



Commissioning and Install Verification

MODULE M39

MASTER TECH

PREREQ M38

Two crews set identical 3 ton systems on the same street in the same week. Both systems blow cold air when the thermostat calls. One crew packs up at that point, because cold air means done. The other crew spends another ninety minutes with a manometer, probes, a clamp meter, a torque driver, and a bucket of water, and leaves behind a system that has been proven: airflow measured against design, charge verified against the nameplate, every lug torqued, every safety tripped on purpose, every number written down. Twelve months later one of those systems has had two callbacks and a slow leak nobody can find paperwork on, and the other has a complete birth certificate that makes every future service call faster. Commissioning is the difference, and this module turns the install skills you already own into a single, ordered, documented verification sequence that you run on every system you start up, including the ones somebody else installed.

Short Version

Commissioning is the ordered proof that an installed system actually performs to its design, and "it blows cold" proves almost nothing, because a system 20 percent low on charge with a strangled return still blows cold on a mild day. The sequence has seven stages and the order is load-bearing. Stage 1, pre-power: nitrogen pressure test held, evacuation to 500 microns with a decay test, electrical terminations torque-checked, drain pitched and trapped, breaker and disconnect verified against nameplate MCA and MOCP. Stage 2, airflow before charge: blower configured to spec, TESP measured against the 0.5 in WC design number, CFM verified at roughly 400 per ton, because every refrigerant reading you take afterward assumes the air is right. Stage 3, charge: weigh-in as the baseline, then subcooling verification on a TXV (8 to 12 F default) or chart superheat on a fixed orifice, after honest stabilization time. Stage 4, the 18 to 22 F temperature split as a sanity check, never as proof of charge. Stage 5, electrical under load: running amps against RLA, voltage at the contactor under load, capacitor microfarads against the minus 6 percent line. Stage 6, controls and safeties: every thermostat stage, defrost on heat pumps, a float switch tripped with real water, full furnace sequence and combustion numbers on dual fuel. Stage 7, documentation: the complete data sheet and photo record, because an unrecorded commissioning never happened. Then a customer walkthrough that teaches the homeowner to live with the system. Most 30 day callbacks trace to exactly one skipped stage, which is the entire argument for never skipping one.

Key Values

VALUE	TARGET OR THRESHOLD	NOTES
Nitrogen pressure test	150 to 200 psig held 15 minutes, zero drop	Temperature-corrected. Before evacuation, always

VALUE	TARGET OR THRESHOLD	NOTES
Evacuation	500 microns or below, with a decay test	Rise then stabilize: moisture. Continuous rise: leak. From C15
Design TESP	0.5 in WC	From C12 and M38. Measured, not assumed, on every commissioning
Airflow target	400 CFM per ton nominal	Verified by fan table or temperature rise method
Temperature rise method	Temp rise = output BTU/h divided by (1.08 x CFM)	Rearranged: CFM = output divided by (1.08 x measured rise)
Subcooling, TXV systems	8 to 12 F unless nameplate says otherwise	Nameplate always wins. From C17
Superheat, fixed orifice	Chart target from indoor wet bulb and outdoor dry bulb	No single number exists. From C17
Superheat, TXV verification	10 F plus or minus 5	Confirms the valve, never sets the charge
Line set adjustment	0.6 oz per extra foot, 3/8 liquid line	Beyond the nameplate's included length, commonly 15 ft
Stabilization before readings	10 to 15 minutes of runtime	Readings off an unstable system are fiction
Temperature split	18 to 22 F, return to supply	A sanity check, not a charge verification
Running amps	At or below nameplate RLA / FLA	Well below is normal at moderate load. Above is a finding
Supply voltage	Within plus or minus 10 percent of nameplate rating	Measured at the contactor, under load
Voltage drop across closed contactor contacts	Near zero; more than about 2 to 3 V means pitted or loose	Measured contact-to-contact with the unit running
Capacitor tolerance	Replace beyond minus 6 percent of rated microfarads	Even on a brand new unit. Verify, do not assume
Condensate slope	1/4 inch per foot, continuous, 3/4 inch PVC	Float switch tested with poured water
Gas manifold pressure (dual fuel)	Natural gas 3.5 in WC, LP 9 to 11 in WC	From C18
Combustion check (dual fuel)	O2 about 6 to 9 percent on an 80 percent furnace, CO air-free under 100 ppm	From D28
Warranty registration window	60 days, registered on site	10 year registered parts vs 5 year unregistered on most brands

Field Checklist

The seven-stage commissioning sequence. Run it in order on every new install, changeout, and uncommissioned system you inherit.

Stage 1: Pre-power

- Line set inspected: insulation continuous, supported, no kinks, no bare suction copper
- Nitrogen pressure test held 150 to 200 psig for 15 minutes with zero temperature-corrected drop
- Evacuated to 500 microns or below with a passing decay test
- Every field electrical termination torque-checked: disconnect lugs, contactor lugs, breaker lugs, ground
- Breaker and wire verified against nameplate: wire ampacity at or above MCA, breaker at or below MOCP
- Disconnect within sight of the unit and weatherproof
- Drain sloped 1/4 inch per foot, trapped where the equipment requires it, secondary protection in place

Stage 2: Airflow, before any charge work

- Blower speed, tap, or dip switches set to the design CFM for the installed tonnage
- Filter installed, correct size, and its pressure cost known
- TESP measured with a manometer and compared to the 0.5 in WC design number
- CFM confirmed: fan table against measured static, or temperature rise method
- Target: roughly 400 CFM per ton before any refrigerant reading gets trusted

Stage 3: Charge

- Charge weighed in: factory charge plus line set adjustment math, on a scale
- 10 to 15 minutes of stable runtime before any verification reading
- TXV or EEV: subcooling against nameplate or 8 to 12 F, superheat confirmed sane
- Fixed orifice: superheat against the wet bulb / dry bulb chart
- Final pressures, line temperatures, superheat, and subcooling recorded

Stage 4: Temperature split

- Return and supply dry bulb measured, split compared to 18 to 22 F
- Out-of-range split investigated, never "fixed" by adding refrigerant

Stage 5: Electrical under load

- Running amps on compressor and both fan motors, compared to RLA / FLA
- Voltage at the contactor under load, within 10 percent of nameplate
- Voltage drop across the closed contactor contacts near zero
- Capacitor microfarads measured against the minus 6 percent rule

Stage 6: Controls and safeties

- Every thermostat stage exercised: each cooling stage, each heating stage, fan-only
- Heat pumps: defrost board forced through a defrost cycle, reversing valve confirmed
- Float switch tripped with poured water, system shutdown confirmed
- Dual fuel: full furnace ignition sequence watched, manifold pressure set, combustion analyzed

Stage 7: Documentation and handoff

- Full commissioning data sheet recorded
- Photo record completed
- Warranty registered on site
- Customer walkthrough delivered

IB STANDARD

Island Breeze treats the commissioning data sheet as part of the installation, not paperwork after it. No install closes in ServiceTitan without the full data set (static, CFM basis, charge math, final readings, amps, voltages, capacitor values, safety test results) and the 8-photo close-out. The startup numbers recorded at commissioning are the baseline every future maintenance and diagnostic visit on that system gets compared against.

Full Breakdown

An installed system is not a verified system

Every module before this one taught you a piece of the install: load calculation and selection in M37, duct design and static in M38, brazing in C16, evacuation in C15, charging in C17, electrical in F7 and F8, controls in F9. Commissioning is the stage where all of it gets proven, because installed and working are two different claims. Installed means the equipment is set, connected, and runs. Verified means somebody measured the things that matter and compared each one to a number the manufacturer or the design specified.

"It blows cold" is the most dangerous sentence in installation work, and here is why it proves so little. Cold supply air is what you get from a correctly commissioned system, and also from a system 20 percent undercharged on a 78 degree day, and from a system moving 300 CFM per ton through a strangled return, and from a system with a loose lug that will arc itself apart in August, and from a heat pump whose defrost board was never configured and will ice into a block the first cold week. Every one of those systems blows cold in front of the customer on install day. The differences only show up on instruments, and they only show up at all if someone puts instruments on the system. That someone is the commissioning tech, and the day to find these problems is the day you are already standing there with the panels off, not thirty days later on a callback.

There is a second reason commissioning exists, and it is about time. A new system's startup numbers are the healthiest numbers it will ever produce. Static pressure, subcooling, amp draws, capacitor microfarads, temperature split: recorded at commissioning, those become the baseline every future reading is judged against. A tech five years from now who finds 0.74 in WC of static is asking a very different question if the

commissioning sheet says it started life at 0.52. Without the baseline, every future diagnosis starts from zero. Commissioning is you doing a favor for every tech who ever touches this system again, including future you. One vocabulary point before the sequence. Commissioning is not a final inspection walk-around and it is not a punch list. It is an ordered series of measurements, each compared to a target, with the order arranged so that each stage validates the assumptions of the next. That ordering is the skill, so we take the stages in order.

Stage 1: Pre-power checks

Everything in this stage happens before the system runs, and most of it happens before the system even has high voltage. The theme of Stage 1 is integrity: the refrigerant circuit is tight and dry, the electrical connections are mechanically sound, the water has somewhere safe to go.

Lineset and circuit integrity. From C16 and C15, one sentence each: brazed joints get made under flowing nitrogen so no oxide scale forms inside the pipe, and an opened circuit gets pressure tested and evacuated before refrigerant touches it. At commissioning you verify the outcomes. The pressure test is nitrogen at 150 to 200 psig, held 15 minutes minimum, with zero pressure drop after temperature correction, because nitrogen pressure moves with temperature and a reading that fell 3 psig as a cloud rolled over is not a leak. If you set the test up and the install plan has you returning later, write down the start pressure and the temperature, because "it looks about the same" is not a held test.

Then the evacuation: 500 microns or below, proven with a decay test. Valve off the pump and watch the gauge. Holding steady is a pass. Rising and then leveling off means moisture is still boiling out of the oil and the circuit needs more pump time. Rising steadily without leveling means a leak, and you are back to the nitrogen stage. The decay test is the difference between a system that reached 500 microns for one second and a system that is actually dry and tight, and only the second one gets charged.

IB STANDARD

The 500 micron evacuation with a passing decay test is the Island Breeze standard on every opened system, every time, and the micron gauge photo is part of the close-out record. A changeout that gets charged without a documented decay test is an incomplete install regardless of how well it runs.

While the pump runs, your hands are free for the electrical and drain checks, which is exactly how an efficient commissioning uses its time.

Torque-checked terminations. A loose electrical lug is the patient zero of electrical failures. Loose connections have resistance, resistance under current makes heat, heat oxidizes the connection and loosens it further, and the spiral ends in a melted lug, a burned wire, or an arc. New installs are where loose lugs are born: a crew moving fast hand-tightens a disconnect lug and nobody ever checks it again. So commissioning checks every field termination with a torque driver against the listed spec, which is printed on the equipment label or panel: line and load lugs at the disconnect, the contactor lugs, the breaker terminations at the panel, the equipment ground. Tug-testing low voltage connections counts too. This takes ten minutes and it removes one of the most common causes of first-summer failures.

Breaker and disconnect versus the nameplate. From F7 you know wire ampacity and overcurrent protection exist to keep conductors from cooking. The nameplate gives you two numbers that govern the whole branch

circuit. MCA, minimum circuit ampacity, is the smallest wire ampacity allowed to feed the unit. MOCP, maximum overcurrent protection, is the largest breaker or fuse permitted to protect it. Commissioning verifies both directions: the wire is rated at or above MCA, and the breaker is at or below MOCP. A breaker above MOCP will not protect the equipment the way the manufacturer designed; a breaker far below it gives nuisance trips on hot-day starts. Typical residential numbers run around 30 A for 2 to 3 ton equipment and 40 to 45 A for 4 to 5 ton, but the nameplate on the actual unit is the only authority. While you are there: the disconnect must be within sight of the unit and weatherproof, and the breaker handle should be labeled.

Drain pitch and trap. Condensate is the only part of the system that works by gravity, and gravity does not get commissioned by looking. The primary drain runs 3/4 inch PVC with a continuous 1/4 inch per foot slope, no bellies, supported so summer heat does not sag it into one. Where the equipment's drain pan sits in negative pressure (most horizontal air handlers and many uncased coils), the drain needs a trap, because a blower pulling air backward up an untrapped drain will hold water in the pan until it overflows. Verify the trap is actually a trap, with a depth that beats the blower's static, and that there is a way to clean it. Attic installations get a secondary pan with its own protection. The functional test of all this plumbing happens in Stage 6 with real water; Stage 1 is where you confirm the geometry is right while you can still fix it easily.

Stage 2: Airflow verification, before charge

One sentence of recall: C12 taught you that capacity is airflow times temperature change ($\text{BTU/h} = 1.08 \times \text{CFM} \times \text{temperature difference}$) and that every refrigerant reading assumes the coil is seeing design airflow, and M38 taught you how the duct system creates or destroys that airflow. Commissioning is where the rule becomes a sequence: airflow gets verified before the charge gets verified, every time, no exceptions.

The reason is contamination of evidence. Low airflow on a TXV system drags suction down and bends your subcooling story. Low airflow on a fixed orifice system drives superheat down and reads exactly like an overcharge. If you verify charge first and airflow second, every refrigerant number you wrote down is suspect the moment the airflow comes back wrong, and you get to do Stage 3 again. Air first. Always.

Set the blower to spec. Equipment ships at a factory default blower setting, and the factory does not know what tonnage of coil you matched or what duct system you inherited. Commissioning means deliberately configuring the blower: the speed tap on a PSC motor, the dip switches or board pins on a constant torque ECM, the airflow setting on a constant airflow ECM, chosen from the installer manual to deliver the design CFM for the installed cooling tonnage. Write down what you set it to. A blower left on its shipping default is one of the most common hidden defects in new installs, and it is invisible from the supply register, because the air still comes out and it is still cold.

Measure TESP. Drill the two test ports if the install did not already provide them, return side before the blower, supply side after the equipment, and read both with a manometer exactly as C12 taught. The design number is 0.5 in WC for most residential equipment, and M38 taught you why so many duct systems blow past it. On a brand new install, you built or at least connected this duct system, so TESP is your own report card. A new install reading 0.85 in WC is telling you about a filter choice, an undersized return, or a crushed flex run while the crew is still on site to fix it.

Verify CFM. Two methods, both from C12, one sentence each. The fan table method: take your measured TESP into the manufacturer's blower table at the configured speed and read the delivered CFM. The temperature rise

method, when there is a gas furnace to fire: $\text{temp rise} = \text{output BTU/h} \div (1.08 \times \text{CFM})$, rearranged in the field as $\text{CFM} = \text{output} \div (1.08 \times \text{measured rise})$, where output is input times efficiency. Fire the furnace, let the rise stabilize, measure return to supply, and the formula hands you the CFM. The two methods cross-check each other, and on a dual fuel commissioning you will have both anyway. The verdict you need before Stage 3: roughly 400 CFM per ton of installed cooling.

Filter restriction. The filter that ships with the job, or the one the homeowner buys next month, is a pressure component. Record the filter type and size on the data sheet and take your TESP reading with the real filter installed, not with the rack empty, because an empty-rack static is a number for a system that will never exist. If the design only works with the rack empty, the design is wrong, and commissioning just caught it.

PHOENIX FIELD NOTE

Desert air is dry, so Phoenix systems lean on sensible capacity and tolerate airflow at and even above the 400 CFM per ton nominal, where a humid market might pull down toward 350 for latent removal. What Phoenix does not tolerate is attic duct laziness: a commissioning TESP taken at 7 AM on a new attic install can pass while the 150 degree afternoon attic softens unsupported flex into bellies by September. Strap and support get verified as part of Stage 2, not just the manometer reading.

Stage 3: Charge verification

One sentence of recall: C17 taught you the whole discipline, weigh-in as the gold standard on every new install with the line set adjustment math, then subcooling verification on a TXV or chart superheat on a fixed orifice. Commissioning does not re-teach it; commissioning sequences it and holds you to the proof.

The weigh-in already happened during the install: factory charge off the data plate, plus 0.6 oz per foot of 3/8 liquid line beyond the included length (commonly 15 ft), pounds carried at 16. A 9 lb 11 oz target on a 40 ft line set against an 8 lb 12 oz plate is the worked example you know. Commissioning asks two questions about it. First: does the data sheet show the math? A total without the plate value, the measured length, and the per-foot factor is a number nobody can audit. Second: does a verification reading agree with the scale?

That second question is the heart of the stage. The scale said the right mass went in; the readings prove the system agrees. On a TXV or EEV system, the proof is subcooling against the nameplate target, or 8 to 12 F when the plate is silent, with superheat checked as a sanity witness near 10 F plus or minus 5. On a fixed orifice system, the proof is superheat against the chart target built from indoor wet bulb and outdoor dry bulb. And the readings only count after stabilization: 10 to 15 minutes of continuous runtime, panels on, before the first reading you trust, and settling time again after any adjustment. A commissioning sheet filled out four minutes after compressor start is a work of fiction with good handwriting.

When the scale and the readings disagree, neither one simply wins. A correct weigh-in showing 3 F of subcooling means something specific is wrong: the line set math, the measured length, a restriction, a probe. Find which, because shrugging and adding refrigerant until the number looks right just buried an install defect under extra charge, and it will come back.

Record everything: refrigerant type, total weighed charge with the math, final pressures, line temperatures, superheat, subcooling, the target used, and the ambient conditions the readings were taken in. The ambient

matters because the next tech needs to judge your baseline numbers in context, exactly as you judge condensing temperature against outdoor air.

Stage 4: The temperature split sanity check

One sentence of recall: from C12 and D24, the indoor temperature split is supply dry bulb subtracted from return dry bulb, with 18 to 22 F as the healthy steady-state band. At commissioning, the split is the closing handshake of the airflow and charge stages: with CFM verified and charge proven, a split inside the band says the whole sensible delivery chain agrees with itself.

Know exactly what the split can and cannot prove, because this number gets abused more than any other in the trade. What it can do: catch gross problems fast. A 9 F split on a new install means something major is wrong and the commissioning is not done. A 26 F split says the coil is starved for air and sends you back to Stage 2. What it cannot do: verify charge. The split is blind to small charge errors, it moves with indoor humidity (a humid return air condition spends capacity on moisture removal and shrinks the dry bulb split legitimately), and it cannot tell low airflow from overcharge from a dozen other faults. A perfect 20 F split coexists comfortably with a 15 percent charge error. So the split is a sanity check that can fail a commissioning, but it can never pass one by itself, and "the split was good" is never the answer to "did you verify the charge."

Stage 5: Electrical verification under load

One sentence of recall: F7 and F8 gave you amps, volts, and the component family, and D23 taught you to diagnose them. Commissioning flips the purpose: instead of hunting a failure, you are proving health and recording the healthy numbers, with the system running under real load.

Running amps versus RLA and FLA. Clamp the compressor common wire and compare to the nameplate RLA, rated load amps. A healthy compressor at moderate conditions typically draws comfortably below RLA; climbing toward it on a mild day is a finding. Then both fan motors against their FLA, full load amps. Record all three numbers. These amp draws are baseline gold: a compressor that commissions at 11.2 A against a 16.7 RLA and reads 15.9 three summers later is telling a story that only exists because you wrote down the first number.

Voltage at the contactor under load. Measure supply voltage at the contactor line lugs with the unit running, not just sitting idle, because voltage that looks fine unloaded can sag under starting and running current if a connection or conductor is marginal. The unit must see voltage within plus or minus 10 percent of nameplate rating. Then the test that catches the install defect a voltmeter was born for: measure across each closed contactor pole, line lug to load lug on the same pole, with the unit running. A healthy closed contact reads near zero volts, because a closed switch should be a wire. A reading of more than about 2 to 3 V across a closed contact means resistance, which means heat, which on a new install almost always means a lug that never got torqued or a contactor damaged in shipping. Five minutes with a meter, and it catches the exact failure that otherwise shows up as a no-cool call in the first heat wave.

Capacitor verification. One sentence of recall: from F8 and the failure data, capacitors are the single most common service failure, and the standard is replacement beyond minus 6 percent of rated microfarads. Commissioning measures the capacitor on a new unit anyway, because factory components arrive out of spec more often than the word "new" suggests, and because the commissioning value is the baseline that future tune-ups will track decline against. Measure, compare to the rating printed on the can, record both numbers.

Stage 6: Controls and safeties

Everything in this stage answers one question: when the system is asked to do something, or asked to protect itself, does it actually do it? Nothing here is verified by inspection. Everything is verified by making it happen.

Thermostat staging. Run every stage the equipment has, from the thermostat, not by jumpering. First stage cooling, second stage if the equipment stages, each heating stage, fan-only. On a heat pump, confirm the reversing valve energizes in the mode the thermostat is configured for, because an O/B configuration error produces a heat pump that heats on a call for cooling, runs a correct-looking cycle the whole time, and turns into a baffling callback the first time the season changes. Watch each stage produce its physical result at the equipment: contactor pulls, blower ramps, valve shifts, aux heat amps climb.

Defrost on heat pumps. One sentence of recall: C19 taught the defrost cycle and D29 taught you to diagnose it. At commissioning you force a defrost using the board's test pins or service procedure and watch the full choreography: reversing valve shifts, outdoor fan stops, aux heat covers the indoor side, then everything returns to heating. You are confirming board configuration, sensor placement, and valve operation in two minutes on a day of your choosing, instead of discovering an ice-block failure during the first cold snap, which in Phoenix is exactly the week nobody has time for callbacks.

Float switch trip test. Pour water into the pan, or lift the float by hand where pouring is impractical, and watch the system actually shut down. A float switch that is wired but never tripped is a hope, not a safety. Water poured at commissioning costs nothing; water through a ceiling costs a drywall contractor and the customer's trust.

IB STANDARD

A float switch goes on every Island Breeze install, and it gets tested with poured water at commissioning, not just installed. The test result is recorded in the close-out. Arizona attic installations also get the secondary pan with a conspicuous termination, and the walkthrough teaches the homeowner what water dripping from that fitting means: call us, the safety is doing its job.

Gas furnace sequence and combustion on dual fuel. One sentence each of recall: C18 taught the ignition sequence (thermostat call, inducer, pressure switch, igniter, gas valve, flame proof, blower) and the manifold pressures, 3.5 in WC natural gas and 9 to 11 in WC LP; D28 taught combustion analysis with O₂ around 6 to 9 percent on an 80 percent furnace and CO air-free under 100 ppm. On a dual fuel commissioning, you watch one full sequence end to end, clock the flame-to-blower delay, set and record manifold pressure with a manometer, and put the analyzer in the flue for the chemistry numbers. You also verify the dual fuel changeover logic: the heat pump and the furnace must never run heat simultaneously on a system not designed for it, and the balance point or changeover setting gets recorded.

Stage 7: Documentation

A commissioning that is not recorded did not happen. That is not a slogan, it is operationally true: the entire baseline value of stages 1 through 6 lives in the record, and an undocumented commissioning protects nobody, trains nobody, and proves nothing in a warranty dispute.

The complete commissioning data sheet carries: equipment model and serial numbers, indoor and outdoor; pressure test value and hold; final micron reading and decay result; blower setting and measured TESP; CFM and the method that produced it; filter type and size; full charge math and final refrigerant readings with ambient conditions; temperature split; all amp draws against RLA and FLA; supply voltage; capacitor measured versus rated; every safety and control test with its result; warranty registration confirmation. Every line is a number or a pass, never a checkmark next to a vague word. "Electrical: good" is not data. "Compressor 11.2 A against RLA 16.7" is data.

IB STANDARD

Island Breeze closes every install in ServiceTitan with the 8-photo standard, and each photo exists to prove a specific thing. (1) The condenser set: level, clearances, pad, proving the outdoor installation quality. (2) The disconnect and wiring: proving the electrical termination work and disconnect placement. (3) The line set: proving insulation, support, and penetration sealing. (4) The air handler or furnace as installed: proving the indoor set, connections, and workmanship. (5) The drain and float switch: proving the condensate path and the safety that guards it. (6) The filter: proving type, size, and a clean starting point. (7) The startup gauge readings with the temperature split: proving the system was actually commissioned with instruments, not eyeballed. (8) The system running: proving the job ended with a working system. Eight photos, every install, before the truck leaves the street. A future tech, a warranty processor, or Seth should be able to reconstruct the install from the photos alone.

Warranty registration happens on site, inside the 60 day window with weeks to spare, because most brands pay 10 year registered parts coverage versus 5 year unregistered, and an unregistered install silently costs the customer half their warranty. On-site registration is a commissioning line item, not an office task that might happen.

The customer handoff walkthrough

Commissioning ends with a human handoff, and it is a service quality task, not a sales conversation. The customer just bought a machine they will live with for fifteen years, and the next thirty minutes decide whether they operate it well or fight it.

Show, at the equipment. Walk them to each piece and show them what is theirs to know: where the filter lives and how it comes out, the disconnect and what it is for, the breaker that feeds the system, the float switch and what it does, the secondary drain termination if there is one and exactly what dripping from it means, the outdoor unit and the clearance it needs from plants and stored items.

Explain, at the thermostat. Teach the thermostat in the customer's hands, not yours: mode, setpoint, fan settings, schedule basics if it has one. Two settings deserve plain warnings. Fan ON versus AUTO: ON runs the blower continuously, which some people want, with the tradeoff of energy use and, in humid weather, re-evaporating coil moisture. And large setbacks: a system sized correctly by Manual J does not have a 10 degree recovery sprint in it on a design day, so deep setbacks recover slowly, and that slowness is physics, not a defect. Sixty seconds on heat pump basics if it is one: supply air feels cooler than a furnace and that is normal; the defrost cycle makes steam and a whoosh and that is normal too. Every minute of this is callback prevention, because a large share of "it's not working" calls are actually "nobody taught me."

Set expectations. Filter schedule with a specific interval for their filter type and home, in writing on the data sheet copy. What the system sounds like in normal operation. Who to call and what to mention if something seems wrong. Confirmation that the warranty registration is done, and where their copy of the commissioning data lives. Then the last question: "What can I show you again before I go?" Asked like you mean it, because you do.

Callbacks are commissioning failures

One sentence of recall: a callback is the customer reporting the same problem within 30 days, and D22 taught that callbacks come from skipped verification, not bad luck. On installs, the mapping is nearly one to one: take the most common 30 day install callbacks and each one points back at a specific commissioning stage that got skipped.

30 DAY CALLBACK	SKIPPED COMMISSIONING STEP
Low charge, leak at a fitting or joint	Stage 1: pressure test not held, or not actually performed for the full window
Compressor or TXV trouble, acid or moisture signature	Stage 1: evacuation shortcut, no decay test
Breaker trips, burned lug, no-cool in the first heat wave	Stage 1 and 5: terminations never torqued, breaker vs MOCP never checked, contact drop never measured
Water leak, ceiling stain, float switch flooding	Stage 1 and 6: drain pitch and trap unverified, float switch never trip-tested
Frozen coil, weak cooling, high bills	Stage 2: blower left on factory default, TESP never measured, CFM never verified
"Never cooled right since install"	Stage 3: charge weighed but never verified, or line set math skipped
Heats when cooling is called, or vice versa	Stage 6: thermostat staging and O/B configuration never exercised
Iced-up heat pump in the first cold week	Stage 6: defrost never forced and confirmed
No heat on the first furnace call of fall	Stage 6: heating stages never run during a summer install
Warranty claim denied as unregistered	Stage 7: registration never completed

Read that table backward and it becomes the strongest argument for the sequence: roughly ninety minutes of commissioning buys out the large majority of first-month failures. A callback costs a truck roll, a tech's morning, and a customer's confidence; the commissioning stage that would have prevented it costs minutes.

IB STANDARD

Every Island Breeze install callback within 30 days gets reviewed against the commissioning record, and the review question is always the same: which stage would have caught this, and does the data sheet show that stage was done? More than 1 callback per 10 installs triggers coaching. The commissioning record is what makes that review fair: a tech with a complete data sheet showing the stage was done and passed is protected by it.

Commissioning a system someone else installed

Sooner or later you will stand in front of a running system that was installed, by another company or another crew, and never commissioned: no data sheet, no startup numbers, maybe a homeowner who says it has "never been quite right since they put it in." The job is the same seven stages with one honest amendment: some Stage 1 facts are no longer directly testable, so you verify their consequences instead.

You cannot re-witness the pressure test or the evacuation without recovering the charge, and you do not open a sealed running circuit just to audit history. What you can do is interrogate the outcomes. A charge that verifies clean against the nameplate, stable subcooling, sane superheat, and no acid or moisture indicators is circumstantial evidence the circuit was handled adequately. A system months old and already low has failed the Stage 1 audit retroactively, and now there is a leak search in this job's future. Everything else in the sequence is fully testable today, and you run all of it: torque every termination, verify breaker against MOCP, measure TESP and verify the blower setting against the installed tonnage, verify the charge by readings against the nameplate, take the split, run the amps and voltages and capacitor, trip the float switch, force the defrost, exercise every stage, and write down everything as this system's first real baseline.

Two professional disciplines while you do it. Document as-found versus as-left, separately and honestly: the as-found column describes the install you inherited, the as-left column describes the system after your corrections, and the difference is your work product. And keep the commentary clinical, exactly per D30: the record says "blower at factory default, reconfigured to 1,200 CFM for 3 ton" and never says the other company was garbage. The readings make the point better than the editorial would, and you have no idea what constraints the original crew worked under. What you walked into, what you measured, what you changed, what it measures now. That is the whole story, and a commissioning record told that way turns an inherited liability into a documented, verified system.

Common Mistakes

1. **Treating cold supply air as a finish line.** Cold air at the register coexists with wrong charge, wrong airflow, loose lugs, untested safeties, and an unregistered warranty. It is the beginning of verification, not the end of the job.
2. **Verifying charge before verifying airflow.** Low airflow bends every refrigerant reading, so charge numbers taken first are unauditably the moment static comes back high. Stage 2 before Stage 3 is the load-bearing order in the whole sequence.
3. **Leaving the blower on the factory default.** The factory setting is a shipping guess, not your design CFM. It hides perfectly behind cold air and surfaces as a frozen coil or a 26 F split weeks later. Configure it, verify it,

write down the setting.

4. **Skipping the torque driver because the install is new.** New is exactly when lugs are loose, because nobody has ever checked them. The contact-drop test under load takes five minutes and catches the failure before it becomes an August no-cool.
5. **Trusting the temperature split as charge verification.** The split is blind to small charge errors and moves with humidity and airflow. It can fail a commissioning; it can never pass one. Subcooling or chart superheat is the proof, the split is the handshake.
6. **Installing safeties without tripping them.** A float switch that was never fed water, a defrost that was never forced, a heating stage never run during a July install: each is an untested promise, and untested promises become callbacks in exactly the season you cannot afford them.
7. **Recording adjectives instead of numbers.** "Static good, amps normal, charge verified" protects no one and baselines nothing. Every data sheet line is a measured value next to its target. If there is no number, the line is not done.
8. **Walking into someone else's install and editorializing instead of measuring.** Trashing the previous company is unprofessional and proves nothing. Run the full sequence, document as-found and as-left, and let the numbers tell the story. The customer needed a verified system, not a verdict on the last crew.

Module Visuals

AIRFLOW VERIFICATION METHODS

Verifying Airflow Before the Charge

Stage 2 verdict required: roughly 400 CFM per ton, proven by one of two methods

FIRST: set the blower on purpose. Tap, dip switches, or CFM setting from the installer manual
for the installed tonnage. The factory default is a shipping guess. Record the setting. Real filter in.

METHOD 1: STATIC + FAN TABLE

Manometer ports: return before blower,
supply after the equipment.

TESP = both magnitudes added.

Design number: 0.5 in WC

Example: minus 0.22 + plus 0.30 = 0.52 in WC

Fan table: configured speed row,
measured static column, read CFM.

1,180 CFM / 3 tons = 393 CFM per ton

Works on every system, any season

METHOD 2: TEMPERATURE RISE

Fire the furnace, let the rise stabilize,
measure return to supply rise.

Temp rise = output BTU / (1.08 x CFM)

solved in the field as:

CFM = output / (1.08 x measured rise)

Output = input x efficiency.

Example: 64,000 output, 50 F rise:

64,000 / (1.08 x 50) = about 1,185 CFM

Needs a furnace to fire; cross-checks Method 1

AIR BEFORE CHARGE, ALWAYS

Low airflow bends every refrigerant reading; charge numbers taken first are unauditale.

CHARGE VERIFICATION MATRIX

Charge Verification at Commissioning

The scale sets the charge. The readings prove the scale was right.

BASELINE: WEIGH-IN, EVERY NEW INSTALL AND CHANGEOUT

Plate charge + (extra feet x 0.6 oz per ft, 3/8 liquid line) carried at 16 oz per lb
Example: 7 lb 6 oz plate, 15 ft included, 28 ft actual: $13 \times 0.6 = 8$ oz, target 7 lb 14 oz

Then verify by metering device:

TXV or EEV: SUBCOOLING

Target: nameplate value. Plate silent: 8 to 12 F.
Liquid saturation temp minus liquid line temp.
Superheat is the WITNESS, not the gauge:
10 F plus or minus 5 confirms the valve works.

**Never charge a TXV to superheat:
the valve hides overcharge while subcooling climbs**

FIXED ORIFICE: CHART SUPERHEAT

Target from indoor WET BULB + outdoor DRY BULB.
A moving target. No single number exists.
Within about 3 F of the chart target.
Chart target below 5 F: stop, weigh-in decides.

**Never charge a piston to subcooling:
nothing regulates condenser liquid on a piston**

STABILIZATION BEFORE ANY READING COUNTS: 10 to 15 minutes of runtime, panels on,
and settling time again after every adjustment. Unstable readings are fiction.

SCALE AND READINGS DISAGREE? Never just add refrigerant.

Check the line set math, the measured length, a restriction, or a probe. Find why, then act.

COMMISSIONING FLOW

The Seven-Stage Commissioning Sequence

The order is load-bearing: each stage validates the assumptions of the next

1

PRE-POWER CHECKS

Nitrogen 150 to 200 psig held 15 min, zero drop. Evacuation 500 microns + decay test. Every lug torque-checked. Wire at or above MCA, breaker at or below MOCP. Disconnect within sight. Drain: 1/4 in per ft slope, trapped, secondary protection.

2

AIRFLOW, BEFORE ANY CHARGE WORK

Blower deliberately set to design CFM, never left on the factory default. TESP measured against the 0.5 in WC design number. Real filter installed. CFM verified by fan table or temperature rise: roughly 400 CFM per ton. **Low airflow bends every refrigerant reading. Air first, always.**

3

CHARGE VERIFICATION

Weigh-in baseline: plate charge + 0.6 oz per extra ft of 3/8 liquid line, math on the sheet. 10 to 15 min stable runtime, then proof: subcooling on a TXV (8 to 12 F default), chart superheat on a fixed orifice. Scale and readings must agree.

4

TEMPERATURE SPLIT SANITY CHECK

Return to supply dry bulb, 18 to 22 F. Confirms the sensible chain agrees with itself. **Can FAIL a commissioning. Can never PASS one. The split is not charge proof.**

5

ELECTRICAL UNDER LOAD

Running amps vs RLA / FLA, all motors recorded. Supply voltage within 10 percent. Voltage drop across each CLOSED contactor pole: near zero. 2 to 3 V+ = loose or pitted. Capacitor measured vs rating: replace beyond minus 6 percent, baseline recorded.

6

CONTROLS AND SAFETIES: MAKE THEM PROVE IT

Every thermostat stage run from the thermostat. Heat pump: O/B confirmed, defrost forced. Float switch tripped with poured water, shutdown confirmed. Dual fuel: full ignition sequence, manifold pressure set, combustion analyzed. **Nothing is verified by inspection. Everything is verified by making it happen.**

7

DOCUMENTATION AND HANDOFF

Full data sheet: every line a number next to a target, never an adjective. Photo record complete. Warranty registered on site (60 day window, 10 yr vs 5 yr). Customer walkthrough: filter, thermostat, safeties, expectations.

A commissioning that is not recorded did not happen.

Nearly every 30 day install callback maps to exactly one skipped stage on this ladder.

DOCUMENTATION STANDARD

The Documentation Standard

A commissioning that is not recorded did not happen

THE DATA SHEET

Every line: a NUMBER next to a TARGET

Pressure test: 175 psig / 15 min, 0 drop

Evacuation: 480 microns, decay PASS

TESP: 0.52 in WC vs 0.5 design

CFM: 1,180 = 393 per ton

Subcool 10 F vs target 9 / SH 11 F

Split 19.5 F / amps vs RLA / volts / cap

Safeties: float trip, defrost, all stages

Banned words: good, fine, OK, normal

Today's numbers are the baseline
every future tech compares against

THE PHOTO RECORD: 8 SHOTS

Each photo proves one specific thing

- 1 Condenser set: pad, level, clearances
- 2 Disconnect and wiring, cover off
- 3 Line set: insulated and supported
- 4 Air handler / furnace as installed
- 5 Drain, trap, and float switch
- 6 Filter: clean, correct size, seated
- 7 Gauge readings with the temp split
- 8 System running, panels back on

Shot 7 proves instruments were used, not a hand over a register

WARRANTY: REGISTER ON SITE, BEFORE LEAVING THE DRIVEWAY

Registered: 10 year parts warranty. Unregistered: 5 years. The window is 60 days.

A 60 day window nobody should ever need: it closes with the truck door, today.

THE RECORD IS THE PRODUCT

Sheet, photos, registration: done on site, attached to the job, before the truck moves.
Memory is not documentation. The office is not the place to reconstruct readings.

HANDOFF WALKTHROUGH

The Customer Handoff Walkthrough

Service quality, not sales: the customer inherits the system today

1. SHOW

The filter: where it lives, how it comes out, which way air flows

The disconnect and the breaker

The float switch and the secondary drain outlet

The outdoor unit and its clearance space to protect

Walk to each one. Pointing from the doorway is not showing.

2. TEACH

Thermostat in THEIR hands: they press, you narrate

Mode, setpoint, schedule, fan AUTO vs ON as a choice

Filter schedule, in writing, with the size written down

Deep setbacks recover slowly on design days: set and leave

If they did not touch it, they did not learn it.

3. SET EXPECTATIONS

What normal SOUNDS like: start, run, shift, stop

A drip from the secondary line means call us: the safety worked

Heat pump in winter: steam in defrost is normal, not smoke

Who to call, and that the system has a recorded baseline on file

An expected event never becomes a panic call.

The last sentence, every time:

"What can I show you again before I go?"

THE HANDOFF IS SERVICE, NOT SALES

No upsell, no pitch, no products. The walkthrough has one job: the customer can run, maintain, and trust the system you just proved. That trust is the entire deliverable.

A customer who understands the system calls about real problems and sleeps through normal ones.

Ten unhurried minutes at the end of the install prevents the "it sounds weird" callback.