

## Chapter E 725

## REMOTE-CONTROL, LOW-ENERGY POWER, LOW-VOLTAGE AND SIGNAL CIRCUITS

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## A. SCOPE AND GENERAL

**E 725.01 Scope.** Provisions of this chapter shall apply to remote-control circuits, including low-voltage relay switching, low-energy power circuits, low-voltage power circuits and signal circuits, as defined in Wis. Adm. Code chapter E 100, Definitions.

*Note:* The provisions of this chapter are not intended to apply to remote-control, low-energy or signal circuits which form an integral part of a device or appliance.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.02 Hazardous locations.** Circuits or equipment coming within the scope of this chapter and installed in hazardous locations shall also comply with the appropriate provisions of chapters E 500-E 517 inclusive.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.03 Classification.** Remote-control and signal circuits shall be classified as follows:

(1) **CLASS 1 CIRCUITS.** Control and signal circuits in which power is not limited in accordance with section E 725.31.

(2) **CLASS 2 CIRCUITS.** Control and signal circuits in which the power is limited in accordance with section E 725.31.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.04 Low-energy power circuits.** Circuits which are neither remote-control nor signal circuits, but which have the power limited in

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accordance with section E 725.31 shall, for the purpose of this code, be treated as class 2 remote-control circuits.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.05 Low-voltage power circuits.** Circuits which are neither remote-control nor signal circuits but which operate at not more than 30 volts, where the current is not limited in accordance with section E 725.31, and which are supplied from a source not exceeding 1000 volt-amperes, shall for the purpose of this code, be treated as class 1 remote-control circuits.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.06 Safety-control devices.** Remote-control circuits to safety-control devices, the failure of operation of which would introduce a direct fire or life hazard, shall be considered as class 1 circuits.

*Note:* Room thermostats, service hot-water temperature regulating devices, and similar controls used in conjunction with electrically-controlled domestic heating equipment, are not considered to be safety-control devices.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.07 Remote-control and signal circuits in communication cables.** Remote-control and signal circuits which use conductors in the same cable with communication circuits shall, for the purpose of this chapter, be classified as communication circuits and meet the requirements of chapter E 800 of this code.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

## B. CLASS 1 SYSTEM

**E 725.11 Wiring method.** Conductors and equipment of class 1 remote-control and signal systems and low-voltage power circuits shall be installed in accordance with the requirements of chapters E 300 to E 391 inclusive of this code, except as provided in sections E 725.12 to E 725.15 inclusive.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.12 Other chapters.** The wiring method required in section E 725.11 does not apply where other chapters of this code specifically permit or require other methods for remote-control or signal circuits. See chapter E 620, Elevators, for example.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.13 Conductor sizes.** Nos. 18 and 16 gauge conductors may be used provided they are installed in a raceway or a cable approved for the purpose, or in flexible cords in accordance with the provisions of chapter E 400.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.14 Conductor insulation.** Conductors larger than No. 16 shall be rubber-covered type R, thermoplastic-covered type T, or other approved type. Fixed conductors Nos. 18 and 16 gauge shall have an insulation at least equal to that of type TF thermoplastic-covered fixture wire. Conductors approved for the purpose having insulation of a thickness less than specified above or having other kinds of insulation may be used.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.15 Number of conductors in raceways.** The number of conductors of remote-control or signal circuits in a raceway may be determined according to section E 300.17 and note 8 of tables E 310.12 through E 310.15 need not be observed. Where there are four or more conductors in a raceway, some of which are remote-control, as permitted by section E 300.03, the provisions of note 8 of tables E 310.12 through E 310.15 shall apply, as determined by the number of power and lighting circuit conductors only.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.16 Conductors of different systems.** Conductors of 2 or more class 1 remote-control and/or signal circuits may occupy the same enclosure or raceway without regard to whether the individual systems or circuits are alternating or direct current, provided all conductors are insulated for the maximum voltage of any conductor in the enclosure or raceway. Conductors of remote-control, low-energy power and signal circuits, in which the current is limited as for class 2 systems, shall be considered as class 1 system conductors for the purpose of this requirement if insulated and installed in accordance with the provisions of class 1 system conductors. Power supply conductors may occupy the same enclosure or raceway with class 1 system conductors when supplying only equipment to which class 1 system conductors are connected.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.17 Mechanical protection of remote-control circuits.** Where damage to a remote-control circuit would introduce a hazard as covered in section E 725.06, all conductors of such remote-control circuits shall be installed in conduit, electrical metallic tubing, type MI cable or be otherwise suitably protected from physical damage.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.18 Overcurrent protection.** Conductors shall be protected against overcurrent in accordance with the ampacities of tables E 310.12 through E 310.15 except as follows:

(1) **EXCEPTION NO. 1. OTHER CHAPTERS.** Where other chapters of this code specifically permit or require other overcurrent protection. See section E 430.072.

(2) **EXCEPTION NO. 2. CONDUCTORS OF NOS. 18 AND 16.** Conductors of Nos. 18 and 16 shall be considered as protected by overcurrent devices of 20-ampere rating or setting.

(3) **EXCEPTION NO. 3. OMISSION OF OVERCURRENT PROTECTION.** In remote-control and signal circuits having main and branch circuits, the branch circuits need not be individually protected against overcurrent where the operating voltage does not exceed 30 volts.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.19 Location of overcurrent protection.** Overcurrent devices shall be located at the point where the conductor to be protected receives its supply unless the overcurrent device protecting the larger conductor also protects the smaller conductor in accordance with tables E 310.12 through E 310.15.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.20 Circuits extending beyond one building.** Class 1 circuits which extend aerially beyond one building shall also meet the requirements of chapter E 730.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.21 Grounding.** Class I remote-control and signal circuits and equipment shall be grounded in accordance with chapter E 250.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

### C. LIMITATION OF LOW-VOLTAGE POWER CIRCUIT

**E 725.22 Overcurrent protection.** Transformer devices supplying low-voltage power circuits shall be provided with overcurrent protection in the secondary circuit rated or set at not more than 250% of the rated secondary current of the transformer. Such protection and mounting shall be approved for the purpose. Overcurrent protection required shall not be interchangeable with protection of a higher rating. The overcurrent protection may be an integral part of a transformer or other power supply device approved for the purpose.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.23 Transformer rating.** Transformer devices supplying low-voltage power circuits shall be approved for the purpose and be restricted in their rated output to not exceeding 1000 volt-amperes and to not exceeding 30 volts. They shall be marked where plainly visible to show their rated output and the voltage to be applied to the circuit.

**Note:** A transformer is considered as meeting the 1000 volt-ampere requirement where the approximate temperature limit is reached at 1000 volt-ampere load.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

### D. CLASS 2 SYSTEM VOLTAGE AND CURRENT LIMITS

**E 725.31 Limits of class 2 systems.** Class 2 remote-control and signal systems, depending on the voltage shall have the current limited as follows:

(1) **MAXIMUM 15 VOLTS: 5 AMPERES.** Circuits in which the open-circuit voltage does not exceed 15 volts and having overcurrent protection of not more than 5-amperes rating. Where the current supply is from a transformer or other device having energy-limiting characteristics and approved for the purpose, the overcurrent protection may be omitted.

(2) **15 TO 30 VOLTS: 3.2 AMPERES.** Circuits in which the open-circuit voltage exceeds 15 volts but does not exceed 30 volts and having overcurrent protection of not more than 3.2 amperes rating. Where the current supply is from a transformer or other device having energy-limiting characteristics and approved for the purpose, the overcurrent protection may be omitted.

(3) **30 TO 60 VOLTS: 1.6 AMPERES.** Circuits in which open-circuit voltage exceeds 30 volts but does not exceed 60 volts and having overcurrent protection of not more than 1.6 amperes rating. Where the current supply is from a transformer or other device having energy-

limiting characteristics and approved for the purpose, the overcurrent protection may be omitted.

(4) 60 TO 150 VOLTS: 1 AMPERE. Circuits in which the open-circuit voltage exceeds 60 volts but does not exceed 150 volts, and having overcurrent protection of not more than 1-ampere rating, provided that such circuits are equipped with current-limiting means other than overcurrent protection which will limit the current as a result of a fault to not exceeding 1 ampere.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.32 Overcurrent protection and mounting.** Where current is limited in class 2 systems by means of overcurrent protection, such protection and its mounting shall be approved for the purpose. Overcurrent protection required shall not be interchangeable with protection of a higher rating. The overcurrent protection may be an integral part of a transformer or other power supply device approved for the purpose.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.33 Transformer rating.** Transformer devices supplying class 2 systems shall be approved for the purpose and be restricted in their rated output to not exceeding 100 volt-amperes. Such devices shall not be paralleled or otherwise interconnected. They shall be marked where plainly visible to show the voltage to be applied to the circuit.

*Note:* A transformer is considered as meeting the 100-volt-ampere requirement if the approximate temperature limit is reached at a 100-volt-ampere load.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.34 Transformer leads.** The primary leads of transformers supplying class 2 remote-control and signal circuits may be smaller than No. 14 but not smaller than No. 18, provided they are not over 12 inches long, have insulation at least equal to type RF-2 rubber-covered fixture wire, or approved equivalent.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

#### E. INSTALLATION OF CLASS 2 REMOTE-CONTROL AND SIGNAL CIRCUITS

**E 725.41 On supply side of overcurrent protection, transformers or current-limiting devices.** Conductors and equipment on supply side of overcurrent protection, transformers or current-limiting devices shall be installed in accordance with the appropriate requirements of chapters E 300 to E 391, inclusive, of this code. Transformers or other devices supplied from electric light and power circuits shall be protected by an overcurrent device with a rating or setting not exceeding 20 amperes.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.42 On load side of overcurrent protection, transformer or current-limiting devices.** Conductors on load side of overcurrent protection, transformer or current-limiting devices shall be insulated and shall comply with the following:

(1) **SEPARATION FROM OTHER CONDUCTORS.** Conductors shall be separated from conductors of electric light and power circuits as follows:

(a) *Open conductors.* Conductors shall be separated at least 2 inches from any light or power conductors not in a raceway unless permanently separated from the conductors of the other system by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, additional to the insulation on the wire.

(b) *In raceways and boxes.* Conductors of class 2 remote-control and signal circuits shall not be placed in any raceway, compartment, outlet box or similar fitting with conductors for either light and power circuits or class 1 signal and control circuits, unless the conductors of the different systems are separated by a partition; provided that this shall not apply to conductors in outlet boxes, junction boxes or similar fittings or compartments where power supply conductors are introduced solely for supplying power to the remote control or signal equipment to which the other conductors in the enclosure are connected. (See section E 725.16).

(c) *In shafts.* Conductors may be run in the same shaft with conductors for light and power where the conductors of the two systems are separated at least 2 inches, or where the conductors of either system are encased in noncombustible tubing.

(2) **VERTICAL RUNS.** Conductors in a vertical run in a shaft or partition shall have a fire-resistant covering capable of preventing the carrying of fire from floor to floor except where conductors are encased in tubing or other outer covering of noncombustible material or are located in a fireproof shaft having fire stops at each floor.

*Note:* Where 3 or more conductors are used, it is recommended that such conductors be grouped under a common braid or covering.

(3) **CONDUCTOR INSULATION.** Conductor insulation shall comply with the following:

(a) *30 volts or less.* The insulation shall be suitable for the particular application.

*Note:* The kind of insulation for the conductors is not specified in further detail as reliance is placed on current limitation to stop dangerous currents.

(b) *30 to 150 volts.* 1. Conductors of a cable shall be of solid or stranded copper not smaller than No. 22 Awg, and shall have thermoplastic insulation of not less than 0.012 inch nominal (0.010 inch minimum) thickness. The cable conductors shall have a thermoplastic jacket overall having a nominal thickness of not less than 0.035 inch (0.030 inch minimum). Where the number of conductors in a cable exceeds 4, the thickness of the thermoplastic jacket overall shall be increased so as to provide equivalent performance characteristics. Similarly, where the size of conductors in a cable exceeds No. 16 gauge, the thickness of the conductor insulation shall be increased so as to provide equivalent performance characteristics.

2. Two-conductor assemblies of No. 16 gauge or smaller, may be in flat parallel construction with  $\frac{1}{2}$  inch nominal integral-insulation jacket and a 0.047 inch minimum web. Approved low-energy circuit cable may be used.

3. Other insulation having equivalent performance characteristics may be acceptable.

4. Where single conductors are used they shall be not smaller than No. 18 Awg and shall be insulated in conformity with section E 725.14.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.43 Circuits extending beyond one building.** Class 2 remote-control and signal circuits which extend beyond one building and are so run as to be subject to accidental contact with light or power conductors operating at a potential exceeding 300 volts, shall also meet the requirements of Wis. Adm. Code sections E 800.02, E 800.11 and E 800.12.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 725.44 Grounding.** Class 2 remote control and signal circuits and equipment shall be grounded in accordance with chapter E 250.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.