

Dorman Training Center Presents:

"HD AIR CONDITIONING PRIMER"

PART 2



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RevUp - Smarter Solutions for Faster Repairs

Join this hands-on, in-person training hosted by Dorman Training Center and Motor Age Training—a full-day event designed to sharpen your diagnostic skills and deepen your understanding of advanced vehicle repair.

Attendees must choose one class to attend per session.

MORNING SESSION:

- **Upping Your Diagnostic Skills**
Instructor: Jerry "G" Truglia
- **Diagnostic Strategies**
Instructor: Pete Meier

AFTERNOON SESSION:

- **Building Your Diagnostic Worksheet**
Instructor: Ken Zanders
- **Driving Down the Rabbit Hole**
Instructor: Josh Weaver



SIGN UP TODAY!

Scan code or click [here](#) to register

For questions please contact:
DTC@DormanProducts.com or visit:
dormantrainingcenter.com

Location:

Automotive Training Center
900 Johnsville Blvd.
Warminster, PA 18974

Date:

September 20, 2025

- **Morning Session:**
8:30 a.m. EST
- **Afternoon Session:**
1:30 p.m. EST

Instructors:

Jerry "G" Truglia, Pete Meier,
Ken Zanders, Josh Weaver

Price: \$149.95



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Your Instructor For This Webinar

- **Owner, O&K Truck and Auto Repairs Ltd.**
- **ATTP Master Instructor, New York State**
- **Author, "Medium/Heavy Duty Truck Electricity and Electronics"**
- **Training provider for various Associations, industry and various NY State agencies**
- **Developed trainings that range from four hours to multiple days, specializing in brakes, electrical, regulations and many other subjects relating to our industry.**
- **Member of various organizations such as SAE, CVSA, TANY**



Sulev "Swede" Oun

okswede1@aol.com



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What Will Be Covered

Instructions For This Webinar

This webinar will be approx. 1 hour long

- All slides that are presented are in your handout and are numbered
- Have a pen or pencil and paper for notes
- Questions can be asked at anytime

- 01 Walk through a typical A/C job
- 02 Detecting leaks
- 03 Case Study
- 04 A/C Diagnostic Steps



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Typical AC JOB



Quick check to get a direction.



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Typical AC Job

Robinair AC machine used for the next sequence of pictures.

This is the display
Used to perform
various
actions/requests.



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Robinair Model 34788 Recovery, Recycling, Recharging Unit



Flushing the Hoses

If the next vehicle to be serviced contains a different type of oil than the previous vehicle serviced, the hoses must be flushed of all residual oil to prevent contamination.

1. Press the **MENU** button on the keypad.
2. Press the **UP** or **DOWN** arrow key to scroll to **HOSE FLUSH**, and press **START / YES**.

Robinair Model 34788 Recovery, Recycling, Recharging Unit



3. Connect the hoses to the unit's storage port connections and open the coupler valves.

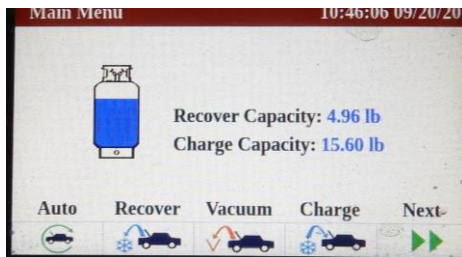
4. Select **START / YES** to begin the hose flush process.

The display will read
FLUSH COMPLETE
CONNECT SERVICE
HOSES TO VEHICLE
START TO CONTINUE

5. Close the coupler valves and press **START / YES**.

6. Press **STOP / NO** to exit the **HOSE FLUSH** menu.

Typical AC Job



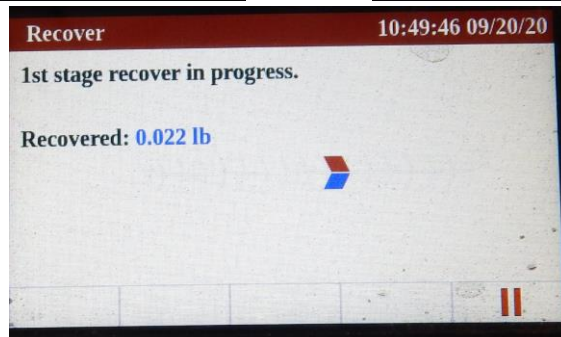
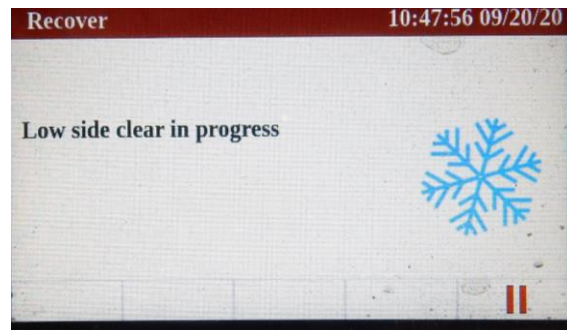
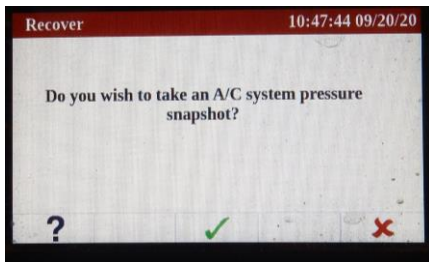
AirSept
Dual
Automatic
Recycle
Guard
Sealant
Remover



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Typical AC Job



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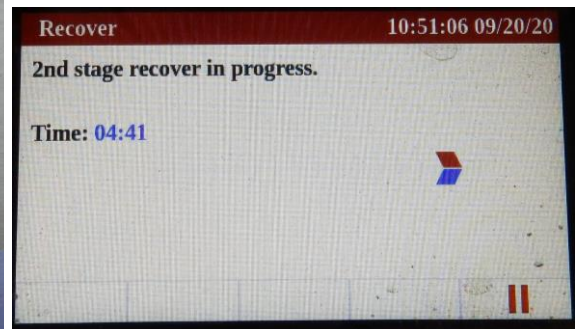
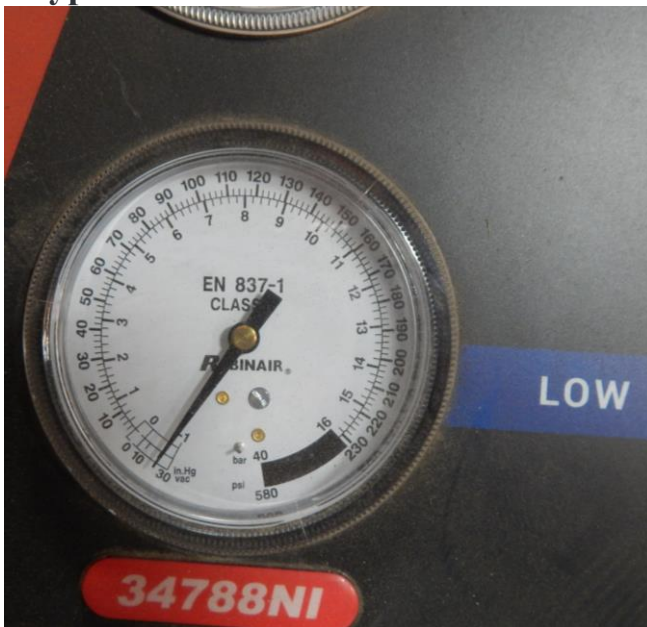
Typical AC Job



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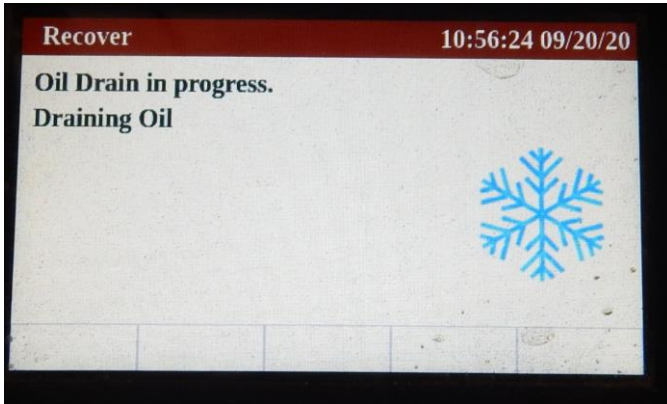
Typical AC Job



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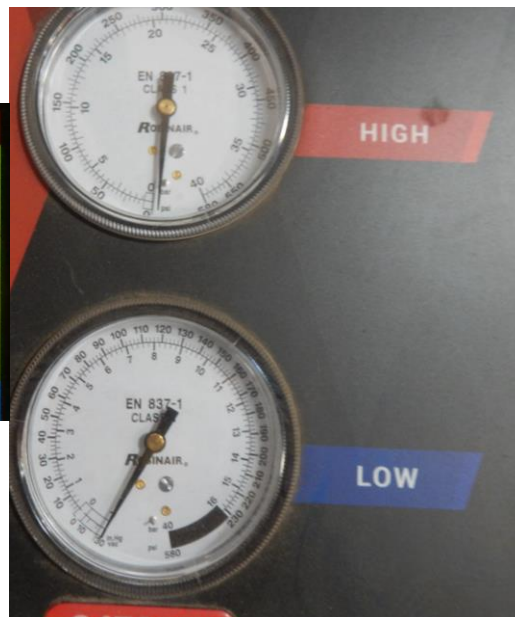
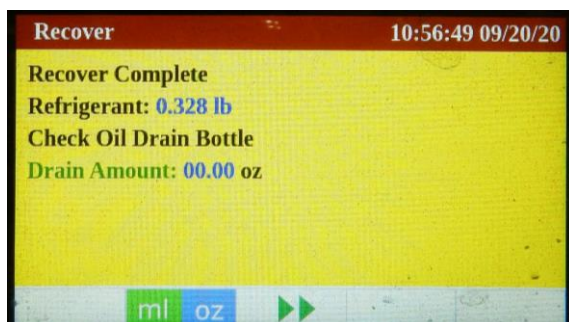
Typical AC Job



Verify the amount of oil recovered, even though the machine tells you also .

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Typical AC Job



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Typical AC Job

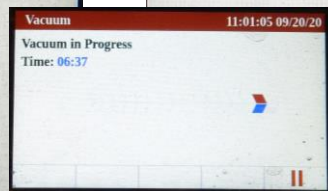
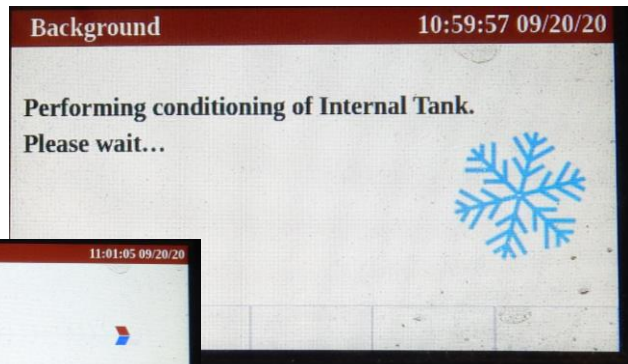
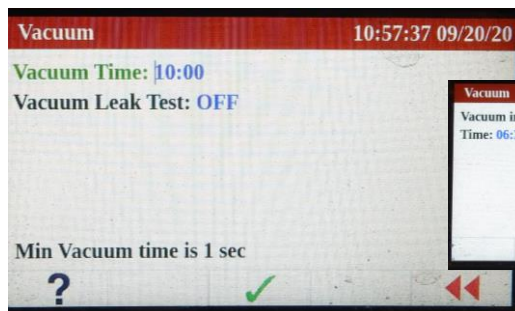


If you use Air Sept Guard, keep the lever in mind.
Has to be in a certain position when **Recovering** or **Vacuum/Recharge**.

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Typical AC Job

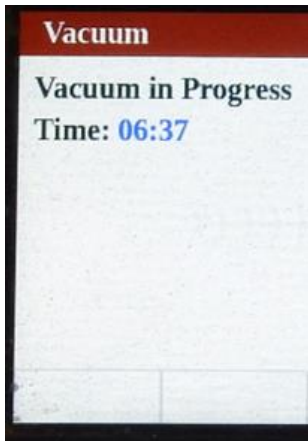


Here we know we have a leak. I am going to give it a partial charge to find a leak. This machine doesn't want to charge unless it sees a certain vacuum. Besides, it keeps me in the habit of always vacuuming before charging. If no issues, always a minimum of 30 minutes.

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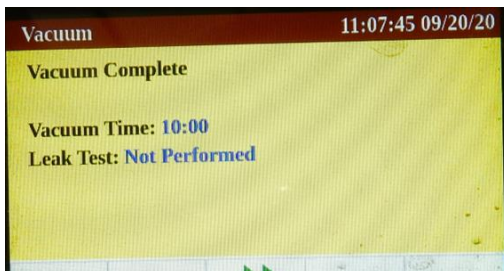
Typical AC Job



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Typical AC Job

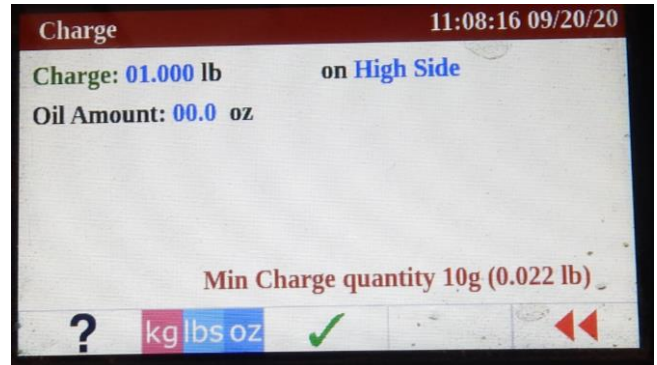
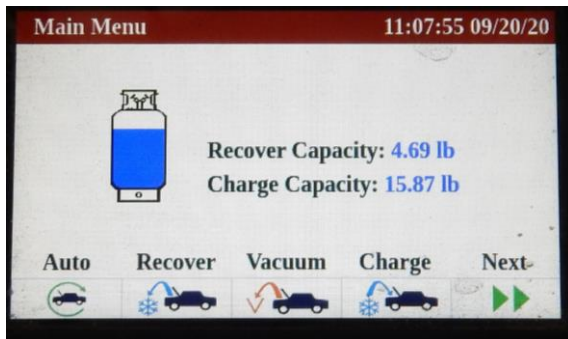


This is a good test. Regardless, walk away and come back later to see if vacuum is maintained.

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Typical AC Job



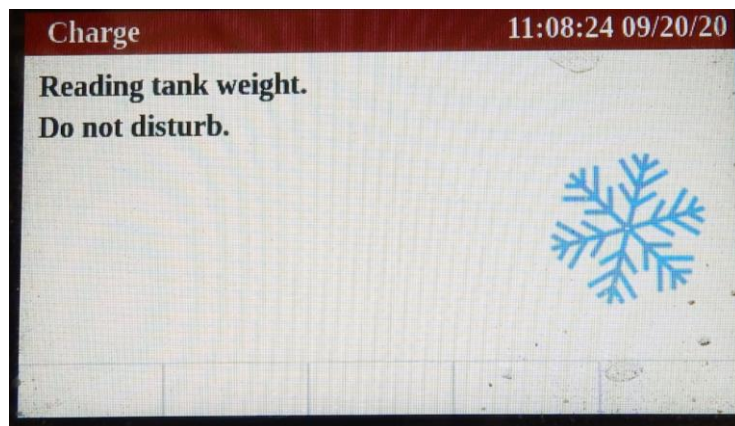
Getting ready to put enough in to run compressor and start looking for leaks.

Keep track of what was recovered and what ultimately gets used and installed. Be fair to the customer.



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Typical AC Job



These machines are very sensitive. I've had a little too much weight on it on occasion and it would let me know and not continue.



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Check Your Machine



33 Pennies = 3 ounces

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Check Your Machine



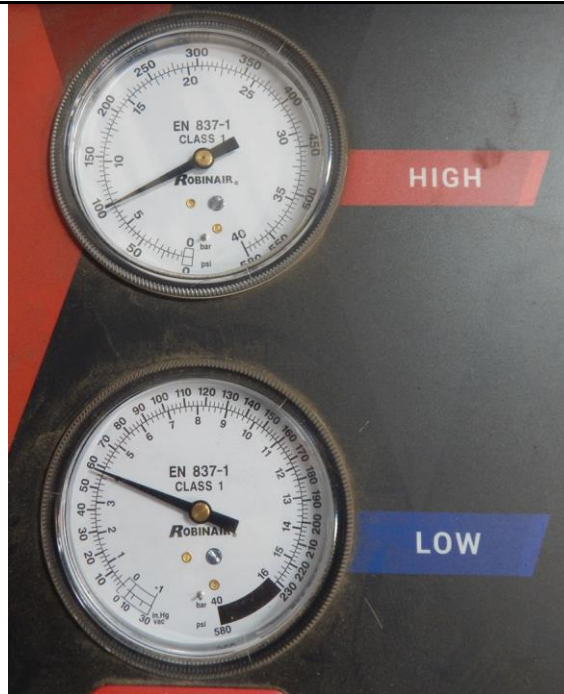
33 Pennies = 3 ounces. Place the pennies on your refrigerant bottle and check the scale reading. **If the scale is adjusted properly the reading on the machine should read 3 oz more.** If it does not read the correct amount **+ or - 1 ounce** adjust the scale.

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Typical AC Job

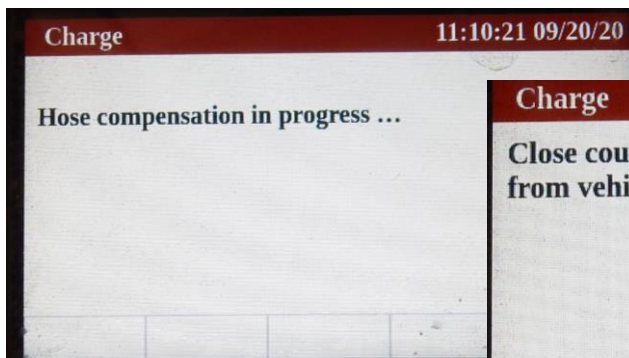
Looks like I am good to go.
Good to go for leak testing
at this point.



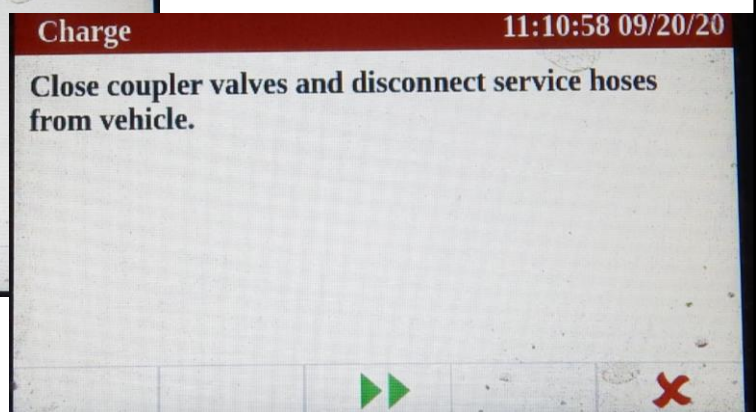
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Typical AC Job



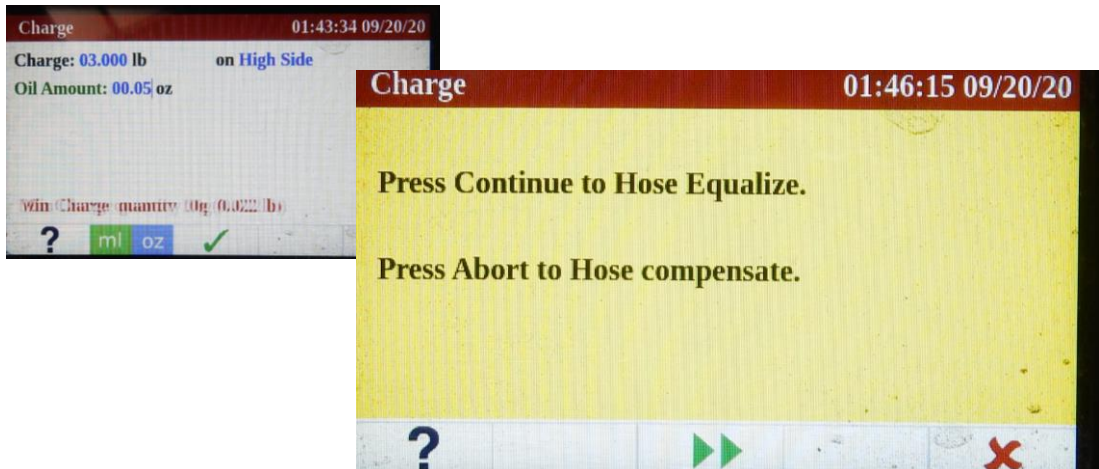
Follow the Prompts and you can't
go wrong.



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Typical AC Job



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A/C Systems Conversion

Conversion

1 ounce (oz.) = 0.0625 pounds (lb.) 28.4 grams (g) .0284 kilograms (kg)

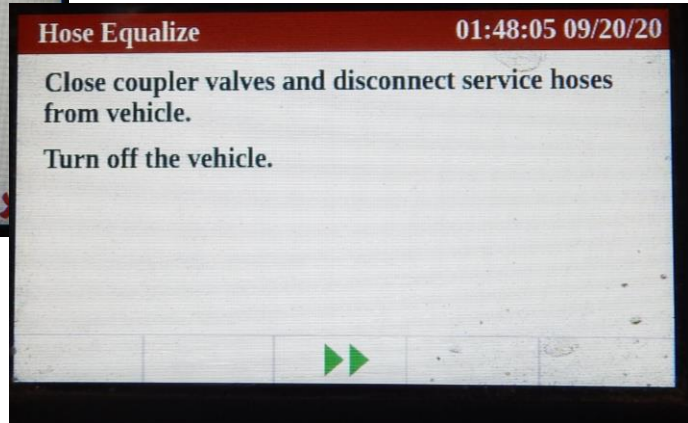
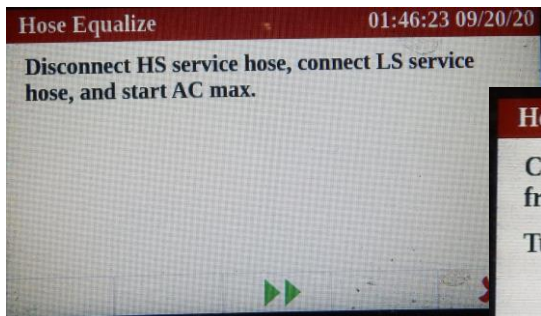
1 pound (lb.) = 16 ounces (oz.) 454 grams (g) 0.454 kilograms (kg)

1 gram (g) = 0.0352 ounces (oz.) 0.00220 pounds (lb.) 0.001 kilograms (kg)

1 kilogram (kg) = 35.2 ounces (oz.) 2.20 pounds (lb.) 1000 grams (g)

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Typical AC Job



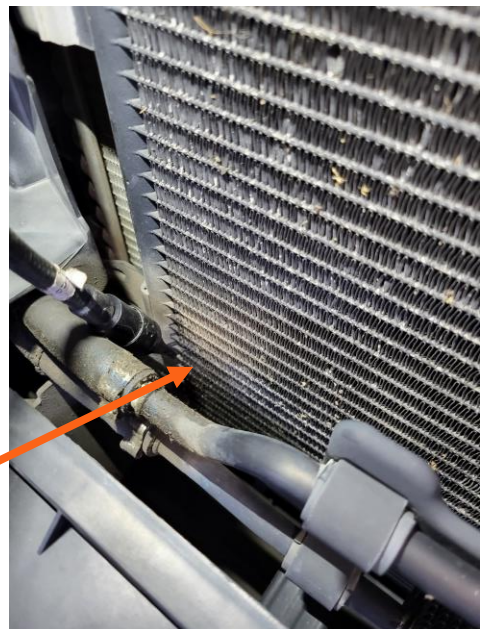
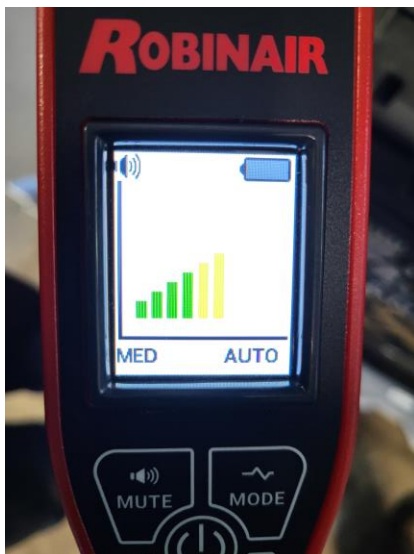
Charging is done.

If there is no issues I would know put the system through a performance check to make sure it is cooling properly. However, we need to find a leak.



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Typical AC Job



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Leak example



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Leak Example



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Leak Checking Equipment



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Time Out Case Study

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RV Not Cooling

Complaint:

Doesn't seem to cool the air like it did last year. Vehicle has been sitting around for six months since it was last used.



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RV Not Cooling

- This RV is probably 30 feet or longer.
- Condenser is in the rear.
- The engine is in the rear..
- Evaporator is in the front.
- Hook ups for reading and charging AC are in the front.
- Put this into perspective.
- How long are the lines?
- What's the distance refrigerant must travel?
- How much refrigerant would this vehicle need?



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RV Not Cooling

Front of RV showing hookup of lines.

Can you name some of the components?

- **Receiver-drier**
- Expansion valve
- **Outside air door/actuator**
- Coolant lines going to heater core
- **Low pressure line going to expansion valve**
- High pressure line going to receiver drier



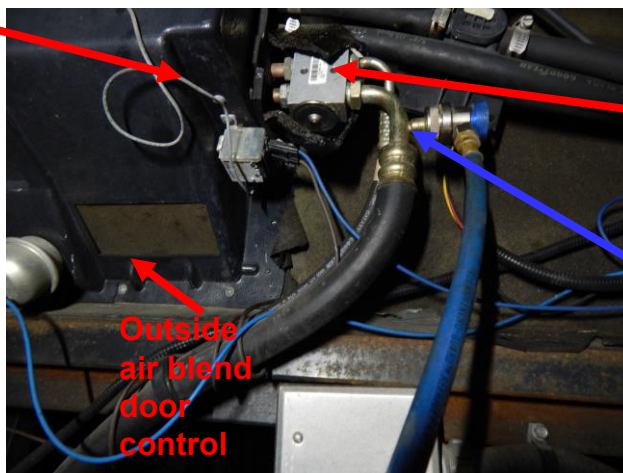
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RV Not Cooling

Remote Sensing Thermostat

- Located in evaporator
- Compressor clutches are often controlled by this Thermostat.
- Sometimes called a cold control.
- A remote bulb is usually located inside the evaporator.



Expansion Valve /Block

Low Side (Suction Line)

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RV Not Cooling

Initial pressure readings

- First glance.
- Do they look okay?
- What would you compare it to.

How about temperature?

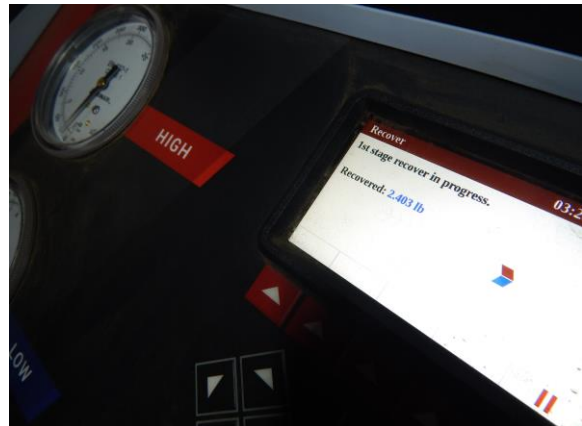
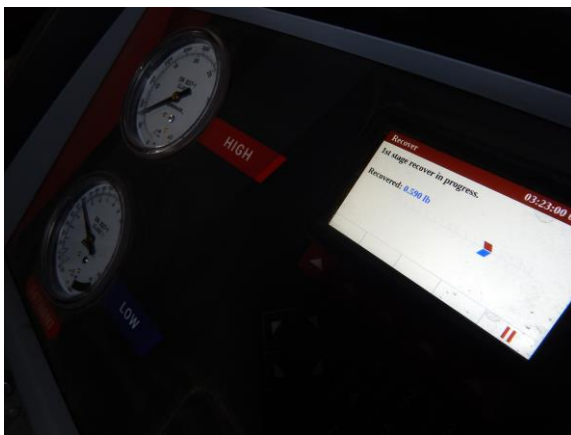


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RV Not Cooling

Started recovery to see how much came out.



**Recovered approximately 2.5 lbs.
Is this enough refrigerant ?
Remember the length of lines etc.**

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RV Not Cooling

Unfortunately, we don't know how much refrigerant it is supposed to hold.

In the real world that does happen.

Blank - No Weight



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Someone Stole The Condenser ☺ - That's The Radiator

Rear engine driven RV



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RV Not Cooling

The condenser is between the radiator and engine. Need to get bed inside apart to get on at anything. Seemed like a very slow leak. Customer said he wants just a "top-off the refrigerant" (recharge). It took 8 lbs. How did we determine 8 lbs. was enough? We had to revert to using the gauges and observing the pressures. It's an older vehicle and it worked.

Important: With newer vehicles, you need to be precise.



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RV Not Cooling

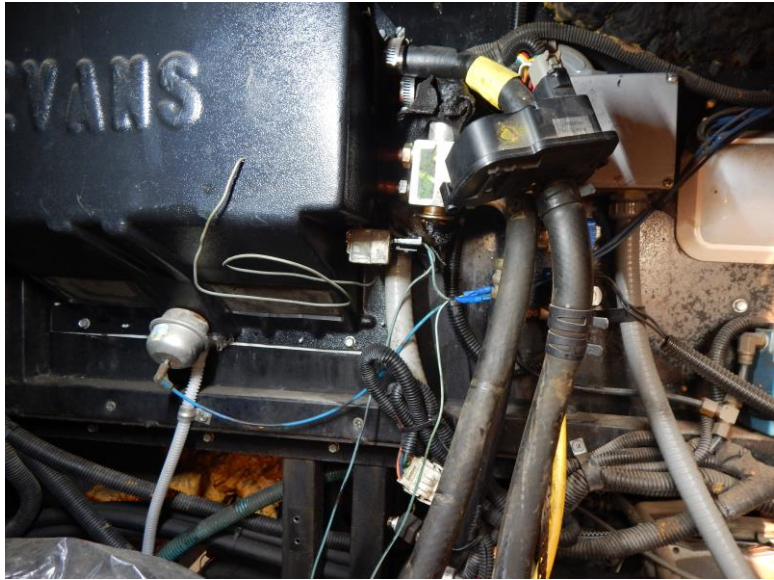


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RV Not Cooling

High Side Pressure High
after charging.
What's up with that.



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RV Not Cooling



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RV Not Cooling



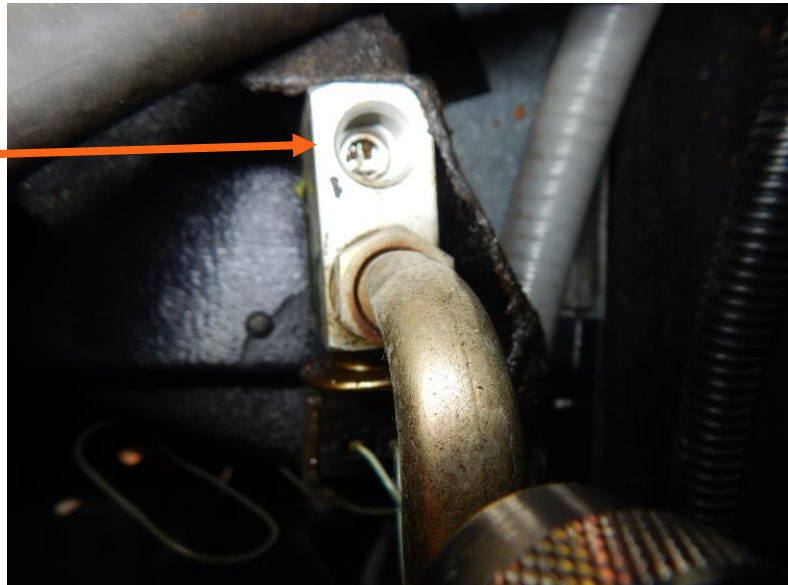
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RV Not Cooling

Little pellets in there.

What valve is this?
What goes along with
this valve.
Remember Part 1?



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Case Study 30-foot-long RV



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RV Not Cooling



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RV Not Cooling

Receiver Drier

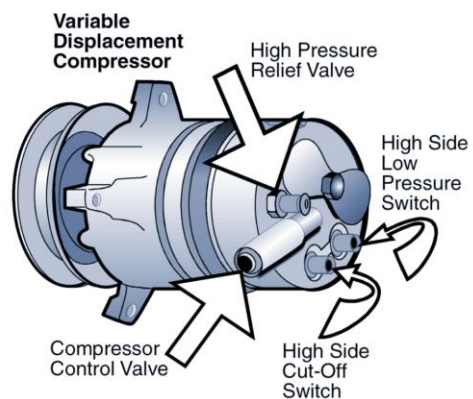


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A/C Compressors

- The compressor's primary function is to compress refrigerant vapor and circulate the refrigerant throughout the system.
- Note: If enough liquid refrigerant enters the compressor, it will "slug" the compressor and may destroy it. **Liquids are not compressible!**



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Why Compressors Fail

- **Compressors fail for several reasons;**
- Insufficient oil
- **Too much oil**
- The wrong type of oil
- **Cooling system blockages that prevent proper oil circulation**
- If a compressor fails, we need to determine **WHY** it failed before installing a replacement.



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Compressor Clutch Failures

- **Is it the clutch or the compressor?**
- What causes clutches to fail?
- **How do they fail?**
- How about voltage?

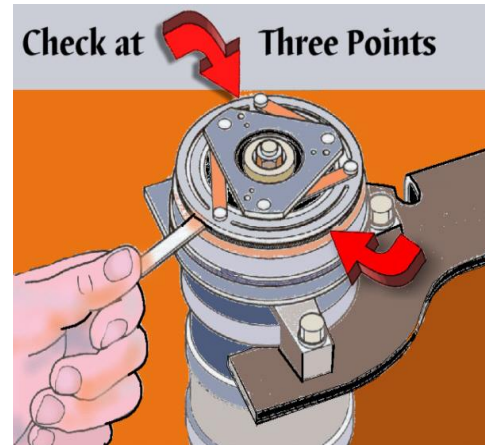


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Check The Compressor Clutch Air Gap

- The compressor clutch air gap. Before installing a new compressor, or one that's received a replacement clutch, take the time to measure the air gap at three places (120 degrees apart) with a feeler gauge.
- Make sure the gap is correct and that the gap is equal all the way around the clutch's circumference.
- Incorrect air gaps cause noise and performance (sticking or slipping) problems.

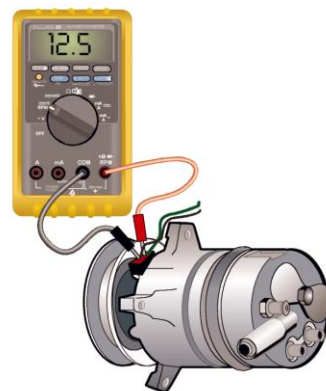


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Check The Compressor Clutch Voltage Drop

- What are we testing here?
- How do we test it?
- Why is this test important?

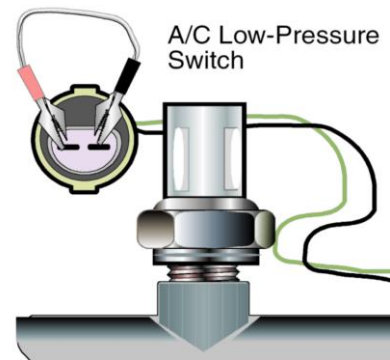


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Pressure Switches

- **What are the jobs of the switches inside the refrigerant system?** Pressure switches cycle the compressor on or off. **They also protect the system by shutting off the compressor if the system pressure is too low or if the pressures get too high.** They are also used to supply an input to the computer to aid in engine performance. The compressor may be disengaged during wide - open throttle to improve acceleration.



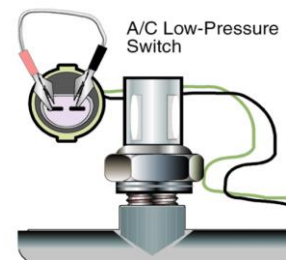
- **Note: DO NOT JUMP ANY CONNECTOR WITHOUT CONSULTING A WIRING DIAGRAM.**

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Pressure Switches

- **How many switches are there?** There are several different types of switches in a typical system. Usually there will be at least 2 inside most systems.
- **Are all switches the same?** No! Be sure that you use the correct switch for your application.
- **Where may these be located?** These switches are usually located in refrigerant lines, at the accumulator or receiver drier, or in the compressor itself.
- **How can we test these devices?** We would typically test these switches with our scan tools, or with our volt/ohm meters. We can also jump the switches **(make sure you consult a wiring diagram)** to simulate closing on some applications.

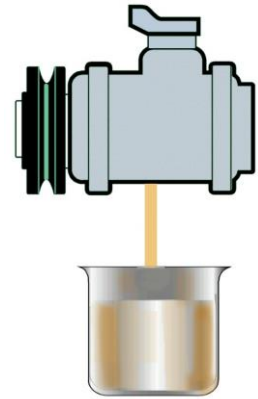


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Removing The Old Oil

- Do we need to drain the compressor? That depends. Chrysler, and Mercedes have both recommended draining compressors in some of their TSBs. Some new compressors come dry.
- Do all compressors have sumps? No. But you should probably drain those that do since they may contain excessive amounts of oil.

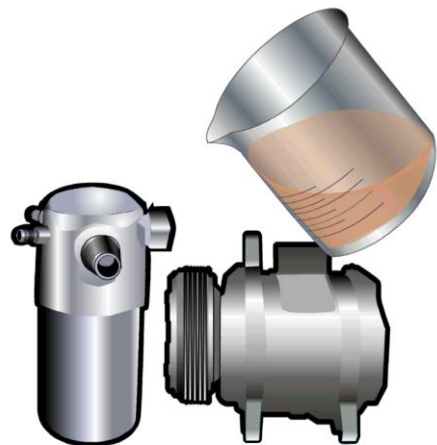


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Adding Oil

- Half in Drier?
- Half in Compressor?
- NO - RTFI!
- Just before charging the air condition system add 2 ounces of oil / dye to the system. **The A/C system should be in a vacuum when adding oil to the system. Some A/C machines and oil injections tools allow the technician to add oil while the system is under pressure.** When the system is low on refrigerant most likely some oil escaped with the refrigerant through a hole in the system.



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Avoid "Slugging" On Initial Start Up

- **Set the cabin ventilation to the "center duct" position and open the ducts completely.**
- **Adjust the blower speed to mid - level and the A/C to "MAX Cool" performance.**
- **Start the engine (without running the air conditioning system) and let the engine idle uninterrupted for 2 - 3 minutes.**
- **Turn on the air conditioning system for approx. 10 seconds at idle, then immediately turn the air conditioning system off again for approx. 10 seconds.**
- **Repeat the process 5 - 10 times while the engine is idling.**
- **Perform a final operational test of the air conditioning system as specified by the vehicle manufacturer to confirm system performance.**

PAG Oils



PG Come In Different Weights - RTFI

Evacuation Causes Moisture to Boil

- **Water boils at 59 Degrees F at 29.5 inches of vacuum.**
- **Evacuation causes moisture to boil so it can be removed from system prior to recharging**



30 to 45 Minutes Evacuation Time R134a & R-1234yf

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A/C System Diagnostic Steps



Check the basics. The A/C system cannot work when other major systems are malfunctioning. The cooling and battery/charging systems are especially important, a problem in either will reduce cooling. A visual inspection can turn up simple stuff like low coolant, loose or frayed belts, blocked air inlet, clogged condenser, or bent, damaged, or missing condenser fins, etc.

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A/C System Diagnostic Steps

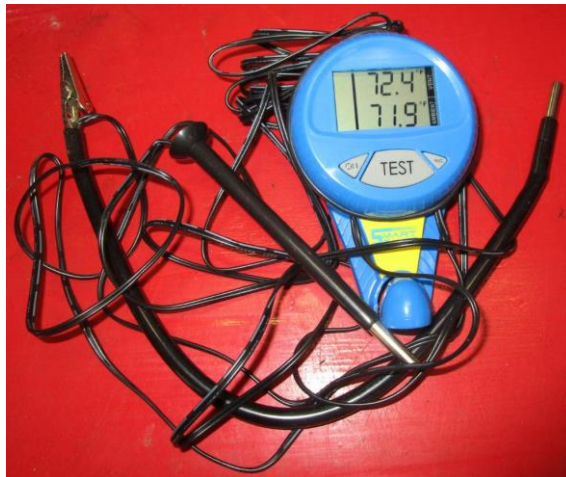
- **Verify complaint (in detail)**
- **Perform visual inspection**
- **Check system pressures**
- **Performance tests**
- **Pull any codes**
- **Isolate and repair problem**



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Check Duct Temperature Look For 30 Degrees Difference

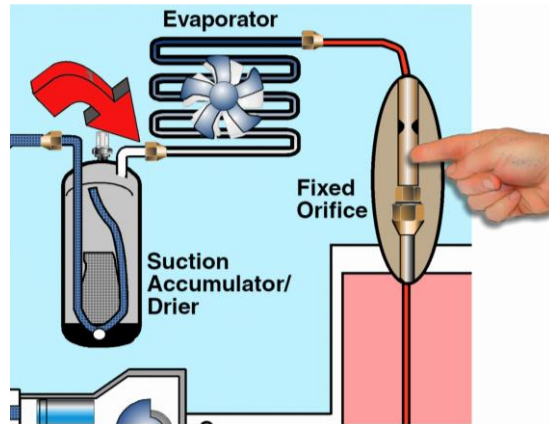


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Quick Temperature Checks

- What type of system is this?
- What should the temperatures at these two points (outlet side of liquid hose and inlet side of accumulator)?
- Should be close to equal (± 5 degrees).

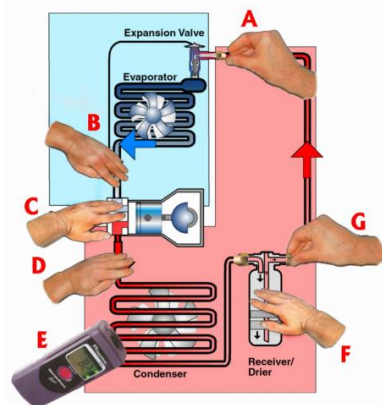


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Quick Temperature Checks

- What type of system is this?
- A = Expansion Valve inlet should be warm to the touch. Frost indicates low charge or restriction. Frost at outlet of expansion valve also indicates plugged or restricted valve.
- B = Suction line back to compressor should be cool to the touch. Some sweating normal. Heavy sweating or frost indicate restriction.
- C = Check for excessive compressor vibration caused by internal compressor problem or loose/improper mounting.

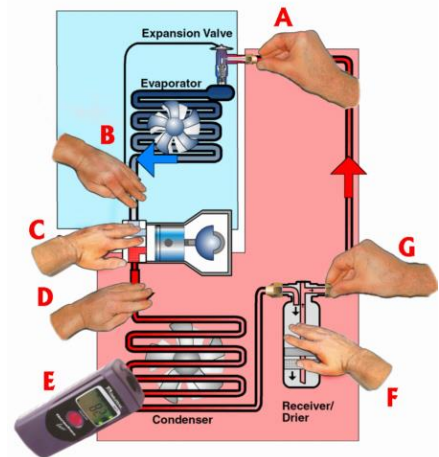


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Quick Checks

- **D = Compressor outlet line temperature should be uniform across its entire length. Careful, it may be HOT, especially if there is an oil overcharge.**
- **E = Look for 40 - 50 - degree temp drop across condenser face. Excessive temperature changes indicate restrictions. Too little temp change may mean there's an airflow obstruction.**
- **F = Drier body should be warm and free of frost rings.**
- **G = Drier inlet and outlet should both be warm.**



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Quick Performance Test



Set to MAX A/C and open doors

This is the best way to test the air condition system. Make sure you have all the doors open and the A/C system set to the MAX position and the blower fan on MAX.

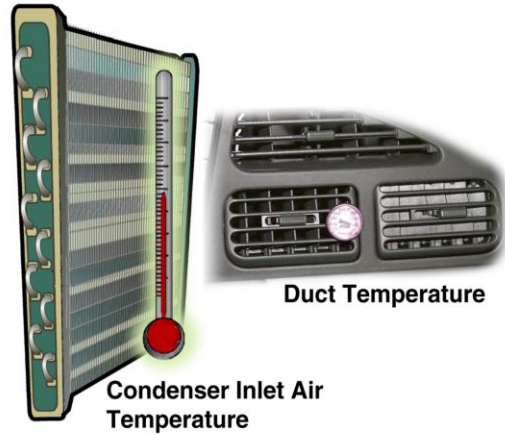
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Compare Inlet Air To Duct Temperature

2

Duct temp should be 30 degrees F colder than air just ahead of condenser inlet

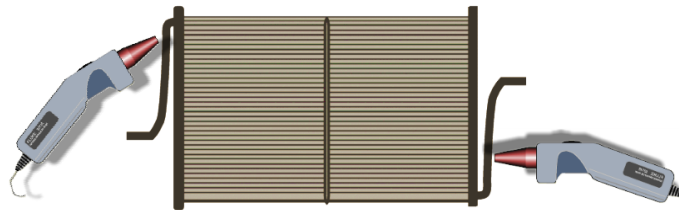


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Compare Condenser Inlet & Outlet Temps

3



Difference less than 20 degrees F look for restricted condenser air flow

Difference more than 60 degrees F look for plugged condenser

An approximate 40 - 50 - degree temperature drop across the condenser maybe normal. Test and several points to be sure the temperature drops uniformly. Tip: Check a few good vehicles for a good baseline since A/C systems are changing.

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Troubleshooting



Low Refrigerant Charge
Refrigerant Restriction

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Troubleshooting

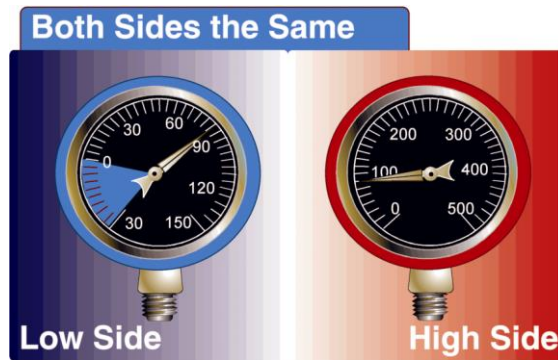


- **Refrigerant overcharge**
- **Oil overcharge**
- **Poor airflow through condenser**
- **Expansion Valve stuck open or temperature sensing bulb mounted incorrectly**

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Troubleshooting



- **Failed compressor**
- **Control Valve failure in variable displacement compressors**



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Expansion Valve System Pressure Diagnostics

Low-Pressure Gauge	High-Pressure Gauge	Action Required
IN RANGE	IN RANGE	NONE - A/C is working properly
LOW	LOW	Add Refrigerant
LOW	HIGH	Possible blockage of the expansion valve or orifice tube
HIGH	LOW	Possibly faulty compressor
HIGH	HIGH	System is overcharged - Recover refrigerant



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A/C Machine R1234yf



R1234yf is the new refrigerant that is used in many new vehicles with more to come. The new SAE standard for the R1234yf machine has a built in Identifier to make sure that only the correct refrigerant is recovered from the correct vehicle. A vehicle VIN maybe required to make sure that the machine is attached to the correct vehicle.



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A/C Facts

- **All R1234yf machine's perform leak checks. 1. Vacuum leak check
2. Pressure leak check.**
- This procedure is mandatory since it checks for flammable refrigerant being released into the vehicle's interior.
- **R1234yf maximum charge during LEAK CHECK is 15% of the total charge. This charge is to check for a leak at the Evaporator, after the panel duct is selected to the floor panels with the fan on low speed. Using a J2913 leak detector selected on the highest sensitive position.**
- Chrysler R1234yf machine requires the VIN number to be read by the OBD II port.



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A/C Facts

- **R1234yf / SAE J2842 design criteria and certification for OEM Mobile Air Conditioning Evaporator and Service Replacements.**
- **ND 11 Hybrid/Electric A/C POE Oil is anywhere \$172.00 an ounce for GM - Ford vehicles and \$160.00 for Chrysler only sold as a 3 - ounce minimum.**
- **Only use an oil installer that has NEVER had a PAG oil in it.**
- **Make sure only to install the special Hybrid / Electric A/C oil.**



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- This was an A/C system primer.
- We all need extensive training to properly diagnose and repair these systems.
- That requires devoting time.
- Ideally a classroom setting with hands -on .
- Dorman training has AC classes.
- We have classrooms and can also travel to your or any host facility.
- Next summer will be back again before we know it.
- Plan early.

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Questions?

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Date:
September 20, 2025

- **Morning Session:**
8:30 a.m. EST
- **Afternoon Session:**
1:30 p.m. EST

Instructors:
Jerry "G" Truglia, Pete Meier,
Ken Zanders, Josh Weaver

Price: \$149.95



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