

**First Revision No. 39-NFPA 79-2019 [Global Input]**

Global FR for Reorganization of Chapter 5.

Supplemental Information

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Committee:

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Committee Statement

Committee Statement: See the attached document (FR-39 PI Statements Rev 2.0 - 3_14_2019.docx) for the committee statements on each Section within Chapter 5.

Response Message: FR-39-NFPA 79-2019

[Public Input No. 110-NFPA 79-2019 \[Section No. A.5.3.1.1.1\]](#)

[Public Input No. 102-NFPA 79-2019 \[Global Input\]](#)

[Public Input No. 113-NFPA 79-2019 \[Section No. A.5.3.3.1\]](#)

[Public Input No. 108-NFPA 79-2019 \[Section No. A.5.1.1\]](#)

[Public Input No. 109-NFPA 79-2019 \[Section No. A.5.2\]](#)

[Public Input No. 114-NFPA 79-2019 \[Section No. A.5.3.3.2\]](#)

[Public Input No. 101-NFPA 79-2019 \[Section No. 5.3.4.2\]](#)

[Public Input No. 33-NFPA 79-2018 \[Section No. 5.5.4\]](#)

[Public Input No. 43-NFPA 79-2019 \[Section No. 5.3.1.4\]](#)

[FR-39]

Chapter 5 Disconnecting Means

~~5.1 Machine Supply Circuit Conductor Terminations.~~ Machine Supply Circuit and Disconnecting Means

5.1.1* Machine Supply Circuit. Where practicable, the electrical equipment of a machine shall be connected to a single power supply circuit. Where it is necessary to use another supply circuit for certain parts of the equipment (e.g., electronic circuits, electromagnetic clutches), that supply circuit shall, as far as is practicable, be derived from devices (e.g., transformers, converters) forming part of the electrical equipment of the machine.

A.5.1.1

For large complex machinery comprising a number of widely spaced machines working together in a coordinated manner, more than one machine supply circuit might be needed, depending upon the site supply circuit arrangements (see 5.1.99-1).

~~5.1.6~~ 5.1.2 Machine Supply Circuit Conductor Separation. Each set of machine supply circuit conductors on the line side of the machine supply circuit disconnecting means shall be separated from all other internal conductors, including conductors of other circuits by either of the following:

- (1) Mounting the machine supply circuit disconnect as near as practicable to the top of the enclosure with dedicated wire bending space as in 5.1.5
- (2) Mounting the machine supply circuit disconnect other than at the top of the enclosure and by separating the machine supply circuit conductors from other internal conductors by the use of a barrier.

~~5.1.4~~ 5.1.3 Machine Supply Circuit Conductor Terminations. The machine supply circuit conductors shall be terminated at the machine supply circuit disconnecting means, where practicable. Connections to terminal blocks ahead of the machine supply circuit disconnecting means shall be permitted for excepted circuits according to ~~5.3.5~~ 5.1.13 or where the machine supply circuit conductors are other than those identified for the machine supply circuit disconnecting means. Terminals for more than one conductor shall be so identified.

~~5.1.4~~ 5.1.3.1 Marking. All terminals for each machine supply circuit shall be legibly marked (such as L1, L2, L23) and shall correspond with markings on the technical documentation.

5.1.4 Back-Fed Terminations.

5.1.4.1 The connections to the machine supply circuit disconnecting means shall not be back-fed or reversed with the load side if it is marked line and load.

5.1.4.2 A machine supply circuit disconnecting means that is not marked line and load shall be permitted to be back-fed provided there is a marking on or adjacent to the disconnecting means identifying the line and load terminations.

5.1.5 Wire Bending Space. The wire bending space provided between the terminals of ~~a the~~ supply circuit disconnecting means ~~for~~ terminals described in 5.1.23 and the wall of the enclosure shall not be less than required by Section 430.10(B) of NFPA 70. Space shall be determined by the maximum wire size of the supply circuit conductors or not smaller than the conductors required by Section 670.4(A) of NFPA 70. When the wire bending space is based on more than one conductor per phase, the intended conductor size and number shall be so identified on interconnection diagrams as in 17.5.7.

~~5.1.75~~ 5.1.6 Protection of Line Side Live Parts. All live parts on the line side of the machine supply circuit disconnecting means shall be protected from unintentional direct contact by use of insulation or obstacle(s) when the machine supply circuit disconnecting means is in the open (off) position and the enclosure door is open.

5.1.3-7 Grounded Conductor. Where a grounded conductor is used, it shall be ~~clearly~~ indicated in the technical documentation of the machine, such as in the installation diagram and in the circuit diagram. A separate insulated terminal shall be provided for the grounded conductor.

A.5.1.73

See Question 14 in Annex B, Figure B.1.

~~5.25.1.8~~* Machine Supply Circuit Equipment Grounding Conductor Terminal. A grounding terminal shall be provided for each machine supply circuit equipment grounding conductor.

A.5.1.85-2

For additional information on the equipment grounding conductor terminal, see 8.2.1.3.

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5.3 Machine Supply Circuit Disconnecting (Isolating) Means

~~5.3.1 General~~ 5.1.9 Machine Supply Circuit Disconnecting (Isolating) Means. The ~~general~~ requirements in ~~5.3.1-15.1.9.1~~ through ~~5.3.1-55.2.6.5.4~~ also apply to ~~5.3.25.2.7~~ through ~~5.3.55.2.9~~.

~~5.3.1-15.1.9.1~~ A machine supply circuit disconnecting means shall be provided for the following:

- (1) Each machine supply circuit ~~connecting to a machine~~
- (2) Each machine supply circuit connecting to a feeder system using collector wires, collector bars, slip-ring assemblies, or flexible cable systems (reeled, festooned) to a machine or a number of machines
- (3) Each on-board power source (e.g., generators, uninterruptible power supplies)

Exception: Communication, remote control, and signaling circuits of less than 50 volts shall not be required to be provided with a machine supply circuit disconnecting means.

~~5.3.1.1.15.1.9.2~~* Each machine supply circuit disconnecting means ~~required by 5.3.1.1~~ shall be legibly marked to indicate the equipment it disconnects.

~~A.5.3.1.1.1 1.9.2~~

When a single disconnecting means is provided, a marking such as "main machine disconnect" is sufficient to convey the purpose. Where multiple supplies are present, a descriptive marking is necessary to clearly indicate the controlled supply voltage or equipment that is disconnected, such as "main disconnect — 480V, 3ph," or "main disconnect — drive motors."

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~~5.3.1.1.25.1.9.3~~ A machine supply circuit disconnecting means shall be marked as "Machine Supply Circuit Disconnect" if additional disconnecting means are supplied from the supply circuit disconnecting means.

~~5.3.1.1.35.1.9.4~~ Where a machine is supplied by more than one supply circuit, a marking shall be installed at each supply machine circuit disconnect location denoting the location of all other machine supply circuit disconnects.

~~5.3.1.25.1.9.5~~ The machine supply circuit disconnecting means shall disconnect (isolate) the electrical equipment of the machine, including all control circuits, from the machine supply circuit when required (e.g., for work on the machine, including the electrical equipment). Circuits that are not required to be disconnected by the machine supply circuit disconnecting means shall comply with ~~5.3.5.1.13~~.

~~5.3.1.35.1.9.6~~ Each machine supply circuit disconnecting means other than attachment plugs and receptacles shall be mounted within the control enclosure or immediately adjacent thereto.

~~Exception No. 1: Externally mounted machine supply circuit disconnecting means, whether interlocked or not interlocked with the control enclosure, supplying machines totaling 2 hp or less shall be permitted to be mounted up to 6 m (20 ft) away from the control enclosure, provided the control enclosure is marked to indicate the location of the machine supply circuit disconnecting means and the machine supply circuit disconnecting means complies with all the following:~~

~~(1) Is in sight of the control enclosure it supplies~~

~~(2) Is readily accessible~~

~~(3) Is marked in accordance with ~~5.3.1.1.15.1.9.2~~~~

~~Exception No. 2: A supply circuit disconnecting means mounted in a separate enclosure and interlocked in accordance with 6.2.3.1 with the control enclosure(s) it supplies shall be permitted to be mounted up to 6 m (20 ft) away from the control enclosure, provided the control enclosure is marked to indicate the location of the supply circuit disconnecting means and the supply circuit disconnecting means complies with all the following:~~

~~(1) Is in sight of the control enclosure it supplies~~

~~(2) Is readily accessible~~

~~(3) Is marked in accordance with ~~5.3.1.1.1~~~~

~~5.3.1.4~~ ~~5.1.9.7~~ Each supply circuit disconnecting means mounted within or adjacent to the control enclosure shall be interlocked with the control enclosure. Access to enclosures containing the machine supply circuit disconnecting means shall be in accordance with 6.2.3.1.

~~Exception No. 1: An interlock for the control enclosure shall not be required where devices other than the handles of circuit breakers or switches are guarded by a dead front cover and the use of a key or tool is necessary for opening the supply circuit disconnecting means enclosure to access exposed live parts. A safety sign shall be provided in accordance with Section 16.2.~~

~~Exception No. 2: Where a supply circuit disconnecting means supplying machines totaling 2 hp or less is not located within or adjacent to the control enclosure it supplies, the control enclosure shall comply with 6.2.3.1 or 6.2.3.2. Where a supply disconnecting means is an attachment plug and receptacle, the control enclosure it supplies shall comply with 6.2.3.2. Where compliance with 6.2.3.2 is required, a safety sign shall be provided in accordance with Section 16.2.~~

~~5.3.1.5~~ ~~5.1.9.8~~ Where two or more machine supply circuit disconnecting means are provided within the control enclosure for multiple machine supply circuits, they shall be grouped in one location where practicable. Protective interlocks for their correct operation shall be provided where a hazardous condition or damage to the machine or to the work in progress can occur.

~~5.3.25.1.10~~ Type.

The machine supply circuit disconnecting device means shall be one of the following types:

- (1) A listed motor circuit switch rated in horsepower
- (2) A listed molded case circuit breaker
- (3) A listed molded case switch
- (4) An instantaneous trip circuit breaker that is part of a listed combination motor controller limited to single motor applications
- (5) A listed self-protected combination controller limited to single motor applications
- (6) An attachment plug and receptacle for cord connection

~~5.3.35.1.11~~ Requirements.

~~5.3.3.45.1.11.1~~* Where the machine supply circuit disconnecting device-means is one of the types in ~~5.3.25.1.10~~(1) through ~~5.3.25.1.10~~(5), ~~the device~~ it shall fulfill all of the following requirements:

(1) Isolate the electrical equipment from the machine supply circuit and have one off (open) and one on (closed) position only. Circuit breakers, instantaneous trip circuit breakers, molded-case switches, and self-protected combination motor controllers are permitted to have a reset (tripped) position between off (open) and on (closed).

(2) Have an external operating means (e.g., handle) that complies with ~~5.3.45.1.12~~.

Exception: Power-operated switchgear need not be operable from outside the enclosure where there are other means to open it.

(3) Be provided with a permanent means permitting it to be locked in the off (open) position only (e.g., by padlocks), independent of the door or cover position. When so locked, remote as well as local closing into the on position shall be prevented.

(4) Simultaneously disconnect all ungrounded conductors of the supply circuit.

(5) Be operable by qualified persons independent of the door or cover position without the use of accessory tools or devices.

(6) Be rated for the application as follows:

(a) With an ampere rating at least 115 percent of the sum of the full-load currents required for all equipment that is in operation at the same time under normal conditions of use

(b) Where rated in horsepower, with a horsepower rating at least equal to that which is defined by Table 430.251(B) of *NFPA 70* for a locked rotor current equal to the largest sum resulting from the locked rotor currents of any combination of motors that can be started simultaneously and the full-load currents of the remaining motor and non-motor loads that can be operated at that time

(c) With a voltage rating at least equal to the nominal supply circuit voltage

(7) Be of a type that plainly indicates whether it is in the off (open) or on (closed) position.

~~A.5.3.3.45.1.11.1~~

For additional information, see IEC 61310-3 or 404.7 of *NFPA 70* for direction of operation of the disconnecting actuator.

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~~5.3.3.25.1.11.2~~* When the machine supply circuit disconnecting device-means is an attachment plug and receptacle, it shall fulfill all of the following requirements:

(1) Have a load-break rating or be interlocked with a switching device that is load-break rated and complies with ~~5.3.3.45.1.11.1~~(6)

- (2) Be listed as a switch-rated plug and receptacle rated greater than 20 amperes or 2 hp
- (3) Be of such a type and be so installed as to prevent unintended contact with live parts at any time, even during insertion or removal of the connectors
- (4) Have a first-make, last-break electrical grounding contact
- (5) Have a retaining means to prevent unintended or accidental disconnection where rated at more than 20 amperes
- (6) Be located within sight from the operator station and be readily accessible

A.5.3.3.2-1.11.2

A suitably rated attachment plug and receptacle listed to UL 498 or UL 1682 is a method of meeting the requirements of ~~5.1.11.23.3.2~~(2) and ~~5.1.11.23.3.2~~(3).

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~~5.3.3.3~~5.1.11.3 In addition to the requirements in ~~5.3.3.2~~5.1.11.2.2, an additional switching device on the machine shall be provided for routine power switching operations of the machine on and off.

~~5.3.4~~5.1.12 Operating Handle

~~5.3.4.1~~5.1.12.1 The center of the grip of the operating handle of ~~the a~~ supply circuit disconnecting means, when in its highest position, shall be not more than 2.0 m (6 ft 7 in.) above the servicing level. A permanent operating platform, readily accessible by means of a permanent stair(s) or ladder, shall be considered the servicing level ~~for the purpose of this requirement.~~

~~5.3.4.2~~5.1.12.2 An operating handle of ~~the a machine~~ supply circuit disconnecting means ~~required by 5.3.3.15.1.9.1~~ shall meet the following criteria:

- (1) Be readily accessible with doors in the open or closed position
- (2) Maintain the environmental rating of the enclosure to the degree necessary for the application when installed through the control enclosure
- (3) Not be restricted by the enclosure door when the door is in the open or closed position

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~~5.3.5~~5.1.13 Excepted Circuits.

~~5.3.5.15~~5.1.13.1 The following circuits shall not be required to be disconnected by the machine supply circuit disconnecting means:

- (1) Lighting circuits for lighting needed during maintenance or repair
- (2) Attachment plugs and receptacles for the exclusive connection of repair or maintenance tools and equipment (e.g., hand drills, test equipment)

(3) Undervoltage protection circuits that are only used for automatic tripping in the event of supply circuit failure

(4) Circuits supplying equipment that need to remain energized for satisfactory operation [e.g., temperature-controlled measuring devices, product (work in progress) heaters, program storage devices, inputs, non-motion outputs, displays, and safety interlocks]

~~5-3-5-25.1.13.2~~ Excepted circuits shall be provided with all of the following:

(1) A disconnecting means, isolating transformer, and overcurrent protection mounted in an enclosure adjacent to the main control enclosure or within the control enclosure, adjacent to the ~~main-machine~~ supply circuit disconnecting means

(2) Line side (of the supply circuit disconnect) supply circuit conductors, when internal to the control enclosure, that are separate from and do not share a raceway with other conductors and that are encased in rigid or flexible conduit if longer than 460 mm (18 in.)

~~5-3-5-35.1.13.3~~ The control interlocking circuits shall be capable of being disconnected at the control panel from which they are sourced.

~~5-3-5-45.1.13.4~~ Where the excepted circuits are not disconnected by the ~~machine~~ supply circuit disconnecting means, all of the following requirements shall be met:

(1) Permanent safety sign(s) shall be placed adjacent to the ~~machine~~ supply circuit disconnecting operating handle(s), indicating that it does not de-energize all exposed live parts when it is in the open (off) (isolated) position as in 16.2.4.

(2) A statement containing the information from 16.2.4 shall be included in the machine documentation.

(3) A permanent safety sign shall be placed on a nonremovable part inside the control enclosure in proximity to each excepted circuit, or shall be identified by color as defined in 13.2.4.

~~5-5.2~~ ~~Devices~~ ~~Other for~~ Disconnecting ~~Means (Isolating) Electrical Equipment.~~

~~5-5.45.2.1~~ Devices shall be ~~permitted to be~~ provided for disconnecting (isolating) electrical equipment to enable work to be performed ~~on individual portions of the machine~~ when it is de-energized and isolated.

~~5-5.25.2.2~~ The machine supply circuit disconnecting means (~~see Section 5-35.1.9~~) shall be permitted to fulfill this requirement where there is no need for disconnecting individual portions of the ~~machine electrical circuit.~~

~~5-5.3~~ ~~Where it is expected that it will be necessary to work on separately operable parts of a machine, a disconnecting means shall be permitted for the electrical equipment of each such part of the machine requiring separate disconnection.~~

~~5-5.45.2.3~~ The following devices shall be permitted to fulfill the ~~isolating~~ function of ~~5-5.35.2.1~~:

(1) Devices described in ~~5-3-25.1.10~~

(2) A manual motor controller marked “suitable as motor disconnect” and in compliance with UL 508, ~~Standard for Industrial Control Equipment~~, where located on the load side of the last short-circuit protective device (in the branch)

(3) System isolation equipment that incorporates control lockout stations and is listed for disconnection purposes where located on the load side of the main supply circuit disconnecting means and overcurrent protection

~~5.5.5.2.4 Each Other~~ operating means of the isolation devices in ~~5.5.45.2.43~~ shall be as follows:

(1) Readily accessible and complies with 5.31.4

Exception: Switches and circuit breakers installed adjacent to motors, appliances, or other equipment that they supply shall be permitted to be accessible by portable means.

(2) Within sight of the part of the machine requiring disconnection

(3) Readily identifiable as an isolating means and marked to identify the equipment that is disconnected

(4) For other than attachment plugs, provided with permanent means for locking in the off position only

~~5.2.5 Interlocking. Enclosures containing other devices for deenergizing electrical equipment shall be interlocked.~~

5.2.5 Enclosure Access. Access to enclosures containing other disconnecting means shall be in accordance with 6.2.3.1.

~~The opening sentence has been revised to reflect the changes to the enclosure access requirements in Chapter 6.~~

~~5.2.5.1 Enclosures containing devices for deenergizing electrical equipment, other than the machine supply circuit disconnecting means, shall be permitted to interlocked by one of the methods permitted in 6.2.3.2.~~

~~The requirements were deleted as the enclosure access requirements have been incorporated into 5.2.5.~~

~~5.4.5.3~~ **Means for Removal of Power for Prevention of Unexpected Start-Up.**

~~5.4.45.3.1~~ Means for removal of power shall be provided when prevention of unexpected start-up is required (e.g., during maintenance where the unexpected start-up of a machine or part of the machine results in a hazardous situation). Such means shall be as follows:

(1) Appropriate for the intended use

(2) Conveniently located

(3) Readily identifiable as to their function and purpose

(4) Provided with permanent means for locking in the off position only

[5.4.25.3.2](#) Removal of power shall be accomplished by ~~the use of~~ one of the following:

- (1) The machine supply circuit disconnecting means
- (2) Additional devices conforming to [5.3.25.1.10](#) or [5.5.45.2.4](#)
- (3) Other means (e.g., a contactor switched off by a control circuit) that meet the requirements of [5.4.35.3.3](#) and [5.4.45.3.4](#)

[5.4.35.3.3](#)* Where other means of removal of power are used, a single failure of any of its components shall not result in an inadvertent or unexpected start-up.

A.5.43.3

The selection of other means is dependent on many factors, taking into account those persons for whom its use is intended. (See ANSI B11.0 and ISO 12100.)

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[5.4.45.3.4](#) Other means of removal of power shall be employed only for situations that include the following:

- (1) Routine exchange of work pieces, fixtures, and tools requiring no significant dismantling of the machine
- (2) Work on the electrical equipment where all of the following conditions exist:
 - (a) There is no hazard arising from electric shock and burn.
 - (b) The switching off means cannot be negated by the work.
 - (c) The work is of a minor nature (e.g., replacement of plug-in devices without disturbing existing wiring).
 - (d) There is no hazard arising from the unexpected energizing or de-energizing of circuits.

Section		DISPOSITION	
Chapter 5 Global		FR	
Public Input	2018 Section	2021 Section	Committee Statements
102	Chapter 5	Chapter 5	Chapter 5 has been revised as the result of a Global Public Input to reorganize and renumber for consistency and clarity and to identify there are three types of disconnecting means with specific requirements for each. Section 5.1 provides the requirements for the machine supply circuit disconnecting means, 5.2 provides the requirements for other disconnecting means used to enable work to be performed in a deenergized state and 5.3 provides the requirements for the means for removal of power for preventing unexpected startup. Although the machine supply circuit disconnecting means may be used to deenergize the electrical equipment to allow work to be performed in a deenergized state, other disconnecting means used for the purpose can be located downstream of the machine supply circuit disconnecting means. This revision also continues the work of the 79 Committee from the 2018 Cycle regarding the consistent use of the terms “machine supply circuit,” “machine supply circuit disconnecting means” and “plainly and clearly visible.” The enclosure interlocking requirements in Chapter 6 were not relocated to Chapter 5 as Chapter 6 more appropriately addresses protection from electrical hazards. Additional revisions have been made in Chapter 6 to clarify how the enclosure access requirements are applied to enclosures containing the machine supply circuit disconnecting means and enclosures that contain other disconnects. A task group may be necessary between the First and Second Drafts to review references to Chapter 5 within other Chapters to correlate with the renumbering in Chapter 5.

Section		DISPOSITION	
Chapter 5 Global		FR	
Public Input	2018 Section	2021 Section	Committee Statements
			The following information is provided as a summary of any changes made to the individual sections and as a cross reference for the 2018 and 2021 section numbering.
	5.1	5.1	The section was retitled as “Machine Supply Circuit Disconnecting Means” to clearly identify the disconnecting means covered in the requirements.
	5.1.1	5.1.1	The title “Machine Supply Circuit” was added for clarity.
	5.1.6	5.1.2	The section was titled “Machine Supply Circuit Conductor Separation” was added, the term “machine” was added in three locations and the term “machine supply circuit” was added in one location for consistency with the use of the terms.
	5.1	5.1.3	The term “machine” was added in four locations and “machine supply circuit” in one location for consistency with the use of the terms. The section number referenced within the text was revised to correlate with the renumbering of the Chapter.
	5.1.4	5.1.3.1	The section was titled “Marking” and the term “shall” was added for clarity and consistency respectively. An example of acceptable making was provided for additional clarity.
		5.1.4	The added text addressing back-fed terminations makes it clear that a machine supply circuit disconnecting means that is marked with line and load cannot be back-fed. Text has been added to identify the requirements for when machine supply circuit disconnecting means can be back-fed and for the marking requirements for when it is back-fed.
	5.1.5	5.1.5	The section was titled “Wire Bending Space” for clarity.
	5.1.7	5.1.6	The section was titled “Protection of Line Side Live Parts” for clarity. The terms “machine” and “machine supply circuit” were added in one location for consistency with the use of the terms.
	5.1.3	5.1.7	The title “Grounded Conductor” was added for clarity and the term “clearly” was removed before “indicated” in the first sentence for consistency with actions taken in the cycle to remove vague and unenforceable terms.

Section		DISPOSITION	
Chapter 5 Global		FR	
Public Input	2018 Section	2021 Section	Committee Statements
	5.2	5.1.8	The title was changed to “Equipment Grounding Conductor Terminal” and the term “equipment grounding conductor” was added to the text to clarify the terminal is to be provided for the equipment grounding conductor. Adding these terms also correlates with the use of the term “equipment grounding conductor” in 8.2 and in the National Electrical Code.
	A.5.2	A.5.1.8	The text was revised to indicate the information is relative to the “equipment grounding conductor terminal” to correlate with changes made in the section and the use of the term in Chapter 8.
	5.3 and 5.3.1	5.1.9	The standalone title of former 5.3 was combined with text of former 5.3.1 and renumbered as 5.1.9. Additionally, the term “General” was removed from the former title of 5.3.1 and the first sentence as it was not necessary. The section numbers referenced within the text were revised to correlate with the renumbering of the Chapter.
	5.3.1.1	5.1.9.1	The term “machine” was added for consistency with the use of the term “machine supply circuit disconnecting means” and the reference to 5.3.1.1 was removed as it was no longer necessary.
	5.3.1.1.1.	5.1.9.2	The term “machine” was added for consistency with the use of the term and the reference to 5.3.1.1 removed as it was no longer necessary. All the requirements in 5.1 apply to the machine supply circuit disconnecting means.
	5.3.1.1.2	5.1.9.3	The term “machine” was added for consistency with the use of the term “machine supply circuit disconnecting means.” Former Exceptions No. 1 and 2 have been combined into one exception. Because the enclosure access requirements in Chapter 6 have been revised to permit different options for restricting access, it was no longer necessary to distinguish between machines that are more than 2 hp from ones are not.
	5.3.1.1.3	5.1.9.4	
	5.3.1.2	5.1.9.5	The term “machine” was added in three places for consistency with the use of the term “machine supply circuit disconnecting means.”
	5.3.1.3	5.1.9.6	The term “machine” was added in seven places for consistency with the use of the term “machine supply circuit disconnecting means.” The section numbers

Section		DISPOSITION	
Chapter 5 Global		FR	
Public Input	2018 Section	2021 Section	Committee Statements
			referenced within the text were revised to correlate with the renumbering of the Chapter.
	5.3.1.4	5.1.9.7	The text of the opening sentence was revised to reflect the changes made to the enclosure access requirements of Chapter 6. The exceptions were deleted as the concepts they contained were addressed in the Chapter 6 revisions.
	5.3.1.5	5.1.9.8	The term “machine” was added in two places for consistency with the use of the phrase “machine supply circuit disconnecting means.”
	5.3.2	5.1.10	The term “machine” was added in one place for consistency with the use of the phrase “machine supply circuit disconnecting means.”
	5.3.3	5.1.11	The term “supply circuit disconnecting device” was changed to “machine supply circuit disconnecting means” for consistency with the use of the term. The section numbers referenced within the text were revised to correlate with the renumbering of the Chapter.
	5.3.3.1*	5.1.11.1*	The term “machine” was added in one place for consistency with the use of the phrase “machine supply circuit disconnecting means” and the term “plainly” was removed from before “indicates” in List Item (7). The sections referenced within the text were revised to correlate with the renumbering of the Chapter.
PI 102	5.3.3.2*	5.1.11.2*	The term “machine” was added in opening sentence for consistency with the use of the phrase “machine supply circuit disconnecting means.”
	5.3.3.3	5.1.11.3	The section number referenced within the text was revised to correlate with the renumbering of the Chapter.
	5.3.4	5.1.12	
	5.3.4.1	5.1.12.1	The phrase “for the purpose of this requirement” was removed from the end of the second sentence as it did not add clarity or usability to the document.
	5.3.4.2	5.1.12.2	The term “machine” was added in one place for consistency with the use of the phrase “machine supply circuit disconnecting means.” The section number referenced within the text was revised to correlate with the renumbering of the Chapter. The text has been revised to clarify the operating handle of the disconnecting means cannot be restricted by the door no matter what position the enclosure door is in.
	5.3.5	5.1.13	

Section		DISPOSITION	
Chapter 5 Global		FR	
Public Input	2018 Section	2021 Section	Committee Statements
	5.3.5.1	5.1.13.1	
	5.3.5.2	5.1.13.2	The term “main” was replaced with “machine” in opening sentence for consistency with the use of the phrase “machine supply circuit disconnecting means.”
	5.3.5.3	5.1.13.3	
	5.3.5.4	5.1.13.4	The term “machine” was added in two places for consistency with the use of the phrase “machine supply circuit disconnecting means.”
	5.5	5.2	Other Disconnecting Means The title was changed from “Devices for Disconnecting (isolating) Electrical Equipment” to “Other Disconnecting Means” for clarity. This revision continues the efforts started in the 2018 Cycle to clarify that Chapter 5 not only contains requirements for more than just the machine supply circuit disconnecting means and to separate the requirements for each type.
	5.5.1	5.2.1	The requirement was revised to specify the “other disconnecting means” are optional as the machine supply circuit disconnecting means can serve this purpose. The former 5.5.3 was combined with 5.2.1 as the desire to work on the equipment in a deenergized state is the enabling requirement.
	5.5.2	5.2.2	The section number referenced within the text was revised to correlate with the renumbering of the Chapter.
	5.5.3		The section was combined with 5.2.1 so the enabling requirement for when the disconnecting means is being provided is located as part of the opening section.
	5.5.4	5.2.3	The section number referenced within the text was revised to correlate with the renumbering of the Chapter. The title of the UL Standard was revised by removing the redundant text “Standard for.”
	5.5.5	5.2.4	
		5.2.5	A section titled “Enclosure Access” was added to clarify that access to enclosures containing other disconnecting means must be in accordance with 6.2.3.1. The opening sentence has been revised to reflect the changes to the enclosure access requirements in Chapter 6.

Section		DISPOSITION	
Chapter 5 Global		FR	
Public Input	2018 Section	2021 Section	Committee Statements
	5.4	5.3	Means for Removal of Power for Prevention of Unexpected Start-Up.
	5.4.1	5.3.1	
	5.4.2	5.3.2	The words “the use of” were removed from the opening sentence as they are unnecessary and do not add clarity to the document. The section numbers referenced within the text was revised to correlate with the renumbering of the Chapter.
	5.4.3	5.3.3	
	5.4.4	5.3.4	



First Revision No. 1-NFPA 79-2019 [Chapter 2]

Chapter 2 Referenced Publications

2.1 General.

The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications.

National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 70®, *National Electrical Code®*, 2017 2020 edition.

NFPA 70E®, *Standard for Electrical Safety in the Workplace®*, 2018 2021 edition.

2.3 Other Publications.

2.3.1 ANSI Publications.

American National Standards Institute, Inc., 25 West 43rd Street, 4th Floor, New York, NY 10036.

ANSI Z535.4, *Product Safety Signs and Labels*, 2011, reaffirmed 2017 .

2.3.2 ASTM Publications.

ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM B8, *Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft*, 2011, reapproved 2017 .

ASTM B174, *Standard Specification for Bunch-Stranded Copper Conductors for Electrical Conductors*, 2010, reapproved 2015 2017 .

ASTM B286, *Standard Specification for Copper Conductors for Use in Hookup Wire for Electronic Equipment*, 2007, reapproved 2012 2017 .

2.3.3 IEC Publications.

International Electrotechnical Commission, 3, rue de Varembe, P.O. Box 131, CH-1211 Geneva 20, Switzerland.

IEC 60072-1, *Dimensions and output series for rotating electrical machines — Part 1: Frame numbers 56 to 400 and flange numbers 55 to 1080*, 1991.

IEC 60072-2, *Dimensions and output series for rotating electrical machines — Part 2: Frame numbers 355 to 1000 and flange numbers 1180 to 2360*, 1990.

2.3.4 IEEE Publications.

IEEE, 3 Park Avenue, 17th Floor, New York, NY 10016-5997.

IEEE 315, *Graphical Symbols for Electrical and Electronics Diagrams (Including Reference Designation Letters)*, 1993.

2.3.5 NEMA Publications.

National Electrical Manufacturers Association, 1300 North 17th Street, Suite 900, Arlington, VA 22209.

NEMA ICS 2, *Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts*, 2000, errata 2008.

NEMA MG-1, *Motors and Generators*, 2014 2016 .

NEMA 250, *Enclosures for Electrical Equipment (1000 Volts Maximum)*, 2014.

2.3.6 UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL50, ~~Standard for Enclosures for Electrical Equipment, 2007, revised 2012~~ 2015 .

UL50E, ~~Standard for Electrical Equipment, Environment Considerations, 2007, revised 2012~~ 2015 .

UL508, ~~Standard for Industrial Control Equipment, 1999, revised 2013~~ 2018 .

UL508A, ~~Standard for Industrial Control Panels, 2001, revised 2014~~ 2018 .

UL870, ~~Standard for Wireways, Auxiliary Gutters and Associated Fittings, 2008, revised 2013~~ 2016 .

UL1063, ~~Standard for Machine-Tool Wires and Cables, 2006~~ 2017 , revised ~~2012~~ 2018 .

UL1581, ~~Reference Standard for Electrical Wires, Cables and Flexible Cords, 2001, revised 2015~~ 2017 .

2.3.7 U.S. US Government Publications.

~~U.S.~~ US Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Title 29, Code of Federal Regulations, Part 1910.331–335, "Safety-Related Work Practices."

2.3.8 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 70[®], National Electrical Code[®], 2017 2020 edition.

NFPA 70E[®], Standard for Electrical Safety in the Workplace[®], 2018 edition.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Thu Feb 28 12:54:31 EST 2019

Committee Statement

Committee Statement: Update standard revision dates and remove "Standard for" from the UL standard. It is considered repetitive language and removed from the UL title.

Response Message: FR-1-NFPA 79-2019

[Public Input No. 12-NFPA 79-2018 \[Chapter 2\]](#)

[Public Input No. 27-NFPA 79-2018 \[Section No. 2.3.6\]](#)

**First Revision No. 7-NFPA 79-2019 [Section No. 3.3.4]****3.3.4*** Actuator, Machine.

A power mechanism used to effect motion of the machine.

A.3.3.4 Actuator, Machine.

Some examples of a machine actuator are a motor, solenoid, and pneumatic or hydraulic cylinder.

Submitter Information Verification

Committee: EEI-AAA

Submission Date: Mon Mar 04 15:53:59 EST 2019

Committee Statement

Committee Statement: The added annex note provides examples of machine actuators.

Response Message: FR-7-NFPA 79-2019

Public Input No. 34-NFPA 79-2019 [Section No. 3.3.4]



First Revision No. 4-NFPA 79-2019 [New Section after 3.3.8]

3.3.9* 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. [70: 100]

A.3.3.9 Attachment Plug (Plug Cap) (Plug).

A plug/socket combination is a plug and socket outlet, a cable coupler, or an appliance coupler.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Mar 04 15:37:24 EST 2019

Committee Statement

Committee Statement: The definition for attachment plug, extracted from NFPA 70 is added to Chapter 3. An Annex note for the definition is added. This note appeared in the 2015 edition of NFPA 79.

Response Message: FR-4-NFPA 79-2019

Public Input No. 69-NFPA 79-2019 [New Section after 3.3.8]



First Revision No. 3-NFPA 79-2019 [New Section after 3.3.44]

3.3.47* 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. [70: 100]

A.3.3.47 Fault Current, Available (Available Fault Current).

A short circuit can occur during abnormal conditions such as a fault between circuit conductors or a ground fault.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Mar 04 15:31:55 EST 2019

Committee Statement

Committee Statement: The definition for fault current, available is extracted from NFPA 70 is added to Chapter 3. An Annex note for the definition is also added.

Response Message: FR-3-NFPA 79-2019

Public Input No. 81-NFPA 79-2019 [New Section after 3.3.44]

**First Revision No. 64-NFPA 79-2019 [New Section after 3.3.48]****3.3.52** 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. [**70:** 100]

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 17:59:21 EST 2019

Committee Statement

Committee Statement: The definition for ground fault, extracted from NFPA 70 is added to Chapter 3.

Response Message: FR-64-NFPA 79-2019

**First Revision No. 62-NFPA 79-2019 [Section No. 3.3.69]****3.3.73 Machine Supply Circuit.**

The conductors between the premises wiring and the machine supply circuit disconnecting means or terminals.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 17:39:11 EST 2019

Committee Statement

Committee Statement: The words "supply circuit" were added for consistency with the use of the term "machine supply circuit disconnecting means."

Response Message: FR-62-NFPA 79-2019

**First Revision No. 8-NFPA 79-2019 [Section No. 3.3.79]****3.3.83* Programmable Electronic System (PES).**

A system based on one or more central processing units (CPUs), connected to sensors or actuators, or both, for the purpose of control or monitoring.

A.3.3.83 Programmable Electronic System (PES).

This term includes all elements in the system extending from sensors to other input devices via ~~data highways~~ field bus or other communication paths to the machine actuators or other output devices.

Supplemental Information

File Name	Description Approved
FR-8_A.3.3.79.docx	For staff use

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Mar 04 16:02:32 EST 2019

Committee Statement

Committee Statement: The addition of the term "machine" clarifies the definition. The annex is revised to reflect current field bus terminology and to align with the definition of machine actuator.

Response Message: FR-8-NFPA 79-2019

[Public Input No. 35-NFPA 79-2019 \[Section No. 3.3.79\]](#)

[Public Input No. 38-NFPA 79-2019 \[Section No. A.3.3.79\]](#)

**First Revision No. 5-NFPA 79-2019 [New Section after 3.3.81]****3.3.86*** 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. A multiple receptacle is two or more contact devices on the same yoke or strap. [70: 100]

A.3.3.86 Receptacle.

A plug/socket combination is a plug and socket outlet, a cable coupler, or an appliance coupler.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Mar 04 15:46:23 EST 2019

Committee Statement

Committee Statement: The definition for receptacle, extracted from NFPA 70 is added to Chapter 3. An Annex note for the definition is added. This note appeared in the 2015 edition of NFPA 79.

Response Message: FR-5-NFPA 79-2019

Public Input No. 71-NFPA 79-2019 [New Section after 3.3.81]

**First Revision No. 6-NFPA 79-2019 [New Section after 3.3.89]****3.3.95** Safety Circuit.

A circuit containing one or more devices that perform a safety related function.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Mar 04 15:51:33 EST 2019

Committee Statement

Committee Statement: A new definition for safety circuit is added to clarify the requirement in 7.8.1 relative to when overvoltage protection is required.

Safety circuit is the proper term to be used and satisfies the intent of PI-88.

Response Message: FR-6-NFPA 79-2019

[Public Input No. 88-NFPA 79-2019 \[New Section after 3.3.88\]](#)

[Public Input No. 90-NFPA 79-2019 \[New Section after 3.3.89\]](#)

**First Revision No. 9-NFPA 79-2019 [Section No. 3.3.93]****3.3.46 Short-Circuit Fault Current.**

An overcurrent resulting from a short circuit due to a fault or an incorrect connection in an electric circuit. The current delivered at a point on the system during a short-circuit condition. [**70:** 100]

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Mar 04 16:06:00 EST 2019

Committee Statement

Committee Statement: The definition for fault current, extracted from the draft 2020 NFPA 70 is added to Chapter 3.

Response Message: FR-9-NFPA 79-2019

Public Input No. 80-NFPA 79-2019 [Section No. 3.3.93]

**First Revision No. 10-NFPA 79-2019 [Section No. 4.4.2.7]****4.4.2.7 Voltage Dips.**

The electrical equipment shall be designed to operate correctly where the supply voltage dips do not exceed 20 percent of the peak rms voltage of the supply for more than one supply cycle. The time interval between successive dips shall be more than 1 second.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Mar 04 16:08:47 EST 2019

Committee Statement

Committee Referencing rms in lieu of peak would align with similar requirements in IEC 60204-1.

Statement: Referencing "supply" covers both 50 or 60 Hz or other frequencies.

Response FR-10-NFPA 79-2019

Message:

[Public Input No. 63-NFPA 79-2019 \[Section No. 4.4.2.7\]](#)

**First Revision No. 26-NFPA 79-2019 [Section No. 4.4.2.8]****4.4.2.8** Circuits Supplied From from Power Conversion Equipment.

Electrical conductors ~~and for~~ equipment supplied by power conversion equipment as part of adjustable speed drive systems and servo drive systems shall be one of the following: ~~listed flexible motor supply cable marked type RHH, RHW, RHW-2, XHH, XHHW, or XHHW-2 or selected based on the equipment manufacturer's instructions.~~

- (1) Listed flexible motor supply cable marked type RHH, RHW, RHW-2, XHH, XHHW, or XHHW-2
- (2) ~~selected~~ Selected based on the equipment manufacturer's instructions

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Mar 05 14:00:32 EST 2019

Committee Statement

Committee Statement: This revision will clarify that there are two options for satisfying the requirements in 4.4.2.8.

Response Message: FR-26-NFPA 79-2019

Public Input No. 37-NFPA 79-2019 [Section No. 4.4.2.8]

Public Input No. 116-NFPA 79-2019 [Section No. 4.4.2.8]

**First Revision No. 12-NFPA 79-2019 [Section No. 4.9]****4.9 Available Fault Current.**

The available fault current at each machine supply circuit disconnecting means shall not be greater than the corresponding short-circuit current rating marked on the machine industrial control panel nameplate.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Mar 04 16:13:08 EST 2019

Committee Statement

Committee Statement: The addition of the term "corresponding" clarifies that each supply circuit will have its own SCCR rating.

Response Message: FR-12-NFPA 79-2019

Public Input No. 40-NFPA 79-2019 [Section No. 4.9]



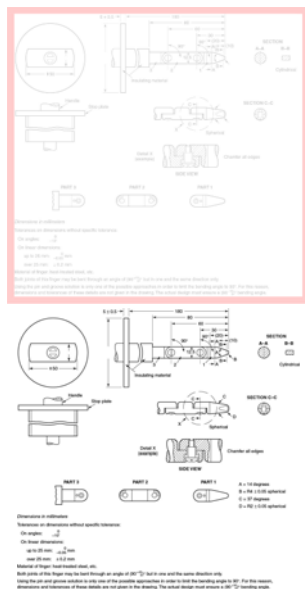
First Revision No. 69-NFPA 79-2019 [Section No. 6.2.3]

6.2.3 Protection by Enclosures.

Equipment enclosures, ~~and enclosure openings, and observation windows~~ shall meet the requirements of UL 508, UL 508A, UL 50, or NEMA 250. ~~(See Figure 6.2.3.)~~

Exception: In the absence of a rated enclosure, the determination of the suitability of an enclosure as protection from electrical shock If an enclosure is not rated, its suitability shall be permitted to be determined by using a test finger as described in Figure 6.2.3. The test finger shall be applied, with only not be able to contact live parts in any direction by applying minimal force in every opening in the enclosure after, including openings created by removal of all parts of the enclosure that are capable of being removed without the use of a tool. The test finger shall not encounter live parts in any direction mounted through the enclosure walls, doors, or covers.

Figure 6.2.3 Jointed Test Finger.



6.2.3.1* Enclosure Access.

When a qualified person, using appropriate work practices, needs to enter an enclosure that does not have a disconnect, one of the following conditions shall be met Opening of an enclosure (opening doors, lids, covers) containing live parts operating at 50 volts ac (rms value) or 60 volts dc or more shall be permitted only under one or more of the following conditions :

- (1) The use of a key or tool shall be required for opening the enclosure is necessary for access to live parts operating at over 50 volts. Live parts mounted on the inside of doors or covers that are operating at over 50 volts shall be protected from unintentional direct contact by the inherent design of components or the application of barriers or obstacles such that a 50 mm (2 in.) sphere cannot contact any live parts. A safety sign shall be provided in accordance with 16.2.4 .
- (2) The disconnecting means supplying the enclosure is interlocked with the enclosure door(s) in accordance with 6.2.3.2 .
- (3) An enclosure door shall be permitted to be opened Opening without the use of a key or a tool and without disconnection of live parts shall be permitted only when all live parts inside that are operating at over 50 volts are separately enclosed or guarded such that there cannot be any direct contact with live parts. A safety sign shall be provided in accordance with 16.2.4 .

A.6.2.3.1

The use of a key or tool or enclosure interlocking is intended to restrict access to qualified persons. It is the responsibility of the employer to determine the relevant safe work practices and the qualifications necessary to perform a specific task(s). See NFPA 70E for additional information on work practices.

6.2.3.2 Enclosure Interlocking.

~~When required by 5.1.9.7, each disconnecting means mounted within or adjacent to a control enclosure that contains live parts operating at 50 volts ac (rms value) or 60 volts dc or more shall be mechanically or electrically interlocked, or both, with the control enclosure doors so that none of the doors open unless the power is disconnected. Interlocking shall be reactivated automatically when all the doors are closed. If 6.2.3.2 (2) is used to limit enclosure access, none of the door(s) shall open unless the power is disconnected, and upon closing the door(s), the interlock is automatically restored. Access shall be permitted without removing power if all of the following conditions are met:~~

- ~~(1) It is possible at all times while the interlock is defeated to open the disconnecting means without the use of tools and lock the disconnecting means in the OFF (open) position.~~
- ~~(2) Closing of the disconnecting means while the door of the enclosure containing the disconnecting means is open shall be prevented unless an interlock is operated by deliberate action.~~
- ~~(3) Where provided with a defeat mechanism as permitted in 6.2.3.2.2(1), All live parts mounted on the inside of the doors that are operating at over 50 volts shall be protected from unintentional direct contact by the inherent design of components or the application of barriers or of obstacles such that a 50 mm (2 in.) sphere cannot contact any of the live parts in question.~~
- ~~(4) Relevant information about the procedures for the defeat of the interlock is provided with the instructions for use of the electrical equipment.~~

~~Exception No. 1: A disconnecting means used only for maintenance lighting circuits within control enclosures shall not be required to be interlocked with the control enclosure. A safety sign shall be provided that meets the requirements of 16.2.4.~~

~~Exception No. 2: A disconnecting means used for power supply circuits within control enclosures to memory elements and their support logic requiring power at all times to maintain information storage shall not be required to be interlocked with the control enclosure doors. A safety sign shall be provided that meets the requirements of 16.2.4.~~

6.2.3.2.1

~~Means shall be permitted to be provided for qualified persons, using appropriate work practices, to gain access without removing power.~~

6.2.3.2.2

~~The interlocking means shall meet the following requirements:~~

~~Utilize a device or tool as specified by the manufacturer of the interlock to allow qualified persons to defeat the interlock~~

~~Be reactivated automatically when the door(s) is closed~~

~~Prevent closing of the disconnecting means while the door of the enclosure containing the disconnect is open, unless an interlock is operated by deliberate action~~

6.2.3.2.3

~~Where provided with a defeat mechanism as permitted in 6.2.3.2.2(1), live parts mounted on the inside of doors that are operating at over 50 volts shall be protected from unintentional direct contact by the inherent design of components or the application of barriers or obstacles such that a 50 mm (2 in.) sphere cannot contact any of the live parts in question.~~

6.2.3.3 Excepted Circuits.

~~All parts operating at over 50 volts that are still energized after switching off the machine supply circuit disconnecting means (see 5.1.13) shall be protected from unintentional contact by the inherent design of components or the application of barriers or obstacles such that a 50 mm (2 in.) sphere cannot contact any live parts.~~

Supplemental Information

File Name	Description	Approved
Figure_6.2.3_missing_data_pi-20.PNG	Updated Figure 6.2.3-For staff use	
Figure_6.2.3_missing_data.PNG	For ballot	

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Mar 11 14:07:16 EDT 2019

Committee Statement

Committee Statement: 6.2.3: The term “observation windows” was added to specify that windows in enclosures are to meet the requirements in the referenced standards. The term “observation windows” was chosen instead of “viewing windows” to match the term used in the applicable standards.

6.2.3 Exception: The exception to the use of a rated enclosure required by 6.2.3 has been revised for clarity by directly addressing how the suitability of the non-rated enclosure is determined and to identify the test finger would be used for any opening in an enclosure that is created by removing a part regardless of whether a tool is used.

Figure 6.2.3: Figure 6.2.3 was revised to include critical dimensions needed to permit the probe to reproduced.

6.2.3.1 and 6.2.3.2: The requirements for gaining access to enclosures have been revised for clarity and usability of the document and to harmonize, as much as possible, with IEC 60204-1. As revised, one of three permitted options for limiting access to enclosures as 6.2.3.1(1), (2) and (3) must be used. The most significant changes resulting from this revision are the ability of the user and/or manufacturer to determine the acceptable means of access to the enclosure, as it is no longer mandatory to interlock the enclosure door with the machine supply circuit disconnecting means, and that all three options apply whether or not the enclosure contains the machine supply circuit disconnecting means. By permitting one of the three options to be used to gain access to an enclosure, the change recognizes the responsibility of the employer to determine the level of safety necessary for the given application and qualifications of the worker(s).

Option (1), a combination of former 6.2.3.1.3 and 6.2.3.2, will require the use of a key or tool to gain access to the inside of the enclosure with all parts on the inside of the door guarded and a safety sign provided. Option (2) is the traditional interlocking of the enclosure door as now described in 6.2.3.2. Option (3) would permit access to the enclosure without interlocking or the use of a tool or key but all parts operating at over 50 volts would have to be guarded against contact and a safety sign provided.

The text “qualified persons using appropriate work practices” has been relocated from 6.2.3.2 to a new Annex Note A.6.2.3.2. The text was combined with reference to NFPA 70E for safe work practices that was formally located in 6.2.3.1.1 which has been deleted as part of the enclosure access revisions in Chapter 6. NFPA 79 is an Equipment Standard, not a safe work practice Standard. Safe work practices are more appropriately addressed in NFPA 70E.

6.2.3.3: A new section, 6.2.3.3 was added to address guarding of parts exempted circuits operating at over 50 volts against unintentional contact. The same hazard exists for exempted circuits as with normal circuits.

As part of this revision, the references to “direct” contact were changed to just “contact.”

As part of the revision, the phrases “machine supply circuit” and “machine supply circuit disconnecting means” have been used consistently.

The enclosure interlocking requirements applicable to the machine supply circuit disconnecting means, were not relocated to Chapter 5 as Chapter 6 more appropriately addresses protection from electrical hazards.

A.6.2.3.1 The annex note regarding work practices is being relocated to 6.2.3.1. In accordance with NFPA 70E it is the employer’s responsibility to establish, document, and implement the safety-related work practices and procedures and to provide the necessary training.

Response FR-69-NFPA 79-2019

Message:

[Public Input No. 107-NFPA 79-2019 \[Section No. 6.2.3.2\]](#)

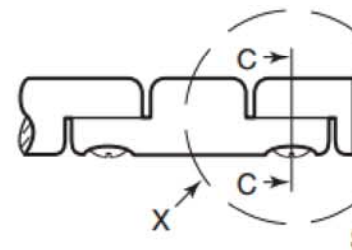
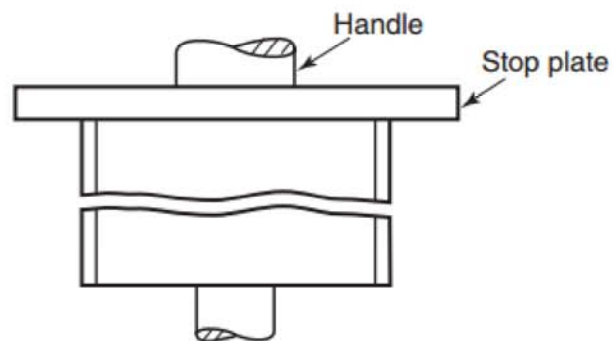
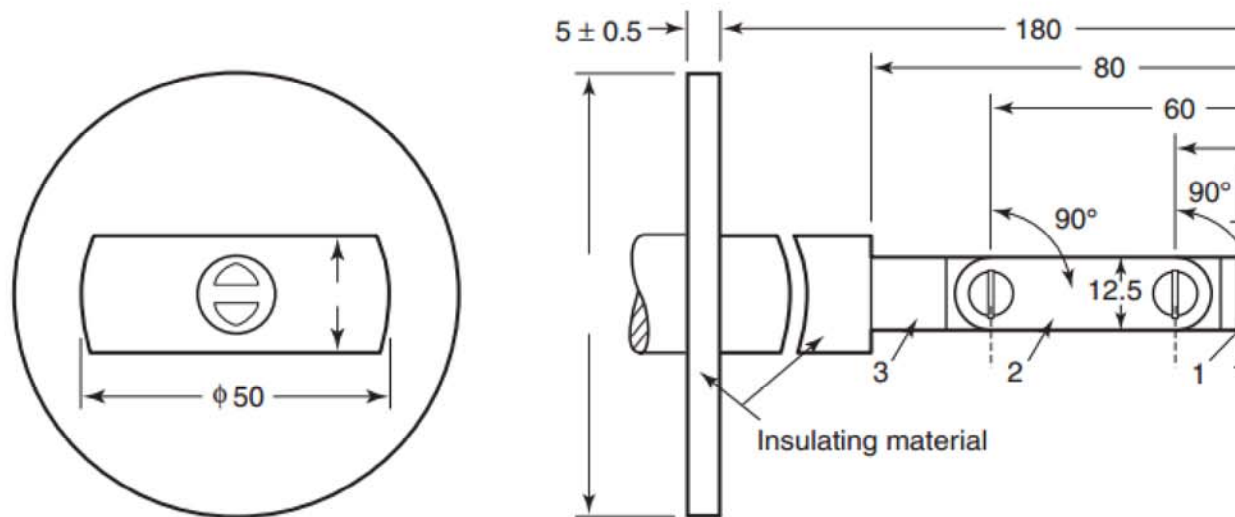
[Public Input No. 105-NFPA 79-2019 \[Section No. 6.2.3.1\]](#)

[Public Input No. 111-NFPA 79-2019 \[Section No. A.6.2.3.1.1\]](#)

[Public Input No. 20-NFPA 79-2018 \[Section No. 6.2.3 \[Excluding any Sub-Sections\]\]](#)

[Public Input No. 74-NFPA 79-2019 \[Section No. 6.2.3.1.3\]](#)

[Public Input No. 53-NFPA 79-2019 \[Section No. 6.2.3 \[Excluding any Sub-Sections\]\]](#)

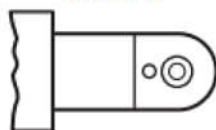


Detail X
(example)



SIDE VIEW

PART 3



PART 2



PART 1



Dimensions in millimeters

**First Revision No. 43-NFPA 79-2019 [Section No. 6.5.3.1]****6.5.3.1 Time of Discharge.**

The residual voltage of a capacitor shall be reduced to 50 volts, nominal, or less, within 1 minute after the capacitor is disconnected from the source of supply. [70:460.6(A)]

Exception: Where the requirement would interfere with the functioning of the equipment, a safety sign that draws attention to the hazard and states the delay required before entry to the enclosure shall be permitted to be displayed at a visible location on or immediately adjacent to the enclosure containing the capacitor(s).

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 15:31:27 EST 2019

Committee Statement

Committee Statement: The added exception allows for an alternate mean of mitigating the shock hazard presented by charged capacitor(s) when the requirement in 6.5.3.1 cannot be met due to the design and operation of the machine.

Response Message: FR-43-NFPA 79-2019

[Public Input No. 103-NFPA 79-2019 \[Section No. 6.5.3.1\]](#)

**First Revision No. 44-NFPA 79-2019 [Section No. 6.5.3.2]****6.5.3.2 Means of Discharge.**

The discharge circuit shall be either permanently connected to the terminals of the capacitor or capacitor bank, or provided with automatic means of connecting it to the terminals of the capacitor bank on removal of voltage from the line. Manual means of switching or connecting the discharge circuit shall not be used. [70:460.6(B)]

Exception: Where conductors in the main power circuit are protected against direct contact and where the capacitor is being used as an energy storage device in accordance with the manufacturer's instructions, a manual means of switching or connecting the discharge circuit shall be permitted.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 15:35:39 EST 2019

Committee Statement

Committee Statement: In some machines the capacitor(s) are used as an energy storage device (i.e. a super capacitor). In such cases it is not desirable to discharge the capacitor(s) each time the machine power is removed.

Response Message: FR-44-NFPA 79-2019

Public Input No. 104-NFPA 79-2019 [Section No. 6.5.3.2]

**First Revision No. 19-NFPA 79-2019 [Section No. 7.2.9]****7.2.9*** Short-Circuit Current Rating or Interrupting Rating.

The short-circuit current rating or interrupting rating shall be at least equal to the available fault current at the point of application. Where the short-circuit fault current to an overcurrent protective device includes additional currents other than from the supply (e.g., from motors, from power factor correction capacitors), these shall be taken into consideration.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Mar 05 09:57:24 EST 2019

Committee Statement

Committee Statement: This change correlates with the 2020 NEC.

Response Message: FR-19-NFPA 79-2019

[Public Input No. 83-NFPA 79-2019 \[Section No. 7.2.9\]](#)



First Revision No. 67-NFPA 79-2019 [Section No. 7.2.10]

7.2.10 Rating and Setting of Overcurrent Protective Devices.

7.2.10.1*

Each motor controller and its associated wiring shall be protected as an individual branch circuit by a short-circuit protective device (SCPD) as specified by the controller manufacturer. The maximum rating of the designated SCPD shall be as shown in Table 7.2.10.1.

Exception No. 1: Table 7.2.10.1 shall not apply to Design B energy efficient motor circuits. The provisions of NFPA 70 shall be observed for Design B energy efficient motor circuits.

Exception No. 2: Where the controller is an adjustable speed drive that is listed and marked "Suitable for Output Motor Conductor Protection," the maximum rating of the designated SCPD shall be permitted to be determined by replacing the full-load current in Table 7.2.10.1 with the drive's rated input current. The SCPD shall not exceed the rating marked on the adjustable speed drive or in the manufacturer's instructions.

Table 7.2.10.1 Maximum Rating or Setting of Fuse and Circuit Breakers: Motor, Motor Branch Circuit, and Motor Controller

Fuse Class with Non-Time Delay	Full-Load Current (%)		
	AC-2	AC-3	AC-4
R	300	300	300
CF or J	300	300	300
CC	300	300	300
T	300	300	300
Fuse Class with Time Delay ^b	Type of Application ^a		
	AC-2	AC-3	AC-4
RK-5 ^c	150	175	175
RK-1	150	175	175
CF or J	150	175	225
CC	150	300	300
Instantaneous trip circuit breaker ^d	800	800	800
Inverse trip circuit breaker ^e	150	250	250

Note: Where the values determined by this table do not correspond to the standard sizes or ratings, the next higher standard size, rating, or possible setting shall be permitted.

^a Types of starting duty are as follows:

(1) AC-2: All light-starting duty motors, including slip-ring motors; starting, switching off

(2) AC-3: All medium starting duty motors including squirrel-cage motors; starting, switching off while running, occasional inching, jogging, or plugging but not to exceed 5 operations per minute or 10 operations per 10 minutes and all wye-delta and two-step autotransformer starting motors

(3) AC-4: All heavy starting duty motors including squirrel-cage motors; starting, plugging, inching, jogging

^b Where the rating of a time-delay fuse (other than CC type) specified by the table is not sufficient for the starting of the motor, it shall be permitted to be increased but shall in no case be permitted to exceed 225 percent. The rating of a time-delay Class CC fuse and non-time-delay Class CC, J, CF, or T fuse shall be permitted to be increased but shall in no case exceed 400 percent of the full-load current.

^c Unless a motor controller is listed for use with RK-5 fuses, Class RK-5 fuses shall be used only with NEMA-rated motor controllers.

^d Instantaneous trip circuit breakers shall be permitted to be used only if they comply with all of the following:

(1) They are adjustable.

(2) Part of the combination controller has motor-running protection, short-circuit protection, and ground-fault protection in each conductor.

(3) The combination is especially identified for use.

(4) It is installed per any instructions included in its listing or labeling.

(5) They are limited to single motor applications; circuit breakers with adjustable trip settings are to be

set at the controller manufacturer's recommendation, but not greater than 1300 percent of the motor full-load current.

^eWhere the rating of an inverse time circuit breaker specified in this table is not sufficient for the starting current of the motor, it shall be permitted to be increased but 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.

7.2.10.1.1

A listed self-protected combination controller shall be permitted in lieu of the devices specified in Table 7.2.10.1 for branch circuit and overload protection of a single motor circuit.

7.2.10.1.2

Where a listed self-protected combination controller has an adjustable, instantaneous trip setting, the setting shall not exceed 1300 percent of full-load motor current for other than Design B energy efficient motors and not more than 1700 percent of full-load motor current for Design B energy efficient motors.

7.2.10.2

Several motors, each not exceeding 1 hp in rating, shall be permitted on a nominal 120-volt branch circuit protected at not over 20 amperes or a 1000-volt nominal or less branch circuit, protected at not over 15 amperes, where all of the following conditions are met:

- (1) The full-load rating of each motor does not exceed 6 amperes.
- (2) The rating of the branch-circuit short-circuit and ground-fault protective device marked on any of the controllers is not exceeded. The short-circuit and ground-fault protection is provided by a single inverse time circuit breaker or single set of fuses.
- (3) Individual overload protection conforms to Section 7.3.

7.2.10.3

Where the branch-circuit short-circuit and ground-fault protective device is selected not to exceed that allowed by 7.2.10.1 for the smallest rated motor, two or more motors or one or more motors and other load(s) loads, with each motor having individual overload protection, shall be permitted to be connected to a branch circuit where it can be determined that the branch-circuit short-circuit and ground-fault protective device will not open under severe normal conditions of service that might be encountered. The short-circuit and ground-fault protection shall be provided by a single inverse time circuit breaker or single set of fuses.

7.2.10.4

Two or more motors, or one or more motor(s) motors and other load(s) loads, and their control equipment shall be permitted to be connected to a single branch circuit where short-circuit and ground-fault protection is provided by a single inverse time circuit breaker or a single set of fuses, provided the following conditions under 7.2.10.4(1) and either 7.2.10.4(2) or 7.2.10.4(3) are met:

- (1) Each motor controller and overload device is either listed for group installation with specified maximum branch-circuit protection or selected such that the ampere rating of the motor branch short-circuit and ground-fault protective device does not exceed that permitted by 7.2.10.1 for that individual motor controller or overload device and corresponding motor load.
- (2) The rating or setting of the branch short-circuit and ground-fault protection device does not exceed the values in Table 7.2.10.4 for the smallest conductor in the circuit.

Exception: Where a controller is an adjustable speed drive that is listed and marked "Suitable for Output Motor Conductor Protection," the conductors from the drive to the motor shall not be required to be used when determining the smallest conductor in the circuit. The conductors from the drive to the motor shall have an ampacity in accordance with Sections 12.5 and 12.6.

- (3) The rating or setting of the branch short-circuit and ground-fault protection does not exceed the value specified in 7.2.10.1 for the highest rated motor connected to the branch circuit plus an amount equal to the sum of the full-load current ratings of all other motors and the ratings of other loads connected to the circuit. Where this calculation results in a rating less than the ampacity of the branch circuit conductors, it shall be permitted to increase the maximum rating of the fuses or circuit breaker to a value not exceeding that permitted by Sections 12.5 and 12.6. Overcurrent protection for loads other than motor loads shall be in accordance with 7.2.3, 7.2.4, and 7.2.11. Where 16 AWG or 18 AWG conductors are used for branch circuit conductors or tap conductors under 7.2.10.5, the rating and type of the branch short-circuit and ground-fault protection shall be in accordance with 12.6.1.

Table 7.2.10.4 Relationship Between Conductor Size and Maximum Rating or Setting of Short-Circuit Protective Device for Power Circuits Group Installations

Conductor Size (AWG)	Maximum Rating Fuse or Inverse Time* Circuit Breaker (amperes)
18	See footnote.
16	See footnote.
14	60
12	80
10	100
8	150
6	200
4	250
3	300
2	350
1	400
0	500
2/0	600
3/0	700
4/0	800

*Maximum ratings and type of branch short-circuit and ground-fault protective devices for 16 AWG and 18 AWG shall be determined in accordance with 12.6.1.

7.2.10.5

For group installations described in 7.2.10.4(3), the conductors of any tap supplying a single motor shall not be required to have an individual branch-circuit short-circuit and ground-fault protective device, provided they comply with one of the following:

- (1) No conductor to the motor shall have an ampacity less than that of the branch-circuit conductors.
- (2) No conductor to the motor shall have an ampacity less than one-third that of the branch-circuit conductors, with a minimum in accordance with Sections 12.5 and 12.6, the conductors to the motor overload device being not more than 7.5 m (25 ft) long and being suitably protected from physical damage in accordance with Chapter 13.
- (3) Conductors from the point of the tap from the branch-circuit to a listed manual motor controller additionally marked "Suitable for Tap Conductor Protection in Group Installations" or to a branch circuit protective device shall be permitted to have an ampacity not less than 1/10 the rating or setting of the branch-circuit short-circuit and ground-fault protective device. The conductors from the controller to the motor shall have an ampacity in accordance with Sections 12.5 and 12.6. The conductors from the point of the tap to the controller shall (1) be enclosed either by an enclosed controller or by a raceway and be not more than 3 m (10 ft) long or (2) have an ampacity not less than that of the branch-circuit conductors.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 18:27:24 EST 2019

Committee Statement

Committee Statement: The proposed change to add the word "Motor" aligns with the marking requirement in UL 61800-5-1

Response Message: FR-67-NFPA 79-2019

**First Revision No. 16-NFPA 79-2019 [Section No. 7.8.1]****7.8.1* Surge-Protective Devices (SPDs).**

~~SPDs shall be provided for industrial machinery with safety interlock circuits to protect against circuits not effectively protected from the effects of overvoltages due to lightning or switching surges shall have surge protection installed .~~

Exception: SPDs shall not be required where the risks associated with the effects of overvoltages are mitigated such that the safety performance determined by a risk assessment is met.

A.7.8.1

The manufacturer of the industrial machinery can determine what specific type of SPD, if any, is to be used to provide the needed protection based on the installation and equipment design.

A risk assessment can be used to identify if the overvoltage protection for safety circuits is sufficient or if additional surge protection devices are needed.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Mar 04 19:48:03 EST 2019

Committee Statement

Committee Statement: Safety interlock circuits has been revised to safety circuit to avoid confusion with other interlocking circuits. This correlates with the new proposed definition of safety circuit. An “*” has been added to 7.8.1 and corresponding Annex material accepted in a separate action to provide guidance on how to protect against overvoltages. The remaining text in 7.8.1 has been revised to correlate with the NEC. An exception has been added to 7.8.1 which allows for the risk assessment to identify if the surge protection for safety circuits are sufficient or if additional surge protection devices are needed.

Response Message: FR-16-NFPA 79-2019

[Public Input No. 89-NFPA 79-2019 \[Section No. 7.8.1\]](#)

[Public Input No. 75-NFPA 79-2019 \[New Section after A.7.7\]](#)

[Public Input No. 100-NFPA 79-2019 \[New Section after A.7.7\]](#)

[Public Input No. 99-NFPA 79-2019 \[Section No. 7.8.1\]](#)

[Public Input No. 76-NFPA 79-2019 \[Section No. 7.8.1\]](#)



First Revision No. 15-NFPA 79-2019 [Section No. 7.8.3]

7.8.3 SPD Type and Location.

The type of SPD provided shall be suitable for the installation circuit location within the electrical equipment of the industrial machinery. Type 1, Type 2, and Type 3 SPDs shall be listed devices.

7.8.3.1 Type 1 SPD.

Where the SPD is located on the line side of the service disconnect overcurrent protection, a Type 1 SPD shall be provided,

7.8.3.2 Type 2 SPD.

Where the SPD is located on the load side of the service disconnect overcurrent protection, feeder circuit, or separately derived system, a Type 1 or Type 2 SPD shall be provided. Where Type 2 SPDs are provided, the SPD shall be on the load side of an overcurrent protective device.

7.8.3.3 Type 3 SPD.

Where the SPD is located on the load side of the branch-circuit overcurrent protective device, a Type 1, Type 2, or Type 3 SPD shall be provided. Where Type 3 SPDs are provided and where included in the manufacturer's instructions, the Type 3 SPD connection shall be a minimum of 10 m (30 ft) of conductor distance from the service or separately derived system disconnect.

7.8.3.4 Component Assembly and Other Type 4 SPD.

~~Where a Type 4 SPD is used within the industrial control panel of industrial machinery, it shall be identified for use in Type 1, Type 2, or Type 3 applications and be suitable for the location of the industrial machinery. Component assembly SPDs (Type 1, 2, or 3) shall be applied in accordance with 7.8.3.1 through 7.8.3.3 and any additional conditions of use specified by the device manufacturer. Where a Type 4 component assembly SPD or other component type is used, it shall be identified as suitable for the intended use. Component assembly SPDs or other component type SPDs shall only be installed by the industrial control panel manufacturer .~~

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Mar 04 19:40:45 EST 2019

Committee Statement

Committee Statement: The text in 7.8.3 has been revised to identify the protection is for the circuits within the machinery. The text in 7.8.3.4 has been modified to add guidance for the proper application of various types of component assemblies and component type SPDs. These changes correlate with the terminology of the fourth edition of UL 1449.

Response Message: FR-15-NFPA 79-2019

Public Input No. 44-NFPA 79-2019 [Section No. 7.8]

**First Revision No. 45-NFPA 79-2019 [New Section after 8.1.1]****8.1.2 Separately Derived Systems.**

Separately derived systems shall be installed in accordance with 250.30 of NFPA 70 .

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 15:47:07 EST 2019

Committee Statement

Committee Statement: The proposed change does not provide technical justification for limiting the scope with the proposed frequency and DC voltage.

Response Message: FR-45-NFPA 79-2019

Public Input No. 77-NFPA 79-2019 [Sections 8.1.2, 8.1.3]

**First Revision No. 46-NFPA 79-2019 [Section No. 8.2.3.6]****8.2.3.6**

Portable, pendant, and resilient-mounted equipment shall be bonded by separate conductors; ~~where~~ .
Where multiconductor cable is used and an equipment grounding conductor is required to carry fault
current , the bonding equipment grounding conductor shall be included as one conductor of the
cable used to provide the bonding .

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 15:50:36 EST 2019

Committee Statement

Committee Statement: First revision created to help clarify that when a multiconductor cable is used a separate bonding jumper shall not be required.

Response Message: FR-46-NFPA 79-2019

[Public Input No. 67-NFPA 79-2019 \[Section No. 8.2.3.6\]](#)

**First Revision No. 47-NFPA 79-2019 [Section No. 8.3]****8.3 Control Circuits.**

Control circuits shall be permitted to be grounded or ungrounded.

Exception: Exposed control circuits as permitted by Section 6.4 shall be grounded.

8.3.1

Where grounding is provided, ~~that side of the circuit common to the coils shall be grounded at the secondary winding the secondary side~~ of the control transformer ~~if alternating current or at the power supply terminal if direct current~~ or power supply that is connected to the circuit common shall be grounded.

Exception: Overload relay contacts shall be permitted to be connected between the coil and the grounded conductor where the conductors between such contacts and coils of magnetic devices do not extend beyond the control enclosure.

8.3.2

Ungrounded control circuits shall be provided with an insulation-monitoring device that either indicates a ground fault or interrupts the circuit automatically after a ground fault.

Exception: Class 2 low-voltage circuits in Article 725 of NFPA 70 shall not require insulation monitoring.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 15:55:53 EST 2019

Committee Statement

Committee Statement: The proposed revisions updates the grounding provisions for control circuits to account for control devices that are not coils and to address use of control transformers or power supplies with single connection terminals or use of plug/socket connections where direct grounding at the terminal is not practicable. In addition, it corrects an oversight that Exception 1 in 8.3.1 was intended to apply to 8.3.

Response Message: FR-47-NFPA 79-2019

[Public Input No. 45-NFPA 79-2019 \[Section No. 8.3\]](#)

**First Revision No. 20-NFPA 79-2019 [Section No. 9.1.1]****9.1.1 Control Circuit Supply.****9.1.1.1**

Where control circuits are supplied from an ac source, control transformers shall be used for supplying the control circuits. Control circuits shall not be derived from autotransformers. Control circuits supplied from windings of multiwinding power transformers shall be permitted if the output voltage of the winding supplying the control circuit does not exceed 120 volts ac and the available short-circuit fault current does not exceed 1000 amperes rms.

9.1.1.2

Where dc control circuits are connected to the equipment grounding circuit, they shall be supplied from a separate winding of the ac control circuit transformer or by another control circuit transformer or a listed dc power supply.

9.1.1.3

Transformers shall not be required if the supply voltage does not exceed 120 volts ac and the available short-circuit fault current does not exceed 1000 amperes rms.

9.1.1.4

The source of supply for all control circuits shall be taken from the load side of the supply disconnecting means.

Exception: Control circuits meeting the requirements of excepted circuits in 5.1.13.1(4) shall be permitted to be taken from the line side of the supply disconnecting means or other power source. The marking requirements of 16.2.4 shall apply.

9.1.1.5

~~The marking requirements of 16.2.4 shall apply.~~

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Mar 05 10:37:50 EST 2019

Committee Statement

Committee Statement: This change clarifies the marking requirement of 16.2.4 only apply for excepted circuits. The change from short-circuit to fault circuit correlates with the 2020 NEC.

Response Message: FR-20-NFPA 79-2019

[Public Input No. 46-NFPA 79-2019 \[Section No. 9.1.1\]](#)

[Public Input No. 85-NFPA 79-2019 \[Section No. 9.1.1.1\]](#)

[Public Input No. 86-NFPA 79-2019 \[Section No. 9.1.1.3\]](#)

**First Revision No. 21-NFPA 79-2019 [Section No. 9.2.5.3.1]****9.2.5.3.1***

Category 0, Category 1, and/or Category 2 stops shall be provided as required with the minimum of at least one stop function. The number of stop functions and the stop function category shall be determined by the risk assessment and the functional requirements of the machine. Category 0 and Category 1 stops shall be operational regardless of operating modes, and Category 0 shall take priority.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Mar 05 10:58:10 EST 2019

Committee Statement

Committee Statement: This change clarifies that a stop function is required. The number and type are determined by the risk assessment.

Response Message: FR-21-NFPA 79-2019

Public Input No. 64-NFPA 79-2019 [Section No. 9.2.5.3.1]



First Revision No. 24-NFPA 79-2019 [Section No. 9.2.5.4.1.3]

9.2.5.4.1.3

The emergency stop shall function as either a Category 0 or a Category 1 stop (see 9.2.2). The choice of the category of the emergency stop shall be determined by the risk assessment of the machine.

Exception: In some cases, to avoid creating additional risks, it can be necessary to perform a controlled stop and maintain the power to machine actuators even after stopping is achieved. The stopped condition shall be monitored and upon detection of failure of the stopped condition, power shall be removed without creating a hazardous situation.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Mar 05 11:18:49 EST 2019

Committee Statement

Committee Statement: This correlates with the requirements of IEC 60204-1 Edition 6 and addresses the need to maintain control after an emergency stop. It was determined identifying “category 2 stop” was not needed.

Response Message: FR-24-NFPA 79-2019

[Public Input No. 48-NFPA 79-2019 \[Section No. 9.2.5.4.1.3\]](#)

[Public Input No. 19-NFPA 79-2018 \[Section No. 9.2.5.4.1.3\]](#)

**First Revision No. 25-NFPA 79-2019 [Section No. 9.2.7.2.2]****9.2.7.2.2**

Where necessary to prevent a hazardous condition , means shall be provided so that the machine can be controlled only from operator control station(s) in one or more predetermined zones or locations.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Mar 05 11:25:19 EST 2019

Committee Statement

Committee Statement: The revised text clarifies this requirement only applies where a hazardous condition could arise, which may not necessarily be due to multiple control stations.

Response Message: FR-25-NFPA 79-2019

[Public Input No. 14-NFPA 79-2018 \[Section No. 9.2.7.2.2\]](#)

**First Revision No. 27-NFPA 79-2019 [Section No. 10.2.3.1]****10.2.3.1**

A legend or symbol shall be provided for each operator interface device to identify its function and shall be located so that it can be easily read by the machine operator from the normal operator position. ~~The legends shall be durable and suitable for the operating environment~~ Legends and symbols shall be marked in accordance with Section 16.3 .

Exception: Emergency stop devices require no legend or symbol if they meet the requirements of 10.7.3.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Mar 05 14:34:45 EST 2019

Committee Statement

Committee Statement: This change allows for the marking of either a legend and/or symbol as well as reference to 16.3 for marking requirements.

Response Message: FR-27-NFPA 79-2019

Public Input No. 106-NFPA 79-2019 [Section No. 10.2.3.1]



First Revision No. 28-NFPA 79-2019 [Section No. 10.3.3]

10.3.3* Colors.

Indicator lights and icons of color graphic interface devices shall be color-coded with respect to the condition (status) of the machine in accordance with Table 10.3.3. Alternative purposes shall be permitted to indicate machine or process status.

Table 10.3.3 Machine Indicator Lights and Icons

Color	Purposes		
	Safety of Persons or Environment	Condition of Process	State of Equipment
RED	Danger	Emergency	Faulty
YELLOW (AMBER)	Warning/ Caution	Abnormal	Abnormal
GREEN	Safe	Normal	Normal
BLUE	Mandatory action		
CLEAR	No specific meaning assigned		
WHITE			
GRAY			
BLACK			

Table 10.3.3 Machine Indicator Lights and Icons

Color	Meaning	Explanation	Action by Operator
RED	Emergency	Hazardous condition	Immediate action to deal with hazardous condition (for example, switching off the machine supply, being alert to the hazardous condition, and staying clear of the machine)
YELLOW	Abnormal	Abnormal condition Impending critical condition	Monitoring and/or intervention (for example, by re-establishing the intended function)
BLUE	Mandatory	Indication of a condition that requires action by the operator	Mandatory action
GREEN	Normal	Normal condition	Optional
WHITE	Neutral	Other conditions; can be used whenever doubt exists about the application of RED, YELLOW, GREEN, BLUE	Monitoring

Supplemental Information

File Name	Description	Approved
Table_10.3.3_FR-28.docx	Table 10.3.3. For staff use	

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Mar 05 14:38:35 EST 2019

Committee Statement

Committee Statement: The table has been revised to clarify color coding of indicator lights and icons and remove terms “danger” and “safe” and harmonize with IEC 60204.

Response FR-28-NFPA 79-2019

Message:

[Public Input No. 78-NFPA 79-2019 \[Section No. 10.3.3\]](#)

**First Revision No. 29-NFPA 79-2019 [Section No. 10.4]****10.4** Illuminated Pushbuttons.

Illuminated pushbutton actuators shall be color-coded in accordance with ~~Table 10.3.3~~ Section 10.2 . The color RED for the emergency stop actuator shall not depend on the illumination source.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Mar 05 14:42:12 EST 2019

Committee Statement

Committee Statement: The text of 10.4 has been corrected to refer to 10.2 which relates to requirements for pushbuttons.

Response Message: FR-29-NFPA 79-2019

**First Revision No. 30-NFPA 79-2019 [New Section after 10.7.1.2]****10.7.1.3**

Emergency stop pushbuttons shall be listed as emergency stop devices.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Mar 05 14:44:36 EST 2019

Committee Statement

Committee Statement: This new section requires all emergency stop pushbuttons to be listed as emergency stop devices.

Response Message: FR-30-NFPA 79-2019

Public Input No. 96-NFPA 79-2019 [New Section after 10.7.1.2]



First Revision No. 33-NFPA 79-2019 [Section No. 12.1.2]

12.1.2 Wire Conductor Insulation.

Conductors shall be insulated.

Exception No. 1: Busbars shall not be required to be insulated.

Exception No. 2: Bare conductors, such as capacitor or resistor leads and jumpers between terminals, shall be permitted where the method of securing provides electrical clearance.

Exception No. 3: Equipment grounding conductors and bonding jumpers shall be permitted to be covered or bare.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Mar 05 15:42:22 EST 2019

Committee Statement

Committee Statement: Conductor is the technically correct term.

Response Message: FR-33-NFPA 79-2019



First Revision No. 71-NFPA 79-2019 [Section No. 12.3.2]

12.3.2

The average and the minimum thickness of the insulation in constructions A and B shall be in accordance with Table 12.3.2.

Table 12.3.2 Thickness of Single Conductor Insulation (mils)

Wire Size (AWG or kcmil)	<u>Construction A</u> *	<u>Construction B</u> †
	Average/ Minimum	Average/ Minimum (Jacket)
22 AWG	30/27	15/13(4)
20	30/27	15/13(4)
18	30/27	15/13(4)
16	30/27	15/13(4)
14	30/27	15/13(4)
12	30/27	15/13(4)
10	30/27	20/18(4)
8	45/40	30/27(5)
6	60/54	30/27(5)
4-2	60/54	40/36(6)
1-4/0	80/72	50/45(7)
250-500 kcmil	95/86	60/54(8)
550-1000	110/99	70/63(9)

* A: No outer covering.

† B: Nylon covering.

Source: UL 1063, Table 1.1, NEC Construction.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Fri Mar 29 10:39:13 EDT 2019

Committee Statement

Committee Statement: Section 12.9.2 refers to the proposed deleted sections.

By adding the term construction to the table it will clarify the table applies to construction A and B single conductor types.

No technical substantiation has been provided to support the deletion of these sections.

Response Message: FR-71-NFPA 79-2019

[Public Input No. 68-NFPA 79-2019 \[Sections 12.3.2, 12.3.3\]](#)

**First Revision No. 32-NFPA 79-2019 [Section No. 12.4]****12.4 Wire Conductor Markings.****12.4.1**

A durable legend printed on the outer surface of the insulation of construction A, on the outer surface of the nylon jacket of construction B, on the outer surface of the insulation under the jacket of construction B (only if readable through the nylon), or on the outer surface of the jacket of a multiconductor cable shall be repeated at intervals of no more than 610 mm (24 in.) throughout the length of the single-conductor or the multiconductor cable.

Exception: Sizes smaller than 16 AWG shall be permitted to be marked on the reel or on the smallest unit of the shipping carton.

12.4.2*

The legend shall include the manufacturer's name or trademark, wire type, voltage rating (where permitted by *NFPA 70*), and gauge or size.

12.4.3

Where the conductor is 16 through 10 AWG and the stranding is intended for flexing service, the legend shall include "flexing" or "Class K."

12.4.4

Wire Conductor insulation shall be identified and adequate for the voltage on that conductor.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Mar 05 15:40:24 EST 2019

Committee Statement

Committee Statement: Conductor is the technically correct term.

Response Message: FR-32-NFPA 79-2019

Public Input No. 3-NFPA 79-2018 [Section No. 12.4]



First Revision No. 38-NFPA 79-2019 [Section No. 12.5.1]

12.5.1

The ampacities of conductors shall not exceed the corresponding temperature values given in Table 12.5.1 before any correction factors for ambient temperature or adjustment factors for the number of current-carrying conductors have been applied.

Table 12.5.1 Conductor Ampacity Based on Copper Conductors with 60°C (140°F), 75°C (167°F), and 90°C (194°F) Insulation in an Ambient Temperature of 30°C (86°F)

Conductor Size (AWG)	Ampacity		
	60°C (140°F)	75°C (167°F)	90°C (194°F)
30	—	0.5	0.5
28	—	0.8	0.8
26	—	1	1
24	2	2	2
22	3	3	3
20	5	5	5
18	7	7	14
16	10	10	18
14	~~20~~ 15	20	25
12	~~25~~ 20	25	30
10	30	35	40
8	40	50	55
6	55	65	75
4	70	85	95
3	85	100	~~110~~ 115
2	95	115	130
1	110	130	~~150~~ 145
1/0	125	150	170
2/0	145	175	195
3/0	165	200	225
4/0	195	230	260
250	215	255	290
300	240	285	320
350	260	310	350
400	280	335	380
500	320	380	430
600	355	420	475
700	385	460	520
750	400	475	535
800	410	490	555
900	435	520	585
1000	455	545	615

Notes:

(1) Wire types listed in 12.3.1 shall be permitted to be used at the ampacities listed in this table.

(2) The sources for the ampacities in this table are is Table 310.15(B)(16) of *NFPA 70*.

Supplemental Information

File Name	Description	Approved
Table_12.5.1.docx	Revised Table 12.5.1. For staff use	

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 09:03:13 EST 2019

Committee Statement

Committee Statement: The table ampacities have been edited to match the ampacity table 310.15(b)(16) of NFPA 70.

Response Message: FR-38-NFPA 79-2019



First Revision No. 34-NFPA 79-2019 [Section No. 12.5.5]

12.5.5

Where ampacity correction for ambient temperature correction for other than 30°C (86°F) or adjustment for more than three current-carrying conductors in a raceway or cable is required, the factor(s) shall be taken from Table 12.5.5(a) and Table 12.5.5(b). Sizing of conductors within control enclosures in wiring harnesses or wiring channels shall be based on the ampacity in cable or raceway. These factors shall apply to Class 1 control conductors, Article 725 of *NFPA 70* only if their continuous load exceeds 10 percent of the conductor ampacity.

Exception: The provisions of 376.22 of NFPA 70 shall be permitted to be applied for conductors in metallic wireways.

Table 12.5.5(a) Ambient Temperature Correction Factors

For ambient temperatures other than 30°C (86°F), multiply the allowable ampacity by the appropriate factor shown below.

Ambient Temperature (°C)	Correction Factor 60°C	Correction Factor 75°C	Correction Factor 90°C
21–25	1.08	1.05	1.04
26–30	1.00	1.00	1.00
31–35	0.91	0.94	0.96
36–40	0.82	0.88	0.91
41–45	0.71	0.82	0.87
46–50	0.58	0.75	0.82
51–55	0.41	0.67	0.76
56–60	—	0.58	0.71
61–70	—	0.33	0.58
71–80	—	—	0.41

Table 12.5.5(b) Adjustment Factors for More Than Three Current-Carrying Conductors in a Raceway or Cable

Number of Current-Carrying Conductors	Percent of Values in Table 12.5.5(a) as Adjusted for Ambient Temperature if Necessary
4–6	80
7–9	70
10–20	50
21–30	45
31–40	40
41 and above	35

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Mar 05 15:46:05 EST 2019

Committee Statement

Committee Statement: Currently 12.5.5 requires the tabulated ampacity values of 12.5.1 to apply ampacity temperature correction factors for other than 86 degrees F from table 12.5.5(a) and/or adjustment factors from 12.5.5(b) for more than three current carrying conductors in a raceway. The inclusion of this exception will provide a permitted reference for calculating the ampacity of conductors within metallic

wireways when the metallic wireway has no more than a 20% fill and no more than 30 current carrying conductors at any cross section of the wireway.

Response FR-34-NFPA 79-2019
Message:

[Public Input No. 50-NFPA 79-2019 \[Section No. 12.5.5\]](#)

**First Revision No. 48-NFPA 79-2019 [Section No. 13.1.2.2]****13.1.2.2**

Mating ~~molded nylon~~ insulated connectors using crimped terminations shall not be considered a splice or a joint when used or contained in an enclosure, machine compartment, or conduit body.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 16:08:06 EST 2019

Committee Statement

Committee Statement: Removed the term "molded nylon" and added "insulated" to apply to all mating insulated connectors regardless of material.

Response Message: FR-48-NFPA 79-2019

[Public Input No. 93-NFPA 79-2019 \[Section No. 13.1.2.2\]](#)

**First Revision No. 54-NFPA 79-2019 [Section No. 13.1.2.3]****13.1.2.3***

Factory-applied connectors molded onto cables shall be permitted. Such connectors shall not be considered as splices or joints.

A.13.1.2.3

For examples, see UL 2237 Outline and UL 2238.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 16:59:27 EST 2019

Committee Statement

Committee Statement: The current Annex A note for 13.1.2.4 should also apply to 13.1.2.3. The UL Standards cited in the note to 13.1.2.4 apply to both factory and field installed connectors.

Response Message: FR-54-NFPA 79-2019

Public Input No. 91-NFPA 79-2019 [New Section after A.13.1.2.1]

**First Revision No. 49-NFPA 79-2019 [Section No. 13.2.3.2]****13.2.3.2**

The use of other colors for the following applications shall be as follows:

- (1) WHITE with BLUE stripe for grounded (current-carrying) dc circuit conductor
- (2) WHITE with ORANGE stripe for grounded (current-carrying) ~~ac circuit~~ conductor, which remains energized when the main supply circuit disconnecting means is in the off position
- (3) Whichever color stripe is selected, that color stripe shall be consistent with the ungrounded conductor of the excepted circuit described in ~~5.3.5~~ 5.1.13 .

Exception No. 1: Multiconductor cables shall be permitted to be permanently reidentified at the time of installation.

Exception No. 2: Where the identification of machine power and control wiring is such that compliance with the mandatory color codes is too restrictive for specific applications, it shall be permitted to use additional identification at selected locations as an alternative. This means of identification shall be permitted to be by separate color coding, marking tape, tagging, or other approved means and shall be permanently posted on the inside of the main electrical control panel enclosure in a visible location.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 16:18:14 EST 2019

Committee Statement

Committee Statement: There is no justification to limit the white with orange stripe to AC for the current carrying conductor that remains energized.

Response Message: FR-49-NFPA 79-2019

Public Input No. 23-NFPA 79-2018 [Section No. 13.2.3.2]

**First Revision No. 50-NFPA 79-2019 [Section No. 15.2.1.3]****15.2.1.3**

The conductors to stationary ~~lights~~ luminaires used as an integral part of the machine shall be Type MTW, and the conductors within the ~~fixtures~~ luminaires shall be not smaller than 18 AWG.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 16:27:46 EST 2019

Committee Statement

Committee Statement: Change made terms "lights" and "fixtures" to "luminaires" to coordinate with terms used in the NEC.

Response Message: FR-50-NFPA 79-2019

Public Input No. 29-NFPA 79-2018 [Section No. 15.2.1.3]

**First Revision No. 51-NFPA 79-2019 [Section No. 15.2.2.1]****15.2.2.1**

The lighting circuit voltage shall not exceed 150 volts between conductors.

Exception: Lighting systems designed for use and operating at voltage(s) greater than 150 volts shall be permitted where listed and installed in the machine area according to the manufacturer's instructions.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 16:28:51 EST 2019

Committee Statement

Committee Statement: This change adds an exception that would allow for installations of lighting in the machine area where the supply is greater than 150 volts.

Response Message: FR-51-NFPA 79-2019

Public Input No. 115-NFPA 79-2019 [Section No. 15.2.2.1]

**First Revision No. 52-NFPA 79-2019 [Section No. 15.2.4]****15.2.4** ~~Lighting Fixtures~~ Luminaires .**15.2.4.1**

Adjustable ~~lighting fixtures~~ luminaires shall be suitable for the physical environment.

15.2.4.2

The lampholders shall be as follows:

- (1) Rated for the voltage and wattage of the lamp
- (2) Constructed with an insulating material protecting the lamp so as to prevent unintentional contact

15.2.4.3

Reflectors and protectors shall be supported by a bracket and not the lampholder.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 16:46:17 EST 2019

Committee Statement

Committee Statement: This changes the term "fixture" to "luminaire" to coordinate with the NEC.

Response Message: FR-52-NFPA 79-2019

Public Input No. 30-NFPA 79-2018 [Section No. 15.2.4]

**First Revision No. 35-NFPA 79-2019 [Section No. 18.6]****18.6 Functional Tests.**

The functions of electrical equipment, particularly those related to safety and safeguarding, shall be tested and documented .

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 08:37:32 EST 2019

Committee Statement

Committee Statement: The revision will require that proof of the process is being done and available. This wording will be in line with the ISO 13849-2.

Response Message: FR-35-NFPA 79-2019

[Public Input No. 57-NFPA 79-2019 \[Section No. 18.6\]](#)

**First Revision No. 36-NFPA 79-2019 [Section No. 19.1 [Excluding any Sub-Sections]]**

Overload Overcurrent protection shall be provided for each motor.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 08:48:34 EST 2019

Committee Statement

Committee Statement: "Overcurrent" is the correct term in this clause.

Response Message: FR-36-NFPA 79-2019

Public Input No. 112-NFPA 79-2019 [Section No. 19.1 [Excluding any Sub-Sections]]

**First Revision No. 17-NFPA 79-2019 [Section No. A.3.3.3]****A.3.3.3 Actuator.**

The actuator can take the form of a handle, knob, pushbutton, roller, plunger, touchscreen, and so forth. There are some actuating means that do not require an external actuating force but only an action. See also 3.3.4, ~~Machine Actuator~~ Actuator, Machine .

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Mar 05 08:38:08 EST 2019

Committee Statement

Committee Statement: The added term "touchscreen" aligns the examples of types of actuators with IEC 60204-1.

Response Message: FR-17-NFPA 79-2019

**First Revision No. 13-NFPA 79-2019 [Section No. A.3.3.75]****A.3.3.79** Overcurrent Protective Device, Supplementary.

Supplementary overcurrent protective devices are not general use devices, as are branch circuit devices, and must be evaluated for appropriate application in every instance where they are used. Supplementary overcurrent protective devices are extremely application oriented, and prior to applying the devices, the differences and limitations for these devices must be investigated. Such a device is allowed to be incomplete in construction or restricted in performance. Such a device is not suitable for branch circuit protection and is not used where branch circuit protection is required.

One example of differences and limitations is that a supplementary overcurrent protective device could have spacing, creepage, and clearance that are considerably less than those of a branch circuit overcurrent protective device.

Example: A supplemental protector, listed to UL 1077, has spacings that are 9.5 mm (0.375 in.) through air and 12.7 mm (0.5 in.) over surface. A branch circuit-rated UL 489 molded-case circuit breaker has spacings that are 19.1 mm (0.75 in.) through air and 31.8 mm (1.25 in.) over surface.

Another example of differences and limitations is that branch circuit overcurrent protective devices have standard overload characteristics to protect branch circuits and feeder conductors. Supplementary overcurrent protective devices do not have standard overload characteristics and could differ from the standard branch circuit overload characteristics. Also, supplementary overcurrent protective devices have interrupting ratings that can range from 32 amperes to 100,000 amperes. When supplementary overcurrent protective devices are considered for proper use, it is important to be sure that the device's interrupting rating equals or exceeds the available short-circuit fault current and that the device has the proper voltage rating for the installation (including compliance with slash voltage rating requirements, if applicable).

Examples of supplemental overcurrent protective devices include, but are not limited to, those listed to the following:

- (1) UL 248-14
- (2) UL 1077

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Mar 04 16:15:09 EST 2019

Committee Statement

Committee Statement: The term "available short-circuit current" is changed to "available fault current." This correlates with the proposed added definition for "Fault Current."

Response Message: FR-13-NFPA 79-2019

[Public Input No. 87-NFPA 79-2019 \[Section No. A.3.3.75\]](#)

**First Revision No. 72-NFPA 79-2019 [Section No. A.4.2]****A.4.2**

Semiconductor manufacturing equipment for use in semiconductor fabrication facilities could be accepted by one of the following judged under the requirements of a testing laboratory to an international (e.g., IEC 60204-1 or IEC 61010-1), regional (e.g., BS EN 60204 or BS EN 61010-1), national (e.g., UL 508, UL 508A, ~~IEC/ UL 61010A-1~~ 61010-1 , this document), or industry standard (e.g., SEMI S2 or SEMI S22 electrical standard(s) deemed appropriate by the testing laboratory, field evaluation to this document, or another approach, such as “acceptable to the local authority having jurisdiction.”

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Apr 24 10:30:24 EDT 2019

Committee Statement

Committee Statement: Replaced UL 61010A-1 with UL 61010-1 to align with FR 2 which deleted UL 61010A-1

Response Message: FR-72-NFPA 79-2019



First Revision No. 14-NFPA 79-2019 [Section No. A.4.5.2]

A.4.5.2

The electrical interferences generated by the equipment itself should not exceed levels specified in the relevant equipment standards and others dealing with electromagnetic compatibility (EMC) levels. The levels allowed should be determined for the specific application.

Generated interference signals can be kept to a minimum by the following:

- (1) Suppression at the source by using capacitors, inductors, diodes, Zener diodes, varistors, or active devices, or a combination of these
- (2) Equipment screening in a bonded electrically conductive enclosure to provide segregation from other equipment

Undesirable effects of electrostatic discharge, radiated electromagnetic energy, and supply conductor (mains borne) interference should be avoided (e.g., use of appropriate filters and time delays, choice of certain power levels, suitable wiring types and practices).

The effects of interference on equipment can be reduced by the following:

- (1) Use of surge protective devices and filters. The installation of surge protection devices and/or filters for equipment sensitive to electromagnetic influences is recommended to improve electromagnetic compatibility with regard to conducted electromagnetic phenomena.
- (2) *Reference potential circuit or common connections.* Each common connection treated as a single circuit and connected to one of several central reference points that are connected to ground (wired to earth) by insulated conductors of large cross-sectional area.
- (3) *Frame connections.* In each piece of equipment all frame connections are to be taken to a common point with a conductor of large cross-sectional area (e.g., braided conductors, foil strips having a width much greater than the thickness) used between slides and enclosures. The connections to the frame are to be as short as possible.
- (4) *Transmission of signals.* Electrostatic screens, electromagnetic shields, twisted conductors, and orientation (i.e., crossing cable runs at as near to 90 degrees as practicable) as necessary to ensure that the low level signal wiring is not affected by interference from control or power cables, or running the connections parallel to the ground plane as necessary.
- (5) *Separation of equipment.* Separating and/or shielding sensitive equipment (e.g., units working with pulses and/or at low signal levels) from switching equipment (e.g., electromagnetic relays, thyristors); separation of low level signal wiring from control and power cables.
- (6) *Electromagnetic disturbances.* Measures to limit the generation of electromagnetic disturbances — that is, conducted and radiated emissions — include the following:
 - (a) Power supply filtering
 - (b) Cable shielding
 - (c) Enclosures designed to minimize RF radiation
 - (d) RF suppression techniques.
- (7) *Enhance immunity.* Measures to enhance the immunity of the equipment against conducted and radiated RF disturbance using the designs of a functional bonding system include the following:
 - (a) Connection of sensitive electrical circuits to the chassis. Such terminations should be marked or labeled with the IEC Symbol 5020 from IEC 60417-1. [See Figure A.4.5.2(a).]
 - (b) Connection of the chassis to earth (PE) using a conductor with low RF impedance and as short as practicable.
 - (c) Connection of sensitive electrical equipment or circuits directly to the PE circuit or to a functional earthing conductor (FE), to minimize common mode disturbance. This latter terminal should be marked or labeled with the IEC Symbol 5018 from IEC 60417. [See Figure A.4.5.2(b).]
 - (d) Separation of sensitive circuits from disturbance sources.
 - (e) Enclosures designed to minimize RF transmission.
 - (f) EMC wiring practices as follows:
 - i. Using twisted conductors to reduce the effect of differential mode disturbances
 - ii. Keeping distance between conductors emitting disturbances and sensitive conductors
 - iii. Using cable orientation as close to 90° as possible when cables cross
 - iv. Running the conductors as close as possible to the ground plane
 - v. Using electrostatic screens and/or electromagnetic shields with a low RF impedance

termination

Figure A.4.5.2(a) Symbol that Represents Functional Equipotential Bonding — IEC Symbol Number 5020.

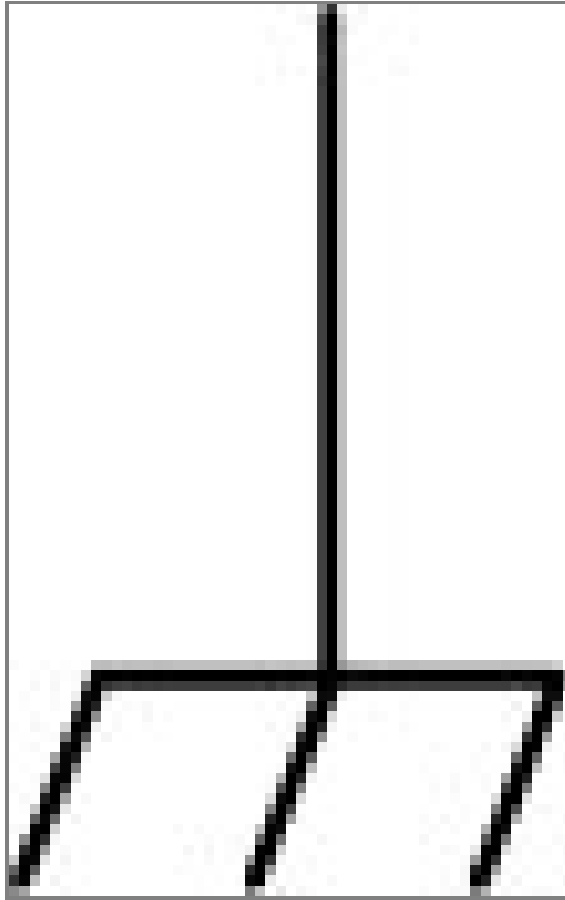
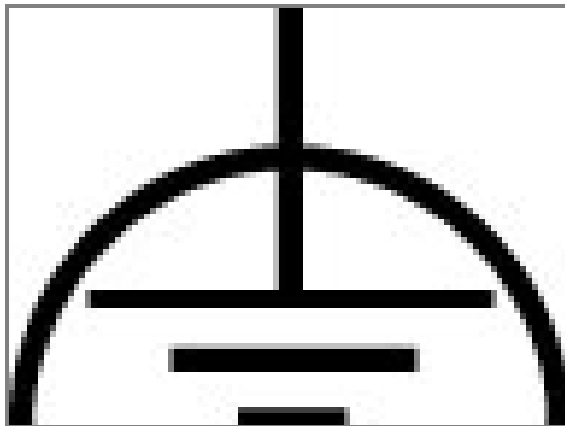


Figure A.4.5.2(b) Symbol that Represents Functional Earthing — IEC Symbol Number 5018.



Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Mar 04 16:23:42 EST 2019

Committee Statement

Committee Statement: The added text provides a specific reference to use of surge protection and filters to protect against electromagnetic interference. This text is adapted from similar language in IEC 60204-1 Ed. 6 Annex H.

Response FR-14-NFPA 79-2019
Message:

[Public Input No. 54-NFPA 79-2019 \[Section No. A.4.5.2\]](#)



First Revision No. 70-NFPA 79-2019 [Section No. A.9.2.5.4]

A.9.2.5.4

For other safety-related stop functions, see 9.4.3.4.

~~Emergency stop and emergency switching off are complementary protective measures that are not primary means of risk reduction for hazards (e.g., trapping, entanglement, electric shock, or burn) at a machine (see ISO 12100). An emergency stop function might be required based on the risk assessment and when one or more of the following criteria exist:~~

- ~~(1) Hazards and hazardous situations could arise rapidly as in the case of fast-moving equipment.~~
- ~~(2) Hazard zones for a large machine extend beyond an area immediately accessible by one person [e.g., length exceeds 10 m (30 ft)].~~
- ~~(3) Machine hazard zones are not completely within view from a single vantage point.~~
- ~~(4) There are motions accessible that are deemed low risk but still have the potential for causing harm (e.g., product moving on a roller conveyor).~~
- ~~(5) Multiple workstations and/or multiple personnel are involved in the normal production operation.~~

Principles for the design of emergency stop equipment, including functional aspects, are given in ISO 13850.

See IEC 60204-1, Annex E.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Fri Mar 29 10:23:54 EDT 2019

Committee Statement

Committee Statement: Text has been added to Annex 9.2.5.4 to provide guidance on when an emergency stop function may be required based on the risk assessment. The equivalent distance in ft has been added to item 2. Proposed items 3 and 7 were not included as the term "complexity" is unclear.

Response Message: FR-70-NFPA 79-2019

Public Input No. 66-NFPA 79-2019 [Section No. 9.2.5.4 [Excluding any Sub-Sections]]

**First Revision No. 53-NFPA 79-2019 [Section No. A.11.4.6]****A.11.1.2**

Windows provided for viewing internally mounted indicating devices should be of a material suitable to withstand mechanical stress and chemical attack [e.g., toughened glass, polycarbonate sheet of 3 mm ($\frac{1}{8}$ in.) thickness], maintained to the applicable construction standards (e.g., UL 50, UL 508, UL 508A, or NEMA 250).

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 16:50:38 EST 2019

Committee Statement

Committee Statement: This change helps explain requirements of UL 508, UL 508A, UL 50 or NEMA 250, also apply to the viewing window of an enclosure. Additionally changed the reference to better align with the enclosure requirements.

Response Message: FR-53-NFPA 79-2019

[Public Input No. 52-NFPA 79-2019 \[Section No. A.11.4.6\]](#)

**First Revision No. 65-NFPA 79-2019 [Section No. A.12.1.1]****A.12.1.1**

Typical operating conditions include the following:

- (1) Voltage and frequency
- (2) Current
- (3) Protection against electric shock
- (4) Grouping of cables
- (5) Characteristics associated with power conversion equipment

Circuit conductors on the output of power conversion equipment 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.

External influences include the following:

- (1) Ambient temperature
- (2) Presence of water, oil, or other fluid substances
- (3) Radiation
- (4) Ultraviolet light
- (5) Corrosive substances
- (6) Mechanical stresses
 - (a) Installation
 - (b) Fire hazards

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 18:03:01 EST 2019

Committee Statement

Committee Statement: The proposed changes provide additional guidance on the proper selection of conductors when used with power conversion equipment. The text is taken from pending changes in the 430.122(A) in the 2020 NEC.

Response Message: FR-65-NFPA 79-2019

[Public Input No. 51-NFPA 79-2019 \[Section No. A.12.1.1\]](#)

**First Revision No. 55-NFPA 79-2019 [Section No. A.13.1.7.1]****A.13.1.7.1**

For additional information on flexible cords, refer to UL 62. [For additional information on connectors and assemblies of connectors and cords, refer to UL 2237 Outline and UL 2238.](#)

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 17:03:12 EST 2019

Committee Statement

Committee Statement: Since this section references factory-applied molded connectors, the existing Annex A note should also reference the product standards for these connectors and assemblies.

Response Message: FR-55-NFPA 79-2019

[Public Input No. 92-NFPA 79-2019 \[Section No. A.13.1.7.1\]](#)

**First Revision No. 66-NFPA 79-2019 [Section No. A.18.1]****A.18.1**

A relevant ANSI specialist standard might deem necessary tests 1 through 5 inclusively or individually. It is recommended that the sequence listed be followed. Following this order will help ensure the accuracy of the tests results and the safety of personnel. Refer to SEMI S9 for additional information on performing the testing described in Section 18.1.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 18:09:57 EST 2019

Committee Statement

Committee Statement: Section 18.1 requires testing where deemed necessary in (1) through (5). IEC 60204 stated "The extent of verification will be given in the dedicated product standard for a particular machine." The committee proposes additional text be added in front of the existing A.18.1. The addition of this text will clarify the origins of the text "deemed necessary" as coming from a specialist standard (type C standard).

Response Message: FR-66-NFPA 79-2019

**First Revision No. 73-NFPA 79-2019 [Section No. A.18.2]****A.18.2**

The concepts of SELV are further explained in UL 60950-1, IEC/ ~~UL 61010A-1~~ 61010-1 , and IEC 60364-4-1. It should be noted that there is a difference in the definitions of SELV in these standards.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Apr 24 10:55:02 EDT 2019

Committee Statement

Committee Statement: Replaced UL 61010A-1 with UL 61010-1 to align with FR 2 which deleted UL 61010A-1

Response Message: FR-73-NFPA 79-2019



First Revision No. 37-NFPA 79-2019 [Section No. F.5.5]

F.5.5

However, because the IP requirements can be interpreted to be inclusive to the type-rating requirements, a conservative IP-rating can be assigned to a type-rated enclosure as shown in Table F.5.5.

As a practical matter, many electrical enclosures are tested to both the IP and type requirements and carry both IP-rating and type-rating designations.

Table F.5.5 Assignment of IP-Ratings to Type-Rated Enclosures

A*	NEMA- Enclosure Type													B†
IP First Character	1	2	3	3R	3S	4	4X	5	6	6P	12	12K	13	IP Second Character
IP0_	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	IP_0
IP1_	A	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	IP_1
IP2_	A	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	IP_2
IP3_	A		AB	B	AB	AB	AB	AB	AB	AB	AB	AB	AB	IP_3
IP4_			AB	B	AB	AB	AB	AB	AB	AB	AB	AB	AB	IP_4
IP5_			AB		AB	AB	AB	A	AB	AB	A	A	A	IP_5
IP6_			A		A	AB	AB		AB	AB				IP_6
									B	B				IP_7
									B					IP_8

* A: The first IP character designation is the protection against access to hazardous parts and solid foreign objects. The respective NEMA enclosure type meets the requirements for the IEC 60529 IP first character designation.

† B: The IP second character designation is the protection against ingress of water. The respective NEMA enclosure type meets the requirements for the IEC 60529 IP second character designation.

Notes:

(1) Type-rated enclosures for hazardous locations and potentially explosive areas have been excluded from the table. The additional and supplementary letters for IP-ratings have also been excluded from the table. (See NEMA 250, UL 508, and IEC 60529.)

(2) This table should be used only to assign an IP-rating to a type-rated enclosure, and not to assign a type-rating to an IP-rated enclosure. This table assists in specifying enclosure ratings and should not be used as a definitive guide. For example, if the conditions of installation require an IP 55, this table indicates that a Type 3, 3S, 4, 4X, 6, or 6P enclosure can be utilized. However, if the conditions of installation require a NEMA Type 4, an enclosure that is only IP-rated cannot be used as a substitute.

(3) Although the corresponding NEMA type-ratings meet or exceed the corresponding IP-ratings as indicated in the table, IEC does not currently accept these type-ratings without further IEC testing.

Supplemental Information

File Name	Description	Approved
PI_24_Table_F.5.5_Revision.PNG	Table. F.5.5. For staff use.	

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Wed Mar 06 08:58:28 EST 2019

Committee Statement

**Committee
Statement:**

Per UL 50 type ratings, type 1 meets the requirements of IP2x. The change corrects the current table.

Additionally, the reference to NEMA was deleted from within the table to clarify the enclosure type is not limited to NEMA and permits the use of UL 50 and UL 50 E product standards. This change also aligns with NFPA 70.

**Response
Message:**

FR-37-NFPA 79-2019

[Public Input No. 24-NFPA 79-2018 \[Section No. F.5.5\]](#)



First Revision No. 2-NFPA 79-2019 [Chapter K]

Annex K Informational References

K.1 Referenced Publications.

The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

K.1.1 NFPA Publications.

National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 70®, *National Electrical Code®*, 2017 2020 edition.

NFPA 70E®, *Standard for Electrical Safety in the Workplace®*, 2018 2021 edition.

NFPA 77, *Recommended Practice on Static Electricity*, 2014 2019 edition.

K.1.2 Other Publications.

K.1.2.1 ANSI Publications.

American National Standards Institute, Inc., 25 West 43rd Street, 4th Floor, New York, NY 10036.

ANSI B11.0, *Safety of Machinery*, 2015.

ANSI B11-TR4, *Selection of Programmable Electronic Systems (PES/PLC) for Machine Tools*, 2004, reapproved 2015.

ANSI B11-TR6, *Safety Control Systems for Machine Tools*, 2010.

ANSI Z535.4, *Product Safety Signs and Labels*, 2011, reaffirmed 2017.

K.1.2.2 CEMA Publications.

Conveyor Equipment Manufacturers Association, 5672 Strand Ct., Suite 2, Naples, FL 34110.

CEMA 110, *Electrical Terms and Definitions*, 1995.

K.1.2.3 CENELEC Publications.

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NOTE: The IEC publishes consolidated editions of its publications with all the amendments and corrigenda included with the base document. For example:

Edition 1.0 is a base document without any amendments.

Edition 1.1 is the base 1.0 edition consolidated with one amendment.

Edition 1.2 is the base 1.0 edition consolidated with two amendments.

Edition 2.0 is the second edition of a base document. This may include new information combined as well as amendments from edition 1.x.

Edition 2.1 is the second edition of a document consolidated with amendment 1 to that edition.

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K.2 Informational References.

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[Public Input No. 13-NFPA 79-2018 \[Chapter K\]](#)

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