

# BFAAM Apprenticeship Program

Period # 4

Related Training Instruction (RTI)

Module 5 – NFPA 70 –

Reading material associated with this  
module: Chapter 5, NFPA 70,  
*National Electrical Code (NEC)*, 2014 Edition

# **National Electric Code® NEC(760)**

## **Chapter 5 - Special Occupancies**

# **Article 500**

**Hazardous (Classified) Locations, Classes  
I, II, and III, Divisions 1 and 2**

# National Electric Code® NEC(760)

## Chapter 5 - Special Occupancies

500.1 Scope – Articles 500 through 504 cover the requirements for electrical & electronic equipment and wiring for all voltages in Class I, Divisions 1 and 2; Class II, Divisions 1 and 2,; and Class III, Divisions 1 and 2 locations where fire or explosion hazards may exist due to flammable gases, flammable liquid-produced vapors, combustible liquid-produced vapors, combustible dusts, or ignitable fibers/flyings.

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### 500.2 Definitions

**Combustible Dust.** Dust particles that are 500 microns or smaller in diameter (material passing a U.S. No. 35 Standard Sieve) and presents a fire or explosion hazard when dispersed and ignited in air.

**Combustible Gas Detection System** A protection technique utilizing stationary gas detectors in industrial establishments.

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## Chapter 5 - Special Occupancies

### 500.2 Definitions - Cont.

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

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### 500.2 Definitions - Cont.

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

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### 500.2 Definitions - Cont.

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

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### 500.2 Definitions - Cont.

**Electrical and Electronic Equipment** Materials, fittings, devices, appliances, and the like that are part of, or in connection with, an electrical installation.



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### 500.2 Definitions -

Article 100 Definitions;

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

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### 500.2 Definitions - Cont.

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

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### 500.2 Definitions - Cont.

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

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### 500.2 Definitions - Cont.

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

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### 500.2 Definitions - Cont.

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

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### 500.2 Definitions - Cont.

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

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### 500.2 Definitions - Cont.

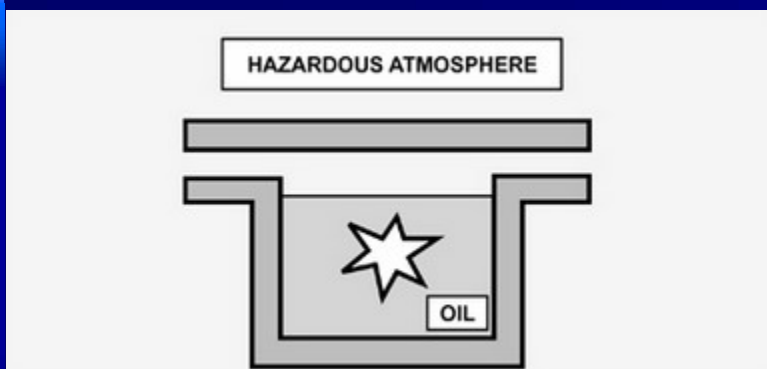
**Nonincendive Field Wiring Apparatus** Apparatus intended to be connected to nonincendive field wiring.

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



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### 500.2 Definitions - Cont.

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

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### 500.2 Definitions - Cont.

**Unclassified Locations** Locations determined to be neither Class I, Division 1; Class I, Division 2; Class I, Zone 0; Class I, Zone 1; Class I, Zone 2; Class II, Division 1; Class II, Division 2; Class III, Division 1; Class III, Division 2; Zone 20; Zone 21; Zone 22; or any combination thereof.

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### 500.5 Classifications of Locations

**(A) Classifications of Locations** Locations shall be classified depending on the properties of the flammable gas, flammable liquid-produced vapor, combustible-liquid produced vapors, combustible dusts, or fibers/flyings that may be present, and the likelihood that a flammable or combustible concentration or quantity is present. Each room, section, or area shall be considered individually in determining its classification.

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### **500.5 Classifications of Locations - Cont.**

Where pyrophoric materials are the only materials used or handled, these locations are outside the scope of this article.

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### 500.5 Classifications of Locations - Cont.

**(B) Class I Locations** Class I locations are those in which flammable gases, flammable liquid-produced vapors, or combustible liquid-produced vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures. Class I locations shall include those specified in 500.5(B)(1) and (B)(2).

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### 500.5 Classifications of Locations - Cont.

**(1) Class I, Division 1** A Class I, Division 1 location is a location

**(1)** In which ignitable concentrations of flammable gases, flammable liquid-produced vapors, or combustible liquid-produced vapors can exist under normal operating conditions, or

**(2)** In which ignitable concentrations of such flammable gases, flammable liquid-produced vapors, or combustible liquids above their flash points may exist frequently because of repair or maintenance operations or because of leakage, or

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### 500.5 Classifications of Locations - Cont.

**(3)** In which breakdown or faulty operation of equipment or processes might release ignitable concentrations of flammable gases, flammable liquid-produced vapors, or combustible liquid-produced vapors and might also cause simultaneous failure of electrical equipment in such a way as to directly cause the electrical equipment to become a source of ignition.



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### 500.5 Classifications of Locations - Cont.

**(2) Class I, Division 2** A Class I, Division 2 location is a location

**(1)** In which volatile flammable gases, flammable liquid-produced vapors, or combustible liquid-produced vapors are handled, processed, or used, but in which the liquids, vapors, or gases will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or systems or in case of abnormal operation of equipment, or

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### 500.5 Classifications of Locations - Cont.

**(2)** In which ignitable concentrations of flammable gases, flammable liquid-produced vapors, or combustible liquid-produced vapors are normally prevented by positive mechanical ventilation and which might become hazardous through failure or abnormal operation of the ventilating equipment, or

**(3)** That is adjacent to a Class I, Division 1 location, and to which ignitable concentrations of flammable gases, flammable liquid-produced vapors, or combustible liquid-produced vapors above their flash points might occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

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### 500.5 Classifications of Locations - Cont.

**(C) Class II Locations** Class II locations are those that are hazardous because of the presence of combustible dust. Class II locations shall include those specified in 500.5(C)(1) and (C)(2).

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### 500.5 Classifications of Locations - Cont.

**(1) Class II, Division 1** A Class II, Division 1 location is a location

- (1)** In which combustible dust is in the air under normal operating conditions in quantities sufficient to produce explosive or ignitable mixtures, or
- (2)** Where mechanical failure or abnormal operation of machinery or equipment might cause such explosive or ignitable mixtures to be produced, and might also provide a source of ignition through simultaneous failure of electrical equipment, through operation of protection devices, or from other causes, or
- (3)** In which Group E combustible dusts may be present in quantities sufficient to be hazardous.

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### 500.5 Classifications of Locations - Cont.

**(2) Class II, Division 2** A Class II, Division 2 location is a location

- (1)** In which combustible dust due to abnormal operations may be present in the air in quantities sufficient to produce explosive or ignitable mixtures; or
- (2)** Where combustible dust accumulations are present but are normally insufficient to interfere with the normal operation of electrical equipment or other apparatus, but could as a result of infrequent malfunctioning of handling or processing equipment become suspended in the air; or
- (3)** In which combustible dust accumulations on, in, or in the vicinity of the electrical equipment could be sufficient to interfere with the safe dissipation of heat from electrical equipment, or could be ignitable by abnormal operation or failure of electrical equipment.

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### 500.5 Classifications of Locations - Cont.

**(D) Class III Locations** Class III locations are those that are hazardous because of the presence of easily ignitable fibers or where materials producing combustible flyings are handled, manufactured, or used, but in which such fibers/flyings are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixtures. Class III locations shall include those specified in 500.5(D)(1) and (D)(2).

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### 500.5 Classifications of Locations - Cont.

**(1) Class III, Division 1** A Class III, Division 1 location is a location in which easily ignitable fibers/flyings are handled, manufactured, or used.

**(2) Class III, Division 2** A Class III, Division 2 location is a location in which easily ignitable fibers/flyings are stored or handled other than in the process of manufacture

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**500.6 Material Groups.** For purposes of testing, approval, and area classification, various air mixtures (not oxygen-enriched) shall be grouped in accordance with 500.6(A) and (B).



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### 500.6 Material Groups - Cont.

**(A) Class I Group Classifications** Class I groups shall be according to 500.6(A)(1) through (A)(4).

**(1) Group A** Acetylene.

**(2) Group B** Flammable gas, flammable liquid–produced vapor, or combustible liquid–produced vapor mixed with air that may burn or explode, having either a maximum experimental safe gap (MESG) value less than or equal to 0.45 mm or a minimum igniting current ratio (MIC ratio) less than or equal to 0.40

**(3) Group C** Flammable gas, flammable liquid–produced vapor, or combustible liquid–produced vapor mixed with air that may burn or explode, having either a maximum experimental safe gap (MESG) value greater than 0.45 mm and less than or equal to 0.75 mm, or a minimum igniting current ratio (MIC ratio) greater than 0.40 and less than or equal to 0.80

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### 500.6 Material Groups - Cont.

**(4) Group D.** Flammable gas, flammable liquid–produced vapor, or combustible liquid–produced vapor mixed with air that may burn or explode, having either a maximum experimental safe gap (MESG) value greater than 0.75 mm or a minimum igniting current ratio (MIC ratio) greater than 0.80.

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### 500.6 Material Groups - Cont.

**(B) Class II Group Classifications** Class II groups shall be in accordance with 500.6(B)(1) through (B)(3).

**(1) Group E** Atmospheres containing combustible metal dusts, including aluminum, magnesium, and their commercial alloys, or other combustible dusts whose particle size, abrasiveness, and conductivity present similar hazards in the use of electrical equipment.

**(2) Group F.** Atmospheres containing combustible carbonaceous dusts that have more than 8 percent total entrapped volatiles or that have been sensitized by other materials so that they present an explosion hazard. Coal, carbon black, charcoal, and coke dusts are examples of carbonaceous dusts.

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### 500.6 Material Groups - Cont.

**(3) Group G** Atmospheres containing combustible dusts not included in Group E or F, including flour, grain, wood, plastic, and chemicals.

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### **500.7 Protection Techniques**

Section 500.7(A) through (L) shall be acceptable protection techniques for electrical and electronic equipment in hazardous (classified) locations.

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### 500.7 Protection Techniques - Cont.

**(A) Explosionproof Equipment** This protection technique shall be permitted for equipment in Class I, Division 1 or 2 locations.

**(B) Dust Ignitionproof** This protection technique shall be permitted for equipment in Class II, Division 1 or 2 locations.

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### 500.7 Protection Techniques - Cont.

**(C) Dusttight** This protection technique shall be permitted for equipment in Class II, Division 2 or Class III, Division 1 or 2 locations.

**(D) Purged and Pressurized** This protection technique shall be permitted for equipment in any hazardous (classified) location for which it is identified.



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### 500.7 Protection Techniques - Cont.

**(E) Intrinsic Safety** This protection technique shall be permitted for equipment in Class I, Division 1 or 2; or Class II, Division 1 or 2; or Class III, Division 1 or 2 locations. The provisions of Articles 501 through 503 and Articles 510 through 516 shall not be considered applicable to such installations, except as required by Article 504, and installation of intrinsically safe apparatus and wiring shall be in accordance with the requirements of Article 504

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### 500.7 Protection Techniques - Cont.

**(F) Nonincendive Circuit** This protection technique shall be permitted for equipment in Class I, Division 2; Class II, Division 2; or Class III, Division 1 or 2 locations.

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### 500.7 Protection Techniques - Cont.

**(G) Nonincendive Equipment** This protection technique shall be permitted for equipment in Class I, Division 2; Class II, Division 2; or Class III, Division 1 or 2 locations.

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### 500.7 Protection Techniques - Cont.

**(H) Nonincendive Component** This protection technique shall be permitted for equipment in Class I, Division 2; Class II, Division 2; or Class III, Division 1 or 2 locations.

**(I) Oil Immersion** This protection technique shall be permitted for current-interrupting contacts in Class I, Division 2 locations as described in 501.115(B)(1)(2).

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### 500.7 Protection Techniques - Cont.

**(J) Hermetically Sealed** This protection technique shall be permitted for equipment in Class I, Division 2; Class II, Division 2; or Class III, Division 1 or 2 locations.

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### 500.7 Protection Techniques - Cont.

**(K) Combustible Gas Detection System** A combustible gas detection system shall be permitted as a means of protection in industrial establishments with restricted public access and where the conditions of maintenance and supervision ensure that only qualified persons service the installation.

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### **500.8 Equipment.**

Articles 500 through 504 require equipment construction and installation that ensure safe performance under conditions of proper use & maintenance.

**(C) Marking.** Equipment shall be marked to show the environment for which it has been evaluated. Unless otherwise specified or allowed in (C)(6), the marking shall include the information in (C)(1) through (C)(5).

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- (1) Class.** The marking shall specify the class(es) for which the equipment is suitable.
- (2) Division.** The marking shall specify the division if the equipment is suitable for Division 2 only. Equipment suitable for Division 1 shall be permitted to omit the division marking.
- (3) Material Classification Group.** The marking shall specify the applicable material classification group(s) in accordance with 500.6.
- (4) Equipment Temperature.**
- (5) Ambient Temperature Range.**



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## Chapter 5 - Special Occupancies

# Article 501

## Class I Locations

**501.1 Scope.** Article 501 covers the requirement for electrical & electronic equipment and wiring for all voltages in Class I, Division 1 & 2 locations where fire or explosion hazards may exist due to flammable gases or vapors or flammable liquids.

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### **501.150 Signaling, Alarm, Remote-Control, and Communications Systems**

**(A) Class I, Division 1** In Class I, Division 1 locations, all apparatus and equipment of signaling, alarm, remote-control, and communications systems, regardless of voltage, shall be identified for Class I, Division 1 locations, and all wiring shall comply with 501.10(A), 501.15(A), and 501.15(C).

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### 501.150 Signaling, Alarm, Remote-Control, and Communications Systems - Cont.

**(B) Class I, Division 2** In Class I, Division 2 locations, signaling, alarm, remote-control, and communications systems shall comply with 501.150(B)(1) through (B)(4).

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### 501.150 Signaling, Alarm, Remote-Control, and Communications Systems - Cont.

**(1) Contacts** Switches, circuit breakers, and make-and-break contacts of pushbuttons, relays, alarm bells, and horns shall have enclosures identified for Class I, Division 1 locations in accordance with 501.105(A).

Exception: General-purpose enclosures shall be permitted if current-interrupting contacts are one of the following

- (1)** Immersed in oil
- (2)** Enclosed within a chamber hermetically sealed against the entrance of gases or vapors
- (3)** In nonincendive circuits
- (4)** Part of a listed nonincendive component

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### 501.150 Signaling, Alarm, Remote-Control, and Communications Systems - Cont.

**(2) Resistors and Similar Equipment** Resistors, resistance devices, thermionic tubes, rectifiers, and similar equipment shall comply with 501.105(B)(2).

**(3) Protectors** Enclosures shall be provided for lightning protective devices and for fuses. Such enclosures shall be permitted to be of the general-purpose type.

**(4) Wiring and Sealing** All wiring shall comply with 501.10(B), 501.15(B), and 501.15(C).

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# Article 502

## Class II Locations

**502.1 Scope.** Article 502 covers the requirement for electrical & electronic equipment and wiring for all voltages in Class II, Division 1 & 2 locations where fire or explosion hazards may exist due to combustible dust.

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

**(A) Class II, Division 1.** In Class II, Division 1 locations, signaling, alarm, remote-control, and communications systems; and meters, instruments, and relays shall comply with 502.150(A)(1) through (A)(3).

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

**(1) Contacts** Switches, circuit breakers, relays, contactors, fuses and current-breaking contacts for bells, horns, howlers, sirens, and other devices in which sparks or arcs may be produced shall be provided with enclosures identified for the location.

**(2) Resistors and Similar Equipment** Resistors, transformers, choke coils, rectifiers, thermionic tubes, and other heat-generating equipment shall be provided with enclosures identified for the location.

**(3) Rotating Machinery** Motors, generators, and other rotating electrical machinery shall comply with 502.125(A).



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

**(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).

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

**(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.

**(2) Transformers and Similar Equipment.** The windings and terminal connections of transformers, choke coils, and similar equipment shall comply with 502.120(B)(2).

**(3) Resistors and Similar Equipment.** Resistors, resistance devices, thermionic tubes, rectifiers, and similar equipment shall comply with 502.120(B)(3).

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

**(4) Rotating Machinery.** Motors, generators, and other rotating electrical machinery shall comply with 502.125(B).

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## Chapter 5 - Special Occupancies

# Article 503

## Class III Locations

**503.1 Scope.** Article 503 covers the requirement for electrical & electronic equipment and wiring for all voltages in Class III, Division 1 & 2 locations where fire or explosion hazards may exist due to ignitable fibers / flyings.

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# Article 504

## Intrinsically Safe Locations

**504.1 Scope.** This Article covers the installation of intrinsically safe (I.S.) apparatus, wiring, and systems for Class I, II, and III locations.

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# Article 505

Zone 0, 1, and 2 Locations

Hazards may exist due to flammable  
gases, vapors or liquids

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# Article 506

Zone 20, 21, and 22

Hazards may exist due to  
combustible dust or ignitable  
fibers/flyings

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# **Article 510**

**Hazardous(Classified) Locations –  
Specific Articles 511 through 517**



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# **Article 511**

## **Commercial Garages, Repair and Storage**

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# Article 513

## Aircraft Hangers

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# Article 514

## Motor Fuel Dispensing Facilities

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# **Article 515**

## **Bulk Storage Plants**

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# **Article 516**

## **Spray Application, Dipping, and Coating Processes**

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# **Article 517**

## **Health Care Facilities**

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**517.32 Life Safety Branch.** No function other than those listed in 517.32(A) through (H) shall be connected to the life safety branch. The life safety branch of the emergency system shall supply power for the following lighting, receptacles, and equipment.

**(C)Alarm and Alerting Systems** Alarm and alerting systems including the following:

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### 517.32 Life Safety Branch - Cont.

**(1)** Fire alarms

**(2)** Alarms required for systems used for the piping of nonflammable medical gases

**(3)** Mechanical, control, and other accessories required for effective life safety systems operation shall be permitted to be connected to the life safety branch.

**(D)Communications Systems** Hospital communications systems, where used for issuing instructions during emergency conditions.



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### **VI. Communications, Signaling Systems, Data Systems, Fire Alarm Systems, and Systems Less Than 120 Volts, Nominal**

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**517.80 Patient Care Areas.** Equivalent insulation and isolation to that required for the electrical distribution systems in patient care areas shall be provided for communications, signaling systems, data system circuits, fire alarm systems, and systems less than 120 volts, nominal.

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### **517.80 Patient Care Areas -Cont.**

Class 2 and Class 3 signaling and communications systems and power-limited fire alarm systems shall not be required to comply with the grounding requirements of 517.13, to comply with the mechanical protection requirements of 517.30(C)(3)(5), or to be enclosed in raceways, unless otherwise specified by Chapter 7 or 8.

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### **517.80 Patient Care Areas -Cont.**

Secondary circuits of transformer powered communications or signaling systems shall not be required to be enclosed in raceways unless otherwise specified by Chapter 7 or 8.

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# Article 518

## Assembly Occupancies

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# **Article 520**

**Theaters, Audience Areas of Motion  
Picture and Television Studios,  
Performance Areas, and Similar  
Locations**

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# **Article 522**

## **Commercial Systems for Permanent Amusement Attractions**

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# **Article 525**

## **Carnivals, Circuses, Fairs, and Similar Events**



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# **Article 530**

## **Motion Picture and Television Studios and Similar Locations**

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# Article 540

## Motion Picture Projection Rooms

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# **Article 545**

## **Manufactured Buildings**

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# Article 547

## Agricultural Buildings

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# **Article 550**

**Mobile Homes, Manufactured Homes,  
and Mobil Home Parks**

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# **Article 551**

## **Recreational Vehicles and Recreational Vehicle Parks**

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# Article 552

## Park Trailers

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# Article 553

## Floating Buildings



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# **Article 555**

## **Marinas and Boatyards**

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# Article 590

## Temporary Installations

# BFAAM Apprenticeship Program

Period #

Reading Assignment for  
Module ## – NFPA 70 NEC –

Reading material associated with this  
module: Chapter 5, NFPA 70, *National  
Electrical Code, (NEC) 2014 Edition*