
CONTENTS

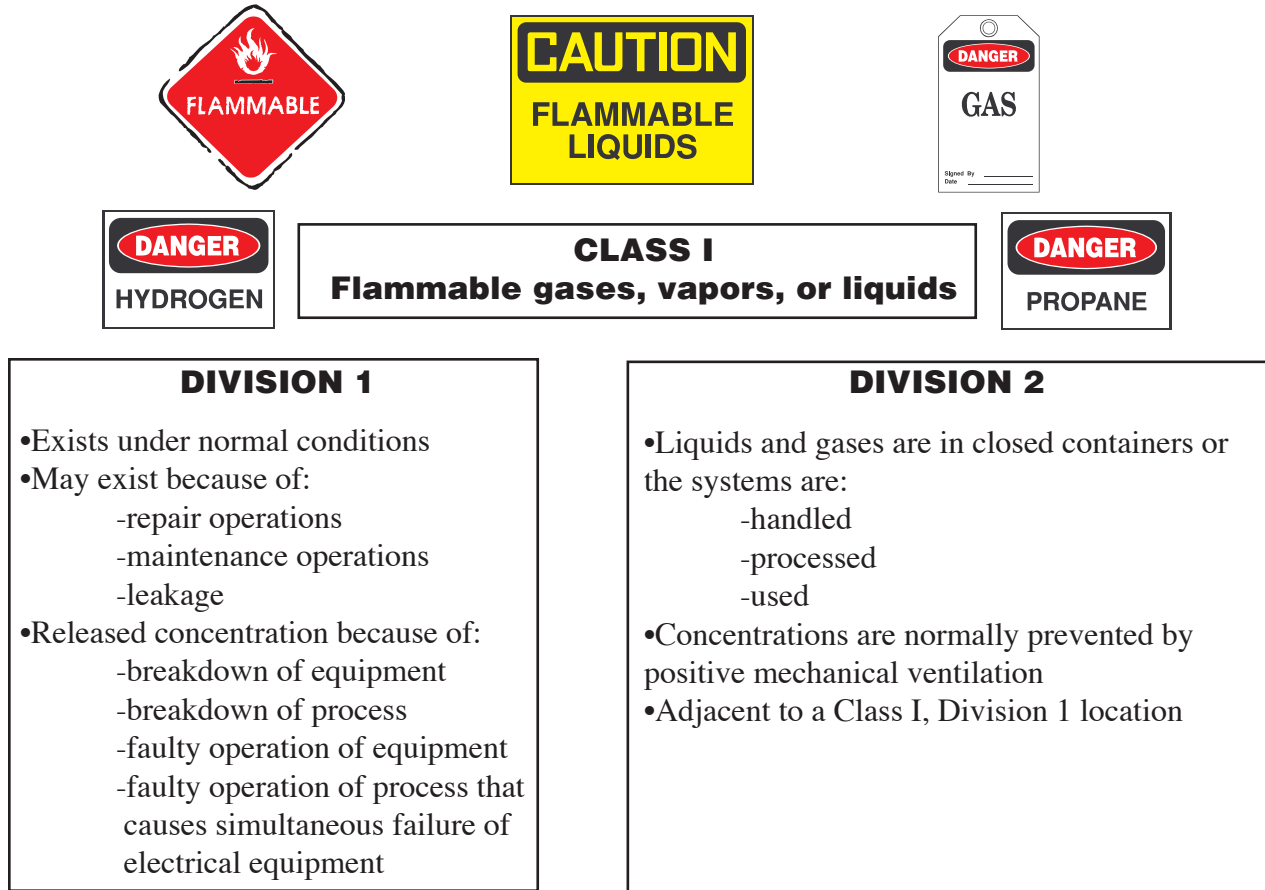
	<u>PAGE</u>
Article 500 - Hazardous Locations, Classes I, II, and III	1
Article 501 - Class I Locations	18
Quiz #1 - Articles 500 - 501	58
Quiz #2 - Articles 500 - 501	60
Article 502 - Class II Locations	62
Article 503 - Class III Locations	84
Articles 504 - Intrinsically Safe Systems	94
Article 505 - Class I, Zone 0, 1, and 2 Locations	101
Article 506 - Zone 20, 21, and 22 Dusts, Fibers, Flyings	125
Quiz #1 - Articles 502 - 506	128
Quiz #2 - Articles 502 - 506	131
Quiz #3 - Articles 502 - 506	133
Article 510 - Hazardous Locations - Specific	135
Articles 511 - Commercial Garages	137
Article 513 - Aircraft Hangars	151

CONTENTS

	<u>PAGE</u>
Article 514 - Motor Fuel Dispensing Facilities _____	160
Quiz #1 - Articles 510 - 514 _____	176
Quiz #2 - Articles 510 - 514 _____	178
Article 515 - Bulk Storage Plants _____	180
Article 516 - Spray Application, Dipping and Coating ____	190
Article 517 - Health Care Facilities _____	215
Article 517.18 - General Care Areas _____	221
Article 517.25 - Essential Electrical System _____	229
Article 517.40 - Nursing Home and Limited Care _____	243
Article 517.60 - Anesthetizing Locations _____	251
Article 517.70 - X-Ray Installations _____	259
Quiz #1 - Articles 515 - 517 _____	268
Quiz #2 - Articles 515- 517 _____	270
Quiz #3 - Articles 515 - 517 _____	272
Final Exam _____	274
Answers _____	282

Part I. General

501.1. Article 501 contains specific regulations that control the selection of equipment and the installation techniques required where flammable mixtures of gases, vapors or liquids either exist or can occur are identified as Class I locations.



GROUP A: Atmospheres containing acetylene

GROUP B: Atmospheres such as butadiene, ethylene, oxide, propylene oxide, acrolein, hydrogen, or gases or vapors equivalent in hazard to hydrogen, such as manufactured gas.

GROUP C: Atmospheres such as cyclopropane, ethyl ether, ethylene, or gases or vapors equivalent in hazard.

GROUP D: Atmospheres such as acetone, alcohol, ammonia, benzene, benzol, butane, gasoline, hexane, lacquer solvent vapors, naphtha, natural gas, propane, or gases or vapors equivalent in hazard.

•Note: The major reason Group A (acetylene) is separate from Group B materials (such as hydrogen) is that the pressure generated when acetylene-air mixtures explode are greater than the pressures generated when hydrogen-air mixtures explode.

501.5. Equipment "listed and marked" for installation in Zone 0, 1, and 2 locations may be used, provided it is suitable for the location as determined in accordance with 505.9(C)(2)

Part II. Wiring

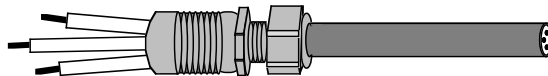
501.10(A)(1). Class I, Division 1 wiring rules are:

(1) Threaded rigid metal conduit or threaded steel intermediate conduit.



(2) Type PVC conduit, Type RTRC conduit, and Type HDPE conduit shall be permitted where buried 24" and encased in 2" of concrete.

(3) MI cable terminated with fittings. Although MI cable is not "explosionproof" by definition, the magnesium oxide acts as both an electrical insulator for the conductors and as a continuous seal. Standard Type MI cable fittings are not permitted in Class I, Division 1 locations. Special explosionproof Type MI cable fittings are required, because the unthreaded joints between the outside of the cable and the inside of the fitting must be explosionproof.



(4) Metal clad cable Type TC-ER-HL listed for Class I, Zone 1 or Division 1 where installed in industrial buildings with restricted public access and where only qualified persons service the installation.



(5) In restricted industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, listed Type P cable with metal braid armor, with an overall jacket, terminated with fittings listed for the location, and installed in accordance with 335.4.



501.10(A)(2). Where it is necessary to employ flexible connections, as at motor terminals, flexible fittings listed for the location, or flexible cord in accordance with 501.140 terminated with cord connectors listed for the location, must be used.

501.10(A)(3). All boxes and fittings shall be approved for Class I, Division 1.

501.10(B)(1). In Class I, Division 2 locations, the following wiring methods shall be permitted:

- (1) Rigid metal conduit (RMC) and intermediate metal conduit (IMC) with listed threadless fittings.
- (2) Enclosed gasketed wireways and busways.
- (3) Type PLTC and PLTC-ER cable per Article 725 including installations in cable tray systems.
- (4) Type ITC and ITC-ER cable per 727.4.
- (5) Type MC, MV, TC, or TC-ER cable including installations in cable tray systems.
- (6) Listed reinforced thermosetting resin conduit, RTRC, all fittings marked with the suffix -XW.
- (7) Optical fiber cable.
- (8) Cablebus.
- (9) In restricted industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, listed Type P cable with or without metal braid armor, with an overall jacket, terminated with fittings listed for the location, and installed in accordance with 337.10.

501.10(B)(2). Where provisions must be made for limited flexibility, one or more of the following shall also be permitted:

- (1) Listed flexible metal fittings.
- (2) Flexible metal conduit with listed fittings.
- (3) Liquidtight flexible metal conduit with listed fittings.
- (4) Liquidtight flexible nonmetallic conduit with listed fittings.
- (5) Flexible cord listed for extra-hard usage and terminated with listed fittings. An additional conductor for grounding shall be included in the flexible cord.
- (6) Flexible cord listed for extra-hard usage.
- (7) For elevator use, an identified elevator cable.
- (8) Type P cable in restricted industrial establishments.

501.10(B)(3). Nonincendive field wiring is permitted using any of the wiring methods permitted for unclassified locations.

Separate nonincendive field wiring circuits shall be installed in accordance with one of the following:

- (1) In separate cable.
- (2) In multiconductor cables where the conductors of each circuit are within a grounded metal shield.
- (3) In multiconductor cables or raceways, where the conductors of each circuit have insulation with a minimum thickness of 0.01".



Author's note: We need to understand about the meaning and application of nonincendive circuits in Division 2 locations. It is important to understand what the term means.

Most equipment that has been tested and listed as being nonincendive are *battery-operated* self-contained items. They are permitted to be used in a Class I, Division 2 location because a hazardous condition is not likely to exist in such an area except under *abnormal* circumstances.

A piece of nonincendive equipment is not permitted to be used in a Class I, Division 1 location because if damaged, the equipment could possibly ignite a hazardous gas or vapor present there. But the probability of a hazardous atmosphere being present in a Class I, Division 2 is low. The probability of such catastrophic failure of the nonincendive circuit is also low.

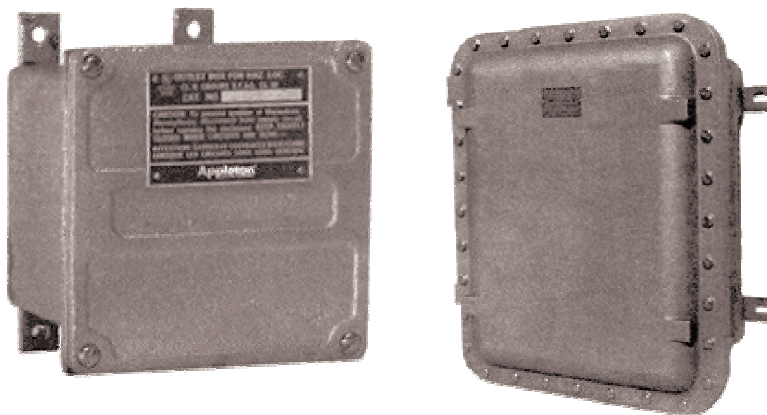
A nonincendive component is one having contacts for making or breaking an incendive circuit and the contacting mechanism constructed so that the component is incapable of igniting the specified flammable gas or vapor air mixture.

A nonincendive circuit is one in which any arc or thermal effect produced, under *intended operating conditions* of the equipment or due to opening, shorting, or grounding of field wiring, is not capable, under specified test conditions, of igniting the flammable gas, vapor, or dust-air mixture.

Many of the items listed as nonincendive involve hand-held instruments and process control and instrumentation.

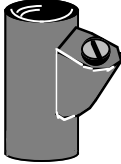
The word "nonincendive" is not found in very many dictionaries. It means **not** capable of causing ignition under *normal* conditions of operation.

501.10(B)(4). Boxes, fittings, and joints are required to be explosionproof if required by 501.105(B)(2), 501.115(B)(1), or 501.150(B)(1).



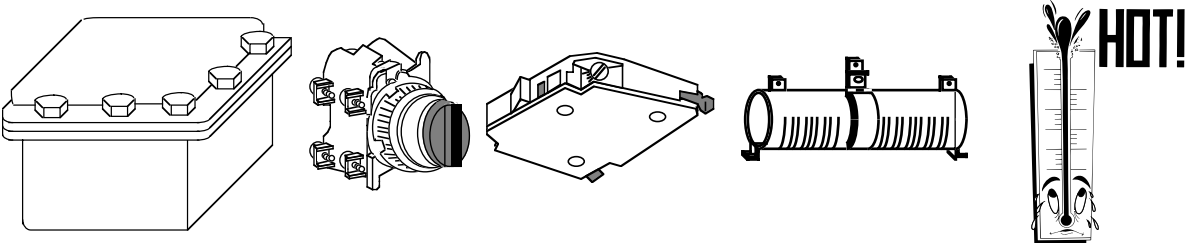
501.15(A)(1)

501.15. When installing electrical equipment in a Class I location, it is usually necessary to use seal fittings to prevent the transmission of hazardous gases or vapors from one part of the system to the other, and to contain an explosion (pressure piling) that occurs within an enclosure from affecting the rest of the system. If the explosionproof enclosure does not house an ignition-capable part, and the conduit system is 1 1/2" or smaller, a seal is not required at the enclosure.

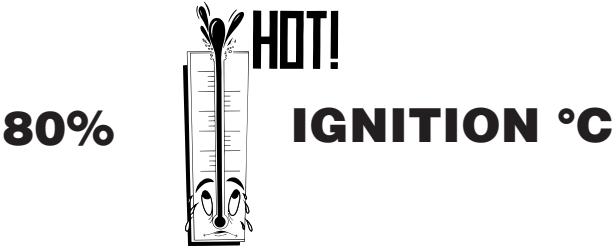


501.15(A)(1). In Class I, Division 1 locations, conduit seals shall be located in each conduit entry into an explosionproof enclosure where either of the following apply:

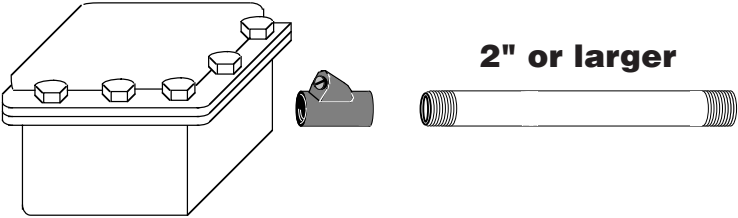
(1) The enclosure contains switches, breakers, fuses, relays, or resistors that exceed 80% of the autoignition temperature, in degrees Celsius, of the gas or vapor involved in normal operation.



501.15(A)(1)(1). High temperatures shall be considered to be any temperature exceeding 80% of the autoignition temperature in degrees Celsius of the gas or vapor involved.



(2) The conduit entry is 2" or larger and the enclosures contains terminals, splices, or taps.



501.15(A1)ex.

501.15(A)(1) Exception. The exception states seals are not required for conduits entering enclosures with switches, relays, breakers, fuses, or resistors with one of the following:

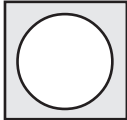
(1) Are enclosed within a chamber of hermetically sealed against the entrance of gases or vapors.



(2) Are immersed in oil.



(3) The switch, circuit breaker, fuse, relay, or resistor is enclosed within an enclosure, identified for the location, and marked "Leads Factory Sealed," or "Factory Sealed," "Seal not Required," or equivalent.

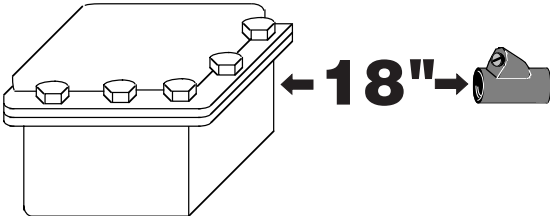


(4) Are in nonincendive circuits.



Factory-sealed enclosures shall not be considered to serve as a seal for another adjacent explosionproof enclosure that is required to have a conduit seal.

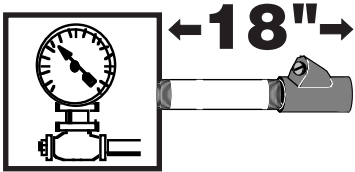
501.15(A)(2). Conduit seals shall be installed within 18" of the enclosure.



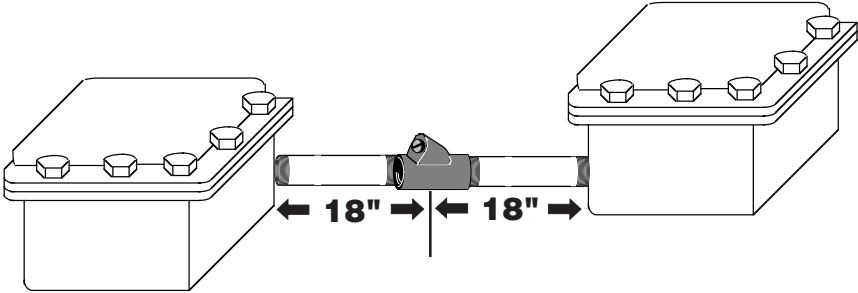
Only threaded couplings, or explosionproof fittings such as unions, couplings, reducers, elbows, capped elbows, and conduit bodies similar to L, T, and Cross types that are not larger than the conduit are the only enclosures or fittings permitted between the seal and the enclosure.

501.15(A)(2)

501.15(A)(2). A conduit seal must be placed in each conduit entering a pressurized enclosure where the conduit is not pressurized as part of the protection system. The seal must be within 18" of the enclosure.

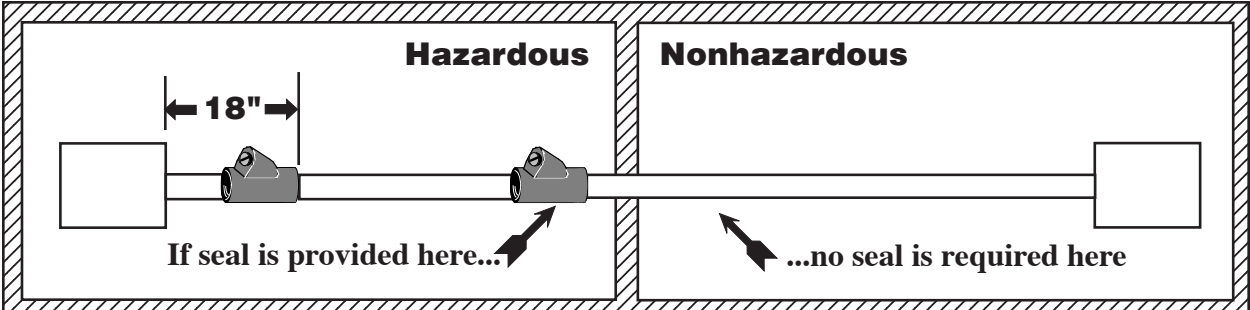
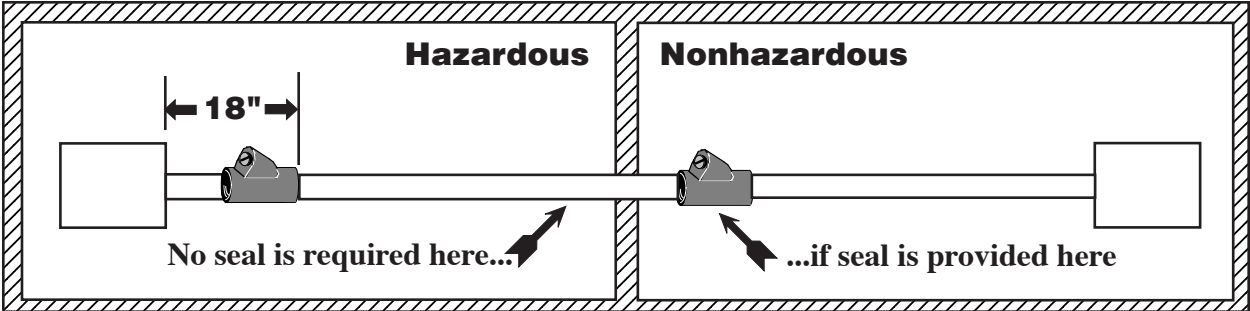


501.15(A)(3). Where two explosionproof enclosures are connected by a conduit not over 3' in length, a single seal is permitted provided if it is in the center of the 3'.

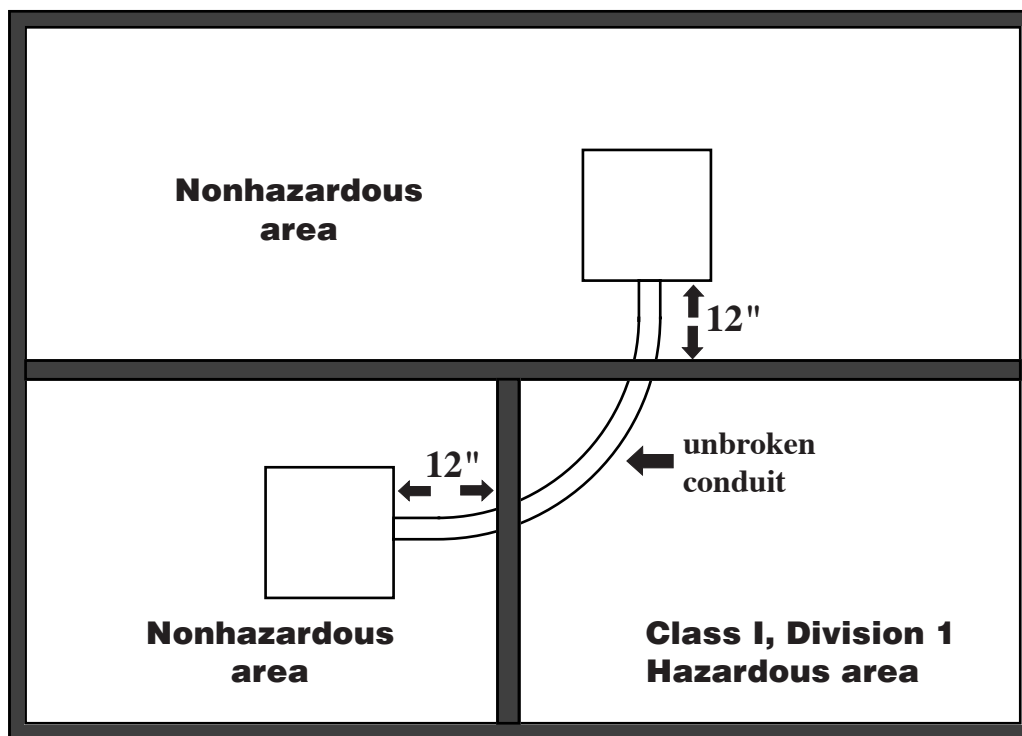


Note: According to UL Hazardous Location Equipment Directory, no splices are permitted within a seal.

501.15(A)(4). This section requires a seal in each and every conduit that leaves the Class I, Division 1 location, whether it passes into a Division 2 location or into a nonhazardous location. This required seal may be installed on either side of the boundary and within 10' of the boundary.



501.15(A)(4) Exception 1. This exception covers the installation where a metal conduit system passes from a nonhazardous area, runs through a Class I, Division 1 hazardous area, and then returns to a nonhazardous area. This is permitted without installing a seal at either of the boundaries where it enters or leaves the hazardous area provided the conduit has no unions, couplings, boxes, or fittings extending 12" into each nonhazardous area.



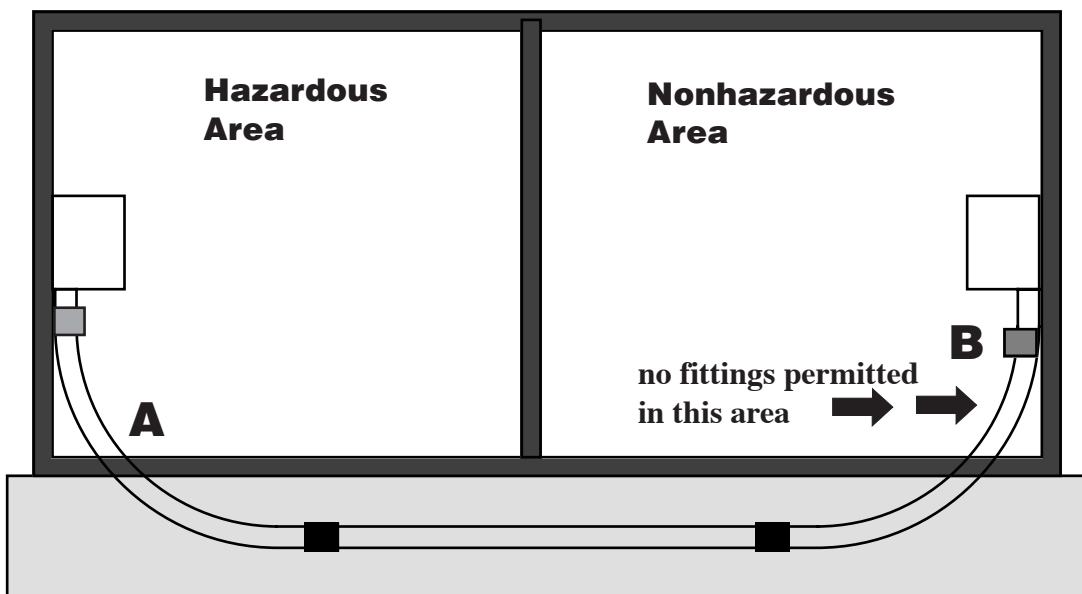
•**Author's note:** Explosionproof enclosures often use special high-strength bolts. Substitution of an equivalent size bolt of a different strength can reduce the effectiveness of the enclosure. The bolt strength is usually indicated by a coded marking on the head of the bolt. A bolt must be replaced with a bolt of the same size and *strength*.

Routine maintenance is always required because many hazardous locations are also corrosive locations.



501.15(A)(4) Exception 2. For underground conduit installed where the boundary is below the grade, the sealing fitting shall be permitted to be installed after the conduit emerges from below grade, but there shall be no union, coupling, box, or fitting, other than explosionproof reducers at sealing fittings, in the conduit between the sealing fitting and the point at which the conduit emerges from below grade.

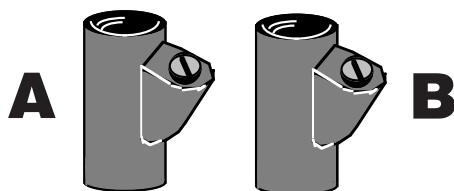
The exception is provided due to the impossibility of being able to install and fill a seal underground. Where the boundary with Class I, Division 1 is below the grade, the Code permits the sealing fitting to be installed after the conduit emerges from below grade.



Author's note: The Code provides no definition of *boundary*. The inspection authority should be consulted in cases not covered by the Code. Always remember, there are no provisions in the Code that prohibit the use of seals, when in doubt, install a seal. Some authorities may require seals at both **A** and **B**. With a seal at **A** and not at **B**, a heavier-than-air gas or liquid (such as gasoline) might penetrate a crack in the floor, enter the conduit through a coupling, and pass into the enclosure in the nonhazardous area.

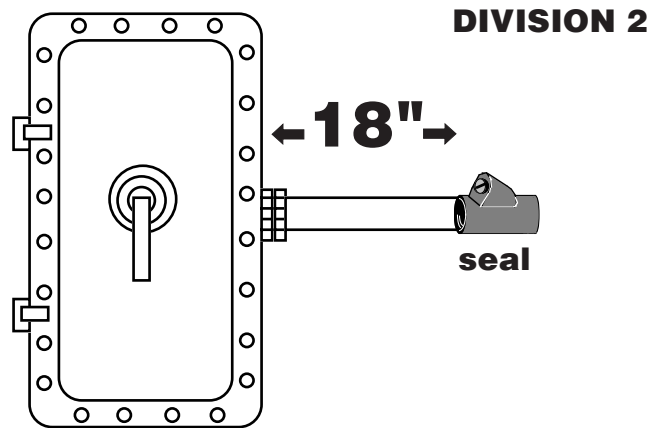
Or, a seal at **B** but not at **A** might not prevent vapor in the conduit from entering the nonhazardous area through a coupling in the concrete and then through a crack in that floor. That has happened in the past.

With the sketch above, the argument could be made, it would be best to install a seal at both locations **A** and **B**.



501.15(B)(1)

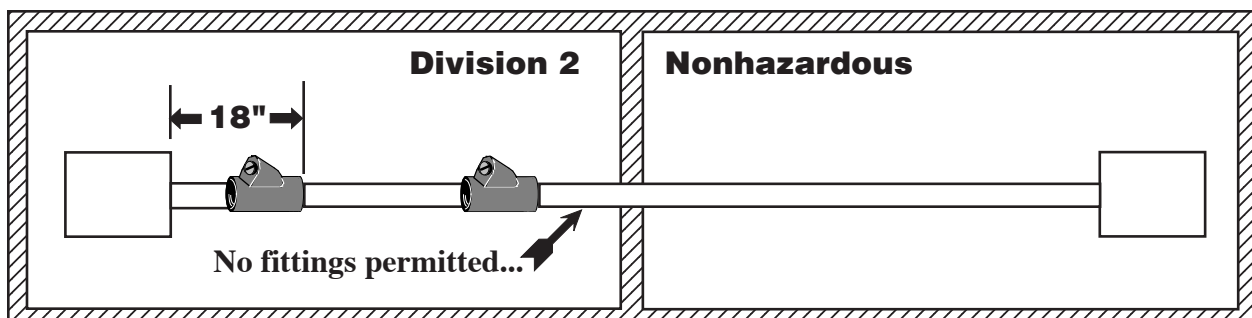
501.15(B)(1). Class I, Division 2, connections entering enclosures that are required to be explosionproof are required to have a seal installed under the same rules as Class I, Division 1.



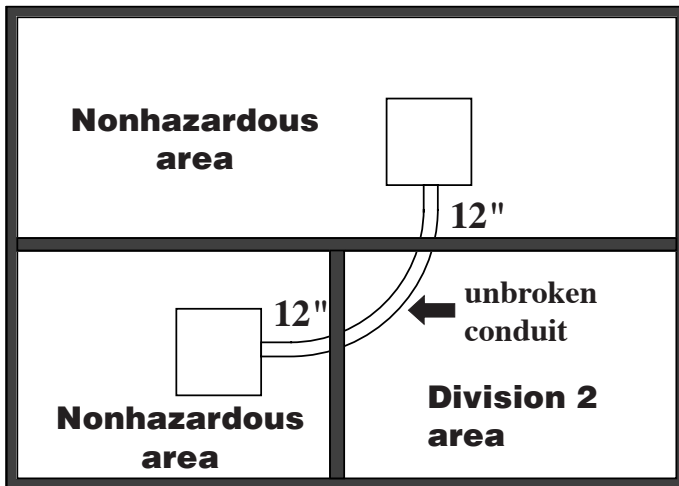
501.15(B)(2). Class I, Division 2 boundary, the seal is permitted on either the Division 2 or nonhazardous side of the boundary. It must be installed in a manner that will minimize the gas or vapor that can enter the conduit system within the Division 2 location and be communicated beyond the seal.

Rigid metal conduit or threaded IMC conduit must be used between the sealing fitting and the point at which the conduit leaves the Division 2 location.

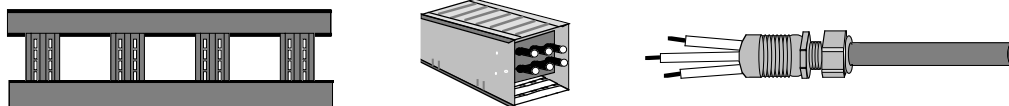
A threaded connection must be used at the sealing fitting, and no fittings, unions, etc. except an explosionproof reducer at the sealing fitting can be installed between the sealing fitting and the point at which the conduit leaves the Division 2 location.



501.15(B)(2) Exception 1. A continuous run of metal conduit passing completely through a Class I, Division 2 location without any fittings within the Division 2 location, and not less than 12" beyond each of the boundaries, is not required to be sealed if both ends are in nonhazardous locations.



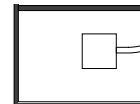
501.15(B)(2) Exception 2. No seal is needed in the conduit run from a Division 2 to a nonhazardous area where a transition is made in the nonhazardous location from a conduit to cable tray, cablebus, ventilated busway, Type MI cable or open wiring.



The principle here is that a Division 2 location is one that seldom contains the hazardous atmosphere. This, in combination with an outdoor termination to a wiring method that is incapable of serving as a means of conducting the hazardous agent, means that chance of ignition is very slight.



No seal is required where the transmission is made *indoors* if the conduit system is in *one room* and the conduit does not terminate in an enclosure containing an ignition source.



This assumes that only part of a large room is classified as Division 2 and the rest of the room is nonhazardous. Here, the transmission of the hazardous atmosphere in case of accidental release is not limited by walls, by not having a seal would not contribute greatly to the increased hazard in the nonhazardous area.

FINAL EXAM 50 Questions - Open Book

•Circle your choice of answer and write the Code section where it was found.

1. Color coding shall be permitted to identify ____ conductors where they are colored light blue and where no other conductors colored light blue are used.

(a) fire alarm (b) elevator (c) intrinsically safe (d) electrolytic cell

2. All of the following motors are permitted in a Class III, Division 1 area except ____.

(a) totally enclosed pipe ventilated (b) non-ventilated
(c) totally enclosed fan cooled (d) water cooled

3. Class III locations are those that are hazardous because of ____.

(a) the presence of combustible dust
(b) over 8' depth of water
(c) flammable gases or vapors may be present in the air
(d) the presence of easily ignitable fibers or flyings

4. Sealing compound is employed with mineral-insulated cable in a Class I location for the purpose of ____.

(a) preventing passage of gas or vapor (b) excluding moisture
(c) limiting a possible explosion (d) preventing escape of powder

5. A point located 24" above grade level and 20 feet from the edge of an indoor remote gas pump is considered ____.

(a) Class I, Group D, Division 2 (b) Class I, Group D, Division 1
(c) Class I, Group C, Division 2 (d) Class I, Group C, Division 1

6. Which of the following about an aircraft hangar is true?

- I. Any area below the floor level shall be considered a Class I, Division I location up to the floor level.
II. The area within 5' horizontally of aircraft power plants or fuel tanks shall be considered a Class I, Division II location extending from the floor to a level 5' above the upper surface of wings and engine enclosures.

(a) I only (b) II only (c) both I and II (d) neither I nor II

7. Lighting fixtures installed over vehicle lanes inside a commercial garage shall be installed a minimum of ____ feet.

(a) 8 (b) 10 (c) 12 (d) 15

8. The disconnecting means for portable diagnostic imaging and treatment equipment operating on 120v, 30 ampere or less branch circuits may be a ____.

I. general duty snap switch loaded not more than 80%

II. grounding type attachment plug and receptacle

(a) I only (b) II only (c) both I and II (d) neither I nor II

9. In minor repair garages, entire space within any pit, below workgrade work area is classified as ____ if not ventilated.

(a) Class I, Division 1 (b) Class I, Division 2 (c) Class II, Division 2 (d) Class II, Division 1

10. The minimum thickness of the sealing compound in Class I, Division 1 and 2 locations shall not be less than the trade size of the conduit and in no case less than ____.

(a) 3/16" (b) 3/8" (c) 1/2" (d) 5/8"

11. Locations where combustible dust is normally in heavy concentrations are designated as ____.

(a) Class I, Division 2

(b) Class II, Division 1

(c) Class II, Division 2

(d) Class III, Division 1

12. The minimum depth of oil over the power contacts in an oil immersion type switch for use in a Class I Division 2 location is ____ inches.

(a) 1 (b) 1 1/2 (c) 2 (d) 3

13. No transformer or capacitor shall be installed in a Class II, Division 1, ____ location.

(a) Group A

(b) Group C

(c) Group B

(d) Group E

14. Zone equipment is required to have flanged openings placed a certain minimum distance away from steel, walls, weather guards, mounting brackets, pipes, etc. unless the equipment is listed for a smaller distance of separation. This distance provides for the expanding gases flowing out through the flanged opening. The minimum distance for IIB gas group is ____.

(a) 5/8" (b) 25/64" (c) 1 3/16" (d) 1 1/2"

15. Fixed wiring, which is to provide external power to aircraft hangers, shall be installed at least _____ above floor level.

- (a) 12" (b) 18" (c) 24" (d) 30"

16. In a major repair garage, the pit shall be classified _____ unless provisions are made for ventilation.

- (a) **Class I, Division 2** (b) **Class II, Division 2** (c) **Class II, Division 1** (d) **Class I, Division 1**

17. Underground wiring for a motor fuel dispenser shall be installed in _____.

- (a) **threaded rigid metal conduit**
(b) **threaded steel intermediate metal conduit**
(c) **Type PVC conduit buried not less than 24"**
(d) **Any of the above**

18. Any room or location in which flammable anesthetics are stored shall be considered to be a _____ location from floor to ceiling.

- (a) **Class I, Division 1** (b) **Class I, Division 2**
(c) **Class II, Division 2** (d) **nonhazardous**

19. Above ground storage tanks with a fixed roof shall be classified _____ when the space between 5 feet and 10 feet from open end of vent extends in all directions.

- (a) **Class I, Division 1** (b) **Class I, Division 2**
(c) **Class II, Division 1** (d) **Class II, Division 2**

20. A building or part thereof used on a 24 hour basis for the housing of four or more persons who are incapable of self preservation because of age, physical limitation due to accident or illness, or mental limitations, such as mental retardation/developmental disability, mental illness or chemical dependency is a/an _____.

- (a) **limited care facility** (b) **nursing home**
(c) **psychiatric hospital** (d) **ambulatory health care center**

21. For spraying operations confined to an enclosed spray booth or room, the Division 2 area extends _____ in all directions from any opening.

- (a) 3' (b) 10' (c) 900' (d) **unlimited**

22. At a gasoline dispensing, self service station which is unattended, the emergency disconnect for a circuit leading to dispensing equipment, must be located more than ___ feet from the dispensers.

(a) 3 (b) 5 (c) 10 (d) 20

23. Parking garages used for parking or storage and where no repair work is done, open flame, welding, or the use of volatile flammable liquids are _____.

(a) Class I (b) Class II (c) Class III (d) not classified

24. In a Class II location, there shall be no uninsulated exposed part that operates at more than _____ volts (15 volts in wet locations).

(a) 10 (b) 12 (c) 24 (d) 30

25. To reduce the danger of spontaneous combustion in Class III locations, the Code limits the surface temperature of electrical equipment used in these locations. The temperature for motors, transformers, etc. that can operate while overloaded is _____.

(a) 212°F (b) 248°F (c) 304°F (d) 329°F

26. Which of the following would **not** be approved in all Class II locations?

(a) flexible connections (b) threaded bosses
(c) dust-tight boxes (d) EMT

27. In a Class III location, each luminaire shall be clearly marked to show the _____.

(a) ballast rating (b) voltage (c) maximum lamp wattage (d) current

28. Rooms and areas containing ammonia refrigeration systems that are equipped with adequate mechanical ventilation may be classified as _____ locations.

(a) unclassified (b) Group D (c) Division 2 (d) Class III

29. In commercial garages using electrical hand tools, portable lights, etc., ground fault protection shall be provided for _____.

(a) receptacles in pits below floor level only
(b) receptacles located in adjacent bathrooms only
(c) receptacles within 18" above the floor only
(d) personnel

30. Gasoline stations shall have emergency disconnects to shut off all power to dispensing equipment. Such devices shall be located more than ___ feet but less than ___ feet from the dispensers.

(a) 20 - 100 (b) 20 - 50 (c) 10 - 100 (d) 10 - 50

31. In commercial garages, all 125v single-phase, 15 and 20 amp receptacles where ____ are to be used, shall provide GFCI protection for personnel.

- I. portable lighting equipment
- II. electrical hand tools
- III. electrical automotive diagnostic equipment

(a) I only (b) II only (c) III only (d) I, II and III

32. What is the minimum burial depth for Type PVC conduit in a dispensing station Class I, Division 1 location?

(a) 18" (b) 24" (c) 30" (d) cannot be used in Class I, Division 1 location

33. Where there is no patient **equipment grounding** point, it is important that the distance between the reference grounding point and the patient vicinity be ____ to minimize any potential differences.

(a) 6 feet (b) 8 feet (c) 10 feet (d) as short as possible

34. The hazardous area in a pit of a spray operation without proper vapor stop is classified as a ____ location.

**(a) Class I, Division 1 (b) Class I, Division 2
(c) Class II, Division 1 (d) Class III, Division 1**

35. A nursing home is a building or part thereof used for the lodging, boarding and nursing care, on a 24-hour basis, of ____ or more persons.

(a) 4 (b) 12 (c) 50 (d) 100

36. Where are conduit seals **NOT** required in a Class I installation?

- (a) Where metal conduit passes completely through the Class I area with no fittings less than 12" outside any classified area.**
- (b) Where a conduit less than 36" in length connects two enclosures.**
- (c) Where the conduit enters an explosion-proof motor.**
- (d) Where the conduit exits the Class I area.**

37. For limited flexibility for motor connections in a Class I, Division 2 location, flexible conduit ____.

- (a) must be explosionproof**
- (b) must be liquidtight flexible conduit or equal**
- (c) may be standard flexible metal conduit**
- (d) shall not be used**

38. In Class I, Division 1 locations, the Code requires conduit seals adjacent to boxes containing splices if the conduit is equal to or larger than ____.

- (a) 3/4"**
- (b) 1 1/2"**
- (c) 1"**
- (d) 2"**

39. In Class II locations ____ dust may dehydrate or carbonize making them even more dangerous.

- (a) plastic**
- (b) coal**
- (c) organic**
- (d) metallic**

40. Where Type PVC conduit is used as a raceway system in bulk storage plant wiring, the raceway shall include ____.

- (a) sunlight resistant listing**
- (b) an equipment grounding conductor**
- (c) a bushing with double locknuts**
- (d) PVC raceway is not permitted**

41. In patient care areas of a hospital, the equipment grounding terminal bars of the normal and essential electrical system panelboards shall be bonded together with an insulated continuous copper conductor not smaller than ____.

- (a) #8**
- (b) #6**
- (c) #10**
- (d) #12**

42. In an open paint spraying area, the Division 2 area extends ____ horizontally outside of the Division 1 location.

- (a) 8'**
- (b) 15'**
- (c) 20'**
- (d) unlimited**

43. All fixed wiring above Class I locations in a repair garage shall be in ____.

I. flexible nonmetallic conduit II. rigid nonmetallic conduit III. TC cable

- (a) I only**
- (b) II only**
- (c) I and II only**
- (d) I, II and III**

44. Conductors and cables of intrinsically safe circuits not in raceways or cable trays shall be separated at least _____ and secured from conductors and cables of any nonintrinsically safe circuits.

- (a) 24"**
- (b) 12"**
- (c) 6"**
- (d) 2"**

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

- (a) **low voltage** (b) **intrinsically safe** (c) **hazardproof** (d) **explosiveproof**

46. Which wiring method is **not** permitted in a Class II, Division 1 location?

- (a) **MI cable** (b) **cable tray** (c) **IMC** (d) **rigid metal conduit**

47. A propane-dispensing unit is located outdoors, 50 feet from an office in which the branch circuit supplying the unit originates. Conduit seals shall be required ____.

- (a) **where the conduit emerges from the earth at the office only**
(b) **where the conduit emerges from the earth at the dispensing unit only**
(c) **where the conduit emerges from the earth at both the dispensing unit and at the office**
(d) **No seals are required for propane gas**

48. An approved seal shall be provided in each conduit run entering or leaving a dispenser or any cavities or enclosures in direct communication therewith. The sealing fitting shall be ____.

- (a) **concrete-tight**
(b) **3/4" minimum thickness**
(c) **the last fitting after the conduit emerges from the earth or concrete**
(d) **the first fitting after the conduit emerges from the earth or concrete**

49. A system of feeders and branch circuits supplying power for lighting, receptacles, and equipment essential for life safety that is automatically connected to the alternate power sources by one or more transfer switches during interruption of the normal power source.

- (a) **essential system** (b) **critical branch** (c) **life safety branch** (d) **line isolation monitor**

50. In a Class I, Division 2 area, bonding can be accomplished by ____.

I. double locknuts II. locknut-bushings

- (a) **I only** (b) **II only** (c) **both I and II** (d) **neither I nor II**