STANDARDS, 2020 NATIONAL ELECTRICAL CODE®

Applications: Steel Boxes

RACO® high-quality steel boxes:

- Are used in branch circuit wiring
- Accommodate wiring devices, such as switches and receptacles
- Most may also serve as fixture supports
- Provide excellent protection for wiring system or devices
- Must be closed with a cover, light fixture canopy or wallplate
- Permit access to conductors for maintenance
- Allow for branch circuit runs
- Provide two-hour fire rating for 4x4 or smaller wall opening

Product Features: Outlet Boxes for Fixture or Fan Support

These high-quality boxes:

- Are listed to support lighting fixture canopies or fans
- Feature oversized #10 screws to provide strength and rigidity

Product Features: TKO® Knockouts

- TKO® knockouts offer greater flexibility with RACO® combination 1/2" and 3/4" knockout
- Stock just one product instead of two or three
- One product for the installer to carry

TKO Provides Reliable Grounding Path

- Independent tests conducted by UL prove that the TKO passes the same high-current fault test used to test grounding bushings and ground lugs
- RACO® TKO knockout is UL Listed, providing bonding without the use of bonding jumpers
- Suitable for bonding without any additional bonding means around concentric (or eccentric, TKO) knockouts where used in circuits above or below 250V
- This knockout does not impair the electrical connection to ground

Most Raco® Boxes Have At Least One Tapped #10-32 Grounding Hole

- The products that do not have a grounding screw hole are: plenum boxes catalog numbers 226 and 239

Product Features: Combination Screw Heads

- Cover and clamp screws have combination slotted/Phillips heads
- Self-tapping screws provide for 100% thread engagement

Metallic Boxes: Fire Resistance Rating Wall Penetrations*

Listed single and double gang metallic outlet and switch boxes with metallic or nonmetallic cover plates, also metallic 4x4 and octagon boxes may be used in bearing and non-bearing wood stud and steel stud walls, and floor-ceiling and roof-ceiling assemblies with ratings not exceeding two hours.

The surface area of individual metallic outlet or switch boxes shall not exceed 16 square inches through a fire rated wall. The aggregate surface area of the boxes shall not exceed 100 square inches per 100 square feet. Boxes located on opposite sides of walls or partitions shall be separated by a horizontal distance of 24 inches.

The metallic outlet or switch boxes shall be securely fastened to the studs, and the opening in the wallboard facing shall be cut so that the clearance between the box and the wallboard does not exceed 1/8 inch.

* Reference: Fire Resistance Ratings ANSI/UL 263, Sec. III-6.

Standard Materials: Steel Covers, Outlet and Standard Switch Boxes

- Steel boxes and covers are made of .0625 inch thick pre-galvanized sheet steel
- Handy Box covers are made of .030 inch thick galvanized sheet steel

Compliances

RACO® steel boxes and covers generally carry the following compliance ratings. Check specific catalog pages for individual compliances.

- UL Listed – Standard 514-A, file E195978 ("QCIT" Category)
- Boxes and covers are listed for their Electrical Applications (electrical codes), UL Electrical Construction Equipment Online Directory (electrical codes).
- Boxes are listed for Fire Resistance Directory, including the Two-Hour Fire Rating, (building codes) UL Orange Book
- UL Classified Standard – UL263 file R16536, CEYY, QBWY
- CSA Certified – C22.2 #18, CSA File LR-1082
- ANSI/NEMA OS1
- Federal Manufacturer's number 28488

NEMA® Member

For installation guidelines and to learn more about RACO® products, visit the NEMA website at http://www.nema.org.

The National Electrical Manufacturers Association (NEMA) website is a valuable electrical resource providing the information you need - quickly.

Wiring Capacity: Steel Outlet and Switch Boxes; Cubic Inches

Maximum Number of Conductors or Minimum Size Box Required – National Electrical Code Article 314.16 (A and B) also table 314.16(A)

The purpose of NEC® Article 314.16 is to determine the maximum conductor count or the minimum box size required for an application. It also may be used to determine how many other conductors may be added without exceeding the Code-prescribed limit.

STANDARDS, 2020 NATIONAL ELECTRICAL CODE®

Most applications have determined the number of conductors. The question that then remains is the smallest (minimum) size box that is permitted. The rules of Article 314.16 are to be used to determine the Code-recognized limit.

Selection of an outlet or junction box for use in an electrical circuit work must take into consideration the maximum number of wires permitted in the box. Safe electrical practice demands that wires not be jammed into boxes because of the possibility of nicks, abrasions or other damage to the insulating material, creating the potential for ground faults or short circuits.

Article 314 – Boxes and Fittings

NEC® 314.16 (A and B) also table 314.16(A). Number of Conductors in Outlet, Device, and Junction Boxes, and Conduit Bodies.

Boxes shall be of sufficient size to provide free space for all enclosed conductors. In no case shall the volume of the box, as calculated in (a) below, be less than the fill calculation as calculated in (b) below. The minimum volume for conduit bodies shall be as calculated in (c) below.

The provisions of this section shall not apply to terminal housings supplied with motors. See Section 430.12.

Boxes and conduit bodies enclosing conductors, size #4 or larger, shall also comply with the provisions of Section 314-28.

(a) Box Volume Calculations. The volume of a wiring enclosure (box) shall be the total volume of the assembled sections, and, where used, the space provided by plaster rings, domed covers, extension rings, etc., that are marked with their volume in cubic inches or are made from boxes the dimensions of which are listed in Table 314.16(A).

(1) Standard Boxes. The volume of standard boxes that are not marked with a cubic inch capacity shall be as given in *Table 314.16(A).

(2) Other Boxes. Boxes 100 cubic inches (1,640 cu. cm3.) or less, other than those described in table, and nonmetallic boxes shall be durably and legibly marked by the manufacturer with their cubic inch capacity. Boxes described in table that have a larger cubic inch capacity than is designated in the table shall be permitted to have their cubic inch capacity marked as required by this section.

(b) Box Fill Calculations. The volumes in paragraphs (1) through (5) below, as applicable, shall be added together. No allowance shall be required for small fittings such as locknuts and bushings.

(1) Conductor Fill. Each conductor that originates outside the box and terminates or is spliced within the box shall be counted once, and each conductor that passes through the box without splice or termination shall be counted once. The conductor fill, in cubic inches, shall be computed using Table 314.16(B)(1). A conductor, no part of which leaves the box, shall not be counted.

Exception: Where an equipment grounding conductor or not over four fixture wires smaller than #14, or both, enter a box, from a domed fixture or similar canopy and terminate within that box, it shall be permitted to omit these conductors from the calculations.

(2) Clamp Fill. Where one or more internal cable clamps, whether factory or field supplied, are present in the box, a single volume allowance in accordance with NEC® 314.16(B)(2) shall be made based on the largest conductor present in the box. No allowance shall be required for a cable connector with this clamping mechanism outside the box.

(3) Support Fittings Fill. Where one or more fixture studs or hickeys are present in the box, a single volume allowance in accordance with NEC® 314.16(B)(3) shall be made for each type of fitting based on the largest conductor present in the box.

(4) Device or Equipment Fill. For each yoke or strap containing one or more devices or equipment, a double volume allowance in accordance with NEC® 314.16(B)(4) shall be made for each yoke or strap based on the largest conductor connected to a device(s) or equipment supported by that yoke or strap.

(5) Equipment Grounding Conductor Fill. Where one or more equipment grounding conductor(s) enter(s) a box, a single volume allow-ance in accordance with Table 314.16B shall be made based on the largest equipment grounding conductor present in the box. Where an additional set of equipment grounding conductors, as permitted by NEC® 314.16(B)(5) are present in the box, an additional volume allowance shall be made based on the largest equipment grounding conductor in the additional set.

STANDARDS, 2020 NATIONAL ELECTRICAL CODE®

MOST OFTEN REQUESTED SECTIONS OF THE NATIONAL ELECTRICAL CODE®	HOW RACO® PRODUCTS HELP COMPLETE THE INSTALLATION
250.97 Method of Bonding Service Equipment — Bonding Jumpers. Bonding jumpers are not required for concentric and eccentric knockouts if they are listed.	This Section is used to ensure that there is ground continuity when a concentric or eccentric knockout incorporated in a box. A bonding jumper is not required when using any of the RACO® patented TKO knockout boxes.
314.27 (A) Boxes at Lighting Fixture Outlets. Boxes to support light fixtures must be listed for fixture support.	Device boxes use #6-32 screws to secure devices such as snap-switches and receptacles. They are not suitable for support of other than very lightweight lighting fixtures, such as some wall-bracket types.
314.27 (B) Floor Boxes. Boxes listed specifically for this application shall be used for receptacles located in the floor. Exception: Boxes located in elevated floors of show windows and similar locations where the authority having jurisdiction judges them free from physical damage, moisture and dirt.	Only boxes that are UL Listed for the application may be fastened into the floor. RACO® floor boxes are in Section A of this catalog.
314.27 (C) Boxes at Fan Outlets. Boxes at Ceiling-Suspended (Paddle) Fan Outlets. Outlet boxes or outlet box systems used as the sole support of a ceiling suspended (paddle) fan shall be listed, shall be marked by their manufacturer as suitable for this purpose, and shall not support ceiling-suspended (paddle) fans that weigh more than 32kg (70lb).	For any ceiling outlet that is intended to have a ceiling (paddle) fan installed, a UL Listed outlet box rated for ceiling fan support must be installed. RACO® offers a complete line of products designed for various applications and mounting needs.
314.16 (A)(3) Space for Conductors. Canopies and outlet boxes taken together shall provide adequate space so that fixture conductors and their connecting devices can be properly installed.	When calculating the minimum cubic inch requirements for an outlet box, the canopy may be included in the calculation at the discretion of the Authority Having Jurisdiction. If the canopy of the fixture/fan is marked with the cubic inch capacity, then the additional volume must be accepted by the Authority Having Jurisdiction.
314.27 (B) Maximum Luminaire Weight. Fixtures greater than 50 pounds cannot be supported by a fixture box unless additional independent support is provided.	All outlet boxes that are intended to be used with fixtures are tested in accordance with UL Standard 514A.
250.146 (A) Surface-Mounted Box. Where the box is mounted on the surface, direct metal-to-metal contact between the device yoke and the box or a contact yoke or device that complies with 250.146(B) shall be permitted to ground the receptacle to the box.	This new method provides better bonding for the cover. RACO flat corner covers and mud rings comply.

STANDARDS, 2020 NATIONAL ELECTRICAL CODES®

MOST OFTEN REQUESTED ARTICLES OF THE 2020 NATIONAL ELECTRICAL CODE®	HOW RACO® PRODUCTS HELP COMPLETE THE INSTALLATION
800.133 Exception (A)(1)(d) Installation of Communications Wires, Cables and Equipment – Electric Light or Power Circuits. Communications conductors shall not be placed in any raceway, compartment, outlet box, junction box, or similar fitting with conductors or electric light or power circuits or Class 1 circuits.	When power and voice/data are brought to one enclosure, a means of dividing the wiring is required. Voltage barriers are available on the following box types: 4" and 4-11/16" square boxes, three- and four-gang switch boxes, masonry boxes, and gang boxes.
406.12, Tamper-resistant Receptacles. In all areas specified in 406.12(1) through 406.12(8), all 125 volt, 15 and 20 amp receptacles shall be listed tamper-resistant receptacles.	This is to prevent shocks ot small children that like to insert keys, paper clips, etc. into the receptacle slots.
314.24 (B) Depth of Boxes. Minimum depth of boxes for outlets, devices, and utilization equipment.	Boxes must be a minimum depth depending on their use and/or are required to have a minimum clearance behind the device or equipment of per 314.24 (B).

BOX SELECTION

CALCULATE THE MINIMUM SIZE BOX

NEC® 314.16 (A) and (B) describes the detailed way of counting wires, as well as clamps, fittings or devices (i.e., switches, receptacles, combination devices) – by establishing an equivalent conductor value for each. Those values are added together to get a total number of conductors. The minimum size box is the smallest one in Table 314.16(A) that can accommodate that number of conductors.

1. No matter how many ground wires come into a box, they only count as one conductor within the box.
2. Any wire 12 inches or less in length running unbroken through the box counts as one wire.
3. Each wire coming into a splice device (crimp or twist-on type) is counted as one wire.
4. Each wire coming into the box and connecting to a device counts as one wire of that size.
5. Fixture studs, cable clamps and hickeys are to be counted as one for each type of fitting. If a box contains two cable clamps, the total is only to be increased by one.
6. Where devices are mounted in the box, the total conductor count must be increased by two for each mounting strap.

Example #1: – Conduit Boxes: Supply power to a switch that will control a remote light with #14 conductors. Metal conduit and fittings will be used as the wire way. You must provide space for four conductors and one switch, totaling 6. Read across the line "Allowances" in the **Box Fill** table to column 6, then read down to the minimum cubic inches required for #14 conductor. This example requires a minimum of 12.0 cubic inches.

Example #2: – Cable Boxes:

This example will illustrate how the minimum size is determined for a box with cable clamps fed by two #12-2 nonmetallic sheathed cables and supplying a 15A duplex receptacle. After supplying the receptacle, the conductors are extended to other outlets.

Circuit conductors.....4
Ground conductors 1
Cable clamps 1
Device (receptacle).....2
Total.....**8**

Using the **Box Fill** table from the next page, read across the line "Allowances" to column 8, then down to the minimum cubic inches required for #12 conductor. This example requires a minimum of 18.0 cubic inches.

STEEL BOX SELECTION CHART

CUBIC INCHES:	42.0	30.3	29.5	21.5	21.0	18.0
CONDUIT STEEL BOXES	 **4-11/16" Sq.** 2-1/8" Deep (inside)	 **4" Sq.** 2-1/8" (Depth Inside)	 **4-11/16" Sq.** 1-1/2" (Depth Inside)	 **4" Oct.** 2-1/8" (Depth Inside)	 **4" Sq.** 1-1/2" (Depth Inside)	 **Switch** 3-1/2" (Depth Inside)

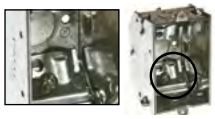
CUBIC INCHES:	30.3	42.0	21.5	21.0	18.0
MC/BX & NONMETALLIC CABLE STEEL BOXES	 **4" Sq.** 2-1/8" (Depth Inside)	 **4-11/16" Sq.** 2-1/8" (Depth Inside)	 **4" Oct.** 2-1/8" (Depth Inside)	 **4" Sq.** 1-1/2" (Depth Inside)	 **Switch** 3-1/2" (Depth Outside)

CLAMP TYPES


"L" TYPE


"X" TYPE

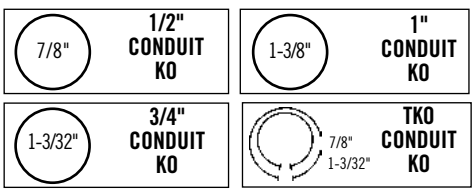

"#9" or "AOL" TYPE

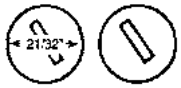

"BN" TYPE


"Q" TYPE

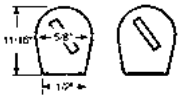

STAB-IT® TYPE

KNOCKOUTS AND PRIOUTS



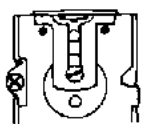


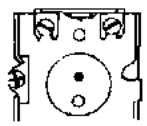
CABLE PRIOUTS
Always in pairs.



FLAT-BOTTOMED CABLE PRIOUTS
Eliminate chance of cable being cut.

PLASTER EARS


ONE-SCREW EAR


TWO-SCREW EAR

Adjustable plaster ears are included on many switch boxes and one octagon box. They are set forward 1/32".

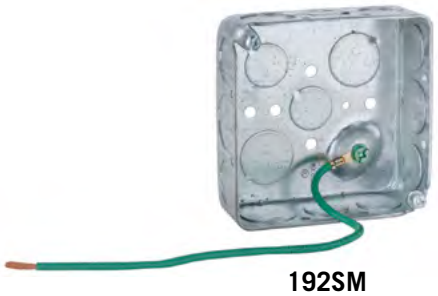
4" SQUARE BOXES – DRAWN WITH CONDUIT KO'S

185

190, 8190

191, 8191

192, 8192



192SM

204

CAT. #	DESCRIPTION	CUBIC INCHES (CM³)	KNOCKOUTS		STD. PKG.	BAR CODE
			SIDES CONDUIT	BOTTOM CONDUIT		
4" Square Box, 1-1/4" Deep – *Drawn with Conduit KO's*						
185	—	18.0 (295.0)	(10) 1/2"	(5) 1/2"	50	IIIIIIII
4" Square Box, 1-1/2" Deep – *Drawn with Conduit KO's*						
190	Raised Ground	21.0 (344.1)	(12) 1/2"	(4) 1/2"	50	—
8190	Raised Ground	21.0 (344.1)	(12) 1/2"	(4) 1/2"	50	IIIIIIII
191	Raised Ground	21.0 (344.1)	(8) 3/4"	(1) 1/2", (3) 3/4"	50	—
8191	Raised Ground	21.0 (344.1)	(8) 3/4"	(1) 1/2", (3) 3/4"	25	IIIIIIII
192	Raised Ground	21.0 (344.1)	(8) 1/2", (4) 3/4"	(2) 1/2", (2) 3/4"	50	—
8192	Raised Ground	21.0 (344.1)	(8) 1/2", (4) 3/4"	(2) 1/2", (2) 3/4"	50	IIIIIIII
192SM	Raised Ground, 10" #12 Stranded Copper Pigtail	21.0 (344.1)	(8) 1/2" (4) 3/4"	(2) 1/2" (2) 3/4"	50	IIIIIIII
4" Square Thru-the-Wall Box, 1-1/2" Deep – *Drawn with Conduit KO's*						
204	—	22.5 (368.7)	(8) 1/2", (4) 3/4"	—	50	—

APPLICATIONS

- RACO® Boxes are installed in walls or ceilings for lighting fixtures, switches or receptacles
- Square boxes are used where multiple conductor runs are split into two or more directions to bring power to a number of electrical devices
- Drawn boxes are ideal for exposed work applications

PRODUCT FEATURES

- Combination screw heads provide for faster installation
- Thru-the-wall box is designed for shallow wall applications and allows for attachment of wall plate to both faces of box

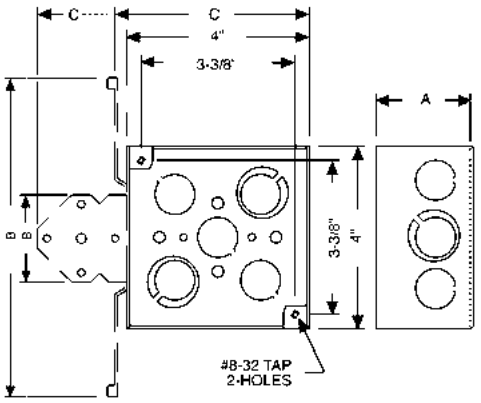
COMPLIANCE

- UL LISTED
- All RACO UL listed steel boxes are acceptable for use in 2 hr. fire rated floor-ceiling and roof-ceiling assemblies, as well as 2 hr. fire rated bearing and non-bearing wood stud and steel stud walls. For additional information consult Fire Resistance Ratings ANSI/UL 263, Sec. III-6

SEE END OF SECTION (PG A78) FOR DETAILED DRAWINGS »

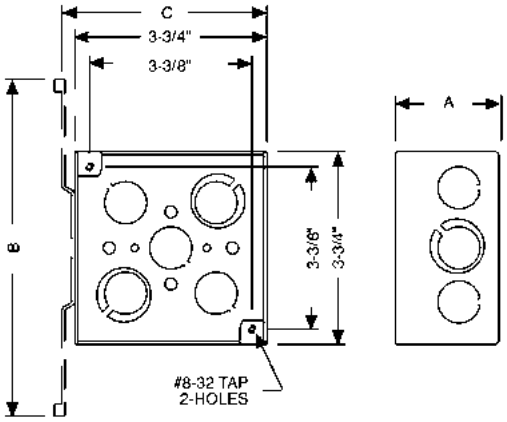
SQUARE BOXES

4" SQUARE CONDUIT BOXES



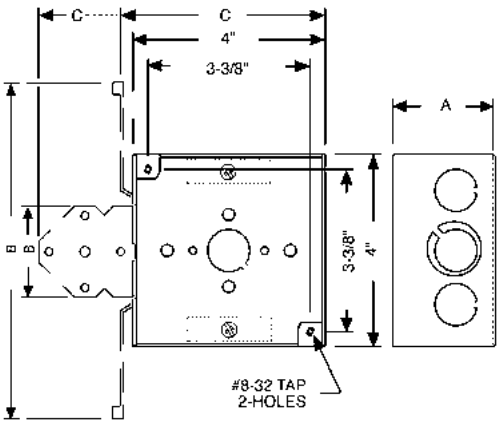
CAT. #	DIMENSIONS		
	A (INSIDE)	B	C
181	1-1/2"	-	-
185	1-1/4"	-	-
187	1-1/2"	-	-
199	1-1/2"	6-7/8"	4-3/8"
202	1-1/2"	-	-
204	1-1/2"	-	-
207	2-1/8"	-	-
226	1-1/2"	-	-
227	1-1/2"	4-5/8"	5-1/2"
236	2-1/8"	7-5/8"	4-3/8"
237	2-1/8"	7-5/8"	4-3/8"
238	2-1/8"	4-5/8"	5-1/2"
239	2-1/8"	-	-
251	2-1/8"	1-31/32"	6"
8197	1-1/2"	7-3/8"	4-3/8"
189, 8189	1-1/2"	-	-
189F	1-1/2"		
189H	1-1/2"	3-1/8"	4-15/16"
189HS	1-1/2"	3-1/8"	4-15/16"
189HWP	1-1/2"	3-1/8"	4-15/16"
189M	1-1/2"	3-1/8"	4-15/16"
189RAC	1-1/2"	-	-
189SM	1-1/2"	-	-
190, 8190	1-1/2"	-	-
191, 8191	1-1/2"	-	-
192, 8192	1-1/2"	-	-
192SM	1-1/2"	-	-
193, 8193	1-1/2"	1-31/32"	6"
196, 8196	1-1/2"	6-7/8"	4-3/8"
201, 8201	1-1/2"	-	-
203, 8203	1-1/2"	-	-
208, 8208	1-1/2"	6-13/16"	5-15/16"
231, 8231	2-1/8"	-	-
232, 8232	2-1/8"	-	-
232F	2-1/8"	-	-
232H	2-1/8"	3-1/8"	4-15/16"
232HS	2-1/8"	3-1/8"	4-15/16"
232HWP	2-1/8"	3-1/8"	4-15/16"
232M	2-1/8"	7"	4-15/16"
232-OW	2-1/8"	-	-
232RAC	2-1/8"	-	-
232SM	2-1/8"	-	-
233, 8233	2-1/8"	-	-
235, 8235	2-1/8"	7"	4-5/16"
911-3	2-1/8"	-	-
911-4	2-1/8"	7-5/8"	4-3/8"
911-6	1-1/2"	-	-
911-9	1-1/2"	-	-

3-3/4" SQUARE CONDUIT BOXES



CAT. #	DIMENSIONS		
	A (INSIDE)	B	C
255	3-1/2"	7-5/8"	3-3/4"
911-1	3-1/2"	7-5/8"	3-3/4"
256	3-1/2"	-	-
911-2	3-1/2"	-	-

4" SQUARE CABLE BOXES



CAT. #	DIMENSIONS		
	A (INSIDE)	B	C
223	1-1/2"	6-7/8"	4-3/8"
224	1-1/2"	1-31/32"	6"
225	1-1/2"	1-31/32"	6"
228	1-1/2"	4-5/8"	5-1/2"
229	1-1/2"	4-5/8"	5-1/2"
242	2-1/8"	-	-
243	2-1/8"	4-5/8"	5-1/2"
248	1-1/2"	-	-
249	2-1/8"	1-31/32"	6"
211, 8211	1-1/2"	-	-
213, 8213	1-1/2"	-	-
213HWP	1-1/2"	3-1/8"	4-15/16"
218, 8218	1-1/2"	6-7/8"	4-3/8"
240, 8240	2-1/8"	7"	4-5/16"
241, 8241	2-1/8"	7"	4-5/16"
248HWP	2-1/8"	3-1/8"	4-15/16"