

Cable Wiring Methods: NM, UF, MC, and Boxes

YES Electric • NEC 2026 with NEC 2023 numbers in parentheses

Draft 1 (October 2026). This chapter is under review. Code numbers are NEC 2026. Your local inspector may use an earlier edition, so ask your journeyman which one applies. Boxes marked "Picture coming" will get drawings and photos in a later version.

YES Electric Residential Electrical Course • Phase 1, Install

Code edition: this module cites NEC 2026. Where a section number changed from NEC 2023, the 2023 number is in parentheses. The local inspector (the AHJ, "authority having jurisdiction") may enforce an earlier edition, so ask your journeyman which one applies before your first inspection.

Read R1.2 first. R1.2 walks a whole stud-open house from panel to last outlet. This module goes deeper on four things R1.2 uses on every run: which cable to pick, how to run and fasten it, how to size the box, and how to mount the box.

1. Learning Objectives

When you finish this module you can do these things without help:

1. Pick the right cable for the place it goes: NM-B indoors in dry places, UF-B underground and in wet places, MC or AC where NM is not allowed or the customer wants armor.
 2. Bore framing at the right setback, add steel nail plates where the hole is too close to the face, and staple cable at the right spacing.
 3. Count a box: conductors, devices, clamps, studs, and grounds, add up the cubic inches, and pick a box that is big enough.
 4. Mount new-work boxes on studs at the right depth, and mount old-work boxes in finished drywall.
 5. Strip cable and make up a box in the right order: grounds first, then neutrals, then hots.
 6. Say the reason behind each rule, so you can explain it to a customer or an inspector.
-

2. Plain-Language Background

2.1 What a "wiring method" is

A wiring method is the way wires get from the panel to the outlet. In a house, almost every branch circuit is cable. A cable is two or more insulated wires plus a ground wire, wrapped together in one jacket at the factory. You pull the whole bundle as one piece.

Commercial jobs mostly use conduit, which is a pipe you pull single wires through. Conduit is covered in commercial Module 1.2. In houses we use conduit for short exposed runs, for protection where cable could get hit, and underground. The cable inside the house is the main event.

2.2 The four cables you will handle

Cable	What it looks like	Where it goes	Where it never goes
NM-B ("Romex")	Flat or round plastic jacket. Inside: black, white, sometimes red, and a bare copper ground, each wrapped in paper	Inside walls, ceilings, floors, and attics of houses, in dry places	Wet or damp places, buried in the ground, buried in concrete, as service cable
UF-B	Solid gray plastic. The wires are molded into the jacket, so you can't slide them out	Buried in the ground, wet places, damp places. It can also be used indoors wherever NM is allowed	Concrete, sunlight unless marked sunlight resistant, service cable
MC (metal-clad)	Spiral aluminum or steel armor. Inside: insulated wires including a green ground wire, with a plastic wrap	Exposed runs in garages and basements, places where the customer or the job calls for armor	Places where it can get hit hard, and buried or wet places unless the cable is marked for it
AC ("BX")	Spiral steel armor with a thin aluminum bonding strip inside, and paper around the wires	Older houses, dry places	Wet or damp places, places where it can get hit

Picture coming: Four cables side by side on a white background, each with 6 inches of jacket stripped so the inner wires show: NM-B 12-2 with yellow jacket, UF-B 12-2 gray, MC 12-2 with aluminum armor and green ground, AC with steel armor, thin aluminum bonding strip, and red plastic anti-short bushing. Under each, a caption row: "Dry indoor," "Underground and wet," "Exposed or by request," "Older homes, dry only."

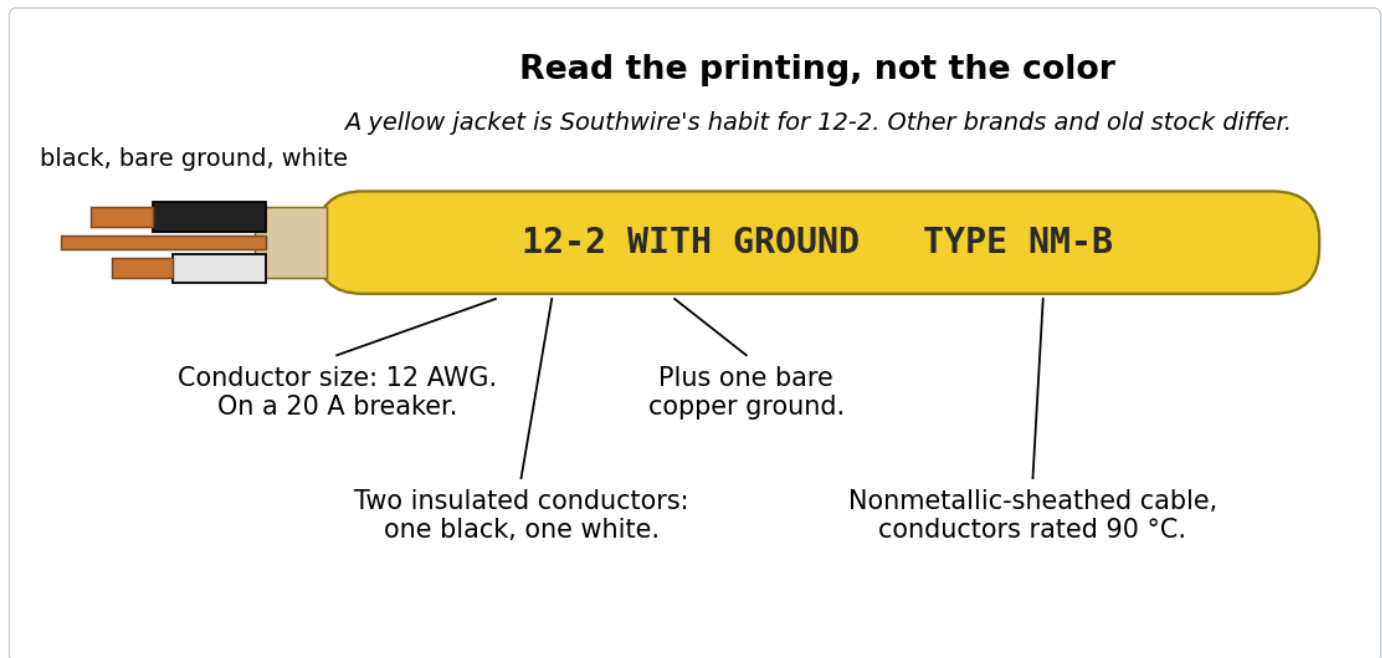
2.3 Reading the cable name

The name printed on the jacket tells you what is inside.

- "12-2 WITH GROUND" means two insulated 12 AWG conductors (black and white) plus a bare ground.

- "14-3 WITH GROUND" means three insulated 14 AWG conductors (black, white, red) plus a bare ground.
- "NM-B" means nonmetallic-sheathed cable with conductors rated 90 °C. The NEC requires NM conductors to be rated 90 °C (334.112), and the informational note says NM-B meets that rule.

Southwire color-codes the outside jacket so you can tell the size from across the room. The color is a manufacturer's habit, not an NEC rule, so always read the print on the jacket before you trust the color.



The printing on the jacket of NM-B cable tells you the wire size, the number of insulated conductors, whether there is a ground, and the cable type. Read the printing instead of trusting the jacket color.

Drawing: YES Electric.

Wire size (AWG)	Two-conductor jacket (12-2 style)	Three-conductor jacket (12-3 style)	Breaker it normally goes on
14	White	Blue	15 A
12	Yellow	Purple	20 A
10	Orange	Pink	30 A
8	Black	Black	40 A
6	Black	Black	55 A max by ampacity; usually 50 A breaker

Source for the jacket colors: Southwire Romex SIMpull NM-B spec sheet, ©2024 (<https://images.thdstatic.com/catalog/pdfImages/c8/c88dd66a-47bf-4d95-957c-a3757f9480e6.pdf>). The same sheet notes that 8-2 and 6-2 NM-B carry a 10 AWG bare ground. Older stock and other brands may color 14-3 white and 12-3 yellow, the same as the two-conductor cable.

NM-B jacket colors (Southwire)

The color is a manufacturer's habit, not an NEC rule. Always read the print on the jacket.

Wire size (AWG)	Two-conductor jacket (12-2 style)	Three-conductor jacket (12-3 style)	Breaker it normally goes on
14	14-2 WHITE	14-3 BLUE	15 A
12	12-2 YELLOW	12-3 PURPLE	20 A
10	10-2 ORANGE	10-3 PINK	30 A
8	8-2 BLACK	8-3 BLACK	40 A
6	6-2 BLACK	6-3 BLACK	55 A max by ampacity; usually 50 A breaker

Source: Southwire Romex SIMpull NM-B spec sheet (2024). 8-2 and 6-2 carry a 10 AWG bare ground. Older stock and other brands may color 14-3 white and 12-3 yellow.

Southwire colors its NM-B jackets by wire size: white, yellow, and orange for 14, 12, and 10 AWG two-conductor cable, blue, purple, and pink for three-conductor, and black for 8 and 6 AWG. The right column shows the breaker each size normally goes on.

Drawing: YES Electric.

2.4 Why NM ampacity is held to the 60 °C column

The wires inside NM-B are rated 90 °C. The NEC still holds NM to the 60 °C column of Table 310.16 (334.80(A)). The reason is the jacket and the devices. Most receptacle and switch terminals are only rated 60 °C or 75 °C, and the cable sits packed in insulation where heat can't escape. The 90 °C rating can be used only as the starting point for derating math, and the final answer still can't go above the 60 °C number.

Copper size	60 °C ampacity (Table 310.16)	Max breaker for that wire in a house
14 AWG	15 A	15 A (240.4(D)(4))
12 AWG	20 A	20 A (240.4(D)(6))
10 AWG	30 A	30 A (240.4(D)(8))
8 AWG	40 A	40 A
6 AWG	55 A	50 A is the next standard size down; 60 A is allowed only under the next-size-up rule in 240.4(B), so ask your journeyman

The 240.4(D) "small conductor rule" is the one you will use every day. It says 14 AWG copper gets no more than a 15 A breaker, and 12 AWG copper gets no more than 20 A. That rule exists because the wire would overheat long before a bigger breaker tripped.

2.5 Why boxes have a size limit

Every splice and every device makes heat. Wires in a box also need room so you can fold them in without nicking insulation or loosening a terminal. When a box is overfilled, you have to force the device in. That pressure loosens screws and cracks insulation, and you get a hot spot inside a wall where nobody will see it until it smokes. NEC 314.16 turns "big enough" into a number you can check with a pencil.

3. Step-by-Step Procedures

Procedure A: Choose the cable

Walk the run in your head from the panel to the last box and ask these questions in order.

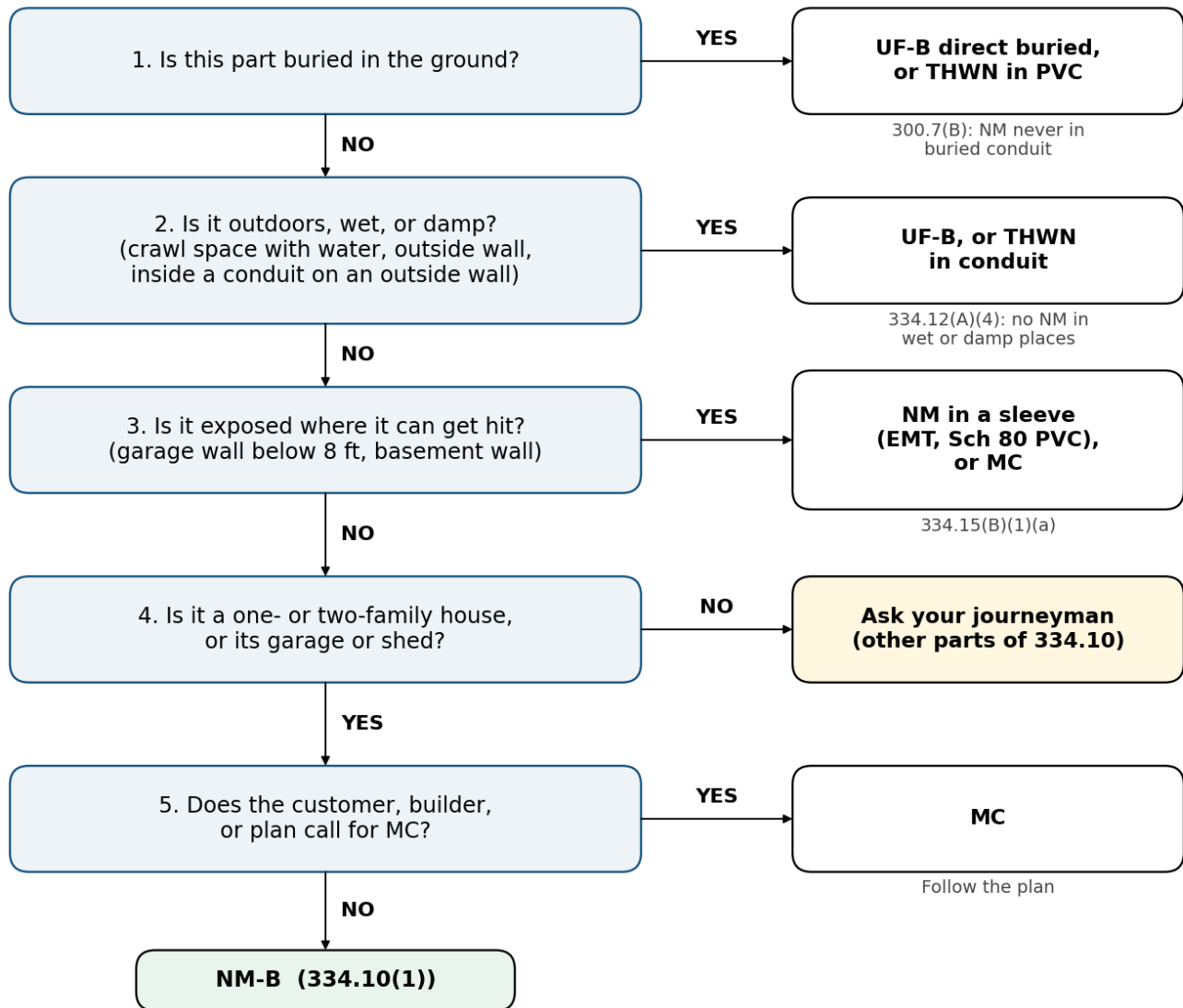
1. Is any part of the run buried in the ground? If yes, that part is UF-B (direct burial) or conductors in conduit. The inside of an underground raceway is a wet location (300.7(B)), so NM-B can never be pulled through buried conduit, even for 3 feet.
2. Is any part outdoors, in a wet place, or in a damp place? A crawl space with standing water, an outdoor wall, the inside of a conduit on an outside wall, and a car wash bay all count. The inside of a raceway on an outside wall is a wet location (300.11(A)). Use UF-B, or wet-rated wire such as THWN in conduit. NM-B is not allowed in wet or damp locations (334.12(A)(4)).
3. Is the run exposed where it can get hit? Examples are a garage wall below 8 feet, the side of a basement wall, or the run down a wall to a well pump. NM there needs protection such as EMT, Schedule 80 PVC, or other approved means (334.15(B)(1)(a)), or you can switch to MC.
4. Is it a one- or two-family house or its garage or shed? NM-B is allowed there (334.10(1)). Townhomes and apartments follow other parts of 334.10. Ask your journeyman before you run NM in anything bigger than a duplex.

5. Does the customer, the builder, or the plan call for MC? Some remodel customers want armored cable in basements. Follow the plan.

Default answer for a house interior: NM-B. Default for buried: UF-B, or THWN in PVC. Default for exposed garage or basement runs: MC, or NM in a sleeve.

Procedure A: choose the cable

Ask these in order for each part of the run, from the panel to the last box.



Procedure A as a flowchart. Answer the five questions in order for each part of the run to land on UF-B or THWN in PVC, NM in a sleeve or MC, or plain NM-B.

Drawing: YES Electric.

Procedure B: Plan the run before you drill

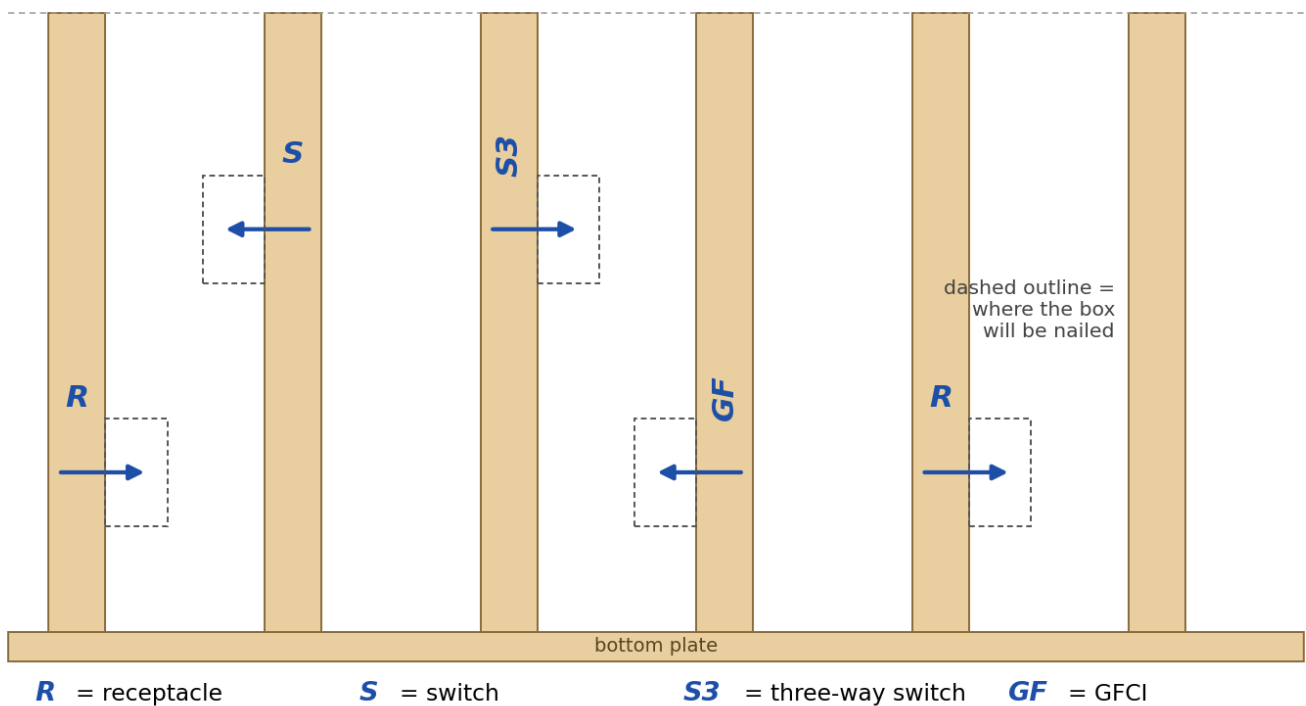
1. Mark every box location on the studs with a lumber crayon. Use an arrow to show which side of the stud the box goes on. Write a code next to it: "R" for receptacle, "S" for switch,

"S3" for a three-way, "GF" for GFCI. NAVEDTRA 14026, Chapter 5, pp. 5-12 to 5-13, shows this marking system.

2. Set the boxes first, then drill. A box nailed in place shows you exactly where the cable has to land.
3. Plan the shortest path from box to box. Electricians run box to box in straight lines because it saves wire and labor (NAVEDTRA 14026, p. 5-13).
4. Decide the drilling height. A common habit is to drill a straight line through the studs about 12 to 18 inches above the floor for receptacles. A straight row of holes makes pulling easy. Holes at angles or zigzagging up and down make the cable drag (NAVEDTRA 14026, p. 5-14, Figure 5-24).
5. Look for plumbing, ductwork, and HVAC chases. Keep your holes away from where the plumber will drill.

Procedure B: mark every box on the studs before you drill

Write the code with a lumber crayon. The arrow points to the side of the stud the box goes on.



Box locations marked on the studs with a lumber crayon before drilling. The letter tells what goes there (R, S, S3, GF) and the arrow shows which side of the stud the box is nailed to.

Drawing: YES Electric.

Procedure C: Drill the framing

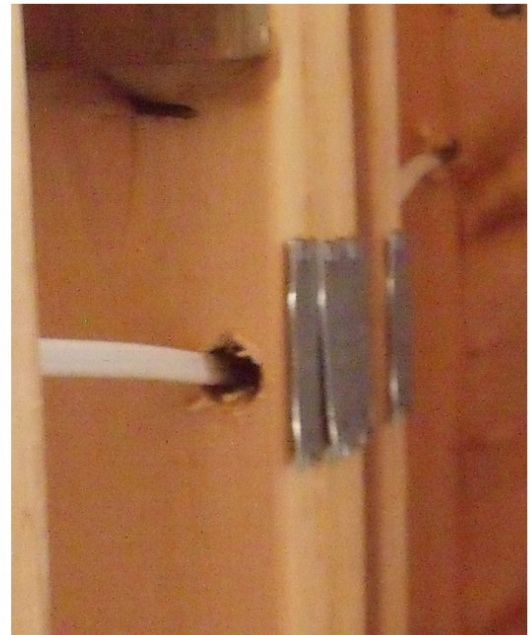
Tools: right-angle drill, 3/4-inch or 7/8-inch self-feed or auger bit, safety glasses, gloves. For metal studs, use the factory punch-outs and listed plastic grommets.

1. Put on safety glasses. A right-angle drill can kick hard when the bit binds on a nail. Brace the handle against your body or the next stud, never your face. Use the side handle and the clutch if the drill has one.
2. Center the hole in the stud. A 2x4 is 3½ inches deep. A hole centered in it leaves 1¼ inches or more from each face to the edge of a 3/4-inch hole. That 1¼ inches is the code number.
3. The rule: the edge of the hole must be at least 1¼ inches from the nearest edge of the wood (300.6(A)(1); 2023: 300.4(A)(1)). The reason is that drywall screws and trim nails are about 1¼ inches long. Cable that sits deeper than that can't be hit by a normal fastener.
4. If you can't keep 1¼ inches, cover the area with a steel nail plate at least 1/16 inch thick. The plate must be long enough and wide enough to cover where the cable passes (300.6(A)(1)). A listed and marked plate thinner than 1/16 inch is allowed if it is listed for equal protection (Exception No. 2).
5. Notches: a notch in the edge of a stud is allowed only if it does not weaken the framing, and the cable in a notch must always get a 1/16-inch steel plate (300.6(A)(2)). The plate goes on before the drywall. Avoid notching. Bore instead.
6. Cable running along the side of a stud or joist (parallel) must also stay 1¼ inches back from the face where nails or screws are likely (300.6(D)). If it can't, use a plate or a sleeve.
7. Under roof decking, keep cables at least 1½ inches below the deck (300.6(E)). Roofers drive long screws and nails through the deck during reroofs.
8. Metal studs: NM through a metal stud needs a listed bushing or grommet in the hole, snapped in before the cable goes through (300.6(B)(1)). 334.17 adds that the grommets must stay in place and be listed for cable protection.
9. Don't make big holes in framing. Building codes limit how big a hole or notch can be in a stud or joist. Ask your journeyman or the framer before drilling a hole bigger than 1 inch, or within 2 inches of the top or bottom of a joist. (Ask your journeyman for the building code limits.)

SAFETY: In a remodel, a wall may already have live wiring, water lines, and gas lines in it. Before you drill into an existing wall or floor, turn off the circuits you know about, scan with a stud finder that has an AC detection mode, and look at both sides of the wall. Drill slowly the last half inch.



NM cable run through holes bored in the studs



Steel nail plates nailed over the stud edge where the cable passes close to the face

Left: NM cable run through holes bored in wood studs during rough-in. Right: steel nail plates fastened over the stud edge where the cable passes close to the face, so drywall screws cannot reach it.

Photo: Electrical-wiring-rough-in.jpg by Amy Bonilla (Flickr); file optimized by Gazebo, CC BY-SA 2.0.

Picture coming: Top-down cross-section of a 2x4 stud (3½ inches deep) with a ¾-inch hole bored in the center. Dimension lines show 1¼ inches from each face to the edge of the hole. A second stud next to it has a hole bored ¾ inch from the face, with a steel nail plate nailed over the face, labeled "1/16 in. steel plate, required when less than 1¼ in." A drywall screw is drawn on each, showing it misses the centered cable and stops at the plate on the other.

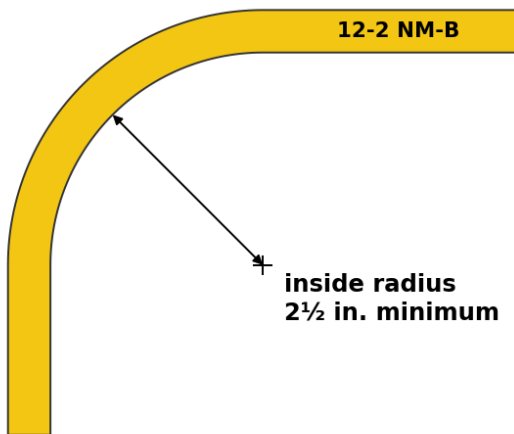
Procedure D: Pull and secure NM cable

1. Set the reel or box of cable at the panel end or the first box. Pull the cable straight out of the box. Don't pull it off the side of the coil, or it will kink and twist.
2. Leave enough at the start box. Strip and land later. Leave at least 8 inches of cable past the face of the box so you will have 6 inches of free wire after stripping (see Procedure G).
3. Feed the cable through the bored holes. Don't let it rub hard on a sharp stud edge. If it is tight, have a helper feed while you pull.
4. Bends must be gentle. The inside radius of a bend can't be less than five times the cable diameter (334.24). For a 12-2 cable that is about 1/2 inch wide flat, a 2½-inch inside radius bending flat is the minimum. A tight fold damages the conductors.
5. Staple or strap the cable within 12 inches of every box and every 4½ feet along the run (334.30). Horizontal runs through bored holes count as supported if the holes are no more than 4½ feet apart and the cable is still stapled within 12 inches of each box (334.30(A)).

6. Use listed staples or straps that are designed for NM (334.2(2), 334.30). Drive the staple so it holds the cable firmly but doesn't dent the jacket. A crushed jacket can cut the insulation of the conductor inside. NAVEDTRA 14026 p. 5-13 makes the same warning.
7. Flat cable must never be stapled on edge (334.30). Lay it flat on the face of the stud and staple across it.
8. Single-gang plastic boxes with no clamp: if the box is no bigger than 2¼ by 4 inches, you don't have to clamp the cable to the box as long as the cable is stapled within 8 inches of the box and the jacket goes at least 1/4 inch into the box through the knockout (314.17(B) (2) Exception). That is why the first staple on a plastic single-gang box goes close, at about 6 to 8 inches.
9. In unfinished basements and crawl spaces: cables run across the bottoms of joists must be at least two 6 AWG or three 8 AWG conductors to staple directly to the joist bottoms. Smaller cable, which is almost everything (14 AWG, 12 AWG, 10 AWG), must go through bored holes or on running boards (334.15(C)). The reason is that a cable stapled under a joist is where people hang things and hit with tools.
10. Cable on a basement wall: put it in listed conduit or tubing, or protect it per 300.6. Use a bushing or adapter on the conduit end so the edge doesn't cut the jacket. The jacket must go through the conduit and at least 1/4 inch into the box, and the cable must be secured within 12 inches of where it enters the conduit (334.15(C)).
11. Exposed NM must follow the building surface closely (334.15(A)). Where it passes through a floor, sleeve it in EMT, rigid, IMC, Schedule 80 PVC, or other approved means extending at least 6 inches above the floor (334.15(B)(1)(b)).
12. Accessible attics: 334.23 sends you to 320.23. Where cable runs across the tops of joists or across the face of rafters, add guard strips at least as high as the cable within 6 feet of the scuttle hole if the attic has no permanent stairs or ladder. If it has permanent stairs or a pull-down ladder, guard strips go anywhere within 7 feet of the floor or horizontal surface (320.23(A)). Cable that runs along the side of a joist or rafter needs no guard strip but still follows 300.6(D) (320.23(B)).
13. Bundles: if you pass more than two NM cables (each with two or more current-carrying conductors) through the same hole without spacing, and that hole will be sealed with insulation, caulk, or foam, you must derate the wire per Table 310.15(C)(1) (334.80(B)). The same rule applies to more than two NM cables in contact with thermal insulation without spacing (334.80(C)). In practice, drill a second hole and split the bundle. Fire caulk and spray foam at top plates trigger this rule, which is why we keep cables spread out.

Bend radius for NM cable (334.24)

Inside radius of the bend: at least 5 × the cable diameter.



✓ **Gentle bend: OK**

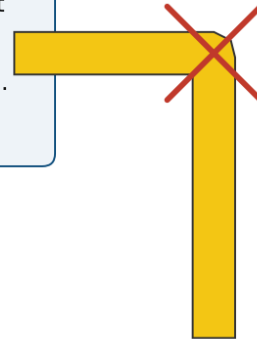
The math

12-2 NM-B is about
1/2 in. wide (flat)
 $5 \times 1/2 \text{ in.} = 2\frac{1}{2} \text{ in.}$

end view (enlarged)



about 1/2 in.



Tight fold: WRONG

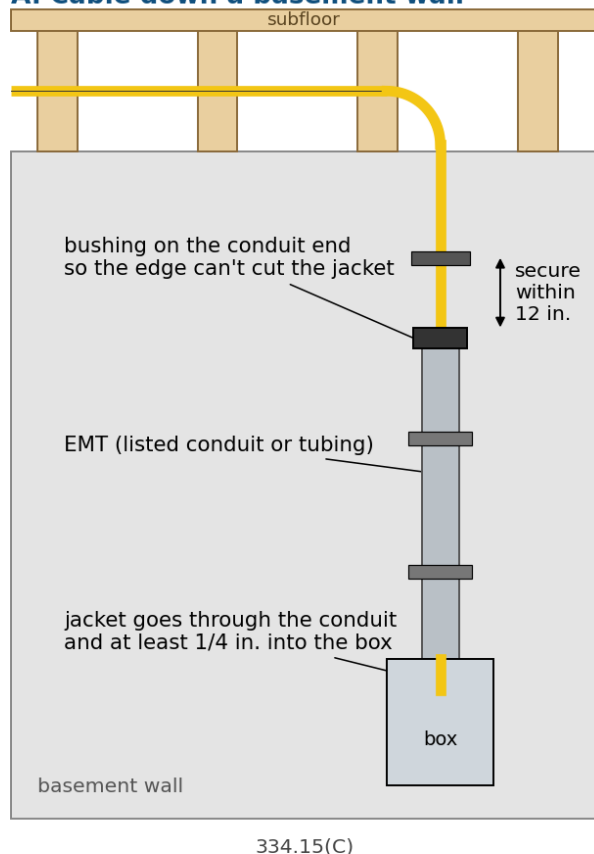
A sharp fold damages the
conductors inside.

The inside radius of a bend in NM cable must be at least five times the cable diameter. For 12-2 NM-B, which is about 1/2 inch wide, that is 2 1/2 inches, and a tight fold is wrong.

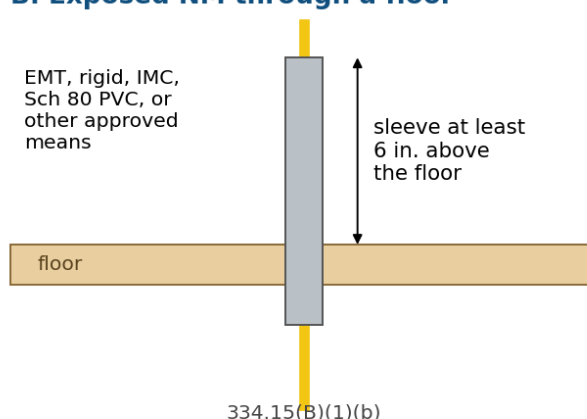
Drawing: YES Electric.

Protecting NM in a basement (Procedure D, steps 10 to 13)

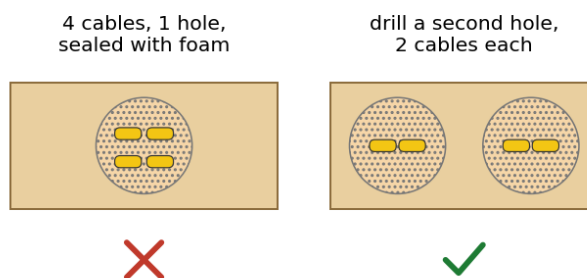
A. Cable down a basement wall



B. Exposed NM through a floor



C. Sealed holes: two cables per hole



More than two NM cables in a sealed hole = derate (334.80(B))

NM cable on a basement wall runs in EMT with a bushing on the end and is secured within 12 inches of the conduit. Exposed NM through a floor needs a sleeve at least 6 inches above the floor, and a sealed hole should hold no more than two cables.

Drawing: YES Electric.

SAFETY: Never staple cable that is already connected to a live circuit. A staple through a live cable makes a dead short in your hand. On remodels, kill the circuit and lock it before you staple near existing cable.

Picture coming: Side view of a 16-foot wall with studs 16 inches on center. A single 12-2 NM cable runs from a receptacle box at left, through bored holes in a straight line, to a second receptacle box at right. Callouts: "staple within 12 in. of box," "bored holes no more than 4½ ft apart = supported," "flat cable stapled flat, not on edge," and "staple within 8 in. on a single-gang plastic box with no clamp."

Procedure E: UF cable underground

UF-B is the cable for a run to a detached shed, a post light, a well pump, or an outdoor receptacle away from the house. These numbers come from Table 300.7(A) (2023: Table 300.5).

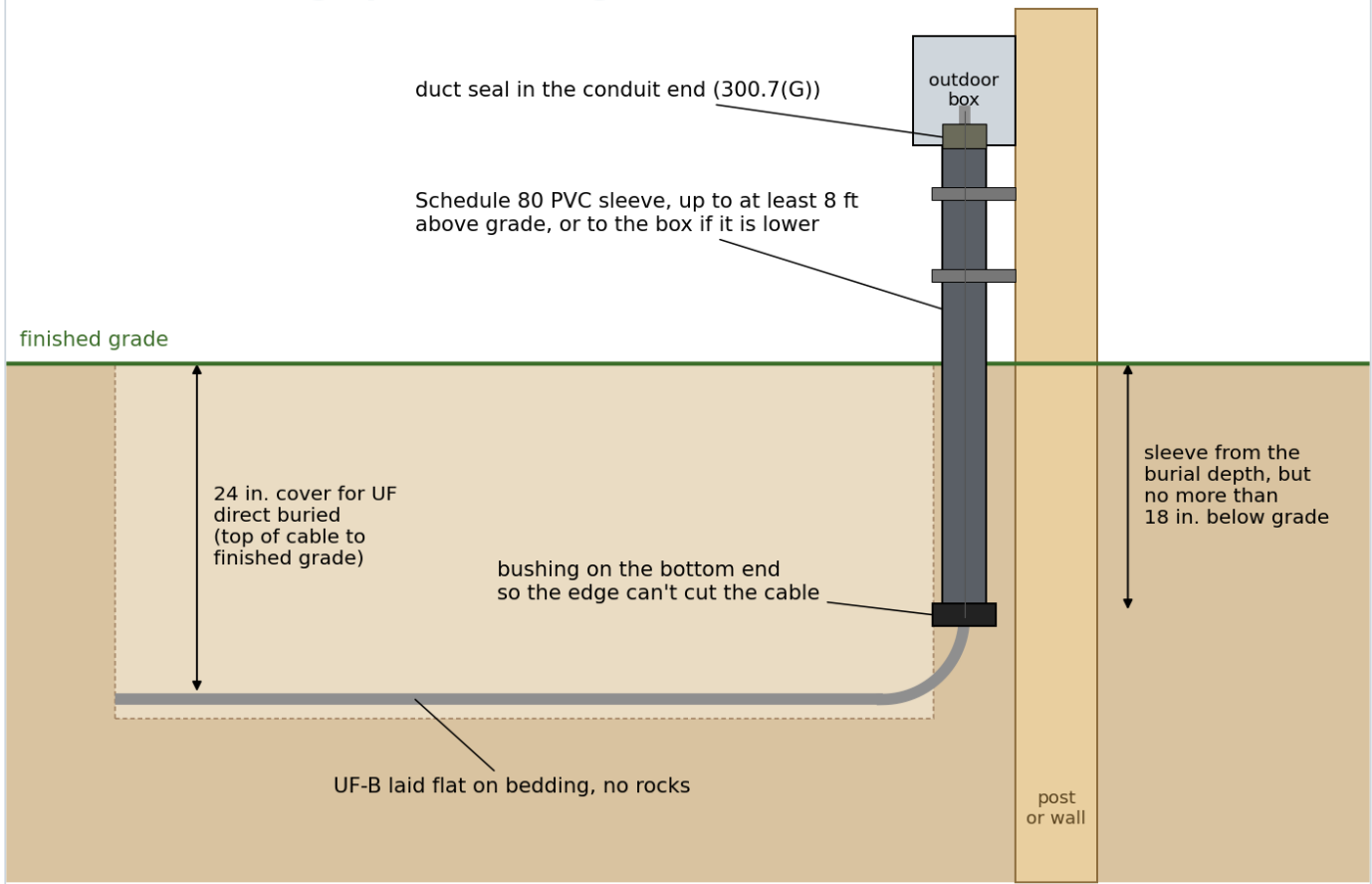
Where the cable or raceway is	UF direct buried (Column 1)	PVC conduit (Column 3)	120 V, 20 A max, GFCI-protected residential circuit (Column 4)
Yard, normal ground	24 in.	18 in.	12 in.
Under a 4-inch-plus concrete slab with no vehicle traffic, slab extends 6 in. past the run	18 in.	4 in.	6 in.
Under a house driveway or parking used only for the house	18 in.	18 in.	12 in.
Under a street, road, alley, or commercial parking lot	24 in.	24 in.	24 in.

"Cover" is measured from the top of the cable or conduit to the top of finished grade (Table 300.7(A), Note 1).

1. Call 811 at least a few business days before you dig. Wait for the locate marks. In Alabama, digging without a locate ticket can hit a gas line. (Ask the office for Alabama 811's current notice period.)
2. Decide the method. A 120 V, 20 A or smaller circuit on a GFCI breaker can go 12 inches deep (Column 4). A 240 V circuit, a 30 A circuit, or anything not GFCI-protected goes 24 inches in UF, or 18 inches in PVC.
3. Dig the trench to the depth plus 2 inches for bedding. Rake out rocks. Backfill with large rocks, cinders, or sharp material is not allowed (300.7(F)).
4. Lay the UF flat in the trench. Don't pull it tight against corners.
5. Where the cable comes up out of the ground, protect it in conduit from the required burial depth (but no more than 18 inches below grade) up to at least 8 feet above finished grade, or to the box if it is lower (300.7(D)(1)). Use Schedule 80 PVC or rigid where it can get hit (300.7(D)(4)). Put a bushing on the bottom end of the sleeve so the edge doesn't cut the cable.
6. Where the cable enters the house, protect it to the point of entrance (300.7(D)(2)).
7. Seal the conduit end where moisture could run into live parts (300.7(G)). Duct seal works.
8. UF ampacity is the 60 °C column, the same as NM (340.80).
9. UF in sunlight must be marked "sunlight resistant" (340.12(9)). Most gray UF-B is, but read the jacket.
10. Splices in direct-buried cable are allowed without a box if you use a listed underground splice kit (300.7(E)).

SAFETY: When you set the trench depth, measure from the finished grade the landscaper will leave, not from today's dirt pile. If the yard is going to be cut down 4 inches, your 12-inch cover becomes 8 inches.

UF cable coming up out of the ground (Procedure E)



Cover depths (Table 300.7(A)), yard:

UF direct buried 24 in. PVC conduit 18 in. 120 V, 20 A max, GFCI-protected circuit 12 in.

UF cable leaves the trench and rises into a Schedule 80 PVC sleeve that starts no more than 18 inches below grade, has a bushing on its bottom end, and is sealed with duct seal at the box. Cover depth is measured from the top of the cable to finished grade.

Drawing: YES Electric.

Picture coming: Cross-section of a backyard trench from the house wall to a post light 40 feet away. The house end shows UF cable rising in a Schedule 80 PVC sleeve with a bushing on the bottom end, sleeve top at the outdoor box. Depth labels show 24 in. for UF direct burial, 18 in. for PVC, and 12 in. for a 120 V 20 A GFCI circuit. Note the cover is measured from the top of the cable to the finished grade line.

Procedure F: MC and AC cable

MC and AC are armored. The armor protects against nails and bumps, which is why we use them on exposed runs.

1. Cut armor with a rotary armor cutter (Roto-Split style), not a hacksaw. Set the cutter on the armor about 8 inches from the end, squeeze, and crank until the blade cuts one spiral. Twist the armor off. A hacksaw nicks the conductors inside.
2. Check the cut end. If a sharp spiral edge is sticking up, nip it off with pliers.

3. AC cable: put the red plastic anti-short bushing ("redhead") over the conductors and push it into the armor end. Fold the thin aluminum bonding strip back over the armor. The bonding strip is what makes the armor a good ground path.
4. MC cable with a green insulated ground: the green wire is the ground. Some MC has an aluminum bonding wire too. Follow the manufacturer's instructions for that type.
5. Use connectors listed for the cable type (300.15 and 320.40, 330.40). An AC or MC connector has a set screw or a snap-in clamp. NM connectors are not listed for armored cable.
6. Secure AC within 12 inches of every box and every 4½ feet (320.30(B)). Secure MC every 6 feet and within 12 inches of every box when the cable has four or fewer conductors no larger than 10 AWG (330.30(B)).
7. AC may be left unsupported up to 2 feet at a terminal where flexibility is needed (320.30(D)(2)). Interlocked MC may be left unsupported up to 3 feet from its last support to connect equipment (330.30(D)(3)). Both may run unsupported up to 6 feet to a luminaire in an accessible ceiling.
8. Bend radius: AC's inside bend radius is at least five times the cable diameter (320.24). Interlocked-armor MC's is at least seven times the armor diameter (330.24(B)).
9. AC is for dry locations only (320.12(2)). MC is not allowed where it is subject to physical damage (330.12(1)), and buried MC must be identified for direct burial (330.12(2)).

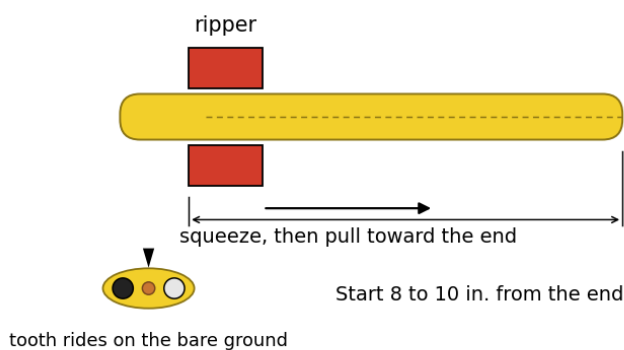
Picture coming: Three-step strip: (1) rotary armor cutter clamped on MC cable 8 inches from the end, (2) armor twisted off showing conductors, (3) AC cable with a red anti-short bushing in the armor end and the aluminum bond strip folded back over the armor, then into a listed set-screw connector on a 4-inch square box.

Procedure G: Strip the cable and make up a box

1. Lead the cable into the box. Leave enough cable so that after stripping you will have at least 6 inches of free conductor measured from where it comes out of the jacket inside the box (300.16(A); 2023: 300.14). If the box opening is smaller than 8 inches in any direction, which is every device box, each conductor must also reach at least 3 inches past the front edge of the box (300.16(B)). In practice, cut the cable so 8 to 10 inches of wire sticks out of the box.
2. Slit the jacket with a cable ripper. Slide the ripper onto the cable 8 to 10 inches from the end, squeeze, and pull toward the end. The ripper rides on the bare ground wire in the middle of flat NM, so it slits the jacket without touching the black and white insulation. Don't slit with a utility knife down the middle unless you have done it a hundred times. One nick in the insulation becomes a short later.
3. Peel the jacket and paper back and cut them off at the box.
4. Leave at least 1/4 inch of jacket inside the box past the clamp or the knockout (314.17(B)(2); 334.19). The jacket must reach in so no bare paper or single wire is outside the box.
5. Secure the cable to the box with the clamp, or rely on the single-gang plastic box exception from Procedure D, step 8.

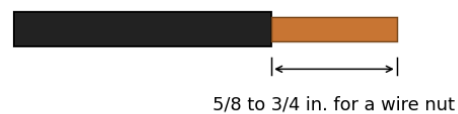
6. Strip each conductor. Use the strip gauge on your wire strippers or on the back of the device. Typical is 5/8 to 3/4 inch for a wire nut and the strip length shown on the device for a screw terminal. Strip with the correctly sized hole in the stripper so you don't ring the copper.
7. Make up the grounds first. Join every bare and green ground in the box together with a crimp sleeve or a green wire nut, and leave one or two pigtails to go to each device and to a metal box (250.148(A)). Grounds go first because they go in the back of the box and stay there.
8. Make up the neutrals next. Join the whites that belong together with a wire nut, plus a pigtail if a device needs one. Fold them in behind the grounds.
9. Hots go last, either to a device or spliced with a pigtail to the device.
10. Fold the wires in neatly in an accordion shape with the grounds at the back and the hots at the front where the device is. Wires should go in without force.
11. Close unused knockouts (314.17(A); 110.12(A)).
12. A metal box needs a ground connection. Use a green ground screw in the tapped hole in the back of the box or a listed ground clip (250.148(C)).

1. Slit the jacket with a cable ripper

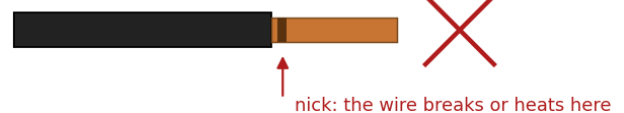


2. Strip each conductor

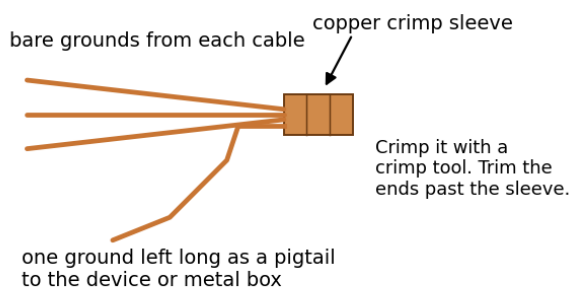
Right: clean strip, no marks on the copper



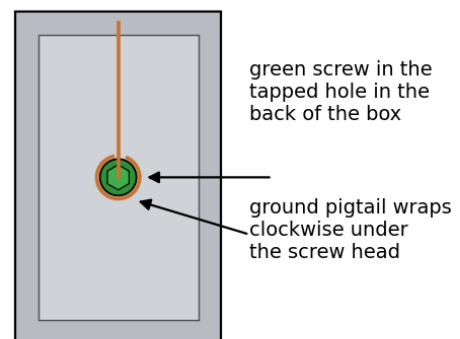
Wrong: copper nicked (ringed) by the stripper



3. Grounds first: join with a crimp sleeve



4. Metal box: green ground screw



Making up a box in four steps: slit the jacket with a cable ripper, strip each conductor without nicking the copper, join the grounds with a crimp sleeve and leave a pigtail, and land the ground on the green screw in a metal box.

Drawing: YES Electric.

SAFETY: Before you open any box that already has wire in it, test it dead. Use the non-contact tester, then your meter: hot to neutral, hot to ground, neutral to ground. R1.1 teaches this three-way dead check. Wires from a second circuit may share the box.

Picture coming: Front view of an open single-gang box with two 12-2 NM cables entering from the top through the internal clamps. 1/4 inch of yellow jacket shows past the clamp. Grounds are crimped together at the back with one pigtail. White neutrals are wire-nutted at the middle. Black hots go to the receptacle at the front. A ruler shows 6 inches of free conductor inside and 3 inches sticking out past the box face.

Procedure H: Count the box (box fill)

This is the calculation inspectors catch. It comes from 314.16. Do it on paper for every box until it becomes automatic.

Step 1. Find the box volume.

- A metal box that isn't marked with its volume uses Table 314.16(A).
- A plastic box, and any box not in the table, is marked with its volume inside, stamped in cubic inches (314.16(A)(2)).
- A plaster ring, mud ring, or extension ring adds its marked volume to the box (314.16(A)).

Table 314.16(A), the boxes we use most (volumes verified in the NEC 2026 text):

Box (trade size)	Volume, in ³
4 in. round or octagon x 1¼ in. deep	12.5
4 in. round or octagon x 1½ in.	15.5
4 in. round or octagon x 2⅞ in.	21.5
4 in. square x 1¼ in.	18.0
4 in. square x 1½ in.	21.0
4 in. square x 2⅞ in.	30.3
4-11/16 in. square x 1¼ in.	25.5
4-11/16 in. square x 1½ in.	29.5
4-11/16 in. square x 2⅞ in.	42.0
3 x 2 x 2 in. device box	10.0
3 x 2 x 2½ in. device box	12.5
3 x 2 x 2¾ in. device box	14.0
3 x 2 x 3½ in. device box	18.0
4 x 2½ x 1½ in. device box	10.3
4 x 2½ x 1⅞ in. device box	13.0
4 x 2½ x 2⅞ in. device box	14.5

The table also lists the maximum number of conductors for each box. Those counts only work when the box has no clamps, devices, studs, or grounds (the asterisk note to the table). In a house, that almost never happens, so do the full count.

Step 2. Know the per-conductor volume, from Table 314.16(B)(4):

Conductor size	Volume per allowance
18 AWG	1.50 in ³
16 AWG	1.75 in ³
14 AWG	2.00 in ³
12 AWG	2.25 in ³
10 AWG	2.50 in ³
8 AWG	3.00 in ³
6 AWG	5.00 in ³

Step 3. Count the allowances. Use this table every time.

Item in the box	How many allowances	At what wire size	Code
Each hot or neutral that comes in from outside the box and is spliced or lands on a device	1 each	Its own size	314.16(B) (1)
Each conductor that passes straight through without a splice	1 each	Its own size	314.16(B) (1)
A pigtail that starts and ends inside the box	0	n/a	314.16(B) (1)
Internal cable clamps (all of them together)	1 total	Largest conductor in the box	314.16(B) (2)
Clamps outside the box (a connector with the locknut inside)	0	n/a	314.16(B) (2)
Each fixture stud or hickey	1 each	Largest conductor in the box	314.16(B) (3)
Each yoke (strap) holding a device: receptacle, switch, dimmer, GFCI	2 per yoke	Largest conductor connected to that device	314.16(B) (4)
A device wider than one 2-inch gang	2 per gang it needs	Largest conductor connected to it	314.16(B) (4)
Equipment grounds, first four	1 total	Largest ground in the box	314.16(B) (5)
Each ground past the fourth	1/4 each	Largest ground in the box	314.16(B) (5)
Each terminal block	1 each	Largest conductor on it	314.16(B) (6)
Wire nuts, crimp sleeves, locknuts, bushings	0	n/a	314.16(B)

Step 4. Multiply each allowance by its cubic inches and add.

Step 5. The box volume (plus any ring) must be equal to or more than the total. If it is short, use a deeper box, a bigger box, or add a marked extension ring or mud ring.

Two old rules of thumb get people in trouble. The Arc Guide's quick reference (Part 3, "Box Fill — Quick Reference," and Part 10, "Box Fill — The Inspector-Catching Calculation") says all grounds together always count as one, and that you use the largest wire size for every count. Under NEC 2026 those are both wrong. Grounds count as one only up to four, and each ground past four adds a quarter. Hots and neutrals count at their own size; only the clamp, stud, device, and ground allowances use the "largest" rule, and the device allowance uses the largest wire

connected to that device, not the largest in the box. The worked examples in Section 4 use the 2026 rules.

Box-fill pocket card (NEC 314.16)

Step 2. Volume per allowance, Table 314.16(B)(4)

Size	in ³ each
18 AWG	1.50 in ³
16 AWG	1.75 in ³
14 AWG	2.00 in ³
12 AWG	2.25 in ³
10 AWG	2.50 in ³
8 AWG	3.00 in ³
6 AWG	5.00 in ³

Step 4. Multiply each allowance by its in³ and add.

Step 5. Box volume (plus any marked ring) must be equal to or more than the total.

Step 3. Count the allowances

Item in the box	Count	At size	314.16
Each hot or neutral from outside the box (spliced or on a device)	1 each	its own size	(B)(1)
Each conductor passing straight through	1 each	its own size	(B)(1)
Pigtail that starts and ends in the box	0	n/a	(B)(1)
Internal cable clamps, all together	1 total	largest in box	(B)(2)
Clamps outside the box (connector, locknut inside)	0	n/a	(B)(2)
Each fixture stud or hickey	1 each	largest in box	(B)(3)
Each yoke: receptacle, switch, dimmer, GFCI	2 per yoke	largest on that device	(B)(4)
Device wider than one 2 in. gang	2 per gang	largest on that device	(B)(4)
Equipment grounds, first four	1 total	largest ground	(B)(5)
Each ground past the fourth	1/4 each	largest ground	(B)(5)
Each terminal block	1 each	largest on it	(B)(6)
Wire nuts, crimp sleeves, locknuts, bushings	0	n/a	(B)

Hots and neutrals count at their own size. Only the clamp, stud, device, and ground allowances use the "largest" rule. The device allowance uses the largest wire connected to that device, not the largest in the box.

A box-fill pocket card with the cubic-inch volume for each wire size from Table 314.16(B)(4) and the rules for counting allowances from Procedure H.

Drawing: YES Electric.

Procedure I: Mount a new-work box on a stud

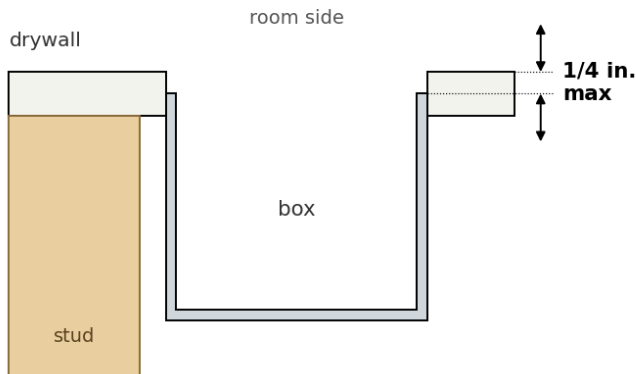
1. Find the height. Read the plan first. If none is given, YES habit is 12 inches from the subfloor to the bottom of a receptacle box and 48 inches to the bottom of a switch box (or match the house). Kitchen and bath countertop receptacles go about 42 to 44 inches from the subfloor, set so the box clears the backsplash. Mark a stick or your hammer handle so every box lands the same (NAVEDTRA 14026 p. 5-12, Figure 5-20).

2. Find the depth. The front edge of the box must end up flush with, or stick out past, the finished wall surface when the wall is wood or another combustible material (314.20(B)). In drywall, gypsum, plaster, tile, or other noncombustible material, the front edge may sit back no more than 1/4 inch (314.20(A)). Most nail-on boxes have depth marks molded on the side for 1/2-inch and 5/8-inch drywall. Use them. If the wall is getting tile over drywall, add the tile thickness.
3. Hold the box against the stud at the mark, depth gauge tight to the stud face, and drive the two captive nails. Nails must pass through the box's mounting holes or brackets, or within 1/4 inch of the back or ends of the box (314.23(B)(1)). Don't drive extra screws through the inside of the box where they could cut wires.
4. Check that the box is plumb and the face is square to the wall.
5. For a 4-inch square metal box, fasten it with its bracket, then put on a mud ring sized to the drywall thickness (1/2-inch or 5/8-inch raised). The mud ring is what makes the box flush.
6. Ceiling light boxes must be able to hold a 50-pound luminaire (314.27(A)(2)(a)). A plain nail-on round box on a joist meets that. A heavier light needs a box listed and marked for its weight (314.27(A)(2)(b)).
7. Wall light boxes: a scone of 6 pounds or less can hang on a regular box with two No. 6 or larger screws (314.27(A)(1)(a)). A heavier scone needs a box marked for that weight, unless the box is marked 50 pounds (314.27(A)(1)(b)).
8. Fan boxes: a box that will hold a ceiling fan must be listed and marked on the inside as suitable for fan support. It can hold no more than 70 pounds (32 kg). If the fan weighs more than 35 pounds, the box must also be marked with the weight it can hold (314.27(B)(1)). In a bedroom or living area where a fan might go later, put in a fan-rated box now if the room could take a fan (314.27(B)(2)). R1.7 covers hanging the fan.

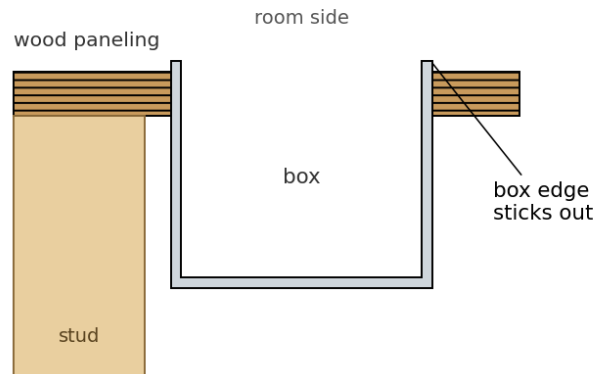
Where the front edge of the box must be (314.20)

Noncombustible wall (drywall, plaster, tile): up to 1/4 in. back. Combustible wall (wood): flush or out.

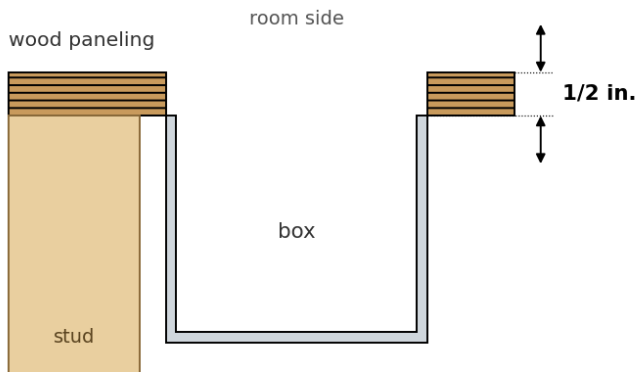
**Drywall or plaster: set back
1/4 in. max is OK**



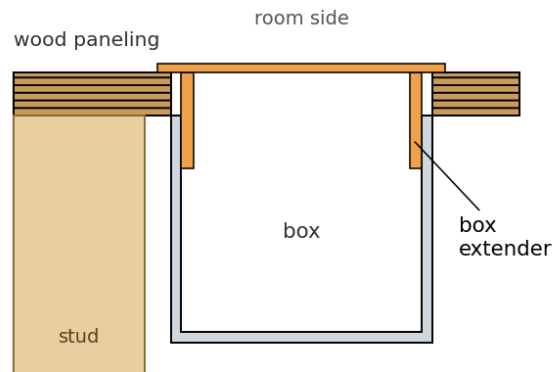
**Wood paneling: flush or
sticking out is OK**



**Wood paneling: set back
1/2 in. is NOT allowed**



**Fix: add a box extender so the
edge comes out to the surface**



In drywall or plaster the front edge of a box may sit back up to 1/4 inch, but in wood paneling it must be flush or stick out. A box extender brings a set-back box out to the surface.

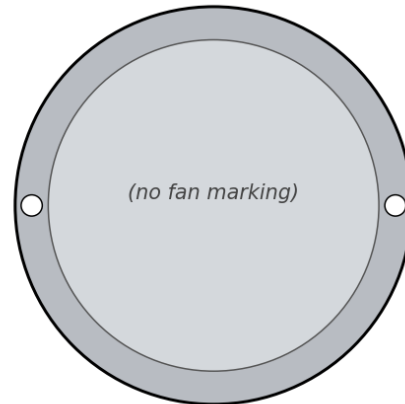
Drawing: YES Electric.

Fan-rated box: marked inside



Needed for any ceiling fan (314.27(B)).
A fan over 35 lb needs the weight marked too.

Standard ceiling box



Holds a light fixture up to 50 lb.
Do not hang a fan from it.

Drawing. The wording and layout of the stamp vary by maker; look for the fan-support words inside the box.

A box that can hold a ceiling fan is marked inside as acceptable for fan support, up to 70 pounds. A standard ceiling box without that marking holds a light fixture but not a fan.

Drawing: YES Electric.

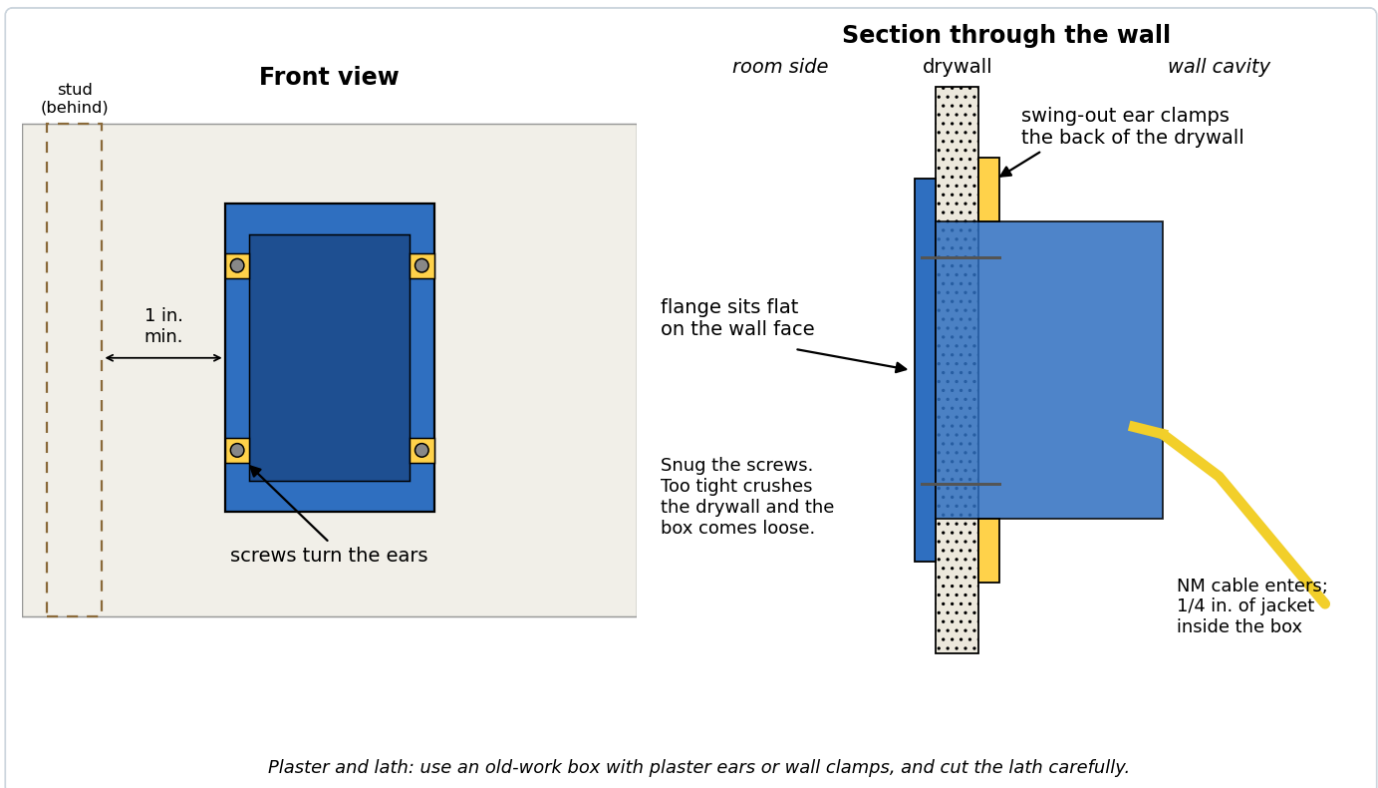
Picture coming: Four boxes on studs, each labeled: a single-gang plastic nail-on box with depth gauge set to 1/2 in. drywall; a 4-inch square metal box with a 1/2-in. raised single-gang mud ring; a round ceiling box on a joist marked "luminaires to 50 lb"; a metal fan brace between joists with a box stamped "acceptable for fan support, 70 lb max."

Procedure J: Mount an old-work box in finished drywall

Use this when you add a receptacle or switch to a finished wall. R1.12 covers how to fish the cable to it. Here we set the box.

1. Turn off any circuit that might be in that wall. Find the studs with a stud finder. An old-work box goes between studs, not against one. Keep at least 1 inch from the stud so the box ears can swing.
2. Hold the box's template, or the box itself, face-down on the wall at the right height. Level it. Trace around it with a pencil. Don't trace the ears.
3. Cut a small test hole in the middle of the outline with a drywall saw. Bend a wire coat hanger and swing it around inside to check for studs, pipes, ducts, and fire blocking.
4. Cut out the outline. Stay inside the line. A tight hole is what the box clamps against. If the hole is too big, the box will spin.
5. Fish the cable into the hole (R1.12). Pull 10 to 12 inches out of the hole.
6. Knock out the cable entry on the box. Push the cable through the entry so at least 1/4 inch of jacket shows inside.
7. Push the box into the hole until the front flange sits flat on the drywall face.

8. Tighten the box's screws. Swing-out ears or wings flip out behind the drywall and pull tight. Stop when the box is snug. If you overtighten, you crush the drywall and the box gets loose.
9. Old-work boxes rely on clamps or anchors identified for the use (314.23(C)). Use only boxes made for old work. Never "float" a new-work box in drywall with no support.
10. If the wall is plaster and lath, use an old-work box with plaster ears or a box with wall clamps and cut the lath carefully so you don't crack the plaster (NAVEDTRA 14026, p. 5-11, Figures 5-18 and 5-19 show hollow-wall clamps and supports).
11. Gaps around a box in drywall or plaster bigger than 1/8 inch must be patched before the plate goes on (314.21).



An old-work box sits in a hole cut in finished drywall, at least 1 inch from the stud. Its flange rests on the wall face and its swing-out ears clamp the back of the drywall when the screws are snugged.

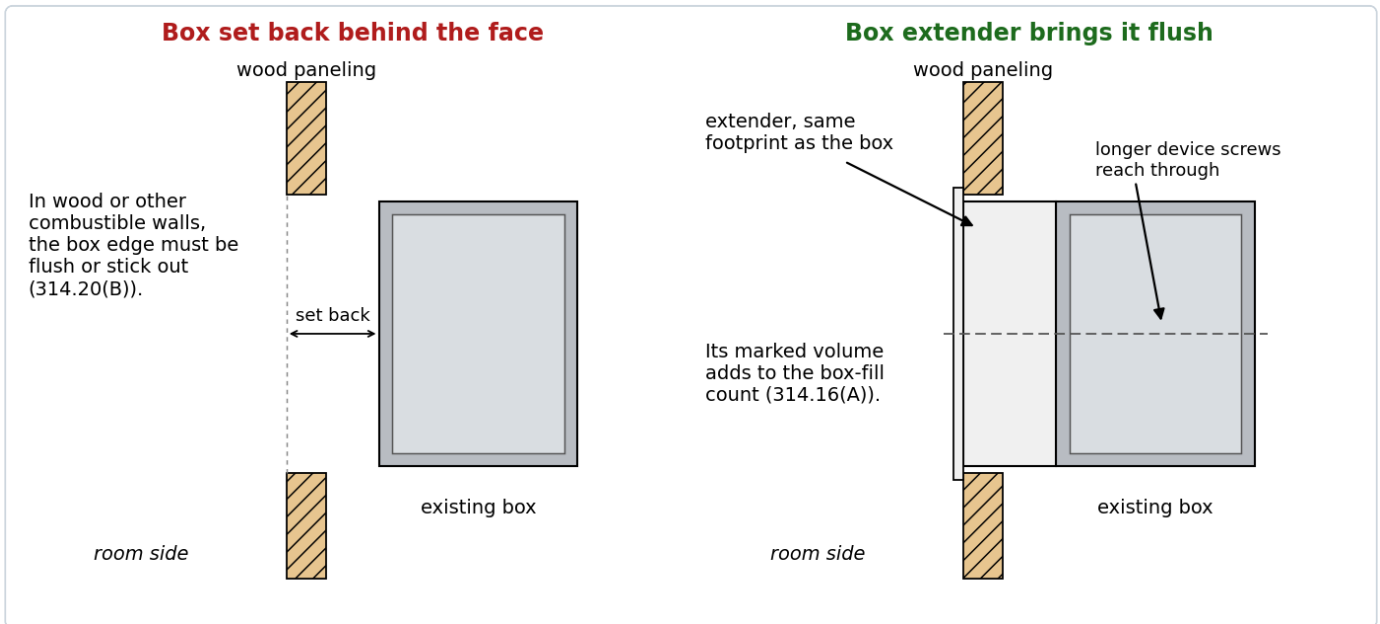
Drawing: YES Electric.

Picture coming: Old-work box installation in three panels. Panel 1: the box held face-down on drywall, level on top, pencil tracing the outline without the ears. Panel 2: a drywall saw cutting just inside the line, with a bent coat hanger swinging in a test hole. Panel 3: the box pushed in with the flange flat on the wall and the swing-out ears clamped behind the drywall, cable jacket showing 1/4 in. inside.

Procedure K: When a box is too small in a finished wall

1. Don't force the device. Do the count first.
2. If the count is short by a few cubic inches, add a marked box extender or extension ring of the same footprint over the existing box. The ring's marked volume adds to the box (314.16(A); 314.22).

3. If it is short by more, replace the box with a deeper old-work box. Cut the old box out with an oscillating tool, holding the cables back.
4. If two circuits share the box and it still won't fit, move one splice to a new junction box that stays accessible (314.29).



A box set back behind wood paneling leaves the combustible wall exposed at the device. A box extender of the same footprint brings the edge flush, and its marked volume counts toward box fill.

Drawing: YES Electric.

4. Worked Examples

Every volume below comes from Table 314.16(A) and every allowance from Table 314.16(B)(4), both checked in the NEC 2026 text.

Example 1: Two 12-2 cables, one receptacle, internal clamps

This is the outline's field exercise box. A 20 A receptacle circuit. One 12-2 cable comes in from the panel side. One 12-2 cable goes out to the next receptacle. One duplex receptacle. The box has built-in cable clamps.

Item	Count	Size	in ³ each	Total
Hots: black in, black out	2	12 AWG	2.25	4.50
Neutrals: white in, white out	2	12 AWG	2.25	4.50
Internal clamps (all together)	1	largest = 12	2.25	2.25
Receptacle yoke	2	largest on it = 12	2.25	4.50
Grounds: 2 bare grounds (4 or fewer)	1	largest = 12	2.25	2.25
Ground pigtail to the receptacle	0	starts and ends in box	n/a	0
Total	8 allowances			18.00 in ³

Pick the box:

Box	Volume	Pass?
3 x 2 x 2¾ metal device box	14.0	No, 4.00 short
3 x 2 x 3½ metal device box	18.0	Yes, exactly
Plastic single-gang marked 18 in ³	18.0	Yes, exactly
Plastic single-gang marked 20.3 or 22.5 in ³	20.3 / 22.5	Yes, with room
4 in. square x 1½ with 1/2-in. single-gang ring	21.0 + ring	Yes

Answer: an 18 in³ box is legal, but there is no spare room. YES habit is to use a 20 in³ or bigger single-gang for 12 AWG pass-through receptacles, because a GFCI receptacle is deeper than a standard one and fills the box faster in real life even though the count is the same.

Example 2: Mixed 14 and 12 AWG in a two-gang box with a three-way switch

A two-gang box by the back door holds a 20 A countertop-style receptacle (12 AWG) and a three-way switch for the porch light (14 AWG). Power for the light comes into this box. The box has internal clamps.

Cables in the box:

- 12-2 in from the previous receptacle.
- 12-2 out to the next receptacle.
- 14-2 in from the lighting circuit (power for the three-way).
- 14-3 out to the other three-way switch (carries the two travelers and the neutral on to the light).

Item	Count	Size	in ³ each	Total
12 AWG hots and neutrals (2 cables x 2)	4	12	2.25	9.00
14 AWG from the 14-2 (black, white)	2	14	2.00	4.00
14 AWG from the 14-3 (black, red, white)	3	14	2.00	6.00
Internal clamps	1	largest in box = 12	2.25	2.25
Receptacle yoke	2	largest on receptacle = 12	2.25	4.50
Three-way switch yoke	2	largest on switch = 14	2.00	4.00
Grounds: 4 bare grounds (two 12, two 14)	1	largest ground = 12	2.25	2.25
Pigtails (grounds to devices, neutral pigtail)	0	start and end in box	n/a	0
Total	15 allowances			32.00 in ³

Notice two things. The 14 AWG wires count at 2.00, not 2.25. The three-way switch's device allowance uses 14 AWG because only 14 AWG lands on that switch.

Pick the box:

Box	Volume	Pass?
Plastic two-gang marked 25 in ³	25.0	No, 7.00 short
Plastic two-gang marked 32 in ³	32.0	Yes, exactly
Plastic two-gang marked 34 in ³ or more	34.0+	Yes
Two 3 x 2 x 3½ metal device boxes ganged	18.0 + 18.0 = 36.0	Yes
4-11/16 in. square x 2⅞ with two-gang mud ring	42.0 + ring	Yes, lots of room

If you counted it the old way, with every allowance at 12 AWG, you would get $15 \times 2.25 = 33.75$ in³ and reject the 32 in³ box. The old way is safe but costs you a bigger box. The 2026 method is the legal answer.

Example 3: Junction box with six cables (the "past four grounds" rule)

In an attic, six 14-2 cables meet in a 4-inch square junction box. No devices. Internal clamps.

Item	Count	Size	in ³ each	Total
Hots and neutrals (6 cables x 2)	12	14	2.00	24.00
Internal clamps	1	14	2.00	2.00
Grounds: first four	1	14	2.00	2.00
Grounds: 5th and 6th at 1/4 each	0.5	14	2.00	1.00
Total	14.5 allowances			29.00 in ³

Box	Volume	Pass?
4 in. square x 1½	21.0	No, 8.00 short
4 in. square x 2⅞	30.3	Yes

Under the Arc Guide's old shortcut you would have counted 28.00 in³. Here the 2⅞-inch box passes either way, but in a tighter box the extra 1.00 in³ can be the difference.

Example 4: Ceiling light box with a fixture stud

A ceiling box gets one 14-3 from a switch (black switched leg, red unused and capped, white neutral) and nothing else. The light hangs on a fixture stud in the box. The fixture comes with a domed canopy and two 18 AWG leads plus its own ground lead.

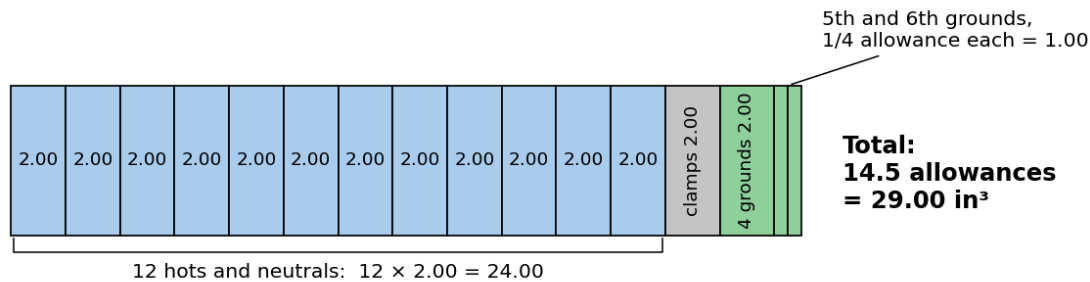
Item	Count	Size	in ³ each	Total
14-3 conductors (black, red, white)	3	14	2.00	6.00
Ground (1, which is four or fewer)	1	14	2.00	2.00
Fixture stud	1	largest = 14	2.00	2.00
Internal clamps	1	14	2.00	2.00
Fixture leads from a domed canopy (four or fewer, smaller than 14 AWG)	0	exception to 314.16(B)(1)	n/a	0
Total				12.00 in ³

A 4-inch round x 1½ box (15.5 in³) passes. A 4-inch round x 1¼ pancake box (12.5 in³) also passes, by 0.5 in³.

Box fill as blocks: Examples 3 and 4

Every wire in both boxes is 14 AWG, so every full allowance is 2.00 in³.

Example 3: junction box, six 14-2 cables, internal clamps, no devices



4 in. square $\times 1\frac{1}{2} = 21.0$ in³: No, 8.00 short

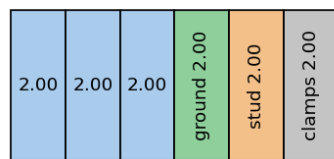


4 in. square $\times 2\frac{1}{8} = 30.3$ in³: Yes



Hatched bar = box volume. Black line = what the box must hold.

Example 4: ceiling box, one 14-3 from the switch, fixture stud, internal clamps



Total = 12.00 in³

Fixture leads from a domed canopy (four or fewer, smaller than 14 AWG) count 0.

black, red, white
 $3 \times 2.00 = 6.00$

4 in. round $\times 1\frac{1}{2} = 15.5$ in³: Yes



4 in. round $\times 1\frac{1}{4} = 12.5$ in³: Yes, by 0.5 in³



Examples 3 and 4 drawn as blocks, one block per allowance. The six-cable junction box needs 29.00 cubic inches, so the 21.0 cubic inch box fails and the 30.3 cubic inch box passes, and the ceiling box needs 12.00 cubic inches.

Drawing: YES Electric.

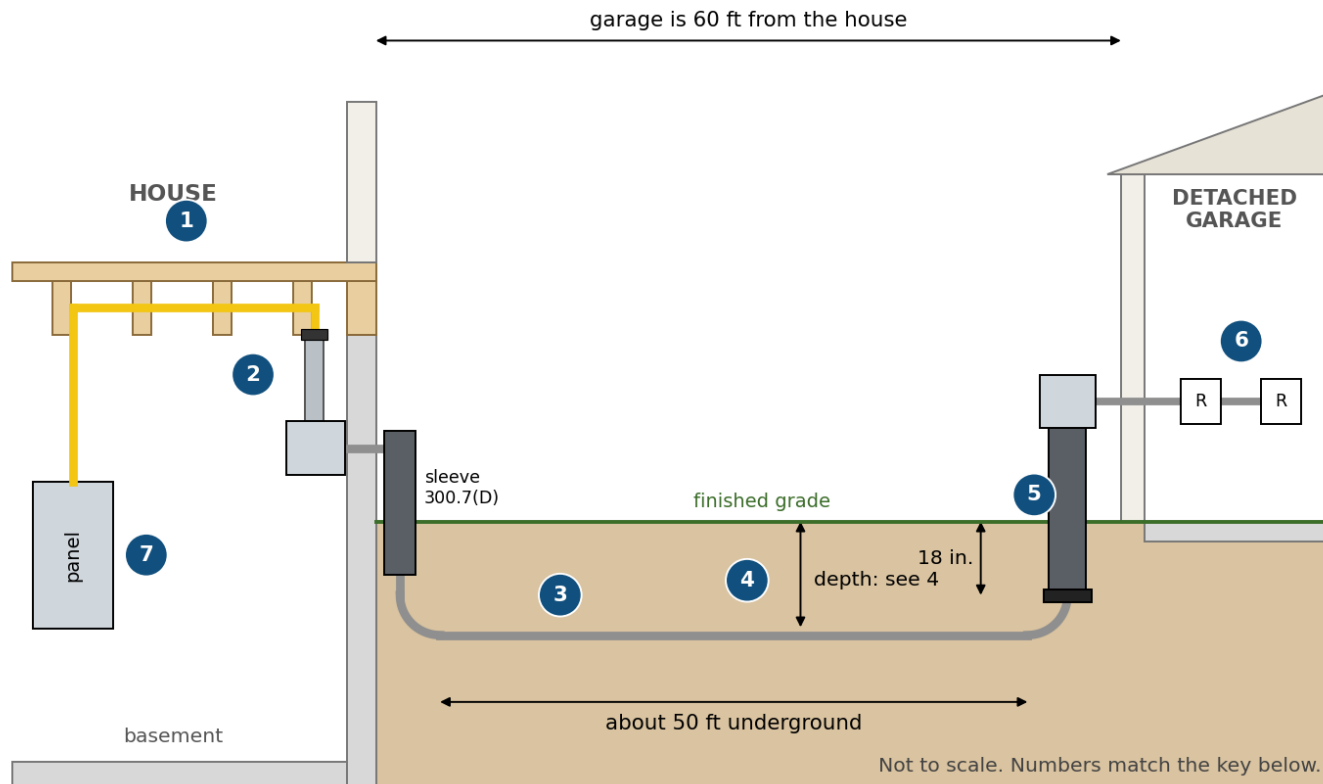
Example 5: Picking cable and breaker for a garage run

A customer wants a 20 A receptacle circuit in a detached garage 60 feet from the house. Some of the run is in the house basement, some is buried, and some is inside the garage.

Part of the run	Method	Why
Panel through the finished basement ceiling	12-2 NM-B through bored joists	Dry, inside a one-family house (334.10(1))
Down the basement wall to the rim joist	12-2 NM-B in EMT with a bushing on the end	Exposed on a wall where it can be hit (334.15(C))
Out through the wall and underground, 50 feet	12-2 UF-B direct buried, or THWN in PVC	Underground is wet; NM not allowed (334.12(A)(4); 300.7(B))
Depth	12 in. if the circuit is 120 V, 20 A max, GFCI-protected at the panel. Otherwise 24 in. UF or 18 in. PVC	Table 300.7(A), Column 4 vs Columns 1 and 3
Rising up the garage wall	UF-B in Schedule 80 PVC sleeve from 18 in. below grade to the box	300.7(D)(1) and (D)(4)
Inside the garage	12-2 UF-B or NM-B to the receptacles, protected below 8 ft if exposed	A detached garage of a one-family house allows NM (334.10(1)); protect from damage (334.15(B))
Breaker	20 A, GFCI	240.4(D)(6) for 12 AWG; GFCI for garage receptacles is covered in R1.4

A feeder to a detached garage with its own panel is a different job. It follows 250.32 and is covered in R1.12.

Example 5: 20 A receptacle circuit to a detached garage



- 1 Panel through the finished basement ceiling: 12-2 NM-B through bored joists. Dry, one-family house (334.10(1)).
- 2 Down the basement wall to the rim joist: 12-2 NM-B in EMT with a bushing on the end (334.15(C)).
- 3 Out through the wall and underground, 50 ft: 12-2 UF-B direct buried, or THWN in PVC. Never NM (334.12(A)(4); 300.7(B)).
- 4 Depth: 12 in. if the circuit is 120 V, 20 A max, GFCI-protected at the panel. Otherwise 24 in. UF or 18 in. PVC (Table 300.7(A), Column 4 vs. Columns 1 and 3).
- 5 Rising up the garage wall: UF-B in a Schedule 80 PVC sleeve from 18 in. below grade to the box (300.7(D)(1) and (D)(4)).
- 6 Inside the garage: 12-2 UF-B or NM-B to the receptacles, protected below 8 ft if exposed (334.10(1), 334.15(B)).
- 7 Breaker: 20 A, GFCI (240.4(D)(6) for 12 AWG).

The whole Example 5 run to a detached garage 60 feet away, from the panel through the basement, underground, and up into the garage. The numbered key gives the cable, protection, burial depth, and breaker for each part.

Drawing: YES Electric.

5. Common Mistakes

Mistake	What goes wrong	Fix
Hole bored 3/4 in. from the stud face with no nail plate	A drywall screw shorts the cable years later, usually behind a finished wall	Bore centered. Plate any hole within 1¼ in. of the face (300.6(A)(1))
Staple hammered flat into the jacket	The insulation is crushed and fails later	Drive staples snug, not tight. If you dent the jacket, pull the staple and move it
NM stapled on edge	Staple splits the cable between conductors	Lay flat cable flat (334.30)
First staple 18 in. from a single-gang plastic box with no clamp	Fails inspection; cable can pull out of the box	Staple within 8 in. on unclamped single-gang boxes (314.17(B)(2) Exc.)
NM pulled through underground conduit to a shed	Water inside the conduit soaks the paper filler and the jacket. NM is not allowed in wet locations	Use UF-B or THWN in the conduit (300.7(B); 334.12(A)(4))
Jacket stripped back to the clamp, single wires showing outside the box	Single wires can be cut by the clamp or the framing	Leave 1/4 in. of jacket inside the box (314.17(B)(2))
Wires cut flush at the box, 3 in. of free conductor	Too short to work; fails 300.16	Leave 6 in. free and 3 in. past the box face
Counting all the grounds as one allowance with six cables in the box	Box too small by a quarter allowance per extra ground	Count 1 for the first four grounds, 1/4 for each ground after (314.16(B)(5))
Using a plastic box's "max wires" sticker without counting devices and clamps	Box is overfilled once the device goes in	Do the full count every time
Box set back 1/2 in. behind a wood paneled wall	Combustible surface exposed to sparks at the device	In combustible walls the box must be flush or stick out (314.20(B)). Use a box extender
Hacksaw used to cut MC armor	Conductors nicked inside the armor	Use a rotary armor cutter
No red anti-short bushing on AC cable	Sharp armor edge cuts the insulation	Always put in the bushing and fold back the bonding strip
Bundle of six NM cables through one hole, then sealed with fire foam	Wires run hot, ampacity must be derated (334.80(B))	Drill another hole. Keep it to two cables per sealed hole
Old-work box crushed into drywall	Box spins, device falls in	Cut the hole tight and snug the ears without overtightening
A standard ceiling box used to hang a fan	The fan wobbles and can fall	Use a box listed and marked for fan support (314.27(B))

6. Field Exercise (from the outline, written out in full)

Time: about 4 hours on a training wall. Your journeyman signs each step.

Materials: a training wall with at least six 2x4 studs 16 inches on center and one bottom and top plate; 12-2 and 14-3 NM-B; listed NM staples; four 1/16-inch steel nail plates; one single-gang plastic new-work box (18 in³ or more); one 4-inch square metal box 1½ or 2⅞ deep with a 1/2-inch raised single-gang mud ring; one old-work single-gang box; a scrap of 1/2-inch drywall about 2 by 3 feet screwed to two studs; one duplex receptacle; crimp sleeves and wire nuts.

Tools: right-angle drill and 3/4-inch bit, hammer, tape measure, lumber crayon, cable ripper, strippers, linemans, drywall saw, stud finder, safety glasses, and the box-fill worksheet below.

Part 1: Drill the row

1. Mark a line across all the studs at 16 inches above the bottom plate.
2. Bore a 3/4-inch hole centered on each stud along the line. Measure from each face of one stud to the hole edge and write the number down. It should be 1¼ inches or more.
3. On one stud, bore a second hole deliberately off-center so its edge is 3/4 inch from the face. Install a steel nail plate over that hole on the face side. Have the journeyman check that the plate covers the full width of the hole.
4. Bore one hole in the top plate for a cable to go up, and plate it if it is closer than 1¼ inches to either face.

Part 2: Run and staple

1. Mount the single-gang plastic box on stud 1 at the receptacle height using the 1/2-inch drywall depth mark.
2. Mount the 4-inch square box with its mud ring on stud 5 at switch height.
3. Run 12-2 NM from the plastic box through the bored holes toward stud 5. Leave 10 inches past the face of each box.
4. Run 14-3 NM from the 4-inch square box up through the top plate.
5. Staple each cable: within 8 inches of the plastic box (no-clamp exception), within 12 inches of the metal box, and every 4½ feet or less elsewhere. Lay the flat cable flat.
6. Measure every staple distance and write it down.

Part 3: Mount an old-work box

1. Pick a stud bay covered by the drywall scrap. Find the studs with the stud finder.
2. Trace the old-work box outline at receptacle height.
3. Cut a test hole and check the cavity with a bent wire.
4. Cut out the hole, feed a piece of 12-2 into it from behind, push the cable through the knockout with 1/4 inch of jacket showing, and set the box. Snug the ears.
5. Have the journeyman pull on the box. It should not move.

Part 4: Box-fill worksheet

Fill out this worksheet for a box with two 12-2 cables, one duplex receptacle, and internal clamps. Then pick the box.

Line	Item	Count	in ³ each	Total
1	12 AWG hots and neutrals from outside			
2	Internal clamps			
3	Receptacle yoke			
4	Grounds (first four)			
5	Grounds past four, 1/4 each			
6	Total required			
7	Box volume (from Table 314.16(A) or the box marking)			
8	Pass or fail			

Check your answer against Example 1. You should get 18.00 in³. Then do the same worksheet for Example 2 without looking.

Part 5: Make up a box

1. In the single-gang plastic box, bring in two 12-2 cables (one in, one out).
2. Slit the jacket with the cable ripper. Strip the paper. Leave 1/4 inch of jacket inside.
3. Make up the grounds first: two grounds plus one pigtail, crimped.
4. Make up the neutrals next: two whites plus one pigtail, wire-nutted.
5. Make up the hots last: two blacks plus one pigtail, wire-nutted.
6. Land the pigtails on the receptacle side screws: black on brass, white on silver, ground on green. R1.4 covers the terminal hook and torque.
7. Fold the wires in, grounds at the back. The receptacle should go in with light hand pressure.
8. Have the journeyman measure free conductor length (6 inches inside, 3 inches past the face).

Sign-off: the journeyman checks setbacks, plates, staples, box depth, box fill math, jacket length, and make-up order, and initials each line on the checklist in Section 9.

7. NEC Cross-References

All section numbers are NEC 2026, checked against the local NEC 2026 text. NEC 2023 numbers are in parentheses where they differ.

Section	What it covers	Used in
110.12(A)	Unused openings closed	Procedure G
110.14(D)	Terminal torque to the marked value with a torque tool	Procedure G, R1.4
240.4(D)	14 AWG Cu max 15 A, 12 AWG Cu max 20 A, 10 AWG Cu max 30 A	Section 2.4
250.148	All grounds in a box connected together; metal box grounded	Procedure G
300.6(A), (B), (D), (E) (2023: 300.4)	1¼ in. setback, 1/16 in. plates, metal stud grommets, 1½ in. below roof deck	Procedure C
300.7(A), (B), (D), (E), (F), (G) (2023: 300.5) and Table 300.7(A)	Burial depth, underground is wet, protection where cable leaves the ground, splices, backfill, seals	Procedure E
300.11(A)	Inside of a raceway in a wet location above grade is wet	Procedure A
300.16 (2023: 300.14)	6 in. free conductor; 3 in. past openings under 8 in.	Procedure G
314.16 and Tables 314.16(A), 314.16(B)(4)	Box volume and fill	Procedure H, Section 4
314.17	Cable entry; 1/4 in. of jacket inside; 8-in. single-gang exception	Procedures D, G
314.20	Box flush in combustible walls; 1/4 in. max setback in noncombustible	Procedure I
314.21	Patch gaps over 1/8 in.	Procedure J
314.22	Extension rings	Procedure K
314.23	Box supports; nails within 1/4 in. of back; finished-surface clamps	Procedures I, J
314.24	Box depth	Procedure I
314.27	Light box 50 lb; wall box 6 lb; fan box 70 lb max, marked over 35 lb	Procedure I
314.29	Boxes must stay accessible	Procedure K
320.12, 320.23, 320.24, 320.30, 320.40	AC cable rules; attic guard strips	Procedures D, F
330.12, 330.24, 330.30	MC cable rules	Procedure F
334.10, 334.12	Where NM may and may not go	Procedure A
334.15	Exposed NM, floor sleeves, basements and crawl spaces	Procedure D

Section	What it covers	Used in
334.17	Through or parallel to framing; grommets stay in	Procedure C
334.19	Sheath 1/4 in. past the clamp	Procedure G
334.23	NM in accessible attics follows 320.23	Procedure D
334.24	Bend radius 5x the cable	Procedure D
334.30	Secure every 4½ ft and within 12 in. of each box	Procedure D
334.80	60 °C ampacity; bundle derating	Sections 2.4, Procedure D
334.112	NM conductors rated 90 °C	Section 2.3
340.10, 340.12, 340.80	UF uses, limits, 60 °C ampacity	Procedure E
Table 310.16	60 °C copper ampacity: 15, 20, 30, 40, 55 A for 14 through 6 AWG	Section 2.4

Other sources used in this module:

- NAVEDTRA 14026, Construction Electrician Basic, Chapter 5 "Interior Wiring," pp. 5-11 to 5-15 (box mounting, box heights, staples, drilling, notches, cable stripping).
- Arc Workforce, Residential Electrical Field Guide, Part 2 "Wiring," Part 3 "Box Fill — Quick Reference," Part 10 "NM Cable — Installation Rules That Inspectors Catch" and "Box Fill — The Inspector-Catching Calculation." Its code numbers are NEC 2020. Use the numbers in this module.
- Southwire, Romex SIMpull NM-B spec sheet, ©2024: <https://images.thdstatic.com/catalog/pdfImages/c8/c88dd66a-47bf-4d95-957c-a3757f9480e6.pdf>
- Croft, Wiring of Finished Buildings (1915). Its fishing chapters are used in R1.12.
- Commercial Module 1.2 (raceway and conduit) and the MATERIALS masterclass (box hardware).

9. End-of-Chapter Checklist

Check each box only when you can do it without looking at this module.

- [] I can name NM-B, UF-B, MC, and AC on sight and say one place each is allowed and one place it is not.
- [] I know NM-B can't go in buried conduit, outdoor conduit, or any wet or damp place.
- [] I can read "12-2 WITH GROUND" off a jacket and say what is inside.
- [] I know 14 AWG goes on 15 A, 12 AWG on 20 A, 10 AWG on 30 A, and why.
- [] I bore holes so the edge is at least 1¼ in. from the face, and I put a 1/16 in. plate on any hole that is closer.
- [] I staple NM within 12 in. of each box (8 in. on unclamped single-gang plastic) and every 4½ ft.

- [] I lay flat cable flat and never crush the jacket.
 - [] I know three NM cables through one sealed hole needs derating, and I drill another hole instead.
 - [] I know the burial depths: 24 in. UF, 18 in. PVC, 12 in. for 120 V 20 A GFCI residential circuits.
 - [] I protect cable coming out of the ground up to 8 ft.
 - [] I cut armor with a rotary cutter, use a red bushing on AC, and use connectors listed for the cable.
 - [] I leave 6 in. of free conductor and 3 in. past the box face, and 1/4 in. of jacket inside the box.
 - [] I make up grounds first, neutrals second, hots last.
 - [] I can do a box-fill count, including mixed wire sizes and more than four grounds, and pick the box.
 - [] I know the 2026 rule: hots and neutrals count at their own size; grounds count 1 for the first four and 1/4 for each more.
 - [] I set boxes flush in wood and no more than 1/4 in. back in drywall.
 - [] I know a fan needs a fan-rated box, 70 lb max.
 - [] I can cut in and set an old-work box that does not move.
 - [] My journeyman signed off the field exercise.
-

Videos to watch

These videos are made by other electricians and companies, not YES Electric. Watch each one after you read the section it goes with. Where a video does something differently from this module, the caution line says so. Follow this module and your journeyman, not the video. Click a title to open it on YouTube.

Section	Video
Procedure C: Drill the framing (1¼ in. setback and nail plates)	The 1¼-Inch Rule: The Part Everyone Misses Smarter Sparky • 14:07 A licensed master electrician shows the 1¼ in. no-drill zone on a 2x4 and 2x6, the largest legal hole, how to cover an oversize or off-center hole with 1/16 in. steel nail plates, and the parallel-run rule along the side of a stud. Caution: Quotes both NEC 2026 300.6(A)(1) and 2023 300.4(A)(1), which matches R1.3. Ask the carpenter before boring big holes, as he says; R1.3 Unverified #2 notes the IRC limits are not in the module.
Procedure D: Pull and secure NM cable	ROMEX Cable Support Requirements (2025) Backyard Maine • 11:38 A 40-year electrician walks 334.30: staples every 4½ ft and within 12 in. of a box, the 18 in. cable-length limit for a service loop, bored holes counting as support, and why a clamp-less plastic box needs a staple within 8 in. Caution: Has a sponsor segment (standing desk) in the middle. Code numbers are NEC 2023; the rules match R1.3 Procedure D.
Procedure E: UF cable underground	#1 UNKNOWN Conduit and UF Cable Rule you Need to Know! Electricians In Action Electrical Code Coach • 8:46 Reads Table 300.5 column by column, shows the 12 in. depth for 120 V, 20 A or less GFCI-protected residential circuits, and explains that burial depth is measured to the top of the cable or conduit. Caution: Classroom whiteboard, no digging shown. Measure cover from finished grade, per the R1.3 safety note.
Procedure F: MC and AC cable	Klein Tools MC Cable Cutter How-To Palmer Electrical • 4:09 Sets up a rotary armor cutter, cuts one spiral of MC armor, twists it off, and lands the cable in a listed connector on a 4-in. square box. Caution: He puts a red anti-short bushing in MC. R1.3 requires the bushing on AC cable; on MC it is not required by code, so follow the connector instructions. Harmless either way.
Procedure H: Count the box (box fill)	Box Fill Calculations NEC 2026 314.16 (B) Sparky Channel • 6:12 Works one box-fill problem start to finish: conductors, double allowance per device yoke, one allowance for internal clamps, and the NEC 2026 grounding rule (first four grounds count as one, each extra counts as one quarter). Caution: His example is a 4-in. square box with a mud ring, not the single-gang boxes in R1.3's worked examples; the method is the same. He reads one clamp rule from the 2020 book on screen.

Procedure J: Mount an old-work box in finished drywall

[How to Install an "Old-Work" Electrical Box](#)

Fine Homebuilding • 1:08

One-minute clip: find the studs, trace the box level, score and cut the drywall, test-fit, feather a tight hole, and tighten the swing tabs.

Caution: Does not show feeding the cable through the box clamp with ¼ in. of sheath inside; follow R1.3 Procedure J for that part.

Image credits

Photos are used under the licenses listed. Drawings without a credit line were made by YES Electric.

Figure	Source	Author	License
r13-05	Electrical-wiring-rough-in.jpg	Amy Bonilla (Flickr); file optimized by Gazebo	CC BY-SA 2.0