

Condensate: Gravity vs Pumps, Interlocks

YES Electric • Arc Workforce Academy HVAC Apprenticeship

Draft 1 (October 2026). This lesson is under review. Videos are made by other companies, not YES Electric; follow this lesson and your journeyman where they differ. Boxes marked "Shop photo coming" will get real photos from our shop in a later version.

Unit 9 • Ductless Mini-Splits • Job Function 18 • Appendix A Competency 48 — "Install single-zone ductless mini-split systems (indoor head, outdoor unit, lineset, and electrical)" **Class time:** ~4 hrs (1 video/discussion + 3 bench)

1. What you'll be able to do

By the end of this lesson you will be able to:

- Explain why **condensate planning has to happen before you mount the indoor head**, not after — this is the single decision that most often forces re-work on a ductless install.
- Correctly slope and route a gravity condensate drain from a wall or ceiling-mounted indoor head to a proper outdoor termination.
- Select, mount, and wire a **condensate pump** (including its safety interlock) when gravity drainage isn't available, and explain the pump's head-height and lift limits.
- Explain why most single-zone wall-mount ductless heads run **without a trap**, unlike the ducted air handlers you studied in Unit 7 — and when a trap IS required.
- Identify and prevent the biofilm/algae (zoogloea) clogging that is the #1 cause of ductless condensate callbacks.

2. Tools & materials

- Condensate drain tubing/hose (per manufacturer — often vinyl or the hose supplied with the line-hide kit), insulation sleeve for the drain line
- Torpedo level, tape measure
- Mini condensate pump (bench demo unit) with reservoir, float switch, and discharge tubing
- Low-voltage wire and connectors for the pump's safety interlock
- The Lesson 9.2 mock install (indoor head mounted, line set routed)
- A cutaway or bench-mounted example of a wall-mount indoor head's internal drain pan, if available

3. Watch first

Order	Video	Channel	Length	Why
1	Does a Wall Mounted MINISPLIT Need a CONDENSATE TRAP? Ductless vs Ducted Air Handlers!	AC Service Tech	5:42	Answers the exact question this lesson opens with
2	MINI Condensate Pump MISTAKES You Need to Avoid!	Taddy Digest	8:18	The failure catalogue for pump installs specifically
3	Mastering Mini Condensate Pump: Pro Installation and Maintenance Hacks	Taddy Digest	15:54	Full pump install procedure
4	diy mini split condensate pump install	Taddy Digest	7:07	A second full install for pattern comparison
5	Mini Split Maintenance and Drain Options	Taddy Digest	15:17	Gravity vs pump decision-making in the field
Reference	How to Install a Float Switch for Samsung Ducted Air Handler	Taddy Digest	10:22	Ducted-side comparison — float switch wiring logic is the same idea, different equipment class

4. The idea

Plan the drain before you mount the head — Lesson 9.2 already told you this; here's why it matters this much

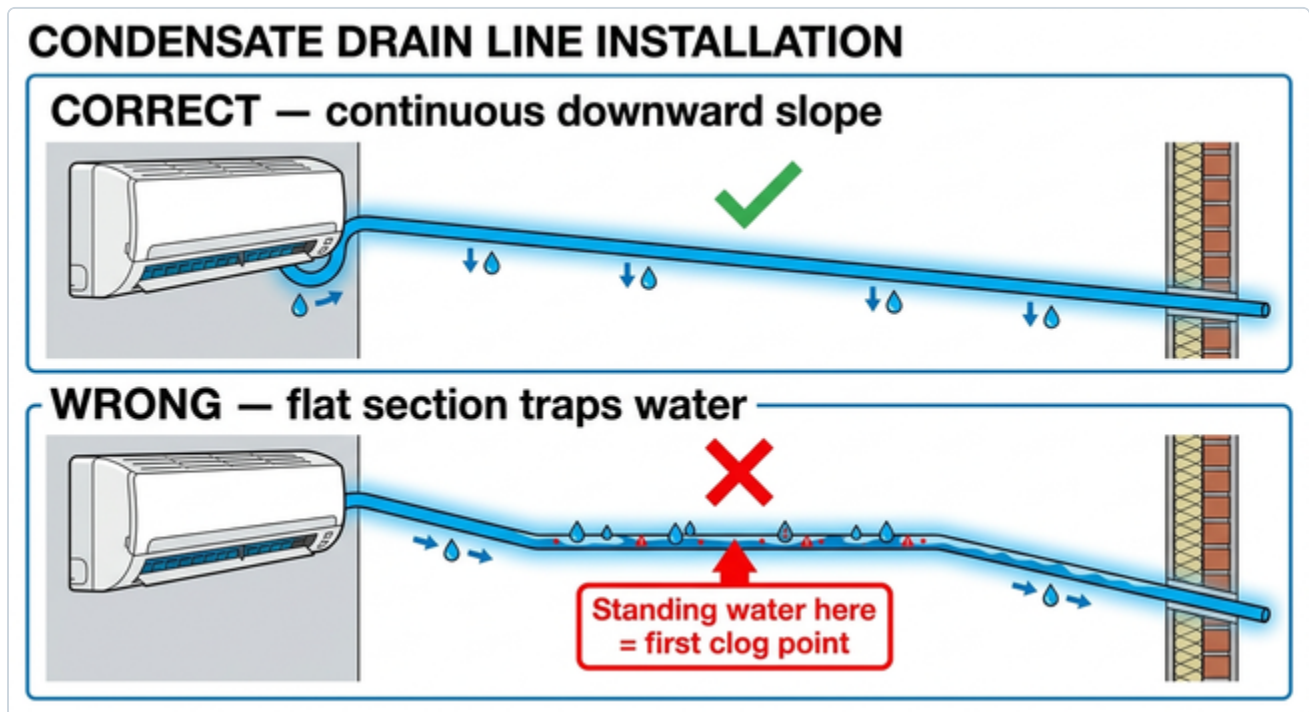
A wall or ceiling-mounted indoor head has an internal drain pan under the coil that has to get water OUT of the unit and, eventually, outside the building — with **no floor drain, no nearby plumbing stack, and often no straight gravity path** the way a basement or attic air handler enjoys. That's why Lesson 9.2 put "confirm the condensate path" as decision #2 in choosing indoor head location, ahead of everything except airflow throw. Moving a mounted head because the drain doesn't work is one of the most expensive re-dos in this trade — plan it first.

Gravity drainage — the preferred method, when the geometry allows it

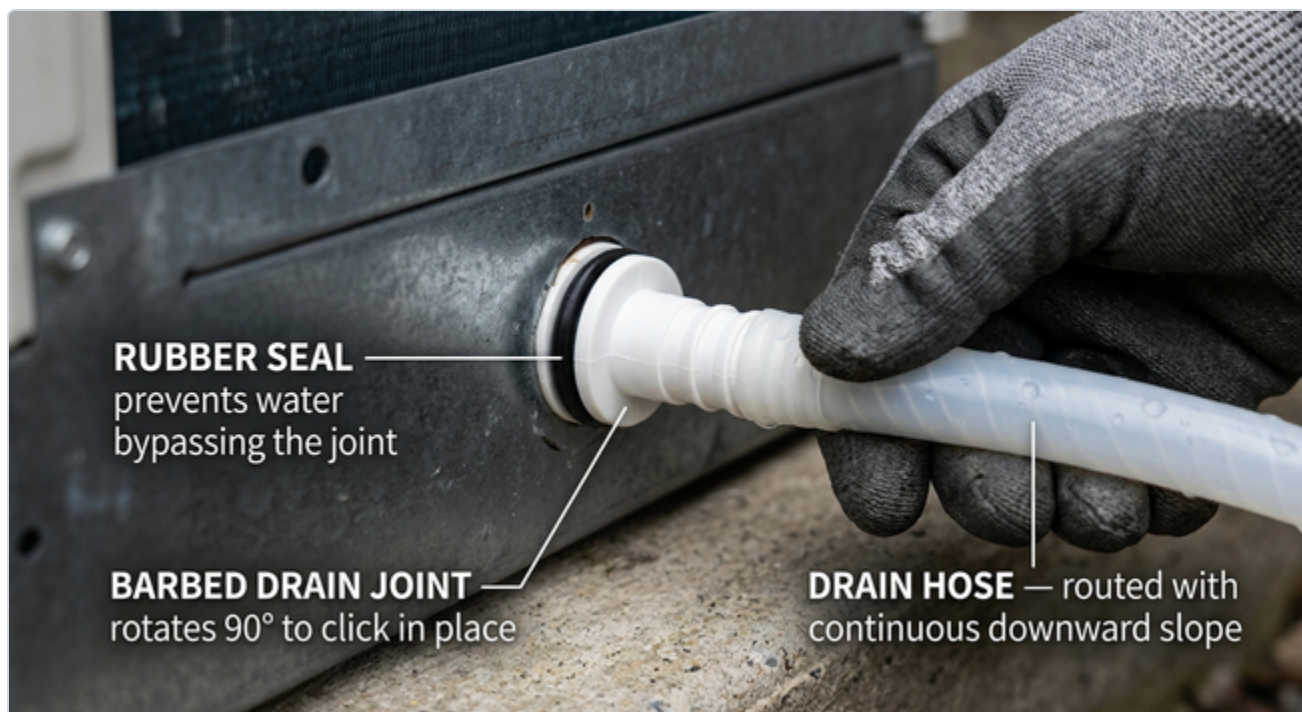
If the indoor head can be mounted with a **continuous downward path to a suitable outdoor termination** (never onto a walkway, never against the foundation, check local code for acceptable discharge points), gravity is always the first choice — no moving parts, nothing to fail electrically, nothing to maintain beyond keeping the line clear.

- **Minimum slope:** the drain line needs a consistent downward pitch for its ENTIRE run — even a short flat or backward-pitched section will hold standing water and become the first clog site.

- **Route with the line-set bundle** (as covered in Lesson 9.2) but never let the condensate line kink or get compressed by tape/ties — a pinched drain line is functionally the same as a clogged one.
- **Insulate the drain line** anywhere it runs through conditioned or semi-conditioned space — an uninsulated condensate line sweats just like an uninsulated suction line (Lesson 4.1/9.2) and will drip inside a wall cavity or ceiling, which the homeowner will discover as a stain long before you find the actual cause.
- **Terminate correctly outside** — daylight, away from foundation, not discharging onto a walkway that ices in winter, and check whether your jurisdiction allows tying into an existing gravity drain system (many don't allow direct connection to sanitary systems without an air gap).



This is the actual joint that connects the drain line to the unit — a barbed fitting with a rubber seal, rotated into place, hose pushed on over the barb:



Why most single-zone wall-mount heads **DON'T** get a trap (and when they do)

Lesson 7.10 and the ducted air-handler content in Unit 7 taught you that a trap is standard on equipment where the blower creates a pressure difference across the drain pan that could pull air (and stall drainage) without one. **Most wall-mount ductless indoor heads are built differently** — the drain pan sits largely at or near atmospheric pressure relative to the room, so a trap generally isn't required and, on some models, isn't recommended because the pan and internal geometry weren't designed to work against one. **Always check the specific manufacturer's install manual** — some ducted or high-static ductless-adjacent equipment (slim duct air handlers, larger ceiling cassettes) DOES call for a trap, closer to the Unit 7 logic. The rule isn't "ductless never needs a trap" — it's "check the manual for THIS unit's design."

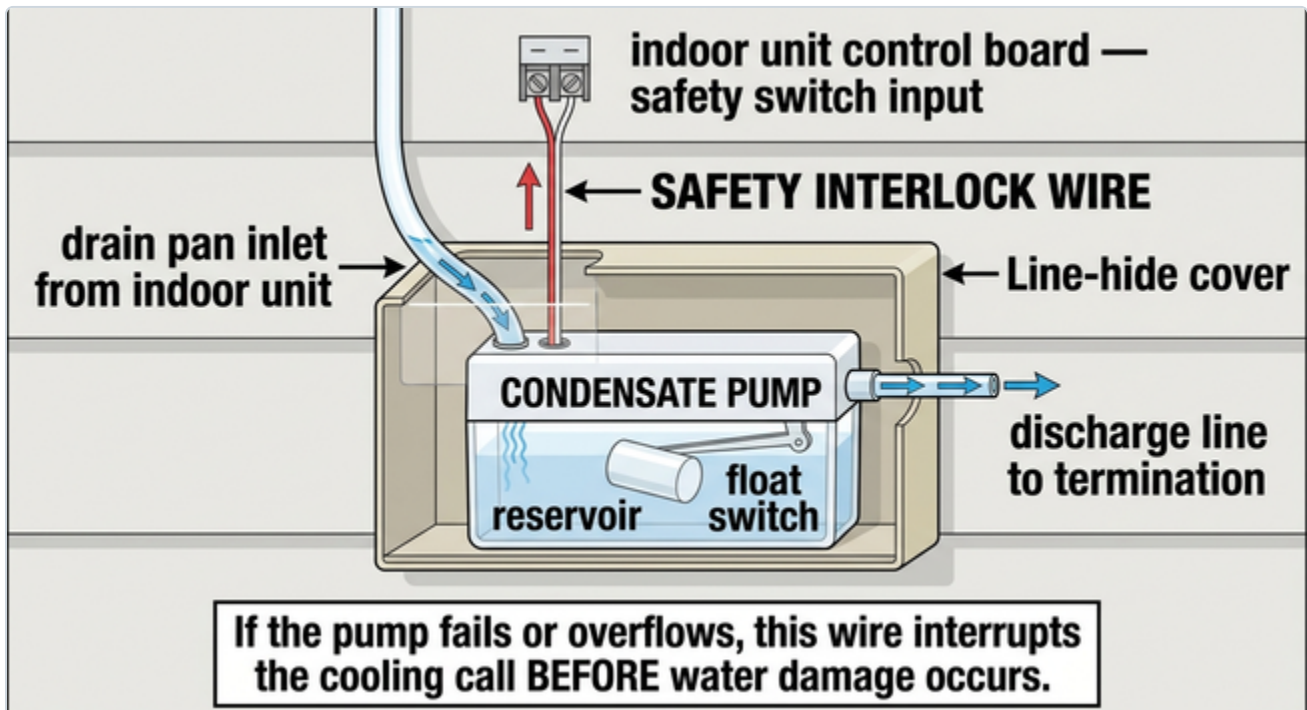
When gravity isn't possible — the condensate pump

If there's no viable gravity path (interior room, no easy route to an exterior wall at a low enough point, or a location that's actually below the nearest usable exterior discharge point), a **condensate pump** picks up where gravity can't:

- Small pumps built for this application are often integrated into or mounted inside the **line-hide cover** alongside the refrigerant lines and interconnect wire — keeps the whole run looking clean and protects the pump from weather if it's on the outdoor run.
- **Head height / lift limit is a real number, not a guess** — every pump has a maximum vertical lift and/or total equivalent run it can push condensate against. Exceeding it means the pump runs constantly, wears out fast, or simply can't keep up during a heavy cooling call — check the pump's spec sheet against your actual route.
- **Reservoir + float switch:** the pump has a small reservoir that fills, and a float switch that triggers the pump motor once it reaches a set level.

The safety interlock — the part that isn't optional

Every condensate pump install gets a **safety switch interlock**, wired so that if the pump fails or the reservoir overflows anyway, **the unit's cooling call is interrupted** before water damages the ceiling, wall, or floor below. This isn't a redundant nice-to-have — it's the difference between "the pump quietly failed and the unit kept running and dumping water into the wall for three days while the customer was out of town" and "the unit stopped cooling and displayed a fault, and the customer called before any real damage happened." Wire the interlock into the unit's control circuit per the pump manufacturer's instructions — usually by breaking a designated safety-switch input on the indoor head's terminal block, not just cutting power to the unit at the breaker (which wouldn't register as a controlled shutdown the way the proper interlock does).



A real length limit worth knowing: the pump's safety-interlock conductor is a low-voltage signal wire, and field experience says splicing/extending it much beyond roughly 40–50 feet can start causing communication problems with the indoor unit — the interlock circuit isn't designed as a long-haul run. If your install has the pump located far from the indoor head's terminal block, plan the wire path with that limit in mind rather than discovering it after the unit starts misbehaving. On installs where the customer wants a non-fully-conditioned space (a lanai run as a dehumidifier, for example) some techs tie the pump's safety circuit in with a dehumidistat instead of the unit's own safety terminal — a legitimate alternative configuration, but confirm it against the pump manufacturer's wiring instructions before defaulting to it.

The slow killer: biofilm and zoogloea

Condensate is warm, damp, and constantly available — perfect conditions for the same **zoogloea** biofilm growth that clogs ducted-equipment drains (a topic that'll get full treatment when Unit 11 is built). On ductless equipment the drain tubing is often smaller diameter than a

ducted system's PVC drain, which means it clogs FASTER on less buildup. Prevention beats reaction: keep the line clear of standing water (slope discipline above), and include a condensate line flush in the maintenance routine covered in Lesson 9.9.

5. Bench procedure

1. **Site assessment drill:** on the Lesson 9.2 mock install, evaluate whether the mounted indoor head location supports gravity drainage. If yes, plan the route; if no (instructor may deliberately pick a location that doesn't), plan a pump install instead.
2. **Gravity route (if applicable):** run and secure the drain line with the line-set bundle, verify continuous downward slope with a level at multiple points along the run — no flat spots, no backward pitch. Insulate the portion running through "conditioned space" on the mock-up.
3. **Pump route (if applicable):** mount the condensate pump per its instructions, connect the drain-pan outlet to the pump reservoir, run the pump's discharge line to a suitable termination, and confirm the route doesn't exceed the pump's rated lift.
4. **Wire the safety interlock.** Land the pump's safety switch output into the indoor head's designated safety-interlock terminal (per the shop unit's manual) — NOT just wired to cut power at the breaker.
5. **Fault simulation:** instructor manually triggers the pump's float switch (or fills the reservoir) to simulate a pump failure/overflow condition. Student observes and confirms that the unit's cooling call is interrupted as designed — this is the single most important checkout step in this lesson.
6. **Termination check:** for both gravity and pump routes, walk the outdoor termination point and confirm it doesn't discharge onto a walkway, against the foundation, or into a location that will ice over in winter.

Checkout (graded, pass/redo): Student completes a condensate installation (gravity or pump, per the assigned mock scenario) that passes a level-check on slope (gravity) or a functioning interlock demonstration (pump), and correctly explains why a trap is or isn't used on the specific unit being installed.

6. Field gotchas

- **A flat or back-pitched section anywhere in a gravity run WILL become the first clog point** — check the ENTIRE run with a level, not just the ends.
- **Skipping the pump's safety interlock "because the customer's on a budget" is how a \$150 mistake becomes a \$15,000 ceiling replacement.** This is not a line item to cut.
- **Pumps pushed past their rated lift limit run constantly and fail early** — verify the spec before you commit to a route, not after the pump is already mounted.
- **Uninsulated drain line through conditioned space sweats and gets blamed on "a leak in the unit"** when the real cause is a bare tube in humid Alabama air — insulate it like you would a suction line.

- **Terminating condensate onto a walkway or driveway** creates a customer-visible ice hazard every winter and a callback every time it happens — plan the termination point as carefully as the route.
- **Assuming every ductless head needs a trap because ducted equipment does (or the reverse) is a mistake either direction** — read the specific unit's manual; don't apply a Unit 7 rule blind to Unit 9 equipment.
- **Extending the pump's safety-interlock wire past ~40-50 feet without planning for it** can produce communication problems that look like a control-board fault but are really a wiring-length issue.

7. Competency link

- **Competency 48** — condensate is part of a correctly completed installation; a unit that runs but leaks water into a wall is not a completed install by this program's standard.
- Cross-references Lesson 7.10 (straight AC condensate/trap logic) by contrast — knowing WHY the rule differs here demonstrates real understanding, not memorization.
- Sets up Lesson 9.9's cleaning/maintenance content — condensate line flushing is part of the routine service this unit will need for its whole life.

8. Check yourself

1. Why does condensate planning have to happen BEFORE the indoor head is mounted, not after?
2. What is the minimum acceptable slope condition for a gravity condensate run, described in plain terms?
3. Why do most single-zone wall-mount ductless heads run without a trap, when Unit 7's ducted equipment requires one?
4. What two numbers do you need to check before committing to a condensate pump's route?
5. What does the safety interlock actually do, and why is wiring it into the head's designated terminal different from just relying on the breaker?
6. What is zoogloea, and why does it clog ductless drain lines faster than a typical ducted PVC drain?
7. Name two unacceptable outdoor condensate termination points and explain why each is a problem.
8. A customer wants the indoor head in a location with no viable gravity path and says "just point it toward the window, it'll be fine." What do you tell them?
9. Why does an uninsulated condensate drain line running through a wall cavity cause a problem that often gets misdiagnosed as something else?
10. During the fault-simulation checkout, what SHOULD happen when the pump's float switch trips, and why does that outcome matter more than "the pump works when it works"?
11. What real-world limit should you plan around when routing a condensate pump's safety-interlock wire, and what symptom shows up if you ignore it?

