ISLAND BREEZE TECHNICIAN CERTIFICATION PROGRAM

EPA 608: Type I and Type II (Type III Overview)

MODULE C14 | CORE SYSTEMS | PREREQ C13

The scene. You are sitting in the exam room. Core is behind you and it went fine. Then the Type II section opens with this: "A recovery unit manufactured in 1998 is used to evacuate an appliance that normally contains 240 pounds of R-502. To what level must the appliance be evacuated?" There are four answers and three of them are real numbers from the real table. The tech next to you is guessing. You are not, because you walked in knowing the recovery vacuum table cold, knowing the two thresholds that drive it, and knowing the handful of trap questions the test writers have been recycling for thirty years. This module is the Type I and Type II sections of the EPA 608 exam, plus enough Type III to recognize it on sight, because Island Breeze sends you in for Universal.

Short Version

In C13 you learned the Core rules: venting refrigerant is illegal, recovery is mandatory, and certification is what makes you legal to touch a charged system. Type I and Type II are where those rules get specific numbers. Type I covers small appliances: hermetically sealed, factory charged with 5 pounds of refrigerant or less. Recovery there is measured in percentages, 80 or 90 percent depending on the machine's age and whether the compressor runs, or a 4 inches of mercury vacuum. Type II covers high-pressure appliances, which is nearly everything Island Breeze services, and its centerpiece is the recovery vacuum table: how deep you must pull a system down before opening or disposing of it, driven by the refrigerant class, the 200 pound charge threshold, and whether the recovery machine was built before or after November 15, 1993. Add the leak repair rules (30, 20, 10 percent thresholds for appliances holding 50 pounds or more), the leaky appliance exception (stop at 0 psig), and the iron rule that you pressurize with nitrogen and never oxygen, and you have the two sections covered. Type III is low-pressure chillers; you will rarely touch one, but the Universal exam tests it, so this module gives you the awareness layer.

Key Values

The recovery vacuum table (40 CFR Part 82, learn it cold)

"Required evacuation level" means how far down you must take the appliance with recovery equipment before opening it for service or disposing of it. Inches of mercury vacuum (in Hg) is the gauge scale below atmospheric pressure: 0 in Hg is atmospheric, bigger numbers are deeper vacuum.

APPLIANCE	RECOVERY MACHINE BUILT BEFORE NOV 15, 1993	RECOVERY MACHINE BUILT AFTER NOV 15, 1993
HCFC-22 appliance normally containing less than 200 lb	0 in Hg (atmospheric)	0 in Hg (atmospheric)

APPLIANCE	RECOVERY MACHINE BUILT BEFORE NOV 15, 1993	RECOVERY MACHINE BUILT AFTER NOV 15, 1993
HCFC-22 appliance normally containing 200 lb or more	4 in Hg	10 in Hg
Other high-pressure appliance, less than 200 lb (R-12, R-500, R-502, R-114)	4 in Hg	10 in Hg
Other high-pressure appliance, 200 lb or more	4 in Hg	15 in Hg
Very high-pressure appliance (R-13, R-503)	0 in Hg	0 in Hg
Low-pressure appliance (R-11, R-113, R-123)	25 in Hg	25 mm Hg absolute

Leaky appliance exception: if pulling the required vacuum would drag air into a leaking system, you may stop recovery at 0 psig.

Type I recovery requirements (small appliances, 5 lb or less)

SITUATION	REQUIRED RECOVERY
Recovery equipment built before Nov 15, 1993	80% of the charge, or 4 in Hg
Post-Nov 15, 1993 certified equipment, compressor RUNS	90% of the charge, or 4 in Hg
Post-Nov 15, 1993 certified equipment, compressor DEAD	80% of the charge, or 4 in Hg
System-dependent (passive) recovery equipment	Allowed only on appliances holding 15 lb or less

Leak repair thresholds (current rule, appliances with 50 lb or more of ODS refrigerant)

APPLIANCE TYPE	ANNUALIZED LEAK RATE THAT TRIGGERS ACTION
Industrial process refrigeration (IPR)	30%
Commercial refrigeration	20%
Comfort cooling and everything else	10%

Older study material prints 35% and 15%. Those are the pre-2019 legacy values. If you see them on a practice test, recognize them as historical; teach yourself the current 30/20/10.

Other numbers that show up on the exam

VALUE	MEANING
5 lb or less, hermetically sealed	Definition of a Type I small appliance
200 lb	Charge threshold that changes the required vacuum for high-pressure appliances

VALUE	MEANING
Nov 15, 1993	Recovery equipment manufacture date that splits the table columns
15 lb	Maximum appliance charge for system-dependent (passive) recovery
0 psig	Where recovery stops on a leaky appliance
30 days	Deadline to repair a leak above threshold (or to develop a retrofit/retire plan)
1 year	Deadline to complete a retrofit or retirement plan
10 psig	Maximum test pressure on a low-pressure chiller (rupture disk relieves at 15 psig)
25 mm Hg absolute	Low-pressure recovery level with post-1993 equipment (absolute scale, not gauge)

Field Checklist: Recovery Before Opening Any System

- [ ] Identify the refrigerant from the nameplate and identify the appliance's normal full charge. These two facts pick your row on the table.
- [ ] Know your recovery machine's manufacture date. Every machine on an Island Breeze truck is post-1993 certified, so you use the right-hand column.
- [ ] Connect with low-loss fittings. Open-ended hoses are a venting violation, not a shortcut.
- [ ] Recover liquid first when the system holds enough charge to matter, then finish with vapor. Liquid recovery is faster and carries oil out with it.
- [ ] Pull to the required level from the table, then close the valves and watch the gauge for several minutes. Refrigerant dissolved in the compressor oil boils out slowly and the pressure will creep up. Recover again until it holds.
- [ ] If the system is leaking and the vacuum would pull air in: stop at 0 psig. That is the only legal early stop. There is no "a couple psi above atmospheric is close enough."
- [ ] Never energize a hermetic compressor while the system is in a deep vacuum. The motor windings can arc through the thin vapor and destroy the compressor.
- [ ] Pressurize for leak testing with regulated nitrogen only. A trace of refrigerant mixed with the nitrogen is allowed for electronic leak detection. Oxygen or compressed air mixed with refrigerant oil can explode.
- [ ] Recovery cylinder: never fill past 80% of capacity, verified by weight on a scale.

IB STANDARD

Island Breeze expects every technician to hold Universal certification, all four sections, even though day-to-day residential work is almost entirely Type II. The reasons are practical: Universal means you are never the wrong tech for a job, commercial and chiller opportunities do not get turned away at the door, and a bench of Universal-certified techs is a credential the company can put in front of any commercial client. You sit for all four sections. This module covers Type I and Type II to mastery and Type III to exam-passing awareness.

Full Breakdown

How the exam carves up the equipment world

Recall from C13: the 608 exam is four sections of 25 questions, 70 percent to pass each, and Core is the gatekeeper. The three Type sections are not skill levels. They are equipment categories, sorted by the pressure the refrigerant runs at and the size of the factory charge:

- **Type I:** small appliances. Hermetically sealed, factory charged, 5 pounds of refrigerant or less.
- **Type II:** high-pressure and very high-pressure appliances. Everything from a residential split system to a supermarket rack to a 500 ton rooftop plant, as long as the refrigerant is a high-pressure product like R-22, R-410A, R-404A, or the old CFCs R-12 and R-502.
- **Type III:** low-pressure appliances. Big centrifugal chillers running R-11, R-113, or R-123, machines that operate in a vacuum.

A useful mental sort when you face any question: first ask what pressure class the refrigerant is, then ask how big the charge is, then ask how old the recovery machine is. Those three questions answer most of the Type I and Type II sections by themselves.

Type I: the small appliance world

A **small appliance** has a precise legal definition, and the exam tests the definition itself: a product that is manufactured, charged, and hermetically sealed at the factory with 5 pounds or less of refrigerant. Both halves matter. A unit with 4 pounds that a tech field-charged through service valves is not a small appliance. A factory-sealed unit with 6 pounds is not a small appliance. The category includes household refrigerators and freezers, window and room air conditioners, packaged terminal air conditioners and heat pumps (the through-the-wall hotel units, called PTACs), dehumidifiers, under-counter ice makers, vending machines, and drinking water coolers.

The defining service problem with small appliances is access. They are hermetic: welded shut, no service valves. To recover, you attach a piercing access fitting, a clamp-on valve that punches a small hole in the process tube. Solderless piercing valves work, but their rubber gasket seal leaks over time, so the rule is that they must be removed after service or replaced with a permanent brazed fitting. Leaving a quick-tap valve on a refrigerator as a permanent feature is installing a slow leak on purpose.

Recovery requirements are percentages, not just vacuum levels. Small appliance charges are so tiny that the regulation measures success by how much of the charge you capture:

- Recovery equipment manufactured before November 15, 1993: recover 80 percent of the charge, or pull the appliance to 4 in Hg vacuum.
- Recovery equipment manufactured after November 15, 1993 (which must be certified by an EPA-approved testing organization): recover **90 percent** when the appliance compressor operates, **80 percent** when the compressor does not operate, or pull 4 in Hg.

The logic behind the running/dead split: a running compressor pushes refrigerant around and helps drive it out of the oil and the low side, so more is recoverable. A dead compressor leaves refrigerant pooled and dissolved where it sits, so the bar drops to 80 percent. Field technique follows the same logic. With a working compressor, recover from the high side, where the compressor is conveniently delivering the refrigerant. With a dead compressor, pierce and pull from **both** the high and low sides, because nothing inside is moving the charge toward your single access point.

Self-contained versus system-dependent recovery equipment

Recovery machines come in two classes, and the exam expects you to know the difference.

Self-contained (active) recovery equipment has its own compressor. It generates its own suction and pushes refrigerant into your recovery cylinder regardless of whether the appliance can help. This is the recovery machine on every service truck, and it works on anything.

System-dependent (passive) recovery equipment has no compressor of its own. It relies on the appliance's compressor, or on the pressure inside the system, to move the refrigerant into a non-pressurized recovery bag or container. It is cheap, slow, and weak, and the regulation caps it hard: **system-dependent recovery may only be used on appliances containing 15 pounds of refrigerant or less.** Above 15 pounds, the machine doing the recovery must be self-contained.

Notice the layered thresholds, because the exam loves to swap them on you: 5 pounds or less defines a small appliance, 15 pounds or less is the ceiling for passive recovery equipment, 50 pounds or more triggers the leak repair rules, and 200 pounds is the line that deepens the required vacuum. Four numbers, four different jobs.

Type II: high-pressure appliances, your daily world

A **high-pressure appliance** uses a refrigerant that boils between roughly minus 50 and 10 degrees Celsius at atmospheric pressure: R-22, R-410A, R-404A, R-407C, and the legacy CFCs R-12, R-500, R-502, and R-114. A **very high-pressure appliance** uses a refrigerant boiling below minus 50 C, the exotic pair R-13 and R-503. If it is not a small appliance and not a low-pressure chiller, it is Type II. The residential split systems, heat pumps, package units, and light commercial equipment that fill the Island Breeze schedule are all Type II equipment.

Before the table, two terms must be separated, because the regulation and your field habits use the same words differently. When the EPA says **evacuate the appliance**, it means recovery: pulling the refrigerant out down to the table's required level. When a technician says **pull a vacuum**, they usually mean dehydration: deep evacuation with a vacuum pump to 500 microns or below to boil out moisture before recharging. These are different operations with different tools and different targets. The recovery table is measured in inches of mercury; dehydration is measured in microns. The Island Breeze evacuation standard of 500 microns with a decay test on every opened system is a dehydration spec, and it lives miles below anything on the recovery table. Do not let the exam blur them together, and do not let yourself blur them in the field.

The recovery vacuum table: how to own it

Here is the table again, this time with the reasoning that makes it stick instead of a memorization chore.

The machine date splits the columns. November 15, 1993 is the date after which recovery equipment had to be certified to the ARI 740 standard by an EPA-approved testing organization and had to have low-loss fittings. Certified machines pull deeper vacuums reliably, so the law demands more from them. Older grandfathered machines get shallower targets. On the exam, "recovery device manufactured in 1992" or "1989" is the giveaway phrase pointing you to the left column.

The refrigerant class and the 200 pound threshold pick the row.

- **HCFC-22 under 200 pounds: 0 in Hg, both columns.** Atmospheric pressure is the whole requirement. Why so easy? R-22 was the workhorse refrigerant of small and mid-size equipment, recovery was a brand new legal duty in 1993, and the rule-writers set an achievable floor for the most common case. This is the row your residential R-22 dinosaurs live on.
- **HCFC-22 at 200 pounds or more: 4 in Hg with an old machine, 10 in Hg with a modern one.** Cross the 200 pound line and the required vacuum deepens, because the same percentage of charge left behind is a lot more pounds of refrigerant.
- **Other high-pressure refrigerants under 200 pounds: 4 in Hg old, 10 in Hg modern.** The CFCs named in the regulation (R-12, R-500, R-502, R-114) got stricter treatment than R-22 because CFCs are the heavier ozone destroyers. Note that a small "other high-pressure" appliance has the same requirement as a LARGE R-22 appliance. The exam builds questions on exactly that overlap.
- **Other high-pressure refrigerants at 200 pounds or more: 4 in Hg old, 15 in Hg modern.** The deepest high-pressure requirement on the chart.
- **Very high-pressure (R-13, R-503): 0 in Hg, both columns.** These refrigerants boil so violently at room temperature that holding a deep vacuum against them is impractical; atmospheric is the requirement. You may never see one of these systems. Know the row anyway.
- **Low-pressure appliances: 25 in Hg with an old machine, 25 mm Hg absolute with a modern one.** Two traps in one row. First, these are the deepest levels on the chart, because low-pressure refrigerants are lazy: they barely vaporize at room temperature, so getting them out takes serious vacuum. Second, the modern requirement changes measurement scales. 25 mm Hg **absolute** is measured up from a perfect vacuum, not down from atmospheric. It is nearly a total evacuation, roughly equivalent to 29 in Hg on a gauge scale, and it is NOT the same thing as 25 in Hg. The exam will offer both as answer choices and grade you on noticing the unit.

Where do R-410A and R-404A fit? They are high-pressure refrigerants and non-exempt substitutes, so the venting prohibition and evacuation requirements apply to them. They are not HCFC-22, so they ride the "other high-pressure appliance" rows: 10 in Hg below 200 pounds with a modern machine, 15 in Hg at 200 pounds or more. A tech who assumes a residential R-410A system gets the easy R-22 treatment of 0 in Hg is wrong on the exam and sloppy in the field.

A worked example, exam style. A recovery unit built in 2005 evacuates a supermarket rack that normally holds 250 pounds of R-404A. Three questions: high-pressure refrigerant that is not R-22, charge of 200 pounds or more, machine after November 15, 1993. Row says 15 in Hg. Done in five seconds. Another: the same machine on a residential R-22 condenser holding 7 pounds. R-22, under 200 pounds: 0 in Hg, atmospheric. A

third: a 1990 recovery unit on a 300 pound R-12 chiller (R-12 is high-pressure, so this is a Type II machine despite the word chiller). Old machine column, other high-pressure 200 pounds or more: 4 in Hg.

When you may stop recovery: the leaky appliance rule

Vacuum does not care which direction it pulls. If the appliance has a leak and you drag it below atmospheric pressure, outside air and moisture flow IN through the leak, contaminating the refrigerant in your recovery cylinder and filling the system with the moisture you spend the rest of your career fighting. So the regulation grants exactly one early exit: **when evacuating an appliance with a leak would result in air being drawn into the appliance, you may stop recovery at 0 psig**, atmospheric pressure, instead of pulling the table's required vacuum.

Two fences around that exception. First, it exists for leaky appliances, not for impatient technicians. Second, the stopping point is 0 psig, not "1 or 2 psi positive to be safe." That above-atmospheric stop is a common field shortcut, it feels reasonable, and it has no legal basis. The exam tests it precisely because half the trade believes it is allowed. The choices will include "stop at 0 psig" and "stop slightly above 0 psig," and only one is in the regulation.

There is one more relief valve in the rules: if you are opening the system for a **non-major repair** that will not be followed by a deep evacuation (a major repair is defined as removal of the compressor, condenser, evaporator, or auxiliary heat exchanger coil), the required recovery level relaxes to 0 psig as well. Replacing a pressure control is not a major repair; swapping the compressor is.

Type II service practice the exam expects

Recover liquid first, then vapor. Liquid-phase recovery moves far more refrigerant per minute than vapor recovery, and because oil dissolves in liquid refrigerant, liquid recovery also pulls some oil out with it. On a big charge, vapor-only recovery can turn a 40 minute job into a 4 hour one. Chilling the recovery cylinder helps too: a cold cylinder has lower pressure, and refrigerant flows toward low pressure.

Wait after you reach the target. Refrigerant dissolves into compressor oil the way carbon dioxide dissolves into soda. When you reach the required vacuum and shut the machine off, the refrigerant trapped in the oil starts boiling back out and the pressure rises. The procedure is to reach the level, wait several minutes, watch the gauge, and recover again if it climbs. A pressure rise after recovery means refrigerant outgassing from oil (or a leak); it does not mean your gauge is broken.

Never energize a hermetic compressor under deep vacuum. In a deep vacuum there is not enough vapor density inside the shell to insulate the motor terminals, and line voltage can arc between the windings, destroying the motor and potentially blowing the fusite terminal out of the shell. Recovery machines pull the vacuum; the appliance compressor never runs into one.

Know the low-charge signature. On a fixed-orifice system, a low charge shows up as **high superheat**: the small amount of refrigerant boils off early in the evaporator and the vapor keeps warming. This is C-track diagnostic knowledge from F6 doing double duty as exam material. And the visual clue for the leak itself: refrigerant carries oil with it as it escapes, so traces of oil at fittings, joints, and coil returns mark the leak location.

Non-condensables are air and nitrogen. They do not condense in the condenser; they collect at the top of it as trapped gas, stealing condensing surface and driving head pressure high or unstable. Water is a contaminant but not a non-condensable; solids are filth but not non-condensables. A filter drier removes moisture and solid particles and removes **no** air or nitrogen ever. The fix for non-condensables in a recovery cylinder: let the cylinder rest to room temperature, compare its pressure to the PT chart value for that temperature (the F5 skill), and if the pressure reads high, there is air in the bottle.

Leak repair: thresholds, clocks, and the 2020 asterisk

The leak repair rules apply to appliances with a full charge of **50 pounds or more**. Below 50 pounds there is no federal leak-rate requirement at all: topping off a 12 pound residential system is legal, however poor a long-term answer it is. At 50 pounds and above, the owner must track every charge addition, and the **annualized leak rate** (the rate over a rolling 12 months, expressed as a percent of full charge per year) gets compared to the threshold for the appliance category:

- **30 percent** for industrial process refrigeration (IPR)
- **20 percent** for commercial refrigeration
- **10 percent** for comfort cooling and every other appliance type

Memory hook: the categories run from the dirtiest, hardest-running equipment to the cleanest, and the tolerance shrinks as you go: 30, 20, 10. Older guides and older exam pools print 35 percent for commercial/IPR and 15 percent for everything else. Those were the rule before 2019. They are wrong answers now, but they may appear as distractors or even as the keyed answer on an outdated practice test, so recognize them on sight as the legacy pair.

Once the threshold is exceeded, the clocks start:

1. **Repair within 30 days.** Find the leaks and fix them.
2. **Initial verification test** on the repair before any refrigerant goes back in. Prove the fix at the bench pressure, not by recharging and hoping.
3. **Follow-up verification test** after the appliance is back at normal operating conditions. There is no minimum waiting period; the requirement is that the system proves tight while actually running.
4. **Or choose the off-ramp:** if the owner will not repair, they may instead develop a **retrofit or retirement plan within 30 days** and complete the retrofit or retirement **within 1 year**.
5. **Inspections continue** until the appliance behaves: commercial refrigeration and IPR holding 500 pounds or more get leak inspections every 3 months until the leak rate stays below threshold for 4 consecutive quarters; commercial/IPR from 50 to 500 pounds and all comfort cooling appliances of 50 pounds or more get inspected once per calendar year until they hold below threshold for a year.

The 2020 asterisk: as of the February 26, 2020 EPA rule, the federal leak repair provisions apply **only to appliances containing ozone-depleting refrigerants**. An appliance charged solely with HFCs (an R-410A or R-404A system with no ODS in it) is exempt from the federal leak repair requirements. The venting prohibition still fully applies to those HFCs; only the leak-repair paperwork machinery was rescinded for them. Exam pools vary in how current they are, so read leak repair questions carefully: if the question specifies an HFC-only appliance, the rescission may be the point of the question.

PHOENIX FIELD NOTE

Recovery physics fights you in a Phoenix summer. Recovery works by pressure difference, and a recovery cylinder that has been riding in a 140 degree truck interior is sitting high on the PT curve with almost no pressure advantage over the system you are pulling from. Recovery that takes 20 minutes in spring can crawl in July. Shade the cylinder, set it in a pan of water, or swap to a cooler bottle, and budget the time. What you may not do is get impatient and call 2 psig "close enough." The table does not have a heat exemption.

Evacuation before disposal, and pressurizing safely

Disposal is not exempt. Before an appliance is scrapped, the refrigerant must be recovered to the same table levels. For small appliances headed to disposal, the recovery percentages apply: 90 percent with a working compressor, 80 percent with a dead one, or 4 in Hg, using post-1993 equipment. The final person in the disposal chain is responsible for verifying recovery happened, which is why scrapyards want the recovery tag. For appliances holding 5 to 50 pounds, disposal recordkeeping applies: location, date of recovery, refrigerant type, monthly totals by type, and quantity, type, recipient, and date for anything shipped off for reclamation.

Pressurizing: nitrogen, never oxygen. After recovery, leak testing means raising the pressure back up with a gas, and the only acceptable gas is dry nitrogen through a pressure regulator. A small amount of refrigerant added to the nitrogen as a trace gas for an electronic detector is permitted, and that mixture may legally be vented afterward because the nitrogen makes it a holding-charge mixture, not a refrigerant charge. **Oxygen or compressed air must never be used to pressurize a refrigeration system.** Refrigerant oil plus pressurized oxygen is a fuel-plus-oxidizer pair; compression heat can detonate it. This is simultaneously an exam question and one of the few rules in this module that can kill you. Nitrogen discipline from F1 applies in full: regulator always, know your relief settings, never deadhead a bottle into a system.

Type III overview: the low-pressure world you should recognize

Island Breeze technicians can go years without touching a low-pressure machine. The Universal exam does not care. Here is the awareness layer that gets you through the Type III section's logic.

The machines. Low-pressure appliances are large centrifugal chillers, hundreds of tons of capacity, cooling office towers, hospitals, and campuses. Their refrigerants (R-11 and R-113 historically, R-123 as the bridge replacement) boil **above** 10 degrees Celsius at atmospheric pressure, which means at typical operating temperatures the evaporator side runs **in a vacuum**, below atmospheric pressure.

Everything strange about Type III follows from the vacuum. A leak on a high-pressure system pushes refrigerant out. A leak on a low-pressure system pulls air and moisture IN. So these machines carry a **purge unit**, a small automatic system that collects the air and other non-condensables that accumulate at the top of the condenser and exhausts them. A purge unit that runs excessively is the classic sign of a leak: it is telling you air is getting in somewhere.

The pressure ceiling. Because the vessels are built for vacuum, not pressure, low-pressure chillers carry a **rupture disk** that bursts at 15 psig to protect the shells. Therefore leak testing never exceeds **10 psig**. You raise pressure first with controlled heat (hot water through the tubes or heater blankets), then with nitrogen if needed, and you respect the ceiling.

Recovery runs deep. The table row: 25 in Hg with pre-1993 equipment, 25 mm Hg absolute with modern equipment, the deepest requirement on the chart, because a lazy refrigerant needs maximum persuasion to leave. After liquid removal, a large chiller can still hold around 100 pounds of refrigerant as vapor, which is why the deep evacuation is mandatory. Charging has its own trap: liquid refrigerant introduced into a deep vacuum boils violently and chills everything it touches, and the water sitting in the chiller's tubes can freeze and split them. So charging starts with **vapor** until the saturation pressure corresponds to a temperature safely above freezing, then switches to liquid.

That is the awareness layer: vacuum operation, air leaks in, purge unit, 10 psig ceiling with a 15 psig rupture disk, deep recovery on an absolute scale, vapor before liquid when charging. The Type III section of the exam is 25 questions on these ideas plus details you will pick up from the practice banks. If your career turns toward commercial plant work, Type III becomes its own full course; for the Universal exam, mastery of the logic above plus practice questions clears the 70 percent bar.

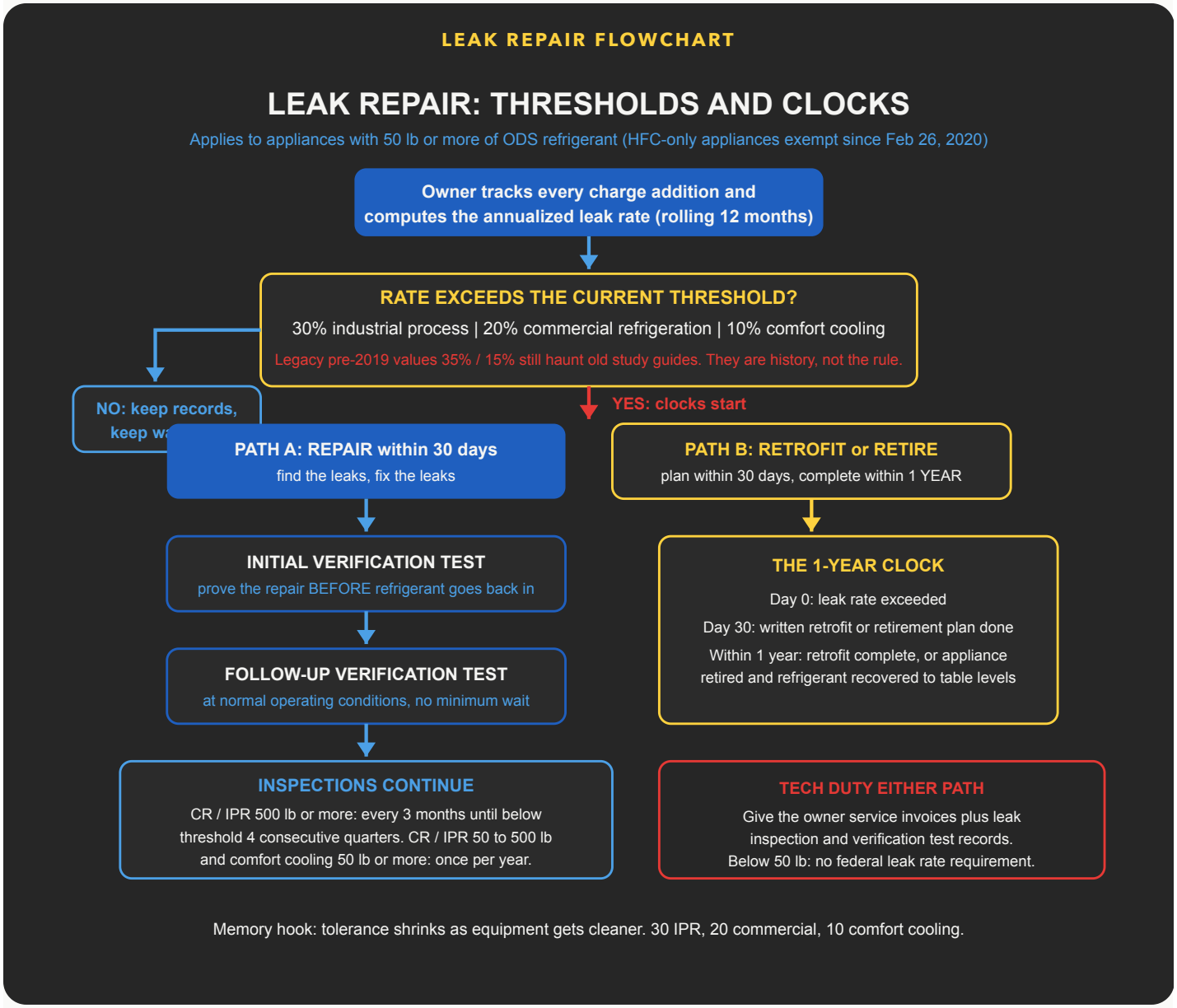
Common Mistakes

1. **Memorizing the table without the units.** Writing "low-pressure: 25" in your notes and losing the distinction between 25 in Hg (old equipment, gauge scale) and 25 mm Hg absolute (modern equipment, absolute scale, nearly a full vacuum). The exam puts both in the answer choices on purpose. Cost: a missed question that one careful flashcard would have saved, and in the field, a chiller recovery stopped 100 pounds early.
2. **Stopping recovery slightly above atmospheric "to keep air out."** The leaky appliance exception stops at 0 psig, exactly, and only when a leak would draw air in. Stopping at positive pressure on a tight system is venting the difference. Cost: an EPA violation that carries per-day, per-violation fines, and refrigerant you paid for drifting off the roof.
3. **Crossing the thresholds: 5, 15, 50, 200.** Each number does one job: 5 pounds defines a small appliance, 15 pounds caps system-dependent recovery, 50 pounds triggers leak repair rules, 200 pounds deepens the required vacuum. Swapping them is the most common way to lose easy points. Cost: wrong answers on questions you actually knew.
4. **Treating R-410A like the R-22 row.** The 0 in Hg easy row belongs to HCFC-22 alone. R-410A and R-404A are "other high-pressure" refrigerants: 10 in Hg under 200 pounds, 15 in Hg at or above, with a modern machine. Cost: under-recovery on every job where the habit formed, and missed exam points.
5. **Pressurizing with shop air because the nitrogen bottle is empty.** Compressed air carries oxygen, and oxygen plus refrigerant oil under compression is an explosion looking for a trigger. There is no acceptable substitute for nitrogen. Cost: at minimum a contaminated system full of moisture and non-condensables; at worst, a burst system and an injured technician.
6. **Quoting 35/15 leak rates because an old study guide said so.** The current thresholds are 30 percent IPR, 20 percent commercial refrigeration, 10 percent comfort cooling, for ODS appliances of 50 pounds or more. The 35/15 pair died in 2019. Cost: wrong on the exam if the pool is current, wrong with a commercial customer who knows their compliance numbers.

What Is Next

C15 takes the recovery levels you now know as legal minimums and builds the full Island Breeze recovery and evacuation procedure on top of them: deep vacuum to 500 microns, decay testing, and the workmanship layer that separates passing the exam from doing the job right.

Module Visuals



RECOVERY VACUUM TABLE

REQUIRED EVACUATION LEVELS FOR RECOVERY

Pick the row: refrigerant class + charge size. Pick the column: recovery machine date.

APPLIANCE	MACHINE BUILT BEFORE Nov 15, 1993	MACHINE BUILT AFTER Nov 15, 1993
HCFC-22 appliance normally containing LESS than 200 lb	0 in Hg	0 in Hg
HCFC-22 appliance normally containing 200 lb OR MORE	4 in Hg	10 in Hg
Other high-pressure appliance, under 200 lb (R-12, R-500, R-502, R-114; R-410A and R-404A ride these rows too, they are NOT the R-22 rows)	4 in Hg	10 in Hg
Other high-pressure appliance normally containing 200 lb OR MORE	4 in Hg	15 in Hg
Very high-pressure appliance (R-13, R-503)	0 in Hg	0 in Hg
Low-pressure appliance (R-11, R-113, R-123 chillers)	25 in Hg	25 mm Hg ABSOLUTE scale!

LEAKY APPLIANCE EXCEPTION: if the required vacuum would draw air in through a leak, stop recovery at 0 psig. There is NO legal stopping point above atmospheric.

Memorize the two thresholds that drive the table: the 200 lb charge line and the Nov 15, 1993 machine date.

SYSTEM DEPENDENT VS SELF CONTAINED

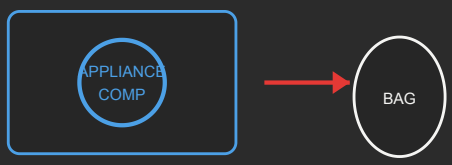
RECOVERY EQUIPMENT: TWO CLASSES

SELF-CONTAINED (ACTIVE)

- Has its own compressor: makes its own suction
- Works on ANY appliance, any charge size
- The machine on every service truck

Post Nov 15, 1993 machines: certified, low-loss fittings.

SYSTEM-DEPENDENT (PASSIVE)



- No compressor of its own
- Borrows the appliance compressor or pressure
- **LEGAL LIMIT: appliances holding 15 lb or less**

Above 15 lb, recovery must be self-contained.

FOUR THRESHOLDS, FOUR DIFFERENT JOBS (the exam swaps them on purpose)

5 lb
defines a small appliance (Type I)

15 lb
ceiling for passive (system-dependent) recovery

50 lb
triggers the leak repair rules

200 lb
deepens the required recovery vacuum

TYPE1 VS TYPE2 SCOPE

WHAT EQUIPMENT BELONGS TO EACH TYPE

TYPE I: SMALL APPLIANCES

Hermetically sealed at the factory with 5 lb of refrigerant OR LESS

- Household refrigerators and freezers
- Window and room air conditioners
- PTACs and packaged terminal heat pumps
- Dehumidifiers
- Under-counter ice makers
- Vending machines
- Drinking water coolers

Both halves required: factory sealed AND 5 lb or less. A field-charged 4 lb unit is NOT a small appliance.

TYPE II: HIGH-PRESSURE APPLIANCES

High and very high-pressure refrigerants, any charge size above the Type I definition

- Residential split systems and heat pumps
- Rooftop package units
- Commercial refrigeration and racks
- Process cooling on high-pressure refrigerant
- Refrigerants: R-22, R-410A, R-404A, R-407C, legacy R-12, R-500, R-502, R-114
- Very high pressure: R-13, R-503

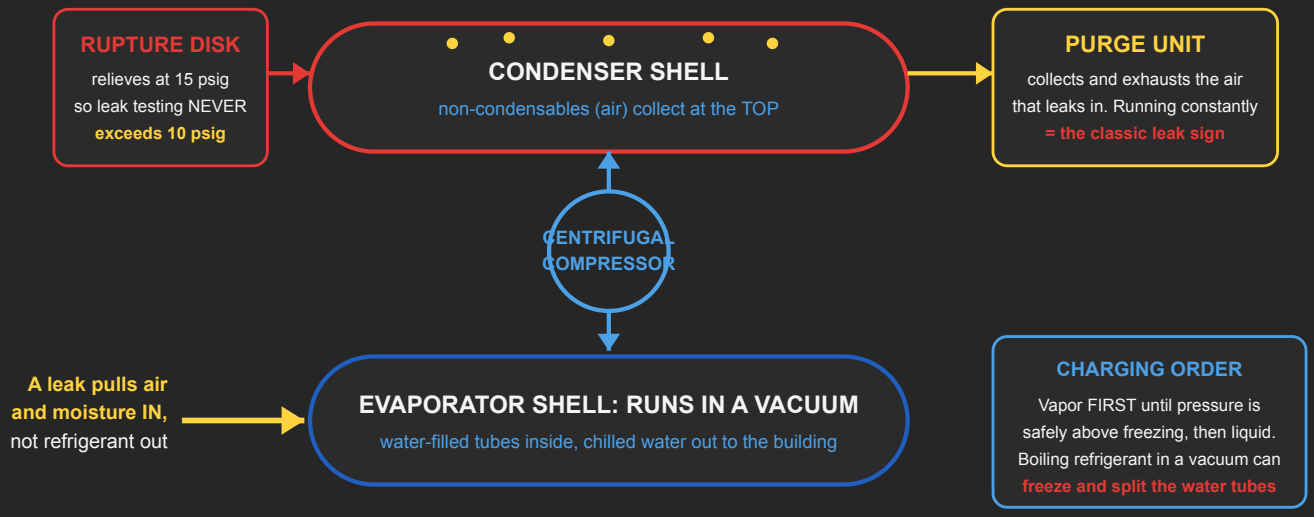
This is nearly everything on a residential and light commercial schedule. Your daily world is Type II.

TYPE III: LOW-PRESSURE APPLIANCES. Centrifugal chillers on R-11, R-113, R-123 that operate in a vacuum.
Rare in residential work, but the Universal exam tests it. See the C14 Type III overview.

TYPE3 OVERVIEW

TYPE III AWARENESS: THE LOW-PRESSURE CHILLER

R-11, R-113, R-123. The evaporator runs IN A VACUUM, and everything strange follows from that.



CHARGING ORDER

Vapor FIRST until pressure is safely above freezing, then liquid. Boiling refrigerant in a vacuum can **freeze and split the water tubes**

TYPE III EXAM ANCHORS

Recovery: 25 in Hg with a pre-1993 machine, 25 mm Hg ABSOLUTE with a modern one (the deepest row on the table).

Pressurize with hot water or heater blankets first, then nitrogen, never past 10 psig.

You may rarely touch one at Island Breeze, but Universal certification covers it, so the exam will ask.

Awareness level only: full low-pressure service practice is its own course if your career goes commercial.