepower</u>	<u>115</u>	<u>200</u>	<u>208</u>	<u>230</u>	<u>277 Volts</u>
	<u>Volts</u>	<u>Volts</u>	<u>Volts</u>	<u>Volts</u>	
$\frac{1}{6}$	4.4	2.5	2.4	2.2	
$\frac{1}{4}$	5.8	3.3	3.2	2.9	
$\frac{1}{3}$	7.2	4.1	4.0	3.6	
$\frac{1}{2}$	9.8	5.6	5.4	4.9	
$\frac{3}{4}$	13.8	7.9	7.6	6.9	
1	16	9.2	8.8	8.0	
$1\frac{1}{2}$	20	11.5	11.0	10	
2	24	13.8	13.2	12	
3	34	19.6	18.7	17	

<u>Horsepower</u>	<u>115</u>	<u>200</u>	<u>208</u>	<u>230</u>	<u>277 Volts</u>
	<u>Volts</u>	<u>Volts</u>	<u>Volts</u>	<u>Volts</u>	
5	56	32.2	30.8	28	
7½	80	46.0	44.0	40	
10	100	57.5	55.0	50	

Table 430.249 Full-Load Current, Two-Phase Alternating-Current Motors (4-Wire)

The following values of full-load current are for motors running at speeds usual for belted motors and motors with normal torque characteristics. Current in the common conductor of a 2-phase, 3-wire system will be 1.41 times the value given. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120, 220 to 240, 440 to 480, and 550 to 600 volts.

<u>Horsepower</u>	<u>Induction-Type Squirrel Cage and</u>				
	<u>Wound Rotor (Amperes)</u>				
	<u>115</u>	<u>230</u>	<u>460</u>	<u>575</u>	<u>2300</u>
	<u>Volts</u>	<u>Volts</u>	<u>Volts</u>	<u>Volts</u>	<u>Volts</u>
½	4.0	2.0	1.0	0.8	—
¾	4.8	2.4	1.2	1.0	—
1	6.4	3.2	1.6	1.3	—
1½	9.0	4.5	2.3	1.8	—
2	11.8	5.9	3.0	2.4	—
3	—	8.3	4.2	3.3	—
5	—	13.2	6.6	5.3	—
7½	—	19	9.0	8.0	—
10	—	24	12	10	—
15	—	36	18	14	—
20	—	47	23	19	—
25	—	59	29	24	—
30	—	69	35	28	—
40	—	90	45	36	—
50	—	113	56	45	—
60	—	133	67	53	14
75	—	166	83	66	18
100	—	218	109	87	23
125	—	270	135	108	28
150	—	312	156	125	32
200	—	416	208	167	43

Table 430.250 Full-Load Current, Three-Phase Alternating-Current Motors

The following values of full-load currents are typical for motors running at speeds usual for belted motors and motors with normal torque characteristics. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120, 220 to 240, 440 to 480, and 550 to 600 volts.

<u>Horsepower</u>	<u>Induction-Type Squirrel Cage and Wound Rotor (Amperes)</u>	<u>S</u>

	<u>115 Volts</u>	<u>200 Volts</u>	<u>208 Volts</u>	<u>230 Volts</u>	<u>460 Volts</u>	<u>575 Volts</u>	<u>2300 Volts</u>	-	<u>230 Vc</u>
½	4.4	2.5	2.4	2.2	1.1	0.9	—	-	—
¾	6.4	3.7	3.5	3.2	1.6	1.3	—	-	—
1	8.4	4.8	4.6	4.2	2.1	1.7	—	-	—
1½	12.0	6.9	6.6	6.0	3.0	2.4	—	-	—
2	13.6	7.8	7.5	6.8	3.4	2.7	—	-	—
3	—	11.0	10.6	9.6	4.8	3.9	—	-	—
5	—	17.5	16.7	15.2	7.6	6.1	—	-	—
7½	—	25.3	24.2	22	11	9	—	-	—
10	—	32.2	30.8	28	14	11	—	-	—
15	—	48.3	46.2	42	21	17	—	-	—
20	—	62.1	59.4	54	27	22	—	-	—
25	—	78.2	74.8	68	34	27	—	-	53
30	—	92	88	80	40	32	—	-	63
40	—	120	114	104	52	41	—	-	83
50	—	150	143	130	65	52	—	-	104
60	—	177	169	154	77	62	16	-	123
75	—	221	211	192	96	77	20	-	155
100	—	285	273	248	124	99	26	-	202
125	—	359	343	312	156	125	31	-	253
150	—	414	396	360	180	144	37	-	302
200	-		552	528	480	240	192	49 -	
250	—	—	—	—	302	242	60	-	—
300	—	—	—	—	361	289	72	-	—
350	—	—	—	—	414	336	83	-	—
400	—	—	—	—	477	382	95	-	—
450	—	—	—	—	515	412	103	-	—
500	—	—	—	—	590	472	118	-	—

*For 90 and 80 percent power factor, the figures shall be multiplied by 1.1 and 1.25, respectively.

Table 430.251(A) Conversion Table of Single-Phase Locked-Rotor Currents for Selection of Disconnecting Means and Controllers as Determined from Horsepower and Voltage Rating

For use only with 430.110, 440.12, 440.41, and 455.8(C).

<u>Rated</u> <u>Horsepower</u>	<u>Maximum Locked-Rotor Current in</u>		
	<u>Amperes, Single Phase</u>		
	<u>115 Volts</u>	<u>208 Volts</u>	<u>230 Volts</u>
½	58.8	32.5	29.4
¾	82.8	45.8	41.4
1	96	53	48
1½	120	66	60
2	144	80	72
3	204	113	102
5	336	186	168
7½	480	265	240
10	1000	332	300

Table 430.251(B) Conversion Table of Polyphase Design B, C, and D Maximum Locked-Rotor Currents for Selection of Disconnecting Means and Controllers as Determined from Horsepower and Voltage Rating and Design Letter

For use only with 430.110, 440.12, 440.41, and 455.8(C).

Rated Horsepower	Maximum Motor Locked-Rotor Current in Amperes, Two- and Three-Phase, Design B, C, and D*					
	115 Volts	200 Volts	208 Volts	230 Volts	460 Volts	575 Volts
	B, C, D	B, C, D	B, C, D	B, C, D	B, C, D	B, C, D
1/2	40	23	22.1	20	10	8
3/4	50	28.8	27.6	25	12.5	10
1	60	34.5	33	30	15	12
1 1/2	80	46	44	40	20	16
2	100	57.5	55	50	25	20
3	—	73.6	71	64	32	25.6
5	—	105.8	102	92	46	36.8
7 1/2	—	146	140	127	63.5	50.8
10	—	186.3	179	162	81	64.8
15	—	267	257	232	116	93
20	—	334	321	290	145	116
25	—	420	404	365	183	146
30	—	500	481	435	218	174
40	—	667	641	580	290	232
50	—	834	802	725	363	290
60	—	1001	962	870	435	348
75	—	1248	1200	1085	543	434
100	—	1668	1603	1450	725	580
125	—	2087	2007	1815	908	726
150	—	2496	2400	2170	1085	868
200	—	3335	3207	2900	1450	1160
250	—	—	—	—	1825	1460
300	—	—	—	—	2200	1760
350	—	—	—	—	2550	2040
400	—	—	—	—	2900	2320
450	—	—	—	—	3250	2600
500	—	—	—	—	3625	2900

*Design A motors are not limited to a maximum starting current or locked rotor current.

Statement of Problem and Substantiation for Public Input

Table 430.248 only list voltages up to 230V. Recommend adding 277V/1-phase motor column. 277V/1-phase motors are common in commercial buildings for use with HVAC and plumbing systems.

Submitter Information Verification

Submitter Full Name: John Romine

Organization: Burns & McDonnell

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 17 15:30:07 EDT 2020

Committee: NEC-P11

Committee Statement

Resolution: The proposal does not contain any information on what the 277V values should be or substantiation as to why they were selected.



Public Input No. 557-NFPA 70-2020 [Part XIV.]

Part XIV. Tables

Table 430.247 Full-Load Current in Amperes, Direct-Current Motors

The following values of full-load currents* are for motors running at base speed.

<u>Horsepower</u>	<u>Armature Voltage Rating*</u>					
	<u>90 Volts</u>	<u>120 Volts</u>	<u>180 Volts</u>	<u>240 Volts</u>	<u>500 Volts</u>	<u>550 Volts</u>
¼	4.0	3.1	2.0	1.6	—	—
⅓	5.2	4.1	2.6	2.0	—	—
½	6.8	5.4	3.4	2.7	—	—
¾	9.6	7.6	4.8	3.8	—	—
1	12.2	9.5	6.1	4.7	—	—
1½	—	13.2	8.3	6.6	—	—
2	—	17	10.8	8.5	—	—
3	—	25	16	12.2	—	—
5	—	40	27	20	—	—
7½	—	58	—	29	13.6	12.2
10	—	76	—	38	18	16
15	—	—	—	55	27	24
20	—	—	—	72	34	31
25	—	—	—	89	43	38
30	—	—	—	106	51	46
40	—	—	—	140	67	61
50	—	—	—	173	83	75
60	—	—	—	206	99	90
75	—	—	—	255	123	111
100	—	—	—	341	164	148
125	—	—	—	425	205	185
150	—	—	—	506	246	222
200	—	—	—	675	330	294

*These are average dc quantities.

Table 430.248 Full-Load Currents in Amperes, Single-Phase Alternating-Current Motors

The following values of full-load currents are for motors running at usual speeds and motors with normal torque characteristics. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120 and 220 to 240 volts.

<u>Horsepower</u>	<u>115 Volts</u>	<u>200 Volts</u>	<u>208 Volts</u>	<u>230 Volts</u>
⅙	4.4	2.5	2.4	2.2
¼	5.8	3.3	3.2	2.9
⅓	7.2	4.1	4.0	3.6
½	9.8	5.6	5.4	4.9
¾	13.8	7.9	7.6	6.9
1	16	9.2	8.8	8.0
1½	20	11.5	11.0	10
2	24	13.8	13.2	12
3	34	19.6	18.7	17
5	56	32.2	30.8	28

<u>Horsepower</u>	<u>115</u> <u>Volts</u>	<u>200</u> <u>Volts</u>	<u>208</u> <u>Volts</u>	<u>230</u> <u>Volts</u>
7½	80	46.0	44.0	40
10	100	57.5	55.0	50

Table 430.249 Full-Load Current, Two-Phase Alternating-Current Motors (4-Wire)

The following values of full-load current are for motors running at speeds usual for belted motors and motors with normal torque characteristics. Current in the common conductor of a 2-phase, 3-wire system will be 1.41 times the value given. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120, 220 to 240, 440 to 480, and 550 to 600 volts.

<u>Horsepower</u>	<u>Induction-Type Squirrel Cage and</u> <u>Wound Rotor (Amperes)</u>				
	<u>115</u> <u>Volts</u>	<u>230</u> <u>Volts</u>	<u>460</u> <u>Volts</u>	<u>575</u> <u>Volts</u>	<u>2300</u> <u>Volts</u>
½	4.0	2.0	1.0	0.8	—
¾	4.8	2.4	1.2	1.0	—
1	6.4	3.2	1.6	1.3	—
1½	9.0	4.5	2.3	1.8	—
2	11.8	5.9	3.0	2.4	—
3	—	8.3	4.2	3.3	—
5	—	13.2	6.6	5.3	—
7½	—	19	9.0	8.0	—
10	—	24	12	10	—
15	—	36	18	14	—
20	—	47	23	19	—
25	—	59	29	24	—
30	—	69	35	28	—
40	—	90	45	36	—
50	—	113	56	45	—
60	—	133	67	53	14
75	—	166	83	66	18
100	—	218	109	87	23
125	—	270	135	108	28
150	—	312	156	125	32
200	—	416	208	167	43

Table 430.250 Full-Load Current, Three-Phase Alternating-Current Motors

The following values of full-load currents are typical for motors running at speeds usual for belted motors and motors with normal torque characteristics. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120, 220 to 240, 440 to 480, and 550 to 600 volts.

<u>Horsepower</u>	<u>Induction-Type Squirrel Cage and Wound Rotor (Amperes)</u>							<u>Syn</u>
	<u>115 Volts</u>	<u>200 Volts</u>	<u>208 Volts</u>	<u>230 Volts</u>	<u>460 Volts</u>	<u>575 Volts</u>	<u>2300 Volts</u>	<u>230 Volts</u>
½	4.4	2.5	2.4	2.2	1.1	0.9	—	—
¾	6.4	3.7	3.5	3.2	1.6	1.3	—	—
1	8.4	4.8	4.6	4.2	2.1	1.7	—	—

<u>Horsepower</u>	<u>Induction-Type Squirrel Cage and Wound Rotor (Amperes)</u>							<u>Syn</u>
	<u>115 Volts</u>	<u>200 Volts</u>	<u>208 Volts</u>	<u>230 Volts</u>	<u>460 Volts</u>	<u>575 Volts</u>	<u>2300 Volts</u>	<u>230 Volts</u>
1½	12.0	6.9	6.6	6.0	3.0	2.4	—	—
2	13.6	7.8	7.5	6.8	3.4	2.7	—	—
3	—	11.0	10.6	9.6	4.8	3.9	—	—
5	—	17.5	16.7	15.2	7.6	6.1	—	—
7½	—	25.3	24.2	22	11	9	—	—
10	—	32.2	30.8	28	14	11	—	—
15	—	48.3	46.2	42	21	17	—	—
20	—	62.1	59.4	54	27	22	—	—
25	—	78.2	74.8	68	34	27	—	53
30	—	92	88	80	40	32	—	63
40	—	120	114	104	52	41	—	83
50	—	150	143	130	65	52	—	104
60	—	177	169	154	77	62	16	123
75	—	221	211	192	96	77	20	155
100	—	285	273	248	124	99	26	202
125	—	359	343	312	156	125	31	253
150	—	414	396	360	180	144	37	302
200	—	552	528	480	240	192	49	400
250	—	—	—	—	302	242	60	—
300	—	—	—	—	361	289	72	—
350	—	—	—	—	414	336	83	—
400	—	—	—	—	477	382	95	—
450	—	—	—	—	515	412	103	—
500	—	—	—	—	590	472	118	—

*For 90 and 80 percent power factor, the figures shall be multiplied by 1.1 and 1.25, respectively.

Table 430.251(A) Conversion Table of Single-Phase Locked-Rotor Currents for Selection of Disconnecting Means and Controllers as Determined from Horsepower and Voltage Rating

For use only with 430.110, 440.12, 440.41, and 455.8(C).

<u>Rated Horsepower</u>	<u>Maximum Locked-Rotor Current in Amperes, Single Phase</u>		
	<u>115 Volts</u>	<u>208 Volts</u>	<u>230 Volts</u>
½	58.8	32.5	29.4
¾	82.8	45.8	41.4
1	96	53	48
1½	120	66	60
2	144	80	72
3	204	113	102
5	336	186	168
7½	480	265	240
10	1000	332	300

Table 430.251(B) Conversion Table of Polyphase Design B, C, and D Maximum Locked-Rotor Currents for Selection of Disconnecting Means and Controllers as Determined from Horsepower and Voltage Rating and Design Letter

For use only with 430.110, 440.12, 440.41, and 455.8(C).

<u>Rated</u> <u>Horsepower</u>	<u>Maximum Motor Locked-Rotor Current in Amperes, Two- and Three-Phase,</u> <u>Design B, C, and D*</u>					
	<u>115 Volts</u>	<u>200 Volts</u>	<u>208 Volts</u>	<u>230 Volts</u>	<u>460 Volts</u>	<u>575 Volts</u>
	<u>B, C, D</u>	<u>B, C, D</u>	<u>B, C, D</u>	<u>B, C, D</u>	<u>B, C, D</u>	<u>B, C, D</u>
½	40	23	22.1	20	10	8
¾	50	28.8	27.6	25	12.5	10
1	60	34.5	33	30	15	12
1½	80	46	44	40	20	16
2	100	57.5	55	50	25	20
3	—	73.6	71	64	32	25.6
5	—	105.8	102	92	46	36.8
7½	—	146	140	127	63.5	50.8
10	—	186.3	179	162	81	64.8
15	—	267	257	232	116	93
20	—	334	321	290	145	116
25	—	420	404	365	183	146
30	—	500	481	435	218	174
40	—	667	641	580	290	232
50	—	834	802	725	363	290
60	—	1001	962	870	435	348
75	—	1248	1200	1085	543	434
100	—	1668	1603	1450	725	580
125	—	2087	2007	1815	908	726
150	—	2496	2400	2170	1085	868
200	—	3335	3207	2900	1450	1160
250	—	—	—	—	1825	1460
300	—	—	—	—	2200	1760
350	—	—	—	—	2550	2040
400	—	—	—	—	2900	2320
450	—	—	—	—	3250	2600
500	—	—	—	—	3625	2900

*Design A motors are not limited to a maximum starting current or locked rotor current.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
CMP_11_TIA_1462_issued_TIA_70_20_7.pdf	NEC TIA 20-7 Log No. 1462	

Statement of Problem and Substantiation for Public Input

NOTE: This public input originates from Tentative Interim Amendment No. 20-7 (Log 1462) issued by the Standards Council on August 6, 2019 and per the NFPA Regs., needs to be reconsidered by the Code Making Panel for the next edition of the Document.

Substantiation: During the 2020 NEC First Draft Meeting CMP-5 created a First Revision that revised how equipment grounding conductors were sized. This revision impacted Table 250.122. As a result CMP-11 viewed this change as negatively impacting the proper sizing of conductors for motor circuits and created a new 430.246 section during the Second Draft Meeting. This action fundamentally adopted the original

equipment grounding conductor sizing method and in essence relocated the original Table 250.122 to Article 430. During the Second Revision meeting CMP-5 reconsidered the change and rejected the new equipment grounding conductor sizing method returning to the original method. During the Correlating Committee Second Meeting, the Correlating Committee created a Correlating Committee Second Revision to correlate sections 250.122 and 430.246. As a result, Section 430.246 was deleted but the corresponding Table 430.252 was inadvertently not removed. This TIA seeks to correct this error by deleting Table 430.252 which has no language referencing the table and will only create confusion for the user if it remains in the 2020 NEC

Emergency Nature: The standard contains an error or an omission that was overlooked during the regular revision process.

This TIA seeks to correct an error by deleting Table 430.252 which has no language referencing the table and will only create confusion for the user if it remains in the 2020 NEC. The Correlating Committee inadvertently overlooked the removal of Table 430.252 when it acted to correlate the actions taken between CMP-5 and CMP-11 during the regular revision process of the Second Revision.

Submitter Information Verification

Submitter Full Name: CMP ON NEC-P11

Organization: Code Making Panel 11

Street Address:

City:

State:

Zip:

Submittal Date: Fri Feb 28 11:33:14 EST 2020

Committee: NEC-P11

Committee Statement

Resolution: The panel affirms the CC position that the table should be removed. However, it is not part of the current text so cannot be deleted. And affirms the action taken by TIA 20-7.



Tentative Interim Amendment

NFPA[®] 70[®]

National Electrical Code[®]

2020 Edition

Reference: Table 430.252

TIA 20-7

(SC 19-8-26 / TIA Log #1462)

Note: Text of the TIA was issued and approved for incorporation into the document prior to printing.

1. Delete Table 430.252 in its entirety:

Table 430.252 Minimum Size Equipment Grounding Conductors for Grounding Motor Circuits and Equipment		
Rating or Setting of Branch Circuit Short-Circuit and Ground-Fault Protective Device in Circuit Ahead of Equipment, Conduit, etc., Not Exceeding (Amperes)	Size (AWG or kcmil)	
	Copper	Aluminum or Copper-Clad Aluminum*
15	14	12
20	12	10
60	10	8
100	8	6
200	6	4
300	4	2
400	3	1
500	2	1/0
600	1	2/0
800	1/0	3/0
1000	2/0	4/0
1200	3/0	250
1600	4/0	350
2000	250	400
2500	350	600
3000	400	600
4000	500	750
5000	700	1200
6000	800	1200

Note: Where necessary to comply with 250.4(A)(5) or (B)(4), the equipment grounding conductor shall be sized larger than given in this table.

*See installation restrictions in 250.120.

Issue Date: August 6, 2019

Effective Date: August 26, 2019

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/docinfo)

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