

The Four Components on Real Equipment

YES Electric • Arc Workforce Academy HVAC Apprenticeship

Draft 1 (October 2026). This lesson is under review. Videos are made by other companies, not YES Electric; follow this lesson and your journeyman where they differ. Boxes marked "Shop photo coming" will get real photos from our shop in a later version.

Unit 1 • HVAC Fundamentals • Appendix A Competency 4 — "Identify system components: compressor, condenser, evaporator, metering device" **Class time:** ~4 hrs (1.5 video/discussion + 2.5 bench)

1. What you'll be able to do

- Open up any residential unit and **identify every major component by sight** — not just the big four, but the supporting cast: service valves, filter drier, accumulator, capacitor, contactor, defrost board.
- Tell apart the **three compressor types** (scroll, reciprocating, rotary) and the **four metering device types** (TXV, piston, EEV, capillary tube) on sight.
- **Read a rating plate** and pull off it: tonnage, refrigerant type, factory charge, design pressures, electrical requirements (MCA/MOP).
- Know what each component looks like when it lives in a heat pump vs straight AC vs mini-split.

Lesson 1.1 gave you the map. This lesson teaches you the territory — what the parts actually look like with the panels off.

2. Tools & materials

- Shop units with panels pulled: split AC condenser, heat pump condenser, gas furnace + A-coil, mini-split (indoor + outdoor)
- A scrapped compressor (cut open if we have one — see the cut-open video below)
- Assorted dead parts box: TXV, piston body, cap tube coil, filter drier, accumulator
- Flashlight, phone camera (students photograph and label parts)

3. Watch first

Order	Video	Channel	Length	Why
1	Outdoor Heat Pump Electrical & Refrigerant Components Walkthrough	AC Service Tech	14:25	Panel-off tour of every part in the outdoor unit
2	Heat Pump Component Tour in 3D	HVAC School	20:51	Same tour, animated — see inside the parts
3	Scroll, Reciprocating, Rotary Compressors — Cut Open!	AC Service Tech	7:27	The three compressor types with the shells cut off
4	HVAC Metering Device Types: EEV, TXV, TEV, Piston, Cap Tube	AC Service Tech	19:10	Every metering device, where it lives, what fails
5	Reading the Rating Plates of an Air Conditioner	AC Service Tech	9:54	Size, refrigerant, pressures, electrical off the plate
Short reviews	Evaporator 101 · Condenser Basics · Compressor Basics	HVAC School	10:20 / 4:18 / 9:31	One per component, night-before review

4. The components up close

Compressors — the three you'll meet

THE THREE HERMETIC COMPRESSOR TYPES

SCROLL

SCROLL — most residential AC & heat pumps — two spirals, one orbits

RECIPROCATING

RECIPROCATING — older units, refrigeration — pistons and valves

ROTARY

ROTARY — mini-splits and window units — compact, inverter-driven

Type	Looks like	Where you'll find it	Field notes
Scroll	Tall smooth cylinder, often a hump-top; quiet smooth hum	Most residential AC/HP since ~2000	Two spirals, one orbits. Hates liquid but tolerates brief slugs. Can run backwards if 3-phase miswired — screams
Reciprocating	Shorter, rounder "pot"; knocks/clunks at start	Older units, refrigerators, some commercial	Pistons + valves. Valves are the wear item — bad valves = low capacity, covered in Unit 8 diagnostics
Rotary	Small, skinny cylinder	Mini-splits, window units, small condensers	Compact and cheap; almost always inverter-driven in ductless

All residential compressors are **hermetic** — motor and pump sealed in one welded steel can. You don't rebuild them; you diagnose them (Unit 6) and replace them.

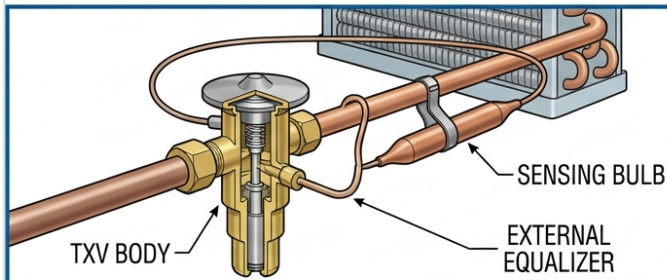
Condensers & evaporators — same part, different job

A coil is a coil: copper tubes (or all-aluminum microchannel), aluminum fins, air forced across. What makes it a condenser or an evaporator is only which direction heat moves.

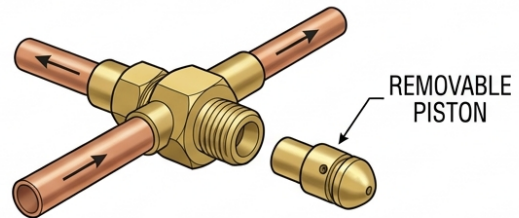
- **Condenser:** wraps 2-4 sides of the outdoor unit. Fins take the beating from weather — comb-able if bent, replace-the-coil if crushed.
- **Evaporator:** hides indoors above the furnace (**A-coil** — two slabs in a tent shape), or slants inside an air handler (**slant coil**), or sits in the mini-split head wrapped around the blower. Always has a **drain pan** under it — cold coil = condensate, every time.
- **Microchannel** coils (flat aluminum tubes, looks like a car radiator): lighter, cheaper, but repair is specialty work and they hold less refrigerant — you'll see them on newer condensers.

Metering devices — the four types

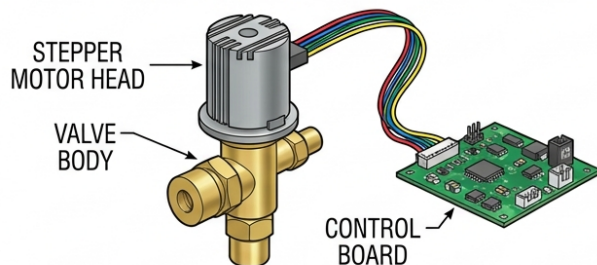
METERING DEVICE TYPES



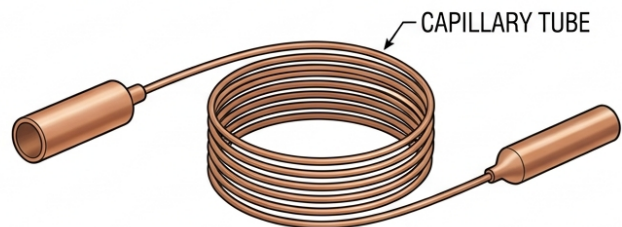
TXV — self-adjusting mechanical — charge by SUBCOOLING



PISTON (fixed orifice) — no adjustment — charge by SUPERHEAT



EEV — electronic, board-controlled — mini-splits & inverters



CAP TUBE — refrigerators, window units, old equipment

Type	Looks like	Adjusts itself?	Where
TXV/TEV	Brass body at the coil inlet with a sensing bulb strapped to the suction line + thin equalizer tube	Yes — mechanical, holds superheat steady	Most modern split systems
Piston (fixed orifice)	Small brass union at the coil inlet; the orifice hides inside	No — fixed hole	Older/budget equipment; charge method differs (Unit 5!)
EEV/LEV	TXV-looking body with a stepper motor head and wires	Yes — electronically, board-commanded	Every mini-split & inverter system; spreading into unitary
Capillary tube	Long skinny copper spaghetti, often coiled	No	Refrigerators, window units, old equipment

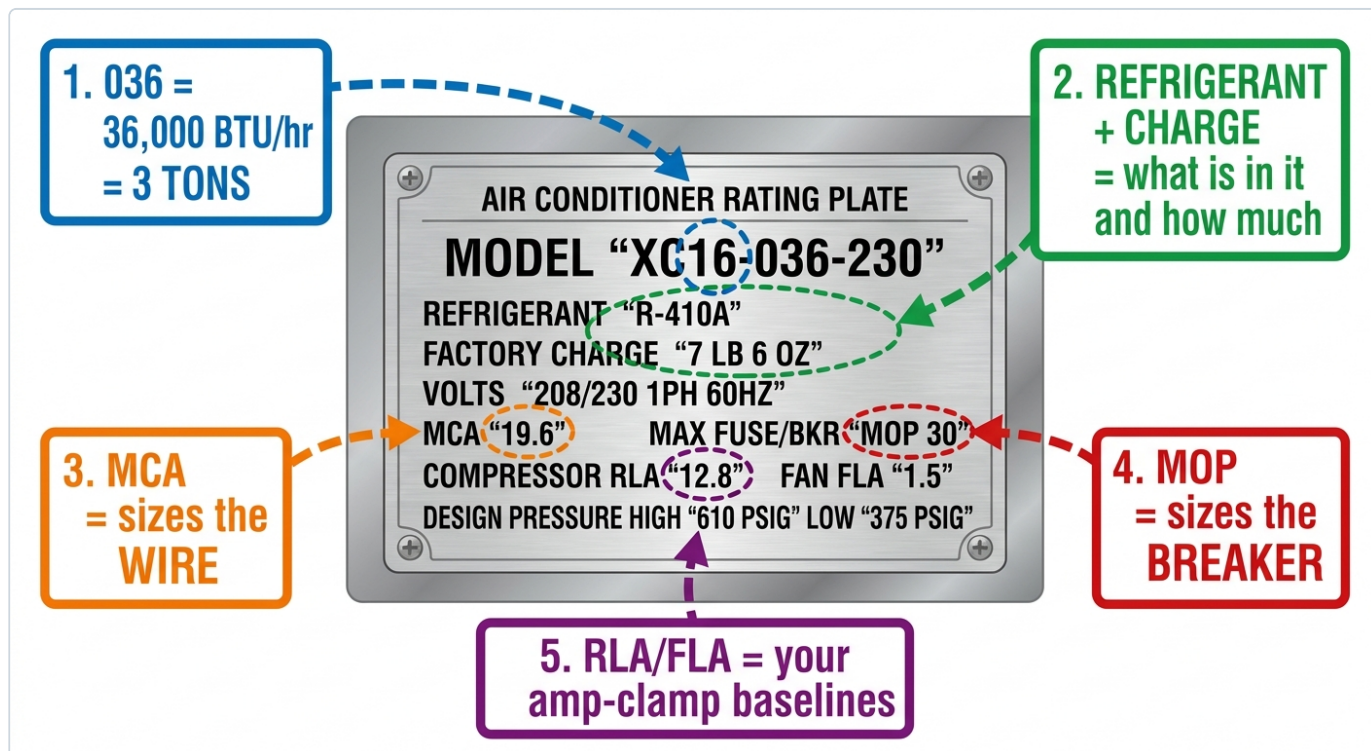
Field rule: identify the metering device BEFORE you charge anything — TXV = charge by subcooling, fixed orifice = charge by superheat (Lessons 5.4-5.5). Mistaking one for the other is the #1 rookie charging error.

The supporting cast (outdoor unit, panel off)



- **Service valves** — where your gauges connect: small = liquid line, large = suction. Caps are the final leak seal — hand-start, wrench-snug.
- **Filter drier** — the system's kidney; catches moisture and debris. On the liquid line. Replaced any time the system is opened. **Biflow** driers (two arrows) on heat pumps.
- **Accumulator** — tank on the suction line before the compressor; catches liquid before it can slug. Standard on heat pumps.
- **Capacitor** — silver can, stores the start/run kick for motors. The most-replaced part in the trade (Lesson 3.5).
- **Contactor** — the 24V-commanded switch that powers the unit (Lesson 3.6).
- **Defrost board + reversing valve** — heat pumps only; full story in Unit 8. For now: brass 4-line valve on top of the pipework = it's a heat pump, not an AC.
- **Crankcase heater** — warm band around the compressor base; keeps refrigerant out of the oil on cold nights.

Reading the rating plate



Find and record, from any plate:

1. **Model number → tonnage:** look for the BTU code — 18/24/30/36/42/48/60 = 1.5 to 5 tons (divide by 12: a "36" is 36,000 BTU/hr = 3 tons).
2. **Refrigerant type & factory charge** (e.g., R-410A, 7 lb 6 oz) — and on R-32/R-454B units, the A2L flame symbol.
3. **Design pressures** (high/low side test pressures).
4. **Electrical:** voltage, phase, **MCA** (minimum circuit ampacity — wire size) and **MOP/MaxFuse** (max overcurrent protection — breaker size). These two numbers rule the electrical hookup (Lesson 3.8).
5. **RLA/FLA** of compressor and fan — your amp-clamp baselines forever after.

5. Bench procedure — the scavenger hunt

Teams of two, four stations, 20 minutes each, rotate. At every station fill in the same worksheet:

1. **Station A — split AC condenser (panels off):** identify compressor (which type?), coil, fan, service valves, capacitor, contactor, filter drier. Photograph each, label the photo.
2. **Station B — heat pump condenser:** everything from A **plus** reversing valve, defrost board, accumulator, biflow drier, crankcase heater. Write down the two visual giveaways that scream "heat pump" (reversing valve + accumulator/defrost board).
3. **Station C — furnace + A-coil:** find the evaporator, metering device (TXV — find the sensing bulb AND the equalizer tube), drain pan, primary & secondary drains.

4. **Station D — mini-split pair:** find the rotary compressor, EEV (follow its wires to the board), wrapped evaporator in the head, flare connections. Note what's MISSING vs station A (no contactor, no run capacitor — inverter board does both jobs; foreshadows Unit 9).
5. **Every station:** read the rating plate → tonnage, refrigerant, charge, MCA/MOP on the worksheet.

Checkout (graded, pass/redo): instructor hands the student five parts from the dead-parts box — student names each, states its job, and says which line it lives on (liquid/suction/discharge). Then on one live unit: full component walk-through unprompted. This completes **Competency 4** at mentor-guidance level.

6. Field gotchas

- **TXV bulb strap loose or unwrapped** — you'll find this constantly; the valve overfeeds/hunts. Note it now, fix it in Unit 5.
- **The "what's the tonnage" trap:** model number says what it IS; the rating plate + coil match says what it DELIVERS. Mismatched coil/condenser = neither number is the truth (Manual S, Lesson 12.1).
- **A2L plates:** R-32/R-454B units carry a flame symbol and different service fittings. Spot it on the plate FIRST — it changes your tools and your torch rules (Lesson 5.8).
- **Microchannel + sweat-on filter drier = trouble:** aluminum coil repairs and brazing near microchannel need different rod and technique (Lesson 4.3 covers it).
- **Missing caps on service valves = slow leak waiting to happen.** Caps are the seal; Schraders are just the door.

7. Competency link

- **Competency 4** — completed here (checkout in §5).
- Feeds: every charging lesson (metering device ID decides the method), Unit 6 electrical (capacitor/contactor), Unit 8 (reversing valve/defrost board), Unit 9 (EEV/inverter parts), Lesson 3.8 (MCA/MOP).

8. Check yourself

1. Three hermetic compressor types — name them and where you'd expect each.
2. What two visual features tell you an outdoor unit is a heat pump, not an AC?
3. You see a brass body at the coil inlet with a bulb strapped to the suction line. What is it, and what charging method does it dictate?
4. What does the filter drier do, and when must it be replaced?
5. Rating plate says "036" in the model and MCA 19.6 / MOP 30. Tonnage? What do the two electrical numbers size?
6. Where does the accumulator live and what does it prevent?

7. Which metering device has wires, and what's driving it?
 8. Why does every evaporator have a drain pan under it?
 9. On the mini-split, where did the contactor and run capacitor go?
 10. What symbol on a rating plate tells you the unit holds an A2L refrigerant, and what does that change?
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Arc Workforce Academy · YES Electric LLC Apprenticeship 2026-AL-141731 · Lesson 1.2 v1.0
(2026-06-10)