



## Article 725 - Code Basics

Looking at some highlights of Article 725 will help you better understand specialized low-power circuit requirements.

Article 725 contains the requirements for remote-control, signaling and power-limited circuits that are not integral to a device or appliance. It includes circuits for burglar alarms, access control, sound, nurse call, intercoms, some computer networks, some lighting dimmer controls, and some low-voltage industrial controls.

As with all other Articles in Chapters 5 through 8, the wiring methods required by Chapters 1 through 4 apply. But, Article 725 specifies conditions where these methods are not required. In fact, the purpose of Article 725 is to allow for the fact that these circuits "are characterized by usage and power limitations that differentiate them from electric light and power circuits." Article 725 provides alternative requirements for minimum wire sizes, adjustment factors, overcurrent protection, insulation requirements, wiring methods, and materials.

### Class X Circuit Requirements

Circuits covered by Article 725 will fall into one of three classes, as summarized by Figure 725-6 un725-06 725-02 06 def sum.cdr:

Note: Graphics are not included in this newsletter.

- Class 1. That portion of the wiring system between the load side of the circuit overcurrent device and the connected equipment. The Code sections specific to Class 1 are 725.21 through 725.29.
- Class 2. That portion of the wiring system between the load side of a Class 2 power source and the connected equipment. Class 2 circuits consider safety from a fire initiation standpoint and provide protection from electric shock by limiting the current [Chapter 9 Table 11(A)]. The Code sections specific to Class 2 are 725.41 through 725.71.
- Class 3. That portion of the wiring system between the load side of a Class 3 power source and the connected equipment. Class 3 circuits consider safety from a fire initiation standpoint. Because these circuits permit dangerous voltages-up to 100V for an inherently limited power source [Chapter 9 Table 11(A)]-the Code contains additional requirements to safeguard against electric shock. The Code sections specific to Class 3 are the same as those for Class 2.

### Some mechanical details

[725.5] Locate cables so they don't prevent access to equipment. Route them so they don't prevent ceiling panels to be moved (see **Figure 725-15 un725-15 725-05.cdr**).

[725.6] The "neat and workmanlike manner" rule applies here, as in other places. Support cables to prevent damage from normal operation. Use hangers and other devices designed to eliminate or minimize damage to the cable. If you install cables in or near framing members, protect them against penetration by screws or nails. To do this, provide a 1.25 in. separation from the face of the framing member or use a suitable metal plate in accordance with 300.4(D). See **Figure 725-17 un725-17 725-06 02 300-04D.cdr**.

[725.8] Where damage to remote-control circuits of safety control equipment would introduce a hazard [725.8(A)], provide a suitable means of protection, such as rigid metal conduit.

### Class 1 Highlights

Of the three classes, this one has the tightest limitations on power levels. If you exceed those power levels, you are no longer at Class 1 and must then adhere to stricter standards of materials and installation. Here are some key points to remember:

- [725.21] Class 1 power-limited circuits can be AC or DC, but must be supplied from a power source that limits the output to 30V with no more than 1000 VA (see **Figure 725-20 un725-20 725-21A.cdr**).
- Class 1 remote-control and signaling circuits shall not operate at more than 600V. But, there is no requirement to limit the VA output of the power supply. One of the most common applications of a Class 1 control circuit is the operating coil for a magnetic motor starter or lighting contactor. This would include coils at 120V, 220V and 460V (see **Figure 725-21 un725-21 725-21B.cdr**).
- A magnetic motor starter having the coil wired to a motor control circuit (tapped from the motor branch circuit) is not a Class 1 circuit. See 725.3(F) and 430.41.
- [725.26] Two or more Class 1 circuits can be in the same cable, enclosure or raceway.
- Class 1 circuits can be in the same cable, enclosure or raceway with power supply circuits, only where the equipment powered is functionally associated with the Class 1 circuit (see **Figure 752-23 un725-23 725-26B1.cdr**).
- [725.27] Flexible cords installed in accordance with Article 400 are permitted.
- Class 1 circuit conductors must have a 600V insulation rating and comply with Table 310.13 or Table 402.3.

### Class 2 and Class 3

The NEC does not require you to install Class 2 and 3 in a raceway. But, if you do install them in a raceway, you should do so per the BICSI Cabling Installation Manual. This installation guideline recommends that raceway runs:

- Be limited to 100 ft
- Have no more than two 90-degree bends
- Have a maximum pull force of 25 pounds for Category 5 cable
- Have a maximum pull force of 100 pounds for optical fiber cable.

Because most installers have no idea how to limit the pulling tension on signal or communication cables, the generally accepted practice is to size the raceway so the cables do not exceed the percentage fill listed in Chapter 9, Table 1 of the NEC.

### Power sources

[725.41] The power source for a Class 2 or a Class 3 circuit must be one of the following:

- A listed Class 2 or Class 3 transformer.
- A listed Class 2 or Class 3 power supply.
- Equipment listed as a Class 2 or Class 3 power source (amplifier for audio program signals).
- Listed information technology equipment.
- A dry cell battery, provided the voltage is 30V or less for a Class 2 circuit.

### Wiring

- [725.42] Equipment must be marked to indicate each circuit that is Class 2 or Class 3.
- [725.51] Conductors and equipment on the supply side of the Class 2 or Class 3 power source must comply with the requirements in Chapters 1 through 4.
- [725.52] and [725.25] Conductors and equipment on the load side of the Class 2 or Class 3 power source can use a Chapter 3 wiring method. There are exceptions to this.
- Where it is necessary to install Class 2 or Class 3 circuits inside the same raceway or cable with power or Class 1 circuits, you can reclassify Class 2 or Class 3 circuits. To do so, the conductors must have 600V insulation. Further, you must remove the Class 2 or Class 3 marking on the equipment, and provide overcurrent protection in accordance with 725.23. If you reclassify Class 2 or Class 3 circuits as Class 1 circuits, you can't install them with other Class 2 or Class 3 circuits that have not been reclassified as Class 1.

### Separation from Other Systems

- [725.55] As indicated earlier, you can't Class 2 or Class 3 circuit conductors in any enclosure, raceway or cable with conductors of power or Class 1 conductors.
- You can install Class 2 and Class 3 circuits with Class 1, non-power-limited fire alarm and medium power network-powered broadband communications circuits, if you separate them with a barrier (see **Figure 725-30 un725-30 725-55B.cdr**).
- Inside an enclosure, you can run Class 2 and Class 3 circuits in a raceway to separate them from Class 1, non-power-limited fire alarm and medium power network-powered broadband communications circuits.
- You can mix Class 2 and Class 3 conductors with power conductors in boxes or enclosures, if the power circuit conductors are introduced solely to connect to the equipment connected to Class 2 and 3 circuits and you meet certain spacing and voltage requirements.
- You can put mix Class 2 conductors with other Class 2 conductors and Class 3 conductors with other Class 3 conductors. But, if you mix Class 2 conductors with Class 3 conductors, you must use Class 3 wiring methods for the Class 2 conductors.

## Lightning

[725.57] Underground installations are not considered exposed to lightning. To reduce electromagnetic interference and to reduce damage from voltage surges, the practice is to ground one end of underground cables (**Figure 725-33 un725-33 725-57.cdr**). Where Class 2 or Class 3 circuits run overhead between buildings, they are susceptible to lightning. The conductors must maintain at least 6 ft separation from lightning conductors. You must also ground (or interrupt) the metallic sheath as close as practicable to the point of entrance. Where grounded, follow 800.40 or 820.40 as applicable.

Article 725 consists of three parts:

- Part I provides general information
- Part II pertains to Class 1 cabling
- Part II pertains to Class 2 and 3 cabling.

The key to understanding and applying each of the three parts is knowing the voltage levels of the cabling involved and the purposes of that cabling. Article 725 allows you to save time and money when working with particular types of circuits. Thus, it's a good investment for people who work with low-power circuits to become familiar with Article 725.

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