

## WIRING METHODS AND MATERIALS

### Chapter E 300

#### WIRING METHODS—GENERAL REQUIREMENTS

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**E 300.01 Scope.** (1) The provisions herein apply to the electrical and mechanical requirements for the various methods of installing fixed electrical conductors for electric light, heat and power and certain signal systems.

(2) The provisions of this chapter shall apply to all wiring installations, except for remote-control, including low voltage relay switching, low-energy power and signal systems as provided in chapter E 725, and communication systems as provided in chapter E 800.

(3) On premises where a continuous underground metallic water-piping network system is not available as a grounding electrode, and where it is not practicable otherwise to secure a ground of permanently low resistance, the use of a wiring method which does not employ metal enclosures for the wires is recommended, unless the character or occupancy of the building is such as to require the use of a metal-enclosed wiring system.

(4) The provisions of this chapter are not intended to apply to the conductors which form an integral part of equipment such as motors, motor controllers and the like.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.02 Voltage limitations.** Wiring methods specified herein may be used for voltages not exceeding 600, unless specifically limited in some chapter. They may be used for voltages over 600 where specifically permitted elsewhere in this code.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.03 Conductors of different systems.** (1) Conductors of light and power systems of 600 volts or less may occupy the same enclosure, without regard to whether the individual circuits are alternating-current or direct-current, only where all conductors are insulated for the maximum voltage of any conductor within the enclosure.

(a) Where A.C. and D.C. lighting or power conductors occupy the same enclosure, the D.C. conductors shall be marked "D.C." at all places of access.

(2) Conductors of light and power systems of over 600 volts shall not occupy the same enclosure with conductors of light and power systems of 600 volts or less.

(3) Secondary wiring to electric discharge lamps of 1,000 volts or less, insulated for the secondary voltage involved, may occupy the same fixture enclosure as the branch circuit conductors.

(4) Primary leads of electric discharge lamp ballasts, insulated for the primary voltage of the ballast, when contained within the individual wiring enclosure may occupy the same fixture enclosure as the branch circuit conductors.

(5) Control, relay and ammeter conductors used in connection with any motor or starter may occupy the same enclosure as the motor circuit conductors.

(6) Conductors of signal or radio systems shall not occupy the same enclosure with conductors of light or power systems except as permitted for sound recording in section E 640.06; for remote-control, low-energy power and signal circuits in sections E 725.16 and E 725.42; and communication systems in sections E 800.03 and E 800.21.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.04 Protection against physical damage.** Where subject to physical damage, conductors shall be adequately protected.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.05 Protection against corrosion.** (1) Metal raceways, cable armor, boxes, cabinets and all metallic elbows, couplings, and fittings, unless made of corrosion-resistant material, shall be suitably protected against corrosion inside and outside (except threads at joints) by a coating of approved corrosion-resistant materials such as zinc, cadmium, or enamel. Ferrous raceways, fittings and boxes protected from corrosion solely by enamel may be used only indoors and in occupancies not subject to severe corrosive influences.

(2) In portions of dairies, laundries, canneries, and other wet locations, and in locations where walls are frequently washed or where there are surfaces of absorbent materials, such as damp paper or wood, the entire wiring system, including all boxes, fittings, conduits and cable used therewith, shall be mounted so that there is at least one-quarter inch air space between it and the wall or supporting surface.

*Note:* Meat-packing plants, tanneries, hide cellars, casing rooms, glue houses, fertilizer rooms, salt storage, some chemical works, metal refineries, pulp mills, sugar mills, round houses, some stables, and similar locations are judged to be occupancies where severe corrosive conditions are likely to be present.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.06 Raceways exposed to different temperatures.** Where portions of an interior raceway system are exposed to widely different temperatures, as in refrigerating or cold-storage plants, provision shall be made to prevent circulation of air from a warmer to a colder section through the raceway.

*Note:* Consideration should be given to expansion and contraction of runs of conduit from temperature changes.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.07 Underground runs.** Conductors run underground shall comply with the provisions of section E 230.032 as far as mechanical protection is concerned.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.08 Through studs, joists and rafters.** (1) Where exposed or concealed wiring conductors in insulating tubes or cables are installed through bored holes in studs, joists or similar wood members, holes shall be bored at the approximate centers of wood members, or at least 2 inches from the top edge.

(2) Where there is no objection because of weakening the building structure, metal-clad or non-metallic sheathed cable, aluminum sheathed cable and type MI cable may be laid in notches in the studing or joists when the cable at those points is protected against the driving of nails into it by having the notch covered with a steel plate at least  $\frac{1}{8}$  inch in thickness before building finish is applied.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.09 Grounding metal enclosures.** Metal raceways, boxes, cabinets, cable armor and fittings shall be grounded if and as prescribed in chapter E 250.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.10 Electrical continuity of metal raceways and enclosures.** Metal raceways, cable armor, and other metal enclosures for conductors, shall be metalically joined together into a continuous electrical conductor, and shall be so connected to all boxes, fittings and cabinets as to provide effective electrical continuity. Raceways and cable assemblies shall be mechanically secured to boxes, fittings, cabinets and other enclosures, except as provided for non-metallic boxes in section E 370.07.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.11 Secured in place.** Raceways, cable assemblies, boxes, cabinets and fittings shall, unless otherwise provided, be securely fastened in place, unless otherwise provided for specific purposes elsewhere in this code.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.12 Mechanical continuity; raceways and cables.** Raceways and cable assemblies shall be continuous from outlet to outlet and from fitting to fitting.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.13 Mechanical continuity; conductors.** Conductors shall be continuous between outlets, devices, etc., and, except as permitted for auxiliary gutters in section E 374.08, and for wireways in section E 362.06, there shall be no splice or tap within a raceway itself.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.14 Free length of conductors at outlets and switch points.** At least 6 inches of free conductor shall be left at each outlet and switch point for the making up of joints or the connection of fixtures or devices, except where conductors are intended to loop without joints through lampholders, receptacles and similar devices.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.15 Boxes.** Except as permitted in sections E 336.11 and E 410.60, a box shall be installed at each outlet, switch, or junction point of conduit, electrical metallic tubing, surface metal raceway, metal-clad cable, aluminum sheathed cable, non-metallic sheathed cable or type MI cable, and at each outlet and switch point of concealed knob-and-tube work.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.16 Raceway or cable to open or concealed wiring.** (1) A box or terminal fitting having a separately bushed hole for each conductor shall be used wherever a change is made from conduit, electric metallic tubing, non-metallic sheathed cable, metal-clad cable, aluminum sheathed cable, or type MI cable and surface metal raceway wiring to open wiring or to concealed knob-and-tube work. A fitting used for this purpose shall contain no taps or splices and shall not be used at fixture outlets.

(2) A bushing may be used in lieu of a box or terminal fitting at ends of conduit or electrical metallic tubing where conductors leave the conduit or tubing behind a switchboard, or where more than 4 conductors leave the conduit or tubing at control apparatus or in similar locations, in which case the conductors shall be bunched, taped and painted with insulating paint. Such a bushing shall be of the insulating type except for lead-covered conductors.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.17 Number of conductors in raceway.** In general the percentage of the total interior cross-sectional area of a raceway occupied by conductors shall not be more than will permit a ready installation or withdrawal of the conductors and dissipation of the heat generated without injury to the insulation of the conductors. See the following rules of this code: conduit, section E 346.06; electric metallic tubing, section E 348.06; flexible metal conduit, section E 350.03; surface metal raceways, section E 352.04; underfloor raceways, section E 354.05; cellular metal floor raceways, section E 356.05; cellular concrete floor raceways, section E 358.09; wireways, section E 362.05; auxiliary gutters, section E 374.05; theatres, section E 520.05; signs, subsection E 600.21 (4); sound recording, sections E 640.03 and E 640.04; and remote-control, low-energy power, low-voltage power and signal circuits, chapter E 725.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.18 Inserting conductors in raceways.** (1) Raceways shall first be installed as a complete raceway system without conductors, except those raceways exposed and having a removable cover or capping.

(2) As far as possible, conductors shall not be inserted until the interior of the building has been physically protected from the weather, and all mechanical work on the building which is likely to injure the conductors has been completed.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

(3) Pull wires, if to be used, shall not be installed until the raceway system is in place.

(4) Graphite, talc, or an approved compound may be used as a lubricant in inserting conductors in raceways.

(5) Cleaning agents or lubricants that might have a deleterious effect on conductor coverings shall not be used.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.19 Supporting conductors in vertical raceways.** (1) Conductors in vertical raceways shall be supported at intervals not greater than those specified in the following table:

			Conductors	
			Aluminum	Copper
No. 18	to No. 8	Not greater than	100 feet	100 feet
No. 6	to No. 0	Not greater than	200 feet	100 feet
No. 00	to No. 0000	Not greater than	180 feet	80 feet
211,601 CM	to 350,000 CM	Not greater than	135 feet	60 feet
350,001 CM	to 500,000 CM	Not greater than	120 feet	50 feet
500,001 CM	to 750,000 CM	Not greater than	95 feet	40 feet
	Above 750,000 CM	Not greater than	85 feet	35 feet

(2) One of the following methods of support, or a method of equal effectiveness is recommended:

(a) By clamping devices constructed of or employing insulating wedges inserted in the ends of the conduits. With cables having varnished cambric or thermoplastic insulation it may also be necessary to clamp the conductor.

(b) By inserting boxes at the required intervals in which insulating supports are installed and secured in a satisfactory manner to withstand the weight of the conductors attached thereto, the boxes being provided with covers.

(c) In junction boxes, by deflecting the cables not less than 90 degrees and carrying them horizontally to a distance not less than twice the diameter of the cable, the cables being carried on 2 or more insulating supports, and additionally secured thereto by tie wires if desired. When this method is used cables shall be supported at intervals not greater than 20% of those mentioned in the preceding tabulation.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.20 Induced currents in metal enclosures.** (1) When conductors carrying 50 amperes or more of alternating current are installed in metal enclosures having magnetic properties they shall be so arranged as to avoid heating the surrounding metal by induction. To accomplish this all phase conductors and the neutral, where one is used, shall be grouped together.

(a) *Exception:* In the case of circuits supplying vacuum or electric discharge lighting systems or signs, or X-ray apparatus, and under-plaster extensions permitted by sections E 344.01 to E 344.04 inclusive, the currents carried by the conductors are so small that the inductive heating effect may be ignored where these conductors are placed in metal enclosures or pass through metal.

(2) When a single conductor of a circuit passes through metal with magnetic properties the inductive effect shall be minimized by:

(a) Cutting slots in the metal between the individual holes through which the individual conductors pass, or

(b) Passing all the conductors in the circuit through an insulating wall sufficiently large for all of the conductors of the circuit.

*Note:* Aluminum being a non-magnetic metal, there will be no heating due to eddy currents. However, induced currents will be present. These are not considered of sufficient magnitude to require grouping of conductors or special treatment in passing conductors through aluminum wall sections.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.21 Prevention of spread of fire.** Electrical installations shall be so made that the possible spread of fire through fire-stopped partitions, hollow spaces, fire walls or fire partitions, vertical shaft, ventilating or air-handling ducts is reduced to a minimum.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.22 Wiring in ventilating and exhaust ducts.** (1) Where it is necessary to run a wiring system through air handling ducts or plenum chambers, the wiring method shall be rigid conduit, electrical metallic tubing, flexible steel conduit with lead-covered conductors, type ACL metal-clad cable with fittings suitable for the location, type MI mineral insulated-metal sheathed cable, or type ALS aluminum sheathed cable. The terminals of circuits of such wiring systems shall be so located that it will not be necessary to install motors or control equipment in the ducts, except for temperature and humidity control. Raceways shall not interfere with the operation of automatic fire dampers in ducts.

(a) *Exception No. 1.* The above provisions shall not apply to integral fan systems specifically approved for the purpose.

(b) *Exception No. 2.* It is not the intent of this section to include habitable rooms or areas of a building, the prime purpose of which is not air handling. It may, however, include false ceiling space, hollow spaces in the wall, and the like if used for air handling purposes.

(c) *Exception No. 3.* In ventilating systems used solely for data processing systems the wiring method shall be rigid conduit, electrical metallic tubing, flexible steel conduit with lead-covered conductors, type ACL metal-clad cable with fittings approved for the purpose, type MI mineral insulated-metal sheathed cable, type ALS aluminum sheathed cable, or flexible cords or cables specifically approved as a part of the data processing system, when such cords or cables may be used in conformance with other sections of this code.

(2) No wiring system of any type shall be installed in ducts for dust, loose stock or vapor removal.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.

**E 300.23 Temporary wiring.** (1) Suitable disconnecting switches or plug connectors shall be installed to permit the disconnection of all conductors of the temporary circuit by a single operation.

(2) No bare conductors nor earth returns shall be used for the wiring of any temporary circuit.

**History:** Cr. Register, April, 1964, No. 100, eff. 5-1-64.