HEAVY-DUTY A/C PARTS & SYSTEMS

# Heavy-Duty Air Conditioning Technical Reference

Service, diagnosis and preventive maintenance for R-134a systems

- System diagrams — TXV and orifice tube
- Verified R-134a pressure/temperature charts
- Evacuation & charging procedure
- Subcooling & superheat diagnosis
- PM schedule & troubleshooting

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# About This Guide

This reference is published by TruckAC+ for the technicians, fleet maintenance staff and owner-operators we supply. It covers the fundamentals of heavy-duty mobile air conditioning: how the system works, how to service it safely, how to read what the gauges are telling you, and how to keep a unit out of the shop during the months it matters most.

It is written for R-134a systems as found in Class 6–8 trucks, buses, and off-highway equipment. These systems differ from automotive A/C in ways that matter: hose runs are far longer, refrigerant charges are larger, condensers are often remote-mounted, and cab heat loads are higher. Procedures written for passenger cars will mislead you on a truck.

## How to use it

Sections 1–5 are background — read once. Sections 6–9 are the working core, and they follow the order a job actually runs in: look up the pressure/temperature relationship, measure subcooling and superheat, interpret the gauge pattern, then evacuate and charge. Those are the pages you will come back to with gauges in hand. Sections 10–11 cover oil handling and planned maintenance, Section 12 looks ahead to the R-1234yf transition, and Section 13 defines the terminology.

**Scope and limitations**

This is general industry guidance, not a substitute for the equipment manufacturer's service documentation. Where an OEM specifies a refrigerant charge weight, oil type, oil quantity, belt tension, or torque value, **the OEM specification governs** — always.

Refrigerant charge amounts in particular vary by system and cannot be generalized. Never charge by pressure alone when a specified weight is available.

## Regulatory note

In the United States, servicing motor vehicle air conditioning for compensation requires technician certification under Section 609 of the Clean Air Act, and venting refrigerant to atmosphere is prohibited. Refrigerant must be recovered with certified equipment. Requirements differ outside the U.S. — check your local regulations before performing this work.

**Manufacturer documentation**

For component-specific procedures, application data and part numbers, consult the documentation published by the manufacturer of the equipment you are servicing. TruckAC+ can supply current manufacturer literature for the lines we carry — contact us and we will point you to the right document.

# Contents

# 1 How a Heavy-Duty A/C System Works

An air conditioner does not create cold. It moves heat from one place to another — out of the cab and into the outside air — and it does this by exploiting a simple physical fact: a liquid absorbs a large amount of heat when it boils, and releases that same heat when it condenses back to liquid.

Refrigerant is the working fluid that carries the heat. R-134a boils at about –15°F (–26°C) at atmospheric pressure, so under the pressures and temperatures found in a truck A/C system it can be made to boil and condense on demand simply by controlling its pressure. That is what the system is doing: raising and lowering refrigerant pressure so it boils where you want heat absorbed and condenses where you want heat rejected.

## The pressure/temperature relationship

This is the single most important idea in A/C service. When liquid refrigerant and its vapor coexist in a closed space, pressure and temperature are locked together. Fix one and you have fixed the other. Knowing the pressure tells you the temperature of the boiling or condensing refrigerant — which is why a set of gauges is a diagnostic instrument and not just a filling aid. The chart in Section 6 is that relationship in tabular form.

It holds only where liquid and vapor are both present. Once all the liquid has boiled away, added heat raises the vapor temperature without raising pressure much — that excess is **superheat**. Once all the vapor has condensed, further cooling drops the liquid temperature below its condensing point — that deficit is **subcooling**. Both are measured, not guessed, and both are covered in Section 7.

## The four stages of the cycle

Refrigerant makes a continuous loop through four functional stages. Two components do work on the refrigerant — the compressor and the expansion valve — and two exchange heat with the surroundings — the condenser and the evaporator.

| Stage | Component | What happens |
|---|---|---|
| 1. Compression | Compressor | Low-pressure vapor is drawn from the evaporator and compressed. Pressure and temperature both rise sharply; the vapor leaves hot, typically 180–250°F. |
| 2. Condensation | Condenser | Hot high-pressure vapor passes through the condenser, where ambient airflow carries heat away. The refrigerant condenses to liquid and is subcooled slightly below its condensing temperature before it leaves. |
| 3. Expansion | Expansion valve | High-pressure liquid is metered through a restriction into the low-pressure side. Pressure drops abruptly and the refrigerant becomes a cold liquid/vapor mix. |
| 4. Evaporation | Evaporator | The cold mixture boils in the evaporator core, absorbing heat from cab air blown across the fins. Refrigerant leaves as superheated vapor and returns to the compressor. |

*Heat picked up in the cab at stage 4 is the heat dumped to atmosphere at stage 2. The compressor supplies the energy that makes the transfer run uphill.*

## High side and low side

The loop divides into two pressure zones. The division points are the compressor discharge and the expansion valve outlet. Knowing which side a component sits on tells you what pressure and temperature to expect there — and lets you diagnose by touch before you ever connect gauges.

| Zone | Extent | Operating pressure | Feel |
|---|---|---|---|
| Low side (suction) | Evaporator outlet → compressor inlet | Typically 15–45 psig | Lines cool to cold, may sweat |
| High side (discharge) | Compressor outlet → expansion valve inlet | Typically 150–350 psig | Discharge line hot; liquid line warm |

**Diagnostic shortcut**
With the system running and stabilized, the suction line into the compressor should be noticeably cool and the discharge line clearly hot. If both are near ambient, the compressor is not pumping or the charge is gone. This one check takes ten seconds and rules out a lot.

## What makes heavy-duty different

Truck and off-highway systems are not scaled-up car systems. The differences change how you service them:

- **Long hose runs.** Ten to thirty feet is common, against three or four in a car. More internal volume, more places for moisture to hide, and a meaningful contribution to total charge.
- **Larger charge weights.** Several pounds rather than a pound or two, so a given percentage error is a much larger absolute error.
- **Remote and roof-mounted condensers.** Airflow depends on electric fans rather than vehicle motion, so fan operation must be verified before any pressure reading is trusted.
- **Higher and more variable heat load.** Large glass area, long idle periods, and sleeper compartments that must be cooled independently.
- **Longer evacuation times.** A direct consequence of hose length — pulling a proper vacuum takes substantially longer than on a car, and rushing it is the most common cause of repeat failures.

# 2 System Types

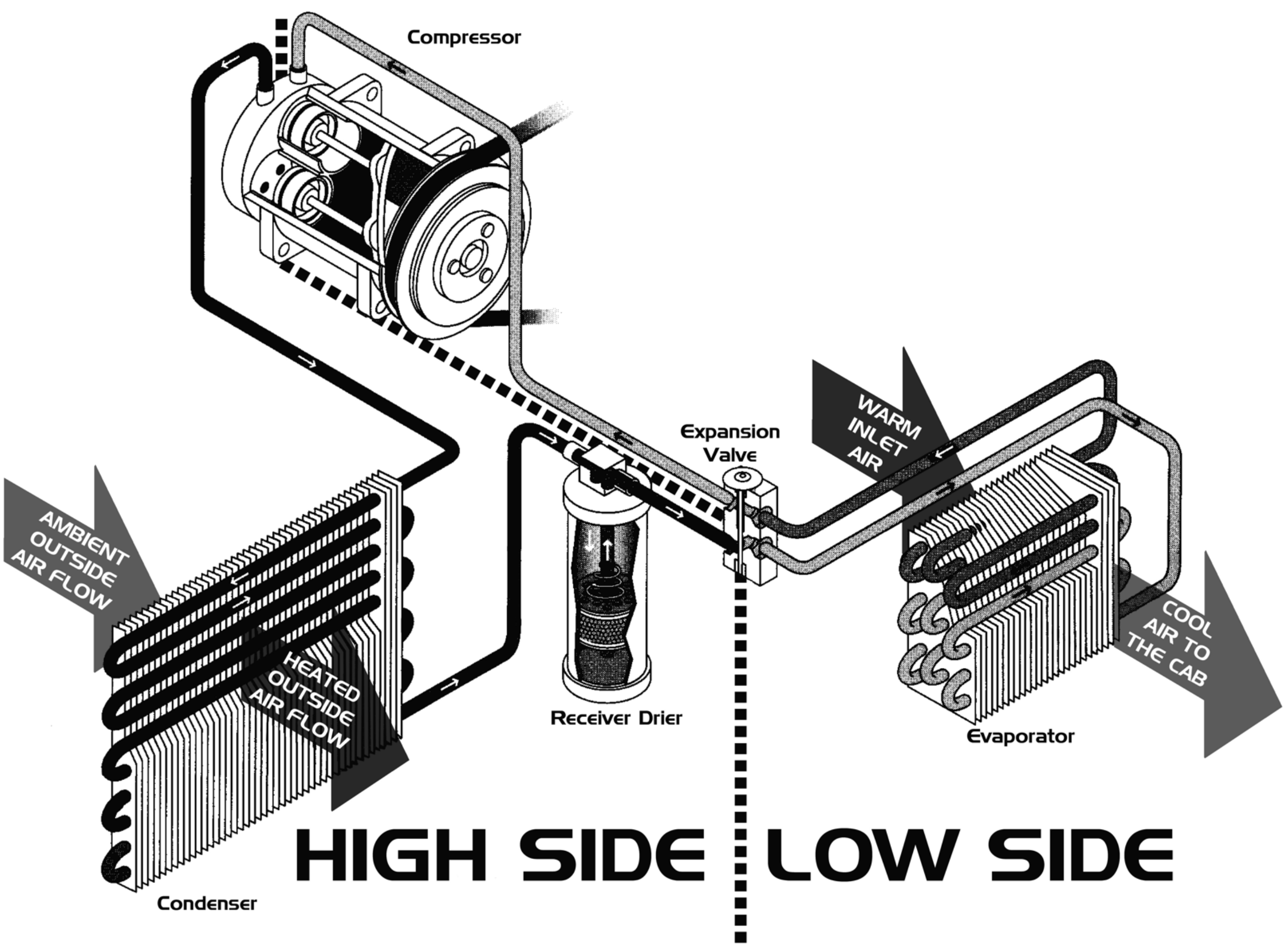
Every system in this guide follows the same four-stage cycle, but they divide into two families according to how refrigerant is metered into the evaporator. Identifying which family you are working on is the first diagnostic step, because it determines which components are present, where the high/low boundary falls, and which measurements are meaningful.

## Expansion valve (TXV) systems

A thermal expansion valve meters refrigerant according to demand. It senses the pressure or temperature at the evaporator outlet — either internally or through a bulb clamped to the suction line and connected by a capillary tube — and opens wider as cooling demand rises, closing down again as demand is satisfied.

Because the valve regulates flow actively, liquid refrigerant is stored on the **high side**, in a receiver-drier between the condenser outlet and the valve inlet. This is the dominant arrangement in heavy-duty trucks and off-highway equipment, where heat load varies widely.

**Figure 1** **Expansion valve system with receiver-drier**



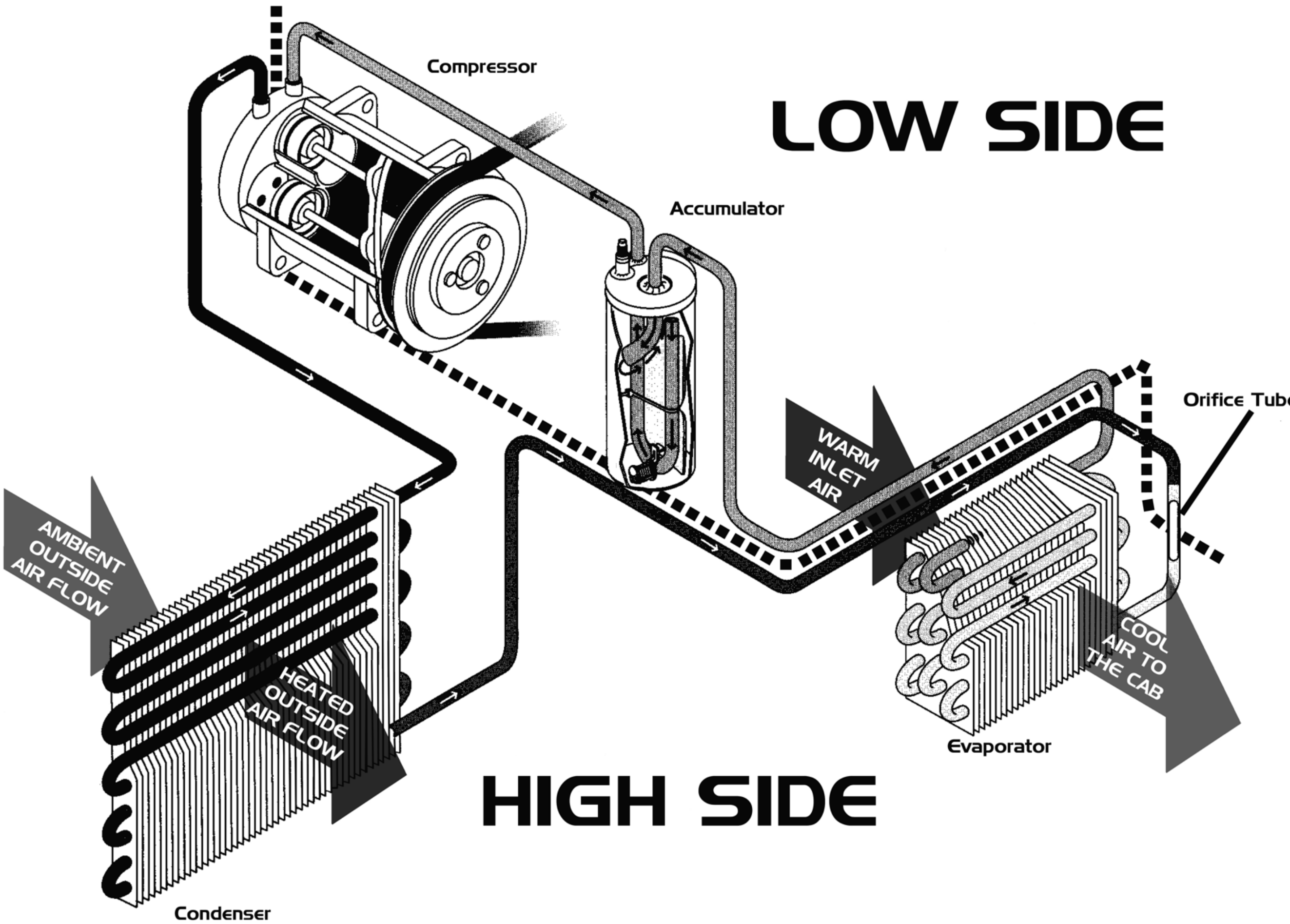

*The high/low boundary falls at the expansion valve. The receiver-drier sits in the liquid line on the high side, downstream of the condenser.*

## Orifice tube systems

An orifice tube is a fixed restriction — a calibrated bore inside a plastic housing, protected by a fine mesh screen that keeps debris from blocking it. It has no moving parts and cannot adapt to changing load, so it passes refrigerant at a rate set purely by the pressure difference across it.

Because flow is not regulated, liquid refrigerant can reach the evaporator outlet at low load. An accumulator is therefore fitted on the **low side**, between the evaporator outlet and the compressor inlet, to trap that liquid before it reaches the compressor and to hold the desiccant.

**Figure 2 Orifice tube system with accumulator**




*The high/low boundary falls at the orifice tube. The accumulator sits in the suction line on the low side, protecting the compressor from liquid carryover.*

## Telling them apart

The quickest identification is to find the desiccant vessel and note which line it sits in. A canister in the liquid line between condenser and evaporator is a receiver-drier, so the system uses an expansion valve. A larger canister in the suction line near the compressor inlet is an accumulator, so the system uses an orifice tube.

| | Expansion valve system | Orifice tube system |
|---|---|---|
| Metering device | Thermal expansion valve (variable) | Orifice tube (fixed) |
| Adapts to cooling load | Yes | No |
| Desiccant vessel | Receiver-drier | Accumulator |
| Vessel location | Liquid line, high side | Suction line, low side |
| Vessel sits after | Condenser outlet | Evaporator outlet |
| Compressor liquid protection | Valve regulates flow | Accumulator traps liquid |
| Primary charge indicator | Subcooling at condenser outlet | Suction pressure and vent temp. |
| Typical heavy-duty use | Most common | Less common; some medium-duty |

**Why this matters for charge diagnosis**

Subcooling is the reliable charge indicator on a **TXV system**, because the receiver-drier holds a liquid reserve on the high side that responds to charge level.

On an **orifice tube system** the accumulator deliberately holds a liquid reserve on the low side, which masks charge level and makes subcooling far less meaningful. Charge these by weight wherever possible, and judge performance by suction pressure and vent temperature against a manufacturer's performance chart.

**Never substitute one metering device for the other**

The two designs require different components, different charge weights, and different desiccant vessel locations. Fitting an orifice tube to a system built around an expansion valve, or the reverse, leaves the compressor without its designed liquid protection.

# 3 Component Reference

What each major component does, what failure looks like, and what to check.

## Compressor

The pump that circulates refrigerant and creates the pressure difference the cycle depends on. It draws low-pressure vapor from the evaporator and discharges it hot and at high pressure to the condenser. Most heavy-duty units are belt-driven through an electromagnetic clutch, so the compressor runs only when the clutch is energized.

**Watch for:** oil and dirt around the shaft seal, which indicates a leak; discoloration on the clutch friction face from slippage; bearing noise; and belt glazing. A compressor that has seized or is drawing high current will usually take the belt with it.

**Never run a compressor on a system with no charge**
The refrigerant carries the oil that lubricates the compressor. Operating with little or no charge starves it of lubrication and will destroy it in minutes. If a system reads empty, find and fix the leak before running the compressor.

## Condenser

A heat exchanger, mounted in the airstream, where hot high-pressure vapor gives up its heat and condenses to liquid. Condenser performance is almost entirely an airflow question. Bugs, chaff, road film and bent fins all restrict airflow, raise high-side pressure, and cut cooling capacity.

**Watch for:** blocked or damaged fins, oil staining at tube joints (a leak indicator), and on remote-mounted units, fans that fail to run or cycle correctly. Clean from the back side out where access allows, using low-pressure water or air — high pressure will flatten the fins.

## Receiver-drier or accumulator

Which one a system has depends on its metering device. A **receiver-drier** sits in the liquid line of a thermal expansion valve system; an **accumulator** sits in the suction line of an orifice tube system. Both store refrigerant, and both contain desiccant that absorbs the small amount of moisture the system will inevitably acquire.

The desiccant has a finite capacity. Once it is saturated it stops protecting the system, and moisture combines with refrigerant and oil to form acids that attack components from the inside. This is why the unit is replaced whenever the system is opened — it begins absorbing atmospheric moisture as soon as it is exposed to air.

**Replace on every opening**
Replace the receiver-drier or accumulator any time the refrigerant circuit has been opened for repair, and after any event that introduced moisture or debris. Fit it last, immediately before evacuation, and keep the sealed caps on until the moment of installation.

## Expansion device

The boundary between high and low side, and the component that controls how much refrigerant enters the evaporator. Two designs are in common use.

| Type | Operation |
| --- | --- |
| Thermal expansion valve (TXV) | Modulates flow to hold a target superheat at the evaporator outlet, using a sensing bulb clamped to the suction line. Adapts to changing heat load. Paired with a receiver-drier. Dominant in heavy-duty applications. |
| Fixed orifice tube | A calibrated restriction with no moving parts. Cheaper and simpler, but cannot adapt to load, so it relies on an accumulator to protect the compressor from liquid carryover. |

**Watch for:** a TXV sensing bulb that has come loose from the suction line — a common and easily missed fault that causes the valve to overfeed or starve the evaporator. Check that the bulb is tight, in full contact, and insulated where the design calls for it. Moisture in the system can freeze at the metering orifice and block flow intermittently, producing a system that cools well for ten minutes and then stops.

## Evaporator

The in-cab heat exchanger where refrigerant boils and absorbs heat from cab air. Because it runs below the dew point it condenses water continuously, which must drain away. It is also the component most exposed to dust, pollen and debris drawn in by the blower.

**Watch for:** blocked drain pans and drain hoses — the usual cause of water on the cab floor and of musty odour. Fouled fins reduce airflow and cooling. A frozen evaporator core, which presents as good cooling that fades to none, points to low airflow, an overcharge of air-side restriction, or a metering or control fault.

## Controls and protection devices

| Device | Function |
| --- | --- |
| Binary pressure switch | Cuts compressor clutch power on both low pressure (charge loss, protecting against lubrication starvation) and high pressure (blockage or airflow loss). |
| Trinary pressure switch | Adds a third function: engaging the condenser fans at a set high-side pressure. Failure typically presents as fans that never run and pressures that climb. |
| Thermostat / freeze control | Cycles the compressor to hold evaporator temperature above freezing, preventing the core from icing over. |
| Water valve | Shuts off coolant flow to the heater core when full cooling is selected. A valve that fails open lets heat back into the cab and is a frequent cause of "the A/C is weak" complaints where system pressures read perfectly normal. |

# 4 Safety Practices

Mobile A/C service involves liquefied gas under pressure, rotating drive components, and sharp heat exchanger fins. None of the hazards are exotic, and all of them are routinely underestimated.

**Liquid refrigerant causes instant frostbite**
R-134a boils at roughly –15°F at atmospheric pressure. Liquid escaping onto skin or into an eye freezes tissue on contact and can cause permanent injury. Wear sealed eye protection and gloves whenever you connect, disconnect, or open any part of the refrigerant circuit — including simply removing a gauge hose.

## Personal protection

- **Sealed eye protection.** Goggles rather than open safety glasses when handling refrigerant.
- **Gloves.** Protection against both cold burns and the fins — condenser and evaporator edges are sharp enough to cause deep cuts.
- **Ventilation.** Work in a well-ventilated area. Refrigerant vapor is heavier than air and displaces oxygen at floor level; pits and confined spaces are the specific risk.
- **Avoid breathing vapor or oil mist.** Neither is intended for inhalation, and decomposition products are considerably worse than the refrigerant itself.

## Pressure and containment

- **Never heat a refrigerant cylinder with a flame** or heat it above the manufacturer's stated limit. Use warm water if a cylinder must be warmed.
- **Never overfill a recovery cylinder.** Fill to no more than 80% of capacity by weight to leave room for liquid expansion. Overfilled cylinders have burst.
- **Use only DOT-approved cylinders** for storage and recovery, within their test date.
- **Secure cylinders upright** and keep them out of direct sun and away from heat sources.
- **Never connect gauges with the engine running,** and confirm both manifold hand valves are closed before connecting.

**Never pressure-test with compressed air**
R-134a mixed with air under pressure can form a combustible mixture, and shop air injects moisture into a system that must stay dry. Leak-test with nitrogen, with an approved trace gas mixture, or with an electronic detector on the refrigerant charge — never with shop air.

## Around the vehicle

- **Treat the clutch as live.** On systems where the compressor engages with defrost, it can start without warning. Keep hands, tools and clothing clear of belts and pulleys.
- **Never open a hot cooling system.** Diagnosing A/C performance often means working near a pressurized radiator that is at operating temperature.
- **Discharge lines run hot.** Compressor discharge can exceed 250°F. Ambient heat load raises hose temperatures further — take extra care in hot weather.
- **Do not vent refrigerant.** Recover it. This is both a legal requirement in most jurisdictions and a straightforward matter of not paying for gas twice.

## Refrigerant identification

Before recovering from an unfamiliar system, identify what is in it. Contaminated and counterfeit refrigerants circulate, including flammable hydrocarbon blends sold as drop-in substitutes. These will contaminate your recovery equipment, cross-contaminate every system you subsequently service, and in the case of flammable blends present a genuine ignition hazard. A refrigerant identifier pays for itself the first time it catches one.

# 5 Service Tools

The minimum equipment needed to diagnose and service an R-134a system properly, and what each tool is actually for.

| Tool | Purpose and notes |
|---|---|
| Manifold gauge set | Reads high and low side pressures simultaneously and provides the service path for evacuation and charging. R-134a sets use quick-disconnect couplers — low side smaller than high side — specifically to prevent cross-connection with other refrigerants. Hoses should have shutoff valves near the couplers to minimize release on disconnection. |
| Vacuum pump | Removes air and moisture before charging. A two-stage rotary vane pump capable of pulling below 500 microns is the practical standard. Capacity matters more on heavy-duty systems than automotive because of hose volume. Change the pump oil regularly — contaminated oil is the most common reason a pump will not reach its rated vacuum. |
| Micron gauge | An electronic vacuum gauge reading in microns. The compound gauge on a manifold set cannot resolve the difference between a usable vacuum and a badly contaminated one; a micron gauge can. Connect it at the system, not at the pump, or you will be measuring the pump rather than the system. |
| Recovery machine | Removes and stores refrigerant for reuse or reclamation. Legally required in most jurisdictions before opening a system. Recovery/recycling stations may combine recovery, evacuation and charging in one unit. |
| Charging scale | An electronic scale reading to 0.1 oz or finer. Charging by weight is the only accurate method. Pressure-based charging is an estimate and should be used only where no specified weight exists. |
| Electronic leak detector | Locates leaks the eye cannot find. Heated diode and infrared types are both in wide use. Calibrate or verify against a known reference before trusting a negative result, and work in still air — a breeze will disperse the trace before the probe reaches it. |
| UV dye and lamp | Complements electronic detection, particularly for slow leaks that need time to show. Add dye, run the system, and inspect later. Use only dye approved for the system and oil. |
| Infrared thermometer | Non-contact surface temperature readings for measuring subcooling and superheat and for tracing restrictions. A clamp-type contact probe on the line gives a more accurate reading than an IR spot on a reflective surface. |
| Thermometer, vent | Measures air-off temperature at the cab outlet — the number that tells you what the operator actually experiences. |

**Keep R-134a equipment dedicated**

Gauges, hoses and pumps retain residual oil. Using the same set across refrigerant types cross-contaminates lubricants and can cause failures that are extremely difficult to diagnose afterwards. Label the set and keep it to one refrigerant.

# 6 R-134a Pressure/Temperature Reference

These charts give the saturation temperature of R-134a at a given gauge pressure — the basis of every subcooling and superheat measurement in Section 7.

*Computed from the R-134a saturation curve and rounded to the nearest degree. Pressures are gauge (psig / kPa above atmospheric), not absolute. Checked against an independent published reference across 28–155°F, agreeing within 0.1 psi throughout — if a printed card disagrees by more than a pound or two, suspect a transcription error on the card.*

## SAE units — psig / °F

| PSIG | °F | PSIG | °F | PSIG | °F | PSIG | °F |
|---|---|---|---|---|---|---|---|
| 16 | 16 | 44 | 49 | 105 | 90 | 220 | 137 |
| 18 | 19 | 46 | 50 | 110 | 93 | 240 | 143 |
| 20 | 22 | 48 | 52 | 115 | 96 | 260 | 149 |
| 22 | 25 | 50 | 54 | 120 | 98 | 280 | 155 |
| 24 | 27 | 55 | 58 | 125 | 100 | 300 | 160 |
| 26 | 30 | 60 | 62 | 130 | 103 | 320 | 165 |
| 28 | 32 | 65 | 66 | 140 | 107 | 340 | 170 |
| 30 | 34 | 70 | 69 | 150 | 112 | 360 | 174 |
| 32 | 37 | 75 | 73 | 160 | 116 | 380 | 179 |
| 34 | 39 | 80 | 76 | 170 | 120 | 400 | 183 |
| 36 | 41 | 85 | 79 | 180 | 123 | 420 | 187 |
| 38 | 43 | 90 | 82 | 190 | 127 | | |
| 40 | 45 | 95 | 85 | 200 | 130 | | |
| 42 | 47 | 100 | 88 | 210 | 134 | | |

## Metric units — kPa / °C

| kPa | °C | kPa | °C | kPa | °C | kPa | °C |
|---|---|---|---|---|---|---|---|
| 110 | -9 | 300 | 9 | 900 | 39 | 1900 | 68 |
| 130 | -6 | 360 | 13 | 1000 | 43 | 2000 | 70 |
| 150 | -4 | 420 | 17 | 1100 | 46 | 2100 | 72 |
| 170 | -2 | 480 | 21 | 1200 | 50 | 2200 | 74 |
| 190 | 0 | 540 | 24 | 1300 | 52 | 2300 | 76 |
| 210 | 2 | 600 | 27 | 1400 | 55 | 2400 | 78 |
| 230 | 3 | 660 | 30 | 1500 | 58 | 2500 | 79 |
| 250 | 5 | 720 | 32 | 1600 | 60 | 2600 | 81 |
| 270 | 7 | 780 | 35 | 1700 | 63 | 2700 | 83 |
| 290 | 8 | 840 | 37 | 1800 | 65 | 2800 | 85 |

# Using these charts

## On the low side

The temperature shown is the boiling temperature of the refrigerant *inside* the evaporator — not the coil surface, and not the air coming off it. Expect air-off temperature to run roughly 8–12°F above the chart figure, and more than that if the core is fouled or airflow is restricted.

## On the high side

The temperature shown is the condensing temperature. This is **not** ambient temperature. A condenser can only reject heat if it runs hotter than the air passing through it, and in practice that means a difference of roughly 30–40°F above ambient. So the high-side pressure you should expect rises with the outside temperature.

| Ambient | Expected condensing temp. | Expected high-side pressure |
|---|---|---|
| 70°F | 105 – 110°F | approx. 135 – 150 psig |
| 80°F | 115 – 120°F | approx. 160 – 175 psig |
| 90°F | 125 – 130°F | approx. 185 – 200 psig |
| 100°F | 135 – 140°F | approx. 215 – 230 psig |
| 110°F | 145 – 150°F | approx. 250 – 270 psig |

*Approximate, for a clean condenser with good airflow at moderate humidity. Readings well above these at a given ambient point to restricted airflow, overcharge, or non-condensables in the system.*

## Worked example — checking subcooling

A unit is running at 95°F ambient. High-side pressure reads 210 psig, and the liquid line at the condenser outlet measures 122°F with a contact probe.

1. Look up 210 psig on the SAE chart. The saturation temperature is 134°F. That is the condensing temperature.
2. Subtract the measured liquid line temperature: 134°F - 122°F = **12°F of subcooling**.
3. That falls inside the normal 10–15°F band, so the condenser is holding an appropriate amount of liquid and the charge level is sound.

Had the liquid line measured 131°F, subcooling would be only 3°F — too little liquid, pointing to undercharge. Had it measured 110°F, subcooling would be 24°F — too much liquid backing up, pointing to overcharge or restricted condenser airflow.

**The curve is not linear**
Near the bottom of the range a few psi represents several degrees; near the top it takes 20 psi or more to move the temperature by the same amount. Small errors in low-side pressure therefore matter considerably more than the same error on the high side.

# 7 Reading the System

Gauge pressures alone will not tell you whether a system is correctly charged. Two systems can show identical pressures with very different charge levels. What separates them is **subcooling** and **superheat** — the two measurements that reveal where the refrigerant actually is in the cycle.

## Subcooling

Subcooling is how far below its condensing temperature the liquid leaving the condenser has been cooled. It tells you whether the condenser holds enough liquid, which makes it the primary charge-level indicator on a TXV system.

**To measure it:** read high-side pressure and convert to saturation temperature using the Section 6 chart. Measure the actual liquid line temperature at the condenser outlet. Subtract.

**Subcooling = condensing temperature minus measured liquid line temperature**

| Subcooling | Interpretation |
|---|---|
| Below about 5°F | Not enough liquid backing up in the condenser. Typically undercharge, though a restriction upstream can mimic it. |
| Roughly 10–15°F | Normal operating range for most heavy-duty TXV systems. Confirm against the OEM figure where one is published. |
| Above about 20°F | Too much liquid in the condenser, reducing the area available for heat rejection. Usually overcharge, restricted condenser airflow, or a liquid-line restriction. |

## Superheat

Superheat is how far above its boiling temperature the vapor leaving the evaporator has been heated. It shows whether the evaporator is being fed correctly — and it is what a TXV actively controls.

**To measure it:** read low-side pressure and convert to saturation temperature. Measure the actual suction line temperature at the evaporator outlet, close to the TXV sensing bulb. Subtract.

**Superheat = measured suction line temperature minus evaporator saturation temperature**

| Superheat | Interpretation |
|---|---|
| Below about 5°F | Evaporator overfed; liquid may be reaching the compressor. Suspect a TXV stuck open, a sensing bulb that has lost contact with the suction line, or overcharge. This condition damages compressors. |
| Roughly 8–15°F | Normal for most systems at moderate to high load. |
| Above about 20°F | Evaporator starved. Suspect undercharge, a TXV stuck closed or restricted, a plugged receiver-drier, or moisture freezing at the metering orifice. |

**Stabilize before you measure**

Readings taken on a system that has not settled are meaningless. Run the A/C at maximum cooling with the blower on high and the doors open for at least 10–15 minutes, with engine speed raised to a fast idle, and confirm the condenser fans are engaged. Only then take readings — and record ambient temperature and humidity alongside them, because both change what "normal" is.

## Baseline performance check

A quick way to judge overall system health without gauges. With the system stabilized as above, measure the air temperature entering the evaporator and the air temperature at the cab vent. A healthy system typically produces a drop of 20–30°F across the evaporator. Less than that, with airflow confirmed good, indicates a refrigeration problem worth putting gauges on.

*High humidity reduces the achievable temperature drop, because a large share of the system's capacity goes into condensing moisture rather than lowering air temperature. Do not diagnose a fault from vent temperature alone on a humid day.*

# 8 Troubleshooting by Gauge Reading

Pressure patterns narrow the field quickly. Take all readings on a stabilized system as described in Section 7, and always confirm condenser airflow and fan operation before drawing conclusions — a great many "high head pressure" faults are simply a fan that is not running.

| Gauge pattern | Symptom | Likely causes and next checks |
|---|---|---|
| Low side high<br>High side low | Pressures tend toward each other | Compressor not pumping effectively — worn reed valves, internal leakage, or slipping clutch. Verify clutch engagement and belt condition first, as these are far more common than internal compressor failure. |
| Low side low<br>High side low | Both below normal, poor cooling | Undercharge, most likely from a leak. Also consider a restriction upstream of the evaporator, or a TXV stuck closed. Confirm with subcooling — it will be low. |
| Low side high<br>High side high | Both above normal | Overcharge, non-condensables (air) in the system, restricted condenser airflow, or engine overheating. Check condenser cleanliness and fan operation before assuming a charge problem. |
| Low side low<br>High side high | Wide split between sides | Restriction between condenser outlet and evaporator inlet — plugged receiver-drier, restricted liquid line, or TXV stuck closed. Look for a temperature drop or frost at the restriction point. |
| Low side in vacuum | Suction pulls below zero | Complete blockage on the low side, or moisture freezing at the metering orifice. If the system recovers after shutdown and then fails again, moisture is the likely cause — recover, replace the drier, evacuate thoroughly, recharge. |
| Pressures normal<br>Cooling poor | Gauges look correct | Look outside the refrigeration circuit: heater water valve leaking through, blend door misadjusted or stuck, blocked cab air filter, failed blower, or duct leakage. Also consider moisture in the system and excessive oil charge. |
| Pressures cycle rapidly | Clutch engages and disengages frequently | Low charge triggering the low-pressure switch, a faulty pressure switch or thermostat, or an iced evaporator core restricting airflow. |

## Faults with no refrigerant involvement

Before condemning the refrigeration circuit, rule out the cheap causes. A substantial share of "the A/C does not work" complaints resolve to one of the following:

- **Blown fuse or failed relay** in the clutch or blower circuit.
- **Poor ground connection** — frequently corroded, frequently intermittent, and often presenting as a fault that comes and goes with vibration.
- **Blocked cab air filter** starving the evaporator of airflow.
- **Heater water valve stuck open,** adding heat back into cooled air.
- **Blend or mode door** jammed, disconnected, or with a failed actuator.
- **Failed blower motor or resistor pack,** commonly presenting as high speed working with the lower speeds dead.
- **Pressure switch open** because of a charge issue elsewhere — the switch is doing its job and pointing you at a leak, not failing.

# 9 Evacuation and Charging

The full field procedure, in order. This assumes repairs are complete and the system is closed. Where the OEM publishes a charge weight, that figure governs everything in this section.

**Before you begin**
Recover any existing refrigerant with certified equipment. Do not vent. If the system has been open to atmosphere, fit a new receiver-drier or accumulator before evacuating — the old desiccant is already saturated and will carry that moisture into your fresh charge.

## Finding the correct charge weight

Charging by weight requires knowing the target weight. Work down this list and stop at the first source that applies to the actual vehicle in front of you — charge weights vary not only by make and model but by cab configuration, condenser location, compressor supplier, number of evaporators, and build date.

| | Source | Notes |
|---|---|---|
| 1 | The vehicle's own A/C label | Usually near the compressor, on the condenser shroud, or under the hood. This is the authoritative source and reflects the specific build. Always check here first. |
| 2 | OEM service information | The manufacturer's published service data for that chassis and build date. |
| 3 | Body or HVAC builder documentation | On trucks where the A/C system was installed by a body builder or upfitter rather than the chassis OEM, their documentation governs. |
| 4 | Published capacity reference | Third-party capacity charts are a reasonable last resort, but verify the build date and configuration match. Older compilations will not cover recent model years. |

As a rough sanity check only — not as a charging target — heavy-duty charge weights commonly fall in these ranges. A figure far outside the range for the vehicle class is worth double-checking before you commit refrigerant to it.

| Configuration | Typical range |
|---|---|
| Medium-duty, single evaporator | approx. 1.0 – 2.5 lb |
| Heavy-duty day cab | approx. 2.0 – 3.5 lb |
| Heavy-duty sleeper cab | approx. 3.0 – 4.5 lb |
| Dual evaporator or roof-mounted systems | approx. 4.0 – 5.5 lb |

**Ranges are not charge specifications**
The figures above span whole vehicle classes and exist only to catch obvious errors. Charging to a class average rather than the vehicle's specified weight will leave the system either undercharged or overcharged, and on a system with no label and no available data the correct procedure is to charge by subcooling as described in Stage 5 — not to guess from a range.

## Stage 1 — Preparation and connection

1. Confirm all fittings are tight and all components correctly installed. Lubricate new O-rings with mineral oil before assembly, even on R-134a systems — it will not migrate into the system in a quantity that matters and it protects the seal during assembly.
2. With the engine off and both manifold hand valves closed, connect the gauge set: blue coupler to the low side service port, red coupler to the high side.
3. Connect the yellow center hose to the vacuum pump.
4. Connect a micron gauge **at the system**, not at the pump. A reading taken at the pump measures the pump and tells you nothing useful about the system.

## Stage 2 — Evacuation

5. Start the vacuum pump, then open both manifold hand valves.
6. Run until the micron gauge reaches 500 microns or lower. On a heavy-duty system with long hose runs this will take considerably longer than on a car — plan for 45 minutes or more, and longer again in humid conditions or if the system has stood open.
7. Once the target is reached, continue running for at least a further 15–30 minutes. Reaching the number briefly is not the same as removing the moisture.
8. Close both manifold hand valves, then switch off the pump. Closing the valves first prevents pump oil being drawn back into the system.

## Stage 3 — Decay test

9. With the pump off and the valves closed, watch the micron gauge for a minimum of 10 minutes. Longer is better.
10. A vacuum that holds steady, or rises only slightly and then levels off, indicates a tight system that is dry.
11. A reading that climbs steadily and does not level off indicates a leak. Repair it before charging — charging a leaking system wastes refrigerant and solves nothing.
12. A reading that rises and then stabilizes around 1,500–5,000 microns usually indicates remaining moisture rather than a leak. Return to Stage 2 and continue evacuating.

> **Remove the micron gauge before charging**
> Most electronic vacuum sensors are rated for vacuum service only and will be damaged if exposed to system pressure. Disconnect the gauge once the decay test has passed and before any refrigerant is introduced.

## Stage 4 — Charging by weight (preferred method)

Charging by weight is the only accurate method and should always be used where a specified charge is available.

13. Move the yellow hose from the vacuum pump to the refrigerant source and purge the hose of air.
14. Place the cylinder on the charging scale and zero it.
15. With the engine off, invert the cylinder for liquid delivery and open the **high side** valve only. Never introduce liquid refrigerant through the low side with the compressor running — liquid does not compress, and the compressor will be damaged.
16. Allow the specified weight to transfer. Pressures will equalise and flow will slow before the full charge is in; this is expected.
17. Close the high side valve. If the full charge has transferred, proceed to verification.
18. If refrigerant remains to be added, turn the cylinder upright for vapor delivery, start the engine, run the A/C at maximum, and meter the balance in through the **low side** only, in small increments, until the specified weight is reached.

## Stage 5 — Charging without a known weight

Use this only where no specified charge exists. It produces an approximation, and it depends on conditions being warm enough to load the system properly — ambient of 90°F (32°C) or above, with cab doors open.

19. Add roughly one half to three quarters of your best estimate of full charge as liquid through the high side, engine off. Close the high side valve.
20. Start the engine and run the A/C at maximum with the blower high. Verify the condenser fans are engaged — fit a fan pressure switch jumper if necessary to hold them on.
21. If suction pressure sits at 5 psig or below, keep engine speed at idle until enough refrigerant has been added to bring it above that figure. Running at speed with very low suction pressure risks the compressor.
22. Add vapor refrigerant through the low side in small increments, allowing the system to stabilize between additions.
23. After each increment, measure subcooling at the condenser outlet using the method in Section 7.
24. Continue until subcooling reaches the target range, typically 10–15°F. Stop there. Adding refrigerant past this point reduces capacity rather than increasing it.

## Stage 6 — Verification and documentation

25. Record ambient temperature, suction pressure, discharge pressure, evaporator inlet and air-off temperatures, subcooling and superheat.
26. Confirm the vent temperature drop is within the expected 20–30°F range for the conditions.
27. Leak-test all connections that were opened.
28. Remove any fan pressure switch jumper fitted during charging.
29. Apply a label near the compressor stating the refrigerant type, the total charge weight, and the oil type. The next technician will need this, and on many systems it is a legal requirement.

**Overcharging is not a safe error**

An overcharged system runs high head pressure, loses cooling capacity, and stresses the compressor and hoses. It is not the harmless side of the target — if anything it does more damage than a modest undercharge. Charge to the number, then stop.

# 10 Refrigerant Oil

Compressor oil circulates with the refrigerant rather than sitting in a sump. That has two consequences: oil is distributed throughout the system, and any component you remove takes some of it with you. Getting oil quantity right matters as much as getting refrigerant charge right.

## Oil types

| Type | Application and handling |
|---|---|
| PAG (polyalkylene glycol) | The standard lubricant for R-134a systems. Supplied in several viscosity grades — commonly ISO 46, 100 and 150 — which are not interchangeable. Strongly hygroscopic: it absorbs atmospheric moisture rapidly, so containers must be kept sealed and part-used containers should not be kept indefinitely. |
| POE (polyol ester) | Used in some R-134a applications and widely used with electric compressors. Also hygroscopic. Follow the compressor manufacturer's specification. |
| Mineral oil | The R-12 era lubricant. It does not circulate properly with R-134a and must not be used as a system charge in an R-134a system. It remains the correct choice for lubricating O-rings during assembly. |

**Use the oil the compressor manufacturer specifies**
Oil type and viscosity grade are compressor-specific. The wrong grade will not circulate or lubricate correctly, and mixing incompatible oils can produce sludge that blocks the metering device. Never substitute on the basis of what is on the shelf.

## Replacing oil after component change

The reliable method is to **measure what comes out and put the same amount back**. Drain the removed component into a graduated container, note the volume, and add that quantity of fresh oil of the correct type to the replacement component.

Where the removed component cannot be drained — it has been destroyed, or the oil has been lost through a rupture — the typical quantities below give a working estimate. Treat them as approximations: actual retention varies considerably with component size, design and orientation, and the OEM figure always takes precedence.

| Component removed | Typical oil retained (US) | Metric |
|---|---|---|
| Evaporator | 1.5 – 3 fl oz | 45 – 90 cc |
| Condenser | 1 – 1.5 fl oz | 30 – 45 cc |
| Receiver-drier | 0.5 – 1 fl oz | 15 – 30 cc |
| Accumulator | 2 – 3 fl oz | 60 – 90 cc |
| Hose or line assembly | approx. 0.5 fl oz | approx. 15 cc |

**A new compressor is not always pre-charged to system quantity**
Some replacement compressors ship with a full system oil charge, some with a shipping charge only, and some dry. Check the supplier's instructions and drain and measure the contents before installation. Fitting a fully charged compressor into a system that already holds its oil is a common cause of overfill — and too much oil coats the heat exchanger walls, insulating them and cutting capacity.

## Conversion factors

| Conversion | Factor |
|---|---|
| Pounds to ounces | lb × 16 = oz |
| Fluid ounces to cubic centimeters | fl oz × 29.6 = cc |
| Ounces to grams | oz × 28.35 = g |
| psi to kPa | psi × 6.895 = kPa |
| °F to °C | (°F - 32) × 5 ÷ 9 = °C |

## Charge allowance for line length changes

If you lengthen or shorten a liquid line, total system charge changes with it. The figures below are the internal volume of common hose sizes converted to a refrigerant weight, calculated from hose bore and typical liquid density at operating conditions.

| Hose | Bore | Volume (cu in/ft) | Liquid refrigerant per foot |
|---|---|---|---|
| #6 | 5/16 in | 0.92 | approx. 0.6 oz/ft |
| #8 | 13/32 in | 1.56 | approx. 1.0 oz/ft |
| #10 | 1/2 in | 2.36 | approx. 1.5 oz/ft |
| #12 | 5/8 in | 3.68 | approx. 2.4 oz/ft |

- **Liquid lines** carry dense liquid, so length changes here have a real effect on charge.
- **Suction and discharge lines** carry vapor, which is far less dense — roughly one twentieth to one fiftieth the mass for the same volume. Length changes on vapor lines have minimal effect on total charge.
- **Condenser changes** can shift required charge substantially, since the condenser holds a large share of the system's liquid inventory. Where a condenser is substituted, verify by subcooling rather than relying on the original charge weight.

# 11 Preventive Maintenance Schedule

A/C failures cluster in the first hot week of the year, when the system is asked to work hard for the first time in months and every latent fault surfaces at once. Planned inspection moves that work into the shop's quiet season and off the roadside.

## Interval definitions

| Code | Every | or | or |
|---|---|---|---|
| 3 | 3 months | 15,000 miles | 375 hours |
| 6 | 6 months | 30,000 miles | 750 hours |
| 12 | 12 months | 60,000 miles | 1,500 hours |

*Apply whichever interval comes first. Severe-duty operation — construction, agriculture, refuse, mining, or any high-debris environment — warrants shortening these substantially, particularly condenser cleaning, which may be needed as often as every 30 days.*

> **Let the system cool before servicing**
> Ambient heat load raises refrigerant hose and component temperatures well above what you might expect. Discharge lines and compressor bodies can cause burns. Allow the system to stand before handling components, and take particular care during hot weather — which is, inconveniently, exactly when this work tends to get done.

## Inspection checklist

| Maintenance task | 3 | 6 | 12 |
|---|---|---|---|
| **1. System operation** | | | |
| Perform full visual inspection of all system components and mountings | ● | ● | ● |
| Verify cooling performance — measure vent air-off temperature and compare to ambient | ● | ● | ● |
| Check all refrigerant hoses for chafing, kinking, heat damage and secure routing | ● | ● | ● |
| Full manifold gauge check: verify pressures, subcooling and superheat | | | ● |
| Recover, evacuate, leak-test and recharge to specified weight | | | ● |
| **2. Compressor and belt drive** | | | |
| Check discharge line — should be warm to hot to the touch | ● | ● | ● |
| Check suction line — should be cool to the touch | ● | ● | ● |
| Inspect clutch hub face for heat discoloration indicating slippage | ● | ● | ● |
| Inspect shaft seal area for oil and dirt accumulation indicating leakage | ● | ● | ● |
| Inspect drive belt for glazing, cracking and edge wear | ● | ● | ● |
| Check belt tension against the manufacturer's specification | ● | ● | ● |
| Confirm clutch pulley alignment with the crankshaft drive pulley | | ● | ● |
| Inspect idler pulley and tensioner for bearing wear and looseness | | ● | ● |
| Check clutch coil voltage and current draw against specification | | | ● |

| Maintenance task | 3 | 6 | 12 |
|---|---|---|---|
| **3. Condenser** | | | |
| Clean debris, insects and road film from the fin face | ● | ● | ● |
| Inspect fins for damage and straighten as required | ● | ● | ● |
| Inspect tubes and joints for dents and oil staining indicating leakage | ● | ● | ● |
| Verify condenser fan operation and cycling (remote-mounted units) | ● | ● | ● |
| **4. Receiver-drier / accumulator** | | | |
| Check moisture indicator sight glass where fitted — blue is dry, pink or white indicates moisture and requires replacement | ● | ● | ● |
| Check canister temperature while running — should be warm, not cold | ● | ● | ● |
| Replace annually, and any time the refrigerant circuit has been opened | | | ● |
| **5. Expansion device** | | | |
| Check liquid inlet line from the drier — should be warm to the touch | ● | ● | ● |
| Verify TXV sensing bulb is tight, in full contact and correctly insulated | ● | ● | ● |
| Inspect valve body and connections for damage and leakage | | | ● |
| **6. Evaporator and air side** | | | |
| Clean dirt, debris and airborne particulate from the fin face | ● | ● | ● |
| Clear the drain pan and drain hose of obstructions | ● | ● | ● |
| Inspect drain pump and float for operation where fitted | ● | ● | ● |
| Inspect and clean or replace cab air filters | ● | ● | ● |
| Verify blower operation across all speed settings | ● | ● | ● |
| **7. Controls and protection** | | | |
| Verify blend door, mode door and control panel operation across full range | | ● | ● |
| Check water valve closes fully in maximum cool position | | | ● |
| Check refrigerant pressure switches for correct operation with gauges installed | | | ● |
| Verify thermostat and freeze protection cycling | | | ● |
| Inspect wiring, connectors and grounds for corrosion and security | | ● | ● |

*Dots indicate the intervals at which each task should be performed. Tasks marked at the 3-month interval are also performed at 6 and 12 months.*

# 12 Looking Ahead: R-1234yf

Everything in this guide describes R-134a systems, and R-134a will remain the refrigerant in the overwhelming majority of the heavy-duty fleet for many years. But a successor is arriving, and the transition is already underway in the lighter end of the truck market. This section covers what is changing, what it means for a shop, and — most importantly — why the two refrigerants must never be treated as interchangeable.

## What R-1234yf is

R-1234yf is a hydrofluoroolefin (HFO) rather than a hydrofluorocarbon. Its cooling performance is broadly similar to R-134a — slightly lower capacity, and it runs at comparable but not identical pressures — but its global warming potential is under 1, against roughly 1,300–1,430 for R-134a depending on the assessment basis used. That difference is the entire reason for the transition.

## Why the change is happening

The American Innovation and Manufacturing (AIM) Act, enacted in December 2020, directs the EPA to phase down U.S. production and consumption of HFCs — R-134a among them — by 85 percent from baseline levels by 2036. This is a **phasedown of supply, not a ban on use**. The distinction matters: this is not a repeat of the R-12 phase-out.

| Year | Allowed production/consumption | Note |
|---|---|---|
| 2022 | 90% of baseline | Phasedown begins |
| 2024 | 60% of baseline | Sharpest early step |
| 2029 | 30% of baseline | |
| 2034 | 20% of baseline | |
| 2036 | 15% of baseline | Final step — 85% reduction achieved |

**What this means practically**

Existing R-134a systems may continue to be serviced with R-134a for their full service life. There is no requirement to retrofit a working system, and R-134a will remain available.

What changes is **price and availability**. As the allowance ceiling steps down, expect R-134a cost to rise and supply to tighten. Reclaimed refrigerant becomes more valuable, and careful recovery practice moves from good discipline to sound economics.

## Where heavy-duty stands right now

This is the part most often reported inaccurately, so it is worth stating precisely. Under the EPA's Significant New Alternatives Policy (SNAP) program, a refrigerant must be listed as acceptable for a specific end use before it may be charged into that class of vehicle. R-1234yf is not yet listed across the whole truck market.

| Vehicle category | R-1234yf status | What it means |
|---|---|---|
| Cars and light-duty trucks | Listed as acceptable (2011) | In widespread use; the transition here is essentially complete. |
| Medium-duty passenger vehicles, heavy-duty pickup trucks, complete heavy-duty vans (GVWR approx. 8,500–14,000 lb) | Listed as acceptable (2016) | Both R-1234yf and R-134a appear in new vehicles of this class. Expect to encounter both. |
| Nonroad and off-highway vehicles | Listed as acceptable (2022) | Covers a range of construction, agricultural and utility equipment. |
| Heavy-duty on-highway vehicles (Class 7–8) and buses | Proposed, not yet final | The subject of proposed SNAP Rule 27, first published October 2025 with a supplemental proposal in April 2026. Until a final rule issues, R-134a remains the refrigerant for new systems in this class. |

**Verify before you rely on this**
The regulatory position above reflects the status as this edition went to press in August 2026, and rulemaking is actively in progress. Confirm the current listing with the EPA SNAP program or a current industry source before making equipment or inventory decisions on the strength of it.

## The safety difference that matters most

**R-1234yf is mildly flammable; R-134a is not**
R-1234yf carries an A2L safety classification — lower toxicity, mildly flammable. R-134a is A1, non-flammable. A technician who treats the two alike is working on a false assumption about ignition risk.
This changes leak detection, recovery equipment, storage, and what is acceptable near open flame, hot work or ignition sources. Equipment and procedures rated for R-134a are not automatically appropriate for R-1234yf.

## Not interchangeable, in either direction

There is no scenario in which one is substituted for the other in a system designed for the other. The separation is deliberate and enforced at several levels:

- **Unique service fittings.** Each SNAP-approved refrigerant is required to use its own fitting set, on the vehicle, on the recovery equipment, and on the containers. This exists specifically to prevent cross-charging. Adapters defeat that protection and must not be used.
- **Separate service equipment.** Recovery, recycling and recharging equipment for R-1234yf is built to its own SAE standards. Shared equipment cross-contaminates both refrigerants.
- **Different lubricant specification.** Follow the compressor manufacturer's requirement; do not assume the PAG grade from an R-134a application carries over.
- **System components must be rated for it.** A system is not made R-1234yf-compatible by changing the gas.
- **Section 609 technician certification still applies,** as does the prohibition on venting.

## What a shop should do now

1. **Identify before you service.** Check the under-hood refrigerant label and the service fittings on every vehicle. As mixed fleets become normal, assuming R-134a because the truck is large stops being safe.
2. **Use a refrigerant identifier.** Already worthwhile against contaminated and counterfeit gas; as a second refrigerant enters the fleet it becomes close to essential.
3. **Tighten recovery discipline.** Recovered R-134a has rising value as supply contracts. Vented refrigerant is money released to atmosphere, and illegally so.
4. **Take leak repair seriously.** A system that loses its charge annually becomes progressively more expensive to keep running as refrigerant prices climb.
5. **Plan equipment purchases with the transition in mind.** If recovery equipment is due for replacement, factor in whether the shop expects to service R-1234yf within that equipment's service life.
6. **Track the rulemaking.** The Class 7–8 listing is the one to watch; it will determine when the transition reaches the heaviest end of the market.

## Quick comparison

| | R-134a | R-1234yf |
|---|---|---|
| Chemical class | HFC (hydrofluorocarbon) | HFO (hydrofluoroolefin) |
| Global warming potential | approx. 1,300–1,430 | under 1 |
| Safety classification | A1 — non-flammable | A2L — mildly flammable |
| Service fittings | R-134a specific | R-1234yf specific; not interchangeable |
| Service equipment | R-134a rated | Must meet R-1234yf SAE standards |
| Cooling capacity | Baseline | Slightly lower |
| Heavy-duty Class 7–8 status | Current refrigerant | Proposed, not yet final |
| Supply outlook | Declining under AIM Act phasedown | Expanding |

**The short version**
R-134a is not going away for the existing fleet, and nothing in this guide becomes obsolete. What is changing is cost, availability, and the growing likelihood that the next truck through the door holds a different refrigerant than the last one. Identify first, keep the two systems strictly separate, and recover everything.

# 13 Glossary

| Term | Definition |
|---|---|
| A1 / A2L | Refrigerant safety classifications. A1 is non-flammable (R-134a). A2L is mildly flammable (R-1234yf), requiring different handling, detection and equipment. |
| Accumulator | Suction-line vessel in orifice tube systems. Holds desiccant and keeps liquid refrigerant off the compressor. |
| AIM Act | American Innovation and Manufacturing Act of 2020. Directs the phasedown of U.S. HFC production and consumption by 85 percent from baseline by 2036. |
| Ambient temperature | The temperature of the outside air entering the condenser. Not the same as condensing temperature. |
| Binary switch | Pressure switch that cuts compressor clutch power on both abnormally low and abnormally high system pressure. |
| Charge | The mass of refrigerant a system is designed to hold, normally specified by weight. |
| Condensing temperature | The saturation temperature corresponding to high-side pressure. |
| Desiccant | Moisture-absorbing material in a receiver-drier or accumulator. Replace once saturated. |
| Evacuation | Using a vacuum pump to remove air and moisture from a system before charging. |
| GWP | Global warming potential. A relative measure of a gas's heat-trapping effect. R-134a is roughly 1,300–1,430; R-1234yf is under 1. |
| HFO | Hydrofluoroolefin. The chemical class of R-1234yf, distinct from the HFC class that includes R-134a. |
| Micron | Unit of vacuum measurement. 1 micron = 1/1000 mm of mercury absolute. Lower is a deeper vacuum; 500 microns or below is the usual target before charging. |
| Non-condensables | Air and other gases that will not condense at system pressures. They occupy condenser volume, raise head pressure, and reduce capacity. Removed by proper evacuation. |
| Orifice tube | Fixed-restriction metering device. Simpler than a TXV but unable to adapt to changing heat load. |
| PAG oil | Polyalkylene glycol lubricant, standard for R-134a. Supplied in viscosity grades that are not interchangeable. Highly hygroscopic. |
| Receiver-drier | Liquid-line vessel in TXV systems. Holds desiccant and ensures solid liquid reaches the valve. |
| Saturation temperature | The temperature at which refrigerant boils or condenses at a given pressure. |
| Schrader valve | Spring-loaded service port valve opened by a depressor pin in the coupler. |
| SNAP | Significant New Alternatives Policy. The EPA program that lists which refrigerants are acceptable for a given end use, such as a specific class of vehicle. |
| Subcooling | The number of degrees the liquid leaving the condenser has been cooled below its condensing temperature. The primary charge indicator on a TXV system. |
| Superheat | The number of degrees the vapor leaving the evaporator has been heated above its boiling temperature. Indicates how well the evaporator is being fed. |
| TXV | Thermal expansion valve. Meters refrigerant into the evaporator to maintain a target superheat, using a sensing bulb on the suction line. |
| Trinary switch | Pressure switch combining binary low/high protection with a third circuit that engages the condenser fans. |

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