

Charging by Subcooling (TXV/EEV Systems)

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 5 • Refrigerants, EPA 608 & Charging • Appendix A Comp 16 — "Charge systems using subcooling method (TXV systems)" **Class time:** ~4 hrs (1 video + 3 bench) — requires EPA cert (5.2 gate)

1. What you'll be able to do

- Explain in one breath why **TXV systems charge by subcooling**: the valve holds superheat steady, so charge level shows up as liquid stacked in the condenser — which is what subcooling measures (1.4's "stacking liquid").
- Find the **target subcooling**: the data plate (most units post it — typically 8–12°F), and the fallback when it's not posted.
- Measure actual subcooling (1.4 verbatim: liquid pressure → sat temp, liquid line clamp, subtract) and **adjust to target $\pm 2\text{--}3^\circ\text{F}$** in patient moves.
- Keep **superheat as the bodyguard**: charge by subcool, but verify SH stays sane (valve working + compressor safe) — the "why measure both" discipline.
- Run the same professional sequence as 5.4 (airflow → stabilize → conditions → target → actual → adjust → settle → verify → document) — the sequence is the constant; only the target number changed.

2. Tools & materials

- TXV-metered bench system (our 5.4 unit's sibling), R-410A supply, recovery rig + scale
- Probes/gauges, liquid-line clamp; data-plate photos incl. two with NO posted target
- Charging worksheet

3. Watch first

Order	Video	Channel	Length	Why
1	Why Charge a TXV System in Subcooling (and why superheat won't work)	AC Service Tech	5:51	The why, fast
2	Setting a Charge by Subcool on a TXV System — 3D	HVAC School	10:36	Inside the condenser while you charge
3	Subcooling Charging Method Directions	AC Service Tech	5:10	The procedure, tight
4	Charging a Very Low R-410A Unit by Subcooling	AC Service Tech	20:45	The long real-time version
5	Subcooling — 4 Scenarios + Undercharged→Overcharged walkthrough	AC Service Tech	5:48 / 12:35	The quiz reels
6	When Target Subcooling Isn't Posted	AC Service Tech	4:13	The fallback

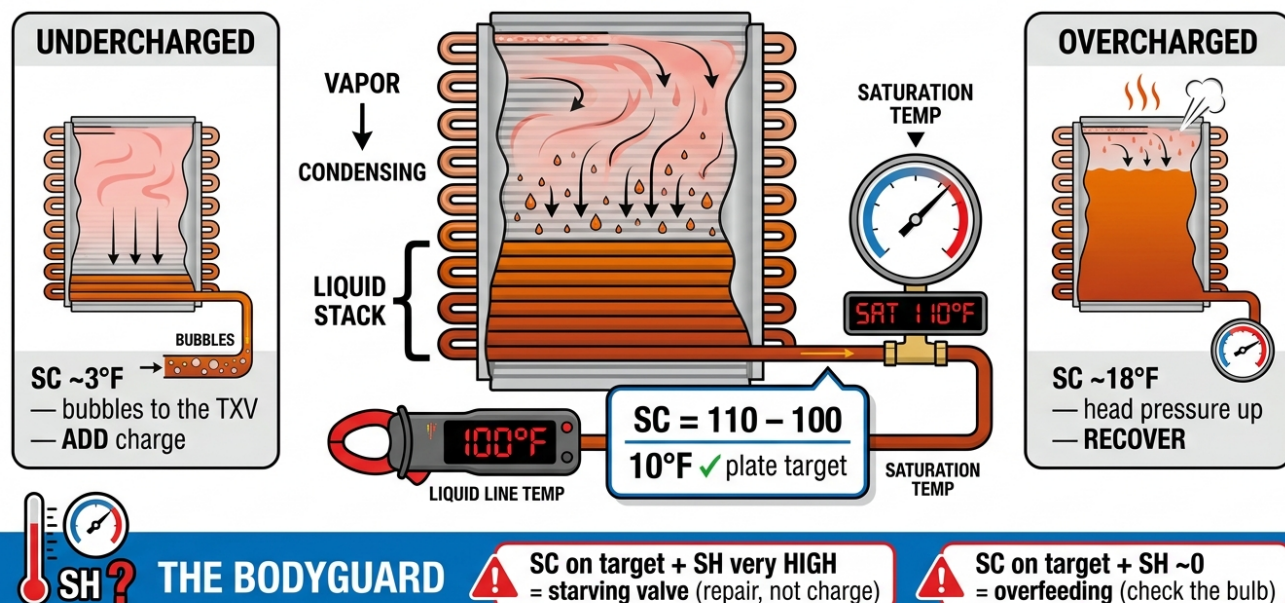
4. The idea

Why subcooling is the TXV's charge gauge

The TXV's whole job (1.2, 1.4) is holding evaporator superheat constant — it opens and closes to keep its setpoint no matter how much refrigerant you add. So superheat goes numb as a charge indicator. Where does added refrigerant go instead? **It stacks as liquid in the bottom of the condenser.** More stacked liquid = liquid cools further below condensing temp = **higher subcooling**. Less charge = thin liquid seal = low subcooling (and bubbles to the valve). Subcooling reads the stack height directly:

Add charge → subcooling rises. Recover → subcooling falls. Same patient-moves discipline as 5.4, different dial.

SUBCOOLING = READING THE LIQUID STACK



The target

- **First: the data plate / install manual.** Most condensers post it ("CHARGE TO 10°F SC @ 95°F" style). That number wins — the engineers sized the condenser.
- **Not posted (older gear, worn plates):** the industry fallback band **8-12°F** (the 4:13 video's method); aim mid-band, mind the conditions, note the assumption on the ticket.
- High-SEER multi-row condensers sometimes spec up to 14-16°F — another reason the plate beats folklore.

The sequence (the 5.4 spine, re-aimed)

Airflow first → stabilize 10-15 → conditions noted (no wet-bulb requirement for the target this time — but log conditions anyway) → **target from the plate** → actual SC measured → adjust (add to raise / recover to lower) in throttled moves with 5-10 min settles → land $\pm 2-3^\circ\text{F}$ → **verify superheat is sane (~6-14°F at the condenser)** → document incl. lbs moved.

Superheat the bodyguard (why both, always)

Charging a TXV by subcool while ignoring superheat misses two failure stories:

- **SC perfect + SH very HIGH** → valve starving the coil (TXV restriction/failing, plugged screen — 4.4's oxide!) → that's a **REPAIR**, not a charge problem. Adding more gas just raises SC.
- **SC perfect + SH near zero** → valve overfeeding (bulb loose/unwrapped — 1.2's field find) → flood-back risk.

Both numbers healthy = charge right AND valve right. One measurement is a number; two is a diagnosis (5.7 builds the full matrix next).

5. Bench procedure

1. **Quiz reels first:** the 4-scenario + walkthrough videos, pause-verdict-reveal, scored.
2. **Target hunt:** six data-plate photos — find the posted SC on four; apply the fallback on the two blanks, narrating the assumption.
3. **Undercharged round:** bench TXV unit set low (SC $\sim 3^{\circ}\text{F}$, bubbles in the sight glass if we have one). Full sequence: add in throttled moves to plate target. Watch SH during — barely moves (the valve doing its job; the 5.4 contrast made flesh).
4. **Overcharged round:** unit set heavy (SC $\sim 18^{\circ}\text{F}$, head pressure up): recover to target. Note head pressure falling as the stack shrinks — efficiency recovered with every ounce out.
5. **The bodyguard round:** instructor's rigged unit — restricted TXV (valve partially plugged). SC lands on target but SH reads 25°F . The pass = refusing to call it "charged" and naming the real problem.
6. **Documentation close** every round: conditions, target source (plate vs fallback), final numbers, lbs moved.

Checkout: unaided full sequence on an unknown-state TXV unit — plate target found, charge corrected the right direction, landed $\pm 3^{\circ}\text{F}$, superheat verified and interpreted, documented.

Comp 16 SIGNED (guided).

6. Field gotchas

- **The #1 TXV-system misdiagnosis:** high superheat read as low charge $\rightarrow$ gas added $\rightarrow$ subcool climbs $\rightarrow$ head climbs $\rightarrow$ still high SH. The bodyguard round is this call. Check SC FIRST on a TXV system; it tells you if charge is even the question.
- **Heat pumps in heat mode don't follow this lesson** — heating-mode charging is charts/ weigh-in (8.5). This lesson is cooling-mode TXV.
- **Sight glasses lie on 410A blends** (flash bubbles at healthy charge) — charge to numbers, glance at glass.
- **Liquid-line length matters:** very long linesets need the manufacturer's trim adders (5.6) — plate SC targets assume standard lengths; a 70-ft run charged "to the plate" may still be light. Cross-check with weigh-in math.
- **Conditions extremes:** very low outdoor temps idle the condenser — same winter limits as 5.4; the heat-mode/weigh-in tools take over.
- **EEV systems** (inverters) hold their own counsel — service-data charging in Unit 9; don't drag this lesson onto a mini-split.

7. Competency link

- **Comp 16 — SIGNED** (guided). With 5.4, the charging pair is complete.

- 5.6 adds weigh-in (the third method and the referee); 5.7 turns SH+SC pairs into the diagnosis matrix; 8.5 handles heat mode.

8. Check yourself

1. Why is superheat numb on a TXV system, and where does added charge show up instead?
 2. Where does the target come from, in order of authority?
 3. Plate says 10°F. You read 4°F. Direction, method, pace?
 4. You read 17°F on that same plate. Direction, and what improves as you correct it?
 5. SC on target, SH = 26°F. Verdict? What did adding more refrigerant do for the last guy?
 6. SC on target, SH = 1°F. Verdict and the 1.2 field-find to check?
 7. Why log conditions even though the SC target doesn't need wet bulb?
 8. What's the fallback band when nothing's posted, and what do you write on the ticket?
 9. When does weigh-in math overrule a "charged to plate" SC reading?
 10. Recite the full sequence from memory — it's the same nine beats as 5.4.
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Arc Workforce Academy · YES Electric LLC Apprenticeship 2026-AL-141731 · Lesson 5.5 v1.0
(2026-06-10)