

Ignition Systems: HSI, Intermittent Spark, Standing Pilot

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 7 • Gas Furnaces & Straight AC • Appendix A Comp 27 (sequence step 4, zoomed)
Class time: ~4 hrs (1 video + 3 bench)

1. What you'll be able to do

- Diagnose the **hot surface igniter** circuit completely: visual (cracks/contamination), **ohm it cold** (silicon carbide ~40–90 Ω , silicon nitride ~11–25 Ω — know which you're holding), and the live split: **voltage TO it at the right moment = igniter guilty; no voltage = board guilty** (6.6's outputs question, applied).
- Handle HSIs like the ceramics they are: never bare fingers (skin oil = hot spots), never bumped, supported on removal — and pick the right replacement (OEM vs universal kits, voltage class 120 vs 80 V — mismatch kills).
- Diagnose **intermittent spark systems**: spark presence/quality (snap-snap-snap at the gap), gap spec, cable/insulation leaks (spark finding shortcuts), module logic — incl. two-rod systems (spark + sense in one assembly).
- Run a **standing pilot / thermocouple** system (the Alabama attic museum): pilot lighting procedure, **thermocouple millivolt test** (~25–30 mV open circuit, the 750 mV powerpile cousin), cleaning vs replacement.
- Place every ignition flavor back into 7.2's sequence and call the dying step correctly.

2. Tools & materials

- Igniter wall: silicon carbide HSIs (healthy + cracked + contaminated), silicon nitride, universal kit; spark assemblies + module; standing-pilot valve + thermocouple rig (our museum bench)
- Meters (Ω + mV scale), spark-gap gauge; the live donors
- The white-glove rule sign (literally — cotton gloves at the HSI station)

3. Watch first

Order	Video	Channel	Length	Why
1	Hot Surface Ignitor Training — Types, Operation, Troubleshooting	AC Service Tech	10:16	The HSI lesson
2	Spark Ignition Operation and Testing	AC Service Tech	17:07	The spark world
3	Intermittent Pilot Ignition — Valve, Spark, Module	AC Service Tech	14:06	The pilot-bearing middle generation
4	Spark Control Troubleshooting — Two Rod	AC Service Tech	13:12	Spark + sense combos
6	White-Rodgers Universal HSI/Spark Modules	HVAC School	3:06	The universal-replacement reality

4. The idea

HSI — the glowing ceramic (the one you'll touch weekly)

A resistor that runs white-hot (1,800–2,500°F) on command. Two materials:

- **Silicon carbide** (the gray fork/spiral classic): fragile as a potato chip, **40–90 Ω cold**, lifespan 3–7 years; the most-replaced furnace part.
- **Silicon nitride** (the modern stick): rugged, **11–25 Ω cold**, often 80 V driven — lasts longer, costs more.

The trial (sequence step 4): no glow at the moment glow belongs → 1. **Ohm it cold** (dead, unplugged): OL/way-off = igniter, done. In-range → 2. **Catch the voltage at the plug at ignition time** (live, careful): 120 V (or 80 — know the system!) present + no glow = igniter (failed under heat despite cold ohms — happens). **No voltage = the board never sent it** (6.6: inputs proven? sequence reached? → board territory). 3. Slow-creep glow (7.2's stopwatch) or glows-but-weak = aging/contaminated → replace proactively on maintenance (the \$20 part vs the no-heat night).

Handling: cotton gloves/by-the-base, support the bracket, no torque on the ceramic, correct gap-to-burner position per manual. **Voltage class matters:** a 120 V universal on an 80 V system glows like a supernova briefly; the reverse barely glows — match or use the kit's instructions exactly.

Intermittent spark — the relay of lightning

A module steps 24 V up to ~15–25 kV pulses across a gap (~1/8" typical — gauge it, don't eyeball it). Diagnosis: **look and LISTEN** — crisp snap-snap at the gap = delivery working; no spark = module/cable/ground question; spark wandering off the electrode (cracked insulator, chafed cable) = the shortcut thief (spark takes the easiest path — which may be the bracket, not

the gas). Two-rod systems: one rod sparks, the other proves (7.4's rectification with its own electrode) — don't swap them. Intermittent-PILOT systems: spark lights a pilot, pilot proves, pilot lights mains — an extra act in the 7.2 play (the 14:06 video maps it).

Standing pilot — the museum that still pays service calls

Always-burning pilot heats a **thermocouple** (two dissimilar metals → millivolts — pure physics, no board): ~**25-30 mV open-circuit** healthy; the millivolts hold the pilot valve's electromagnet open. Pilot goes out → cools → valve drops closed = fail-safe from 1955. Service: pilot orifice cleaning (a needle's work), thermocouple tip position IN the flame's hottest part, the mV test (meter on mV, thermocouple in the adapter), and the lighting ritual (hold the knob — you're manually doing the electromagnet's job until the mV arrive). The **750 mV powerpile/millivolt SYSTEMS** (wall heaters — Alabama classics): a bigger pile runs the WHOLE valve circuit, no 24 V anywhere — different troubleshooting universe, same physics (the 750 mV videos when you meet one).

5. Bench procedure

1. **HSI clinic:** the wall — visual triage (find the hairline crack with the flashlight at an angle), ohm each (carbide vs nitride ranges), the white-glove handling drill, one replacement on the donor incl. position-per-manual.
2. **The trial, live:** instructor rigs no-glow twice — once unplugged igniter (voltage present = igniter guilty), once board-output disabled (no voltage = board guilty). Students run the split with narration; the multimeter timing (catching the moment) is the skill.
3. **Spark bench:** gap gauged and set; spark observed (lights off — see it, hear it); the cracked-insulator demo (watch the spark jump to the bracket instead); two-rod ID drill.
4. **Museum hour:** the standing-pilot rig — light it by ritual, mV test (~28 on ours), blow it out and watch the mV decay + the valve drop (HEAR the fail-safe), clean the pilot orifice, reposition a "lazy" thermocouple.
5. **Sequence re-integration:** each system fired in place on its donor: students call the 7.2 step numbers as each ignition flavor plays its part.

Checkout: one HSI trial unaided (ohm + live split, correct verdict), one spark gap set to spec, one thermocouple mV test with verdict — all with handling discipline intact. **Comp 27 advances.**

6. Field gotchas

- **The igniter that ohms fine and still fails hot** exists — that's why the live-voltage step is mandatory before condemning a board.
- **Carbide HSIs die on maintenance day** if handled — your inspection touch must be glove-light. The crack you cause today is January's no-heat.

- **Universal igniter kits** are legit but the bracket/position spec is the whole job — an igniter 1/4" out of the gas stream lights late or never (delayed ignition WHUMP — the scary one, 7.6's gas-pressure cousin).
- **Spark cables route AWAY from metal edges** — a re-routed-lazy cable arcs to the cabinet and the pilot "mysteriously" won't light on humid days.
- **Thermocouple finger-tight + 1/4 turn** at the valve — gorilla torque cracks the seat; loose = mV never arrive.
- **A pilot that won't STAY lit after a new thermocouple** = pilot flame itself is wrong (orifice/pressure — 7.6) or the valve's electromagnet is done. The thermocouple was the messenger.

7. Competency link

- **Comp 27 advances** (step 4 owned). 7.4 (flame proving) is the natural twin — together they own "lights or doesn't / stays lit or doesn't."
- The board-vs-load split practiced here is 6.6's method paying field dividends.

8. Check yourself

1. Carbide vs nitride: looks, ohms, voltage class, fragility.
 2. The HSI trial: the two measurements and the verdict each renders.
 3. Why catch voltage AT ignition moment rather than "check for 120"?
 4. The white-glove rule's physics (why skin oil kills ceramics).
 5. Spark gap spec region, and what a wandering spark means.
 6. Two-rod systems: which rod does what, and the cost of swapping them.
 7. The thermocouple number, the test, and the fail-safe story.
 8. New thermocouple, pilot still won't stay lit — two remaining suspects.
 9. A universal HSI installed 1/4" shy of the burner stream: the symptom and its scary name.
 10. Slow-glow on the maintenance stopwatch: the proactive call and its sales script.
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