

Chapter E 370

OUTLET, SWITCH AND JUNCTION BOXES,
AND FITTINGS

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A. SCOPE AND GENERAL

E 370.01 Scope. The provisions of this chapter shall apply to the installation of outlet, switch and junction boxes, and fittings as required by section E 300.15. Installations in hazardous locations shall conform to chapters E 500 to E 517 inclusive.

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

E 370.02 Round boxes. Round boxes shall not be used where conduits or connectors requiring the use of locknuts or bushings are to be connected to the side of the box.

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

E 370.03 Non-metallic boxes. Non-metallic boxes approved for the purpose may be used only with open wiring on insulators, concealed knob-and-tube work, non-metallic sheathed cable, and with approved non-metallic conduit.

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

E 370.04 Metallic boxes. Where used with knob-and-tube work or non-metallic sheathed cable, and mounted on metal or metal lath ceilings or walls, such boxes shall be insulated from their supports and from the metal or metal lath, or shall be grounded.

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

B. INSTALLATION

E 370.05 Damp or wet locations. In damp or wet locations, boxes and fittings shall be so placed or equipped as to prevent moisture or water from entering and accumulating within the box or fitting. Boxes and fittings installed in wet locations shall be weatherproof. For boxes in floors, see section E 410.53.

Note: It is recommended that approved boxes of non-conductive material be used with non-metallic sheathed cable or approved non-metallic conduit when such cable or conduit is used in locations where there is likely to be occasional moisture present such as in dairy barns.

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

E 370.06 Number of conductors in a box. Boxes shall be of sufficient size to provide free space for all conductors enclosed in the box. The limitations in subsections E 370.06 (1) and (2) shall not apply to terminal housings supplied with motors, nor to types of boxes or fittings without knockouts and having hubs or recessed parts for terminal bushings and locknuts.

Note: Sections E 370.06 (1) and (2) do not apply to conductors used for rewiring existing raceways as referred to in table 3, chapter E 900.

(1) The maximum number of conductors, not counting fixture wires, permitted in outlet and junction boxes shall be as in tables E 370.06 (1) (a) and (b) with the exceptions noted.

TABLE E 370.06 (1) (a)
DEEP BOXES

Box Dimensions, Inches Trade Size	Maximum Number of Conductors				
	No. 14	No. 12	No. 10	No. 8	No. 6
1½ x 3¼ octagonal.....	5	5	4	0	0
1½ x 4 octagonal.....	8	7	6	5	0
1½ x 4 square.....	11	9	7	5	0
1½ x 4-11/16 square.....	16	12	10	8	0
2½ x 4-11/16 square.....	20	16	12	10	6
2 x 1¾ x 2¾.....	5	4	4	-----	-----
2½ x 1¾ x 2¾.....	6	6	5	-----	-----
3 x 1¾ x 2¾.....	7	7	6	-----	-----

Note: Where there is not sufficient space for a deeper box, four No. 14 AWG conductors may enter a box provided with cable clamps and containing one or more devices on a single mounting strap.

TABLE E 370.06 (1) (b)
SHALLOW BOXES

Box Dimensions, Inches Trade Size	Maximum Number of Conductors		
	No. 14	No. 12	No. 10
3¼.....	4	4	3
4.....	6	6	4
1½ x 4 square.....	9	7	6
4-11/16.....	8	6	6

Note: Any box less than 1½ inch deep is considered to be a shallow box.

(a) Tables E 370.06 (1) (a) and (b) apply where no fittings or devices, such as fixture studs, cable clamps, hickey, switches or receptacles are contained in the box. Where one or more fixture studs, cable clamps, or hickey are contained in the box, the number of conductors shall be one less than shown in the tables, with a further deduction of one conductor for one or several flush devices mounted on the same strap. A conductor running through the box is counted as one conductor and each conductor originating outside the box and terminating inside the box is counted as one conductor. Conductors of which no part leaves the box are not to be counted in the above computation. If single flush boxes are ganged, and each section is occupied by a flush device or combination of flush devices on the same strap, the limitations will apply to each section individually.

(2) For combinations not shown in the above tables the following table shall apply.

TABLE E 370.06 (2)

Size of Conductor	Free Space Within Box for Each Conductor
No. 14.....	2. cubic inches
No. 12.....	2.25 cubic inches
No. 10.....	2.5 cubic inches
No. 8.....	3. cubic inches
No. 6.....	5. cubic inches

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

E 370.07 Conductors entering boxes or fittings. Conductors entering boxes or fittings shall be protected from abrasion and shall conform to the following:

(1) **OPENINGS TO BE CLOSED.** Openings through which conductors enter shall be adequately closed.

(2) **METAL BOXES AND FITTINGS.** Where metal outlet boxes or fittings are installed with open wiring or concealed knob-and-tube work, conductors shall enter through insulating bushings or, in dry places, through flexible tubing extending from the last insulating support and firmly secured to the box or fitting. Where raceway or cable is installed with metal outlet boxes or fittings, the raceway or cable shall be secured to such boxes and fittings.

(3) **NON-METALLIC BOXES.** Where non-metallic boxes are used with open wiring or concealed knob-and-tube work, the conductors shall enter through individual holes. Where flexible tubing is used to encase the conductor, the tubing shall extend from the last insulating support and may be run into the box or terminate at the wall of the box. If non-metallic sheathed cable is used, the cable assembly shall enter the box through a knockout opening. Clamping of individual conductors or cables to the box is not required where supported within 8 inches of the box. Where non-metallic conduit is installed with non-metallic boxes or fittings, the conduit shall be secured to such boxes and fittings in an approved manner.

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

E 370.08 Unused openings. Unused openings in boxes and fittings shall be effectively closed to afford protection substantially equivalent to that of the wall of the box or fitting. Metal plugs or plates used with non-metallic boxes or fittings shall be recessed at least ¼ inch from the outer surface.

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

E 370.09 Boxes enclosing flush devices. Boxes used to enclose flush devices shall be of such design that the devices will be completely enclosed on back and sides, and that substantial support for the devices will be provided. Screws for supporting the box shall not be used in attachment of the device contained therein.

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

E 370.10 In wall or ceiling. In walls or ceilings of concrete, tile or other noncombustible material, boxes and fittings shall be so installed that the front edge of the box or fitting will not set back of the finished surface more than $\frac{1}{4}$ inch. In walls and ceilings constructed of wood or other combustible material, outlet boxes and fittings shall be flush with the finished surface or project therefrom.

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

E 370.11 Repairing plaster. Except on walls or ceilings of concrete, tile or other noncombustible material, a plaster surface which is broken or incomplete shall be repaired so that there will be no gaps or open spaces at the edge of the box or fitting.

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

E 370.12 Exposed extensions. In making an exposed extension from an existing outlet of concealed wiring, a box, extension ring or blank cover shall be mounted over the original box and electrically and mechanically secured to it. The extension shall then be connected to this box in the manner prescribed for the method of wiring employed in making the extension.

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

E 370.13 Supports. (1) **GENERAL.** Boxes, fittings and cabinets shall be securely fastened in place. Boxes and fittings, not over 100 cubic inches in size, which are attached to firmly secured exposed race-way by threading or other connection designed for the purpose, are considered as so fastened.

(2) **CONCEALED WORK.** In concealed work, except as prescribed in subsection (3), boxes and fittings, unless securely held in place by concrete, masonry or other building material in which they are embedded, shall be secured to a stud, joist or similar fixed structural unit, or to a metal or wooden support which is secured to such a structural unit. Wooden supports shall be not less than $\frac{7}{8}$ inch in thickness. Lath of wood, metal or composition shall not be considered a structural unit. See sections E 410.15 and E 410.16 for support of fixtures.

(3) **EXPOSED WORK.** In exposed work, and in concealed work in existing buildings where conductors or cables are fished and boxes cannot be secured as provided in subsection (2) without disturbing the building finish, the boxes may be mounted directly upon the plaster surface when securely fastened in place.

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

E 370.14 Depth of outlet boxes for concealed work. Outlet boxes for concealed work shall have an internal depth of at least $1\frac{1}{2}$ inches, except that where the installation of such a box will result in injury to the building structure or is impracticable, a box not less than $\frac{1}{2}$ inch internal depth may be installed.

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

E 370.15 Covers and canopies. In completed installations each outlet box shall be provided with a cover unless a fixture canopy is used.

(1) Non-metallic covers and plates or metallic covers and plates may be used with non-metallic outlet boxes. When metallic covers or

plates are used, they shall comply with the grounding requirements of section E 250.042. See section E 410.95.

(2) Where a fixture canopy or pan is used, any combustible wall or ceiling finish exposed between the edge of the canopy or pan and the outlet box shall be covered with non-combustible material.

(3) Covers of outlet boxes having holes through which flexible cord pendants pass, shall be provided with bushings designed for the purpose or shall have smooth, well-rounded surfaces on which the cords may bear. So-called hard-rubber or composition bushings shall not be used.

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

E 370.16 Fastened to gas pipes. Outlet boxes used where gas outlets are present shall be so fastened to the gas pipes as to be mechanically secure.

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

E 370.17 Boxes at lighting fixture outlets. Boxes used at outlets for lighting fixtures shall be designed for the purpose. At every outlet used exclusively for lighting, the box shall be so designed or installed that a lighting fixture may be attached.

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

E 370.18 Pull and junction boxes. Pull and junction boxes shall conform to the following:

(1) **MINIMUM SIZE.** For raceways of 1¼ inch trade size or larger, containing conductors of No. 4 or larger, and for cable containing conductors of No. 4 or larger, the minimum dimensions of a pull or junction box installed in a raceway or cable run shall conform to the following:

(a) *Straight pulls.* In straight pulls the length of the box shall be not less than 8 times the trade diameter of the largest raceway.

(b) *Angle or U pulls.* Where angle or U pulls are made, the distance between each raceway entry inside the box and the opposite wall of the box shall not be less than 6 times the trade diameter of the raceway. This distance shall be increased for additional entries by the amount of the sum of the diameters of all other raceway entries on the same wall of the box. The distance between raceway entries enclosing the same conductor shall not be less than 6 times the trade diameter of the larger raceway.

Exception. The limitations of subsections (1) (a) and (1) (b) are not intended to apply to terminal housings supplied with motors, nor to types of boxes or fittings without knockouts and having hubs or recessed parts for terminal bushings and locknuts.

Note: When transposing cable size into raceway size in subsections (1) and (2), the minimum trade size raceway required for the number and size of conductors in the cable shall be used.

(2) **CONDUCTORS IN PULL OR JUNCTION BOXES.** In pull boxes or junction boxes having any dimension over 6 feet, all conductors shall be cabled or racked up in an approved manner.

Note: See section E 373.06 (2) for insulation of conductors at bushings.

(3) **COVERS.** All pull boxes, junction boxes and fittings shall be provided with covers approved for the purpose. Where metallic covers

are used, they shall comply with the grounding requirements of section E 250.042.

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

E 370.19 Junction, pull and outlet boxes be accessible. Junction, pull and outlet boxes shall be so installed that the wiring contained in them may be rendered accessible without removing any part of the building, sidewalks or paving. In finished rooms, wiring and splices in a junction or outlet box having a blank cover, and not more than 6 inches back of the finished wall or ceiling surface, shall be considered accessible when one or more suitable markers extend through the plaster, paint or other finish for future location and identification of the box. Boxes may be installed above false ceilings with panels which are designed to be removed.

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

C. CONSTRUCTION SPECIFICATIONS

E 370.20 Metallic outlet, switch and junction boxes and fittings. Outlet, switch and junction boxes and fittings, when of metal, shall conform to the following:

(1) **CORROSION-RESISTANT.** Metallic boxes and fittings, unless of corrosion-resistant metal, shall be well galvanized, enameled, or otherwise properly coated, inside and out, to prevent corrosion.

Note 1. See section E 300.05 for limitation in the use of boxes and fittings protected from corrosion solely by enamel.

Note 2. It is recommended that the protective coating be of conductive material, such as cadmium, tin or zinc, in order to secure better electrical contact.

(2) **THICKNESS OF METAL.** (a) For sheet steel boxes and fittings not over 100 cubic inches in size, the metal shall not be less than No. 14 MS gauge (0.067 inch in thickness). Cast metal boxes shall have a wall thickness of not less than $\frac{1}{8}$ inch, except that boxes of malleable iron shall have a wall thickness of not less than $\frac{3}{16}$ inch.

(b) An outlet box made of a sheet-aluminum alloy shall not be less than 0.091 inch in thickness at any point except that a sharply bent section having a radius of curvature of not more than $\frac{1}{4}$ inch may be less than 0.091 but not less than 0.087 inch in thickness; and no minus tolerance is applicable to either of these dimensions. The aluminum alloy shall have a tensile strength of not less than 17,000 pounds per square inch.

(3) **BOXES OVER 100 CUBIC INCHES.** Boxes of over 100 cubic inches in size shall be composed of metal and shall conform to the requirements for cabinets and cutout boxes, except that the covers may consist of single flat sheets secured to the box proper by screws, or bolts instead of hinges. Boxes having covers of this form are for use only for enclosing joints in conductors or to facilitate the drawing in of wires and cables. They are not intended to enclose switches, cut-outs or other control devices.

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

E 370.21 Covers. Metal covers shall be of a thickness not less than that specified for the walls of the box or fitting of the same material and with which they are designed to be used, or shall be lined with

firmly attached insulating material not less than 1/32 inch in thickness. Covers of porcelain or other approved insulating material may be used when of such form and thickness as to afford the requisite protection and strength.

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

E 370.22 Bushings. Covers of outlet boxes and outlet fittings having holes through which flexible cord pendants may pass, shall be provided with approved bushings or shall have smooth, well-rounded surfaces, upon which the cord may bear. Where conductors other than flexible cord may pass through a metal cover, there shall be provided a separate hole for each wire, said hole being equipped with a bushing of suitable insulating material.

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

E 370.23 Non-metallic boxes. Provisions for supports, or other mounting means, for non-metallic boxes, shall be outside of the box, or the box shall be so constructed as to prevent contact between the conductors in the box and the supporting screws.

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