

Oxy-Acetylene Setup, Flame Types & Brazing Safety

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 4 • Copper, Brazing & System Integrity • Appendix A Competencies 1 & 5 Class time: ~4 hrs (1.5 video + 2.5 supervised torch bench) — NO unsupervised torch work until 4.4 checkout

1. What you'll be able to do

- Set up an oxy-acetylene rig from bottles to tip: secure bottles, regulators on clean threads, **leak-test every joint**, working pressures set, lines purged.
- Run the **startup and shutdown sequences** in the correct order, every time, from memory.
- Light and adjust to the three flames — **carburizing, neutral, oxidizing** — and dial a **slightly reducing flame** for copper brazing on command.
- Apply the safety frame: acetylene's rules (≤ 15 PSI working, upright bottles, no free-release), flashback arrestors, PPE, the fire watch habit, heat protection for everything near the joint (WetRag/shield discipline).
- Choose tips (incl. the cap-n-hook for service valves) and explain air-acetylene (TurboTorch) vs oxy-acetylene — when each earns its spot on the truck.

Filler metals, joint technique, and nitrogen flow are 4.4. Today is the machine and the flame — mastered cold, because this tool burns at 5,600°F and forgives nothing.

2. Tools & materials

- Oxy-acetylene rig(s) with flashback arrestors, cart-secured bottles; spare regulators for teardown practice
- Tips: standard brazing tips sized for 1/4–7/8 copper, cap-n-hook
- Soapy solution/leak detector, strikers (no lighters — say why), tinted glasses (shade 3–5), gloves, natural-fiber clothing check
- WetRag putty / heat shield pads, fire extinguisher AT THE BENCH (live), spray bottle
- Air-acetylene TurboTorch for comparison

3. Watch first

Order	Video	Channel	Length	Why
1	Oxy-Acetylene Setup, Leak Test, Reg Adjust, Startup, Shutdown	AC Service Tech	11:15	The whole machine ritual
2	Torch Adjustments — Reducing, Oxidizing, Neutral Flame	AC Service Tech	6:16	The three flames, on camera
3	Two Types of HVAC Brazing Torches 3D	HVAC School	4:45	Oxy vs air-acetylene
4	Oxy-Acetylene Brazing 3D	HVAC School	15:47	The full picture, animated
5	WetRag Heat Shield Demo	HVAC School	9:02	Protecting what's near the joint
6	Brazing Required Practices P1 (Roman Baugh)	HVAC School	51:56	The professional standard (P2 in 4.4)

4. The idea

The two torches on a real truck

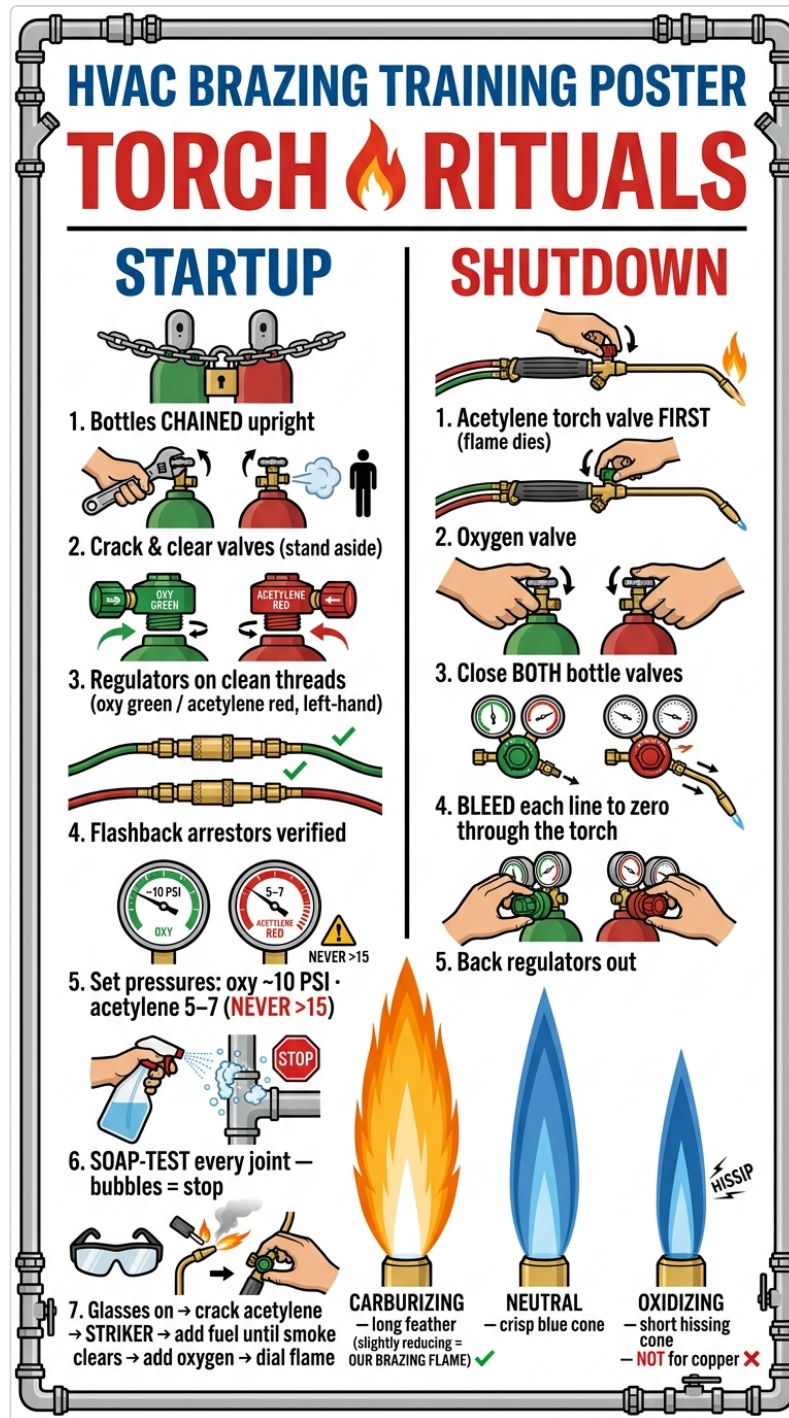
- **Air-acetylene (TurboTorch):** one bottle, swirl tip pulls its own air. Plenty for small soft-solder work and brazing small OD with 15% silver rod patience. Simple, safer, slower.
- **Oxy-acetylene:** two bottles, 5,600°F, brazes anything we touch fast and clean — and the heat-control responsibility scales with the heat. Our program standard; the TurboTorch is the backup skill.

Acetylene's three commandments

1. **Never over 15 PSI working pressure** — free acetylene destabilizes above that (the actual explosion chemistry, not folklore).
2. **Bottles upright, always** (acetone bath inside; tip it and you draw liquid). Stand time after transport before use.
3. **Crack the bottle valve ~1 turn max** (fast shutoff), wrench stays ON the valve.

Oxygen's commandment: **oil/grease near oxygen = fire**. Clean hands, clean threads, never "lubricate" a fitting.

Setup → leak test → light → shut down (the rituals)



Setup: bottles chained → crack-and-clear each valve (blow dust, stand aside) → regulators on (oxy = right-hand green; acetylene = left-hand red, notched nuts) → arrestors verified → hoses → tip. **Set working pressures** (typical copper brazing: oxy ~10 PSI / acetylene ~5-7, tip-chart governs) → **soap-test every joint** bottle-to-tip. Bubbles = no flame today until fixed.

Light: glasses on → acetylene valve cracked → strike (striker, never a lighter — your thumb is not a sacrifice) → add acetylene until smoke just leaves the flame tip → introduce oxygen → dial the flame.

Shutdown: acetylene torch valve FIRST (flame dies — no lingering fuel), then oxygen → both bottle valves closed → **bleed each line to zero through the torch** (one gas at a time) → back regulators out. Lines left charged are the next guy's accident.

The three flames

Flame	Look	Chemistry	Use
Carburizing/ reducing	Long feathery inner cone, acetylene-rich	Excess fuel, no spare O ₂	Slightly reducing = our copper brazing flame — protects the metal from oxidation
Neutral	Crisp blue inner cone, silent-ish	Balanced	General work, the reference point
Oxidizing	Short hissing pale cone	Excess O ₂	NOT for our brazing — burns/oxidizes copper (and the hiss tells on you)

Find neutral first, then back oxygen off a touch until a slight feather appears = the brazing flame. You'll dial this ten times until it's muscle memory.

Heat discipline — protect everything that isn't the joint

The joint needs 1,200°F+; everything around it doesn't: **WetRag putty / heat shield pads** on valve bodies, TXVs, paint, wires, structure; wet rags on service valve internals (or remove cores); a **spray bottle and extinguisher in reach**; move or shield insulation; **30-minute fire watch** after torch work in structures (smoldering starts quiet — this rule is written in insurance claims). Sight line behind the joint: what does the flame hit when it passes the tube?

5. Bench procedure (supervised throughout)

1. **Setup relay:** teams build the rig from bare bottles: every step narrated, soap test witnessed. Tear down, rotate, repeat — each student builds it solo once.
2. **The light/shut 10:** each student lights, dials neutral → reducing → oxidizing → back to slight-reducing (instructor calls them like a drill sergeant), shuts down in order. Ten cycles; the order errors die by rep five.
3. **Flame reading quiz:** instructor sets a flame; students call it from the look/sound at 6 feet.
4. **Heat shield lab:** putty + pad on a practice valve assembly; torch plays NEAR it (instructor hand); IR the protected vs unprotected side — numbers make believers.
5. **Tip tour:** standard vs cap-n-hook around a service valve mockup — see why the wrap-around tip halves the awkward-angle time.
6. **Emergency drills:** flashback recognition (pop + black smoke = valves off NOW, cool the torch), clothing fire response, the extinguisher's pin pulled for real on a pan fire (outdoor station).

Checkout (gate for 4.4): solo setup with leak test → light → dial slight-reducing on first ask → correct shutdown + line bleed → all safety questions answered. No pass, no filler rod.

6. Field gotchas

- **The B-tank rattling loose in a van** is a bomb with paperwork. Cage/chain it; cap when off the regulator; ventilated compartment.
- **Regulator creep:** set pressure drifting upward with valves closed = failing regulator = out of service today, not "I'll watch it."
- **Flashback arrestors are not optional jewelry** — both gases, torch end at minimum.
- **Wind on rooftops** flattens and redirects flames — shield the work, widen your "what's behind it" margin.
- **A2L-era rule (preview of 5.8):** never open flame on a system that hasn't been recovered AND nitrogen-purged — mildly flammable refrigerants make this an absolute, but it was always good practice (refrigerant + flame = phosgene-adjacent nastiness even with A1s).
- **Lighters in the torch pocket** have ended careers. Striker, period.

7. Competency link

- **Comp 1** (safety) major checkpoint; **Comp 5** torch-readiness gate.
- 4.4 (brazing with nitrogen) builds directly on today's checkout; the heat-shield discipline returns at every service valve and TXV job for the rest of your life.

8. Check yourself

1. Acetylene's three commandments, with the WHY on the 15 PSI rule.
2. Why no oil near oxygen fittings?
3. Setup order from bottles to tip — where do the two soap tests happen? (Every joint after assembly; re-test after any change.)
4. Light sequence; shutdown sequence — which gas first at each end and why?
5. The three flames: look, chemistry, our brazing choice and how you dial it.
6. What does the hissing sound usually mean?
7. Four things near a joint that need shielding and the tools you shield with.
8. The fire-watch rule — duration and reason.
9. Flashback: signs and the immediate response.
10. When does the TurboTorch earn its spot over the oxy rig?

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