

EV Chargers

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 Course • Phase 1: Installation Read first: Commercial module 1.9 (EVSE circuit requirements) and commercial 1.10 (power flow, utility to charger). Masterclass R-LOAD covers the load calculations used here. **Code edition:** This chapter cites NEC 2026. Where a section moved, the NEC 2023 number is in parentheses: EV load 120.57 (220.57), existing loads 120.87 (220.87), existing dwelling 120.83 (220.83). The local inspector (AHJ) may enforce an earlier edition, so ask your journeyman which one applies before the rough inspection.

Learning Objectives

When you finish this module you will be able to:

1. Tell Level 1 from Level 2 charging and read a charger nameplate and manual for its amperage and its breaker table.
 2. Size the branch circuit at 125 percent of the charger's continuous load and pick the breaker, the copper conductor, and the equipment grounding conductor for 16, 24, 32, 40, and 48 A chargers.
 3. Choose between a hardwired charger and a NEMA 14-50 receptacle, and know where GFCI protection is required and why it causes nuisance trips on some chargers.
 4. Run the load calc for adding a charger to an existing house with 120.87 (utility history) or 120.83 (existing dwelling), and use an energy management system (power control system) when the service is too small.
 5. Mount the charger at a legal height, run and land the circuit, set the charger's output to match the breaker, label it, provide a lockable disconnect, and commission it in the app.
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Plain-Language Background

What a "charger" is

The box on the garage wall is not really the charger. The real charger is inside the car. It turns the house's AC power into DC for the battery. The box on the wall is called electric vehicle supply equipment, or EVSE. It is a smart switch with safety electronics. It talks to the car through a signal wire in the cable and tells the car how many amps it may draw. It only turns on the power

after the plug is locked into the car. In this chapter we say "charger" because that is what customers say, but the code says EVSE.

Three things set how fast a car charges:

1. The breaker and wire (the circuit).
2. The setting inside the EVSE, which must match the circuit.
3. The car's onboard charger. Many cars cannot take more than 32 A or 40 A no matter what is on the wall. Ask what car the customer has before you sell a 60 A circuit.

Level 1 and Level 2

Type	Voltage	Typical current	Circuit	Miles of range per hour (rough)
Level 1	120 V	12 A	Existing 15 A or 20 A receptacle, or a new 20 A circuit	3-5
Level 2	240 V	16-48 A (charger setting)	Dedicated 20-60 A two-pole circuit	12-36

The range numbers come from charger makers' charts (the ChargePoint Home Flex guide lists 12 miles per hour at 16 A and 36 miles per hour at 48 A). They vary by car.

A Level 1 cord comes with most cars and plugs into a normal receptacle. YES's work is almost all Level 2.

Why the rules are different from a dryer

A dryer runs for an hour. A car can pull its full current for 8 hours straight, every night, in a hot garage. The NEC treats every EV charger as a continuous load (625.41). A continuous load is one that runs at full current for 3 hours or more. Breakers and wire are tested to carry 80 percent of their rating continuously without overheating. That is where the "125 percent" rule comes . 125 percent is the inverse of 80 percent: a 48 A load $\times 1.25 = 60$ A, and $60 \text{ A} \times 0.80 = 48$ A.

What can go wrong

Loose lugs on a charger circuit run hot for hours and burn. An undersized wire runs warm every night for years. A charger set to 48 A on a 40 A breaker trips the breaker at night, or, worse, a charger set to 48 A on wire sized for 40 A overheats the wire with nothing to stop it if the breaker is also too big. A service that was already near its limit gets pushed over it, and the main breaker trips on the first cold night when the heat strips and the car both run.

The Code Rules You Will Use (NEC 2026 Article 625 and Related)

Rule	What it says (plain language)	Section
Qualified installer	Permanently installed EV power transfer equipment shall be installed by qualified persons.	625.4 (new in 2026)
Field markings	The EVSE must have permanent markings outside the enclosure, visible after install: supply voltage, phases, frequency, full-load current, and the short-circuit current rating.	625.5 (new in 2026)
Individual branch circuit	Any outlet for an EVSE over 16 A or over 120 V gets its own branch circuit.	625.40
Continuous load	All EVSE is a continuous load.	625.41
Rating	The service, feeder, and branch circuit must be big enough for the charger, unless a power control system (625.42(A)) or a restricted adjustable setting (625.42(B)) limits it.	625.42
Adjustable setting	A charger set below its maximum may be rated at the adjusted setting if the setting is restricted to qualified persons and the adjusted current is on a field-installed rating label.	625.42(B)
Disconnect	A permanently connected EVSE needs a readily accessible disconnect that is lockable open (110.25). If the disconnect is remote, put a plaque on the charger saying where it is. A cord and plug may be the disconnect if the rating is 60 A or less or the voltage is 150 V or less to ground.	625.43(C)
Emergency shutoff	Required for other than one- and two-family dwellings. Not required in a house.	625.43(D)
Connection method	Cord-and-plug only through the receptacle types listed in 625.44(A) or (B). 30, 50, and 60 A receptacles must be listed for EVSE use. Everything else is hardwired and fastened in place.	625.44
Height	The plug (coupling means) must be stored at least 18 in above the floor indoors and 24 in above grade outdoors, unless the EVSE is listed otherwise.	625.50
GFCI	All receptacles installed for EV charging need GFCI protection for personnel.	625.54
Branch-circuit conductor	Conductor ampacity at least 125 percent of the continuous load.	210.19(A)(1)
Breaker	Breaker rating at least 125 percent of the continuous load.	210.20(A)
Terminal temperature	On circuits of 100 A or less, size the wire from the 60 °C column unless the equipment is listed and marked for 75 °C.	110.14(C)(1)(a)
NM cable	NM cable ampacity cannot exceed the 60 °C column.	334.80(A)
EGC size	20 A → 12 AWG Cu; up to 60 A → 10 AWG Cu.	Table 250.122

Rule	What it says (plain language)	Section
Torque	Tighten terminals to the value on the equipment with a calibrated torque tool.	110.14(D)
EV load in a load calc	Nameplate rating (7,200 VA only if the nameplate is not available).	120.57 (220.57)

Step-by-Step Procedures

Procedure 1: Survey the Job

1. **Ask the customer three questions.** What car (or cars)? Where do you park, and which side is the charge port on? Do you want the charger hardwired, or do you already have a plug-in charger? - Why: the car's onboard charger limit tells you the largest useful circuit. The port side and parking spot tell you where the charger goes so the cable reaches without stretching across a walkway.
2. **Get the charger's installation manual.** Read its breaker table, wire requirements, terminal torque, mounting height, and whether it allows a GFCI breaker. 110.3(B) makes the listed instructions part of the code, so the manual is enforceable.
3. **Read the panel.** Write down the main breaker size, the panel bus rating, the brand and type, whether two full-size spaces are open on the same side for a two-pole breaker, and whether the label allows tandems (R1.12). Photograph the panel label.
4. **Look at the meter base and service conductors from outside.** Burnt meter jaws, a rusted meter can, or damaged SE cable change the job into a service repair (R-SERVICE). A charger adds hours of heavy load every night to a service that may have been lightly loaded for 40 years.
5. **Measure the route.** Panel to charger location, following the path the cable or conduit will actually take: up the wall, across the attic or along the garage ceiling, and down. Add 2 ft at each end for termination.
6. **Do the load calc.** Use Procedure 2 below with R-LOAD.
7. **Pick the charger setting.** The setting is the smallest of: what the car can take, what the load calc allows, and what the customer wants to pay for.

Procedure 2: Load Calc for Adding a Charger

Use the methods from R-LOAD in this order. Stop as soon as one of them shows the service can take the charger.

1. **Existing loads from real data (120.87).** If the customer can download 12 months of 15-minute maximum demand from the utility, take the highest kW, divide by 240 V, multiply by 1.25, add the charger's nameplate amps, subtract any removed load, and compare to the service rating. See Worked Example 3.

2. **Existing dwelling (120.83).** If there is no demand data, list the existing loads, take the first 8 kVA at 100 percent and the rest at 40 percent, add the new charger at 80 percent, divide by 240 V, and compare. See Worked Example 4.
3. **If both say no:** lower the charger setting, add a power control system (Procedure 7), or sell a service upgrade (R1.5).

Use the charger's nameplate amps (or the adjusted setting under 625.42(B)) at 240 V. A 48 A charger is 11,520 VA. Do not add 125 percent in the load calc. 120.5(E) says load calculations do not require continuous loads at 125 percent. The 125 percent goes on the branch circuit (Procedure 3).

Procedure 3: Size the Branch Circuit

Do these steps for every charger. Write each number on the job sheet.

1. **Find the charger's continuous current.** This is the output current setting. For a charger that can be set, use the setting you will program.
2. **Multiply by 1.25.** This is the minimum breaker rating (210.20(A)) and the minimum conductor ampacity (210.19(A)(1)).
3. **Pick the breaker.** Use the result from Step 2 if it is a standard size in Table 240.6(A). If not, go up to the next standard size, but check the charger manual's breaker table; most chargers list exactly which breaker goes with which setting.
4. **Pick the wire temperature column.** Look at the breaker and the charger terminals. - 110.14(C)(1)(a): on circuits of 100 A or less, use the 60 °C column unless both ends are listed and marked for 75 °C. - Most residential two-pole breakers are marked 60/75 °C. Check the charger manual. The Tesla Gen 3 manual gives different minimum wire sizes for a 60 °C breaker and a 75 °C breaker, which tells you the charger terminal itself is good for 75 °C. - NM cable (Romex) is always limited to the 60 °C column (334.80(A)), no matter what the breaker says.
5. **Pick the conductor from Table 310.16, copper.** The conductor's ampacity in the column from Step 4 must be at least the number from Step 2.
6. **Pick the equipment grounding conductor from Table 250.122.** 20 A breaker: 12 AWG copper. 30 A through 60 A breaker: 10 AWG copper.
7. **Check the charger's terminal range.** The Tesla Gen 3 accepts 12–4 AWG copper only. The ChargePoint Home Flex field-wiring terminal accepts up to 6 AWG. If the 60 °C column forces 4 AWG NM and the terminal only takes 6 AWG, you must use THHN/THWN-2 in conduit at the 75 °C column, or splice to a short pigtail in a listed box, following the manual.
8. **Check voltage drop on long runs.** The NEC informational notes suggest keeping branch-circuit voltage drop to 3 percent. For runs over about 100 ft at 48 A, ask your journeyman to check whether to go up one wire size.

Procedure 4: Hardwired or Receptacle?

Question	Hardwired	NEMA 14-50 (or 6-50) receptacle
Max charger setting	Up to 48 A on a 60 A circuit (higher with some models)	40 A on a 50 A circuit, at most
GFCI	Not required by 625.54 for hardwired equipment. Outdoors, see the 210.8(F) note below.	Required (625.54, 210.8(A)(2) in a garage). The GFCI breaker can nuisance-trip with the charger's own ground-fault circuit.
Receptacle listing	Not applicable	Must be listed for EVSE use at 30, 50, or 60 A (625.44(A), (B))
Disconnect	Breaker with a permanent lock-off provision, or a separate disconnect, readily accessible (625.43(C)). Plaque on the charger if the disconnect is remote.	The cord and plug count as the disconnect (625.43(C))
Customer can take it when they move	No	Yes
YES recommendation	Default for every permanent install	Only when the customer insists on a plug-in charger, and then with an EV-listed receptacle on a GFCI breaker

The GFCI conflict. Every listed charger has its own ground-fault protection inside, called a CCID (charging circuit interrupting device). The Tesla Gen 3 manual lists "Integrated CCID20." A GFCI breaker trips at about 5 mA of imbalance (Kuhlman, "Ground Fault Circuit Interrupter circuit breakers," p. 38). When a CCID runs its own self-test or the car's charger leaks a few milliamps, the GFCI breaker can trip first, and the car stops charging in the middle of the night.

ChargePoint's Home Flex guide says to hardwire instead of using a GFCI breaker when local code requires GFCI for the plug-in version, because the GFCI breaker can cause nuisance tripping. The NEC requires GFCI on every EV receptacle (625.54), so a plug-in install must have the GFCI breaker. The way around the conflict is to hardwire.

Outdoor hardwired chargers. 210.8(F) requires GFCI protection for all outdoor outlets at dwellings on single-phase circuits of 150 V or less to ground and 60 A or less. A hardwired charger on an outside wall is an outlet. Some inspectors read 210.8(F) to require a GFCI breaker on an outdoor hardwired charger. Ask the AHJ before you rough in. If GFCI is required, use a GFCI breaker the charger maker lists as compatible.

Procedure 5: Install a Hardwired Charger (Tesla Gen 3 Wall Connector as the Example)

The steps follow the Tesla Gen 3 Wall Connector installation manual (48 A single phase, North America). Other brands differ in the details. Read the manual for the unit you are installing.

1. **Pull the permit.** The office pulls an electrical permit before work starts. Note the edition the inspector enforces.
2. **Pick the mounting height.** The Tesla manual allows 18 in minimum indoors, 24 in minimum outdoors, and 60 in maximum, and recommends about 45 in. NEC 625.50 requires the connector to be stored at least 18 in above the floor indoors and 24 in above grade outdoors. Mount it where the cable reaches the charge port without crossing a walkway, and where a car door or bumper will not hit it. - Why: the 18 in and 24 in minimums keep the connector out of standing water, snow, and flooding.
3. **Pick the wire entry.** Top, bottom, rear left, or rear right. Rear entry through the wall into a stud cavity hides the circuit. Surface entry needs conduit or a listed cable connector.
4. **Mark and drill.** Find a stud. Hold the paper template level at the chosen height. Drill two pilot holes with a 5/32 in bit through the template.
5. **Prepare the wirebox.** Drill the matching holes in the wirebox with a 1/4 in bit. For 1 in conduit entry, open the knockout with a 1-3/8 in step bit.
6. **Mount the wirebox** to the stud with the two supplied wood screws. Outdoors, use the sealing washers; the manual says the Type 3R rating depends on them.
7. **Turn off the main breaker or confirm the panel is safe to work in.** Adding a breaker means working in a live panel unless the main is off. A helper does not add breakers in a live panel. With the main off, the line side of the main and the service conductors are still live.

SAFETY: The lugs on top of the main breaker and the service conductors coming into the panel stay energized with the main off. Only the utility can de-energize them. Verify dead with a meter on every bus you will touch: L1 to L2, L1 to neutral, L2 to neutral (R1.1). Keep tools and the new cable away from the main lugs.

1. **Run the circuit.** Panel to wirebox, by the route you measured. In the garage, protect cable from damage (R1.3). In conduit, size the conduit for the wire fill. - For a 48 A charger on a 60 A breaker: either 6 AWG THHN/THWN-2 copper in conduit (75 °C column = 65 A, allowed when the breaker and charger are 75 °C rated), or 4 AWG copper NM-B (60 °C column = 70 A). - Ground: 10 AWG copper (Table 250.122 for 60 A). - No neutral is needed for most hardwired chargers. The Tesla manual says to wire line-to-line on a split-phase system.
2. **Route into the wirebox.** Use a listed fitting or bushing. The manual calls for bushings so the conductors are not damaged and recommends compression-style fittings for conduit.

3. **Strip and land.** Strip about 1/2 in. Land L1, L2, and ground in the terminal block. Torque the terminal screws to 50 in-lb with a torque driver and the included 4 mm hex bit (Tesla Gen 3 manual; 110.14(D)). Use copper only.

SAFETY: The single biggest failure on charger circuits is a loose termination. A 48 A load through a loose screw for 8 hours makes enough heat to melt the terminal block. Torque every screw with a torque tool to the printed value. Mark each torqued screw with a paint pen so the inspector and the next tech can see it was done.

1. **Install the breaker.** Two-pole, the size from Procedure 3, the brand and type listed for the panel. Land the conductors and torque to the breaker's label value. If the panel is aluminum-bus Eaton BR and you are installing a Tesla Universal Wall Connector, the Tesla manual warns not to use BR breakers and to use BRH breakers instead.
2. **Provide the disconnect (625.43(C)).** The breaker can be the disconnect if the panel is readily accessible and the breaker has a lock-off provision that stays in place with or without the lock (110.25). Install a breaker lock-off accessory made for that breaker. If the panel is not in sight of the charger, put a plaque on the charger that says where the disconnect is ("Disconnect: breaker 32-34, panel in basement"). The Tesla manual says external disconnect switches are "neither required nor recommended"; the NEC still requires a lockable disconnect, which the lockable breaker satisfies.
3. **Label the panel directory** with the charger circuit (408.4). Apply the charger maker's circuit-rating label in the panel if one is supplied (ChargePoint supplies one).
4. **Close up, energize, and check.** Turn on the breaker. All seven LEDs on the Tesla light for up to 5 seconds, then the green LEDs show the breaker size the unit thinks it has. Meter L1 to L2 at the breaker: 230–250 V is normal.
5. **Commission** (Procedure 6).
6. **Field label (625.42(B), 625.5).** If you set the charger below its maximum, put a durable label on the charger showing the adjusted current (for example, "Output set to 40 A, 50 A circuit"). Confirm the charger's outside label shows supply voltage, phases, frequency, full-load current, and short-circuit current rating (625.5). If any of those are missing, field-apply them.
7. **Photograph** the torque marks, the breaker and lock-off, the labels, the app screen showing the breaker setting, and the finished charger.

Picture coming: Garage layout, plan and elevation: car parked nose-in with the charge port on the driver's front fender; charger on the side wall 45 in to the bottom of the unit (dimension lines showing 18 in minimum and 60 in maximum); the charge cable hanging in a loop that reaches the port without crossing the walkway to the house door; panel on the back wall with a two-pole 60 A breaker and lock-off; a dashed line for the circuit along the garage ceiling labeled "4 AWG Cu NM-B or 6 AWG THHN in conduit, 10 AWG ground"; and an alternate 14-50 receptacle position at 20–26 in above the floor, marked "plug-in option: GFCI breaker, EV-listed receptacle."

Procedure 6: Commission the Charger

Using the Tesla Gen 3 as the example:

1. Install or update the Tesla One app on your phone. Log in with a Tesla Partner Portal account.
2. Scan the QR code on the Quick Start Guide that came in the box. Leave the guide with the customer; it is needed if the unit is ever recommissioned.
3. Select Tesla Device Setup, then Begin. Scan the QR code again.
4. Hold the button on the charge handle for 5 seconds until the LED pulses green, then select Join.
5. Select Installation Settings. Select the country, then **Breaker Size (A)**. Pick the actual breaker you installed. The charger sets its maximum output to 80 percent of that breaker: 60 A → 48 A, 50 A → 40 A, 40 A → 32 A, 30 A → 24 A, 20 A → 16 A, 15 A → 12 A.
6. Connect the charger to the customer's Wi-Fi if they want app control.
7. Plug into the car and start a charge. Watch the current in the car's screen or the app. It should climb to the set current and hold. Clamp one leg at the breaker with a clamp meter to confirm.
8. Leave the circuit charging for at least 15 minutes, then turn it off and feel the breaker and the panel cover near the breaker. Warm is normal; too hot to keep your hand on means a loose connection. Recheck torque.

For a ChargePoint Home Flex, the amperage is set in the ChargePoint app during setup, and the guide tells the installer to tell the homeowner the final amperage and the expected charging rate. Other brands set it with a rotary switch or DIP switch inside the cover. Whatever the method, the setting must match the breaker, and only a qualified person changes it (625.42(B)).

Procedure 7: Energy Management When the Service Is Too Small

An energy management system, which the NEC calls a power control system (PCS), watches the service current with current sensors and turns the charger down when the house is using a lot. It lets a charger go on a service that the load calc says is full.

1. **Confirm the PCS is listed** and that the charger or the add-on meter is the PCS the manufacturer intends. 625.42(A) says a PCS used to manage EVSE must comply with Article 130 Part II, and the system must be marked to show the control.
2. **Install the current sensors** on the service conductors per the manufacturer's manual. Tesla's Gen 3 power management uses an energy meter wired to its own breaker (20 A maximum) with current transformers on the service conductors. This is work in a panel with the service conductors energized. A journeyman does it.
3. **Set the control setting.** A qualified person sets it at no more than 80 percent of the rating of the breaker the PCS is protecting (120.7(B)). On a 100 A main, that is 80 A. The Tesla manual says the same thing in its own words: set the "Max Conductor Limit" to 80 percent of the panel's rated limit.

4. **Do the load calc with the PCS (120.7(C)).** If the PCS watches both the charger and the rest of the house, count the charger at its minimum operating current. If the PCS watches only the controlled loads, count them at the control setting. See Worked Example 5.
5. **Test it.** Turn on large loads (oven, dryer, heat strips) with the car charging, and watch the charger current drop. The Tesla manual also suggests temporarily setting the limit lower than the real limit to watch the charger respond, then setting it back.
6. **Post a directory** if the PCS controls are not within sight of the breakers they monitor (130.70(C)).

Picture coming: Energy management diagram: utility → meter → 100 A main breaker; two current sensors clamped on the service conductors inside the panel with a thin signal line to the charger; house loads (range, dryer, heat pump) on breakers; the charger's output graph drops from 48 A to 8 A as a "house load" bar rises toward an 80 A line labeled "PCS setting = 80% of 100 A."

Worked Examples

Worked Example 1: Breaker and Wire for Every Common Charger Setting

All copper. "60 °C" means the wire is NM-B or the terminations are not both marked 75 °C. "75 °C" means THHN/THWN-2 in conduit with a breaker and charger both rated 75 °C. Ampacities are from Table 310.16, copper columns: 12 AWG 20 A (60 °C), 25 A (75 °C); 10 AWG 30 A, 35 A; 8 AWG 40 A, 50 A; 6 AWG 55 A, 65 A; 4 AWG 70 A, 85 A.

Charger setting	× 1.25	Breaker	Copper at 60 °C (NM-B)	Copper at 75 °C (THHN in conduit)	Ground (Table 250.122)
16 A	20 A	20 A, 2-pole	12 AWG (20 A)	12 AWG (25 A)	12 AWG
24 A	30 A	30 A, 2-pole	10 AWG (30 A)	10 AWG (35 A)	10 AWG
32 A	40 A	40 A, 2-pole	8 AWG (40 A)	8 AWG (50 A)	10 AWG
40 A	50 A	50 A, 2-pole	6 AWG (55 A)	8 AWG (50 A)	10 AWG
48 A	60 A	60 A, 2-pole	4 AWG (70 A)	6 AWG (65 A)	10 AWG

Work each row:

- **16 A:** $16 \times 1.25 = 20$ A. Breaker 20 A. 12 AWG at 60 °C = 20 A, which is at least 20 A.
- **24 A:** $24 \times 1.25 = 30$ A. Breaker 30 A. 10 AWG at 60 °C = 30 A.
- **32 A:** $32 \times 1.25 = 40$ A. Breaker 40 A. 8 AWG at 60 °C = 40 A.

- **40 A:** $40 \times 1.25 = 50$ A. Breaker 50 A. At 60 °C, 8 AWG is only 40 A, so it fails; 6 AWG = 55 A passes. At 75 °C, 8 AWG = 50 A passes.
- **48 A:** $48 \times 1.25 = 60$ A. Breaker 60 A. At 60 °C, 6 AWG is 55 A, so it fails; 4 AWG = 70 A passes. At 75 °C, 6 AWG = 65 A passes.

Why 6 AWG NM fails on a 48 A charger: the conductor must have an ampacity of at least 60 A (210.19(A)(1)). 6 AWG NM is limited to 55 A (334.80(A), 60 °C column). 240.4(B) lets you put a 60 A breaker on a 55 A conductor in some cases, but that rule protects the wire from overcurrent; it does not change the 125 percent minimum ampacity that 210.19(A)(1) requires for a continuous load. 55 A is less than 60 A, so 6 AWG NM is not allowed for a 48 A charger.

The Tesla Gen 3 manual agrees: for maximum power with a 60 °C breaker, minimum 4 AWG copper; with a 75 °C breaker, minimum 6 AWG copper rated 90 °C.

Picture coming: Charger amperage to breaker and wire as a picture: five rows of chargers labeled 16 A, 24 A, 32 A, 40 A, 48 A; an arrow " $\times 1.25$ " to a two-pole breaker of 20, 30, 40, 50, 60 A; then two wire icons per row, one gray NM-B cable labeled with the 60 °C size and one black THHN conductor in conduit labeled with the 75 °C size, and a green ground conductor with its size.

Worked Example 2: 40 A or 48 A? Same Garage, Two Answers

A customer has a car whose onboard charger takes 48 A. The panel is on the garage wall 25 ft from the charger location. The breaker is marked 60/75 °C. The charger is a Tesla Gen 3.

Option A: 48 A setting. - Breaker: $48 \times 1.25 = 60$ A, 60 A two-pole. - Wire choice 1: 4 AWG copper NM-B, 60 °C = 70 A. Tesla terminals accept up to 4 AWG, so it lands. - Wire choice 2: 6 AWG THHN/THWN-2 copper in 3/4 in EMT, 75 °C = 65 A. Allowed because the breaker is marked 75 °C and the Tesla manual gives 6 AWG for a 75 °C breaker. - Ground: 10 AWG copper. - Load added to the service calc: $48 \times 240 = 11,520$ VA.

Option B: 40 A setting. - Breaker: $40 \times 1.25 = 50$ A, 50 A two-pole. - Wire choice 1: 6 AWG copper NM-B, 60 °C = 55 A. - Wire choice 2: 8 AWG THHN in conduit, 75 °C = 50 A. - Ground: 10 AWG. - Load added to the service calc: $40 \times 240 = 9,600$ VA.

What changes: 1,920 VA less load on the service, one wire size smaller, and about 6 miles per hour less charging (36 vs 30 miles per hour from the ChargePoint table at 48 A and 40 A). For a customer who drives 40 miles a day, 8 hours at 40 A is far more than they need. The 40 A setting is the right sell when the load calc is tight.

Worked Example 3: Adding a 48 A Charger with Utility History (120.87)

The house. 2,000 ft², 200 A service, gas range, electric dryer (5 kW), electric water heater (4.5 kW), dishwasher, disposal, microwave, and a 3-ton heat pump with 8 kW of heat strips. The customer wants a 48 A charger.

The data. The customer logs into the utility account and downloads 12 months of 15-minute interval data. The highest 15-minute demand was **11.2 kW**, on a cold January morning.

1. **Check the conditions (120.87).** One year of maximum-demand data: yes. Main breaker sized to the service conductors (230.90): yes, 200 A main on 4/0 Al.
2. **Peak in amps.** $11,200 \text{ W} \div 240 \text{ V} = 46.67 \text{ A}$.
3. **125 percent.** $46.67 \times 1.25 = 58.33 \text{ A}$, rounded to **58 A** (120.5(B)).
4. **Add the charger.** Nameplate 48 A. $58 + 48 = \mathbf{106 \text{ A}}$.
5. **Removed load.** None.
6. **Compare.** 106 A is less than 200 A. The service can take the charger with 94 A to spare.

Worked Example 4: Same House Without Utility Data (120.83)

If the customer cannot get 15-minute data, run 120.83.

Existing loads:

Item	VA
2,000 ft ² × 2 VA/ft ²	4,000
Two small-appliance + one laundry circuit × 1,500	4,500
Gas range (no electric cooking load beyond its 120 V igniter on a small-appliance circuit)	0
Dryer	5,000
Water heater	4,500
Dishwasher (10 A × 120 V)	1,200
Disposal (7.2 A × 120 V)	864
Microwave (13 A × 120 V)	1,560
Heating (larger than cooling): strips 8,000 + outdoor unit $17.7 \text{ A} \times 240 = 4,248$ + blower $4.2 \text{ A} \times 240 = 1,008$	13,256
Existing total	34,880

Check: $4,000 + 4,500 = 8,500$. $+ 5,000 = 13,500$. $+ 4,500 = 18,000$. $+ 1,200 = 19,200$. $+ 864 = 20,064$. $+ 1,560 = 21,624$. $+ 13,256 = 34,880$.

Table 120.83: - First 8,000 VA at 100% = 8,000 - Remainder of existing: $34,880 - 8,000 = 26,880 \times 0.40 = 10,752$ - New charger: $11,520 \times 0.80 = 9,216$ - Total = $8,000 + 10,752 + 9,216 = \mathbf{27,968 \text{ VA}}$ - $27,968 \div 240 = 116.53 \text{ A}$, rounded to **117 A**

117 A is less than 200 A. The service can take the charger.

Picture coming: Load-calc worksheet filled in for this house adding a 48 A charger: top half shows the 120.83 table with each existing line, the 8,000 VA at 100%, $26,880 \text{ VA} \times 40\% = 10,752 \text{ VA}$, charger $11,520 \text{ VA} \times 80\% = 9,216 \text{ VA}$, total $27,968 \text{ VA} = 117 \text{ A}$; bottom half shows the 120.87 path: $11.2 \text{ kW} \rightarrow 46.67 \text{ A} \rightarrow \times 1.25 = 58 \text{ A} \rightarrow + 48 \text{ A} = 106 \text{ A}$; both ending at a 200 A service gauge.

Worked Example 5: A Small Old Service with a Power Control System (625.42(A), 120.7)

The house. A 1950s house with a 100 A service. The 120.83 calc without a charger comes to 21,600 VA, which is 90 A. Adding a 48 A charger at 80 percent adds 9,216 VA, for 30,816 VA, which is 128.4 A, rounded to 128 A. 128 A is more than 100 A. The service cannot take the charger the plain way.

Option 1: Lower the setting. A 16 A setting adds $3,840 \times 0.80 = 3,072 \text{ VA}$. $21,600 + 3,072 = 24,672 \text{ VA} = 102.8 \text{ A}$, rounded to 103 A. Still over 100 A.

Option 2: Power control system. Install a listed PCS that watches the whole service with current sensors and turns the charger down when the house load rises. The charger's manual states a minimum operating current; in this example it is 6 A.

1. Control setting: $80 \text{ percent} \times 100 \text{ A} = 80 \text{ A}$ (120.7(B)).
2. The PCS monitors both controlled and uncontrolled loads, so the charger counts at its minimum operating current (120.7(C)(1)(2)): $6 \text{ A} \times 240 \text{ V} = 1,440 \text{ VA}$.
3. Uncontrolled loads: 21,600 VA.
4. Total: $21,600 + 1,440 = 23,040 \text{ VA} = \mathbf{96 \text{ A}}$.
5. 96 A is at or below 100 A. The installation complies.

The charger's branch circuit is still sized for the charger's setting (60 A circuit for a 48 A setting). The PCS limits the service, not the branch circuit.

Annex D Example D15(b) in the NEC works the same idea with a 30 A charger and an 8 A minimum: uncontrolled loads 21,840 VA, charger 1,920 VA, total 23,760 VA or 99 A on a 100 A service.

Option 3: Upgrade the service to 200 A (R1.5). The office prices options 2 and 3 side by side for the customer.

Worked Example 6: A 14-50 Receptacle for a Plug-In Charger

A customer already owns a ChargePoint Home Flex with a NEMA 14-50 plug and refuses to hardwire.

1. ChargePoint allows plug-in only at 50 A (40 A output) or 40 A (32 A output). Pick 50 A circuit, 40 A setting.
2. Breaker: 50 A two-pole **GFCI** breaker (625.54; 210.8(A)(2) for a garage).

3. Wire: a 14-50 has two hots, a neutral, and a ground, so the cable needs a neutral even though the charger does not use it. 6/3 with ground copper NM-B (60 °C = 55 A) or 8 AWG THHN × 3 + 10 AWG ground in conduit (75 °C = 50 A).
4. Receptacle: a 14-50 listed for EVSE use (625.44). Many cheap 14-50s sold for ranges are not. Check the box or the listing.
5. Height: ChargePoint says 20–26 in above the floor, next to the stud where the charger will mount, because its input cord is only 12 in long.
6. Outdoors: a listed weather-resistant receptacle in an enclosure that is weatherproof with the plug inserted (406.9(B)(2)(a)), because a charging car is left unattended.
7. Tell the customer, in two sentences: "The code requires a GFCI breaker on this plug. Some chargers trip a GFCI breaker now and then; if that happens, we can hardwire the charger and remove the plug."

A 6-50 receptacle (two hots and ground, no neutral) also works for the Home Flex and saves the neutral conductor. It needs the same GFCI breaker and EV listing.

Field photo coming: A finished YES hardwired charger install: Tesla Gen 3 on a garage wall at about 45 in, 3/4 in EMT entering from below with a compression fitting, field label on the side reading the circuit size and output setting, and an inset photo of the panel showing the 60 A two-pole breaker with its lock-off accessory, paint-pen torque marks on the lugs, and the directory line "EV charger, garage."

Common Mistakes

Mistake	Why it is wrong	Fix
6 AWG NM on a 60 A breaker for a 48 A charger	NM is 55 A at 60 °C (334.80(A)); a continuous 48 A load needs 60 A of ampacity (210.19(A)(1)).	4 AWG NM, or 6 AWG THHN in conduit with 75 °C terminations.
Charger left at its 48 A factory default on a 40 A or 50 A circuit	The car pulls 48 A through a circuit built for 32 A or 40 A.	Set the breaker size in the app or switch before the first charge. Field label the setting (625.42(B)).
14-50 on a plain breaker	625.54 requires GFCI on every EV receptacle.	GFCI breaker, or hardwire.
Range-grade 14-50 receptacle	30, 50, and 60 A receptacles for EVSE must be listed for EVSE use (625.44). Cheap receptacles overheat at the contacts after months of 40 A.	Use a receptacle listed for EV charging.
No lockable disconnect on a hardwired charger	625.43(C) requires one, lockable per 110.25.	Breaker lock-off accessory that stays in place, plus a plaque if the panel is remote.
Terminals tightened by feel	Loose lugs on an 8-hour load burn.	Torque tool to the printed value (110.14(D)). Paint-pen mark.
Charger mounted with the plug holster below 18 in in a garage	625.50.	18 in minimum indoors, 24 in outdoors, to the stored connector.
Load calc with 125 percent on the charger	Overstates the load and sells an upgrade the customer may not need.	120.5(E): no 125 percent in the load calc. Use nameplate (120.57).
No load calc at all	The main trips on cold nights; the service conductors run hot.	120.87 or 120.83 on every charger job.
Running a charger on an aluminum-bus Eaton BR panel with a BR breaker against the Tesla manual's warning	110.3(B) makes the listed instructions enforceable.	BRH breaker, as the manual says.
Using the Arc Guide wire table to size a charger circuit	The table in its Wiring section shows 4 AWG at 70 A with a 60 A breaker for an EV charger, which happens to work, but the same table mixes 60 °C and 75 °C numbers in other rows.	Size from Table 310.16 and 110.14(C) as in Worked Example 1.
Selling a 60 A circuit for a car that takes 32 A	The extra wire and breaker cost money and the load calc gets harder for nothing.	Ask what car. Match the circuit to the car and the load calc.

Field Exercise

This is the outline's field exercise, written out in full. A journeyman watches and signs off each part.

Part 1: Load calc with utility history

1. You are given a charger nameplate (48 A, 240 V) and a 200 A house with a gas range and a heat pump. Use a real customer's house if one is scheduled; otherwise use the house in Worked Examples 3 and 4.
2. Get the customer's 12 months of utility interval data. Write down the highest 15-minute kW and its date.
3. Run 120.87: peak kW $\rightarrow$ amps $\rightarrow \times 1.25 \rightarrow + 48 \text{ A} \rightarrow$ compare to 200 A.
4. Run 120.83 as a backup.
5. State in one sentence whether the service can take a 48 A charger, and the margin in amps for each method.

Part 2: Size the circuit for 40 A and 48 A

1. For a 40 A charger setting and a 48 A charger setting, write the breaker size, the copper conductor size in NM-B and in THHN in conduit, the ground size, and the section numbers you used (625.41, 210.19(A)(1), 210.20(A), 110.14(C)(1)(a), 334.80(A), Table 310.16, Table 250.122).
2. Check both answers against the charger manual's breaker table.

Part 3: Hardwired install on the training wall

1. Mount a charger on the training wall at a height that meets 625.50 and the manual.
2. Run the circuit from the training panel in the wiring method the journeyman picks.
3. Install the two-pole breaker and a lock-off accessory.
4. Strip and land the conductors at both ends and torque each one with a torque tool to the printed value. Paint-pen mark each screw.
5. Energize, meter L1 to L2 at the charger terminals' feeding breaker, and read the LEDs.
6. Commission in the app. Set the output current to match the breaker. Field-label the setting.
7. If a test car or a load simulator is available, charge for 15 minutes and clamp the current.

Part 4: 14-50 receptacle on a GFCI breaker

1. Wire a NEMA 14-50 receptacle listed for EVSE use on a 50 A two-pole GFCI breaker with 6/3 copper NM-B (or 8 AWG THHN in conduit with a 10 AWG ground).
2. Push the breaker's test button and confirm it trips.
3. Explain to the journeyman, playing the customer, the nuisance-trip tradeoff in two sentences: why the code requires the GFCI, and what you will do if it trips.

Pass: load calc numbers match within rounding; breaker and wire choices match Worked Example 1; every termination torqued and marked; charger setting matches the breaker; labels and lock-off in place.

NEC 2026 Cross-References

Section	Topic	NEC 2023
625.4	Qualified persons install permanently installed EV equipment	new in 2026
625.5	Field markings on EVSE: voltage, phases, frequency, full-load current, SCCR	new in 2026
625.40	Individual branch circuit for EVSE over 16 A or over 120 V	625.40
625.41	EVSE is a continuous load	625.41
625.42, (A), (B)	Rating; power control systems; restricted adjustable settings with a field label	625.42
625.43(C)	Readily accessible, lockable disconnect; plaque if remote; cord and plug as disconnect	625.43
625.44	Equipment connection: receptacle types and EV listing; fastened-in-place hardwired	625.44
625.50	Coupling means at least 18 in indoors, 24 in outdoors	625.50
625.54	GFCI for all EV charging receptacles	625.54
210.8(A)(2), 210.8(F)	GFCI in garages; outdoor outlets at dwellings	210.8
210.19(A)(1)	Conductor ampacity at least 125 percent of continuous load	210.19(A)(1)
210.20(A)	Breaker at least 125 percent of continuous load	210.20(A)
110.3(B)	Install per listing instructions	110.3(B)
110.14(C)(1)(a)	60 °C terminations on circuits 100 A and under unless marked 75 °C	110.14(C)(1)(a)
110.14(D)	Terminal torque	110.14(D)
110.25	Lockable disconnecting means	110.25
334.80(A)	NM ampacity limited to 60 °C	334.80
Table 310.16	Conductor ampacity	Table 310.16
Table 250.122	Equipment grounding conductor size	Table 250.122
406.9(B)(2)(a)	Wet-location receptacle for unattended loads	406.9(B)(2)
120.5(E)	No 125 percent in load calcs	new
120.7	Power control systems in load calcs	new
120.57	EV load at nameplate	220.57
120.83	Existing dwelling, new EVSE at 80 percent	220.83
120.87	Existing loads from maximum demand	220.87
130.70(C)	PCS directory	new

End-of-Chapter Checklist

- [] I asked what car, where it parks, and which side the port is on.
 - [] I read the charger manual's breaker table, wire requirements, torque, and height.
 - [] I ran 120.87 or 120.83 and wrote down the margin.
 - [] I multiplied the charger setting by 1.25 for the breaker and the conductor.
 - [] I picked the conductor from the 60 °C column for NM or non-75 °C terminations, and the 75 °C column only when both ends are marked 75 °C.
 - [] I sized the ground from Table 250.122.
 - [] I chose hardwired unless the customer insisted on a plug, and if a plug, used an EV-listed receptacle on a GFCI breaker.
 - [] I asked the AHJ about GFCI for an outdoor hardwired charger.
 - [] The connector holster is at least 18 in above the floor indoors or 24 in above grade outdoors.
 - [] The disconnect is readily accessible and lockable, with a plaque on the charger if the panel is remote.
 - [] Every termination is torqued with a tool to the printed value and paint-pen marked.
 - [] The charger's output setting matches the breaker, and the setting is on a field label.
 - [] The charger's outside markings include voltage, phases, frequency, full-load current, and SCCR.
 - [] The panel directory names the charger circuit.
 - [] I tested a charge and clamped the current.
 - [] I photographed the install, the labels, the torque marks, and the app setting for the job folder.
-

Sources

- NFPA 70, National Electrical Code, 2026 edition: Article 625 (lines 67617–68112), 210.8 (lines 11899–12100), 210.19 and 210.20 (lines 12326–12465), 110.14(C) (line 8947), 110.25 (line 9235), 120.5(E), 120.7, 120.57, 120.83, 120.87 (lines 10069–10990), 130.70 (line 11399), Table 250.122 (line 18950), Table 310.16 (line 26652), 334.80 (line 30648), 406.9 (line 37627), Annex D Example D15 (lines 94336–94470).
- Tesla, Gen 3 Wall Connector Manual, 48A Single Phase (North America), https://energylibrary.tesla.com/docs/Public/Charging/WallConnector/Gen3/Install/1PNA/g3_wc_install_1pna.pdf, downloaded 2026-10-02: breaker/output table (p. 7 of the manual's contents; "Circuit Breaker Rating / Maximum Output"), conductor requirements (p. 17), mounting height ("Choosing Height"), terminal torque 50 in-lb (Step 5), commissioning in Tesla One, Dynamic Power Management settings (p. 54).
- ChargePoint, ChargePoint Home Flex 16A-50A Flexible Amperage Charger Installation Guide, https://www.chargepoint.com/files/en-ca/home/CPH50_InstallGuide.pdf (Canadian-site copy),

downloaded 2026-10-02: circuit rating and max load table, plug-in vs hardwire, non-GFCI breaker recommendation, 14-50/6-50 outlet height 20–26 in, rating label, app amperage setting (pp. 9–11 and later).

- Kuhlman, Residential Electrical Troubleshooting (2019): "Two-Pole (240-volt) circuit breakers," p. 34 (some 240 V circuits carry no neutral); "Ground Fault Circuit Interrupter circuit breakers (GFCI)," pp. 38–39 (5 mA trip threshold). Paraphrased.
 - Arc Workforce, Residential Electrical Field Guide, Part 5, GFCI section (EV charging receptacles listed as a GFCI location); Wiring table (60 °C ampacities; not used for sizing).
 - (16 January 2025), §3-20.1.1–3-20.1.6: physical protection (wheel stops or bollards where there is no curb), keeping cords out of walkways, ventilation in enclosed spaces, battery temperature limits, metering. Written for government sites; the walkway and physical-protection points apply to carports and driveways.
 - Commercial modules 1.9 and 1.10.
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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
Procedure 3 and Procedure 5: Sizing at 125% and a hardwired 48 A Tesla install	60A Tesla Charger, Licensed Electrician Installation Palmer Electrical • 24:17 A licensed electrician walks through why a 48 A charger needs a 60 A circuit (625.42, 210.20(A)), why 6 AWG NM is not enough (60 °C column, 55 A), mounts the Tesla wall plate to framing, fire-caulks the bored blocking, and lands the circuit. Caution: He uses 6 AWG copper SE cable (XHHW-2) inside the wall at the 75 °C column. The module lists 6 AWG THHN/THWN-2 in conduit or 4 AWG NM; ask your journeyman and the AHJ before using SE cable this way, because 338.10(B)(4) sends interior SE cable back to the 60 °C limit in some installs (for example, in thermal insulation). Code references are 2023. Sponsored Jobber segment in the middle.
Procedure 5 steps 9 to 14: Landing and torquing a Tesla Universal Wall Connector	Electric Vehicle (EV) Charger How To Install A 60 AMP Hardwired RIGHT! Electrician POV Ep. 28 Landers Electric • 12:52 A San Diego electrician mounts a Tesla Universal Wall Connector into a stud, runs 3/4 in conduit straight from the panel, follows Tesla's wire-routing diagram, and torques L1, L2, and the #10 ground to 50 in-lb with a torque screwdriver. Caution: He does not show turning off the main or proving the panel dead before adding the 60 A breaker; module Procedure 5 step 7 requires it. No breaker lock-off (625.43) or commissioning in the app is shown. Tesla's manual warns against Eaton BR breakers for the Universal Wall Connector; check panel brand.
Procedure 4 and Field Exercise Part 4: NEMA 14-50 receptacle on a GFCI breaker	The CORRECT Way To Install A 240v Level 2 EV Charger Plug/Outlet Electrician POV Ep. 30 Landers Electric • 24:58 The same crew installs an EV-rated 14-50 receptacle on a 2-pole GFCI breaker, does a live-dead-live test after turning off every branch breaker and the main, runs FMC through an LB to the garage, and locks out the panel. Caution: Sponsored by the receptacle maker. The existing circuit is NM on 50 A for a 40 A setting; that is correct, but a 60 A circuit could not use that NM (he says so).
Procedure 7: Energy management when the service is too small	Solve Your EV Charger Problems in 1 Day with This Easy Fix! Electrician U • 11:33 Dustin Stelzer explains why adding up breaker handles is not a load calc, then installs a Siemens load manager with CTs on the service conductors ahead of a Siemens charger so charging stops when house load is high. Caution: Siemens-sponsored. Under NEC 2026 the load manager must be listed energy management equipment (130.2) or a PCS (625.42(A), 120.7); confirm the listing on the unit you use. His '3 VA per sq ft' description is a quick summary, not the full Article 120 calc in Procedure 2.