

Residential Load Calculations

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 • Masterclasses Read after: R1.2 (How a House Is Wired) and R1.5 (Panel Upgrades and Service Changes). R1.11 (EV Chargers) uses this masterclass for every charger job. **Time:** about 36 hours of study and practice. This masterclass is the ARC Appendix A related-instruction course "Load Calculations — Residential." **Code edition:** This chapter cites NEC 2026. Load calculations moved from Article 220 (NEC 2023) to Article 120 (NEC 2026), and the 2023 number is in parentheses where a section moved. The local inspector (AHJ) may enforce an earlier edition, so ask your journeyman which one applies before you turn in a calc.

Learning Objectives

When you finish this masterclass you will be able to:

1. Do the standard dwelling calculation (NEC 2026 Art. 120 Part III) by hand for a one-family house and get the same service size an engineer would.
 2. Do the optional dwelling calculation (120.82) by hand for the same house and explain why it gives a smaller number.
 3. Do the existing-dwelling calculation (120.83) to decide whether an existing service can take a new load such as an EV charger or a heat pump.
 4. Use the existing-loads method (120.87) with a year of utility demand data, and know when you are not allowed to use it.
 5. Pick the service rating from the calculated load, size the service conductors with the dwelling rule (310.12), and pick the panel.
 6. Calculate the neutral load (120.61).
 7. Explain to a journeyman, an inspector, or a customer why four honest methods give four different answers for the same house.
-

Plain-Language Background

What a load calculation is

A load calculation is a math worksheet that answers one question: how big does the service (or feeder) to this house need to be? It does not measure anything. It adds up what is in the house using rules in the NEC, then lets you cut some loads down because not everything runs at once. The result is a number of volt-amperes (VA). You divide it by 240 volts to get amps. That amp number picks the service size.

A house with a 4,500-watt water heater, a 12,000-watt range, and a 10,000-watt heat strip has 26,500 watts of just those three things. That is 110 amps at 240 volts. Nobody runs every burner, the oven, the water heater, and the heat strips at full power at the same moment for long. The NEC knows this. It lets you count some loads at less than 100 percent. These cuts are called demand factors. A demand factor of 40 percent means you count 40 cents of every dollar.

Why we do it on residential jobs

YES does load calculations on four kinds of jobs:

Job	Question the calc answers	Method we usually use
New house or full rewire	What size service?	Optional (120.82), checked by standard (Part III) if the inspector asks
Service change on an old house	Is 200 A enough, or does it need more?	Optional (120.82)
Adding a big load (EV charger, heat pump, electric range, hot tub)	Can the existing service carry it, or does it need an upgrade?	Existing dwelling (120.83) or existing loads (120.87)
Subpanel or detached garage feeder	What size feeder?	Standard (Part III) for the loads on that feeder

The office uses your calc to decide what to sell. If you get it wrong one way, the customer pays for a service upgrade they did not need. If you get it wrong the other way, the main breaker trips on the first cold morning, or the service conductors run hot for years. Inspectors in Birmingham and Jefferson County can ask to see the calc on any service change or large added load, so it goes in the job folder every time.

Volt-amperes, watts, and amps

- A volt-ampere (VA) is volts times amps. A 240-volt heat pump that draws 27.5 amps is $240 \times 27.5 = 6,600$ VA.
- For resistive loads like heat strips, water heaters, and ranges, watts and VA are the same number. The NEC says to treat kW as kVA for ranges and dryers (120.54, 120.55).

- To go from VA to amps on a house service, divide by 240. Use 240 V for the whole house, even for 120-volt loads, because the house service is 120/240 V and the 120-volt loads are split between the two legs (120.5(A) lists 120/240 V as a nominal voltage for calculations).
- To go from a 120-volt nameplate in amps to VA, multiply by 120. A 10 A dishwasher is 1,200 VA.
- 1 kVA = 1,000 VA.

Rounding

NEC 120.5(B) lets you round to the nearest whole amp. Fractions smaller than 0.5 are dropped. So 183.99 A becomes 184 A, and 146.28 A becomes 146 A. Round only at the end, when you turn VA into amps. Keep every VA number exact until then.

The four methods in this chapter

Method	NEC 2026 (2023)	Use it for	What it counts
Standard	Art. 120 Part III: 120.40–120.61 (220.40–220.61)	Any building; any feeder	Each kind of load with its own demand factor
Optional, one-family	120.82 (220.82)	One dwelling on a 120/240 V or 208Y/120 V, 3-wire service of 100 A or more	All general loads at 100 percent of the first 8 kVA and 40 percent of the rest, plus the largest heating or cooling selection
Existing dwelling	120.83 (220.83)	Deciding if an existing service can take new loads	Existing loads at 40 percent after the first 8 kVA, new loads at 50 to 80 percent
Existing loads from real data	120.87 (220.87)	Adding load to an existing service using a year of measured peak demand	125 percent of the real peak, plus the new load

The standard method is the strictest. The optional method was written for houses because a house never runs everything at once. The existing-dwelling method gives a further break because the existing loads have already proved themselves on that service. The 120.87 method uses what the house actually drew.

Where the rules are in the book

Open NEC 2026 to Article 120. Read 120.1 first. It says Part III and Part IV are the feeder and service methods, and its Informational Note No. 1 points to Informative Annex D for examples. Annex D Examples D1(a), D1(b), D2(a), D2(b), and D2(c) are one-family houses. Read them alongside this chapter. You will check your work against D2(c) later.

The table below lists the sections you will open over and over.

Rule	NEC 2026	NEC 2023
Voltages, rounding, floor area, no 125 percent in load calcs	120.5(A), (B), (C), (E)	220.5
Noncoincident loads (heat vs air conditioning)	120.6	220.60
Power control systems in load calcs	120.7	(new in 2026)
Dwelling minimum unit load, 2 VA/ft ²	120.41	Table 220.12
Lighting demand factors	Table 120.45	Table 220.42
Motors and air conditioning	120.50	220.50
Fixed electric space heat	120.51	220.51
Small-appliance and laundry circuits	120.52	220.52
Four or more fastened-in-place appliances, 75 percent	120.53	220.53
Dryers	120.54, Table 120.54	220.54
Ranges and cooking units	120.55, Table 120.55	220.55
EV chargers	120.57	220.57
Neutral load	120.61	220.61
Optional one-family	120.82	220.82
Existing dwelling	120.83, Table 120.83	220.83
Two dwelling units	120.85	220.85
Existing loads from real data	120.87	220.87

Before You Start: The Load Survey

Every method needs the same raw data. Get it on the first visit so you do not have to come back.

What to bring

1. The YES load-calc worksheet (or a blank page and the tables in this chapter).
2. A tape measure or laser measure for the outside of the house.
3. A phone camera for every nameplate.
4. A flashlight and a small mirror for nameplates behind ranges, dryers, and air handlers.
5. A clamp meter, only if you are doing the 30-day recording method with a journeyman (see Procedure D).

Survey steps

1. **Measure the floor area from the outside walls.** 120.5(C) says floor area is figured from the outside dimensions of the house. Measure each floor that is lived in. Leave out detached garages, open porches, and unfinished areas that cannot become living space later. A finished basement counts. An unfinished basement that could be finished is a

judgment call; count it unless the inspector tells you otherwise, because counting it only adds 2 VA per square foot.

2. **Count the small-appliance circuits.** These are the 20 A kitchen, pantry, breakfast, and dining receptacle circuits from 210.11(C)(1). Every house has at least two. Count the actual number in the panel if there are more.
3. **Count the laundry circuits.** At least one 20 A laundry circuit (210.11(C)(2)).
4. **Photograph every nameplate on anything that is fastened in place or on its own circuit.** That means the range or cooktop and wall ovens, dryer, water heater, dishwasher, disposal, built-in microwave, trash compactor, well pump, sump pump, attic fan, pool pump, hot tub, EV charger, the outdoor heat pump or AC unit, the indoor air handler or furnace, and any heat strips, baseboard heaters, or wall heaters.
5. **Write down the panel rating, the main breaker size, and the service conductor size and material.** You read these from the panel label and the conductor jacket. Do not remove the dead front to read the conductors unless you are qualified and wearing the PPE in R1.1. If the dead front has to come off, a journeyman does it.
6. **Ask the customer what they plan to add.** EV charger, hot tub, heat pump, shop in the garage, generator. A calc that ignores next year's charger sells the wrong panel.

SAFETY: Reading nameplates. Range and dryer nameplates are often behind the bottom drawer or the back panel. Do not pull a range out on its cord while it is plugged in, and never reach behind a dryer with the cord energized and the back panel off. Outdoor unit nameplates are on the side of the cabinet. Read them without opening the electrical access panel. If you must open any access panel, kill the disconnect first and verify dead with a meter, as in R1.1.

Reading a nameplate

Nameplate shows	Turn it into VA
Watts or kW at 240 V	1 kW = 1,000 VA. A 4.5 kW water heater is 4,500 VA.
Amps at 120 V	Amps × 120. A 7.2 A disposal is 864 VA.
Amps at 240 V	Amps × 240. A 5.0 A blower is 1,200 VA.
RLA (rated load amps) and FLA (fan) on an outdoor unit	Add the RLA of the compressor and the FLA of the fan, then × 240. 26.0 A + 1.5 A = 27.5 A × 240 = 6,600 VA.
Heat strip kW in an air handler	kW × 1,000. A 10 kW strip is 10,000 VA.
Only MCA and MOP on an outdoor unit	Do not use MCA or MOP as the load. MCA already includes a 25 percent add for the compressor. Find RLA and FLA on the same plate.

Why you don't use MCA: The "minimum circuit ampacity" on an outdoor unit is 125 percent of the compressor RLA plus the fan FLA (that is how Article 440 sizes the branch

circuit). If you put MCA into the load calc and then also add 25 percent of the largest motor, you count the same 25 percent twice.

Procedure A: The Standard Method (Art. 120 Part III)

Use the standard method for any feeder, any non-dwelling building, and any house where you cannot or do not want to use the optional method. You will also use it to check the optional method when an inspector asks for both.

Each step below says which section to open and why the rule exists.

- 1. General lighting and general-use receptacles: 2 VA per square foot.** Multiply the floor area by 2 VA/ft² (120.41). This one number covers every general-use 15 A and 20 A receptacle, the bathroom receptacle circuits, the garage receptacle circuits, the outdoor and basement receptacles of 210.52(E) and (G), and every required lighting outlet of 210.70 (120.41(1)–(3)). You do not count receptacles one by one in a house. Motors smaller than ½ hp on lighting circuits, such as bath fans and ceiling fans, are included here too (120.41). - Why: the NEC set a per-square-foot allowance so a calc done before the drywall goes up still covers whatever lamps and plug-in loads people bring. - Watch out: NEC 2026 uses 2 VA/ft² for the service and feeder calc. Older books and older software use 3 VA/ft². The 3 VA/ft² number still exists in 2026, but only for counting how many lighting branch circuits a house needs (120.13). Do not mix them up.
- 2. Small-appliance circuits: 1,500 VA each.** Add 1,500 VA for each 20 A small-appliance circuit, minimum two (120.52(A)).
- 3. Laundry circuit: 1,500 VA each.** Add 1,500 VA for each laundry circuit, minimum one (120.52(B)).
- 4. Add Steps 1 to 3 and apply the lighting demand factors.** Table 120.45 for dwelling units is:

Portion of the lighting load	Demand factor
First 3,000 VA	100 percent
3,001 to 120,000 VA	35 percent
Over 120,000 VA	25 percent

120.52(A) and (B) let you put the small-appliance and laundry loads into this same total before you apply the table. - Why: lights and receptacles in a house are lightly used on average. The first 3,000 VA is assumed to run; the rest is counted at about one third. **5. Fastened-in-place appliances: 75 percent if there are four or more.** List every appliance rated ½ hp or more, or 500 W or more, that is fastened in place: water heater, dishwasher, disposal, built-in microwave, compactor, well pump, attic fan. If there are four or more, add their nameplates and multiply by 75 percent (120.53). If there are three or fewer, count them at 100 percent. - Do not include these in the 75 percent group: ranges and cooking units, dryers, space heating, air

conditioning, or EV chargers (120.53(1)–(5)). They get their own steps. - Why: with four or more appliances, the chance that all run together is low. 6. **Dryer: nameplate or 5,000 VA, whichever is larger.** Use 5,000 VA or the nameplate rating, whichever is larger (120.54). One or two dryers are counted at 100 percent (Table 120.54). 7. **Range or cooking appliances: Table 120.55.** For one range rated not over 12 kW, use 8,000 VA (Column C, one appliance, 8 kW). For a range over 12 kW, Note 1 of Table 120.55 adds 5 percent to the Column C number for each kW over 12. For a cooktop and wall oven, read Note 3 and Columns A and B; Annex D Example D2(b) works one. - Why: a 12 kW range almost never pulls 12 kW. Testing found 8 kW covers real use. 8. **Heating or cooling, whichever is larger (noncoincident loads).** 120.6 lets you count only the larger of two loads that will not run at the same time. A house heats in winter and cools in summer, so you count the larger of the two. - Heating side: fixed electric space heat is counted at 100 percent of connected load (120.51). For a heat pump with heat strips, add the strips, the outdoor unit, and the indoor blower, unless the equipment locks out the compressor whenever the strips are on. Most residential heat pumps run strips and compressor together during defrost and on the coldest mornings, so count both unless the install manual says otherwise. - Cooling side: the outdoor unit (compressor RLA plus fan FLA) plus the indoor blower. - Why: 120.51 counts heat at 100 percent because on a cold morning the strips do run flat out. 9. **Largest motor: add 25 percent.** 120.50(A) sends motor loads to 430.24, and 120.50(B) sends hermetic compressors to Article 440 Part IV. 440.33(3) adds 25 percent of the largest motor-compressor or motor full-load current in the group. In a house this is almost always the heat pump or AC compressor. Take the compressor RLA $\times$ 240 $\times$ 25 percent. Annex D Example D1(b) adds this line ("25% of air-conditioner") the same way. - Why: motors pull more than nameplate current while starting and when the voltage sags. The 25 percent gives the conductors room for that. 10. **EV chargers: nameplate rating at 100 percent.** For each charger, use the nameplate rating. NEC 2026 120.57 falls back to 7,200 VA only when the nameplate is not available. A 48 A charger at 240 V is 11,520 VA. It does not get the 75 percent (120.53(5)) and there is no 125 percent added in the load calc (120.5(E)). See R1.11. 11. **Add everything.** Steps 4 + 5 + 6 + 7 + 8 + 9 + 10, plus any other loads such as a hot tub or well pump that did not fit above (count those at nameplate). 12. **Divide by 240 V and round.** That is the calculated load in amps. Go to Procedure E to pick the service and the wire.

Procedure B: The Optional Method for One Dwelling (120.82)

The optional method is shorter and gives a smaller answer. Most YES service-change calcs use it.

When you may use it

120.82(A) allows it for one dwelling unit whose total load is served by a single set of 120/240 V or 208Y/120 V 3-wire service or feeder conductors with an ampacity of 100 A or more. That covers almost every house YES works on. It does not cover a duplex on one service (use 120.85 or the standard method) or a feeder to just part of a house.

Steps

1. **Build the general load list (120.82(B)).** Add at 100 percent:
2. 2 VA per square foot of floor area (120.82(B)(1)).
3. 1,500 VA for each small-appliance circuit and each laundry circuit (120.82(B)(2)).
4. The nameplate rating of every fastened-in-place, permanently connected, or dedicated-circuit appliance; every range, wall oven, and cooktop at full nameplate (not the 8 kW Table 120.55 number); every dryer not on the laundry circuit; and every water heater (120.82(B)(3)a-d).
5. The nameplate amps or kVA of every permanently connected motor not already counted in item 3 (120.82(B)(4)). - Do not put heating, air conditioning, or EV chargers in this list. They go in Steps 3 and 4.
6. **Apply the general demand factor.** Count the first 8,000 VA at 100 percent and the remainder at 40 percent (120.82(B)). - Why: the optional method lumps all the household loads together and assumes, from experience, that a house uses less than half of everything above the first 8 kVA at any time.
7. **Pick the largest heating or cooling selection (120.82(C)).** Work out all six and use only the largest:

Selection	What to count
(C)(1)	100 percent of the air-conditioning and cooling nameplate(s)
(C)(2)	100 percent of the heat pump nameplate(s) when the heat pump has no supplemental electric heat
(C)(3)	100 percent of the heat pump compressor plus 65 percent of the supplemental electric heat for central electric heat. If the compressor cannot run at the same time as the strips, you do not have to add the compressor.
(C)(4)	65 percent of electric space heat if there are fewer than four separately controlled units
(C)(5)	40 percent of electric space heat if there are four or more separately controlled units
(C)(6)	100 percent of electric thermal storage or other heat expected to run continuously at full nameplate

1. **EV chargers at 100 percent.** 120.82(D) says the EV charger load is counted at 100 percent in accordance with 120.57, which means the nameplate.
2. **Add Steps 2, 3, and 4, divide by 240 V, and round.**

Procedure C: The Existing-Dwelling Method (120.83)

Use this when the house already has a service and you want to know if it can take something new: a charger, a heat pump, a hot tub, a range in place of gas.

When you may use it

120.83 applies when the dwelling is served by a 120/240 V or 208Y/120 V, 3-wire service or feeder. It is a "shall be permitted" rule, so it is a choice. If this method says the service is big enough, you have shown compliance. If it says the service is too small, you can still try 120.87 (Procedure D) or a power control system (R1.11).

What NEC 2026 changed

NEC 2026 replaced the old two-case layout with one table of percentages, Table 120.83. The table is:

Load (kVA)	Percent of load
First 8 kVA of existing and new load	100
Remainder of existing load	40
New EV charger	80
New central electric resistance space heat	80
All other new loads	50

The section also says to use the larger connected load of air conditioning or space heating, but not both.

Steps

- 1. List the existing loads (120.83(1)-(3)).**
- 2 VA/ft² for general lighting and general-use receptacles.
- 1,500 VA for each small-appliance and laundry circuit.
- Nameplates of every fastened-in-place, permanently connected, or dedicated-circuit appliance, every range, oven, and cooktop, every dryer, and every water heater.
- The larger of the air conditioning or the space heating connected load, not both.
- 6. List the new loads separately.** Sort each new load into one of the three new-load rows: new EV charger, new central electric resistance heat, or all other new loads. An EV charger is counted at its nameplate (120.83(3)e lists EV chargers supplied by individual branch circuits).
- 7. Take the first 8,000 VA at 100 percent.** Take it out of the existing load. The table does not say which load the first 8 kVA comes . Taking it from the existing load gives the larger, safer answer, because the existing remainder is counted at only 40 percent while a new charger is counted at 80 percent. YES takes it from the existing load.
- 8. Count the rest of the existing load at 40 percent.**
- 9. Count each new load at its row percentage.** New charger 80 percent, new resistance heat 80 percent, everything else new 50 percent.
- 10. Add Steps 3, 4, and 5, divide by 240 V, and round.**

11. **Compare to the existing service rating.** If the calculated amps are at or below the rating of the service disconnect and conductors, the service can take the new load.
-

Procedure D: Existing Loads from Real Demand Data (120.87)

This method uses what the house actually drew. It often shows that an old 100 A or 150 A service can take a charger when every calc on paper says no.

The conditions (120.87)

You may use it only when all three are true:

1. **One full year of maximum-demand data is available (120.87(1)).** Maximum demand means the highest average kilowatts reached and held for a 15-minute interval. - Exception: if a year of data is not available, you may record for at least 30 days with a recording ammeter or power meter on the highest-loaded leg of the service. The recording must be taken while the house is lived in, and must include the larger of the heating or cooling load and any seasonal loads, by measurement or by calculation. - You may not use the 30-day exception if the house has solar, wind, or any form of peak load shaving.
2. **125 percent of the maximum demand, plus the new load, minus any removed load, does not exceed the rating of the service (120.87(2)).** The new load is figured with Article 120 Parts I, III, and IV. For a charger that means the nameplate (120.57).
3. **The service has overload protection per 230.90 (120.87(3)).** In a house that means a main breaker sized to the service conductors.

Steps

1. **Get the data.** Have the customer log into their utility account and download the interval usage for the last 12 months, or ask the utility for the account's 12-month peak demand. Write down the highest 15-minute kW and the date. - If the utility only gives monthly kWh, you do not have maximum-demand data. A monthly kWh total cannot tell you the peak. Do not divide kWh by hours and call it demand. - If the utility gives hourly kWh only, the highest hourly number is an average over 60 minutes, not 15. It reads lower than the true 15-minute peak. Treat it as not meeting 120.87(1) and ask your journeyman before you rely on it.
2. **Convert the peak to amps.** $\text{kW} \times 1,000 \div 240 \text{ V}$.
3. **Multiply by 125 percent.**
4. **Add the new load in amps.** For a charger, the nameplate amps.
5. **Subtract any load you are removing.** For example, a water heater being changed to gas, figured at its nameplate.
6. **Compare to the service rating.** At or below the rating, the service can take the new load.

SAFETY: 30-day recording. Clamping a recording meter on the service conductors means the panel dead front is off with the service energized. That is energized work. A helper does not install the recording meter. A journeyman does it, in the PPE and with the approach boundaries from commercial module 2.1, or the meter goes on the outside of the panel using a listed meter-base or split-core arrangement the utility allows.

Procedure E: Picking the Service, the Wire, and the Neutral

1. **Pick the service rating.** Take the calculated amps and go up to the next standard rating in Table 240.6(A): 100, 110, 125, 150, 175, 200, 225, 250, 300, 350, 400. The service disconnect must be rated at least the calculated load (230.79) and never less than 100 A for a one-family dwelling (230.79(C)). Annex D Example D2(a) shows an 82 A calculated load that still gets a 100 A service for this reason.
2. **Pick the panel.** The panel bus rating must be at least the main breaker. YES installs 200 A panels as the standard residential size even when the calc allows 150 A, because the material cost difference is small and the customer can add a charger later. When the calc says more than 200 A, the next step is a 320 A meter base with two 200 A disconnects or a 400 A class service; see R-SERVICE.
3. **Size the service conductors with the dwelling rule (310.12).** For a one-family dwelling service rated 100 A through 400 A, the service conductors may have an ampacity of not less than 83 percent of the service rating (310.12(A)). With no temperature correction or bundling adjustment, you may read the size straight from Table 310.12(A):

Service rating (A)	Copper	Aluminum or copper-clad aluminum
100	4 AWG	2 AWG
110	3 AWG	1 AWG
125	2 AWG	1/0 AWG
150	1 AWG	2/0 AWG
175	1/0 AWG	3/0 AWG
200	2/0 AWG	4/0 AWG
225	3/0 AWG	250 kcmil
250	4/0 AWG	300 kcmil
300	250 kcmil	350 kcmil
350	350 kcmil	500 kcmil
400	400 kcmil	600 kcmil

- Why the 83 percent: a whole-house service rarely runs near its rating for long, so the code lets the wire be one or two sizes smaller than the 75 °C table would require at 100 percent. Annex D Example D7 does it: $175 \text{ A} \times 0.83 = 145.25 \text{ A}$, so 1/0 Cu or 3/0 Al at 75 °C.
- Use Table 310.12(A) only when no correction or adjustment factors apply. If SE cable runs through a hot attic, or more than three current-carrying conductors share a raceway, you must work the ampacity from Table 310.16 with the corrections, then compare to 83 percent of the rating (Annex D Example D7 shows the corrected version).
- The terminals on a service over 100 A are rated 75 °C (110.14(C)(1)(b)), so you compare to the 75 °C column. 4. **Calculate the neutral (120.61).** The neutral carries only the unbalanced load between the two legs. 240-volt-only loads (water heater, heat strips, heat pump, well pump) put nothing on the neutral. 120.61(B)(1) lets you count ranges, ovens, cooktops, and dryers at 70 percent of the number used for the hots. Annex D Example D1(a) works it. The neutral can be smaller than the hots (310.12(D)), but never smaller than the minimum in 250.24(D). SE cable comes with a neutral the same size as the hots or one size reduced, so on most service changes the neutral calc confirms what is already in the cable.

Worked Examples: One House, Four Methods

The Practice House

All four examples use the same house. Copy this table onto your worksheet.

Item	Nameplate	VA
Floor area (one story, slab, outside dimensions, detached carport not counted)	2,400 ft ²	—
Small-appliance circuits	2	—
Laundry circuit	1	—
Range	12 kW, 240 V	12,000
Clothes dryer	5.5 kW, 240 V	5,500
Water heater	4.5 kW, 240 V	4,500
Dishwasher	10.0 A, 120 V	1,200
Disposal	7.2 A, 120 V	864
Over-range microwave	13.0 A, 120 V	1,560
Heat pump outdoor unit	Compressor RLA 26.0 A + fan FLA 1.5 A = 27.5 A, 240 V	6,600
Air handler blower	5.0 A, 240 V	1,200
Heat strips in air handler	10 kW, 240 V, compressor not locked out	10,000
Bath fans (3)	On lighting circuits, each under ½ hp	Included in 2 VA/ft ²

It is an all-electric house: electric range, dryer, water heater, and heat pump with strips. No gas.

Picture coming: A filled-in load survey sheet for the Practice House: house outline with "2,400 ft² (outside dimensions)" and the carport marked "not counted," and a table of each appliance with a thumbnail of its nameplate and the VA written beside it, matching the table above.

Worked Example 1: Standard Method (Art. 120 Part III)

Step 1. General lighting (120.41). $2,400 \text{ ft}^2 \times 2 \text{ VA/ft}^2 = 4,800 \text{ VA}$

Step 2. Small-appliance circuits (120.52(A)). $2 \times 1,500 \text{ VA} = 3,000 \text{ VA}$

Step 3. Laundry (120.52(B)). $1 \times 1,500 \text{ VA} = 1,500 \text{ VA}$

Step 4. Lighting demand (Table 120.45). Subtotal: $4,800 + 3,000 + 1,500 = 9,300 \text{ VA}$ First 3,000 VA at 100% = 3,000 VA Remainder: $9,300 - 3,000 = 6,300 \text{ VA}$ $6,300 \text{ VA} \times 0.35 = 2,205 \text{ VA}$
Net lighting and appliance-circuit load = $3,000 + 2,205 = \mathbf{5,205 \text{ VA}}$

Step 5. Fastened-in-place appliances (120.53). Water heater 4,500 + dishwasher 1,200 + disposal 864 + microwave 1,560 = 8,124 VA There are four appliances, so the 75 percent factor applies. $8,124 \text{ VA} \times 0.75 = \mathbf{6,093 \text{ VA}}$

Step 6. Dryer (120.54). Nameplate 5,500 VA is larger than 5,000 VA. One dryer is at 100% (Table 120.54). **5,500 VA**

Step 7. Range (Table 120.55, Column C). One range, 12 kW, not over 12 kW, so Column C = 8 kW. **8,000 VA**

Step 8. Heating or cooling, larger of the two (120.6, 120.51). Heating: strips 10,000 + outdoor unit 6,600 + blower 1,200 = 17,800 VA Cooling: outdoor unit 6,600 + blower 1,200 = 7,800 VA Heating is larger. **17,800 VA**

Step 9. 25 percent of the largest motor (120.50(B), 440.33(3)). Largest motor-compressor: 26.0 A RLA $\times$ 240 V = 6,240 VA 6,240 VA $\times$ 0.25 = **1,560 VA**

Step 10. EV chargers. None in the new-house calc. **0 VA**

Step 11. Total.

Line	VA
Lighting and appliance circuits after demand	5,205
Fastened-in-place appliances at 75%	6,093
Dryer	5,500
Range	8,000
Heat (larger than cooling)	17,800
25% of largest motor	1,560
Total	44,158

Check the addition: 5,205 + 6,093 = 11,298. 11,298 + 5,500 = 16,798. 16,798 + 8,000 = 24,798. 24,798 + 17,800 = 42,598. 42,598 + 1,560 = 44,158.

Step 12. Amps. 44,158 VA $\div$ 240 V = 183.99 A, which rounds to **184 A** (120.5(B)).

Service rating. Next standard size at or above 184 A in Table 240.6(A) is **200 A**.

Service conductors (Table 310.12(A), 200 A). 2/0 AWG copper or 4/0 AWG aluminum.
Check: 200 A $\times$ 0.83 = 166 A. 2/0 Cu at 75 °C = 175 A and 4/0 Al at 75 °C = 180 A (Table 310.16). Both are at least 166 A.

Neutral (120.61).

Line	VA
Lighting and appliance circuits after demand	5,205
Range: $8,000 \times 70\%$ (120.61(B)(1))	5,600
Dryer: $5,500 \times 70\%$ (120.61(B)(1))	3,850
120 V fastened appliances: $(1,200 + 864 + 1,560) \times 75\% = 3,624 \times 0.75$	2,718
Water heater, heat pump, blower, strips (240 V only)	0
Neutral total	17,373

$17,373 \text{ VA} \div 240 \text{ V} = 72.39 \text{ A}$, which rounds to **72 A**. Standard 200 A SE cable has a neutral far larger than 72 A, so the cable as bought is fine.

Picture coming: Standard-method worksheet for the Practice House as a filled form: twelve numbered lines matching Steps 1–12 above, each with the NEC section in a narrow left column, the VA in a right column, the 44,158 VA total boxed, and "184 A → 200 A service, 2/0 Cu or 4/0 Al" written at the bottom.

Worked Example 2: Optional Method (120.82)

Step 1. General load list (120.82(B)), all at 100 percent.

Item	Section	VA
$2,400 \text{ ft}^2 \times 2 \text{ VA/ft}^2$	120.82(B)(1)	4,800
Two small-appliance circuits $\times 1,500$	120.82(B)(2)	3,000
One laundry circuit $\times 1,500$	120.82(B)(2)	1,500
Range at full nameplate	120.82(B)(3)b	12,000
Dryer	120.82(B)(3)c	5,500
Water heater	120.82(B)(3)d	4,500
Dishwasher	120.82(B)(3)a	1,200
Disposal	120.82(B)(3)a	864
Microwave	120.82(B)(3)a	1,560
General load total		34,924

Check the addition: $4,800 + 3,000 = 7,800$. $+ 1,500 = 9,300$. $+ 12,000 = 21,300$. $+ 5,500 = 26,800$. $+ 4,500 = 31,300$. $+ 1,200 = 32,500$. $+ 864 = 33,364$. $+ 1,560 = 34,924$.

Step 2. General demand factor (120.82(B)). First 8,000 VA at 100% = 8,000 VA Remainder: $34,924 - 8,000 = 26,924 \text{ VA}$ $26,924 \text{ VA} \times 0.40 = 10,769.6 \text{ VA}$, carry as 10,770 VA Net general load = $8,000 + 10,770 = \mathbf{18,770 \text{ VA}}$

Step 3. Heating and cooling selections (120.82(C)).

Selection	Math	VA
(C)(1) Air conditioning at 100%	$6,600 + 1,200$	7,800
(C)(2) Heat pump without supplemental heat	Does not apply; this unit has strips	—
(C)(3) Heat pump at 100% + 65% of supplemental heat	$6,600 + 1,200 + (10,000 \times 0.65 = 6,500)$	14,300
(C)(4) 65% of space heat, fewer than four units	Does not apply; strips are central heat covered by (C)(3)	—
(C)(5) 40% of space heat, four or more units	Does not apply	—
(C)(6) Thermal storage at 100%	Does not apply	—

Largest selection: **14,300 VA**.

The blower is counted with the heat pump here because it is part of the split heat pump system. If you count it in Step 1 under 120.82(B)(4) instead, it lands in the 40 percent pile and the answer drops by 720 VA ($1,200 \times 0.60$). Pick one place and count it once.

Step 4. EV chargers (120.82(D)). None. **0 VA**

Step 5. Total and amps. $18,770 + 14,300 = \mathbf{33,070\ VA}$ $33,070\ VA \div 240\ V = 137.79\ A$, which rounds to **138 A**.

Service rating. Next standard size at or above 138 A is **150 A**.

Service conductors (Table 310.12(A), 150 A). 1 AWG copper or 2/0 AWG aluminum.

Check: $150\ A \times 0.83 = 124.5\ A$. 1 AWG Cu at $75\ ^\circ\text{C} = 130\ A$ and 2/0 Al at $75\ ^\circ\text{C} = 135\ A$. Both are at least 124.5 A.

At YES this house still gets a 200 A panel and 200 A conductors, for the reason in Procedure E, Step 2. The calc shows 150 A is the code minimum.

Picture coming: Optional-method worksheet for the Practice House as a filled form, placed side by side with the standard-method form: left column "Standard: 44,158 VA, 184 A, 200 A service"; right column "Optional: 33,070 VA, 138 A, 150 A minimum." Arrows point from the heat line on each form (17,800 VA vs 14,300 VA) and from the range line (8,000 VA at Table 120.55 vs 12,000 VA inside the 40% pile).

Worked Example 3: Existing Dwelling with a 48 A Charger Added (120.83)

Now suppose the Practice House was built with a **150 A service**, which the optional calc in Example 2 allowed. The owner buys an EV and wants a 48 A wall charger. The charger nameplate is 48 A at 240 V.

Charger load: $48\ A \times 240\ V = \mathbf{11,520\ VA}$ (120.57 nameplate).

Step 1. Existing loads (120.83(1)–(3)).

Item	VA
2,400 ft ² × 2 VA/ft ²	4,800
Three 1,500 VA circuits (two small-appliance, one laundry)	4,500
Range	12,000
Dryer	5,500
Water heater	4,500
Dishwasher	1,200
Disposal	864
Microwave	1,560
Larger of heating or cooling: heating = strips 10,000 + outdoor 6,600 + blower 1,200	17,800
Existing load total	52,724

Check: $4,800 + 4,500 = 9,300$. $+ 12,000 = 21,300$. $+ 5,500 = 26,800$. $+ 4,500 = 31,300$. $+ 1,200 = 32,500$. $+ 864 = 33,364$. $+ 1,560 = 34,924$. $+ 17,800 = 52,724$.

Step 2. New loads. New EV charger: 11,520 VA.

Step 3. First 8 kVA at 100 percent (taken from the existing load). 8,000 VA

Step 4. Remainder of existing at 40 percent. $52,724 - 8,000 = 44,724$ VA $44,724 \times 0.40 = 17,889.6$ VA, carry as **17,890 VA**

Step 5. New charger at 80 percent. $11,520 \times 0.80 = \mathbf{9,216\ VA}$

Step 6. Total and amps. $8,000 + 17,890 + 9,216 = \mathbf{35,106\ VA}$ $35,106\ VA \div 240\ V = 146.28$ A, which rounds to **146 A**.

Step 7. Compare. 146 A is at or below the existing 150 A service. The existing service may take the 48 A charger with no upgrade.

That is a 4 A margin. Before you tell the office "no upgrade," check three things on site:

1. The existing service conductors really are rated for 150 A (1 AWG Cu or 2/0 Al per Table 310.12(A)) and are in good shape.
2. The panel has two open spaces for a two-pole breaker, or room for a listed tandem where the label allows it (R1.12).
3. The customer is not also planning a hot tub or a second charger. Any new load added later gets this calc again, and 4 A will not cover it.

If the margin had come out negative, the next options would be a smaller charger setting (a 40 A charger setting on a 50 A circuit gives $9,600 \times 0.80 = 7,680$ VA, and the total drops to 33,570 VA, or 140 A), the 120.7 method, or a power control system (120.7; R1.11).

Picture coming: Existing-dwelling worksheet for the Practice House plus a 48 A charger: an "Existing" box totaling 52,724 VA split into an 8,000 VA bar at 100% and a 44,724 VA bar shrinking to 17,890 VA at 40%; a "New" box with the 11,520 VA charger shrinking to 9,216 VA at 80%; the sum 35,106 VA → 146 A; and a gauge showing 146 A against a 150 A service.

Worked Example 4: Existing Loads from a Year of Utility Data (120.87)

Same house, same 150 A service, same 48 A charger. The customer downloads 12 months of 15-minute interval data from their utility account. The highest 15-minute demand in the year was **10.8 kW** at 6:45 a.m. on a January morning, when the heat strips were running.

Step 1. Check the conditions. - One year of maximum-demand data: yes (120.87(1)). - No solar, no wind, no peak shaving: none present. (This matters only if you use the 30-day exception, but write it down anyway.) - Main breaker sized to the service conductors: yes, 150 A main on 2/0 Al (120.87(3)).

Step 2. Convert the peak to amps. $10.8 \text{ kW} \times 1,000 = 10,800 \text{ W}$ $10,800 \text{ W} \div 240 \text{ V} = \mathbf{45.0 \text{ A}}$

Step 3. 125 percent. $45.0 \text{ A} \times 1.25 = 56.25 \text{ A}$, which rounds to **56 A**

Step 4. Add the new load. Charger nameplate: **48 A** $56 + 48 = \mathbf{104 \text{ A}}$

Step 5. Subtract removed load. None. **104 A**

Step 6. Compare. 104 A is well under 150 A. This method shows 46 A of room left, compared with 4 A from 120.83.

Variation. If the same customer were also replacing the 4.5 kW electric water heater with a gas one, you subtract it: $4,500 \text{ W} \div 240 \text{ V} = 18.75 \text{ A}$, which rounds to 19 A. $104 - 19 = 85 \text{ A}$.

Picture coming: Existing-loads method as a flow picture: a utility interval-usage graph for 12 months with the highest 15-minute bar (10.8 kW, January) circled → " $10.8 \text{ kW} \div 240 \text{ V} = 45 \text{ A}$ " → " $\times 125\% = 56 \text{ A}$ " → "+ 48 A charger = 104 A" → a gauge showing 104 A on a 150 A service with the 46 A of spare capacity shaded.

Worked Example 5: Side by Side, and Why the Answers Differ

Here is the same Practice House under every method, with and without the charger.

Method	Without charger	With 48 A charger	Minimum service
Standard (Part III)	44,158 VA = 184 A	44,158 + 11,520 = 55,678 VA = 232 A	200 A without, 250 A with
Optional (120.82)	33,070 VA = 138 A	33,070 + 11,520 = 44,590 VA = 186 A	150 A without, 200 A with
Existing dwelling (120.83)	—	35,106 VA = 146 A	Existing 150 A is enough
Existing loads (120.87)	—	104 A	Existing 150 A is enough

The arithmetic for the two "with charger" rows: $55,678 \div 240 = 231.99$ A, rounded to 232 A. $44,590 \div 240 = 185.79$ A, rounded to 186 A.

Why the numbers differ:

1. **The heat.** The standard method counts the 10 kW of strips at 100 percent (120.51). The optional method counts them at 65 percent (120.82(C)(3)). The existing-dwelling method lumps the whole heating load into the 40 percent pile. That one line moves the answer by 3,500 to 10,000 VA.
2. **The range.** The standard method uses 8,000 VA for the range (Table 120.55). The optional method puts the full 12,000 VA into the general pile, but 60 percent of everything over 8 kVA disappears, so the range ends up counting for about 4,800 VA.
3. **The 25 percent motor add.** Only the standard method has it (1,560 VA here).
4. **The charger.** Standard and optional count it at 100 percent. The existing-dwelling method counts a new charger at 80 percent. 120.87 counts it at nameplate amps but starts from real usage, which in this house is far below any paper calc.
5. **Real data vs assumptions.** Every paper method assumes the worst reasonable case. 120.87 uses what happened. A family that keeps the thermostat at 68 °F in winter and is gone all day will show a low peak. A family of six with a hot tub will not.

All four answers are code-compliant. The code lets you use any method that applies, and the one you pick depends on the job. For a new service, YES uses the optional method. For adding a charger to an existing service, YES runs 120.83 first because it needs no utility data, and runs 120.87 when 120.83 comes up short.

Worked Example 6: Check Yourself Against Annex D Example D2(c)

The NEC's own example D2(c) is a one-family house with a heat pump, figured by the optional method. Work it yourself before reading the answer. If your number matches, your method is right.

Given (Annex D, Example D2(c)): 2,000 ft². 12 kW range. 4.5 kW water heater. 1.2 kW dishwasher. 5 kW dryer. 2½-ton heat pump, 24 A at 240 V, with 15 kW of supplementary heat. Two small-appliance circuits and one laundry circuit.

General load: $2,000 \times 2 = 4,000$ Small-appliance: 3,000 Laundry: 1,500 Range: 12,000 Water heater: 4,500 Dishwasher: 1,200 Dryer: 5,000 Total: 31,200 VA

Demand: First 8,000 at 100% = 8,000 Remainder $23,200 \times 0.40 = 9,280$ Net general load = 17,280 VA

Heat pump selection (120.82(C)(3)): $240\text{ V} \times 24\text{ A} = 5,760\text{ VA}$ $15,000\text{ VA} \times 0.65 = 9,750\text{ VA}$
 $5,760 + 9,750 = 15,510\text{ VA}$

Total: $17,280 + 15,510 = 32,790\text{ VA}$ $32,790 \div 240 = 136.6\text{ A}$, which rounds to 137 A. The Annex states 137 A and a 150 A service.

If you got 32,790 VA, you are doing the optional method right.

Worked Example 7: A Power Control System in the Calc (120.7)

A power control system (PCS) is a listed device that watches current and turns a load down so the service never goes over a set point. Many EV chargers have one built in (R1.11 calls this energy management). NEC 2026 120.7 lets you use a PCS in the load calc, if it meets Article 130 Part II and a qualified person sets its control setting at no more than 80 percent of the breaker it is watching (120.7(B)).

120.7(C)(1) gives two cases:

PCS watches	What you put in the calc for the controlled load
Only the controlled loads	The PCS control setting
Both controlled and uncontrolled loads (for example, current sensors on the service)	The minimum operating current of the controlled loads

Annex D Example D15 works four versions of this on a house whose calc is 29,040 VA (121 A) on a 100 A utility service. In Example D15(b), a 30 A charger with an 8 A minimum operating current is controlled by a PCS watching the whole service at 80 A. The uncontrolled loads stay at 21,840 VA (91 A). The charger is counted at its 8 A minimum, which is 1,920 VA. The total is 23,760 VA, or 99 A, which fits the 100 A service.

Applied to the Practice House with the 150 A service: if the 48 A charger has a PCS that watches the whole service and can turn the charger down to 0 A, the charger counts as 0 VA in the calc. The uncontrolled loads are the 120.83 or optional number without the charger. R1.11 walks through the commissioning.

Safety Warnings (Summary)

The warnings are placed in the procedures where they apply. Here they are in one list for review:

1. Read nameplates without opening electrical access panels. If a panel has to come off, open the disconnect and verify dead with a meter first (Before You Start).
 2. Do not reach behind a corded range or dryer that is plugged in.
 3. Do not remove a panel dead front to read conductors unless you are qualified and in PPE. A helper asks a journeyman.
 4. A 30-day recording meter on live service conductors is energized work. Only a journeyman installs it (Procedure D).
 5. A calc that says "no upgrade needed" by a thin margin means the panel will run close to its rating. Check the condition of the existing service conductors, main breaker, and meter base before you trust an old service with a new continuous load like a charger. Heat-discolored lugs or a meter base with a burnt jaw get replaced regardless of what the calc says (R2.7, R-SERVICE).
-

Common Mistakes

Mistake	What happens	The fix
Using 3 VA/ft ² for the service calc	The general lighting line is 50 percent too high, and the service comes out a size bigger than needed.	Use 2 VA/ft ² for the service and feeder (120.41). 3 VA/ft ² is only for counting lighting branch circuits (120.13).
Using the outdoor unit's MCA as its load	The compressor's 25 percent gets counted twice in the standard method.	Use RLA plus fan FLA. Add 25 percent of the largest motor once, in its own line.
Adding heat and AC together	The calc is 7,800 VA too high in the Practice House.	Count only the larger (120.6).
Forgetting the compressor when strips and compressor run together	The heat line is too low.	Count both unless the manual says the strips lock out the compressor (120.82(C)(3)).
Putting the range at 8 kW in the optional method	The optional calc comes out low.	Optional uses full nameplate inside the 40 percent pile (120.82(B)(3)b). Table 120.55 is for the standard method.
Putting the dryer or range into the 75 percent appliance group	The standard calc comes out low.	120.53 excludes cooking, dryers, heat, AC, and EV chargers.
Applying 75 percent to the EV charger	Under-sized service.	120.53(5) excludes chargers. 120.57 counts them at nameplate.
Adding 125 percent to the charger in the load calc	The calc comes out 2,880 VA high for a 48 A charger.	120.5(E): load calculations do not require 125 percent for continuous loads. The 125 percent goes on the charger's branch circuit (R1.11).
Rounding each line instead of only the final amps	Small errors add up.	Keep VA exact to the end; round amps once (120.5(B)).
Reading the 60 °C column for service conductors	Wire one size too big, or a wrong "fail."	Service terminals over 100 A are 75 °C (110.14(C)(1)(b)). Field cheat sheets, including the Arc Guide's wire table, mix 60 °C ampacities with 75 °C breakers. Read Table 310.16 yourself.
Using Table 310.12(A) for SE cable in a hot attic	Conductors run over their real ampacity.	Apply Table 310.16 with temperature correction, then compare to 83 percent of the rating (Annex D Example D7).
Using monthly kWh as "demand" for 120.87	The method is not allowed, and the answer is meaningless.	120.87 needs 15-minute maximum demand for a year, or a 30-day recording.

Mistake	What happens	The fix
Using 120.87 on a house with solar	Not allowed for the 30-day exception.	The 30-day exception is barred with solar, wind, or peak shaving (120.87(1) Exception). Use 120.83.
Counting an attached garage or porch in the floor area	Lighting load too high.	120.5(C) excludes detached garages, open porches, and unfinished areas that cannot become living space. Ask the inspector about attached garages.

Field Exercise

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

Part 1: The same house three ways

Use the Practice House in this chapter. Do not look at the worked examples while you work. Then compare.

1. Fill out the standard-method worksheet line by line. Write the NEC section next to every line. Get the total VA, the amps, the service rating, the service conductors in copper and aluminum, and the neutral amps.
2. Fill out the optional-method worksheet. Work all six heating and cooling selections and mark the one you used. Get the total VA, amps, service rating, and conductors.
3. Assume the house has a 150 A service. Fill out the existing-dwelling worksheet with a 48 A charger added. State whether the existing service can take it and by how many amps.
4. Write the three answers in a table like Worked Example 5. Under the table, write one sentence for each line that changed (heat, range, motor add, charger) saying why the methods disagree.
5. Redo Step 3 with a 40 A charger setting instead of 48 A, and write the new margin.

Pass: your three totals match this chapter's within 1 VA (only rounding should differ), and your explanation names the heat line and the range line.

Part 2: A real customer's house

1. With a journeyman, survey a real customer's house using the survey steps in "Before You Start." Photograph every nameplate. Measure the outside of the house.
2. Ask the customer to download 12 months of interval usage from their utility account, or to request the 12-month peak demand. Note what the utility actually gives you: 15-minute demand, hourly kWh, or monthly kWh only.
3. Run the standard method and the optional method on the house as it stands.
4. Run the existing-dwelling method (120.83) for the load the customer wants to add. If they have no plans, use a 48 A charger.

5. If the utility data is 15-minute demand for 12 months, run 120.87. If it is not, write which condition of 120.87 is not met and stop there.
6. For each method, state the service size and the conductor size it requires, and say whether the existing service is enough.
7. Write a one-paragraph explanation for the office: which method you used for the recommendation, the margin, and anything you saw on site (conductor condition, panel spaces, burnt meter jaws) that changes the answer.
8. Put the worksheets and nameplate photos in the job folder.

Field photo coming: The apprentice's completed four-method worksheet for a real customer house, laid on the truck tailgate next to a phone showing the utility's 12-month interval-usage graph with the peak day circled. Customer name and address covered.

Practice Questions

The question bank at has a small set of load-calc questions. Work these three after this chapter: SP-004 (service conductor for a 30,320 VA load at 120/240 V), SP-531 (feeder conductor for a 208Y/120 V load), and SP-012 (rounding). Their code references are NEC 2023 Article 220. Use the 2026 numbers in this chapter to find the same rules.

Then work these, using the Practice House:

1. The customer swaps the 12 kW electric range for a gas range. Redo the optional method. (Answer: general load $34,924 - 12,000 = 22,924$; $8,000 + 14,924 \times 0.40 = 8,000 + 5,969.6 = 13,970$ VA carried; plus 14,300 = 28,270 VA; 117.79 A, rounds to 118 A; 125 A minimum service.)
 2. The heat pump's install manual says the strips lock out the compressor. Redo selection (C) (3). (Answer: compressor need not be added, so $1,200 + 6,500 = 7,700$ VA, which is now smaller than (C)(1) at 7,800 VA. Use 7,800. Total $18,770 + 7,800 = 26,570$ VA, 110.71 A, rounds to 111 A; 125 A minimum.)
 3. Using 120.87 with a 10.8 kW peak, how large a charger can the 150 A service take? (Answer: $150 - 56 = 94$ A of room, so the 48 A charger fits with 46 A to spare.)
-

NEC 2026 Cross-References

Section	What it covers	NEC 2023 number
120.1	Scope and organization of Article 120; Annex D for examples	220.1
120.5(A)	Nominal voltages for calculations (120/240 V)	220.5(A)
120.5(B)	Rounding to the nearest whole amp	220.5(B)
120.5(C)	Floor area from outside dimensions; exclusions	220.5(C)
120.5(E)	No 125 percent required for continuous loads in load calcs	new
120.6	Noncoincident loads	220.60
120.7	Power control systems in load calcs	new
120.13	3 VA/ft ² for counting dwelling branch circuits	—
120.41	Dwelling minimum unit load, 2 VA/ft ²	Table 220.12
120.45, Table 120.45	Lighting demand factors	220.42, Table 220.42
120.50	Motors and air conditioning in feeder and service calcs	220.50
120.51	Fixed electric space heating at 100 percent	220.51
120.52	Small-appliance and laundry circuits, 1,500 VA each	220.52
120.53	75 percent for four or more fastened-in-place appliances	220.53
120.54, Table 120.54	Dryers	220.54
120.55, Table 120.55	Ranges and cooking appliances	220.55
120.57	EV charger load	220.57
120.61	Neutral load	220.61
120.82	Optional method, one dwelling	220.82
120.83, Table 120.83	Existing dwelling	220.83
120.85	Two dwelling units	220.85
120.87	Existing loads from maximum demand	220.87
230.42	Service-entrance conductor size and rating	230.42
230.79, 230.79(C)	Service disconnect rating; 100 A minimum, one-family	230.79
240.4	Conductor protection	240.4
240.6(A), Table 240.6(A)	Standard breaker ratings	240.6(A)
	Dwelling services and feeders, 83 percent rule	310.12

Section	What it covers	NEC 2023 number
310.12, Table 310.12(A)		
Table 310.16	Conductor ampacities	Table 310.16
110.14(C)	Terminal temperature ratings	110.14(C)
440.33	25 percent of the largest motor-compressor	440.33
Informative Annex D	Examples D1(a), D1(b), D2(a), D2(b), D2(c), D7, D15	Annex D (D14 in some references)

End-of-Chapter Checklist

- ☐ I measured floor area from the outside dimensions and left out detached garages, open porches, and unfinished areas that cannot become living space.
- ☐ I used 2 VA/ft² for the service calc and 3 VA/ft² only for counting lighting circuits.
- ☐ I counted every small-appliance and laundry circuit at 1,500 VA.
- ☐ I photographed every nameplate and turned each into VA correctly.
- ☐ I used RLA plus fan FLA for outdoor units, never MCA or MOP.
- ☐ In the standard method, I applied Table 120.45, the 75 percent appliance factor only to qualifying appliances, Table 120.54, Table 120.55, the larger of heat or cooling, and 25 percent of the largest motor.
- ☐ In the optional method, I put full nameplates in the general pile, took 8,000 VA at 100 percent and the rest at 40 percent, worked all six heating and cooling selections, and added EV chargers at 100 percent.
- ☐ In the existing-dwelling method, I used the larger of heat or cooling, took the first 8 kVA from the existing load, and used 40, 80, and 50 percent for the right rows.
- ☐ For 120.87, I confirmed a full year of 15-minute maximum demand (or a proper 30-day recording with no solar or peak shaving), multiplied by 125 percent, added new load, and subtracted removed load.
- ☐ I rounded only once, at the amps, per 120.5(B).
- ☐ I picked the next standard service rating and never less than 100 A.
- ☐ I sized service conductors with Table 310.12(A) or with Table 310.16 plus corrections at 83 percent of the rating, at the 75 °C column.
- ☐ I calculated the neutral with 70 percent for the range and dryer.
- ☐ I checked my optional method against Annex D Example D2(c) and got 32,790 VA.
- ☐ I wrote down which edition the AHJ enforces.
- ☐ The worksheet and nameplate photos are in the job folder.

Sources

- NFPA 70, National Electrical Code, 2026 edition: Article 120 (lines 10069–10990), 230.42 and 230.79 (lines 14125–14625), 240.4 and Table 240.6(A) (lines 14897–15030), 310.12 and Table 310.12(A) (lines 26210–26275), Table 310.16 (line 26652), 110.14(C) (line 8947), 440.33 (line 45330), Informative Annex D Examples D1(a) through D2(c) (lines 92995–93290), D7 (line 93899), D15 (lines 94336–94470). -: questions SP-004, SP-012, SP-531. -: Topic 1 and Topic 7 load-calculation notes (short; this chapter goes further).
 - Arc Workforce, Residential Electrical Field Guide, Part 4, Job 10 (Panel Labeling and Load Survey), for the survey habit; its wire table in the Wiring section mixes 60 °C ampacities with breaker sizes and is not used for sizing here.
 - ARC Appendix A, RTI course "Load Calculations — Residential" (36 hours); this masterclass is that course.
-

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
Plain-Language Background / Procedure A step 1: why NEC 2026 uses 2 VA per sq ft (120.41) and keeps 3 VA only for counting branch circuits (120.13)	2026 NEC Changes: Dwelling Unit Loads National Fire Protection Association • 5:34 NFPA walks through the 2026 code on screen showing Article 220 moved to Article 120, the drop from 3 VA to 2 VA per square foot for the service calc, and the new rule that still uses 3 VA to count lighting branch circuits.
Procedure A steps 1-3: 2 VA/sq ft from outside dimensions, plus 1,500 VA per small-appliance and laundry circuit	Lesson 2.2 (2026 Version) Article 120 2 VA Per Sq Ft Load Calculations Free Electrical Exam Prep Electrical Code Coach • 9:38 Worked practice problems on measuring floor area from the outside walls, leaving out open porches, multiplying by 2 VA, and adding 4,500 VA for two small-appliance circuits and one laundry circuit. Caution: Exam-prep framing. One example counts a 500 sq ft attached garage in the floor area without comment; the module says 120.5(C) only excludes detached garages and to ask the inspector about attached garages.
Procedure A / Worked Example 1: a full standard-method calc (Table 120.45 demand, fixed appliances, dryer, range Table 120.55, larger of heat or cool)	Lesson 4.3 2026 Full Whole House Load Calculation Electrical Exam Prep Electrical Code Coach • 4:40 One 1,600 sq ft house worked start to finish with the NEC 2026 numbers: first 3,000 VA at 100 percent and the rest at 35 percent, three appliances at 100 percent, 5,000 VA dryer, 8 kW for an 11 kW range, then the larger of heating or cooling. Caution: Short exam problem. It does not add 25 percent of the largest motor (module Step 9, 440.33) or an EV charger, and it tells test-takers not to add a blower motor the question did not list; on a real house the module has you count the indoor blower.
Procedure B: optional method for one dwelling (120.82), first 8 kVA at 100 percent and the rest at 40 percent, plus the largest 120.82(C) heating/cooling selection	Lesson 5.1 2026 Optional Feeder and Service Calculations Electrical Exam Coach Section 120.82(B) Electrical Code Coach • 6:58 Shows the optional method with 2026 numbers: 2 VA/sq ft, 4,500 VA for kitchen and laundry circuits, every appliance at nameplate (no 5,000 VA dryer minimum, no range table), first 8,000 VA at 100 percent and the remainder at 40 percent, then the heating or cooling selection added on. Caution: The heat pump example just takes the 10 kW heat as 'the larger' without walking through the six 120.82(C) selections (for example 65 percent of supplemental heat in (C)(3)); use the module's table for that step. No EV charger in the example.

Procedure C: existing-dwelling method (120.83) and the new NEC 2026 Table 120.83 percentages (8 kVA at 100, existing remainder 40, new EV 80, new resistance heat 80, other new 50)	Can Your Service Handle It? (220.83 Load Calculation Explained) CMECP® Program • 24:53 An instructor explains when the existing-dwelling method is allowed, how to gather the loads in the house, and then reads the new 2026 table line by line, including why a new EV charger is taken at 80 percent of nameplate. Caution: Recorded before NEC 2026 was final, so it calls the section 220.83 and the table a proposal. The first half teaches the NEC 2023 two-case version (A/B) using 3 VA per sq ft; the module uses only the 2026 single-table method with 2 VA per sq ft. Watch from about the halfway point for the 2026 table.
Procedure D: existing loads from a year of utility maximum-demand data (120.87), the 30-day recording exception, and 125 percent of peak plus the new load	220.87 - Determining Existing Loads Stallcup Electrical Education • 4:49 Reads the three conditions: one year of 15-minute maximum-demand data (or a 30-day recording on the highest-loaded leg while occupied), 125 percent of that peak plus the new load not exceeding the service rating, and overload protection on the service, plus why the 30-day exception is barred on houses with solar or peak load shaving. Caution: Uses the NEC 2023 number 220.87; NEC 2026 moved it to 120.87 with the same three conditions. It does not mention subtracting removed load, which the module's condition 2 includes.