

Pressure & Its Units: PSI, Inches of Water, Gauge vs Absolute, Microns

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 2 • Trade Math for HVAC • RTI: Trade Math (26 hr) Class time: ~3 hrs (1 classroom + 2 bench)

1. What you'll be able to do

- Keep the trade's **four pressure scales** straight and know which tool reads which: **PSI** (refrigerant), **inches of water column ("WC)** (gas & airflow), **inches of mercury vacuum** (rough vacuum), **microns** (deep vacuum).
- Convert the ones that matter: 1 PSI = 27.7" WC; 1" Hg $\approx$ 25,400 microns — and more importantly, know when you're on the wrong scale.
- Explain **gauge vs absolute** (PSIG vs PSIA) and why a gauge reads 0 sitting on the truck.
- Handle a **manometer** confidently: zero it, connect it, read positive AND negative pressures.

HVAC is a pressure trade on three wildly different magnitudes: hundreds of PSI in the pipes, hundredths of a PSI in the ducts and gas lines, and near-perfect vacuum during evacuation. Most rookie measurement disasters are scale confusion.

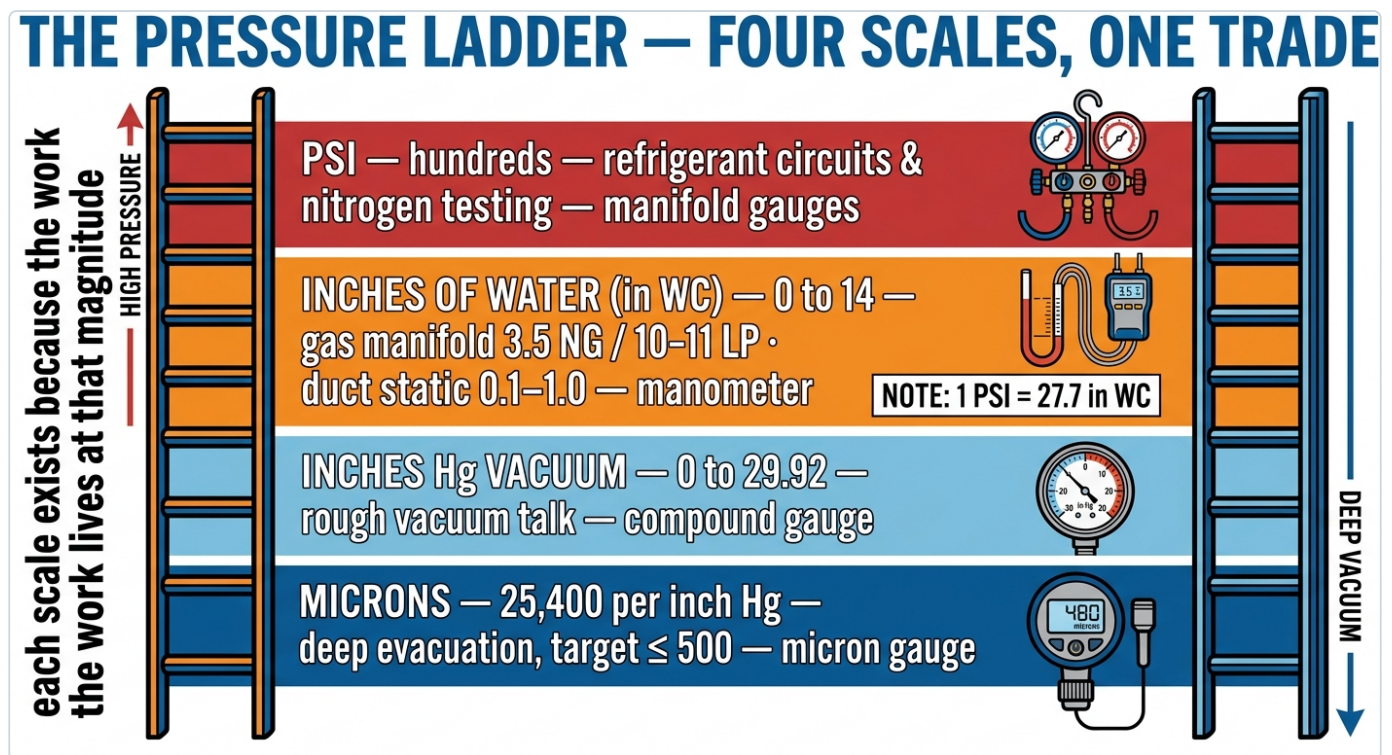
2. Tools & materials

- Digital manometer per team + hose kit
- Manifold gauge set, micron gauge (show-and-tell today; starring role in 4.6)
- A drinking straw and a glass of water (the original manometer)
- Shop unit with gas valve test ports & blower compartment (read-only today)

3. Watch first

Order	Video	Channel	Length	Why
1	Static Pressure and Manometer Basics	HVAC School	32:33	The class — both uses of "WC
2	Practical Training on Manometers	HVAC School	18:58	Hands-on technique
3	Prevent This Common Manometer Mistake	HVAC School	3:57	The zeroing/connection error everyone makes once
4	Proper Use of Manometers for HVAC Technicians	HVAC School	45:41	Optional deep dive / reference

4. The idea — four scales, one trade



Scale	Magnitude	Where you use it	Tool
PSI(G)	0-600	Refrigerant circuits, nitrogen testing	Manifold gauges / probes
Inches WC	0-14 (1 PSI = 27.7" WC!)	Gas manifold (3.5" NG / 10-11" LP), duct static (0.1-1.0)	Manometer
Inches Hg (vacuum)	0-29.92	Rough vacuum talk ("pulled it into a vacuum")	Compound gauge low side
Microns	25,400 per 1" Hg; target ≤500	Deep evacuation (the only honest scale for it)	Micron gauge

Why so many? Sensitivity. Measuring duct static (0.5" WC $\approx$ 0.018 PSI) with a 600-PSI gauge is measuring a feather on a truck scale. Each scale exists because the work lives at that magnitude.

Gauge vs absolute — where zero sits

- **PSIG (gauge):** zero = the air pressure around you. Your manifold reads 0 on the shelf. Negative PSIG = vacuum.
- **PSIA (absolute):** zero = true nothing. Atmosphere at sea level = **14.7 PSIA** = 0 PSIG.
- Conversion: **PSIA = PSIG + 14.7.**

Why care? Three places it bites: deep vacuum (microns are absolute — a micron gauge near 0 means nothing left, not "atmospheric"), P/T math on very low pressures (refrigeration, not residential AC), and understanding why recovery to 0 PSIG still leaves a system FULL of vapor at atmospheric pressure (EPA rules in 5.2 demand recovery below atmospheric — into vacuum — for exactly this reason).

Water column — pressure you can see

A manometer is just a column of water the pressure can push. 1" WC = the pressure that lifts water one inch $\approx$ **0.036 PSI**. Natural gas manifold at 3.5" WC is $\sim$ 1/8 PSI — that's why gas leaks whisper instead of scream, and why duct leaks are silent. The straw demo: blow gently into a straw in a glass — you just generated several inches WC; your lungs are a $\sim$ 1 PSI machine, which is also why "it feels like good airflow" means nothing (Unit 11's drum).

Microns — the honest vacuum scale

Inches Hg runs out of resolution exactly where evacuation gets interesting: the last 1/2 inch before perfect vacuum spans 25,000+ microns, and ALL the moisture removal happens in there. The micron gauge zooms into that last half-inch. Target: pull to **below 500 microns** and hold (full procedure + decay testing in 4.6 — today, just own the scale: 500,000 μ = boiling water territory, 5,000 = wet system, 500 = clean and dry, 50 = laboratory).

5. Bench procedure

1. **Straw manometer:** clear tube, water, blow/sip — watch positive and negative pressure move the column. Read your own lungs in "WC.
2. **Manometer ritual:** zero it OPEN to atmosphere (the famous mistake: zeroing with the hose connected), connect to the blower compartment test port, read duct static. It will be a few TENTHS — log it with the unit ("0.4 in WC", never "0.4 PSI").
3. **Gas port read-along (instructor's hands, gas off then on):** manometer on the manifold test port — see ~3.5" WC NG. Students log it. (Full gas procedure is 7.6 — today is scales, not gas work.)
4. **Scale gymnastics worksheet:** 10 conversions/judgments: "3.5 PSI or 3.5 inches WC on a gas manifold — which is right, and what would the wrong one do?" "0 PSIG = ___ PSIA." "2" Hg from perfect vacuum = roughly ___ microns — done or not done?"
5. **Micron gauge show-and-tell:** watch it climb from 200 to ambient with a cracked fitting — the demo that makes 4.6 make sense.

Checkout: zero + connect + read a manometer unaided; complete 5 scale conversions; answer "your helper reports 'I pulled it down to 29 inches' — what do you ask?" (Microns. Always microns.)

6. Field gotchas

- **PSI where "WC belongs destroys things.** Pressure-testing a gas valve body with high PSI, or "checking gas pressure" with refrigerant gauges, ends valves. The scale IS the safety rule.
- **Zero the manometer disconnected.** Then connect. Every time.
- **Negative static readings are normal** (return side pulls). Sign tells you which side of the blower you're on (Unit 11 maps this).
- **"It's in a vacuum" is not a number.** 29" Hg can still be 20,000+ microns of wet. Vacuum claims without a micron gauge are stories.
- **Altitude moves absolute zero-point** (14.7 is sea level; Birmingham ~14.4). Matters for combustion derating (7.6) more than for daily gauge work.

7. Competency link

- RTI Trade Math; the scale literacy behind **Comp 27** (gas pressure, 7.6), **Comp 42** (static, Unit 11), evacuation (4.6), and EPA recovery levels (5.2).

8. Check yourself

1. Four pressure scales, one example measurement each.
2. 1 PSI = how many inches WC? So 3.5" WC $\approx$ what fraction of a PSI?
3. PSIG vs PSIA — define each and convert 0 PSIG.

4. Why does the trade use microns instead of inches Hg for evacuation?
 5. 500 microns vs 5,000 microns — what does each say about the system?
 6. The two-step manometer ritual before any reading?
 7. Duct static will read in what range, on what scale? Gas manifold NG? LP?
 8. Recovery machine stops at 0 PSIG. Is the refrigerant out? Why not?
 9. A negative number appears on your manometer at the return. Problem?
 10. "I blew into the manometer hose to test it." React. (Don't — you're a multi-inch WC machine and you just pegged/wet the sensor.)
-

Arc Workforce Academy · YES Electric LLC Apprenticeship 2026-AL-141731 · Lesson 2.3 v1.0
(2026-06-10)