

2011 NEC Significant* Changes to Articles 500 to 516 – Hazardous Locations

*Only the text related to the significant changes is included in this overview.

Key

Text highlighted = New text as found in the 2011 NEC.

- Underlined Text in Yellow = Comments on new text or re-wording added to the 2011 NEC.

- Throughout the entire 2011 NEC, FPN's (Fine Print Notes) have been relabeled as Informational Notes.

Article 500

500.2 Definitions

Combustible Dust. Any finely divided solid material that is 420 microns (0.017 in.) or smaller in diameter (material passing a U.S. No. 40 Standard Sieve) and presents a fire or explosion hazard when dispersed and ignited in air. [499, 2008]

- Addition of the definition of a combustible dust.

500.8(C)(5) Ambient Temperature Range. Electrical equipment designed for use in the ambient temperature range between -25°C to $+40^{\circ}\text{C}$ shall require no ambient temperature marking. For equipment rated for a temperature range other than -25°C to $+40^{\circ}\text{C}$, the marking shall specify the special range of ambient temperatures in degrees Celsius. The marking shall include either the symbol "Ta" or "Tamb."

Informational Note: As an example, such a marking might be " $-30^{\circ}\text{C} \leq \text{Ta} \leq +40^{\circ}\text{C}$."

- Clarification that ambient temperature range markings are not required on equipment approved for use within this standard range.

500.8(E) Threading. The supply connection entry thread form shall be NPT or metric.

(1) Equipment Provided with Threaded Entries for NPT Threaded Conduit or Fittings. For equipment provided with threaded entries for NPT threaded conduit or fittings, listed conduit, conduit fittings, or cable fittings shall be used. All NPT threaded conduit and fittings shall be threaded with a National (American) Standard Pipe Taper (NPT) thread.

NPT threaded entries into explosionproof equipment shall be made up with at least five threads fully engaged.

Exception: For listed explosionproof equipment, joints with factory threaded NPT entries shall be made up with at least $4\frac{1}{2}$ threads fully engaged.

Informational Note No. 1: Thread specifications for male NPT threads are located in ANSI/ASME B1.20.1-1983, *Pipe Threads, General Purpose (Inch)*.

Informational Note No. 2: Female NPT threaded entries use a modified National Standard Pipe Taper (NPT) thread with thread form per ANSI/ASME B1.20.1-1983, *Pipe Threads, General Purpose (Inch)*. See ANSI/UL 1203, *Explosionproof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations*.

(2) Equipment Provided with Threaded Entries for Metric Threaded Conduit or Fittings. For equipment with metric threaded entries, listed conduit fittings or listed cable fittings shall be used. Such entries shall be identified as being metric, or listed adapters to permit connection to conduit or NPT threaded fittings shall be provided with the equipment and shall be used for connection to conduit or NPT threaded fittings.

Metric threaded entries into explosionproof equipment shall have a class of fit of at least 6g/6H and shall be made up with at least five threads fully engaged for Group C and Group D, and at least eight threads fully engaged for Group A and Group B.

Informational Note: Threading specifications for metric threaded entries are located in ISO 965-1-1998, *ISO general purpose metric screw threads — Tolerances — Part 1: Principles and basic data*, and ISO 965-3-1998, *ISO general purpose metric screw threads — Tolerances — Part 3: Deviations for constructional screw threads*.

(3) Unused Openings. All unused openings shall be closed with listed metal close-up plugs. The plug engagement shall comply with 500.8(E)(1) or (E)(2).

- Text added to clarify all supply connection threads must be NPT or metric along with describing the required number of threads of for use in hazardous areas. Also includes requirements that fittings be listed.

Article 501

- 501.10 Wiring Methods - Clarification and text added to the various sections that Listed connectors and fittings must be used for terminations.

501.17 Process Sealing.

This section shall apply to process-connected equipment, which includes, but is not limited to, canned pumps, submersible pumps, flow, pressure, temperature, or analysis measurement instruments. A process seal is a device to prevent the migration of process fluids from the designed containment into the external electrical system. Process connected electrical equipment that incorporates a single process seal, such as a single compression seal, diaphragm, or tube to prevent flammable or combustible fluids from entering a conduit or cable system capable of transmitting fluids, shall be provided with an additional means to mitigate a single process seal failure, The additional means may include, but is not limited to the following:

- (1) A suitable barrier meeting the process temperature and pressure conditions that the barrier will be subjected to upon failure of the single process seal. There shall be a vent or drain between the single process seal and the suitable barrier. Indication of the single process seal failure shall be provided by visible leakage, an audible whistle, or other means of monitoring.
- (2) A listed Type MI cable assembly, rated at not less than 125 percent of the process pressure and not less than 125 percent of the maximum process temperature (in degrees Celsius), installed between the cable or conduit and the single process seal.
- (3) A drain or vent located between the single process seal and a conduit or cable seal. The drain or vent shall be sufficiently sized to prevent overpressuring the conduit or cable seal above 6 in. water column (1493 Pa). Indication of the single process seal failure shall be provided by visible leakage, an audible whistle, or other means of monitoring.

Process-connected electrical equipment that does not rely on a single process seal or is listed and marked "single seal" or "dual seal" shall not be required to be provided with an additional means of sealing.

Informational Note: For construction and testing requirements for process sealing for listed and marked "single seal" or "dual seal" requirements, refer to ANSI/ISA-12.27.01-2003, *Requirements for Process Sealing Between Electrical Systems and Potentially Flammable or Combustible Process Fluids*.

- New section explaining what Process Seals are, along with their requirements.

501.30 Grounding and Bonding, Class I, Divisions 1 and 2.

(B) Types of Equipment Grounding Conductors. Flexible metal conduit and liquidtight flexible metal conduit shall include an equipment bonding jumper of the wire type in compliance with 250.102.

- Additional text to clarify the installation grounding method.

501.140 Flexible Cords, Class I, Divisions 1 and 2.

(A) Permitted Uses. Flexible cord shall be permitted:

- (1) For connection between portable lighting equipment or other portable utilization equipment and the fixed portion of their supply circuit.
- (2) For that portion of the circuit where the fixed wiring methods of 501.10(A) cannot provide the necessary degree of movement for fixed and mobile electrical utilization equipment, and the flexible cord is protected by location or by a suitable guard from damage and only in an industrial establishment where conditions of maintenance and engineering supervision ensure that only qualified persons install and service the installation.
- (3) For electric submersible pumps with means for removal without entering the wet-pit. The extension of the flexible cord within a suitable raceway between the wet-pit and the power source shall be permitted.
- (4) For electric mixers intended for travel into and out of open-type mixing tanks or vats.
- (5) For temporary portable assemblies consisting of receptacles, switches, and other devices that are not considered portable utilization equipment but are individually listed for the location.

(B) Installation. Where flexible cords are used, the cords shall comply with all of the following:

- (1) Be of a type listed for extra-hard usage
- (2) Contain, in addition to the conductors of the circuit, an equipment grounding conductor complying with 400.23
- (3) Be supported by clamps or by other suitable means in such a manner that there is no tension on the terminal connections
- (4) In Division 1 locations or in Division 2 locations where the boxes, fittings, or enclosures are required to be explosionproof, the cord shall be terminated with a cord connector or attachment plug listed for the location or a cord connector installed with a seal listed for the location. In Division 2 locations where explosionproof equipment is not required, the cord shall be terminated with a listed cord connector or listed attachment plug.
- (5) Be of continuous length. Where 501.140(A)(5) is applied, cords shall be of continuous length from the power source to the temporary portable assembly and from the temporary portable assembly to the utilization equipment.

- New text that allows specific portable equipment connected by flexible cords to be used for temporary situations. Also includes the requirements for cords and connectors used in these installations.

Article 502

502.6 Zone Equipment.

Equipment listed and marked in accordance with 506.9(C)(2) for Zone 20 locations shall be permitted in Class II, Division 1 locations for the same dust atmosphere; and with a suitable temperature class.

Equipment listed and marked in accordance with 506.9(C)(2) for Zone 20, 21, or 22 locations shall be permitted in Class II, Division 2 locations for the same dust atmosphere and with a suitable temperature class.

- New section allowing listed and marked Zone equipment to be used in Class II, Division installations.

- 502.10 Wiring Methods - Clarification and text added to the various sections that Listed connectors and fittings must be used for terminations.

502.30 Grounding and Bonding, Class II, Divisions 1 and 2.

(B) Types of Equipment Grounding Conductors. Liquidtight flexible metal conduit shall include an equipment bonding jumper of the wire type in compliance with 250.102.

- Additional text to clarify the installation grounding method.

502.100 Transformers and Capacitors.

(3) Group E. No transformer or capacitor shall be installed in a Class II, Division 1, Group E location.

- Text revised to eliminate metal dust reference and changed to specify the hazardous, classified area.

502.115 Switches, Circuit Breakers, Motor Controllers, and Fuses.

(A) Class II, Division 1. In Class II, Division 1 locations, switches, circuit breakers, motor controllers, fuses, push buttons, relays, and similar devices shall be provided with enclosures identified for the location.

- Article paragraphs rewritten to simplify text to reference enclosures identified for use in the specific locations.

502.120 Control Transformers and Resistors.

- Article paragraphs rewritten to simplify text to reference enclosures identified for use in the specific locations.

502.130 Luminaires.

(1) Luminaires. Each luminaire shall be identified for the location and shall be clearly marked to indicate the maximum wattage of the lamp for which it is designed.

- Article paragraphs rewritten to simplify text to reference luminaires identified for the specific location and lamp wattage.

(B) Class II, Division 2. In Class II, Division 2 locations, luminaires shall comply with 502.130(B)(1) through (B)(5).

(4) Pendant Luminaires. Pendant luminaires shall be suspended by threaded rigid metal conduit stems, by threaded steel intermediate metal conduit stems, by chains with approved fittings, or by other approved means. For rigid stems longer than 300 mm (12 in.), permanent and effective bracing against lateral displacement shall be provided at a level not more than 300 mm (12 in.) above the lower end of the stem, or flexibility in the form of an identified fitting or a flexible connector shall be provided not more than 300 mm (12 in.) from the point of attachment to the supporting box or fitting. Where wiring between an outlet box or fitting and a pendant luminaire is not enclosed in conduit, flexible cord listed for hard usage shall be permitted if terminated with a listed cord connector that maintains the protection technique. Flexible cord shall not serve as the supporting means for a luminaire.

- Clarification and text added to specify a Listed cord connector must be used for the termination.

502.135 Utilization Equipment.

- Article paragraphs rewritten to simplify text to reference enclosures identified for use in the specific location.

502.140 Flexible Cords — Class II, Divisions 1 and 2.

Flexible cords used in Class II locations shall comply with all of the following:

- (1) Be of a type listed for extra-hard usage

Exception: Flexible cord listed for hard usage as permitted by 502.130(A)(3) and (B)(4).

- (2) Contain, in addition to the conductors of the circuit, an equipment grounding conductor complying with 400.23
- (3) Be supported by clamps or by other suitable means in such a manner that there will be no tension on the terminal connections
- (4) In Division 1 locations, the cord shall be terminated with a cord connector listed for the location or a listed cord connector installed with a seal listed for the location. In Division 2 locations, the cord shall be terminated with a listed dusttight cord connector.

- Paragraphs rewritten for clarification and to specify the ratings for the Listed connectors required for termination.

502.150 Signaling, Alarm, Remote-Control, and Communications Systems; and Meters, Instruments, and Relays.

(B) Class II, Division 2. In Class II, Division 2 locations, signaling, alarm, remote-control, and communications systems; and meters, instruments, and relays shall comply with 502.150(B)(1) through (B)(4).

(1) Contacts. Contacts shall comply with 502.150(A)(1) or shall be installed in enclosures that are dusttight or otherwise identified for the location.

- Text clarifying enclosure requirements for devices with contacts.

Article 503

503.6 Zone Equipment.

Equipment listed and marked in accordance with 506.9(C)(2) for Zone 20 locations and with a temperature class of not greater than T120°C (for equipment that may be overloaded) or not greater than T165°C (for equipment not subject to overloading) shall be permitted in Class III, Division 1 locations.

Equipment listed and marked in accordance with 506.9(C)(2) for Zone 20, 21, or 22 locations and with a temperature class of not greater than T120°C (for equipment that may be overloaded) or not greater than T165°C (for equipment not subject to overloading) shall be permitted in Class III, Division 2 locations.

- New section allowing listed and marked Zone equipment to be used in Class III, Division installations.

503.10 Wiring Methods.

Wiring methods shall comply with 503.10(A) or (B).

(A) Class III, Division 1.

(1) General. In Class III, Division 1 locations, the wiring method shall be in accordance with (1) through (4):

- (1) Rigid metal conduit, Type PVC conduit, Type RTRC conduit, intermediate metal conduit, electrical metallic tubing, dusttight wireways, or Type MC or MI cable with listed termination fittings.
- (2) Type PLTC and Type PLTC-ER cable in accordance with the provisions of Article 725 including installation in cable tray systems. The cable shall be terminated with listed fittings.
- (3) Type ITC and Type ITC-ER cable as permitted in 727.4 and terminated with listed fittings.
- (4) Type MC, MI, or TC cable installed in ladder, ventilated trough, or ventilated channel cable trays in a single layer, with a space not less than the larger cable diameter between the two adjacent cables, shall be the wiring method employed.

Exception to (4): Type MC cable listed for use in Class II, Division 1 locations shall be permitted to be installed without the spacings required by 503.10(A)(1)(4).

- New paragraph added to clarify the acceptable wiring methods for Class III, Division 1 installations.

(3) Flexible Connections. Where necessary to employ flexible connections, one or more of the following shall be permitted:

- (1) Dusttight flexible connectors
- (2) Liquidtight flexible metal conduit with listed fittings,
- (3) Liquidtight flexible nonmetallic conduit with listed fittings,
- (4) Interlocked armor Type MC cable having an overall jacket of suitable polymeric material and installed with listed dusttight termination fittings
- (5) Flexible cord in compliance with 503.140

- Clarification of the acceptable wiring methods for Class III, Division 1, flexible connection installations.

Article 504

504.30 Separation of Intrinsically Safe Conductors.

(2) Within Enclosures. Conductors of intrinsically safe circuits shall be secured so that any conductor that might come loose from a terminal is unlikely to come into contact with another terminal. The conductors shall be separated from conductors of nonintrinsically safe circuits by one of the methods in (1) through (4).

- Addition of text requiring conductors of intrinsically safe circuits to be secured from movement in addition to the termination.

(B) From Different Intrinsically Safe Circuit Conductors. The clearance between two terminals for connection of field wiring of different intrinsically safe circuits shall be at least 6 mm (0.25 in.), unless this clearance is permitted to be reduced by the control drawing. Different intrinsically safe circuits shall be separated from each other by one of the following means:

- (1) The conductors of each circuit are within a grounded metal shield.
- (2) The conductors of each circuit have insulation with a minimum thickness of 0.25 mm (0.01 in.).

- Addition of specific spacing requirement for IS terminal connections.

Article 505

- In Articles **505.2 Definitions**, and **505.4 General**, reference standards were updated to reflect latest versions.

505.7 Special Precaution.

(E) Simultaneous Presence of Flammable Gases and Combustible Dusts or Fibers/Flyings. Where flammable gases, combustible dusts, or fibers/flyings are or may be present at the same time, the simultaneous presence shall be considered during the selection and installation of the electrical equipment and the wiring methods, including the determination of the safe operating temperature of the electrical equipment.

- Addition of simultaneous presence definition into the 505 Zone Article.

505.9 Equipment.

(C) Marking. (2) Zone Equipment.

Informational Note No. 4: The EPL (or equipment protection level) may appear in the product marking. EPLs are designated as G for gas, D for dust, or M for mining and are then followed by a letter (a, b, or c) to give the user a better understanding as to whether the equipment provides either (a) a "very high," (b) a "high," or (c) an "enhanced" level of protection against ignition of an explosive atmosphere. For example, an AEx d IIC T4 motor (which is suitable by protection concept for application in Zone 1) may additionally be marked with an EPL of "Gb" to indicate that it was provided with a high level of protection, such as AEx d IIC T4 Gb.

Informational Note No. 5: Equipment installed outside a Zone 0 location, electrically connected to equipment located inside a Zone 0 location, may be marked Class I, Zone 0/1. The "/" indicates that equipment contains a separation element and can be installed at the boundary between a Zone 0 and a Zone 1 location. See ANSI/ISA-60079-26, *Electrical Apparatus for Use in Class I, Zone 0 Hazardous (Classified) Locations*.

- EPL's or Equipment Protection Levels have not yet been adopted by the U.S. However, some equipment may include these markings, and this Informational Note provides an explanation of their meaning.

(D) Class I Temperature.

(1) Temperature Classifications. Equipment shall be marked to show the operating temperature or temperature class referenced to a 40°C ambient, or at the higher ambient temperature if the equipment is rated and marked for an ambient temperature of greater than 40°C. The temperature class, if provided, shall be indicated using the temperature class (T Code) shown in Table 505.9(D)(1).

Electrical equipment designed for use in the ambient temperature range between -20°C and +40°C shall require no ambient temperature marking.

- Text added to clarify that equipment T-Codes can be referenced against ambient's higher than 40°C, and that ambient operating ranges only need to be marked when they fall outside the noted range.

Table 505.9(C)(2)(4) Types of Protection Designation

Designation	Technique	Zone*
d	Flameproof enclosure	1
db	Flameproof enclosure	1
e	Increased safety	1
eb	Increased safety	1
ia	Intrinsic safety	0
ib	Intrinsic safety	1
ic	Intrinsic safety	2
[ia]	Associated apparatus	Unclassified**
[ib]	Associated apparatus	Unclassified**
[ic]	Associated apparatus	Unclassified**
m	Encapsulation	1
ma	Encapsulation	0
mb	Encapsulation	1
nA	Nonsparking equipment	2
nAc	Nonsparking equipment	2
nC	Sparking equipment in which the contacts are suitably protected other than by restricted breathing enclosure	2
nCc	Sparking equipment in which the contacts are suitably protected other than by restricted breathing enclosure	2
nR	Restricted breathing enclosure	2
nRc	Restricted breathing enclosure	2
o	Oil immersion	1
ob	Oil immersion	1
px	Pressurization	1
pxb	Pressurization	1
py	Pressurization	1
pyb	Pressurization	1
pz	Pressurization	2
pzc	Pressurization	2
q	Powder filled	1
qb	Powder filled	1

*Does not address use where a combination of techniques is used.

**Associated apparatus is permitted to be installed in a hazardous (classified) location if suitably protected using another type of protection.

- Table updated with additional protection techniques and the Zones they are suitable for use in.

(E) Threading. The supply connection entry thread form shall be NPT or metric. Conduit and fittings shall be made wrenchtight to prevent sparking when fault current flows through the conduit system, and to ensure the explosionproof or flameproof integrity of the conduit system where applicable. Equipment provided with threaded entries for field wiring connections shall be installed in accordance with 505.9(E)(1) or (E)(2) and with (E)(3).

- Additional text to clarify supply connections maybe threaded NPT or metric.

(1) Equipment Provided with Threaded Entries for NPT Threaded Conduit or Fittings. For equipment provided with threaded entries for NPT threaded conduit or fittings, listed conduit, conduit fittings, or cable fittings shall be used.

All NPT threaded conduit and fittings referred to herein shall be threaded with a National (American) Standard Pipe Taper (NPT) thread.

NPT threaded entries into explosionproof or flameproof equipment shall be made up with at least five threads fully engaged.

Exception: For listed explosionproof or flameproof equipment, factory threaded NPT entries shall be made up with at least 4½ threads fully engaged.

Informational Note No. 1: Thread specifications for male NPT threads are located in ANSI/ASME B1.20.1-1983, *Pipe Threads, General Purpose (Inch)*.

Informational Note No. 2: Female NPT threaded entries use a modified National Standard Pipe Taper (NPT) thread with thread form per ANSI/ASME B1.20.1-1983, *Pipe Threads, General Purpose (Inch)*. See ANSI UL/ISA 60079-1, *Electrical Apparatus for Explosive Gas Atmospheres – Part 1: Flameproof Enclosures “d”*.

- Additional text to clarify NPT thread form, and that 5 fully engaged threads are required for entries.

(2) Equipment Provided with Threaded Entries for Metric Threaded Conduit or Fittings. For equipment with metric threaded entries, listed conduit fittings or listed cable fittings shall be used. Such entries shall be identified as being metric, or listed adapters to permit connection to conduit or NPT threaded fittings shall be provided with the equipment and shall be used for connection to conduit or NPT threaded fittings.

Metric threaded entries into explosionproof or flameproof equipment shall have a class of fit of at least 6g/6H and be made up with at least five threads fully engaged for Groups C, D, IIB, or IIA and not less than eight threads fully engaged for Groups A, B, IIC, or IIB + H₂.

Informational Note: Threading specifications for metric threaded entries are located in ISO 965/1-1980, *ISO general purpose metric screw threads — Tolerances — Part 1: Principles and basic data*, and ISO 965-3-1998, *ISO general purpose metric screw threads — Tolerances — Part 3: Deviations for constructional screw threads*; and ISO 965/3-1980, *Metric Screw Threads*.

(3) Unused Openings. All unused openings shall be closed with close-up plugs listed for the location and shall maintain the type of protection. The plug engagement shall comply with 505.9(E)(1) or 505.9(E)(2).

- New text that specifies Listed fittings rated for the installation environment, along with defining the number of required threads and the class of fit for metric entries.

- 505.15 Wiring Methods - Clarification and text added to the various sections that Listed connectors and fittings must be used for terminations.

505.16 Sealing and Drainage.

(C) Zone 2. In Class I, Zone 2 locations, seals shall be located in accordance with 505.16(C)(1) and (C)(2).

(1) Conduit Seals. Conduit seals shall be located in accordance with (C)(1)(a) and (C)(1)(b).

(a) For connections to enclosures that are required to be flameproof or explosionproof, a conduit seal shall be provided in accordance with 505.16(B)(1) and (B)(2). All portions of the conduit run or nipple between the seal and such enclosure shall comply with 505.16(B).

(b) In each conduit run passing from a Class I, Zone 2 location into an unclassified location. The sealing fitting shall be permitted on either side of the boundary of such location within 3.05 m (10 ft) of the boundary and shall be designed and installed so as to minimize the amount of gas or vapor within the Zone 2 portion of the conduit from being communicated to the conduit beyond the seal. Rigid metal conduit or threaded steel intermediate metal conduit shall be used between the sealing fitting and the point at which the conduit leaves the Zone 2 location, and a threaded connection shall be used at the sealing fitting. Except for listed explosionproof reducers at the conduit seal, there shall be no union,

coupling, box, or fitting between the conduit seal and the point at which the conduit leaves the Zone 2 location. Conduits shall be sealed to minimize the amount of gas or vapor within the Class I, Zone 2 portion of the conduit from being communicated to the conduit beyond the seal. Such seals shall not be required to be flameproof or explosionproof but shall be identified for the purpose of minimizing passage of gases under normal operating conditions and shall be accessible.

- New text clarifying Zone 2 seals do not need to be explosionproof, but must be identified for minimizing the passage of gases.

505.17 Flexible Cords, Class I, Zones 1 and 2.

- (5) Be terminated with a listed cord connector that maintains the type of protection where the flexible cord enters boxes, fittings, or enclosures that are required to be explosionproof or flameproof .

- Text changed from explosionproof or flameproof to requiring that the connector must maintain the protection type of the enclosure it is being connected to.

505.26 Process Sealing.

This section shall apply to process-connected equipment, which includes, but is not limited to, canned pumps, submersible pumps, flow, pressure, temperature, or analysis measurement instruments. A process seal is a device to prevent the migration of process fluids from the designed containment into the external electrical system. Process connected electrical equipment that incorporates a single process seal, such as a single compression seal, diaphragm, or tube to prevent flammable or combustible fluids from entering a conduit or cable system capable of transmitting fluids, shall be provided with an additional means to mitigate a single process seal failure. The additional means may include, but is not limited to the following:

- (1) A suitable barrier meeting the process temperature and pressure conditions that the barrier is subjected to upon failure of the single process seal. There shall be a vent or drain between the single process seal and the suitable barrier. Indication of the single process seal failure shall be provided by visible leakage, an audible whistle, or other means of monitoring.

- (2) A listed Type MI cable assembly, rated at not less than 125 percent of the process pressure and not less than 125 percent of the maximum process temperature (in degrees Celsius), installed between the cable or conduit and the single process seal.

- (3) A drain or vent located between the single process seal and a conduit or cable seal. The drain or vent shall be sufficiently sized to prevent overpressuring the conduit or cable seal above 6 in. water column (1493 Pa). Indication of the single process seal failure shall be provided by visible leakage, an audible whistle, or other means of monitoring. Process-connected electrical equipment that does not rely on a single process seal or is listed and marked "single seal" or "dual seal" shall not be required to be provided with an additional means of sealing.

Informational Note: For construction and testing requirements for process sealing for listed and marked "single seal" or "dual seal" requirements, refer to ANSI/ISA-12.27.01-2003, Requirements for Process Sealing Between Electrical Systems and Potentially Flammable or Combustible Process Fluids.

- New section explaining what Process Seals are, along with their requirements.

Article 506

506.2 Definitions.

Combustible Dust. Any finely divided solid material that is 420 microns (0.017 in.) or smaller in diameter (material passing a U.S. No. 40 Standard Sieve) and presents a fire or explosion hazard when dispersed and ignited in air. [499:3.3.3]

- Addition of the definition of a combustible dust.

- Updates to provide the latest versions of the standards referenced in the Definitions section.

506.9 Equipment Requirements.

(C) Marking.

(2) Zone Equipment. Equipment meeting one or more of the protection techniques described in 506.8 shall be marked with the following in the order shown:

- (1) Zone
- (2) Symbol "AEx"
- (3) Protection technique(s) in accordance with Table 506.9(C)(2)(3)
- (4) Temperature classification, marked as a temperature value, in degrees C, preceded by T
- (5) Ambient temperature marking in accordance with 506.9(D)

Informational Note: The EPL (or equipment protection level) may appear in the product marking. EPLs are designated as G for gas, D for dust, or M for mining, and are then followed by a letter (a, b, or c) to give the user a better understanding as to whether the equipment provides either (a) a "very high," (b) "high," or (c) an "enhanced" level of protection against ignition of an explosive atmosphere. For example, an AEx pb IIIB T165°C motor (which is suitable by protection concept for application in Zone 21) may additionally be marked with an EPL of "Db", AEx p IIIB T165°C Db.

- EPL's or Equipment Protection Levels have not yet been adopted by the U.S. However, some equipment may include these markings, and this Informational Note provides an explanation of their meaning.

Table 506.9(C)(2)(3) Types of Protection Designation

Designation	Technique	Zone*
iaD	Protection by intrinsic safety	20
ia	Protection by intrinsic safety	20
ibD	Protection by intrinsic safety	21
ib	Protection by intrinsic safety	21
[iaD]	Associated apparatus	Unclassified**
[ia]	Associated apparatus	Unclassified**
[ibD]	Associated apparatus	Unclassified**
[ib]	Associated apparatus	Unclassified**
maD	Protection by encapsulation	20
ma	Protection by encapsulation	20
mbD	Protection by encapsulation	21
mb	Protection by encapsulation	21
pD	Protection by pressurization	21
p	Protection by pressurization	21
pb	Protection by pressurization	21
tD	Protection by enclosures	21
ta	Protection by enclosures	21
tb	Protection by enclosures	21
tc	Protection by enclosures	22

*Does not address use where a combination of techniques is used.

**Associated apparatus is permitted to be installed in a hazardous (classified) location if suitably protected using another type of protection.

Informational Note: The "D" suffix on the type of protection designation was employed prior to the introduction of Group IIIA, IIIB, and IIIC; which is now used to distinguish between the type of protection employed for Group II (Gases) or Group III (Dusts).

- Table updated with additional protection techniques and the Zones they are suitable for use in.

(E) Threading. The supply connection entry thread form shall be NPT or metric. Conduit and fittings shall be made wrenchtight to prevent sparking when the fault current flows through the conduit system and to ensure the integrity of the conduit system. Equipment provided with threaded entries for field wiring connections shall be installed in accordance with 506.9(E)(1) or (E)(2) and with (E)(3).

(1) Equipment Provided with Threaded Entries for NPT Threaded Conduit or Fittings. For equipment provided with threaded entries for NPT threaded conduit or fittings, listed conduit fittings, or cable fittings shall be used. All NPT threaded conduit and fittings referred to herein shall be threaded with a National (American) Standard Pipe Taper (NPT) thread.

Informational Note: Thread specifications for NPT threads are located in ANSI/ASME B1.20.1-1983, *Pipe Threads, General Purpose (Inch)*.

(2) Equipment Provided with Threaded Entries for Metric Threaded Conduit or Fittings. For equipment with metric threaded entries, listed conduit fittings or listed cable fittings shall be used. Such entries shall be identified as being metric, or listed adapters to permit connection to conduit or NPT threaded fittings shall be provided with the equipment and shall be used for connection to conduit or NPT threaded fittings. Metric threaded entries shall be made up with at least five threads fully engaged.

(3) Unused Openings. All unused openings shall be closed with listed metal close-up plugs. The plug engagement shall comply with 506.9(E)(1) or (E)(2).

- Text added to clarify all supply connection threads must be NPT or metric and the required number of threads of for use in hazardous areas. Also includes the requirement that fittings be listed.

506.15 Wiring Methods.

Wiring methods shall maintain the integrity of the protection techniques and shall comply with 506.15(A), (B), or (C).

(A) Zone 20. In Zone 20 locations, the following wiring methods shall be permitted.

- (1) Threaded rigid metal conduit or threaded steel intermediate metal conduit.
- (2) Type MI cable terminated with fittings listed for the location. Type MI cable shall be installed and supported in a manner to avoid tensile stress at the termination fittings.

Exception: MI cable and fittings listed for Class II, Division 1 locations shall be permitted to be used.

- (3) In industrial establishments with limited public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type MC-HL cable listed for use in Zone 20 locations, with a continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the application, shall be permitted. Type MC-HL cable shall be installed in accordance with the provisions of Article 330, Part II.

Exception: Type MC-HL cable and fittings listed for Class II, Division 1 locations shall be permitted to be used.

- (4) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, and where the cable is not subject to physical damage, Type ITC-HL cable listed for use in Zone 1 or Class I, Division 1 locations, with a gas/vaportight continuous corrugated metallic sheath and an overall jacket of suitable polymeric material, and terminated with fittings listed for the application. Type ITC-HL cable shall be installed in accordance with the provisions of Article 727.

- (5) Fittings and boxes shall be identified for use in Zone 20 locations.

Exception: Boxes and fittings listed for Class II, Division 1 locations shall be permitted to be used.

- (6) Where necessary to employ flexible connections, liquidtight flexible metal conduit with listed fittings, liquidtight flexible nonmetallic conduit with listed fittings, or flexible cord listed for extra-hard usage and provided with listed fittings shall be used. Where flexible cords are used, they shall also comply with 506.17 and shall be terminated with a listed cord connector that maintains the type of protection of the terminal compartment. Where flexible connections are subject to oil or other corrosive conditions, the insulation of the conductors shall be of a type listed for the condition or shall be protected by means of a suitable sheath.

Exception: Flexible conduit and flexible conduit and cord fittings listed for Class II, Division 1 locations shall be permitted to be used.

- Additional text to clarify the acceptable wiring methods for use in Zone, dust installations.

506.17 Flexible Cords.

- (5) Be terminated with a listed cord connector that maintains the protection technique of the terminal compartment.

- Additional text to require listed connectors that are rated to provide the same protection level as the device being terminated.

Article 511

ARTICLE 511 Commercial Garages, Repair and Storage

511.3 Area Classification, General.

(C) Major Repair Garages.

(1) Floor Areas.

(a) *Ventilation Provided.* The floor area shall be unclassified where there is mechanical ventilation providing a minimum of four air changes per hour or $0.3 \text{ m}^3/\text{min}/\text{m}^2$ ($1 \text{ cfm}/\text{ft}^2$) of exchanged air for each square meter (foot) of floor area. Ventilation shall provide for air exchange across the entire floor area, and exhaust air shall be taken at a point within 0.3 m (12 in.) of the floor.

- Update to include both metric and U.S. units.

(D) Minor Repair Garages. Where flammable liquids having a flash point below 38°C (100°F) such as gasoline, or gaseous fuels such as natural gas or hydrogen, will not be dispensed or transferred, the classification rules in (D)(1), (D)(2), and (D)(3) shall apply to the lubrication and service rooms.

(1) Floor Areas. Floor areas in minor repair garages without pits, belowgrade work areas, or subfloor work areas shall be unclassified. Where floor areas include pits, belowgrade work areas, or subfloor work areas in lubrication or service rooms, the classification rules in (a) or (b) shall apply.

(a) *Ventilation Provided.* The entire floor area shall be unclassified where there is mechanical ventilation providing a minimum of four air changes per hour or $0.3 \text{ m}^3/\text{min}/\text{m}^2$ ($1 \text{ cfm}/\text{ft}^2$) of exchanged air for each square meter (foot) of floor area. Ventilation shall provide for air exchange across the entire floor area, and exhaust air shall be taken at a point within 0.3 m (12 in.) of the floor.

- Update to include both metric and U.S. units.

Article 514

- Table 514.3(B)(1) was updated to include an equivalent Zone (Group IIA) column.

514.11 Circuit Disconnects.

(A) General. Each circuit leading to or through dispensing equipment, including all associated power, communications, data, and video circuits, and equipment for remote pumping systems, shall be provided with a clearly identified and readily accessible switch or other approved means, located remote from the dispensing devices, to disconnect simultaneously from the source of supply, all conductors of the circuits, including the grounded conductor, if any.

Single-pole breakers utilizing handle ties shall not be permitted.

- Additional text to clarify all circuit types, not just power must have provisions for disconnecting.

514.13 Provisions for Maintenance and Service of Dispensing Equipment.

Each dispensing device shall be provided with a means to remove all external voltage sources, including power, communications, data, and video circuits and including feedback, during periods of maintenance and service of the dispensing equipment. The location of this means shall be permitted to be other than inside or adjacent to the dispensing device. The means shall be capable of being locked in the open position.

- Additional text to clarify all circuit types, not just power must have provisions for removing any external sources of voltage.