



Safety and the Professional Technician

MODULE F1

FOUNDATIONS

NO PREREQUISITES

Short Version

HVAC work puts four killers in front of you on a normal day: electricity, heat, falls, and pressurized refrigerant. Every one of them is manageable with a routine. Kill power and verify it is dead before you touch anything electrical. Discharge capacitors before you handle them. Set ladders at a 4-to-1 angle and keep three points of contact. Drink water before you are thirsty and follow the heat plan in summer. Wear your PPE every time, not just when someone is watching. The routine is the protection.

Key Values

ITEM	VALUE	WHY IT MATTERS
Hazardous voltage threshold	50 volts and above	OSHA treats 50V or more as capable of causing dangerous shock. Residential HVAC runs 120V and 240V line voltage plus 24V control voltage. Treat anything at or above 50V as live work.
Residential line voltage	240V single phase (condenser, air handler heat strips), 120V (furnaces, some air handlers)	These are the circuits that can kill you. The 24V control side can still bite through a fault or shared chassis, so verify, do not assume.
Meter safety rating	CAT III, 600V minimum	A meter rated below CAT III 600V can fail violently on a residential panel or disconnect. Check the rating printed on the meter face and the leads.
Verification sequence	Live-dead-live	Test the meter on a known live source, test your circuit, then re-test the meter on the live source. Proves the meter worked the whole time.
Lockout/tagout steps	6 steps: notify, identify, shut down, isolate, lock and tag, verify zero	The sequence that guarantees a circuit cannot re-energize while your hands are in it.

ITEM	VALUE	WHY IT MATTERS
Capacitor discharge	20,000 ohm resistor rated 5 watts or more, held across terminals 5 to 10 seconds, then verify under 1 volt with a meter	Capacitors store a lethal charge after power is off. A resistor bleeds the charge safely. A screwdriver short is an arc, a damaged capacitor, and a burned hand.
Ladder angle	4-to-1 rule: base out 1 foot for every 4 feet of working height	Steeper tips backward, shallower kicks out at the base.
Ladder extension above roof edge	3 feet minimum	Gives you a handhold while stepping on and off the roof.
Ladder contact	3 points of contact at all times, belt buckle between the rails	Carrying tools in your hands while climbing is how techs fall. Hoist tools with a rope or wear a tool bag.
Heat index action levels	Under 80F: normal precautions. 80 to 90F: hydrate on schedule. 91 to 103F: mandatory water and shade breaks. 103 to 115F: work-rest cycles, buddy awareness. Above 115F: reschedule non-emergency exposure work	Heat index combines temperature and humidity. These bands follow OSHA and NIOSH heat guidance. Attics run far hotter than ambient, so attic work jumps bands.
Hydration rate in heat	8 ounces every 15 to 20 minutes, not more than about 48 ounces per hour	Drinking on a timer beats drinking on thirst. Thirst lags dehydration. Over-drinking plain water without electrolytes is its own hazard.
Heat stroke threshold	Core body temperature of 104F, confusion, hot skin	Heat stroke is a 911 call plus immediate aggressive cooling. It is fatal if you wait.
Refrigerant cylinder fill	80 percent maximum	Liquid refrigerant expands with temperature. An overfilled cylinder in a hot truck becomes hydrostatically full and can rupture.
Cylinder heating limit	Never above 125F, never with a torch	Warm water only if you must raise cylinder pressure. Open flame on a cylinder is a bomb-building exercise.
R-410A boiling point at atmospheric pressure	About minus 55F	Liquid refrigerant hitting your skin flash-boils and freezes tissue instantly. That is frostbite, and it is why gloves and glasses are non-negotiable on refrigerant work.
Pressure test gas	Dry nitrogen only, through a regulator. Never oxygen, never compressed air	Oxygen or air mixed with refrigerant oil can detonate inside the system.
Safety glasses standard	ANSI Z87.1 marked	Z87.1 is the impact rating stamped on the lens or frame. Unmarked glasses are sunglasses, not PPE.

ITEM	VALUE	WHY IT MATTERS
Lightning standoff	Off the roof and ladder at the first thunder, wait 30 minutes after the last thunder before going back up	Thunder means lightning is within strike range. Rooftops and aluminum ladders are exactly where you do not want to be.

Field Checklist

Before you start any job, run this on your phone:

- Truck parked safe: out of traffic, parking brake set, not blocking the customer
- PPE on or in hand: Z87.1 glasses, gloves for the task, boots, hearing protection if cutting or drilling
- Meter checked: CAT III 600V rating, leads undamaged, battery good
- Power located: disconnect, breaker, and furnace switch identified before touching the equipment
- Power killed and verified: live-dead-live before hands go in any panel
- Capacitors discharged with a resistor and verified under 1 volt before handling
- Ladder inspected: feet, rungs, rails, locks. Set 4-to-1, tied or footed, 3 feet above the roof edge
- Roof check: surface temp, condition, edges, skylights, power lines overhead
- Attic check: temperature estimated, light source on, walk path identified, exit plan known
- Heat plan active in summer: water in hand, timer set, someone knows where you are
- Weather check during monsoon season: storms, lightning, dust on the radar
- Refrigerant gear: gloves and glasses on before connecting hoses, cylinder secured upright

Full Breakdown

A Tuesday in July

Picture this call. It is 11:40 in the morning, the customer says the upstairs is not cooling, and the air handler is in the attic. The outdoor unit hums but the fan is not spinning. A brand new tech walks up, pops the disconnect, pulls the service panel, and reaches in to check the capacitor with the side of a screwdriver, because that is what a video told him to do. The capacitor was still charged. The arc startles him, he yanks his hand back into the condenser fan blade housing, and now he is bleeding, shaking, and standing on a customer's gravel in 110 degree heat with no water in reach.

Nothing in that story required bad luck. Every piece of it was a skipped step. This module exists so that tech is never you. Safety in this trade is not a poster in the shop. It is a set of small, boring, repeatable habits that you run on every call until they are automatic. Master technicians are not the ones who take risks confidently. They are the ones who stopped taking risks years ago.

Why professionals treat safety as a skill

A definition before anything else. A hazard is anything that can hurt you. A control is anything you do to stop it. The entire field of jobsite safety is just matching controls to hazards, in order, every time.

The four hazards that dominate residential HVAC are:

1. Electricity, which you cannot see, smell, or hear until it has you.
2. Heat, which degrades your judgment before it degrades your body, so you are least able to notice it when you most need to.
3. Gravity, in the form of ladders, rooftops, and attic openings.
4. Stored energy, mostly pressurized refrigerant and charged capacitors, which can release violently when power is already off.

Notice that two of the four can hurt you after you think you have made things safe. That is the core lesson of this module: off is not the same as safe. Verified is safe.

Jobsite awareness: the first two minutes

Every call starts with a walk. Before you open a tool bag, look at the property the way an inspector would:

- Where is the equipment, and what do you have to climb, crawl, or cross to reach it?
- Where does power come from? Find the outdoor disconnect (the small box on the wall near the condenser), the breaker panel, and the furnace switch before you need them.
- What is around the work area? Dogs, pool edges, trip hazards, low-hanging lines, wasp nests under the disconnect lid, black widows behind the service panel. Spiders love condenser cabinets. Look before you reach.
- Who is home? Kids and pets find open panels and running power tools fast. Keep your work area controlled.

This survey takes two minutes and it changes the whole job. Most field injuries are not exotic. They are a tech stepping backward off a ladder rung that was not there, or reaching blind into a cabinet.

IB STANDARD

Every Island Breeze truck carries a stocked PPE kit, and it is the tech's job to keep it stocked: two pairs of ANSI Z87.1 safety glasses (clear and tinted), cut-resistant work gloves, low-temperature refrigerant gloves, electrical-rated insulating gloves with leather protectors, foam earplugs plus one pair of earmuffs, an N95 supply for attic and dust work, a bump cap, knee pads, a headlamp with spare batteries, a first aid kit, a 5 lb dry powder fire extinguisher, an electrolyte packet supply, and a 10 quart water cooler. If you use it, restock it that night. A missing item in the kit is treated like a missing tool: the truck is not road-ready without it.

Electrical safety: the discipline that keeps you alive

Electricity deserves its own mindset. Here is the vocabulary you need. Voltage is electrical pressure, measured in volts. Current is electrical flow, measured in amps. It is current through your body that injures and kills, and it

takes shockingly little: well under one amp across the chest can stop a heart. Household circuits deliver far more than that. So the rule is absolute: you never bet your body on a circuit being dead. You verify.

The working threshold is 50 volts. At or above 50V, treat the circuit as capable of seriously hurting you.

Residential HVAC gives you 240V at the condenser, 120V or 240V at the air handler and furnace, and 24V on the control side. The control side is lower risk, but a failed transformer or a chassis fault can put line voltage where you expected 24V. Your meter does not care about your expectations, which is why you use it.

Lockout/tagout, sized for residential work

Lockout/tagout, abbreviated LOTO, is the formal procedure for making sure a circuit you are working on cannot be re-energized by someone else. In a factory that means padlocks and group lock boxes. In a residential attic it means the same logic at our scale. Six steps:

1. Notify. Tell the customer you are killing power and that nobody touches the panel or thermostat until you say so.
2. Identify. Find every energy source feeding the equipment. A condenser has its disconnect. An air handler may have a breaker plus a service switch. A furnace has its toggle switch and breaker. Heat strips can be on separate breakers from the blower.
3. Shut down. Turn the equipment off at the thermostat first so you are not breaking a circuit under load at the disconnect.
4. Isolate. Pull the disconnect block or flip the breaker. When you pull a disconnect, stand to the side of the box, turn your face away, and pull with a firm motion. If a disconnect has ever failed under load, the arc comes out the front. That habit costs you nothing.
5. Lock and tag. Use a breaker lockout device or take the pulled disconnect block with you to the work area so nobody can reinsert it. Hang a tag if anyone else could plausibly touch the panel.
6. Verify zero. This is the step that saves lives, and it has its own name: live-dead-live. Test your meter on a circuit you know is live, so you know the meter works. Test the circuit you are about to touch and confirm zero volts, checking every conductor to ground and to each other. Then test the meter on the known live source again, proving it did not die mid-test. Only now is the circuit dead.

Arc flash awareness

An arc flash is an explosion of superheated air and vaporized metal that happens when electricity jumps a gap, usually triggered by a short: a dropped tool across bus bars, a meter set to ohms across a live circuit, a screwdriver slip. Residential gear produces smaller arc flashes than industrial switchgear, but a 240V arc can still burn your face and flash-blind you. Your protections are habits: glasses on before any panel opens, stand to the side of disconnects, never work a panel with metal jewelry or a dangling lanyard, and never measure voltage with a meter set to resistance or current. Check the dial and the lead sockets every single time you pick the meter up.

Capacitors: the charge that waits for you

A capacitor is a component that stores electrical charge, like a small battery that can dump its entire charge in an instant. Air conditioners use run capacitors (typically rated 370V or 440V) to help the compressor and fan motors run, and some use start capacitors for extra starting torque. Here is the hazard: a capacitor can hold a

dangerous charge for minutes or longer after all power is off. Pulling the disconnect does nothing about the energy already stored in that can.

The professional discharge procedure:

1. Power off and verified dead with live-dead-live.
2. Look at the capacitor. A bulged top, oil leakage, or rust means handle with extra care and do not put your face over it.
3. Take an insulated-handle resistor tool, or a 20,000 ohm resistor rated at least 5 watts with insulated jumper leads.
4. Hold the resistor across the capacitor terminals for 5 to 10 seconds. On a dual run capacitor (the common round type with three terminal groups marked HERM, FAN, and C) discharge HERM to C, then FAN to C, then HERM to FAN.
5. Verify with your meter on DC volts: under 1 volt across every terminal pair.
6. Only now do you touch terminals or pull wires, and you photograph the wiring before you pull anything.

Why a resistor and not a screwdriver across the terminals? The screwdriver short releases all the energy instantly: it arcs, it pits the terminals, it can crack the capacitor internally, and it can spot-weld the screwdriver tip. The resistor releases the same energy slowly as a little warmth. Same result, no violence.

Refrigerant safety

Refrigerant is the working fluid inside the system, stored and moved under pressure. The common residential refrigerant you will meet first is R-410A, with the newer A2L class refrigerants (R-454B and R-32) arriving in new equipment. Refrigerant has three ways to hurt you.

First, frostbite. Inside the system and the cylinder, refrigerant is under pressure and much of it is liquid. Release it to the atmosphere and it boils violently and instantly: R-410A boils at roughly minus 55F at atmospheric pressure. Liquid refrigerant on skin freezes tissue on contact, and a spray in the eyes can cause permanent damage. Gloves and Z87.1 glasses go on before hoses get connected, every time. Crack fittings slowly and stand so a release sprays away from you.

Second, asphyxiation. That word means suffocation: refrigerant vapor displaces the oxygen in the air, and most refrigerants are heavier than air, so they pool in low places: crawlspaces, basements, mechanical closets, even a deep equipment pit. Refrigerant is mostly odorless, and oxygen deprivation does not feel like choking. It feels like dizziness, then nothing. If a large release happens in a tight space, you leave first and think second. Ventilate before re-entry. Never put your head into a low enclosed space to find a leak by smell.

Third, pressure. A refrigerant cylinder is a pressure vessel. The rules: fill recovery cylinders to 80 percent maximum, because liquid expands with temperature and a hydrostatically full cylinder can rupture. Keep cylinders upright, capped, and strapped in the truck. Never heat a cylinder with a torch, and never let one sit above 125F, which is a real consideration when the inside of a parked truck can pass that on a summer afternoon. Never trap liquid refrigerant between two closed valves, in a hose or a line section, because trapped liquid warming up has nowhere to expand. And when pressure testing a system, use dry nitrogen through a regulator. Never oxygen and never compressed air: either one mixed with the refrigerant oil inside the system can explode.

One more old rule that still matters: never apply an open flame to a system that contains refrigerant. Heated refrigerant breaks down into toxic and corrosive gases, including compounds in the phosgene family. Recover first, then braze.

A2L preview

You will hear the term A2L constantly. ASHRAE classifies refrigerants by toxicity (A is lower toxicity) and flammability (1 is no flame propagation, 2L is lower flammability, 3 is highly flammable like propane). R-410A is A1. The new R-454B and R-32 are A2L: mildly flammable, hard to ignite, nothing like propane, but they change a few habits. The two you should know now: with A2L systems you cut the refrigerant circuit open instead of unsweating joints with a torch, and you purge and flow nitrogen before and during any brazing. A2L cylinders look different on purpose: left-hand thread valves and a red band near the top. Module A31 covers A2L work in full depth, including the leak sensors built into the new equipment. For now, the takeaway is simple: A2L safety is mostly just excellent R-410A safety, done without shortcuts.

Heat: the Phoenix hazard that outranks all the others

Heat is not a comfort problem. It is a physiology problem, and in our market it is the most likely thing on this page to actually hospitalize you. Here is what is happening in your body. You cool yourself almost entirely by sweating, and sweat only cools you when it evaporates. As you dehydrate, your blood volume drops, your heart works harder, and your core temperature starts climbing. The dangerous part: the first thing rising core temperature degrades is the brain. Judgment, coordination, and self-awareness fail before you feel sick. The tech who insists he is fine is showing a symptom.

Learn the ladder of heat illness, in order:

1. Heat rash and heat cramps: painful muscle cramps, prickly skin. Your warning shot. Water, electrolytes, shade.
2. Heat syncope: dizziness or fainting when you stand up. Blood pooling, low volume. Stop work, cool down, hydrate.
3. Heat exhaustion: heavy sweating, cool clammy pale skin, nausea, headache, weakness, fast weak pulse. This is the last off-ramp. Stop completely, move to cooling, drink, and do not return to work that day without recovery. Untreated heat exhaustion becomes heat stroke.
4. Heat stroke: core temperature around 104F or higher, confusion, slurred speech, stumbling, skin that may be hot and dry because sweating has shut down, possible collapse or seizure. This kills people. Call 911 immediately, then cool the person aggressively: shade, water on the body, ice packs to neck, armpits, and groin, fan them. Do not wait for the ambulance to start cooling. Minutes decide the outcome.

Prevention beats every cure:

- Drink on a schedule, not on thirst: about 8 ounces every 15 to 20 minutes during hot work, up to roughly 48 ounces per hour maximum. Add electrolytes when you are sweating for hours; plain water alone all day flushes out the salts your muscles and nerves need.
- Acclimatize. Your body takes one to two weeks of gradual exposure to get good at sweating. New hires and anyone returning from a week off are the highest-risk people on the team, and most serious heat injuries hit workers in their first days on the job.

- Use work-rest cycles in high heat: planned breaks in shade or AC before you feel bad, not after.
- Watch each other. The buddy principle: you are responsible for noticing when another tech goes quiet, clumsy, or red-faced, because he will not notice it himself.
- Caffeine and energy drinks are dehydration accelerators. Alcohol the night before starts you in a hole.

PHOENIX FIELD NOTE

Phoenix summers run 100 to 115F ambient from June through September, and an attic over a 110F afternoon can sit at 130 to 150F. The Island Breeze hot season protocol: attic and rooftop work is scheduled for the early morning block whenever the job allows. Above 110F ambient, attic work runs on a hard work-rest cycle: 15 minutes maximum in the attic, then at least 15 minutes of recovery in shade or the truck AC with water before re-entry, and no solo attic entry without the dispatcher or another tech knowing you are in and when you went in. Above 115F ambient, attic and rooftop work is emergency-only and Seth or the lead tech signs off on the plan first. Every tech carries a minimum of 1 gallon of water for the day, drinks roughly 8 ounces every 15 to 20 minutes during exposure work, and adds electrolytes after the second hour of sweating. If your energy crashes, you signal the dispatcher and the schedule moves. A system failure in a Phoenix summer is a health emergency for the customer, and the only thing worse than one casualty on that call is two. Protect the tech first.

Ladders, roofs, and attics

Falls are the most consistent killer in all of construction, and HVAC techs climb every day. The ladder rules are simple and old because they work:

- Inspect before every climb: feet intact, rungs clean and solid, rails straight, rung locks engaged on extension ladders. A ladder with a cracked rail is trash, not a backup.
- Set the angle by the 4-to-1 rule: the base sits 1 foot away from the wall for every 4 feet up to the support point. Quick field check: stand with your toes at the ladder feet and extend your arms straight out; your palms should land on the rung at shoulder height.
- Extend the ladder at least 3 feet above the roof edge, and tie off or secure the top where possible. The extension is your handhold during the most dangerous moment, the transition on and off the roof.
- Three points of contact while climbing: two hands and a foot, or two feet and a hand. Tools go up on a hoist line or in a worn tool bag, never in your hands.
- Belt buckle rule: keep your belt buckle between the rails. Reaching sideways moves your center of gravity past the rail and tips the ladder.
- Fiberglass ladders for our trade. Aluminum conducts electricity, and we work around service drops and live equipment. Look up before you set any ladder: overhead power lines get a minimum 10 foot clearance.
- On the roof: identify the edges, skylights, and any soft or sun-rotted decking before you focus on the equipment. Skylights do not hold a person. Walk like the surface is trying to fool you, because sun-aged surfaces are.

Attics have their own protocol. The footing hazard: you walk only on framing members (joists and truss chords) or laid walk boards, never on the drywall between them, because drywall holds insulation and nothing else. One misstep is a leg through the customer's ceiling or a fall to the floor below. Bring a headlamp plus a backup

light, know your path to the hatch before you move away from it, watch for exposed wiring and nail points from the roof deck, and wear an N95 in blown insulation. Announce attic entries to someone, every time.

PHOENIX FIELD NOTE

Phoenix housing stock is typically 20 to 30 years old, which means attics with brittle, sun-cooked wiring insulation, undersized walk paths, and decades of dust that goes airborne the moment you move. Headlamp, N95, and gloves are the default attic kit here, not an upgrade. And the rooftop reality: package units on roofs are common in this market, so roof work is routine, which is exactly why it cannot become casual. A dark shingle roof on a 112F afternoon is hot enough to burn skin through a knee of fabric and to soften your boot soles. Glove the metal: handrails, unit panels, and copper lines in direct sun will be over 150F.

Monsoon season

PHOENIX FIELD NOTE

Arizona monsoon season runs roughly June 15 through September 30: sudden thunderstorms, lightning, microbursts, and haboobs, which are walls of dust that drop visibility to near zero in seconds. Island Breeze monsoon protocol: check radar before any roof or attic block during monsoon months. Lightning rule: at the first sound of thunder you are off the roof and off the ladder, and you stay off for 30 minutes after the last thunder you hear. No customer's airflow problem outranks that. Dust storm driving rule, straight from ADOT: pull aside, stay alive. Exit the roadway fully, stop, set the parking brake, lights OFF, foot off the brake pedal, and wait it out. Lights off matters because drivers in zero visibility steer toward tail lights and will follow yours off the road and into your truck. After any monsoon storm, treat outdoor electrical equipment as suspect: standing water around disconnects and condensers, wet whips, and storm-damaged service drops all get extra verification before you touch metal. Wet ground plus 240V is a different hazard class than the same equipment dry.

Driving and the truck

You will spend more hours driving than doing any single technical task, and vehicle crashes are the leading cause of on-the-job death across all industries. The rules are unglamorous: phone down or mounted and hands-free, full stop for seatbelts, speed matched to the load you carry. An HVAC truck is heavy and tall: it stops slower and tips easier than your car. Ladders and cylinders are projectiles in a hard stop, so racks get latched and cylinders get strapped upright every time the truck moves. Walk around the truck before reversing on any jobsite. Back in when you arrive so you pull out forward when you leave.

IB STANDARD

The Island Breeze truck standard is part of the safety system, not a cosmetic rule. Before the truck rolls each morning: ladder rack latched and locked, cylinders strapped upright and capped, fire extinguisher charged and accessible, water cooler filled with ice water in summer, PPE kit complete, cab and bed free of loose tools. A clean, organized truck is faster to work from, safer in a crash, and it is the first thing a customer sees. The truck is the storefront.

Professionalism as a safety culture marker

Here is a pattern you will see across your whole career: the tech with the tucked-in shirt, the labeled tool bags, and the photographed before-and-after is almost always the tech with the discharged capacitors and the tied-off ladder. That is not a coincidence. Professionalism and safety are the same trait, which is care about doing things right when nobody is checking, applied to different objects.

What this looks like in practice: you show up looking like someone the customer can trust in their home. You put on shoe covers without being asked. You explain what you are doing in plain language. You photograph your work, including the failed part, the nameplate, and the finished state, because documentation protects the customer, the company, and you. You never leave a job with a panel off, a disconnect pulled, or a gas valve in a state the customer does not know about. And you never, ever fake a reading or skip a verification step to save four minutes. A tech who cuts the boring corners cuts the lethal ones eventually. Customers cannot evaluate your brazing, but they can evaluate your care, and they are right to use one as a proxy for the other.

The professional identity to build from day one: you are the person on the jobsite whose habits do not depend on supervision.

Common Mistakes

1. Trusting the disconnect instead of the meter. Why it happens: the disconnect is pulled, the unit went quiet, and it feels dead. But disconnects fail, units have multiple feeds, and someone can re-energize the panel. Correction: live-dead-live verification before hands go in, every time, no matter how obvious it seems.
1. Shorting capacitors with a screwdriver. Why it happens: it is fast, and an older tech or a video demonstrated it. Correction: discharge through a 20,000 ohm 5 watt or larger resistor for 5 to 10 seconds, then verify under 1 volt with the meter. The resistor lives in your pocket on every capacitor job.
1. Skipping glasses and gloves for a quick gauge connection. Why it happens: hoses come on and off dozens of times a week and nothing has gone wrong yet. Correction: frostbite from a single liquid release is permanent, and your eyes do not heal from it. PPE goes on before the first hose touches a port.
1. Drinking water only when thirsty. Why it happens: thirst feels like a reliable gauge. It is not. Thirst lags dehydration, and heat dulls the signal further. Correction: drink on a timer, about 8 ounces every 15 to 20 minutes during hot work, with electrolytes on long sweat days.
1. Pushing through dizziness in an attic to finish the job. Why it happens: pride, the schedule, and the fact that heat impairs the judgment you would use to stop. Correction: dizziness, nausea, or confusion in heat means work stops immediately. Treat heat exhaustion as the last warning before a 911 call, because it is.

1. Setting the ladder too steep or too shallow to avoid moving a hose bib or a bush. Why it happens: repositioning takes a minute and the climb looks short. Correction: 4-to-1 angle, feet on solid ground, 3 feet above the roofline, every climb. Short falls break backs too.
1. Walking attic drywall between joists. Why it happens: insulation hides where the joists are, and the tech is rushing in the heat. Correction: never put weight anywhere you have not visually confirmed framing or a walk board. Clear insulation with your hand or a tool first. Slow is the only acceptable speed up there.
1. Heating a refrigerant cylinder or leaving it loose in a hot truck bed. Why it happens: cylinder pressure drops during charging in cold weather, or the tech is in a hurry to load up. Correction: warm water only, never flame, never above 125F, 80 percent fill maximum, strapped upright every transport.
1. Driving toward the job through a dust storm or staying on a roof as a storm builds. Why it happens: the schedule has weight, and the storm might pass by. Correction: pull aside, stay alive, lights off in dust. First thunder ends roof work, and the 30 minute clock restarts with every thunder you hear.
1. Treating professionalism as separate from safety. Why it happens: appearance and paperwork feel cosmetic next to electrical work. Correction: documentation, a clean truck, and a controlled work area are the visible half of the same habits that keep you alive. Build them together, because they fail together.

1 HEAT ACTION LADDER

Heat Illness Action Ladder

Heat index band and the minimum protocol required at each level

Above 115F

Extreme

STOP. Reschedule non-emergency exposure work.

Emergency work only, with a written plan and lead sign-off.

No solo attic or rooftop entry under any circumstances.

103 to 115F

High

Work-rest cycles: 15 min exposure, 15 min cooled recovery.

Buddy awareness active: someone always knows you are in.

Water on a timer: 8 oz every 15 to 20 minutes, plus electrolytes.

91 to 103F

Moderate

Mandatory water and shade breaks on a schedule.

Schedule attic and roof blocks for the coolest part of the day.

Watch teammates for clumsiness, silence, or a red face.

80 to 90F

Lower risk

Hydrate on schedule, water within reach at the work area.

New hires and techs back from time off are still acclimatizing:

treat them one band higher for their first two weeks.

Under 80F

Normal

Normal precautions. Water available on the truck.

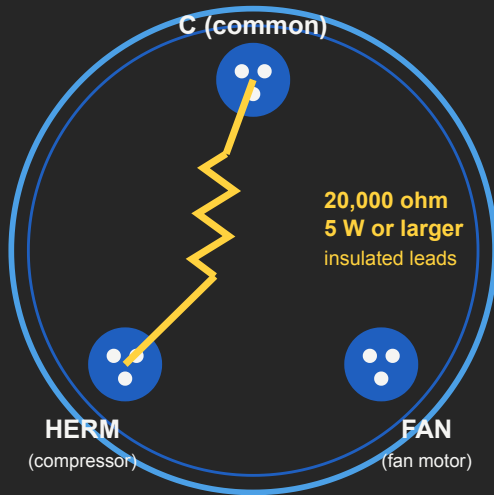
Build the hydration habit now so it is automatic in summer.

Attics run 20 to 40F hotter than ambient: attic work always counts as one band higher.

2 CAPACITOR DISCHARGE

Capacitor Discharge Procedure

Dual run capacitor, top view: power must already be verified dead



The Six Steps

- 1 Power off and verified: live-dead-live with the meter
- 2 Inspect the can: bulge, rust, or oil means extra caution
- 3 Bridge resistor across terminals and hold 5 to 10 seconds
- 4 Repeat for every pair: HERM-C, then FAN-C, then HERM-FAN
- 5 Verify with meter on DC volts: **under 1 volt on every pair**
- 6 Photograph the wiring, then and only then, pull leads

NEVER short a capacitor with a screwdriver.

A dead short arcs, pits terminals, and can crack the can. A capacitor holds its charge after power is off.

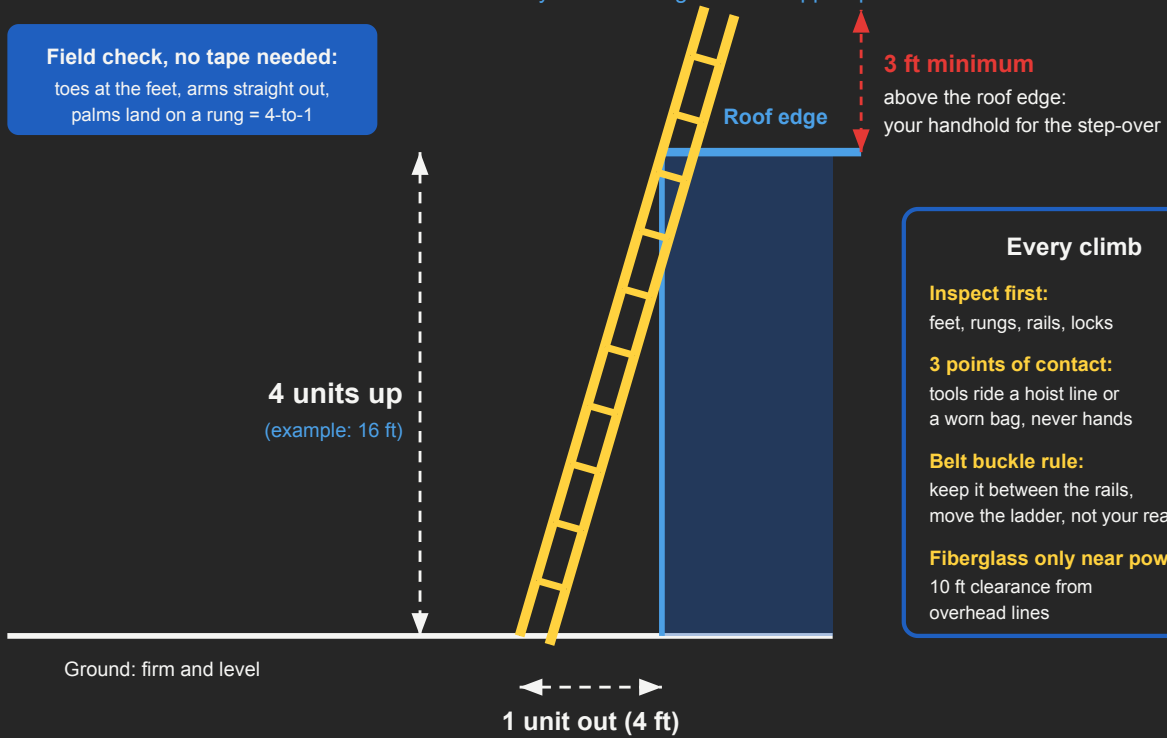
3 LADDER 4 TO 1

Ladder Setup: The 4-to-1 Rule

Base out 1 foot for every 4 feet of height to the support point

Field check, no tape needed:

toes at the feet, arms straight out,
palms land on a rung = 4-to-1



Every climb

Inspect first:

feet, rungs, rails, locks

3 points of contact:

tools ride a hoist line or
a worn bag, never hands

Belt buckle rule:

keep it between the rails,
move the ladder, not your reach

Fiberglass only near power:

10 ft clearance from
overhead lines

4 LOCKOUT TAGOUT FLOW

Lockout/Tagout: Residential HVAC Flow

No hands inside any panel until all six steps are complete

1. NOTIFY

Tell the customer: power is going off, and nobody touches the panel or thermostat

2. IDENTIFY

Find every source: disconnect, breakers, furnace switch, separate heat strip feeds

3. SHUT DOWN

Thermostat off first, so the disconnect is not opened under load

4. ISOLATE

Pull the block or flip the breaker: stand to the side, face away, firm pull

5. LOCK AND TAG

Breaker lockout device, or the pulled block goes in your pocket, tag if others could touch it

6. VERIFY ZERO

Live-dead-live with the meter. Only now is the circuit dead

Remember

50 volts and above is treated as hazardous.
Capacitors stay charged after lockout:
discharge and verify them separately.

LIVE - DEAD - LIVE

How step 6 is actually performed

- L** **LIVE: test a known hot source**
proves the meter works right now
- D** **DEAD: test your circuit, expect zero**
every leg to ground and leg to leg
- L** **LIVE: re-test the hot source**
proves the meter did not fail mid-test

Meter requirement: CAT III, 600 V minimum,
leads inspected, dial confirmed on volts