

The Service Call

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.

Phase 2, Troubleshooting and Service Calls. Read this before any other Phase 2 module. Every later troubleshooting chapter (R2.2 through R2.9) assumes you run each call the way this chapter lays out.

Before this module: R1.1 (safety, tools, and the service truck). You should already know how to use a non-contact tester and a multimeter at a receptacle. R2.2 teaches the meters in depth.

Code edition. Code references are NEC 2026. Where a section 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 you quote a section to anyone.

Learning Objectives

When you finish this module you will be able to:

1. Run the intake questions at the door and get the customer's story before you touch anything.
 2. Do the five safety checks on every call: breaker, upstream GFCI, loose neutral, overload, and meter.
 3. Apply the five-step troubleshooting method from commercial Module 2.1 to a house.
 4. Document what you found with photos and a plain write-up on the job board.
 5. Explain the finding to the customer in plain words and hand pricing and payment to the office. Techs never collect payment.
 6. Know when to stop: faults on the utility's side, work past your training, and unsafe conditions.
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Background: What a Service Call Is

A service call is a visit to a house where something electrical is wrong and the customer wants it fixed. Most calls fall into a short list: a dead outlet, a breaker that trips, lights that flicker, a switch or light that does not work, a burning smell, or "half the house is out." Phase 2 has one module for each of these.

On a new-construction job, the wiring is dead and in front of you. On a service call, the wiring is hidden in finished walls, the house is energized, a family lives there, and somebody else built it, often decades ago. Three things follow from that:

- You are working near live parts most of the time, so safety has to be a routine you do the same way every time.
- You cannot see the fault, so you find it by asking questions and taking readings in a set order. Guessing and swapping parts wastes the customer's time and often leaves the real problem in place.
- The customer is standing next to you. How you talk, what you write down, and how you hand off to the office decides whether YES gets called again.

Jesse Kuhlman, a Massachusetts residential contractor whose book we use in this phase, says a house has "very few moving parts" and that the simplest explanation is usually the right one (Kuhlman, *Residential Electrical Troubleshooting*, p. 75). A tripped GFCI hidden behind a freezer is far more common than a failed breaker. The routine in this chapter makes you check the simple things first, in an order that also keeps you safe.

The shape of every call

Every service call follows the same path. The rest of this chapter walks through each box.

1. Prepare before you leave the shop.
2. Arrive and run the intake.
3. Do the five safety checks.
4. Work the five-step method until you find the cause.
5. Fix it, or stop and escalate.
6. Verify the fix.
7. Document on the job board with photos.
8. Explain the finding to the customer.
9. Hand pricing, options, and payment to the office.
10. Leave the house clean and safe.

Picture coming: Service-call flowchart, one page, top to bottom: "Prepare" → "Intake at the door" → "Five safety checks" → "Five-step method" → a diamond "Can I fix it safely today, within my training?" with a YES arrow to "Fix → Verify" and a NO arrow to "Make safe → Escalate." Both arrows rejoin at "Document on job board" → "Explain to customer" → "Hand off to office (price + payment)" → "Leave it clean." A small stop-sign icon sits beside the diamond with the words "Utility side, past training, unsafe = stop."

Part A: Before You Leave the Shop

Step A1. Read the ticket

The office writes up the call before it reaches you. Read the whole thing before you drive.

1. Note the address, the customer's name, and the phone number on the ticket.
2. Note the complaint in the customer's own words, if the office wrote them down.
3. Note the age of the house if it is on the ticket. A house built from about 1965 to 1973 may have aluminum branch wiring (R2.7, R-OLDHOUSE). A house built before about 1950 may have knob-and-tube (R-OLDHOUSE).
4. Note anything the office already asked, such as "customer already reset all breakers."
5. If the complaint is "whole house out," "half the house out," "lights going bright and dim," or "burning smell," tell your journeyman before you leave. These can be emergencies (R2.5 and R2.7).

Step A2. The phone pre-screen

If the office has not already asked, a quick call from the office before you roll can solve some calls with no visit. Kuhlman's office solves many tripped-GFCI calls over the phone (Kuhlman, p. 32). He also asks owners to turn every breaker fully off and back on before he arrives (Kuhlman, p. 99). That pre-screen belongs to the office, but you should know it happened so you do not repeat it as if it were new.

Questions the office may have asked:

- "Have you pressed RESET on every outlet that has TEST and RESET buttons, including the garage, outside, and the bathrooms?"
- "Have you looked at the panel for a breaker that is sitting in the middle, not fully on or off?"
- "Does anything smell hot or look scorched?" If the answer is yes, the office tells the customer to turn that breaker off and keep it off until we arrive.

Step A3. Check your truck and tools

Before every call, check that you have these and that they work. R1.1 has the full truck list.

Item	Why you need it on every call	Check before leaving
Non-contact voltage tester	Fast first check that a wire or device is live	Test it on a known live outlet at the shop
Digital multimeter, CAT III 600 V or better, with good leads	The reading you trust; every diagnosis in Phase 2 rests on it	Leads not cracked, battery good, test on a known live outlet
Clamp meter	Measures current to tell overload from other trips	Battery good
Plug-in receptacle tester (three-light)	Quick wiring check after a repair	Lights up on a known good outlet
Plug-in GFCI tester	Tests the GFCI with a real ground fault, not just its own button	Trips a known GFCI
Circuit tracer or tone generator	Finds which breaker feeds which outlet and follows hidden cable	Batteries good
Torque screwdriver	Terminations to the value on the label	Present and set
Flashlight or headlamp	Panels and boxes are dark	Charged
Safety glasses	Panel work, drilling, cutting	In the truck
Insulated hand tools	Working near live parts	Insulation not nicked
Phone with camera	Photos for the job board	Charged, job board app logs in
Blue painter's tape and a marker	Label devices and breakers as you go	In the truck
Common parts: 15 A and 20 A receptacles (tamper-resistant), GFCI receptacles, single-pole and 3-way switches, wire connectors, cover plates	Most repairs on a dead-outlet or switch call need one of these	Stocked

Safety: test your tester. A non-contact tester or meter with a dead battery reads "no voltage" on a live wire. That is how people get shocked. Every time you start a call, prove your tester on something you know is live. Commercial Module 2.1 calls this live-dead-live: prove the tester on a known live source, test the thing you are about to touch, then prove the tester on the known live source again.

Part B: Arrival and Intake

Step B1. Arrive

1. Park so you do not block the customer's driveway or a neighbor's.
2. Before you knock, look at the outside of the house for 30 seconds. Look at the overhead service drop or the underground riser, the meter, and anything outside that may be on the problem circuit, such as a post light, a landscape light, or an outdoor receptacle. Kuhlman lost a full trip on one call because he never noticed a post light 50 to 60 feet from the front door that was shorting when the soil was wet (Kuhlman, "Ipswich," pp. 100–101).
3. Look for damage: a tree limb on the drop, a meter base pulled off the wall, a weatherhead with cracked conductors. If you see any of these, do not touch it. That is utility work or service work (Part E).
4. Knock, introduce yourself with your first name and "with YES Electric," and confirm the customer's name.

Step B2. Get the story before you touch anything

The Arc Workforce Residential Electrical Field Guide gives five intake questions to ask on every call, and Kuhlman gives almost the same list (Arc Guide, Part 6; Kuhlman, p. 75). Ask all of them, in this order, before you open anything.

#	Ask this	Why you ask it
1	"Where exactly is the problem? Can you show me?"	Customers say "the kitchen" when they mean one outlet. Have them point to it.
2	"When did it start? Did it start all at once or a little at a time?"	All at once points to a trip or a break. A little at a time points to a connection getting worse.
3	"What was running or happening when it stopped? Was there a storm?"	A space heater and a hair dryer on one circuit explains most trips. Rain points to outdoor wiring.
4	"Has anyone worked on anything here lately? An electrician, a handyman, a carpenter, you?"	Kuhlman says the most common human cause is a customer who tried to change a light, outlet, or switch themselves (p. 75). A nail through a cable after new trim is another.
5	"Is anything else in the house acting strange? Other lights flickering, other breakers tripping, smoke alarms going off, bulbs burning out?"	One circuit acting up is a branch problem. Several unrelated circuits acting up points to the service or the neutral (R2.5).

Add these when they apply:

- For an outdoor or garage problem: "Has it rained recently? Does it happen more when it is wet?" (Kuhlman, p. 75).

- For a breaker that trips sometimes: "When it trips, is someone cleaning with a vacuum? Is a window AC or space heater running?" Kuhlman ranks vacuums as the top cause of nuisance AFCI trips and has had the call at least 50 times (p. 37). R2.4 covers this.
- For a call where something "never worked": "Has it worked since you moved in?" A device that never worked points to a wiring mistake, not a failure.

Step B3. Listen, then repeat it back

Write the answers in the job board notes as you go. Then say the story back in one or two sentences: "So the outlets on this wall in the living room went dead Tuesday night while the space heater was running, and nobody has worked on anything. Is that right?" This catches mistakes before you spend an hour chasing the wrong thing.

Step B4. Do not let the customer's theory steer you

Customers often have a theory. Sometimes it is right. Often it is not, and Kuhlman's two worst callbacks came from following the owner's theory instead of his method. In "Billerica" (pp. 98–99), the owner was sure the ceiling fan was tripping the breaker. He swapped the fan for a plain light, and the breaker tripped again three hours later. The real cause was a cable pinched by a metal post under the addition. In "Ipswich" (pp. 100–101), the owner blamed new stereo equipment. The real cause was a buried feed to a post light that shorted when the soil was wet.

Write the customer's theory down, thank them for it, and then run the method anyway. Kuhlman's advice is to be careful with what the homeowner tells you: if their story does not make sense, it is probably wrong (p. 75).

Part C: The Five Safety Checks

The Arc Guide's Quick Reference lists five things to confirm before any diagnosis: breaker, GFCI, loose neutral, overload, and voltmeter. We do all five, every call, in this order. They are fast, they solve a large share of calls on their own, and two of them (loose neutral and the meter) keep you from getting hurt.

Check	What you are looking for	How long it takes	What it rules out
1. Breaker	A tripped breaker, or a breaker that is on but not passing voltage	2-5 minutes	The most common single cause of "dead"
2. Upstream GFCI	A tripped GFCI receptacle or GFCI breaker feeding the dead spot	5-15 minutes	The most common cause of dead outlets in garages, baths, kitchens, basements, and outside
3. Loose neutral	Lights going bright and dim, voltage readings that do not add up	2 minutes of looking and two readings	The most dangerous residential fault (R2.5)
4. Overload	Too much running on one circuit	2-5 minutes with a clamp meter	The most common cause of a standard breaker tripping
5. Meter	Actual voltage at the point of the complaint	2 minutes	Trusting what the customer or a cheap tester told you

Check 1: The breaker

1. Open the panel door. Do not take the inner cover (the dead front) off yet.
2. Before you touch the panel, look at it. Is the area in front of it clear? Is there water on the floor or rust on the panel? Is there a burning smell? Is anything scorched? If yes to water, rust you can't explain, burning, or scorching, stop and go to Part E.
3. Read the directory. Find the breaker labeled for the dead area. Do not trust it fully. Kuhlman notes that breakers are often labeled wrong (p. 100).
4. Look for a breaker whose handle sits between ON and OFF, or shows an orange or red trip flag. That is a tripped breaker.
5. To reset a tripped breaker, push the handle firmly all the way to OFF until you feel it click, then push it to ON. A breaker will not reset unless you go fully to OFF first.
6. If it trips again right away, stop resetting it. Each reset into a short puts stress on the breaker and the wiring. Go to R2.4.
7. If it holds, ask again what was running. If the dead area now works and the customer has an overload story, do Check 4.

Safety: Federal Pacific Stab-Lok. If the panel says Federal Pacific or the breakers say Stab-Lok, treat every breaker as possibly live even when it looks off. The Arc Guide warns that a tripped Stab-Lok breaker may sit in a position that looks off while the circuit stays energized (Arc Guide, Part 8). Confirm dead with your meter every time. R-OLDHOUSE covers these panels.

Breaker that looks on but is not passing voltage. A breaker can look ON and still be failed inside or not seated on the bus. You cannot see this. You find it with a meter at the breaker's output terminal, which means taking off the dead front. Only do that after Part C Check 5 and with your journeyman's OK on your first several calls. R2.2 and R2.4 show the reading.

Check 2: The upstream GFCI

One GFCI receptacle can feed and protect many outlets after it. When it trips, every outlet downstream goes dead, and the dead outlets look normal: no buttons, no light. The GFCI that tripped is often in another room.

1. Ask the customer where every GFCI in the house is. Most will not know.
2. Check every GFCI receptacle in these places, in this order: the bathrooms (all of them), the kitchen counters, the garage (look behind the freezer, the shelving, and the workbench), outside (front, back, and by the AC unit), the unfinished basement or crawl space, the laundry area, and near any wet bar.
3. Press RESET firmly on each one. Then plug a lamp or your receptacle tester into the dead outlet and see if it came back.
4. Look in the panel for GFCI breakers (they have a TEST button and often a white coiled wire). A tripped GFCI breaker resets like any breaker: fully OFF, then ON.
5. If a GFCI will not reset, that means one of two things: it has no power coming in, or it has failed. Modern GFCIs will not reset without power (Kuhlman, p. 79). R2.3 shows how to tell which.

Meter shortcut: the neutral-to-ground continuity test. Kuhlman uses this on every dead-outlet call (pp. 30, 79). A GFCI that trips opens both the hot and the neutral. A standard breaker that trips opens only the hot. So with the circuit dead:

1. Confirm the dead outlet has no voltage. Set your meter to AC volts and read hot-to-neutral (short slot to tall slot) and hot-to-ground (short slot to round hole). Both should read 0 V.
2. Set the meter to continuity (the beeper) or ohms.
3. Put one probe in the tall slot (neutral) and one in the round hole (ground).
4. Beep (near 0 ohms): the neutral is still connected back to the panel. The circuit is dead because the hot is open. Think tripped standard breaker or a broken hot connection.
5. No beep (open, "OL"): the neutral is open too. Think tripped GFCI somewhere upstream, or a broken neutral.

This works because the neutral and ground are tied together at the main panel (Kuhlman, p. 43). Only test continuity on a circuit you have proven dead with the voltage setting first. An ohmmeter on a live circuit can damage the meter and gives readings that mean nothing.

Check 3: Loose neutral

You are not diagnosing a lost neutral here. You are checking that the house is not in a dangerous state before you start working inside it.

1. Ask: "Are lights in different rooms getting brighter and dimmer? Has anything with a plug burned out, smoked, or died in the last few days? Do the smoke alarms go off for no reason?" Kuhlman's "Somerville" call started with smoke detectors going off and bulbs burning out (p. 101). Those are voltage symptoms.

2. Look at lights in two or three rooms while something big turns on, such as the dryer, the microwave, or the AC. Some lights going bright while others dim is a warning sign.
3. At any working receptacle, read hot-to-neutral with your meter. Normal is about 114 to 126 V (Arc Guide, Part 3). A reading well above 126 V, such as 135 V or 150 V, means stop.
4. If you have a second working receptacle on a circuit on the other leg of the panel (R2.2 explains how to find one), read it too. Normal readings on both legs are close to each other. One leg high and one leg low, adding up to about 240 V, is the lost-neutral pattern.

Safety: a lost neutral is an emergency. If you see one leg high and the other low, or voltage above about 130 V at a receptacle, stop the call. Tell the customer to unplug electronics. Tell your journeyman right away. A lost service neutral can put 150 V or more on half the house, burn up electronics and smoke alarms, and put voltage on metal parts that should be at ground (Arc Guide, Part 10; Kuhlman, pp. 86–92). R2.5 covers the full procedure, including when the main breaker should be shut off and when to call Alabama Power.

Check 4: Overload

A standard breaker trips on overload when the current through it stays above its rating long enough to heat its trip element. Most breakers that trip after running for a while are overloaded (Kuhlman, p. 82).

1. Ask what was plugged in and running on the circuit when it tripped.
2. Add up the nameplate watts. Common household loads:

Appliance	Typical watts	Amps at 120 V
Space heater on high	1,500	12.5
Hair dryer on high	1,500–1,875	12.5–15.6
Toaster oven	1,200–1,500	10–12.5
Microwave (countertop)	1,000–1,500 input	8–12.5
Window AC, small	500–1,000	4–8
Vacuum	600–1,400	5–12

Amps = watts ÷ 120. Check the nameplate on the actual appliance, because these vary.

1. Compare to the breaker. A 15 A breaker on 14 AWG copper and a 20 A breaker on 12 AWG copper are the usual branch circuits (NEC 240.4(D) limits 14 AWG copper to 15 A and 12 AWG copper to 20 A protection). A space heater (12.5 A) plus a hair dryer (12.5 A or more) is 25 A, which trips either one.
2. If the customer cannot say what was running, recreate it. Turn on what normally runs on that circuit, then clamp the circuit's hot wire at the panel with your clamp meter (R2.2) and compare the reading to the breaker size.

Safety: never upsize the breaker. The breaker protects the wire. A 20 A breaker on 14 AWG wire lets the wire carry more current than it is rated for, and the wire overheats inside the wall before the breaker trips. If the circuit is overloaded, the fix is to move loads or add a circuit, which is a scope for the office (R3.1). This rule has no exceptions on a service call.

Check 5: Meter at the point of the complaint

1. Go to the outlet, switch, or fixture the customer pointed at.
2. Prove your meter on a known live outlet (live).
3. Read the problem spot (dead or not).
4. Prove the meter again on the known live outlet (live).
5. Write down every reading. You need them for the method in Part D and for the job board.

At a receptacle, take three readings: hot-to-neutral, hot-to-ground, neutral-to-ground. R2.2 shows what every combination means. The short version:

Hot-Neutral	Hot-Ground	Neutral-Ground	Most likely meaning
About 120 V	About 120 V	0-2 V	Normal. Power is there. If the device still doesn't work, the device or the load is the problem.
0 V	0 V	0 V	No power arriving. Hot is open upstream (tripped breaker, tripped GFCI, broken connection).
0 V	About 120 V	0 V or floating	Neutral is open between here and the panel.
About 120 V	0 V	About 120 V	Ground is open or missing.

Never trust a customer, a directory, or a cheap tester over your meter. The Arc Guide puts it the same way: test with a meter, always (Quick Reference, item 5).

Part D: The Five-Step Method in a House

Commercial Module 2.1 teaches a five-step troubleshooting method. It works the same in a house. Say out loud which step you are on, at least for your first year. It keeps you from jumping ahead.

Step	Name	What you do in a house
1	Recognize	Get the real symptom, in the customer's words, and confirm it yourself. "Dead outlet" might be a dead device, a dead circuit, or half the house.
2	Elaborate	Intake questions (Part B) and the five safety checks (Part C). What changed? What else is affected? Is it constant or once in a while?
3	List probable causes	List causes from most likely and easiest to check, to least likely and hardest. A tripped GFCI before a broken cable in the wall.
4	Localize	Test to narrow it down. In a house the main tool is mid-pointing: split the circuit in half, test, and keep splitting (R2.3, R2.4).
5	Repair and verify	Fix the cause, then prove the whole circuit works, not just the one outlet.

Step 1: Recognize

1. Go to the problem spot with the customer and have them show you the symptom.
2. Confirm it yourself with a lamp, your receptacle tester, or the actual appliance.
3. Find out how big it is. Is it one outlet, several outlets in one area, one circuit, one leg of the panel (about half the house), or the whole house? Plug a lamp into the outlets next to the dead one. Flip lights in nearby rooms.

The size of the problem tells you which module to use:

Size of the problem	Go to
One device or a few devices dead	R2.3
Breaker trips	R2.4
Flicker, bright/dim lights, half the house dead, whole house dead	R2.5
Switch or light problem	R2.6
Heat, smell, buzz, scorched device	R2.7
Generator, EV charger, surge device, smoke alarm	R2.8

Step 2: Elaborate

You already did this with Parts B and C. Add the readings you took and anything you saw outside or in the panel.

Step 3: List probable causes

Write a short list in the job board notes, most likely first. Kuhlman's rule is to look for the simplest solutions first: a tripped breaker, a tripped GFCI, mixed-up 3-way travelers (p. 75). Here is a

typical list for "four outlets dead in the living room, nobody worked on anything, nothing tripped that we can see":

1. A GFCI upstream that we missed. Check neutral-to-ground continuity.
2. A breaker that looks on but is not passing voltage.
3. A backstabbed connection that failed at the last working outlet upstream. Kuhlman finds this so often that if the first outlet he pulls is backstabbed, he expects that to be the problem (p. 82).
4. A loose wire connector in a junction box or switch box.
5. A damaged cable in the wall, which is rare without someone having drilled or nailed.

Step 4: Localize

Test the most likely cause first. If it is not the cause, cross it off and test the next one. When the cause is somewhere along a circuit and you do not know where, mid-point it.

Mid-pointing means you pick a box near the middle of the circuit, open it, and test or separate the connections. The result tells you whether the problem is upstream (toward the panel) or downstream (away from the panel). Then you pick the middle of the half that has the problem and repeat. Kuhlman calls this the most effective way to find a problem without "shooting in the dark" (p. 76). A circuit with 16 boxes takes at most four or five splits to corner the bad box. R2.3 teaches mid-pointing for dead circuits and R2.4 teaches it for tripping breakers.

Safety at every box you open. Before you take a device out of a box: turn off the breaker if you can identify it, prove your meter, read the device dead, and prove the meter again. If you are mid-pointing a dead circuit and need it energized to take readings, you will be reading voltage inside a live box. That is allowed only after your journeyman has watched you do it correctly, with insulated tools, safety glasses, and one hand on the meter. R2.3 covers this.

Step 5: Repair and verify

1. Fix the cause. Common repairs on a service call: replace a failed device, move backstabbed wires to the screw terminals, remake a loose splice, replace a failed breaker of the same brand, type, and rating.
2. Torque terminal screws to the value on the device or breaker label (NEC 110.14(D)). R2.7 explains why torque matters.
3. Turn the circuit back on.
4. Test every outlet and light on the circuit, not just the one the customer showed you. Use your receptacle tester at each receptacle. Use the GFCI tester at every GFCI and every GFCI-protected outlet.
5. Run the load that caused the complaint, if it is safe. If the space heater tripped the breaker, run the space heater on the new circuit or confirm it is now on a different one.
6. Ask the customer to try it too. A fix the customer sees work is a fix they believe.

If the customer says it still does not work after you leave, do not argue. Re-run the whole symptom tree from the start (Arc Guide, Part 6).

Part E: When to Stop

You will be tempted to keep going because the customer is watching and you want to fix it. Stopping is part of the job. Stop in these cases, every time.

E1. The fault is on the utility's side

The service point is where the utility's wires end and the customer's wiring begins (NEC Article 100 defines "service point"). In most houses that is at the connection to the overhead drop near the weatherhead, or at the utility's equipment for an underground service. The utility owns and works on everything on its side. Kuhlman notes that faults can be in the panel, the meter, the overhead connections, the underground tap box, or on the pole itself (p. 86).

Stop and escalate when:

- Your readings at the panel show a dead leg, a high leg and a low leg, or voltage that is low on both legs (R2.5).
- The drop is damaged, sagging into a tree, or pulled off the house.
- The meter base is damaged, burned, or pulled loose.
- The neighbors are out too.

You do not pull the meter. You do not work on the drop. You do not open the meter base. The conductors from the utility into the meter and down to the main breaker stay live even with the main breaker off (Arc Guide, Job 4). Your journeyman or the office calls Alabama Power, or tells the customer to call. R2.5 has the script for that call.

E2. The work is past your training

Stop if the job needs something you have not been signed off on. Examples: replacing a main breaker, changing a panel, any work in the meter base, any work on a generator transfer switch, aluminum branch wiring repairs (R2.7), or anything that needs a permit. Kuhlman, the Arc Guide, and YES all say the same thing: service-entrance and utility work is for a journeyman with the right training and a plan (Arc Guide, Part 6).

E3. The conditions are unsafe

Stop and make it safe if you see any of these:

- Burn marks, melted plastic, or charring in a panel or box. The Arc Guide says any burn marks in a panel mean stop work and tell the homeowner (Symptom 6, Step 4).
- Water in or on the panel, or rust running down the inside of it. Kuhlman's photo pages show panels ruined by years of water coming in from the meter (p. 107).

- A panel you cannot safely reach. NEC 110.26 requires working space in front of the panel: at least 30 inches wide or the width of the equipment, whichever is wider, 3 feet deep for 120/240 V residential equipment (Table 110.26(A)(1), 0-150 V to ground, Condition 1), and clear from the floor to 6½ feet or the height of the equipment. The space cannot be used for storage (110.26(B)). Kuhlman's photo pages show panels behind posts, under a water pipe, behind a vent pipe, and plastered into a wall (pp. 115-119). If shelves, a freezer, or boxes are in the way, ask the customer to move them, or help if it is safe. If a built-in cabinet, a wall, or a pipe blocks it, do not climb around it to work live. Document it and escalate.
- A panel in a clothes closet, a bathroom, or over a stairway. NEC 240.24 does not allow breakers in those places in new work. Older houses may have them. Note it on the job board (R2.9).
- A lost neutral pattern (Part C, Check 3).
- A breaker that is too large for its wire (a 30 A breaker on 12 AWG, for example). Turn it off and escalate.
- Anything that makes you uneasy, such as a smell you can't place or a panel that is hot to the touch. Stopping to ask your journeyman is always correct.

E4. How to make it safe before you leave it

When you stop, leave the house safer than you found it:

1. Turn off and leave off the breaker for anything that is burning, shorted, or dangerous. Put tape on the breaker handle and write "OFF – YES – do not reset" with the date.
2. Cover any open box with a blank cover. Cap any loose wires with wire connectors.
3. Tell the customer, in plain words, what is off and why. Tell them not to turn it back on.
4. Call or message your journeyman before you leave the driveway.
5. Write it all on the job board (Part F).

Part F: Document the Call

Write the job board card before you explain the finding to the customer, while the details are fresh. The job board is the record YES uses to price follow-up work, answer a customer complaint, and train the next tech.

Step F1. Take the photos

Take at least two photos per finding. Take more on anything unsafe. Use this list:

Photo	What it shows
Wide shot of the panel, door open, dead front on	Brand, size, condition, directory
Panel label close-up	Brand, model, amp rating, allowed breaker types
The problem device or spot, before you touch it	The condition as you found it
The inside of the box or the bad connection	The cause: a burned backstab, a loose connector, a nail through a cable
The repair, before you close the box	Proof the work was done right
Meter showing the key reading	The voltage or current that proved the diagnosis
Any other unsafe condition you saw	For the "something else" conversation

Hold the phone steady and get close enough that someone at the office can read a label. Turn on the flash inside boxes and panels.

Step F2. Write the finding

Use plain words and this order. Keep it short. The office will read it on a phone.

1. **Complaint:** what the customer said, in their words.
2. **Found:** what you found, with the readings that prove it.
3. **Cause:** the one thing that caused the complaint.
4. **Done:** what you fixed today and the parts you used.
5. **Verified:** how you tested it.
6. **Other findings:** anything else unsafe or not to code that you saw, each with its photo.
7. **Recommend:** what should be done next, if anything, for the office to price. No prices.
8. **Customer declined or deferred:** anything you recommended that the customer said no to or "later" on.

Picture coming: A filled-in YES job board card on a phone screen. Title: "123 Example St – Dead outlets, living room." Fields shown filled: Complaint: "Four outlets on the front wall dead since Tuesday." Found: "No voltage at 4 receptacles. N-G continuity present. Breaker 7 on and passing 121 V. Last working receptacle upstream had backstabbed hot, burned and open." Cause: "Failed backstab connection." Done: "Replaced receptacle, wires on screw terminals, torqued to label." Verified: "All 6 receptacles on circuit 7 tested with 3-light tester. 1,500 W heater run 10 min, no heat at device." Other findings: "Panel has 2 double-tapped breakers (photo)." Recommend: "Correct double taps." Two photo thumbnails at the bottom: the burned backstab and the new receptacle with wires on screws.

Step F3. What never goes on the card or in a message

- Prices. The office prices.

- License or certification numbers of any kind. YES never puts them in any text, email, form, or note that could reach a customer. If a document needs to say who did the work, it says "licensed electrical contractor."
- Guesses written as facts. If you are not sure, write "suspect" and the reading that made you suspect it.

Part G: Explain and Hand Off

Step G1. Explain the finding

Take the customer to the spot and show them. People believe what they see. Then tell them in three parts: what was wrong, what you did, and how you know it is fixed.

Example: "This outlet here was the last one that worked. The wire going on to the next outlets was pushed into a hole in the back instead of under a screw, and that connection burned and came apart. That's why the four outlets after it went dead. I put in a new outlet and put the wires under the screws, which hold a lot better. I tested every outlet on this circuit and ran your heater for ten minutes, and everything's working."

Words to use and avoid:

Say	Instead of
"safety concern" or "code requirement"	"violation" (Arc Guide, Part 6)
"the connection came loose and overheated"	"your wiring is junk"
"I'd like the office to look at this and get back to you"	"that'll cost you a lot"
"I don't know yet, here's what I'm going to test next"	a guess said as if it were certain

Step G2. "I found something else that is unsafe"

You will often find a problem the customer did not call about: a double-tapped breaker, a missing GFCI in a bathroom, scorched wire in a box, a two-prong outlet with a three-prong cover. The Arc Guide's script is to walk them over, show them, call it a safety concern, and give them a choice (Part 6). At YES, the tech does not quote a price. Use this:

"While I was working on your outlets, I found something in your panel I want to show you." (Walk them over and point.) "These two wires are under one screw on this breaker. That screw is made to hold one wire, so over time it can loosen and get hot. It's a safety concern, not an emergency today. I'm going to write it up with a photo, and the office will get you a price to fix it. You can decide then."

If the problem is dangerous now (burning, a breaker too big for the wire, a lost neutral), say so directly, make it safe (Part E4), and tell your journeyman before you leave.

Document every "something else" on the job board whether or not the customer cares about it. If they decline, write that they declined.

Step G3. "That is past what I can do today"

Use this when you hit Part E:

"What I found is on the service side," or "That's panel work that needs a permit," or "That's past what I'm trained to do on my own. I don't want to guess on something like this. I'm writing up exactly what I found with photos, and my journeyman or the office will call you today about the next step."

Then do it: tell your journeyman before you leave, and make sure the job board says who is calling the customer.

Step G4. Hand off pricing and payment

Techs never collect payment. You do not take cash, checks, cards, or app payments. You do not quote prices, including "ballpark" prices. Pricing goes to the office. Payment goes through the office, which sends the customer an invoice or a payment link.

If the customer asks "how much?" or tries to pay you, say: "The office handles all the pricing and billing so it's done the same way for everybody. They'll send it to you today. If you want to talk about the price, they're the right people to call."

If a customer asks why a bill is high, do not defend a number you did not set. Explain what you did and how long it took, and send them to the office.

Step G5. Messages to the customer

Anything written to a customer from YES is drafted first and sent the way the office approves it. Do not send your own texts to the customer from your personal phone about prices, findings, or schedules. If the customer asks for a photo, note it on the job board and the office sends it.

Part H: Leave the House

1. Put every cover plate and the panel dead front back on, with all screws.
2. Close the panel door.
3. Update the panel directory for any circuit you identified. Kuhlman and the Arc Guide both point out that an unlabeled panel slows down the next person (Arc Guide, Job 10).
4. Pick up every wire scrap, screw, and piece of packaging. Wipe up drywall dust.
5. Put back anything you moved.
6. Show the customer which breaker or GFCI to check if it happens again.
7. Walk through once more with the customer to confirm everything they reported now works.
8. Finish the job board card before you drive away.

Worked Examples

Each example follows the parts of this chapter in order. Later modules work the diagnosis in depth.

Example 1: Dead outlets in the garage

Ticket: "Garage outlets don't work. Garage door opener also dead."

Intake. The customer says it happened Saturday. Nobody has worked on anything. It rained hard Friday night. Nothing else in the house is acting strange. The customer already flipped every breaker off and on.

Five checks.

1. Breaker: none tripped. The directory says "Garage" on breaker 14, which is on.
2. GFCI: the customer knows of no GFCIs in the garage. You find one in the half bath, which works, and one outside by the back door, which works.
3. Loose neutral: no flickering reported. The kitchen receptacle reads 121 V.
4. Overload: nothing big was running. Not likely.
5. Meter at a dead garage receptacle: hot-to-neutral 0 V, hot-to-ground 0 V, neutral-to-ground 0 V. Dead.

Method. Step 3, probable causes: a hidden GFCI, a GFCI breaker, a broken hot. You prove the receptacle dead, then test neutral-to-ground continuity: no beep, open. That points to a tripped GFCI upstream (Kuhlman, p. 79). Step 4, localize: you look behind the shelving and the second freezer along the garage wall and find a GFCI receptacle with its RESET button out. The outdoor receptacle on the side of the garage, which is fed from this GFCI, has a cracked cover and water in the box.

Fix and verify. The GFCI resets but trips again within two minutes. You turn off breaker 14, open the outdoor box, find standing water, and disconnect the outdoor receptacle from the GFCI's LOAD terminals. The GFCI holds. Every other garage receptacle and the opener work. The outdoor receptacle needs a new weather-resistant receptacle and an in-use (bubble) cover.

Document and hand off. Photos: the GFCI behind the shelf, the water in the outdoor box, the cracked cover. Recommend: "Replace outdoor receptacle with WR GFCI-protected receptacle and in-use cover." Tell the customer where the GFCI is and that the outdoor receptacle is disconnected until it is repaired. The office prices the repair.

This matches Kuhlman's "North Andover" call, where the owner insisted there was no GFCI and it turned out to be behind boxes in the garage (pp. 99–100), and his "Lynnfield" call, where an outdoor circuit had a short underground (p. 99).

Example 2: A breaker that trips "for no reason"

Ticket: "Bedroom breaker keeps tripping."

Intake. It trips two or three times a week, usually in the evening. It has been happening for a month. Nothing new was installed. When asked about vacuums and heaters, the customer says a space heater runs in that bedroom at night.

Five checks. Breaker 9 is on now. It is an AFCI breaker. No GFCI involved. No flickering, receptacle reads 122 V. Overload: you ask the customer to turn on what normally runs at night. The space heater (1,500 W), a TV, two lamps, and a phone charger are running. You take the dead front off with your journeyman watching and clamp the hot on breaker 9: 15.4 A on a 15 A breaker.

Method. The current is over the breaker's rating with the normal evening load. This is an overload, and the breaker is doing its job. No mid-pointing needed.

Fix and verify. Nothing to repair. You do not change the breaker size. You explain the reading to the customer and suggest they move the space heater to a receptacle on another circuit. You find one in the hall on breaker 11, which clamps at 2 A with its normal load. The heater runs there with no trip.

Document and hand off. Readings on the card. Recommend: "Customer may want a dedicated circuit for the space heater. Office to price if requested." Customer told the heater should not share the bedroom circuit.

If the clamp had shown 4 A and the breaker still tripped, this would have been an AFCI problem and you would move to R2.4.

Example 3: Lights going bright and dim

Ticket: "Lights flickering all over the house."

Intake. It started three days ago. The kitchen lights get brighter when the dryer runs. A cheap power strip in the office smelled hot yesterday. Two smoke alarms went off with no smoke.

Five checks. You stop at Check 3. At a living room receptacle, hot-to-neutral reads 138 V. At a kitchen receptacle on the other leg, it reads 101 V. They add up to 239 V. This is the lost-neutral pattern.

Stop. You do not open the panel to look for the cause yourself. You tell the customer: "Your house has a problem with the main return wire that comes in with your power. It's making some of your outlets run high and others run low, and that can damage electronics. Please unplug your TVs, computers, and anything expensive right now." You call your journeyman from the driveway. The journeyman decides whether to shut off the main breaker and who calls Alabama Power.

Document. Readings, the time, photos of the meter and the drop, the burned power strip if the customer has it. R2.5 continues this call.

This is the "Somerville" and "North Andover flickering" pattern in Kuhlman (pp. 101–103), where the fault turned out to be in the utility's underground wiring.

Common Mistakes

1. **Touching before asking.** A tech who opens a box before running the intake misses the clue that the customer was about to give. Ask all five questions first.
 2. **Following the customer's theory.** Kuhlman's "Billerica" and "Ipswich" calls each cost a return trip because he let the owner's theory steer him (pp. 98–101).
 3. **Missing the hidden GFCI.** Check every bathroom, the garage behind everything, outside, and the basement before you open a wall box.
 4. **Resetting a breaker over and over.** If it trips right away, there is a fault. Resetting into it again does not fix anything.
 5. **Upsizing a breaker to stop trips.** This makes the wire the weak point. Never do it.
 6. **Trusting the directory.** Breaker labels are often wrong. Confirm with a meter or a tracer.
 7. **Skipping live-dead-live.** A meter that dies between readings reads 0 V on a live wire.
 8. **Fixing one outlet and leaving.** Test the whole circuit and every GFCI-protected outlet before you leave.
 9. **Quoting a price or taking payment.** Techs never do either. Send it to the office.
 10. **Calling it a "violation."** Say "safety concern" or "code requirement," and show the customer.
 11. **Leaving something unsafe without telling anyone.** If you turned a breaker off for safety, tag it, tell the customer, and tell your journeyman before you drive away.
 12. **Thin documentation.** A card that says "fixed outlet" helps no one. Write the complaint, the reading, the cause, the fix, and how you verified it.
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Field Exercise: Three Role-Played Calls

Setup. Your journeyman plays the customer. Use the training wall or a cooperative house. The journeyman sets up each fault in advance and gives the customer story on a card you do not see.

Call 1: Dead outlet. The journeyman trips a GFCI on the training wall and hides it behind a panel or box. Customer story: "The outlet by my couch stopped working. I don't know of any GFCI."

Call 2: Breaker trips. The journeyman sets up a 15 A circuit with a 1,500 W heater and a 1,200 W toaster oven on it. Customer story: "This breaker trips every morning around breakfast."

Call 3: Flickering lights. The journeyman uses the training panel's switchable neutral to create a high leg and a low leg (with the training panel's own protection in place). Customer story: "Lights are going bright and dim all over the house."

For each call, do all of this out loud:

1. Look at the outside or the setup for 30 seconds and say what you see.
2. Ask all five intake questions and repeat the story back.
3. Do the five safety checks in order. Say each reading out loud as you take it.
4. Say which step of the five-step method you are on as you move through it: "Step 1, recognize. Step 2, elaborate.."
5. For Calls 1 and 2, find and fix (or correctly explain) the cause. For Call 3, stop at Check 3 and say what you would do and who you would call.
6. Write the job board card with the eight parts from Part F2 and at least two photos.
7. Explain the finding to the "customer" in plain words.

Practice the two hardest sentences. During one of the calls, the journeyman points out a second problem, such as a double-tapped breaker. Deliver the "I found something else that is unsafe" script from Part G2. During Call 3, deliver the "That is past what I can do today, here is who will call you" script from Part G3. The journeyman grades both on whether you showed the customer, used plain words, avoided a price, and said who would follow up.

Pass standard. You pass when the journeyman signs off that you did the intake before touching anything, did all five checks in order on all three calls, used live-dead-live every time, stopped correctly on Call 3, never quoted a price, and wrote three job board cards the office could act on without calling you.

NEC 2026 Cross-References

Section	What it says	Why it matters on a service call
Article 100, "Service Point"	The point where the utility's conductors connect to the premises wiring	Tells you where the utility's responsibility ends and ours begins
Article 100, "Qualified Person"	A person with skills and knowledge of the equipment and safety training to recognize and avoid the hazards	Working on live parts is for qualified persons. A helper is not one yet.
110.26	Working space about electrical equipment: width of the equipment or 30 in., whichever is greater; depth per Table 110.26(A)(1), which is 3 ft for 0–150 V to ground under Condition 1; height 6½ ft (2.0 m) or the height of the equipment; not used for storage (110.26(B)). Exception No. 2 to 110.26(A)(3) allows less height for existing dwelling service equipment or panelboards 200 A or less.	You can refuse to work on a panel that is blocked, and you note it on the job board
110.14(D)	Terminal torque to the value on the equipment or its instructions	Every repair you make
240.4(D)	Small conductor protection: 14 AWG copper at 15 A, 12 AWG copper at 20 A, 10 AWG copper at 30 A	Why you never upsize a breaker
240.24	Breakers must be readily accessible, not in clothes closets or near easily ignitable material (240.24(D)), not in bathrooms, not over stairway steps	Common finding in older houses

The safety routine in this chapter (verify dead with a tested meter, keep your distance from live parts, use the right PPE, stop when it is beyond you) is NFPA 70E thinking applied to a house. Commercial Module 2.1 covers NFPA 70E, lockout/tagout, and arc-flash PPE in depth.

End-of-Chapter Checklist

Use this on every call until it is automatic.

Before you drive - [] Read the whole ticket, including the house age and what the office already asked. - [] Told the journeyman if the ticket says whole house, half house, bright/dim lights, or burning smell. - [] Tested the non-contact tester and meter on a known live outlet. - [] Truck has the common parts.

At the door - [] Looked at the outside for 30 seconds: drop, meter, outdoor loads, damage. - [] Asked all five intake questions and repeated the story back. - [] Wrote down the customer's theory without letting it steer the diagnosis.

Five safety checks - [] Breaker: checked, reset fully off then on, stopped if it tripped right away. - [] GFCI: checked every bathroom, kitchen, garage, outdoor, basement, and laundry GFCI and the panel. - [] Loose neutral: asked about bright/dim lights and dead electronics; read voltage; stopped if one leg was high and one low. - [] Overload: totaled the running load or clamped it. - [] Meter: took readings at the problem spot using live-dead-live and wrote them down.

Method - [] Recognized and sized the problem (one device, one circuit, one leg, whole house). - [] Listed probable causes, most likely first. - [] Localized with tests or mid-pointing. - [] Repaired, torqued to the label, and verified every device on the circuit.

Stop conditions - [] Stopped for utility-side faults, work past training, burning, water, a blocked panel, or a lost neutral. - [] Made it safe: breaker off and tagged, boxes covered, customer told, journeyman called.

Document and hand off - [] Photos: panel, label, problem before, cause, repair, key reading, other findings. - [] Job board card with complaint, found, cause, done, verified, other findings, recommend, declined. - [] No prices, no license numbers, no guesses written as facts. - [] Explained to the customer at the spot in plain words. - [] Delivered the "something else" or "past what I can do" script when needed. - [] Sent pricing and payment questions to the office. Did not take payment.

Leave - [] Covers and dead front back on, panel door closed. - [] Directory updated for any circuit identified. - [] Work area clean. - [] Customer shown where to reset if it happens again.

Sources

- Jesse Kuhlman, Residential Electrical Troubleshooting (2019). Pages cited: 9 (how the guide works), 30 (GFCI neutral-to-ground clue), 32 (GFCI calls solved by phone), 37 (vacuums and AFCIs), 43 (neutrals and grounds joined at the main panel), 75–78 (troubleshooting steps and first questions), 79 (neutral-to-ground continuity test), 82 (backstab failures; standard breaker trips), 86–92 (neutral connection issue), 98–103 (troubleshooting stories), 107 and 115–119 (photos of water damage and blocked panels). All paraphrased.
 - Arc Workforce, Residential Electrical Field Guide. Quick Reference; Symptom 6; Part 3 (voltage targets); Part 6 (customer scripts); Part 8 (Federal Pacific); Part 10 (lost neutral); Jobs 4 and 10. Its code citations are NEC 2020; this chapter uses NEC 2026 numbers instead.
 - YES Electric commercial course, Module 2.1 (five-step method, live-dead-live, LOTO).
 - NFPA 70, National Electrical Code, 2026 edition, sections listed above.
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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 B, Step B2 Get the story before you touch anything; Part E1 The fault is on the utility's side	Half The House No Power or Lights Dim? (220v Appliances Don't Work!) electronicsNmore • 11:21 On a real no-AC call the tech reads 200 V instead of 240 V, finds one leg at 88 V at the panel lugs, and only then hears from the customer that a tree fell on the service drop, so the fault belongs to the utility. Caution: The tech is a homeowner-electronics channel, not a licensed electrician, and he probes the energized panel lugs with a cheap meter; at YES that reading is a journeyman task with PPE. He also calls FPE panels fine because they lasted 60 years; R-OLDHOUSE says otherwise.
Part D The Five-Step Method (Recognize through Localize), on a real call	Troubleshooting a lighting and receptacle circuit Electrician Ron • 7:31 A licensed electrician on a real dead-receptacle call starts at the panel, confirms every breaker has output, uses a plug-in tester that reads open neutral, opens the first box, and finds a broken neutral at the terminal. Caution: He appears to re-land the neutral with the circuit still on (he reads 118 V hot-to-ground just before). YES turns the breaker off and proves dead before touching the terminal. He also notes a wire wrapped counterclockwise and leaves it; YES rewaps it clockwise.
Part D, Step 5 Repair and verify; callbacks on intermittent problems	Service Calls With Electrician U!!! Electrician U • 17:58 Dustin Stelzer tells how an intermittent whole-house outage was handled in two visits: tighten every termination, wait two weeks, get the callback, then replace the old Zinsco main breaker with a new replacement breaker and follow up again. Caution: Heavy profanity. The second and third stories (school HVAC grounds, light fixtures) are off topic for this module, though the ladder-on-a-rug story at the end is a good safety lesson. He sets his own trip charges and talks pricing with the customer; at YES pricing goes to the office.