

Refrigerant Types, Bottles & Identification (R-22 → R-410A → the A2L Era)

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 12 & 14 Class time:
~3.5 hrs (1 video + 2.5 bench/bottle work)

1. What you'll be able to do

- Identify any refrigerant you'll meet by **label, cylinder color era, and pressure fingerprint** — and never trust color alone (the rules changed in 2020).
- Place the four generations in one story: **R-22 (HCFC, gone) → R-410A (HFC, phasing down) → R-32 / R-454B (A2L HFCs, the present) — and why each handoff happened (ozone, then climate).**
- Read safety classifications (**A1 / A2L / A3**) and state what the "2L" actually means for your work.
- Handle bottles correctly: disposable vs recovery cylinders, transport, storage, the never-refill-a-disposable law.
- Verify "what's in this system" the professional way: label + pressure-temperature fingerprint (1.3's skill, weaponized).

Comp 12 — identify refrigerant types by label and cylinder color code — signs here, with the modern caveat the old curriculum missed: **the label is the law; the paint is a hint.**

2. Tools & materials

- The bottle museum: R-410A (rose), R-32 and R-454B bottles (current paint + left-hand A2L threads to feel), R-22 (green, empty/display), recovery cylinders (gray/yellow), a nitrogen bottle for contrast
- P/T cards & apps from 1.3; thermometer
- Cylinder scale; bottle cart with straps

3. Watch first

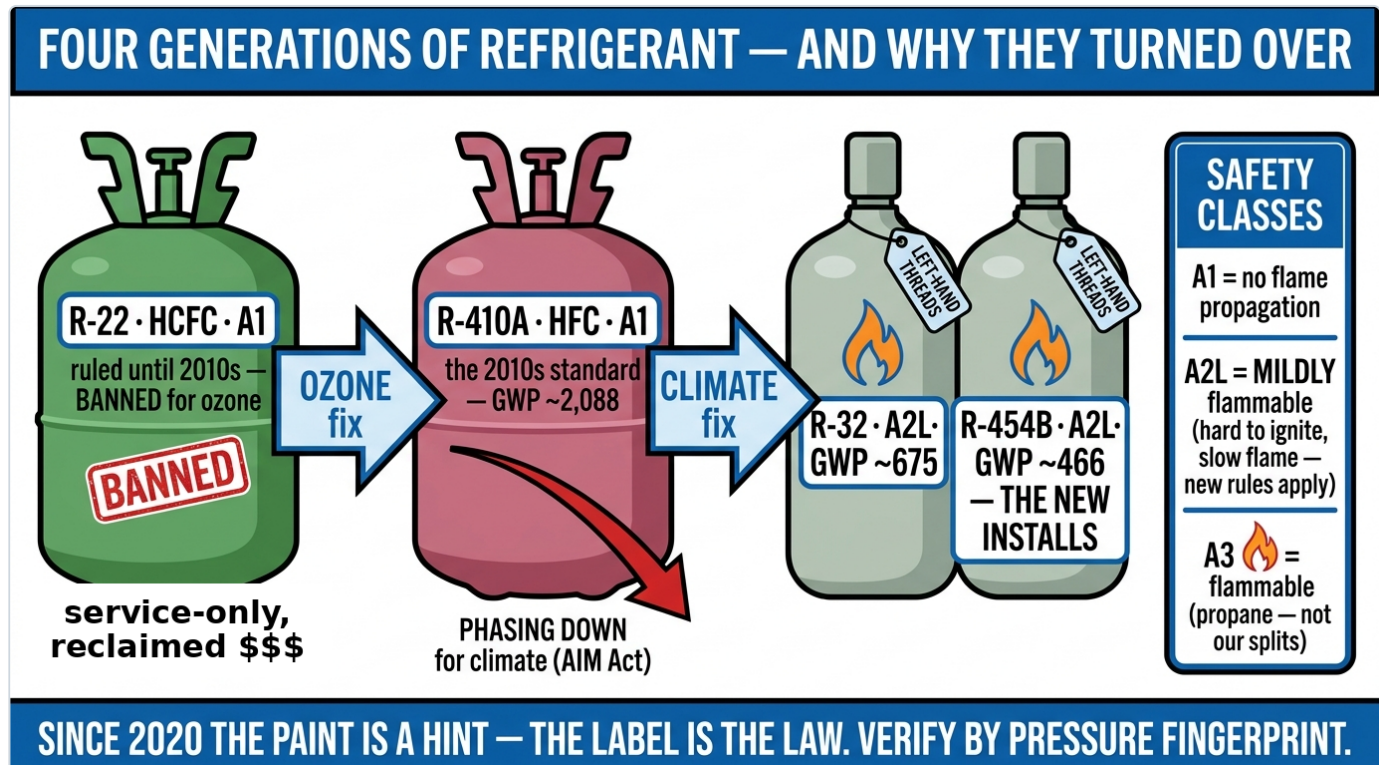
Order	Video	Channel	Length	Why
1	Refrigerant Bottles — R-32, R-454B, R-410A, R-22, Disposable & Recovery	AC Service Tech	26:00	The bottle landscape, current
2	What Is a Refrigerant?	AC Service Tech	6:28	The substance itself
3	How to Identify Refrigerant Type	HVAC School	3:58	The verification method
4	The Chilling History of Refrigerants — Ether to A2Ls	HVAC School	7:31	Why the generations turned over
5	ABC's of New A2Ls w/ Opteon	HVAC School	7:53	The era you're starting in (full handling = 5.8)

4. The idea

The four-generation story (one paragraph each)

- **R-22** (HCFC, green bottles): ruled 1960s–2010. Ozone-depleting → production banned 2020. Still installed in millions of attics; you'll service them with reclaimed supply at painful prices — which is a REPLACEMENT conversation, not a top-off plan (1.7's dinosaur sighting).
- **R-410A** (HFC blend, rose bottles): the 2010s standard, ozone-safe but high global-warming potential (GWP ~2,088) → AIM Act phasedown. The installed base you'll service for 15+ years; no new equipment after the transition years.
- **R-32** (pure HFC, GWP ~675) and **R-454B** (blend, GWP ~466): the **A2L era — every new residential unit you'll install**. Slightly different pressures than 410A (R-32 a bit higher, 454B a bit lower — 1.3's chart drills), new handling rules (5.8), left-hand bottle threads.
- The pattern to remember: **ozone fixed first (22→410A), climate second (410A→A2Ls)**. When a customer asks "why'd they change AGAIN," that's the answer in one breath.

Safety classes — what A2L means



ASHRAE class = toxicity letter + flammability number: **A1** (410A, 22): no flame propagation. **A2L** (32, 454B): mildly flammable — hard to ignite (needs sustained high-energy source), slow flame speed, but "mildly" is an engineering term, not permission: dissipation rules, A2L-rated tools, no open flame on un-purged systems (4.3/4.4 already drilled the right habits; 5.8 formalizes). **A3** (propane R-290): genuinely flammable — appliance refrigeration territory, not our splits.

Bottles

- **Disposables** (DOT-39): the gray-shouldered one-way bottles. **Refilling one is a federal offense and a shrapnel risk.** When empty: recover residual (it's still refrigerant — 5.2), render unusable per the rules, recycle the steel.
- **Recovery cylinders** (gray body/yellow shoulder): rated for re-fill, the only legal destination for recovered gas. **80% fill maximum by WEIGHT** (hydrostatic safety — liquid expands), tare weight stamped on the collar, scale always (5.3 does the math).
- **2020+ color reality:** AHRI retired the guaranteed color code — new bottles trend light gray-green with the LABEL as sole identification. Old paint (rose/green) persists in the field. **Read the label. Then verify by pressure.**
- A2L bottles: **left-hand threads** (your 410A hoses won't connect — by design), flame icon on the label.

The pressure fingerprint (verification, 1.3 cashing out)

A resting bottle (or off system) at known temperature has exactly one correct saturation pressure per refrigerant. 80°F bottle: R-410A ~235 psig, R-32 ~250, R-454B ~220, R-22 ~144. Reads way

off-chart → mixed/contaminated → it goes to the recovery cylinder marked MIXED, never into a system (and mixed refrigerant is a disposal fee, not an asset — the case for never cross-contaminating hoses).

5. Bench procedure

1. **Bottle museum walk:** every bottle handled: read label (name, charge weight, tare, date codes), feel the A2L left-hand threads fail your 410A hose, find the 80% fill statement on the recovery cylinder.
2. **Fingerprint lab:** thermometer on each bottle → predict pressure from the P/T card → gauge it (instructor's adapter set) → verdict. Include the planted "mystery bottle" (it's contaminated — the numbers won't land anywhere).
3. **Generations timeline relay:** cards (refrigerant / class / GWP / bottle / era) get matched on the wall board against the clock.
4. **Transport drill:** load bottles on the cart and "truck" correctly — upright, strapped, capped, recovery vs virgin segregated; the disposable-refill law recited at the station.
5. **The customer question roleplay:** "Why can't you just put more of the old stuff in?" — answer for an R-22 system and for a 410A system, 30 seconds each, plain English.

Checkout: identify four bottles (label + class + era + one handling rule each); one pressure-fingerprint verification with verdict; the disposable law and the 80% rule recited. **Comp 12 signed** (guided).

6. Field gotchas

- **Paint lies after 2020.** A gray-green bottle could be three things; the rose bottle in a flooded basement with no label gets fingerprinted before ANY use.
- **Cross-contamination via your own manifold:** dedicated hose sets (or thorough purge protocol) per refrigerant family; A2L gets its own rated set anyway (threads enforce it).
- **"Drop-in replacement" sales pitches** (R-22 substitutes like R-407C/R-438A): legitimate retrofits exist with oil/TXV caveats — but they're RETROFITS with procedure, never literal drop-ins. The 4-video on R-438A conversion shows the honest workload.
- **Mixed-refrigerant systems** (a previous "top-off artist" added the wrong gas): pressures read nonsense, capacity wanders. Verdict: recover to MIXED, evacuate, weigh in virgin — and bill the truth.
- **Bottle in a hot van:** 150°F van = bottle pressure way up (P/T chart works in vans too) — shade, ventilate, never max-fill in summer.
- **A2L storage/transport quantities** have code limits (van placarding thresholds) — our SOP doc covers the YES Electric numbers; know where it lives.

7. Competency link

- **Comp 12 — signed.** Comp 14 (apply correct handling per type) builds here, completes in 5.8 (A2L) and field reps.
- Sets up 5.2 (EPA law), 5.3 (recovery practice), 5.6 (weigh-in uses the bottle math).

8. Check yourself

1. The four-generation story with the two WHYs (ozone, climate).
 2. What does A2L mean — and what does it NOT mean?
 3. Three differences between a disposable and a recovery cylinder; the law on refilling disposables.
 4. The 80% rule: what, why, and how it's enforced at the bottle (tare + scale).
 5. Why is color identification dead since 2020, and what replaced it?
 6. Fingerprint check: R-410A bottle at 80°F should read ~___; it reads 175. Verdict and action?
 7. What's on an A2L bottle that physically blocks your old hoses?
 8. A customer's 2008 R-22 unit needs 4 lbs. Outline the honest conversation.
 9. Why does mixed refrigerant cost money twice?
 10. GWP of 410A vs 454B, roughly — and which act is driving the change?
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