
TECHNICIAN
TRAINING
BY DORMAN PRODUCTS
DORMAN
Training Center
Presents:
"How to Properly Service R1234yf Air Conditioning Systems"

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DORMAN
Aftermarket Innovators

2

Your Instructor For This Seminar

"G" Jerry Truglia

- **National Trainer, ASE World Class, Master Auto, Truck, School Bus, L1, L3, CNG and…**
- **ATTP Master Instructor, New York State, CT and New Jersey**
- **STS (Service Technician Society) 2003 President**
- **TST (Technicians Service Training) Founder and President**
- **Author / Co Author/ Technical adviser on 25 plus books including OBD II and Mode 6, and Understanding and Diagnosing Hybrid Vehicles**
- **Published articles for multiple newsletters, and magazines**
- **Picked as one of the Top Instructors in the country by EPA & SAE**
- **Numerous Radio, TV, Internet, and SAE Video appearances**
- **PTEN, MotorAge and TST Webcast Instructor**
- **Motor Magazine Top 20 award winner**
- **Provider of OBD II Training for 14 states, Ontario Canada and the US EPA**
- **Guest speaker at SAE Congress, IM Solutions and Clean Air Conference**

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How to Properly Service R1234yf Air Conditioning Systems

This Dorman Lunch and Learn will cover all the components of the R1234yf air conditioning system along with step by step instructions of how to test, recover, evacuate, recharge and add oil/dye to the system. We will have a R1234yr machine connected to a vehicle and provide you with the dos and don'ts when performing system service and repair. At over $50.00 a pound you don't want to guess but rather test and get the job done right the first time. Today's vehicles are more involved so it's important to use a proper diagnostic approach.

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A/C Facts

- **Over 80% of new vehicles have R1234yf installed.**
- **Mercedes Benz and Mazda are still holding out.**
- **R1234yf goes for $50.00 to $60.00 per pound or $500.00 to $600.00 per 10 pound bottle.**
- **Started on January 1, 2018 you were required to present a copy of your 609 AC Certification card to you auto parts store. This is mandatory if you purchase more than 2 pounds. Why is that?**

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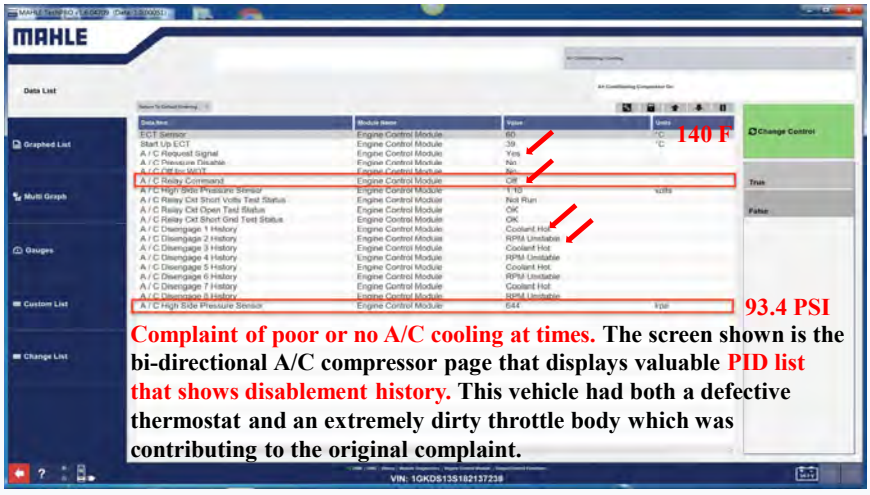
A/C Command OFF



Complaint of poor or no A/C cooling at times. The screen shown is the bi-directional A/C compressor page that displays valuable PID list that shows disablement history. This vehicle had both a defective thermostat and an extremely dirty throttle body which was contributing to the original complaint.

Courtesy of Scott Brown

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Control Panels And Air Distribution

- **The control unit is a mechanical / vacuum or electrically operated unit that allows the driver to regulate temperature intensity, select the air distribution mode, or change the blower motor speed.**

- **Typically, there are only 3 basic types of units. They are either electrical (digital) or mechanical / vacuum, although some may have a combination of mechanical / vacuum and electrical functions.**

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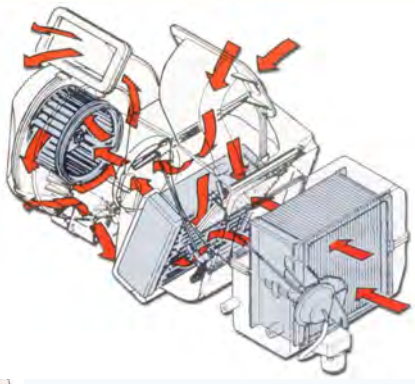
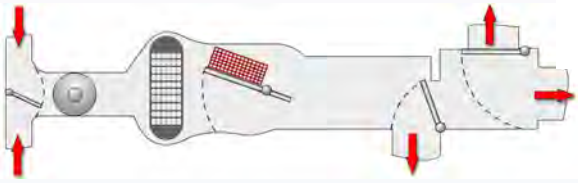
Air Distribution

- **The amount of outside air that passes through the heater core is determined by the position of the intake air door. The flow of air always goes thought the evaporator first to dry the air before going through the heater core. The air mix (blend) door combines the outside and heater core air in order to adjust the temperature to that determined by the driver's controls.**





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Check Duct Air Flow With An Anemometer

The blower motor airspeed at its highest setting should measure about 13 - 16 mph (1000 - 1450 CFM).

Anything less than 10 mph (approx. 900 CFM) airspeed should be considered severely restricted.

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Refrigerant Identification Procedure

- **Step 1. SAFETY is everything! ALWAYS use googles (clear or yellow) to protect your eyes. Use the yellow googles to view dye.**
- **Step 2. Make sure to check for A/C Sealant in EVERY SYSTEM.**
- **Step 3. Is to check Refrigerant purity.**

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A/C Machine R1234yf

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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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Real World Helpers

- Can you use nitrogen to check for leaks with no refrigerant in system or use soapy water?

Yes, but what are you going to use to detect the nitrogen? Better alternatives are; using an approved A/C J 2791/ J2913 Electronic Refrigerant Leak Detector with the refrigerant still in the system, A/C dye, ultrasound and the best for small leaks, CO2 leak detection with BullsEye after all refrigerant has been recovered. Soapy water is not really that helpful when it comes to finding small leaks.

- J2913 sensitive to R1234yf and other refrigerants detects leaks down to 0.1 oz./year (3 g/year).
- 1 psi of A/C pressure roughly equals 1 degree
- With the A/C system at rest the Low and High Side pressures should be equal if there are no blockages in the system.

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Refrigerant Identification Procedure

- Sealant Issues

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Equipment

AirSept
Dual Automatic Recycle Guard Sealant Remover

AirSept
AC Charge Guard
Keeps PAG Oil Out Of Hybrid / Electric Compressors

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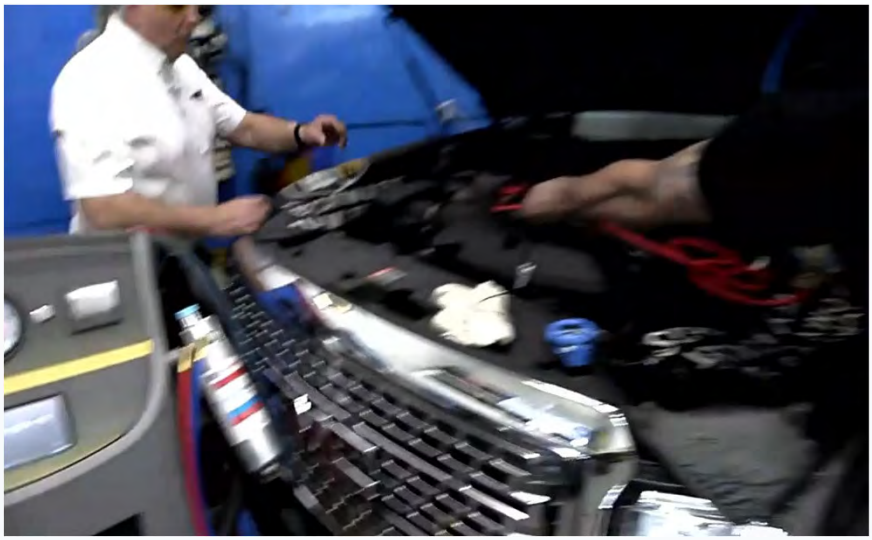
AirSept Sight Glass



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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.**

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Leak Checking Equipment








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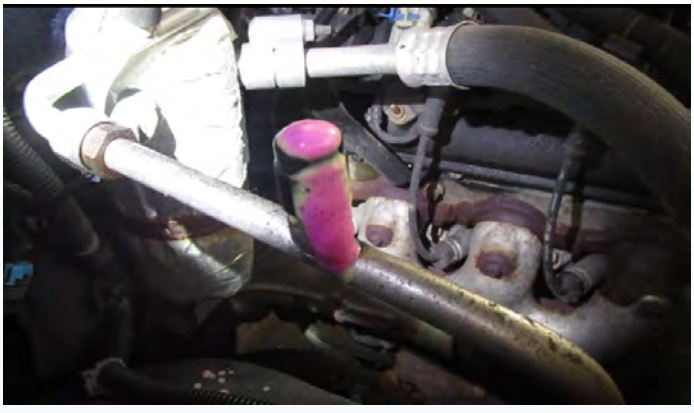
Leak Checking Equipment

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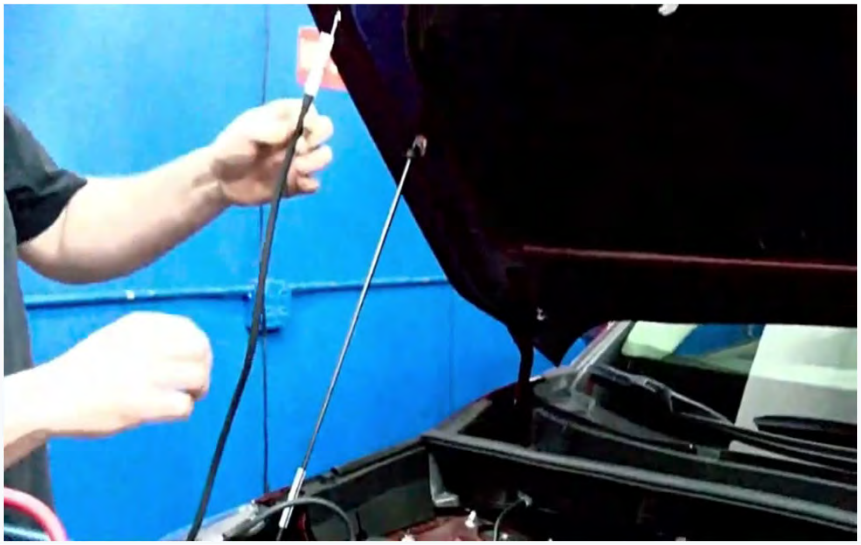
Leak Checking Equipment



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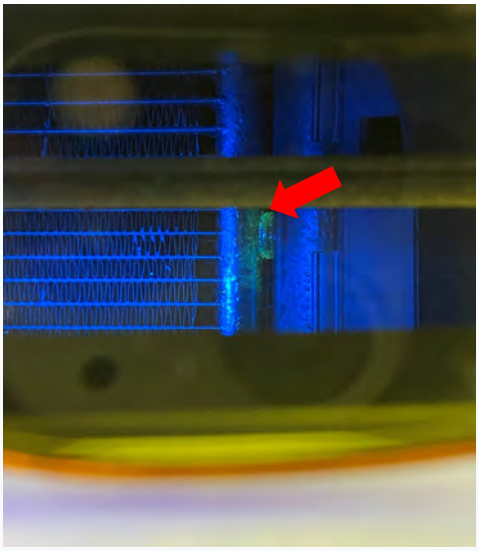
2017 Chev Silverado R1234yf Condenser Leak



Condenser to receiver drier housing leak

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The Leakers

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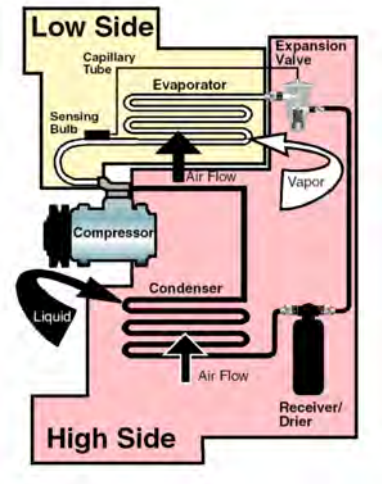
Typical A/C System

- **The purpose of this system is to absorb heat from the passenger area (cabin) and transport it to the condenser where the heat is then transferred to the surrounding air.**
- **Test this system for proper refrigerant pressures, for refrigerant leaks, and for heat transfer. Test equipment needed for proper diagnosis includes manifold gauges, thermometers, scan tools, and volt ohmmeters.**



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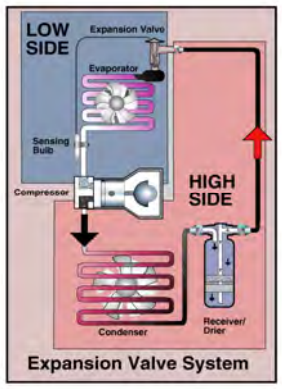
Expansion Valve System

- **The expansion valve sprays refrigerant into a low pressure liquid spray at the evaporator inlet. The amount of refrigerant entering the evaporator is determined by the temperature of the sensing bulb at the evaporator outlet tube.**
- **What should my gauges read? The typical gauge readings for this type of system would be as follows:**
- **Low Side = 35 - 45 PSI**
- **High Side = 150 - 270 PSI**



Expansion Valve System

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Orifice Tube

- **Are all these tubes the same?**
- **Which way is the correct way to install this device?**

Fixed and Adjustable Orifice Tubes

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Variable Orifice Tubes

- **Variable orifice tube can now be found on new vehicles as an original equipment part. This valve is a bit more expensive but it's worth replacing any regular orifice tube with this variable tube, since the refrigerant flow is changeable based on temperature.**
- **The improvements that will result from installing this tube are cooler duct temperatures and lower gauge pressures.**
- **Why would we want to use one?**

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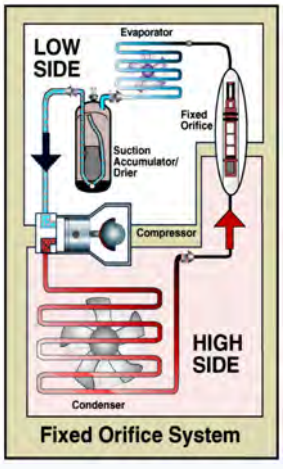
Orifice Tube Systems

- **This system will cycle the compressor on and off to prevent the evaporator from freezing. The orifice tube is used to supply the restriction that is needed to make the low side pressures possible. Compressor clutch cycling or refrigerant flow is controlled by either a pressure switch or a temperature cycling switch.**
- **What commonly occurs? Whenever we have debris in this system it will have a tendency to collect at the screen of the orifice tube. Remember this especially when we have a component failure such as an A/C compressor.**



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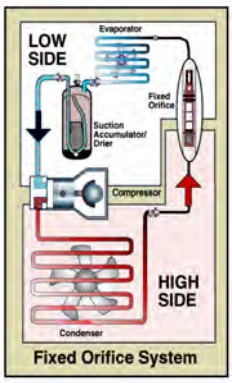
Orifice Tube Systems

- **How do I test this system? Test this system with your manifold gauges / A/C machine with the compressor engaged.**
- **The normal readings will be as follows:**
- **R1234yf - Low Side = 35 - 45 PSI**
- **R12314yf - High Side = 150 - 270**
- **Remember these readings will also vary with outside temperature.**



Fixed Orifice System

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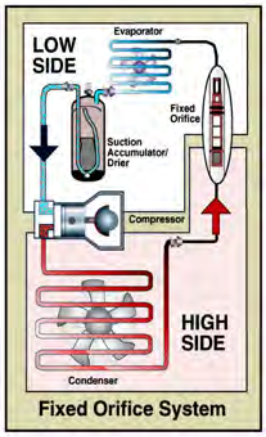
Orifice Tube Systems

- **What should I be aware of ? Remember that this tube can be installed in different ways. Always reinstall the correct way. Orifice tubes come in different sizes. Replace only with the correct size for the application that you are working on. On some vehicles you will need to replace the entire line assembly because you will not be able to remove the orifice tube, so be careful when pricing the job!**
- **Always replace this component whenever AC component replacement work is done!**



Fixed Orifice System

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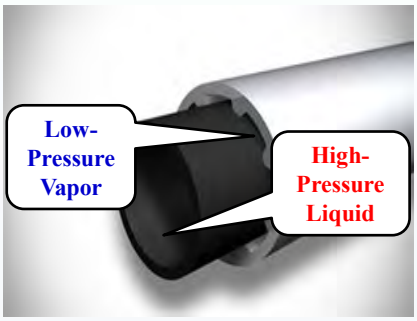
IHX = Internal Heat Exchanger

IHX (Internal Heat Exchanger) has been utilized in stationary air conditioning systems for many years. It was also used in a R134a system in a Toyota Sienna, and now used in R1234yf AC systems.



Courtesy of ContiTech

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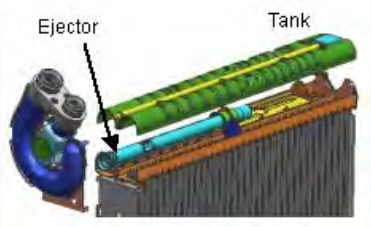
Ejector System

Much of the energy consumed by a vehicle's air conditioning system is used by the compressor to compress the refrigerant. In conventional air conditioning systems, an expansion valve is used to reduce the pressure of the refrigerant. DENSO's new system uses an ejector instead of an expansion valve. The ejector recovers expansion energy, which was previously lost in the expansion valve, and converts it into pressure energy. This, reduces the compressor's workload and helps reduce the air conditioner's overall power consumption. This is used on START / STOP vehicles.



Courtesy of Denso

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Drip Tube

Make sure the drain tube is clear. Don't forget the Cabin Air Filter - Dirty or an incorrect filter can cause low air flow.

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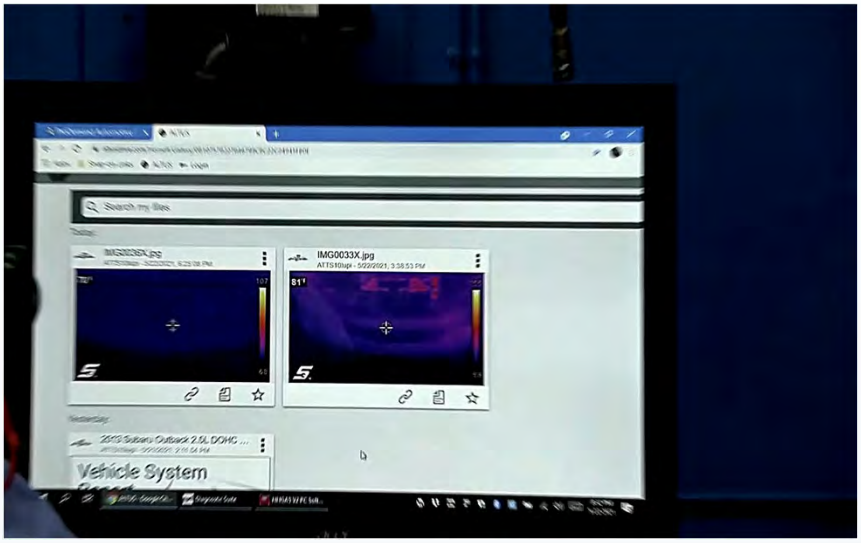
A/C Condenser Compressor Off & Compressor On



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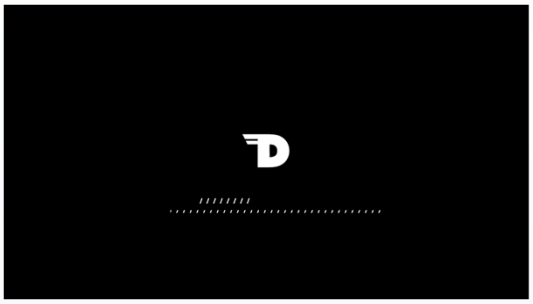
Toyota Compressor Flow Sensor

This Hall Effect sensor fails when it reads over 3.7 volts. That will prevent the A/C amplifier sending a request to PCM to turn the compressor clutch on.



Dorman Products Part # 926-818

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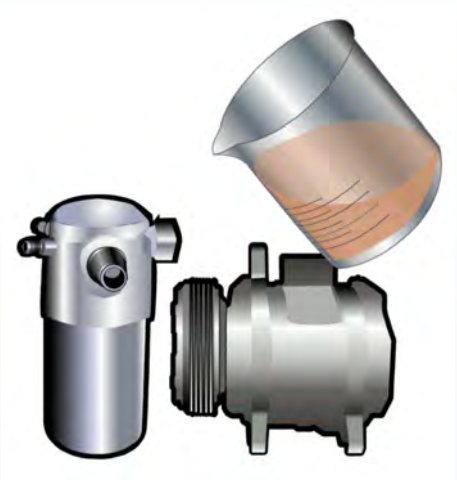
Adding Oil

- **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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Oils

- What kind of oil do we use with R1234yf?
- Is it compatible with R1234yf?
- What if we put PAG oil in an R1234yf system?
- What oil should be used in an electric hybrid compressor?

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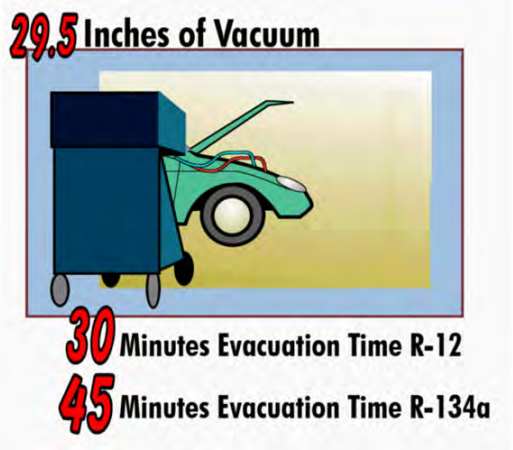
Evacuate

- How Much?
- How Long?



30 to 45 Minutes Evacuation Time R-1234yf

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A/C System Diagnostic App - Mantooth

There are two wireless pressure transducers and a wired temp probe for each transducer (Low & High side) connected. The system is designed to provide the technician with a quick assessment of refrigeration loop performance while documenting it. For example; Complaint A/C not working properly, and the performance numbers look good, you can bet the problem area is the firewall back.

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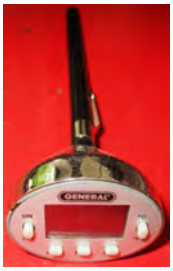
Check Duct Temperature Look For 30 Degrees Difference



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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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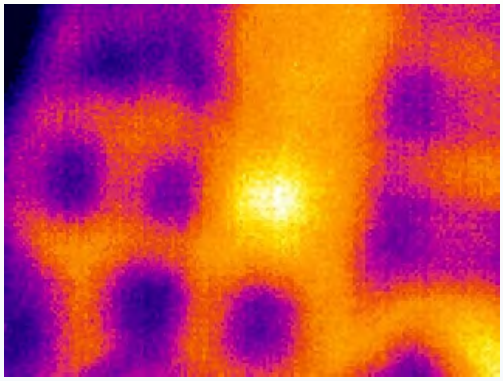
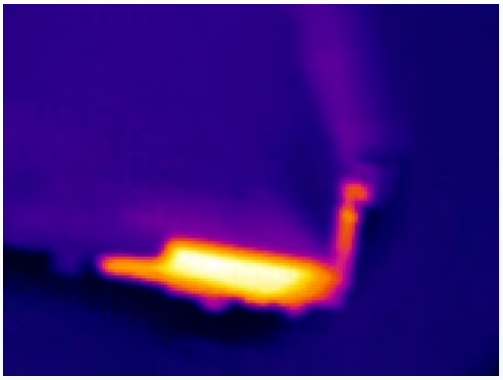
Honda AC Clutch Relay - A/C Compressor Clutch Staying On After Vehicle Was Off



Honda A/C Relay



Honda A/C Clutch

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R1234yf Leak Detector

A R1234yf Leak Detector J2913, must be able to Detect a 0.1 oz or 3 gram leak per year set to its highest sensitive settings.

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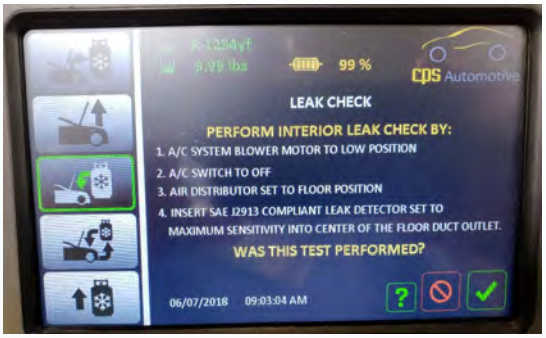
R1234yf Leak Detector



R1234yf Leak Detector J2913 directions on a CPS A/C machine. Perform this test for at least 5 minutes. This is a very important step since there is a safety and legal issue associated with this leak inspection. Remember that R1234yf is FLAMMABLE !

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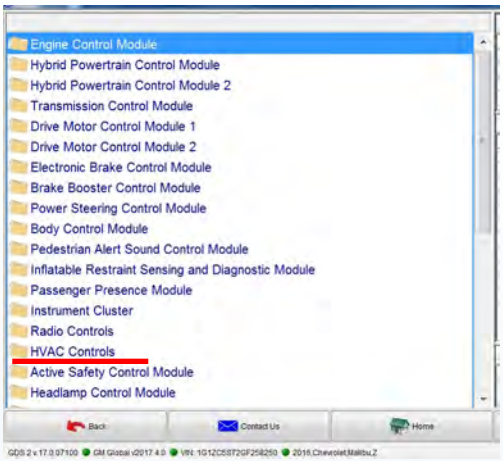
Using Your Scan Tool On ATC

- **Many ATC systems can be accessed with a scan tool.**
- **Automatic Temperature controls are accessed through ATC or body computer scan tool menu selections.**
- **Use the scan tool to read and erase codes, view ATC system pressures, voltages, and resistance values.**



ATC scan tool bidirectional controls are also available on some makes and models.

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We offer greater freedom to fix cars and trucks
by engineering exclusive, labor-saving
and cost-effective repair solutions.
Thank You !
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