

Safety, Tools, and the Service Truck

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 (Installation)

Code edition: this module cites NEC 2026. Where a section number moved, the NEC 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.

Learning Objectives

When you finish this module you will be able to do these things:

1. Test for voltage before you touch any conductor. You will use a non-contact tester first, then prove the result with a meter, and you will check the meter on a known live source before and after.
 2. Name every tool in the residential service kit, say what it is for, and keep the truck stocked to its par levels.
 3. Set up and climb a ladder the right way, and work safely in attics and crawl spaces, including heat, insulation, and footing hazards.
 4. Behave in a customer's home the YES way: where to park, shoe covers and drop cloths, what to say, and what to hand off to the office.
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Part 1: Plain-Language Background

1.1 Why this module comes first

Every other module in this course asks you to put your hands inside a box, a panel, or an appliance. This one teaches the habits that keep you alive while you do that. None of it is hard. The danger comes from skipping a step because you are tired, rushed, or sure the breaker is off.

The service truck is your shop. A residential service call is usually one person or two people, far from the supply house, with a customer watching. If the truck is missing a part, the job stops. If the truck is missing a tool, you will be tempted to use the wrong one. Both problems are fixed by stocking the truck before you leave in the morning.

1.2 How electricity hurts people

Current, not voltage, is what does the damage. Voltage is the push. Your body's resistance decides how much current that push can drive through you. The OSHA booklet Controlling Electrical Hazards (OSHA 3075, printed p. 7) gives this table for current flowing hand to foot for one second:

Current through the body	What happens
Below 1 mA	You usually cannot feel it.
1 mA	Faint tingle.
5 mA	Slight shock. Not painful, but you jerk. Most people can let go.
6–25 mA (women), 9–30 mA (men)	Painful shock. You lose muscle control. This is the "let-go" range: you may not be able to let go of the wire.
50–150 mA	Extreme pain, breathing stops, severe muscle contraction. Death is possible.
1,000–4,300 mA	The heart stops pumping in rhythm. Death is likely.
10,000 mA	Cardiac arrest and severe burns. Death is probable.

A milliamp (mA) is one thousandth of an amp. A 15 A breaker will let 15,000 mA flow before it trips. A breaker protects the wire. It does not protect you. A GFCI protects people because it trips when about 5 mA leaks out of the circuit (OSHA 3075, printed p. 14).

The NIOSH Electrical Safety: Safety and Health for Electrical Trades student manual (Section 2) says dry skin can have a resistance of 100,000 ohms or more, and wet skin can drop to about 1,000 ohms. Sweat counts as wet. An attic in an Alabama summer will soak you in ten minutes.

Here is the math, using Ohm's law (current = voltage ÷ resistance):

- At 120 V with dry skin at 100,000 ohms: $120 \div 100,000 = 0.0012 \text{ A} = 1.2 \text{ mA}$. You feel a tingle.
- At 120 V with sweaty skin at 1,000 ohms: $120 \div 1,000 = 0.12 \text{ A} = 120 \text{ mA}$. That is in the range where breathing stops.

The same 120 V outlet can tingle you one day and kill you the next. The only difference is how wet you are and how good your contact is. Never treat 120 V as "only 120."

1.3 The three ways shock happens in a house

The NIOSH manual (Section 1) lists the ways current gets into a body. In a house it almost always looks like one of these:

1. You touch a hot wire and a neutral or ground at the same time. Example: holding a bare black wire while your other hand rests on a metal box.

2. You touch a hot wire while your body touches something grounded. Example: you are on a damp crawl-space floor or leaning on a copper water pipe.
3. You touch both hots of a 240 V circuit. Example: grabbing both legs of a dryer circuit. No ground is needed for this one.

Burns are the most common injury from electrical contact (OSHA 3075, printed p. 8). Arc burns happen when a short circuit flashes near your face or hands, for example when a screwdriver slips across a hot bus bar in a panel. Falls are the other big killer. A small shock on a ladder can throw you off it.

1.4 What "dead" means

A circuit is dead only after you have proven it dead with a meter that you know works. A breaker in the OFF position is not proof. Breakers fail closed. Panels are mislabeled. Multi-wire circuits share a neutral that can carry current from another breaker. A switch loop can carry power from a different circuit. Older houses have circuits that were tapped off the wrong breaker by someone fifty years ago.

OSHA's general-industry rule says live parts you may be exposed to "shall be deenergized before the employee works on or near them" unless deenergizing is infeasible or creates a bigger hazard (29 CFR 1910.333(a)(1), <https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.333>). At YES, the default is to work dead. When you must take a live reading, like checking a breaker's output, you do it with a meter, the right PPE, and your journeyman's permission.

1.5 The rules that apply to us

Rule	Who wrote it	What it covers for us
29 CFR 1926 Subpart K	OSHA (construction)	New construction and remodel work. Lockout and tagging of circuits is 1926.417.
29 CFR 1910 Subpart S	OSHA (general industry)	Service and repair work in occupied buildings. Work practices are 1910.331–1910.335.
29 CFR 1926.1053	OSHA	Ladders.
NFPA 70E	NFPA	How to work safely around energized equipment, PPE selection, arc flash. Taught in Commercial Module 2.1.
NEC 110.26	NFPA 70	The working space that must be kept clear in front of a panel.
NEC 110.14(D)	NFPA 70	Terminal screws must be tightened to the torque marked on the equipment.

Commercial Module 2.1 teaches lockout/tagout (LOTO) and NFPA 70E in depth. This module does not repeat it. Read 2.1 before you work in a panel.

Part 2: The Residential Service Kit

2.1 Testers and meters

These are the tools that keep you alive. Each one has a job the others cannot do.

Tool	What it does	Limits you must know
Non-contact voltage tester (NCV, "tick tester," "volt stick")	Beeps or lights when held near a wire carrying AC voltage. No metal contact needed.	It can give a false "dead" with a dead battery, through metal armor (MC or BX cable), through metal conduit, or on a shielded wire. It can give a false "live" from induced voltage on a dead wire next to a live one. It is a first check, never the final proof.
Plug-in receptacle tester (three-light)	Plugs into a receptacle and shows a light pattern for correct wiring, open ground, open neutral, open hot, hot/ground reversed, hot/neutral reversed.	It cannot tell a true ground from a bootleg ground (a jumper from neutral to ground screw). It cannot find a high-resistance connection. It reads "correct" on some dangerous faults.
Plug-in GFCI tester	Same as above plus a button that leaks current to ground to trip a GFCI.	It needs an equipment ground to work. On a two-wire circuit with no ground, it will not trip a good GFCI. Use the GFCI's own TEST button there.
Digital multimeter (DMM)	Measures AC and DC volts, resistance (ohms), and continuity. Some measure capacitance and temperature.	It must be on the right setting. Leads must be in the right jacks. It must be rated for the place you use it (see 2.2).
Clamp meter	Measures current (amps) by clamping around one conductor. Most also measure volts and ohms.	Clamp one wire only. Clamping a whole cable reads near zero because the hot and neutral currents cancel.
Circuit tracer (breaker finder)	A transmitter plugs into a receptacle. A receiver passed over the breakers finds the one feeding it.	Works best with the circuit live and the panel cover on. Read the maker's instructions for AFCI and GFCI breakers.
Tone generator and probe	Puts a signal on a dead wire so you can follow it through walls with the probe.	The wire must be de-energized for most tone generators.
Arc-fault diagnostic tool	Kuhlman describes a newer tool that goes in series with an AFCI circuit and shows on a handheld how likely an arc is ("Important tools for troubleshooting," p. 11).	YES does not stock one yet. Your journeyman will tell you if one is on the truck.

Kuhlman calls the meter the most important tool after the hand tools and screw gun, and says the tone generator is next ("Important tools for troubleshooting," p. 11). He also reports that some NCV brands give false "live" readings, and that NCVs do not work on cable with a metal jacket. When an NCV and a meter disagree, the meter leads touching metal decide.

2.2 Meter safety ratings (CAT ratings)

Every meter and every set of test leads carries a measurement category, written near the input jacks as something like "CAT III 600V." The category tells you how big a voltage spike the meter can survive without blowing up in your hand. Spikes come from lightning and from utility switching. They are bigger the closer you are to the utility transformer.

Fluke's guide ABCs of Multimeter Safety (https://media.fluke.com/51012112-8f43-4aa7-a30a-b2e3016e8f2f_original%20file.pdf, Table 1) sorts locations like this:

Category	Where it applies in a house
CAT IV	The service: the meter, the service drop, the run from the meter to the main panel, an underground line to a well pump or a detached building.
CAT III	The panel and short branch circuits fed from it, and outlets with short connections to the service.
CAT II	Receptacles and the things plugged into them, and outlets more than 10 m (30 ft) from a CAT III source.

The same guide warns that a CAT II 1000 V meter is not safer than a CAT III 600 V meter, because the category also sets how much current the spike test uses. On a residential service truck, buy and carry a meter and leads rated CAT III 600 V at minimum, and CAT IV 600 V if you will take readings at a meter base or the service entrance. The leads need the same rating as the meter.

2.3 Hand tools

Tool	Use	Notes
Wire strippers, 10–18 AWG (or 10–20)	Strip NM and THHN.	Use the gauge hole that matches the wire. A nick in copper is a future hot spot.
Lineman's pliers, 9 in.	Cut, twist, and pull wire; cut NM.	Insulated handles are for comfort only unless marked 1000 V rated.
Needle-nose pliers	Form the hook for a screw terminal.	Bend the hook clockwise so tightening the screw closes the loop.
Diagonal cutters (dikes)	Cut wire flush, cut zip ties.	
Cable ripper or utility knife	Slit the NM jacket.	Slit along the flat, away from the conductors.
#2 Phillips screwdriver	Device, plate, and cover screws.	The most-used screwdriver on a residential call.
Flat screwdrivers, 1/4 in. and 3/16 in.	Breaker terminals, device screws.	
Square-drive (#1, #2) and combination-tip drivers	Many device and breaker screws are combination slot/square.	
Torque screwdriver, inch-pounds	Tighten breaker and device terminals to the marked value.	NEC 110.14(D). See Part 4.
Nut drivers, 1/4 in. and 5/16 in.	Panel cover screws, ground screws.	
Multi-bit 11-in-1 driver	Backup.	Never your only driver for a panel.
Fish tape, 50 ft	Pull cable through walls and conduit.	Steel tape is conductive. Keep it out of live panels.
Fiberglass glow rods	Push and pull cable across ceilings and walls.	
Drywall saw (jab saw)	Cut old-work box holes.	
Hammer, 16 oz	Staples, nail plates, new-work boxes.	
Tape measure, 25 ft	Box heights, setbacks.	
2 ft level, torpedo level	Panels plumb, boxes level.	
Flashlight and headlamp	Light inside panels, attics, crawl spaces.	Arc Guide Part 9 says never work in a panel without enough light.
Safety glasses	Panel work, drilling, cutting, overhead work.	Every time, not "when it looks dangerous."
Work gloves	Handling cable, insulation, sharp metal.	Leather gloves are not shock protection.

The bccampus Trades Access Common Core, C-1 Hand Tools book covers how each common hand tool is held and used safely. Read it if you have never used a fish tape, a jab saw, or a hacksaw.

2.4 Power tools

Tool	Use
18 V or 20 V impact driver	Screws, lag bolts.
18 V or 20 V drill/driver with clutch	Device screws on low clutch, small holes.
Right-angle drill with auger bits (7/8 in. to 1 in.)	Boring studs and joists for cable.
Flex bit (fishing bit), 54 in. and 72 in.	Drilling through top and bottom plates in finished walls.
Hole saws, 1-1/2 in. to 4 in.	Recessed lights, fan boxes, penetrations.
Oscillating multi-tool	Cutting box holes in plaster, notching.
Reciprocating saw	Demo, cutting old boxes out.
Rotary hammer with masonry bits	Anchors in brick and block for panels and disconnects.

Pull the battery before you change a bit or blade. Wear eye protection when drilling overhead. Commercial Module 1.1 covers the rotary hammer and silica dust in depth.

2.5 The truck stock list

YES keeps a residential service truck stock list with par levels (the number that should be on the truck every Monday) at. A checkable copy lives in the Google Sheet "Residential Service Truck Checklist." Ask the office for the link. The list has 16 sections:

1. Wire and cable.
2. Fasteners.
3. Splices and terminations.
4. Devices.
5. Plates and covers.
6. Boxes.
7. Breakers.
8. Raceway, fittings, and cable terminations.
9. Lamps and smoke alarms.
10. Chemicals.
11. Hand tools.
12. Test equipment.
13. Power tools and bits.
14. Safety and access.
15. Paperwork.

16. Bin organization.

A few rules from that list explain how the truck is run:

- The restock trigger is "last one out of the bin," not "bin empty." When you use the last 20 A Homeline breaker, write it on the reorder line that day.
- The breaker bin holds 20 A single-pole breakers in five brands: Square D Homeline, Square D QO, Eaton BR, Siemens QP, and GE THQL. Two-pole, tandem, GFCI, and AFCI breakers are picked up per call.
- The truck carries no Federal Pacific Stab-Lok or Zinsco breakers. A call on one of those panels becomes a panel-replacement quote, and the office handles the quote.
- Every replacement duplex receptacle on the truck is tamper-resistant, because the code requires it in dwellings (NEC 406.26, 2023: 406.12; see R1.4).
- Single-cable NM connectors are listed for one cable. Two cables in one needs the two-cable connector. The truck keeps them in separate compartments.

Field photo coming: The inside of a YES service truck with the shelving doors open. Bins are labeled with the section number and item from the stock list (for example "7 – Breakers – HOM 20A 1P"). The wire rack holds 250 ft rolls of 12/2, 14/2, 12/3, and 14/3 NM-B. The meter case, NCV, and torque screwdriver sit in a padded drawer at the front.

Picture coming: The YES residential service kit laid out on a gray tarp, top-down view, every tool labeled with a callout line: non-contact voltage tester, three-light plug-in tester, plug-in GFCI tester, digital multimeter with CAT III 600 V marking visible near the jacks, clamp meter around a single black wire, circuit tracer transmitter and receiver, torque screwdriver set to an inch-pound scale, 10-18 AWG wire strippers, 9 in. lineman's pliers, needle-nose pliers, diagonal cutters, #2 Phillips and 1/4 in. flat screwdrivers, nut drivers, headlamp, safety glasses, leather gloves.

2.6 Taking care of the tools

1. Test the NCV on a known live receptacle at the start of every day. If it does not beep, change the battery and test again. If it still does not beep, throw it out.
 2. Look over the meter leads every morning. Cracked insulation, exposed metal past the finger guard, or a loose tip means the leads go in the trash. Leads are cheap. Burns are not.
 3. Replace the meter's batteries when the low-battery icon shows. Some meters read wrong on a weak battery.
 4. Keep the torque screwdriver in its case and never use it as a regular screwdriver. Dropping it can throw off its setting.
 5. Tag any damaged power tool "Do Not Use" and tell your journeyman. OSHA 3075 (printed p. 18) says to remove a defective tool from service and tag it until it is repaired or replaced.
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Part 3: Proving a Circuit Dead (Step by Step)

This is the most important procedure in the course. You will do it hundreds of times a year. Do it the same way every time so that it becomes automatic.

3.1 The tools for the job

- A non-contact voltage tester.
- A digital multimeter set to AC volts, rated CAT III 600 V or higher.
- A known live source to prove the meter. A receptacle you know is working, or a proving unit made for the purpose.
- Safety glasses.

3.2 The procedure: test before touch

1. Ask the customer which breaker feeds the device, and look at the panel directory. Treat both as guesses.
2. Prove the NCV works. Hold it to a receptacle you know is live. It must beep or light. If you have no known live receptacle nearby, use the hot slot of the nearest working receptacle.
3. Check the device you are about to work on with the NCV while it is still live. Hold the tip to the face of the receptacle or switch. It should beep. If it does not beep on a device that is supposed to be live, the NCV may not see the wire (metal box, MC cable). Note that, because the NCV cannot be trusted on that device later.
4. Turn off the breaker. If the circuit has a two-pole breaker or a handle tie, turn off the whole thing.
5. Tell the customer you have turned off power to that area, and ask them not to touch the panel. If the panel is in a garage or hall where people pass, hang a tag on it that says "Electrician working – do not turn on." Commercial Module 2.1 covers lockout devices for breakers. Use a breaker lock when your journeyman says to, and always when the panel is out of your sight.
6. Check the device again with the NCV. It should be silent. Silence is not proof. Go to step 7.
7. Prove your meter works. Set it to AC volts (V with a wavy line). Put the black lead in COM and the red lead in V. Measure the known live receptacle from step 2, hot slot (short) to neutral slot (tall). It should read about 120 V.
8. Take off the cover plate and pull the device out of the box without touching any terminals or bare wire. Hold it by the yoke (the metal strap) and the plaster ears.
9. Measure the device at the terminals or at the wires. On a receptacle, take three readings: - Hot to neutral (brass screw to silver screw): should read 0 V. - Hot to ground (brass screw to green screw or bare wire): should read 0 V. - Neutral to ground (silver screw to green screw): should read 0 V.
10. Measure every other conductor in the box. A box can hold two or three circuits. Any black, red, or blue wire that is not on your device gets checked to ground. If you find voltage on any wire, stop and find its breaker before you go on.

11. Prove the meter again on the known live receptacle. It should read about 120 V. This proves the meter did not fail between step 7 and step 9. If it fails now, the 0 V readings in step 9 mean nothing. Get another meter and start again at step 7.
12. Only now can you touch the wires.

Steps 7, 9, and 11 are called the "live-dead-live" test. OSHA's general-industry rule requires checking the test equipment before and after only above 600 V (1910.333(b)(2)(iv)(B)). YES does it on every circuit, at every voltage, because a meter with a dead battery or a broken lead reads 0 V on a live wire.

Picture coming: The three-way dead check at a duplex receptacle, three side-by-side panels. Panel 1: meter probes on the brass screw and the silver screw, display reads "120 V" (live) and "0 V" (dead) as two labeled states. Panel 2: probes on the brass screw and the green ground screw, same two states. Panel 3: probes on the silver screw and the green ground screw, display reads "0-2 V" on a healthy live circuit and "0 V" dead. A caption box under the panels: "Prove the meter on a known live source before and after."

3.3 Why each reading matters

Reading	What a healthy live circuit shows	What it tells you when dead
Hot to neutral	About 120 V (114-126 V is the normal range for a 120 V nominal circuit; see Commercial 2.2 and R2.2 for limits).	The hot is off, or the neutral is open. Hot to ground tells you which.
Hot to ground	About 120 V.	The hot is off. If hot to neutral reads 0 V but hot to ground reads 120 V, the hot is live and the neutral is open. That box is still live.
Neutral to ground	0-2 V on a healthy circuit under light load. The Arc Guide (Job 9) gives the same 0-2 V range.	A higher reading means current on the neutral, a long run under load, or a loose neutral. Investigate before you assume anything.

3.4 Panel work: extra steps

Opening a panel is a different level of risk. The main lugs and the service conductors above the main breaker stay live when the main breaker is off. Only the utility can turn those off, by pulling the meter or opening the transformer.

1. Ask your journeyman before you remove a panel cover. Helpers do not open panels alone in their first year at YES.
2. Wear safety glasses and, for any live panel reading, the PPE your journeyman calls for under NFPA 70E (Commercial 2.1).
3. Stand to the side of the panel, not directly in front of it, when you remove the cover. Remove the bottom screws last, holding the cover so it cannot drop onto the breakers.
4. Look before you touch. Note double taps, burned insulation, aluminum wire, missing knockouts, and anything that looks wrong. Take photos.

5. Keep one hand out of the panel whenever you can. Do not lean on the panel or rest a hand on the enclosure while you probe.
6. Never put a metal tape measure, a fish tape, or an uninsulated screwdriver near the bus.

Picture coming: A residential load center with the cover off, viewed from the front. The service conductors, main lugs, and line side of the main breaker are shaded red with the label "Live even with main OFF. Only the utility can de-energize." The branch breakers and bus are shaded yellow with the label "Live until main is OFF and proven dead." A small figure of a technician stands to the left side of the panel, not centered in front of it.

3.5 When you cannot get it dead

Sometimes you cannot find the breaker, or the circuit is fed from two places. Stop. Call your journeyman. Do not work it live to save time. The Arc Guide (Part 6) says it directly: never guess or improvise on service entrance, meter work, or utility connections, because those conductors are always live.

Part 4: Torque, and Why It Is a Safety Rule

NEC 110.14(D) says tightening torque values for terminal connections shall be as indicated on the equipment or in the installation instructions, and that an approved means shall be used to achieve that torque. Its informational note gives torque tools as an example of an approved means. The torque value is printed on the breaker, on the panel label, on the device, or in the instruction sheet.

A loose connection gets hot. The Arc Guide (Part 10, "The 78% Torque Problem") reports studies finding that most hand-tightened connections are off the marked value, some too loose and some too tight. A too-tight screw can crack a breaker body or crush a conductor. A torque screwdriver removes the guess.

How to use it:

1. Read the torque value on the device or the panel label. Example: a breaker label might say 25 lb-in for 14–10 AWG copper. Use the number on the equipment in front of you, not a number from memory.
2. Set the torque screwdriver to that value. Check that the scale is in inch-pounds (lb-in), not newton-meters.
3. Seat the bit fully in the screw head.
4. Turn smoothly until the driver clicks or slips. Stop at the first click.
5. Do not go back and "snug it up" after the click.
6. On panel work, make a small paint-pen line across the screw head and the terminal after torquing. The torque mark shows the inspector and the next electrician that the screw was set.

If no torque value is marked, NEC Informative Annex I has a table of tightening torques from UL 486A-486B. Use it only when the equipment gives no number.

Part 5: Ladders

5.1 The rules

These are OSHA's construction ladder rules (29 CFR 1926.1053, <https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.1053>), with what each means on a house:

Rule	What it says	What it means for you
1926.1053(b)(1)	Side rails extend at least 3 ft above the upper landing surface when the ladder is used to reach a roof or landing.	If you will step off onto a roof, three feet of ladder sticks up above the gutter.
1926.1053(b)(5)(i)	A non-self-supporting ladder is set so the horizontal distance from the top support to the foot is about one-quarter of the working length.	The 4-to-1 rule. For every 4 ft of height up to where the ladder touches, the feet are 1 ft out from the wall.
1926.1053(b)(6)	Ladders are used only on stable and level surfaces unless secured.	Do not set the feet on mulch, wet grass, a slope, or loose gravel without leveling and securing them.
1926.1053(b)(12)	Side rails must be nonconductive if the worker or ladder could contact exposed energized electrical equipment.	Electricians use fiberglass ladders. Aluminum ladders do not go on the YES truck.
1926.1053(b)(13)	The top or top step of a stepladder is not used as a step.	The top cap is not a step. On many stepladders the step below it is also marked "Do not stand at or above this level." Obey the label.
1926.1053(b)(20)	Face the ladder when going up or down.	No climbing backward.
1926.1053(b)(21)	Keep at least one hand on the ladder while moving up or down.	Tools go in a pouch or on a hand line, not in your hand.
1926.1053(b)(22)	Do not carry any object or load that could make you lose balance.	Hand a fixture up, or haul it up with a rope.
1926.1053(b)(3)	Do not load a ladder beyond its rated capacity.	Your weight plus your tools plus material. A Type IA ladder is rated 300 lb. Check the label.
1926.1053(b)(16)	Defective ladders are tagged "Do Not Use" and taken out of service.	A cracked rail or bent rung means the ladder stays off the job.

5.2 Setting up an extension ladder, step by step

1. Look up before you carry the ladder. Find the service drop and any other overhead wires. OSHA 3075 (printed p. 17) says unqualified workers keep at least 10 ft from overhead power lines. Walk the ladder so no part of it can swing into a wire.
2. Inspect the ladder: rails, rungs, locks (rung hooks), rope, pulley, and feet. Do not use it if anything is cracked, bent, or missing.
3. Lay the ladder on the ground with its feet against the base of the wall.
4. Walk it up hand over hand from the top end until it stands against the wall.
5. Raise the fly section with the rope until the top is where you need it. Check that both rung locks are seated over a rung.
6. Pull the feet out to the 4-to-1 angle. Measure the height to the top support point. Divide by 4. That is how far the feet go out from the wall. For a 16 ft touch point, the feet are 4 ft out.
7. Check the angle with your body. Stand with your toes touching the ladder feet. Hold your arms straight out in front of you. Your palms should just reach the rung in front of you at shoulder height.
8. Set the feet on firm, level ground. Turn the swivel feet to the flat pad on hard surfaces and to the spur (spike) side on soft ground. Level an uneven spot with a leveler accessory, not a block of wood or a brick.
9. If the ladder goes to a roof, check that it extends 3 ft past the roof edge.
10. Tie the top off to something solid (a gutter strap is not solid), or have a second person foot the ladder. Tie the bottom off to a stake or the house if no one can foot it.
11. Climb facing the ladder with three points of contact: two hands and a foot, or two feet and a hand.
12. Keep your belt buckle between the rails. If you have to lean out past the rails to reach, climb down and move the ladder.

Picture coming: Ladder setup diagram, side view of a house wall with an extension ladder. Labels: "Height to top support: 16 ft," "Base out from wall: 4 ft (1 ft out for every 4 ft up)," "3 ft above roof edge," "Fiberglass rails," "Feet on firm, level ground," and a small inset of a technician standing at the ladder feet with arms straight out touching a rung to check the angle. An overhead service drop at the corner of the house has a dashed 10 ft circle around it labeled "Keep ladder 10 ft away."

5.3 Stepladders

1. Open it fully and lock both spreaders.
2. Set all four feet on a level floor. Lay a drop cloth under it in a finished house, but make sure the cloth does not slide on hard floors. A rubber-backed drop cloth or a towel under each foot works.
3. Face the ladder. Do not stand on the top cap or the step marked as the highest standing level.
4. Do not use a closed stepladder leaned against a wall like an extension ladder. It was not designed for that (1926.1053(b)(4)).

5. Move the ladder rather than reaching. Your belt buckle stays between the rails.

Part 6: Attics and Crawl Spaces

Attics and crawl spaces are where residential electricians get hurt in ways the code book does not mention. You can fall through a ceiling, pass out from heat, get bitten, or breathe something you should not.

6.1 Attic hazards and what to do about each

Hazard	What to do
Falling through the ceiling	Step only on joists or truss chords, or on a board laid across at least three of them. Drywall and plaster will not hold you. Carry a 2 ft × 4 ft piece of 1/2 in. plywood to kneel on.
Heat	Work attics before 11 a.m. from May through September when you can. Bring water up with you. See 6.2.
Nails through the roof deck	Roofing nails stick down 3/4 in. or more through the decking. Wear a hard hat or bump cap. Move slowly near the eaves.
Live wires buried in insulation	Old knob-and-tube and spliced NM can be hidden. Do not grab wires to steady yourself. Check with the NCV before you move any wire.
Fiberglass insulation	Wear long sleeves, gloves, safety glasses, and an N95 dust mask. Wash exposed skin with cold water first, then warm.
Vermiculite insulation	Grayish-brown or gold, pebbly, light as popcorn. The EPA says to assume it contains asbestos and leave it undisturbed (https://www.epa.gov/asbestos/protect-your-family-asbestos-contaminated-vermiculite-insulation). Stop, take a photo, and call your journeyman. Do not dig through it to run cable.
Wasps, bees, rodents	Look before you climb in. Carry a can of wasp spray in the truck in summer.
Getting lost or stuck	Tell someone you are going into the attic. Keep your phone on you.

6.2 Heat

Alabama attics regularly run far hotter than the outdoor temperature in summer. OSHA's heat guidance (<https://www.osha.gov/sites/default/files/publications/OSHA4200.pdf>) gives these rules:

1. Drink cool water even if you are not thirsty, at least 1 cup every 20 minutes.
2. For work longer than 2 hours with heavy sweating, add an electrolyte drink. OSHA's Water. Rest. Shade. page says water cannot replace the salt you lose (<https://www.osha.gov/heat-exposure/water-rest-shade>).

3. New and returning workers build heat tolerance with the 20% rule: on day one, no more than 20% of the shift at full intensity in the heat, increasing by no more than 20% a day. For an 8-hour day that means 1 hour 36 minutes of heavy heat work on day one (OSHA, <https://www.osha.gov/heat-exposure/protecting-new-workers>).
4. Take breaks out of the attic, in the shade or in the truck with the air on.
5. Never leave someone alone who shows heat symptoms.

Know the signs:

Heat exhaustion	Heat stroke
Heavy sweating, cool clammy skin, headache, nausea, dizziness, weakness, muscle cramps.	Confusion, slurred speech, passing out, seizures, very high body temperature. Sweating may stop.
Get out of the heat. Drink water. Cool down with wet cloths and a fan. If it does not get better in an hour, get medical care.	Call 911. Move the person to shade. Cool them with water, ice, or a fan while you wait. Do not leave them alone.

6.3 Crawl spaces

1. Look in with a flashlight before you go in. Check for standing water, sagging wires, animals, and broken glass.
2. If there is standing water, do not go in until every circuit in the crawl space is proven dead or the water is gone. Wet ground plus a damaged cable is how people die under houses.
3. Wear coveralls, gloves, knee pads, and a headlamp.
4. Check any cable or box you will crawl past with the NCV. Old splices hang loose in crawl spaces.
5. Watch for the access hole. Know where it is at all times. Some houses have only one way out.
6. Tell someone you are going under the house. If you are alone on the job, text the office when you go in and when you come out.

Part 7: Working in a Customer's Home

The customer judges the job by what they see: where you park, whether you track mud, and how you talk to them. They also judge whether you seem to know what you are doing. Their trust is what lets the office sell the next job.

7.1 Arriving

1. Park on the street or at the edge of the driveway, never on the lawn, and never blocking a garage door or another car.
2. Before you knock, look at the outside of the house: the meter, the service drop, any obvious damage. You may see the problem before you go in.
3. Knock or ring once. Step back from the door so the customer can see you through it.

4. Introduce yourself: "Hi, I'm [first name] with YES Electric. I'm here about [the problem they called about]."
5. Put shoe covers on before you step inside, every time, even if they say you do not need to. Put on fresh ones each time you come back in from outside.
6. Ask: "Can you show me where the problem is?" Then ask: "Where is your electrical panel?"

7.2 Intake questions

The Arc Guide (Part 6) lists five questions to ask before you touch anything, and Kuhlman makes the same point in "Troubleshooting Steps to Follow" (p. 75): treat the call as an investigation and question the customer first. Ask all five:

1. "Where exactly is the problem? Can you show me?"
2. "When did it first happen? Did it come on all at once or slowly?"
3. "Was anything happening when it failed, like a storm or an appliance running?"
4. "Has anyone worked on the house recently, or done any repairs?"
5. "Is anything else in the house acting strange, like flickering lights or other breakers tripping?"

Write the answers down. The useful clue often comes last.

7.3 While you work

1. Lay a drop cloth under the work area and anywhere you set tools.
2. Move furniture only with permission. Ask the customer to move fragile items themselves.
3. Keep your tools in a bag or bucket, not spread across their floor.
4. Do not use the customer's bathroom, phone charger, or kitchen without asking.
5. Keep children and pets away from open boxes and panels. If a child comes close, stop and ask the parent to keep them in another room.
6. Do not curse, smoke, vape, or play music in the house.
7. Do not talk about other customers, other electricians' work, or politics.

7.4 What to say and what to hand off

Topic	What you do
What you found	Show the customer. Point to it and explain it in plain words. Take a photo for the work order.
A safety problem you found that is not what they called about	Say "I noticed something I want to show you," walk them to it, and call it a "safety concern" or a "code requirement," not a "violation" (Arc Guide, Part 6). Write it on the work order whether they want it fixed or not.
Price	Do not quote prices or discounts. Tell the customer the office will send the price. Pricing is the office's job.
Payment	YES technicians do not collect payment. The office sends an invoice and a payment link.
Work outside your training	Say "That is work I need to get my journeyman or the office involved in before I go further." Document it and stop.
Someone else's bad work	Describe what you see, not who did it. "This connection is loose and burned" is a fact. "The last guy was a hack" helps no one.

7.5 Leaving

1. Test your work with the customer watching when you can. Show them the receptacle works, the light comes on, the GFCI trips and resets.
2. Put every cover plate back. Never leave an open box or a panel without its cover.
3. Turn back on every breaker you turned off, and check that the customer's clocks, freezer, and garage door opener have power.
4. Pick up every scrap of wire, every wire nut, and every bit of drywall dust. Vacuum if you made dust.
5. Take photos of the finished work for the work order.
6. Tell the customer what you did in one or two sentences, and that the office will follow up.
7. Take your shoe covers off outside.

Part 8: Worked Examples

Example 1: The NCV says dead, the meter says live

You are replacing a receptacle in a 1960s house. The box is metal and the cable is BX (armored cable). You turn off breaker 14, which the directory says is "living room." The NCV is silent at the receptacle.

You prove your meter on the kitchen receptacle: 121 V. You pull the receptacle out by its yoke. Hot to neutral reads 0 V. Hot to ground reads 0 V. You check a second black wire tucked in the back of the box. It reads 119 V to the metal box.

What happened: the box holds a second circuit, fed from a different breaker. The NCV could not see it through the BX armor and the metal box. Kuhlman notes NCVs do not work on metal-jacketed cable ("Important tools for troubleshooting," p. 11). Find that second breaker with the circuit tracer, turn it off, and prove the box dead again before you touch anything.

Example 2: Hot to neutral 0 V, hot to ground 120 V

You turn off what you think is the right breaker. At the receptacle the meter reads hot to neutral 0 V. You almost reach in. Then you take the second reading: hot to ground 120 V.

What it means: the hot wire is still live. The 0 V hot-to-neutral reading came from an open neutral, not a dead hot. The Arc Guide (Job 9) describes the same pattern: 120 V hot to ground with 0 V hot to neutral means an open neutral. This is why you take all three readings, every time. The circuit is still on. Go back to the panel.

Example 3: How much current through a sweaty hand

A helper with wet gloves grabs a 120 V hot conductor with one hand while kneeling on a damp crawl-space floor. Use the NIOSH wet-skin figure of 1,000 ohms. $\text{Current} = 120 \text{ V} \div 1,000 \text{ ohms} = 0.12 \text{ A} = 120 \text{ mA}$. The OSHA 3075 table puts 50–150 mA in the range of extreme pain, respiratory arrest, and possible death. A 20 A breaker would not trip. A GFCI would trip at about 5 mA, which is why GFCI protection on your extension cords and tools matters (see 9.2).

Example 4: Ladder angle

You need to reach a soffit 20 ft up to replace a floodlight. The ladder's top support point is the wall at 20 ft. $20 \div 4 = 5$. The feet go 5 ft out from the wall. If the ladder must also reach a roof, it must extend 3 ft above the roof edge, so you need a ladder long enough to reach 23 ft along its rails plus the overlap between sections. Read the ladder label for its maximum working length.

Part 9: Safety Warnings in One Place

These warnings also appear at the steps where they apply. They are collected here so you can review them.

1. A breaker in the OFF position does not prove a circuit is dead. Prove it with a meter you have checked before and after (Part 3).
2. The service conductors and main lugs stay live with the main breaker off (Part 3.4).
3. A non-contact tester cannot see through metal armor or metal conduit (Part 2.1, Example 1).
4. Wet skin can let 100 times more current through you than dry skin (Part 1.2).
5. Aluminum ladders do not go near electrical work (Part 5).
6. Do not step between joists in an attic (Part 6).
7. Do not disturb vermiculite insulation (Part 6).

8. Stop and call your journeyman when you cannot get a circuit dead (Part 3.5).

9.1 Jewelry and clothing

OSHA 1910.333(c)(8) says workers may not wear conductive jewelry or clothing that could contact energized parts unless it is made nonconductive. Take off rings, watches with metal bands, and neck chains before panel work. A wedding ring across a 240 V bus can weld and burn the finger to the bone.

9.2 Extension cords and power tools

1. Plug your tools into a GFCI-protected receptacle or use a portable GFCI cord. OSHA 3075 (printed p. 14) notes GFCIs trip in as little as 1/40 of a second when 5 mA leaks out.
 2. Check every cord before you use it. A cut jacket, a missing ground prong, or a taped splice means the cord goes out of service.
 3. Do not run cords through doorways that will close on them or across walkways without taping them down.
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Part 10: Common Mistakes

Mistake	Why it hurts you	What to do instead
Trusting the NCV alone.	It misses circuits in metal boxes and armored cable, and fails silently on a dead battery.	Use the NCV first, then the meter, live-dead-live.
Skipping the "after" meter check.	A meter that failed during the test reads 0 V on a live wire.	Re-prove the meter on a known live source after every dead test.
Taking only hot-to-neutral.	An open neutral reads 0 V hot-to-neutral on a live hot.	Take all three readings.
Only checking the wires on the device.	Boxes often hold two circuits.	Check every conductor in the box to ground.
Working a panel with rings on.	Metal jewelry can weld across the bus.	Take jewelry off before the cover comes off.
Tightening by feel.	Many hand-tightened connections are off the marked torque.	Use the torque screwdriver and the value marked on the equipment.
Leaning the ladder too steep or too shallow.	Too steep tips backward. Too shallow slides out.	Use the 4-to-1 rule and the arms-out check.
Climbing with a fixture in one hand.	You lose a point of contact.	Hand it up or use a rope.
Working the attic at 2 p.m. in July without water.	Heat illness can confuse you before you notice.	Work attics early, drink 1 cup every 20 minutes, take breaks outside the attic.
Quoting a price to the customer.	Your number may be wrong and the customer will hold YES to it.	"The office will send you the price."
Leaving a cover off "for a minute."	A child or pet can reach the live parts.	Covers go back on before you leave the room.
Running out of 20 A breakers mid-week.	The job stops and the customer waits.	Restock when the last one leaves the bin, not when the bin is empty.

Part 11: Field Exercise

Do this exercise with a journeyman watching. It takes about two hours. The journeyman signs the checklist at the end.

Part A: Lay out and name the kit (30 minutes)

1. Spread a tarp in the shop or driveway.
2. Take every tool out of the truck's tool drawers and your personal bag and lay them on the tarp in rows: testers and meters, hand tools, power tools, safety gear.

3. Point to each tool, say its name, and say what it is for in one sentence. Example: "This is a clamp meter. It measures current on one wire without disconnecting it."
4. Find the CAT rating on your multimeter and on its leads. Say the rating out loud and say where in a house the meter is allowed to be used.
5. Open the truck stock checklist. Pick one section, for example Section 7, Breakers. Count what is on the truck and compare it to the par level. Write down anything below par on the reorder line.

Part B: Prove the NCV and prove a receptacle dead (30 minutes)

Use a training receptacle on a known circuit, or a receptacle in the shop.

1. Test the NCV on a known live receptacle. It must alert.
2. Set the multimeter to AC volts, leads in COM and V. Measure the known live receptacle hot to neutral. Write the reading.
3. Turn off the breaker for the training receptacle.
4. Check the training receptacle with the NCV. Write whether it alerts.
5. Remove the cover plate and pull the receptacle out by the yoke.
6. Measure and write all three readings: - Hot to neutral. - Hot to ground. - Neutral to ground.
7. Measure the known live receptacle again. Write the reading.
8. Tell the journeyman whether the training receptacle is proven dead, and why.
9. Turn the breaker back on and take the three readings again with the circuit live. Write them. Compare them to the healthy-circuit values in Part 3.3.

Part C: Set up and tie off an extension ladder (30 minutes)

1. Pick a wall of the shop or a house. Look up and point out any overhead wires.
2. Inspect the ladder out loud: rails, rungs, locks, rope, feet. Say whether it passes.
3. Raise the ladder hand over hand and extend the fly to a set height your journeyman gives you.
4. Measure the height to the top support. Divide by 4. Move the feet to that distance. Do the arms-out check.
5. If the ladder reaches a roof edge, show that it extends 3 ft above the edge.
6. Tie the top off to a solid point and tie the bottom off to a stake or solid point.
7. Climb to the third rung facing the ladder with three points of contact, then climb down.

Part D: Walk a mock service call (30 minutes)

Your journeyman or another crew member plays the customer.

1. Park the truck the way you would at a customer's house.
2. Knock, step back, and introduce yourself with your name and YES Electric.
3. Put on shoe covers before you step in.
4. Ask the customer to show you the problem, then ask where the panel is.

5. Ask the five intake questions from Part 7.2 and write the answers.
6. The "customer" will ask what the repair will cost. Answer without giving a number.
7. The "customer" will point out something you think is a code problem. Explain it using the words "safety concern" or "code requirement."
8. Lay a drop cloth, then explain what you would do next.

Part 12: NEC and Other Cross-References

Reference	What it covers	Where it applies in this module
NEC 110.14(D)	Terminal connection torque. Tighten to the values marked on the equipment or in the instructions, using an approved means such as a torque tool.	Part 4.
NEC 110.26	Spaces about electrical equipment.	See the table below.
NEC Informative Annex I	Recommended tightening torque tables from UL 486A-486B, for use when the equipment gives no value.	Part 4.
29 CFR 1926 Subpart K (1926.400–1926.449)	OSHA electrical rules for construction. Lockout and tagging of circuits is 1926.417.	Part 1.5.
29 CFR 1910 Subpart S (1910.301–1910.399)	OSHA electrical rules for general industry. Work practices are 1910.331–1910.335.	Parts 1.4, 3.2, 9.1.
29 CFR 1926.1053	OSHA ladder rules.	Part 5.

NEC 110.26 working space, as it applies to a house panel. A residential panel is 120 V to ground, which falls in the 0–150 V row of Table 110.26(A)(1).

110.26 rule	Requirement	Why
110.26(A)(1), Table 110.26(A)(1)	Clear depth in front of the panel of 900 mm (3 ft) for 0–150 V to ground, in all three conditions.	Room to stand and back away from the panel.
110.26(A)(2)	Width of the working space is the width of the equipment or 762 mm (30 in.), whichever is greater, and must allow equipment doors to open at least 90 degrees.	Room for your shoulders and the panel door.
110.26(A)(3)	Height of the working space is 2.0 m (6-1/2 ft) or the height of the equipment, whichever is greater. Exception No. 2 allows existing dwelling service equipment or panelboards up to 200 A in spaces lower than 2.0 m.	Room to stand upright. The exception covers old basements with low ceilings.
110.26(B)	The working space may not be used for storage.	The customer's shelves, freezer, or boxes in front of the panel are a code problem and a safety problem.
110.26(D)	Illumination is required for working spaces about indoor service equipment and panelboards.	You need light to see what you are touching.
110.26(E)(1) (a)	The space the width and depth of the panel, from the floor to 1.8 m (6 ft) above it or to the structural ceiling, is dedicated to electrical equipment. No piping or ducts.	Keeps water lines and ducts from leaking into the panel.

Part 13: End-of-Chapter Checklist

Check each item off when you can do it without looking at this module.

- [] I can state the current range where a person cannot let go of a wire, and explain why wet skin is more dangerous.
- [] I can name every tool in the service kit and say what it is for.
- [] I can find the CAT rating on my meter and leads and say where in a house the meter may be used.
- [] I test my NCV on a known live source at the start of every day.
- [] I prove a circuit dead with live-dead-live and all three readings, every time.
- [] I check every conductor in a box, not only the ones on the device.
- [] I know the main lugs stay live with the main breaker off.
- [] I take off rings and metal jewelry before panel work.
- [] I set torque with a torque screwdriver to the value marked on the equipment and mark the screw.

- [] I can set up an extension ladder at 4-to-1, 3 ft above a roof edge, with the feet on firm ground, and tie it off.
 - [] I know the attic hazards and the heat-illness signs, and I drink at least 1 cup of water every 20 minutes in the heat.
 - [] I stop and call my journeyman if I see vermiculite or cannot get a circuit dead.
 - [] I park off the lawn, wear shoe covers, use drop cloths, and ask the five intake questions.
 - [] I do not quote prices or collect payment.
 - [] I restock the truck when the last item leaves a bin.
 - [] I can state the working space in front of a house panel: 3 ft deep, 30 in. wide, 6-1/2 ft high, no storage.
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Sources

- Arc Workforce, Residential Electrical Field Guide: Quick Reference; Part 6 (customer scripts); Part 9 (tools); Part 10 ("The 78% Torque Problem"); Job 9 (testing with a multimeter).
 - Kuhlman, Residential Electrical Troubleshooting (2019): "Important tools for troubleshooting," p. 11; "Troubleshooting Steps to Follow," p. 75, for the intake approach. Paraphrased.
 - OSHA 3075, Controlling Electrical Hazards: printed pp. 6–18 (shock effects table p. 7, burns p. 8, insulation, guarding, grounding, protective devices p. 14, work practices, overhead lines p. 17, PPE and tools p. 18).
 - NIOSH, Electrical Safety: Safety and Health for Electrical Trades, Student Manual: Sections 1–2.
 - BCcampus, Trades Access Common Core, C-1 Hand Tools.
 - YES residential service truck stock list.
 - 29 CFR 1910.333, <https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.333>.
 - 29 CFR 1926.1053, <https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.1053>.
 - OSHA, Prevent Heat Illness at Work (OSHA 4200), <https://www.osha.gov/sites/default/files/publications/OSHA4200.pdf>.
 - OSHA, Heat: Water. Rest. Shade., <https://www.osha.gov/heat-exposure/water-rest-shade>.
 - OSHA, Heat: Protecting New Workers, <https://www.osha.gov/heat-exposure/protecting-new-workers>.
 - EPA, Protect Your Family from Asbestos-Contaminated Vermiculite Insulation, <https://www.epa.gov/asbestos/protect-your-family-asbestos-contaminated-vermiculite-insulation>.
 - Fluke, ABCs of Multimeter Safety, https://media.fluke.com/51012112-8f43-4aa7-a30a-b2e3016e8f2f_original%20file.pdf.
 - NEC 2026 text: 110.14(D), 110.26, Informative Annex I.
 - Commercial Module 2.1 (LOTO, NFPA 70E, PPE) and 2.2 (instruments).
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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
Part 3 Proving a circuit dead (§3.2, §3.3)	How to Test for Voltage. What is Voltage? Can't You Just Use a Tick Tracer? Electrician U • 10:46 A licensed electrician shows why the non-contact tester only hints at voltage and how to measure hot-to-neutral, hot-to-ground, and neutral-to-ground with a meter before trusting a circuit. Caution: He does not walk the full live-dead-live sequence; follow the 12 steps in R1.1 §3.2. He also explains the neutral-to-ground bond at the service, which is covered later in R1.6.
§2.1 Testers and meters	4 Basic Electrical Testers & HOW TO USE THEM Electrician U • 15:24 The helper sees the four testers in the YES kit (plug-in tester with GFCI button, non-contact tester, two-lead tester, multimeter) and what each one can and cannot tell you. Caution: Filmed in a commercial shop. He says he uses the tick tracer mostly for tracing wires and that it can be wrong, which matches the module: NCV silence is never proof of dead.
§1.2 and §1.3 How electricity hurts people; the three ways shock happens	How Do I Get Shocked? Why Am I Getting Shocked? It's Simple. Electrician U • 13:34 Plain explanation of shock versus electrocution and how a body becomes part of the circuit, hot to neutral or hot to ground. Caution: He says about 5% of work may have to be done live with PPE. At YES a helper never works live; live work is a journeyman's call under the rules in R1.1 §1.5.
§2.2 Meter safety ratings (CAT ratings)	What Do CAT Ratings Mean? Electrician U • 13:59 Explains what CAT II, III, and IV mean, why available fault current matters at a service, and how to read the rating printed near the meter jacks. Caution: Ends with a comparison of two specific meters; the helper only needs the rating part.
Part 4 Torque, and why it is a safety rule	NEC 2023: How to Find Torque Specs for Panels & Breakers Marked or Unmarked Sparky Channel • 5:58 Shows where the torque value is printed on a load center and on breakers, and torques a breaker with a torque screwdriver set in inch-pounds. Caution: His example torques a Homeline breaker to 36 lb-in. Use the number on the equipment in front of you (R1.1 Part 4 step 1), not a number from the video.

Part 5 Ladders (§5.1, §5.2)

[How to Use Ladders Safely | Ask This Old House](#)

This Old House • 10:22

Ladder types, duty ratings, inspection, footing an extension ladder, and safe setup.

Caution: Says an aluminum ladder is a good choice when you are not working around electricity. YES carries fiberglass only (OSHA 1926.1053(b)(12)); aluminum ladders do not go on the truck.