

Weigh-In Charging & Line-Length Trim: The Referee Method

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 Comps 15-16 (deepened) Class time: ~3.5 hrs (1 video + 2.5 bench)

1. What you'll be able to do

- Charge a virgin (evacuated) system by **weight**: factory charge from the plate + **trim for line length over the base** — computed before the bottle opens.
- Read the trim spec ("0.6 oz/ft over 15 ft" style) off the install manual and apply it for the liquid line size on the job.
- Run the weigh-in: bottle on scale, liquid charge into the high side of a system in vacuum, the remainder pulled as throttled vapor on startup — clean, fast, exact.
- Use weigh-in as the **referee**: when SH/SC numbers argue (or conditions make them unreadable — winter!), weigh-OUT then weigh-IN settles every dispute.
- Keep the books: every ounce in/out on the ticket and the program log (5.3's scale habit, reversed).

The chart methods (5.4/5.5) **VERIFY** a charge under load. Weigh-in **CREATES** a correct charge from zero — it's the install method (Units 7-9), the winter method, and the courtroom of last resort.

2. Tools & materials

- Programmable charging scale per rig; refrigerant supply bottles
- The evacuated capstone assemblies / bench system in vacuum (4.6 output — full circle)
- Install manuals w/ trim tables (3 brands); plate photos
- Throttling/charging valve; worksheets

3. Watch first

Order	Video	Channel	Length	Why
1	Charge a Brand New AC by Weighing In (Line Length)	AC Service Tech	25:13	THE lesson — full math + procedure
2	Vacuum, Weigh In, Check the Charge	AC Service Tech	20:53	The evac→weigh-in→verify chain
3	Break the Vacuum with Refrigerant — Setup, Microns, Weighing	AC Service Tech	15:42	The transition moment done right
4	Weighing Into a Mitsubishi Mini Split	AC Service Tech	9:10	The Unit 9 preview — minis are weigh-in country

4. The idea

The math (do it in the truck, before the attic)

TOTAL CHARGE = factory charge (plate) + trim × (actual liquid-line ft – base ft)

Example: plate says 7 lb 6 oz with a 15-ft base; manual trims **0.6 oz per additional ft** of 3/8" liquid line; your lineset runs 42 ft: - Extra: $42 - 15 = 27$ ft → $27 \times 0.6 = 16.2$ oz $\approx$ **1 lb 0 oz** - **Total: 8 lb 6 oz.** Written on the worksheet, circled, before the bottle moves.

Notes that matter: trim follows the **liquid line** (that's where the mass lives — vapor in the suction line weighs ~nothing by comparison); bigger liquid lines trim more per foot (the manual's table, not folklore); long-line applications past the manual's max need the long-line kit guidance (crankcase heater, hard-start, sometimes TXV changes — flag and read, 8.7).

THE WEIGH-IN MATH — DO IT BEFORE THE BOTTLE MOVES

$$\text{TOTAL} = \text{FACTORY CHARGE} + \text{TRIM} \times (\text{actual ft} - \text{base ft})$$

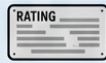


plate: 7 lb 6 oz (base 15 ft)



lineset measured: 42 ft

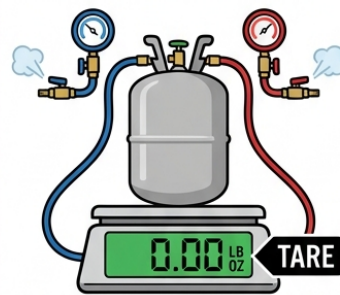
trim: $0.6 \text{ oz/ft} \times 27 \text{ extra ft} = 16.2 \text{ oz} \approx 1 \text{ lb}$

trim follows the
LIQUID LINE —
that is where
the mass lives

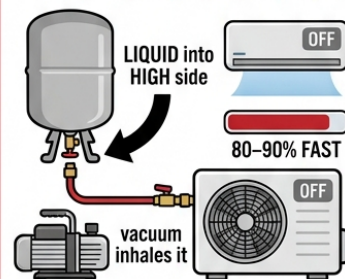
TOTAL: 8 lb 6 oz

THE PROCEDURE

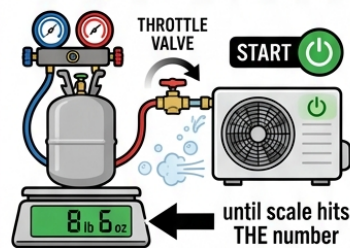
1) TARE bottle ON SCALE,
hoses connected & purged



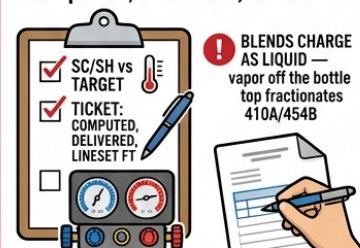
2) system OFF & IN VACUUM:
LIQUID into the HIGH side —
vacuum inhales it (80–90% goes in fast)



3) START SYSTEM: finish as
THROTTLED VAPOR into suction
until the scale hits THE number



4) VERIFY like a skeptic:
SC/SH vs target + ticket:
computed, delivered, lineset ft



The procedure (system in vacuum — 4.6's gift)

1. **Bottle on the scale, zero/tare** the display with hoses connected and purged (hose gas counts!).
2. **Liquid charge into the LIQUID/high side** with the system OFF and in vacuum: invert the bottle (or use its liquid port), open — the vacuum inhales liquid fast. Most of the charge transfers in minutes. (Liquid into the high side can't slug a compressor that isn't running.)
3. Flow stalls (pressures equalized) → **close, note the scale** — usually 80–90% in.

4. **Start the system; finish as throttled VAPOR into the suction side** (bottle upright / throttle valve — never liquid into a running suction line) until the scale says THE number.
5. Close, disconnect low-loss (1.3's hygiene), caps on.
6. **Verify like a skeptic:** run 10–15 min, then read SC (TXV) or SH (piston) against target — weigh-in sets the charge; the verification numbers confirm system HEALTH (a perfect weight with terrible SC says equipment problem, not charge problem — diagnosis brain on).
7. Ticket: total computed, total delivered, lineset length, verify numbers.

Blends charge as liquid (the why)

R-410A/R-454B are blends — vapor charging off the top of a bottle fractionates them (the lighter component leaves first), shifting the blend. **Liquid-feed always** (inverted bottle through a throttling device when feeding a running suction). Single-component R-32 is forgiving here — but the liquid-feed habit is universal and harmless.

Weigh-in as referee

- **Winter changeout?** Charts dead (5.4/5.5 limits) → weigh in the computed charge, verify in spring or by heat-mode chart (8.5).
- **"This system never acted right since the last guy"** → recover EVERYTHING through the scale (weigh-OUT — now you know what was in it; the evidence is often damning), evacuate, weigh-IN the computed charge. Dispute settled with arithmetic.
- **Mini-splits (Unit 9): weigh-in is the ONLY method** — no charging charts, tiny critical charges, EEV doing its own thing. The trim math above IS mini-split commissioning math.

5. Bench procedure

1. **Math gauntlet:** five worksheet scenarios across three manuals (different bases, trims, line sizes; one long-line flag case; one mini-split). All five right before touching a scale.
2. **The full weigh-in (each student):** their evacuated 4.6 capstone assembly (or bench system): tare → liquid into high side → watch the stall → throttled vapor finish to the gram → verify numbers → ticket. The scale's accuracy is the grade.
3. **The fractionation demo (instructor):** vapor-charge a clear sight rig from a 410A bottle top vs liquid-feed — pressure behavior difference narrated (or the manufacturer's data shown) — why the bottle gets inverted.
4. **Referee roleplay:** the "mystery charge" bench unit (instructor pre-loaded WRONG): student recovers through the scale (weigh-out: "9 lb 2 oz in a system computing 7 lb 6... someone gas-and-go'd it"), evacuates (4.6 speed-run), weighs in correct, verifies. The complete craft in one exercise — recovery, evac, weigh-in, verify, document.
5. **Scale care:** calibration check with the test weight, level surface discipline, cold-weather battery reality.

Checkout: unaided math (2 scenarios) + one full weigh-in to ± 1 oz of computed with verification numbers interpreted + complete ticket. **Comps 15-16 deepened to install-grade.**

6. Field gotchas

- **Hose refrigerant is real weight** — tare WITH hoses connected/purged, or your "8 lb 6" is 8 lb 2 in the system and 4 oz in the rubber.
- **The plate charge assumes the MATCHED coil** (1.7's AHRI lesson) — oddball coil pairings shift true charge; verify numbers catch it.
- **Don't trust the lineset length the homeowner remembers** — measure (count straps × spacing, or walk it). 10 mystery feet = 6 oz of wrong.
- **Windy scale = drifting numbers**: shelter the scale; a milk crate windbreak is a professional tool.
- **Recovered "what was in it" weight includes oil mist error** on big burnouts — note approximate on the ticket where contamination muddled it.
- **A2L trim tables differ from 410A** even on lookalike equipment — the manual for THE unit, every time (454B charges run notably smaller).

7. Competency link

- **Comps 15-16 complete at install grade.** This method IS the charging half of every install capstone: 7.x (AC), 8.7 (HP), 9.2 (mini — where it's the only method).
- 5.7 next: all three methods' numbers feed the diagnosis matrix.

8. Check yourself

1. The weigh-in formula. Compute: plate 6 lb 12 oz / base 15 ft / trim 0.6 oz-ft / actual 38 ft.
 2. Why does trim follow the liquid line?
 3. Why liquid into the HIGH side with the system off — two reasons it's both fast and safe?
 4. When and how does vapor finish the job, and what's the throttle protecting?
 5. Why must blends charge as liquid?
 6. Weigh-in done, SC reads 2°F at target conditions. Charge problem? What's your brain doing now?
 7. Three referee scenarios where weigh-in overrules the charts.
 8. What did the weigh-OUT tell you in the roleplay, and why is it evidence?
 9. Two ways your scale lies and the countermeasures.
 10. Why is weigh-in the only method on mini-splits?
-