



Second Revision No. 2-NFPA 79-2020 [Global Comment]

12.3.1 The insulation and the finished ~~wires~~ conductors and cables shall have flame- retardant properties and temperature limits and characteristics as follows:

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

Table 12.2.2 Single Conductor Characteristics

~~Wire~~ Conductor Size (AWG or kcmil)

Table 12.3.2 Thickness of Single Conductor Insulation (mils)

~~Wire~~ Conductor Size (AWG or kcmil)

Table 12.5.1 Conductor Ampacity Based on Copper Conductors

Notes:

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

Submitter Information Verification

Committee:

Submittal Date: Mon Jan 20 10:10:02 EST 2020

Committee Statement

Committee Statement: The cited occurrences of the term “wire” are revised to reflect the technically accurate term “conductor.” These changes are made for consistency. Other examples in the document where the term “wire” is used are not revised with this action due to lack of public review to evaluate unintended consequences that may result from a collective change. The public is encouraged to submit Public Inputs for the next edition where a change in terms would be appropriate.

Response Message: SR-2-NFPA 79-2020

Public Comment No. 46-NFPA 79-2019 [Section No. 12.1.2]



Second Revision No. 24-NFPA 79-2020 [Section No. 3.3.95]

3.3.95* Safety Circuit.

A circuit The part of a control system containing one or more devices that perform a safety-related function.

A.3.3.95 Safety Circuit.

“Safety-related control system” and “safety interlock circuit” are common terms used to refer to the safety circuit in other standards. The safety circuit can include hardwired, communication, and software-related components.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Jan 21 11:40:20 EST 2020

Committee Statement

Committee Statement: The definition of the new term "safety circuit" was to align with terminology in other functional safety standards. An annex note was added to reference the common use terms of safety circuit and safety related controls system and information on examples of architectures that can comprise a safety circuit.

Response Message: SR-24-NFPA 79-2020

[Public Comment No. 9-NFPA 79-2019 \[Section No. 3.3.95\]](#)

**Second Revision No. 19-NFPA 79-2020 [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 ~~rms~~ peak 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: Tue Jan 21 09:44:40 EST 2020

Committee Statement

Committee Statement: Reverting back to current text eliminates the confusion with "supply cycle" being redundant in the text.

Response Message: SR-19-NFPA 79-2020

[Public Comment No. 23-NFPA 79-2019 \[Section No. 4.4.2.7\]](#)

[Public Comment No. 43-NFPA 79-2019 \[Section No. 4.4.2.7\]](#)

**Second Revision No. 20-NFPA 79-2020 [Section No. 4.4.2.8]****4.4.2.8*** Circuits Supplied from Power Conversion Equipment.

Electrical conductors for and equipment supplied by power conversion equipment as part of adjustable speed drive systems and servo drive systems shall be ~~one of the following:~~ identified as suitable for the electrical power characteristics and in accordance with any instructions provided by the manufacturer(s).

~~Listed flexible motor supply cable marked type RHH, RHW, RHW-2, XHH, XHHW, or XHHW-2~~

~~Selected based on the equipment manufacturer's instructions~~

A.4.4.2.8

Electrical equipment connected to the output of power conversion equipment can exhibit different behavior due to the characteristics of the output waveform. Manufacturers of such equipment provide guidance on suitability and proper use. See Chapter 12 and A.12.1.1 for information on conductor selection.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Jan 21 09:51:46 EST 2020

Committee Statement

Committee Statement: The requirements in 4.4.2.8 were revised to address general concerns for compatibility of both equipment and conductors supplied by power conversion equipment. The Annex note was added to direct the user to Chapter 12 for conductor selection and A.12.1.1 addressing electrical power characteristics affecting conductor selection.

Response Message: SR-20-NFPA 79-2020

[Public Comment No. 25-NFPA 79-2019 \[Section No. 4.4.2.8\]](#)

[Public Comment No. 4-NFPA 79-2019 \[Section No. 4.4.2.8\]](#)

**Second Revision No. 18-NFPA 79-2020 [Section No. 4.5.2]****4.5.2* Electromagnetic Compatibility (EMC).**

Transient suppression, isolation, or other appropriate means shall be provided where ~~the equipment of an industrial machine generates electrical noise or transients, which can affect the operation of equipment that is on or part~~ necessary to ensure that the expected level of electromagnetic interference or electrical transients in the machine supply circuit(s) or generated by the electrical equipment of the machine does not lead to the loss of the safety-related control function(s) of the industrial machine.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Jan 21 09:29:19 EST 2020

Committee Statement

Committee Statement: The current EMC requirements are ambiguous as the phrase "which can affect operation of equipment" could be any aspect of operation. The revised text limits the required scope to those that would lead to the loss of the safety related function(s) of the machine and is consistent with 7.8.1 regarding incoming supply transients.

Electrical noise was changed to electromagnetic interference to be consistent with NFPA_70 406.3(D) and 406.4(C).

Response Message: SR-18-NFPA 79-2020

[Public Comment No. 26-NFPA 79-2019 \[Section No. 4.5.2\]](#)



Second Revision No. 7-NFPA 79-2020 [Chapter 5]

Chapter 5 Disconnecting Means

5.1 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.

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 required 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~~ with a barrier

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 5.1.13 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.

5.1.3.1 Marking.

All terminals for each machine supply circuit shall be legibly marked (~~such as e.g.,~~ L1, L2, L3) 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 supply circuit disconnecting means or terminals described in 5.1.3 and the wall of the enclosure shall not be less than what is required by 430.10(B) of *NFPA 70*. ~~Space~~ The wire-bending space shall either be determined by the maximum wire size of the supply circuit conductors ~~or not smaller~~ be equal to or larger than the conductors required by 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 required in 17.5.7.

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.

5.1.7* Grounded Conductor.

Where a grounded conductor is used, it shall be 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.

5.1.8* Equipment Grounding Conductor Terminal.

A grounding terminal shall be provided for each machine supply circuit equipment grounding conductor.

5.1.9 Machine Supply Circuit Disconnecting (~~Isolating~~) Means.

The requirements in 5.1.9.1 through 5.1.9.8 apply to 5.1.10 through 5.1.13.

5.1.9.1

A machine supply circuit disconnecting means shall be provided for the following:

- (1) Each machine supply circuit
- (2) Each machine supply circuit to a machine or a number of machines 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 rms ac or 60 volts dc shall not be required to be provided with a machine supply circuit disconnecting means.

5.1.9.2*

Each machine supply circuit disconnecting means shall be legibly marked to indicate the equipment it disconnects.

5.1.9.3

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.

5.1.9.4

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

5.1.9.5

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 5.1.13.

5.1.9.6

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

Exception: Externally mounted machine supply circuit disconnecting means 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 5.1.9.2*

5.1.9.7

Access to enclosures containing the machine supply circuit disconnecting means shall be in accordance with ~~6.2.3.2~~ 6.2.3.1.

5.1.9.8

Where two or more machine supply circuit disconnecting means are provided within the same 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.

5.1.10 Type.

The machine supply circuit disconnecting 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

5.1.11 Requirements.**5.1.11.1***

Where the machine supply circuit disconnecting means is one of the types in 5.1.10(1) through 5.1.10(5), it shall fulfill all of the following requirements:

- (1) ~~Isolate~~ Disconnect 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 5.1.12.
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 enclosure door or enclosure 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 enclosure door or enclosure 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 indicates whether it is in the off (open) or on (closed) position.

5.1.11.2*

When the machine supply circuit disconnecting 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 5.1.11.1(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

5.1.11.3

In addition to the requirements in 5.1.11.2, an additional switching device on the machine shall be provided for routine power switching operations of the machine on and off.

5.1.12 Operating Handle.**5.1.12.1**

The center of the grip of the operating handle of 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.

5.1.12.2

An operating handle of a machine supply circuit disconnecting means shall meet the following criteria:

- (1) Be readily accessible with the enclosure door(s) 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(s) when the door is in the open or closed position

5.1.13 Excepted Circuits.**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]

5.1.13.2

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 containing the machine supply circuit disconnecting means
- (2) Line side (of the machine supply circuit disconnect disconnecting means) 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.)

5.1.13.3

The control interlocking circuits shall be capable of being disconnected at the control panel from which they are sourced.

5.1.13.4

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

- (1) ~~Permanent~~ A 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.

5.2 Other Additional Disconnecting Means.

5.2.1

~~Devices~~ In addition to the machine supply circuit disconnecting means, 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~~.

5.2.2

~~The machine supply circuit disconnecting means (see 5.1.9) shall be permitted to fulfill this requirement where there is no need for disconnecting individual portions of the machine.~~

5.2.2

The following devices shall be permitted to fulfill the function of ~~5.2.3~~ 5.2.1 :

- (1) Devices described in 5.1.10
- (2) A manual motor controller marked “suitable as motor disconnect” and in compliance with UL 508 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~~ machine supply circuit disconnecting means and overcurrent protection

5.2.3

~~Other~~ An operating means of the ~~isolation devices~~ additional disconnecting means in ~~5.2.3~~ 5.2.2 shall be as follows:

- (1) Readily accessible and complies with 5.1.12
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~~ a disconnecting 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

5.2.4 Enclosure Access.

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

5.3 Means for Removal of Power for Prevention of Unexpected Start-Up.

5.3.1

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 and~~ 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

5.3.2

Removal of power shall be accomplished by one of the following:

- (1) The machine supply circuit disconnecting means
- (2) Additional devices conforming to 5.1.10 or ~~5.2.3~~ 5.2.2
- (3) Other means (e.g., a contactor switched off by a control circuit) that meet the requirements of 5.3.3 and 5.3.4

5.3.3*

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.

5.3.4

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.

Supplemental Information

File Name	Description	Approved
79_SR7_Chapter_5.docx	FOR STAFF USE	

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Jan 20 12:55:45 EST 2020

Committee Statement

Committee Statement: 5.1.9.1 Ex.: The reference to 50 volts ac or 60 volts dc has been revised throughout the document to "50 volts rms ac or 60 volts dc" for clarity and consistency.

5.1.9.6: The section was revised by clarifying the machine supply circuit disconnecting means is to be mounted in or immediately adjacent to the control enclosure it is supplying.

5.1.9.7: The section was revised to clarify the section being referenced is 6.2.3.1.

5.1.9.8: The word "same" was added before "control enclosure" to clarify the grouping requirement is to be applied when the two or more disconnecting means are in the same control enclosure.

5.1.11.(3): The term "enclosure" was added ahead of "door" and "cover" to clarify it is the enclosure door or cover that was the subject of the independent requirement.

5.1.11.(5): The term "enclosure" was added ahead of "door" and "cover" to clarify which door or cover is the subject of the requirement.

5.1.12.2(1): The term "enclosure" was added to clarify which door is the subject of the requirement and the term "door" was changed to "door(s)" to clarify there may be one or more enclosure doors.

5.1.12.2(3): The term "door" was changed to "door(s)" to clarify there may be one or more enclosure doors.

5.1.13.2(1): The section was revised to clarify the requirement applies to the enclosure that contains the machine supply circuit disconnecting means.

5.1.13.2(2): The section was revised for consistent use of the phrase "machine supply circuit disconnecting means."

5.2: The title of the section was changed from "Other Disconnecting Means" to "Additional Disconnecting Means" to clarify that these disconnecting means are in addition to the machine supply circuit disconnecting means. The revision correlates with 5.1.9.3 that already uses "additional disconnecting means."

5.2.1: The words "in addition to the machine supply disconnecting means" were added to clarify these disconnects are in addition to the machine supply circuit disconnecting means which correlates

with the revisions made to the section title.

5.2.2: The section was deleted as additional disconnecting means are now "permitted" versus "required" and with the revisions made to 5.2.1, these disconnects are permitted in addition to the machine supply circuit disconnecting means.

5.2.3: The section was revised to clarify the referenced section is 5.2.1.

5.2.4: The term "isolation" was no longer used after the First Draft revisions to Chapter 5, so it was replaced with "additional disconnecting means" for consistency throughout the chapter.

Response Message: SR-7-NFPA 79-2020 5.1.9.3: The recommendation in PC 5 to delete the section was not accepted as this requirement is to mark the machine supply circuit disconnect as such when there are other disconnecting means present. The requirements in 5.1.9.2 are to identify what equipment is being disconnected by the supply circuit disconnecting means. 5.1.11.1(5): Replacing the term "operable" with "openable," as recommended in PC 5, was not accepted as the requirement is so the disconnecting means can be opened or closed. The Chapter 6 requirements are related to opening of the enclosure door or cover, not the disconnecting means.

[Public Comment No. 5-NFPA 79-2019 \[Chapter 5\]](#)

[Public Comment No. 30-NFPA 79-2019 \[Section No. 5.2.4\]](#)

[Public Comment No. 40-NFPA 79-2019 \[Global Input\]](#)



Second Revision No. 9-NFPA 79-2020 [Chapter 6]

Chapter 6 Protection from Electrical Hazards

6.1* General.

Electrical equipment shall provide basic protection (see Sections 6.2 and 6.4) and fault protection (see Sections 6.3 and 6.4) to persons from electric shock.

6.2 Basic Protection.

Live parts operating at or above 50 volts rms ac or 60 volts dc ~~or more~~ shall be guarded against contact.

6.2.1 General.

The basic protection (see 3.3.11) requirements of 6.2.2 or 6.2.3 shall be applied to live parts operating at or above 50 volts rms ac or 60 volts dc ~~or more~~.

6.2.2 Protection by Insulation of Live Parts.

6.2.2.1

Live parts protected by insulation shall be completely covered with insulation that ~~can~~ is removable only ~~be removed~~ by destruction.

6.2.2.2

Such insulation as described in 6.2.2.1 shall be capable of withstanding the mechanical, chemical, electrical, and thermal stresses to which the insulation is subjected under normal operating conditions.

6.2.2.3

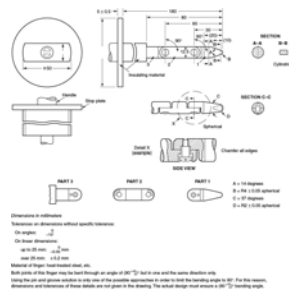
Paints, varnishes, lacquers, and similar products shall not be considered protection against electric shock under normal operating conditions.

6.2.3 Protection by Enclosures.

Equipment enclosures, enclosure openings, and observation windows shall meet the requirements of UL 508, UL 508A, UL 50, or NEMA 250.

Exception: 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 not be able to contact live parts in any direction by applying minimal force in every opening in the enclosure, including openings created by removal of parts mounted through the enclosure walls, doors, or covers.

Figure 6.2.3 Jointed Test Finger.



6.2.3.1* Enclosure Access.

Opening of an enclosure (e.g., opening doors, lids, covers) ~~containing that contains~~ live parts operating at ~~or above~~ 50 volts rms 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 is necessary for access to live parts operating at ~~over or above~~ 50 volts rms ac or 60 volts dc. ~~Live~~ All live parts mounted on the inside of doors or covers that are operating at ~~over or above~~ 50 volts rms ac or 60 volts dc 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) 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 or above~~ 50 volts rms ac or 60 volts dc are separately enclosed or guarded such that there cannot be any contact with live parts. A safety sign shall be provided in accordance with 16.2.4.

6.2.3.2 Enclosure Interlocking.

If 6.2.3.1(2) is used to limit enclosure access, none of the interlocked enclosure 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) All live parts mounted on the inside of the doors that are operating at ~~over or above~~ 50 volts rms ac or 60 volts dc 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.
- (4) Relevant information about the procedures for the defeat of the interlock is provided with the instructions for use of the electrical equipment.

6.2.3.3 Excepted Circuits.

All parts operating at ~~over or above~~ 50 volts rms ac or 60 volts dc 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.

6.3 Fault Protection.**6.3.1* General.**

Fault protection (see 3.3.48) preventing hazardous conditions to continue in the event of an insulation fault between live and exposed conductive parts shall be provided.

6.3.1.1

For each circuit part or part of the electrical equipment, at least one of the following measures shall be applied:

- (1) Measures to prevent the occurrence of a hazardous touch voltage by means of double insulation (see 6.3.2)
- (2) Automatic disconnection of the supply (interruption of one or more of the ungrounded conductors affected by the automatic operation of a protective device in case of a fault) (see 6.3.2.3)

6.3.2 Protection by Double Insulation.**6.3.2.1**

Measures to prevent the occurrence of a hazardous touch voltage ~~by means of double insulation~~ shall be by use of double insulation to prevent the occurrence of hazardous touch voltages on the accessible parts through a failure in the basic insulation.

6.3.2.2

When the means described in 6.3.2.1 is used to prevent a hazardous touch voltage, the equipment shall be distinctively marked and shall be listed to be protected by a system of double insulation or its equivalent.

6.3.2.3 Protection by Automatic Disconnection of Supply.

Automatic disconnection of the supply of any circuit affected by the particular circuit overcurrent protective device in the event of a fault shall prevent an exposure to a continuous hazardous touch voltage with the following .~~These protective measures shall comprise both of the following :~~

- (1) Protective bonding of exposed conductive parts (see 8.2.3)
- (2) The use of overcurrent protection devices for the automatic disconnection of the supply in the event of a fault

6.4 Protection by the Use of Protective Extra Low Voltage (PELV) or Class 2 Circuits.

6.4.1 General Requirements.

6.4.1.1

The use of PELV, as described in Section 6.4, shall protect persons against electric shock from indirect contact and limited area direct contact.

6.4.1.2

Class 2 circuits, as covered in 13.1.1 and Article 725 of *NFPA 70* (NEC), shall be permitted to be used to provide protection from electric shock and other hazards.

6.4.2

PELV circuits shall satisfy all of the following conditions:

- (1) The nominal voltage shall not exceed the following:
 - (a) 30 volts ac (rms value) or 60 volts dc (ripple-free) when the equipment is used in normally dry locations and when large area contact of live parts with the human body is not expected
 - (b) 6 volts ac (rms value) or 15 volts dc (ripple-free) in all other cases
- (2) One side of the circuit or one point of the source of the supply of that circuit shall be connected to the equipment grounding circuit.
- (3) Live parts of PELV circuits shall be electrically separated from other live circuits. Electrical separation shall be not less than that required between the primary and secondary circuits of a safety isolating transformer.
- (4) Conductors of each PELV circuit shall be physically separated from those of any other circuit. When this requirement is impracticable, the insulation provisions of 13.1.3 shall apply.
- (5) Attachment plugs and receptacles for a PELV circuit shall conform to the following:
 - (a) Attachment plugs shall not be able to enter receptacles of other voltage systems.
 - (b) Receptacles shall not admit plugs of other voltage systems.

6.4.3 Sources for PELV.

The source for PELV shall be one of the following:

- (1) A safety isolating transformer
- (2) A source of current providing a degree of safety equivalent to that of the safety isolating transformer (e.g., a motor generator with winding providing equivalent isolation)
- (3) An electrochemical source (e.g., a battery) or another source independent of a higher voltage circuit (e.g., a diesel-driven generator)
- (4) An identified electronic power supply conforming to standards specifying measures to be taken to ensure that, even in the case of an internal fault, the voltage at the outgoing terminals does not exceed the values specified in 6.4.2(1)

6.5 Protection Against Residual Voltages.

6.5.1

Live parts having a residual voltage greater than 60 volts after the supply has been disconnected shall be reduced to 60 volts or less within 5 seconds of disconnecting the supply voltage.

Exception No. 1: Components having a stored charge of 60 microcoulombs or less shall be exempt from this requirement.

Exception No. 2: Where such a provision would interfere with the functioning of the equipment, a durable safety sign that draws attention to the hazard and states the delay required before entry to the enclosure is allowed shall be displayed at a visible location on or immediately adjacent to the enclosure containing the capacitance.

6.5.2

The withdrawal of plugs or similar devices, which results in the exposure of conductors (e.g., pins), shall have a discharge time that does not exceed 1 second.

Exception No. 1: Exempted from this requirement are components having a stored charge of 60 microcoulombs or less.

Exception No. 2: Exempted from this requirement are conductors that are protected against direct contact.

6.5.3 Discharge of Stored Energy.

Capacitors shall be provided with a means of discharging stored energy. ~~[70: 460.6]~~

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).

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.

6.6 Arc Flash Hazard Warning.

A safety sign shall be provided in accordance with 16.2.3.

Supplemental Information

File Name	Description	Approved
79_SR9_Chapter_6.docx	FOR STAFF USE	

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Jan 20 16:44:24 EST 2020

Committee Statement

Committee Statement: 6.2.3.1: The reference to 50 volts ac or 60 volts dc has been revised throughout the chapter to "at 50 volts rms ac or 60 volts dc or more" for clarity and consistency.

6.2.3.1(1): The reference to 50 volts ac or 60 volts dc has been revised throughout the chapter to "at 50 volts rms ac or 60 volts dc or more" for clarity and consistency. The word "all" was added before "live parts" to clarify the requirement applies to all live parts mounted on the doors or covers.

6.2.3.1(3): The reference to 50 volts ac or 60 volts dc has been revised throughout the chapter to “at 50 volts rms ac or 60 volts dc or more” for clarity and consistency.

6.2.3.2: Revisions were made to clarify the referenced section and the requirements apply to the enclosure door(s) that are interlocked.

6.2.3.3: The reference to 50 volts ac or 60 volts dc has been revised throughout the chapter to “at 50 volts rms ac or 60 volts dc or more” for clarity and consistency.

6.5.3: The section was revised by removing the bracketed (extracted text) reference to NFPA 70 (NEC). The scope of NEC Article 460 (460.1) states "Surge capacitors or capacitors included as a component part of other apparatus and conforming with the requirements of such apparatus are excluded from these requirements."

Response Message: SR-9-NFPA 79-2020 6.2.3.1(1): The proposed text regarding operation and locking of all disconnecting means independent of the door position in PC 8 were not accepted as no substantiation been submitted to expand the requirements beyond the machine supply circuit disconnecting means. Additionally, these operating requirements for the machine supply circuit disconnecting means are covered in Chapter 5. Chapter 6 requirements are related to accessing the enclosure. 6.2.3.1(3): The proposed text regarding operation and locking of all disconnecting means independent of the door position in PC 8 were not accepted as no substantiation been submitted to expand the requirements beyond the machine supply circuit disconnecting means. Additionally, the operating requirements for disconnecting means are in Chapter 5. Chapter 6 requirements are related to accessing the enclosure.

[Public Comment No. 44-NFPA 79-2019 \[Section No. 6.5.3.1\]](#)

[Public Comment No. 8-NFPA 79-2019 \[Chapter 6\]](#)

[Public Comment No. 45-NFPA 79-2019 \[Section No. 6.5.3.2\]](#)

[Public Comment No. 24-NFPA 79-2019 \[Section No. 6.5.3\]](#)



Second Revision No. 8-NFPA 79-2020 [Section No. 8.3.1]

8.3.1

~~Where grounding is provided, the secondary side of the control transformer or power supply that is connected to the circuit common shall be grounded. If the control system is grounded, the output shall be grounded as near as practicable to the control power source and before the first control device. Switching devices shall not be permitted in a grounded conductor(s) unless the control circuit conductor(s) is opened simultaneously.~~

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

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Jan 20 15:02:01 EST 2020

Committee Statement

Committee Statement: The revised wording eliminates the word “common” which was undefined, clarifies where the grounding connection is to be made, and clarifies when switching devices are permitted in grounded conductors.

Response Message: SR-8-NFPA 79-2020

[Public Comment No. 31-NFPA 79-2019 \[Section No. 8.3.1\]](#)



Second Revision No. 1-NFPA 79-2020 [Section No. 8.3.2]

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 accordance with Article 725 of NFPA 70 shall not require insulation monitoring unless required by 9.4.2.1.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Jan 20 10:03:53 EST 2020

Committee Statement

Committee Statement: The revised exception text adds a reference to 9.4.2.1 for ungrounded control circuits to ensure all requirements are considered.

Response Message: SR-1-NFPA 79-2020

[Public Comment No. 27-NFPA 79-2019 \[Section No. 8.3.2\]](#)



Second Revision No. 10-NFPA 79-2020 [Section No. 9.2 [Excluding any Sub-Sections]]

Where control circuits perform safety-related functions, they Safety circuits shall meet the safety performance requirements determined by the risk assessment of the machine and the applicable functional safety standards.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Jan 20 17:02:05 EST 2020

Committee Statement

Committee Statement: Revised text refers to “safety circuits” to align with this newly defined term as found in the first draft.

Response Message: SR-10-NFPA 79-2020

[Public Comment No. 10-NFPA 79-2019 \[Section No. 9.2 \[Excluding any Sub-Sections\]\]](#)



Second Revision No. 11-NFPA 79-2020 [Section No. 9.2.7.4]

9.2.7.4* Serial Data Communication.

In a machine where the control of safety-related functions circuit relies on serial data transfer, correct communications shall be ensured by using an error detection method that is able to cope with up to three error bits in any command sequence. The safety capability of the serial data communication system shall be listed to have the same degree of safety capability as hardware-based components installed in accordance with this standard.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Jan 20 17:06:12 EST 2020

Committee Statement

Committee Statement: Revised text refers to "safety circuits" to align with this newly defined term as found in the first draft.

Response Message: SR-11-NFPA 79-2020

[Public Comment No. 11-NFPA 79-2019 \[Section No. 9.2.7.4\]](#)



Second Revision No. 12-NFPA 79-2020 [Section No. 9.3.6]

9.3.6 Protective Interlock.

Where doors or guards have interlocked switches used in safety ~~circuits with safety-related functions~~, the interlocking devices shall be listed, either ~~either~~ have direct opening operation or provide similar reliability, and prevent the operation of the equipment when the doors or guards are open (difficult to defeat or bypass).

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Jan 20 17:19:33 EST 2020

Committee Statement

Committee Statement: Revised text refers to “safety circuits” to align with this newly defined term as found in the first draft.

Response Message: SR-12-NFPA 79-2020

Public Comment No. 12-NFPA 79-2019 [Section No. 9.3.6]

**Second Revision No. 17-NFPA 79-2020 [Section No. 9.4.2.1]****9.4.2.1** Ground Faults.

Ground faults on any control circuit shall not cause unintentional starting or potentially hazardous motions or prevent stopping of the machine. Grounded control circuits shall be in accordance with Section 8.2 and Section 8.3. 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. A restart of the machine with a detected ground fault shall be prevented.

Exception: Ungrounded Class 2 low-voltage circuits installed in accordance with Article 725 of NFPA 70 shall not require insulation monitoring so long as the ground fault(s) will not cause unintentional starting or potentially hazardous motions or prevent stopping of the machine.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Jan 21 09:25:58 EST 2020

Committee Statement

Committee Statement: An exception for insulation monitoring of ungrounded Class 2 circuits was added to align with 8.3.2 and clarify when it is required

Response Message: SR-17-NFPA 79-2020

[Public Comment No. 38-NFPA 79-2019 \[Section No. 9.4.2.1\]](#)



Second Revision No. 13-NFPA 79-2020 [Section No. 9.4.3.4]

9.4.3.4* Use in ~~Safety-Related Functions~~ Circuits .

9.4.3.4.1

Software- and firmware-based controllers ~~to be~~ used in ~~safety-related functions~~ circuits shall be listed for such use.

9.4.3.4.2

~~Control systems~~ Safety circuits incorporating software- and firmware-based controllers ~~performing safety-related functions~~ shall be self-monitoring and conform to all of the following:

- (1) In the event of any single failure, the failure shall be as follows :
 - (a) Not lead to the loss of the safety-related function(s)
 - (b) Lead to the shutdown of the system in a safe state
 - (c) Prevent subsequent operation until the component failure has been corrected
 - (d) Prevent unintended startup of equipment upon correction of the failure
- (2) ~~Provide~~ The safety circuit shall provide protection equivalent to that of control systems incorporating hardwired/hardware components.
- (3) ~~Be~~ The safety circuit shall be designed in conformance with an approved standard that provides requirements for such systems.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Jan 20 17:22:38 EST 2020

Committee Statement

Committee Statement: Revised text refers to “safety circuits” to align with this newly defined term as found in the first draft.

Response Message: SR-13-NFPA 79-2020

Public Comment No. 13-NFPA 79-2019 [Section No. 9.4.3.4]



Second Revision No. 25-NFPA 79-2020 [Section No. 10.1.4.2]

10.1.4.2*

Position sensors used in safety circuits ~~for safety-related functions~~ shall either ~~shall~~ have direct opening operation or ~~shall~~ provide similar reliability.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Jan 21 11:44:11 EST 2020

Committee Statement

Committee Statement: Revised text refers to "safety circuits" to align with this newly defined term as found in the first draft.

Response Message: SR-25-NFPA 79-2020

Public Comment No. 14-NFPA 79-2019 [Section No. 10.1.4.2]

**Second Revision No. 26-NFPA 79-2020 [Section No. 10.7.1.3]****10.7.2.3**

~~Emergency stop pushbuttons~~ The devices for emergency stop described in [10.7.2.1](#) shall be listed as emergency stop devices.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Jan 21 11:51:48 EST 2020

Committee Statement

Committee Statement: The committee concluded that all devices referenced in 10.7.2.1 shall be listed for emergency stop.

Response Message: SR-26-NFPA 79-2020

[Public Comment No. 17-NFPA 79-2019 \[Section No. 10.7.1.3\]](#)

**Second Revision No. 3-NFPA 79-2020 [Section No. 15.2.1.2]****15.2.1.2**

~~Machine work lights~~ Luminaires used for machine work lighting shall not contain switches or receptacles where exposed to liquids or condensing mists unless identified for the purpose. Lampholders shall not incorporate a switch or receptacle. ~~Work lights~~ Luminaires used for machine work lighting used in wet locations shall be provided with ground-fault circuit-interrupter (GFCI) protection for personnel .

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Jan 20 10:20:30 EST 2020

Committee Statement

Committee Statement: The term "machine work lights" was changed to "luminaries used for machine work lighting" for clarity and consistency with 15.2.1.3. Ground fault circuit interrupter protection for personnel is more appropriate than ground fault protection.

Response Message: SR-3-NFPA 79-2020

[Public Comment No. 32-NFPA 79-2019 \[Section No. 15.2.1.2\]](#)

[Public Comment No. 47-NFPA 79-2019 \[Section No. 15.2.1.3\]](#)



Second Revision No. 4-NFPA 79-2020 [Section No. 15.2.1.3]

15.2.1.3

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

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Mon Jan 20 11:03:00 EST 2020

Committee Statement

Committee Statement: The change allows other types of conductors to be used for wiring to or within luminaires.

Response Message: SR-4-NFPA 79-2020

Public Comment No. 18-NFPA 79-2019 [Section No. 15.2.1.3]

**Second Revision No. 5-NFPA 79-2020 [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: Mon Jan 20 11:07:27 EST 2020

Committee Statement

Committee Statement: The scope of 15.2 is local lighting of the machine and equipment. The wording " in the machine area" is not necessary.

Response Message: SR-5-NFPA 79-2020

[Public Comment No. 33-NFPA 79-2019 \[Section No. 15.2.2.1\]](#)

**Second Revision No. 14-NFPA 79-2020 [Section No. 19.1 [Excluding any Sub-Sections]**

]

Overcurrent protection shall be provided for each motor.

Submitter Information Verification

Committee: EEI-AAA

Submission Date: Mon Jan 20 17:29:15 EST 2020

Committee Statement

Committee Statement: The requirement was deleted as it is redundant with 19.1.1 and 19.1.2.

Response Message: SR-14-NFPA 79-2020

[Public Comment No. 19-NFPA 79-2019 \[Section No. 19.1 \[Excluding any Sub-Sections\]\]](#)

[Public Comment No. 48-NFPA 79-2019 \[Section No. 19.1\]](#)

**Second Revision No. 22-NFPA 79-2020 [Section No. A.3.3.9]**

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: Tue Jan 21 11:03:04 EST 2020

Committee Statement

Committee Statement: The Annex Material is deleted. The IEC comparable terms and their definitions are in Annex J and should not be duplicated in Annex A.

Response Message: SR-22-NFPA 79-2020

[Public Comment No. 34-NFPA 79-2019 \[Section No. A.3.3.9\]](#)

[Public Comment No. 41-NFPA 79-2019 \[Section No. 3.3.8\]](#)

**Second Revision No. 23-NFPA 79-2020 [Section No. A.3.3.86]****~~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: Tue Jan 21 11:08:44 EST 2020

Committee Statement

Committee Statement: The Annex Material is deleted. The IEC comparable terms and their definitions are in Annex J and should not be duplicated in Annex A.

Response Message: SR-23-NFPA 79-2020

[Public Comment No. 42-NFPA 79-2019 \[Section No. 3.3.81\]](#)

[Public Comment No. 35-NFPA 79-2019 \[Section No. A.3.3.86\]](#)



Second Revision No. 6-NFPA 79-2020 [Section No. A.7.8.1]

A.7.8.1

The manufacturer of the industrial machinery can determine what specific type of SPD, if any, and circuit location 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 Jan 20 11:10:43 EST 2020

Committee Statement

Committee Statement: The revised text clarifies that the circuit location of overvoltage protection is an additional factor that must be considered by the equipment manufacturer.

Response Message: SR-6-NFPA 79-2020 The committee concludes the preferred term is “safety circuit” as it is more consistent with the NEC.

[Public Comment No. 16-NFPA 79-2019 \[Section No. A.7.8.1\]](#)



Second Revision No. 16-NFPA 79-2020 [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., entrapment, 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 or 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 Annex E of IEC 60204-1, Annex-E.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Jan 21 09:18:21 EST 2020

Committee Statement

Committee Statement: The proposed text reinstates the second sentence which should not have been deleted in the FR as there was no substantiation given for the deletion and it provides useful information.

Response Message: SR-16-NFPA 79-2020

Public Comment No. 20-NFPA 79-2019 [Section No. A.9.2.5.4]



Second Revision No. 15-NFPA 79-2020 [Section No. A.9.4.3.4]

A.9.4.3.4

IEC 62061, ISO 13849-1, and ISO 13849-2 provide requirements for the design of control systems incorporating the use of software- and firmware-based controllers to ~~performing~~ perform safety-related functions (i.e., safety circuits). IEC 61508 provides requirements for the design of software- and firmware-based safety controllers. IEC 61800-5-2 and IEC 61508 give guidance to the drive manufacturer on the design of drives intended to provide safety functions.

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Jan 21 09:15:49 EST 2020

Committee Statement

Committee Statement: Revised text refers to “safety circuits” to align with this newly defined term in the first draft report.

Response Message: SR-15-NFPA 79-2020

[Public Comment No. 15-NFPA 79-2019 \[Section No. A.9.4.3.4\]](#)



Second Revision No. 27-NFPA 79-2020 [Section No. A.11.1.2]

A.11.1.2

~~Windows provided for viewing internally mounted indicating devices should be 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: Tue Jan 21 12:52:54 EST 2020

Committee Statement

Committee Statement: The Annex material was deleted because it is similar but in conflict with the requirement in 11.1.2.

Response Message: SR-27-NFPA 79-2020

[Public Comment No. 36-NFPA 79-2019 \[Section No. A.11.1.2\]](#)

[Public Comment No. 49-NFPA 79-2019 \[Section No. A.11.1.2\]](#)

**Second Revision No. 21-NFPA 79-2020 [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~~ Some insulated circuit conductors (e.g., thermoplastic) connected to the output of power conversion equipment ~~are can be~~ susceptible to breakdown from arcing (i.e., corona discharge) ~~occurring~~ 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 of the output; 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 due to the following:
 - (a) Installation
 - (b) Fire hazards

Submitter Information Verification

Committee: EEI-AAA

Submittal Date: Tue Jan 21 10:12:28 EST 2020

Committee Statement

Committee Statement: The changes provide additional guidance on the proper selection of conductors when used with power conversion equipment.

Response Message: SR-21-NFPA 79-2020



Second Revision No. 30-NFPA 79-2020 [Section No. B.1]

B.1

It is recommended that the information in Figure B.1 be provided by the intended user of the equipment. It facilitates an agreement between the user and supplier on basic conditions and additional user requirements to ensure proper design, application, and utilization of the electrical equipment of the machine (see Section 4.1).

Figure B.1 Inquiry Form for the Electrical Equipment of Machines.

INQUIRY FORM FOR THE ELECTRICAL EQUIPMENT OF MACHINES	
Name of manufacturer/supplier _____	
Name of end user _____	
Tender/Order No. _____	Date _____
Type of machine/serial number _____	
1. Are there to be modifications as allowed for within this standard? ☐ Yes ☐ No	
Operating Conditions — Special Requirements (see Chapter 4)	
2. Ambient temperature range _____	
3. Humidity range _____	
4. Altitude _____	
5. Environmental (e.g., corrosive atmospheres, particulate matter, EMC) _____	
6. Non-ionizing radiation _____	
7. Vibration, shock _____	
8. Special installation and operation requirements (e.g., additional flame-retardant requirements for cables and conductors) _____	
Power Supply(ies) and Related Conditions (see Chapter 4)	
9. Anticipated voltage fluctuations (if more than ±3%) _____	
10. Anticipated frequency fluctuations (if more than in 4.4.2.2) _____	
Specification of short-term value _____	
11. Indicate possible future changes in electrical equipment that will require an increase in the electrical supply requirements _____	
12. Indicate for each source of electrical supply required:	
Nominal Voltage (V) _____ ac _____ dc	
If ac, number of phases _____ frequency _____ Hz	
Prospective short-circuit current at the point of supply to the machine _____ kA rms (see also question 15)	
Fluctuations outside values given in 4.4.2.1 _____	
13. Type of power supply system grounding:	
Wye phases midpoint grounded _____ Delta phases midpoint grounded _____	
Delta phases corner grounded _____ High impedance grounded _____	
Wye phases midpoint ungrounded _____ Delta phases ungrounded _____	
14. Is the electrical equipment to be connected to a grounded supply conductor? (see Section 5.1) ☐ Yes ☐ No	
15. Does the user or the supplier provide the overcurrent protection of the supply conductors? (see 7.2.2) ☐ Yes ☐ No	
Type and rating of overcurrent protective devices _____	
16. Machine supply circuit disconnecting device means _____	
— Is the disconnection of the grounded conductor required? ☐ Yes ☐ No	
— Is a link for the grounded conductor permissible? ☐ Yes ☐ No	
17. Type of machine supply circuit disconnecting device and associated external operating means (e.g., handle) to be provided _____	
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18. Limit of power up to which three-phase AC motors can be started directly across the incoming supply lines _____ HP	
19. Can the number of motor overload detection devices be reduced? (see Section 7.3) ☐ Yes ☐ No	
20. Where the machine is equipped with local lighting:	
— Highest permissible voltage _____ V	
— If lighting circuit voltage is not obtained directly from the power supply, state preferred voltage _____ V	
Other Considerations	
21. Functional identification (see Section 16.3) _____	
22. Inscriptions/special markings _____	
23. Mark of certification ☐ Yes ☐ No IF YES, which one? _____	
On electrical equipment? _____ In which language? _____	
24. Technical documentation (see Section 17.1)	
On what media? _____ In which language? _____	
25. Size, location, and purpose of wireways, open cable trays, or cable supports to be provided by the user (see Section 17.5) (additional sheets to be provided where necessary) _____	
26. Are locks with removable keys to be provided for fastening doors or covers? (see 6.2.3.1) ☐ Yes ☐ No	
27. Indicate if special limitations on the size or weight affect the transport of a particular machine or control equipment to the installation site:	
— Maximum dimensions _____	
— Maximum weight _____	
28. In the case of machines with frequent repetitive cycles of operation dependent on manual control, how frequently will cycles of operation be repeated? _____ per hour	
29. For what length of time is it expected that the machine will be operated at this rate without subsequent pause? _____ minutes	
30. In the case of specially built machines, is a certificate of operating tests with the loaded machine to be supplied? ☐ Yes ☐ No	
31. In the case of other machines, is a certificate of operating-type tests on a loaded prototype machine to be supplied? ☐ Yes ☐ No	
32. For cableless control systems, specify the time delay before automatic machine shutdown is initiated in the absence of a valid signal (see 9.2.7.3): _____ seconds	
33. Do you need a specific method of conductor identification to be used for the conductors referred to in 13.2.4? ☐ Yes ☐ No Type _____	
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INQUIRY FORM FOR THE ELECTRICAL EQUIPMENT OF MACHINES

Name of manufacturer/supplier _____
Name of end user _____
Vendor/Order No. _____ Date _____
Type of machinery/equipment number _____

1. Are there to be modifications as allowed for within this standard? ☐ Yes ☐ No

Operating Conditions — Special Requirements (see Section 4.4)

2. Ambient temperature range _____
3. Humidity range _____
4. Altitude _____
5. Environmental (e.g., corrosive atmospheres, particulate matter, EMC) _____
6. Non-ionizing radiation _____
7. Vibration, shock _____
8. Special installation and operation requirements (e.g., additional flame-retardant requirements for cables and conductors) _____

Power Supplies and Related Conditions (see Section 4.3)

9. Anticipated voltage fluctuations (if more than $\pm 10\%$) _____
10. Anticipated frequency fluctuations (if more than in 4.3.2.3) _____
11. Specification of short-term value _____
12. Indicate possible future changes in electrical equipment that will require an increase in the electrical supply requirements _____

12. Indicate for each source of electrical supply required:
Nominal Voltage (V) _____ ac _____ dc
If ac, number of phases _____ frequency _____ Hz
Prospective short-circuit current at the point of supply to the machine _____ kA rms (see also question 10)
Fluctuations outside values given in 4.3.2 _____

13. Type of power supply system grounding:
Wye phases midpoint grounded _____ Delta phases midpoint grounded _____
Delta phases corner grounded _____ High impedance grounded _____
Wye phases midpoint ungrounded _____ Delta phases ungrounded _____

14. Is the electrical equipment to be connected to a grounded supply conductor? (see Section 5.1) ☐ Yes ☐ No

15. Does the user or the supplier provide the overcurrent protection of the supply conductors? (see 7.2.2) ☐ Yes ☐ No

Type and rating of overcurrent protective device _____

16. Machine supply circuit disconnecting device means _____
— Is the disconnection of the grounded conductor required? ☐ Yes ☐ No
— Is a link for the grounded conductor permissible? ☐ Yes ☐ No

17. Type of machine supply circuit disconnecting device and associated external operating means (e.g., handle) to be provided _____

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18. Limit of power up to which three-phase AC motors can be started directly across the incoming supply lines _____ HP

19. Can the number of motor overload detection devices be reduced? (see Section 7.3) ☐ Yes ☐ No

20. Where the machine is equipped with local lighting:
— Highest permissible voltage _____ V
— If lighting circuit voltage is not obtained directly from the power supply, state preferred voltage _____ V

Other Considerations

21. Functional identification (see Section 16.3) _____
22. Incriptions/special markings _____
23. Mark of certification ☐ Yes ☐ No If YES, which one? _____ In which language? _____
On electrical equipment? _____

24. Technical documentation (see Section 17.1) _____
On what media? _____ In which language? _____

25. Size, location, and purpose of wireways, open cable trays, or cable supports to be provided by the user (see Section 17.6) (additional sheets to be provided where necessary) _____

26. Are lugs with removable keys to be provided for fastening doors or covers? (see 6.2.2) ☐ Yes ☐ No

27. Indicate if special limitations on the size or weight affect the transport of a particular machine or control equipment to the installation site:
— Maximum dimensions _____
— Maximum weight _____

28. In the case of machines with frequent repetitive cycles of operation dependent on manual control, how frequently will cycles of operation be repeated? _____ per hour

29. For what length of time is it expected that the machine will be operated at this rate without subsequent pause? _____ minutes

30. In the case of specially built machines, is a certificate of operating tests with the loaded machine to be supplied? ☐ Yes ☐ No

31. In the case of other machines, is a certificate of operating-type tests on a loaded prototype machine to be supplied? ☐ Yes ☐ No

32. For reliable control systems, specify the time delay before automatic machine shutdown is initiated in the absence of a valid signal (see 9.2.7.3): _____ seconds

33. Do you need a specific method of conductor identification to be used for the conductors referred to in 13.2.4? ☐ Yes ☐ No Type _____

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Supplemental Information

File Name	Description	Approved
NFPA_79_B1_comments.pdf	xref comments - for staff use	

Submitter Information Verification

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Committee Statement

Committee Statement: updated cross-references in B1(1) and B1(2)

Response Message: SR-30-NFPA 79-2020



Second Revision No. 28-NFPA 79-2020 [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*	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
N/A	—	—	—	—	—	—	—	—	B	B	—	—	—	IP_7
N/A	—	—	—	—	—	—	—	—	—	B	—	—	—	IP_8

N/A: Not applicable.

*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, Type 3S, Type 4, Type 4X, Type 6, or Type 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 enclosure 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.

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Committee Statement

Committee The acronym "NEMA" was deleted from the table notes to correlate with removing the acronym

Statement: from the table for the First Draft. The term “enclosure” was added before “type-ratings” in Table Note (3) for consistency with the other table notes.

Response SR-28-NFPA 79-2020

Message:

[Public Comment No. 50-NFPA 79-2019 \[Section No. F.5.5\]](#)



Second Revision No. 29-NFPA 79-2020 [Section No. K.1.2.3]

K.1.2.3 CENELEC Publications.

CENELEC, European Committee for Electrotechnical Standardization, CEN- CENELEC Management Centre, Avenue Marnix 17, 4th floor, B - 1000 Brussels.

~~BS- EN 60204-1, Safety of machinery — Electrical equipment of machines — Part 1: General requirements, 2017~~ 2018 .

~~BS- EN 61010-1, Safety requirements for electrical equipment for measurement, control, and laboratory use — Part 1: General requirements, 2017~~ 2019 .

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