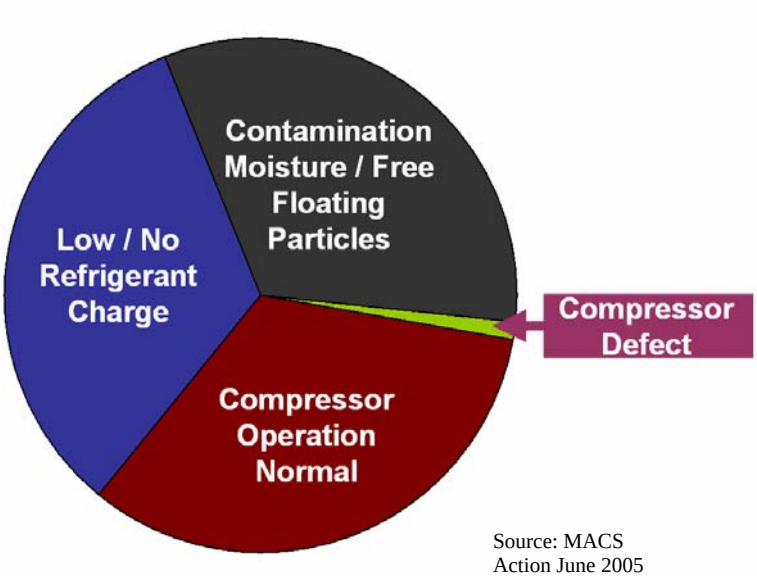
Why are compressors removed from vehicles?



Source: MACS
Action June 2005

Loss of Charge

Cold refrigerant entering the compressor from evaporator provides cooling. Without refrigerant the compressor simply overheats.

Contamination

Moisture will increase discharge pressures, degrade lubricant and reduce cooling performance. Particles will foul bearings and other moving parts of the compressor.

Compressor Operation Normal

Misdiagnosis results in the wrong part being removed. Misdiagnosis can be prevented by using compressor function check list below.

Confirm compressor failure before removing

The time to diagnose a compressor is **on the vehicle** and can be determined using a few simple steps. In many instances compressors are removed due to low refrigerant or a blown fuse.

1) Is compressor rotation smooth?
With vehicle off turn the compressor shaft with a 14mm socket to check for smooth rotation. Grinding or hanging during shaft rotation is caused by broken components within the compressor.

Yes - Continue with steps 2 through 4
No – Remove compressor and return for evaluation

2) Is field coil receiving greater than 11.5 volts?
This test should be conducted with engine running and clutch engaged.

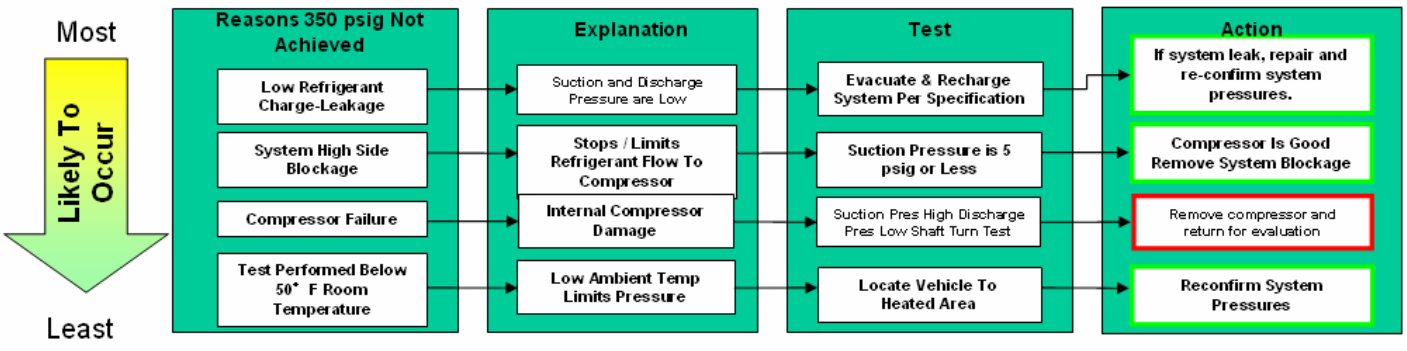
Yes – Continue with steps 3 through 4
No – Correct vehicle electrical system

3) Is field coil resistance between 2.8 and 4.4 ohms?
Coil resistance outside of this range will not engage or will cause fused circuits to open.

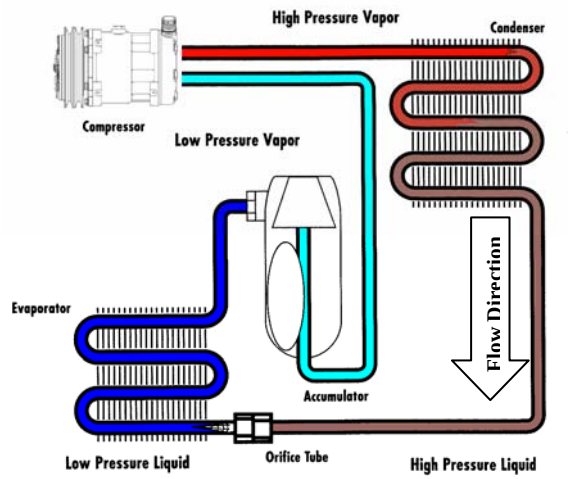
Yes – Continue with step 4
No – Remove compressor and return for evaluation

4) Is compressor capable of producing 350 psig or more?
Excessive high pressures can be artificially produced by preventing air flow across the condenser, thus minimizing heat removal from the system. This can be best accomplished by disconnecting the fan switch / relay, or simply blocking the condenser with a sheet of cardboard.

Yes – Compressor is functioning do not remove compressor
No – Use flow chart below



Contamination (Keep It Clean and Dry)

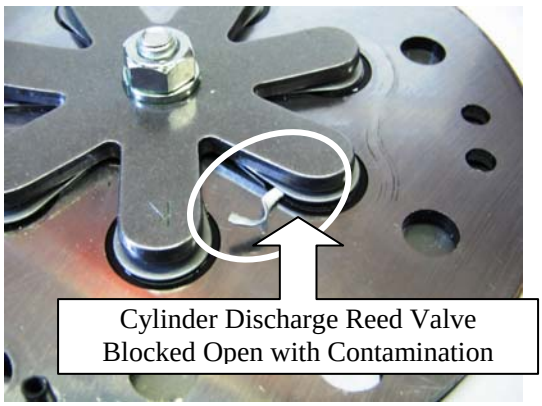


Refrigerant and oil circulate through the refrigeration loop during compressor operation. Contamination from rust due to moisture, desiccant or metal particles from a failed compressor ***will travel*** with the refrigerant oil mixture and ***settle throughout the system***.

If a new compressor is placed in a dirty refrigerant system the new compressor will suck in loose contamination particles and fail quickly.

Inspect the oil and expansion devices for signs of grit or foreign particles. If foreign particles are present it is imperative that the system is fluid flushed.

Clean Orifice Tube



Cylinder Discharge Reed Valve Blocked Open with Contamination

Dirty Orifice Tube removed from contaminated system. **This system must be flushed before a new compressor can be installed.** If not damage like the blocked discharge valve in the photo at left will occur.

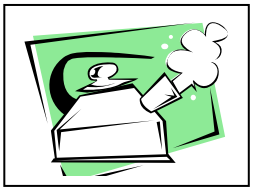
When flushing a system never flush compressors, expansion valves, orifice tubes, receiver driers or accumulators. These components should be replaced with new parts.

Water Boils under a Vacuum	
System Vacuum Inches Hg	Boiling Point Degrees Fahrenheit
24.04	140
25.39	130
26.45	120
27.32	110
27.99	100
28.50	90
28.89	80
29.18	70
29.40	60
29.66	50
29.71	40
29.76	30
29.82	20
29.86	10
29.87	5

System Evacuation

System Evacuation is the process where moisture and air are removed from the system before charging with refrigerant. It is important to note that water boils at specific temperatures and pressures according to the table to the left.

Example—Water will boil at 70º F once vacuum reaches 29.18 " Hg or lower at sea level.



Warning
Vacuum pumps with contaminated oil will **not be capable** of reaching the vacuum level necessary to boil water. It is critical to maintain all equipment per the manufacturer recommendation. Failure to do so can result in newly repaired systems leaving the shop with moisture contamination.

Loss of Refrigerant Charge

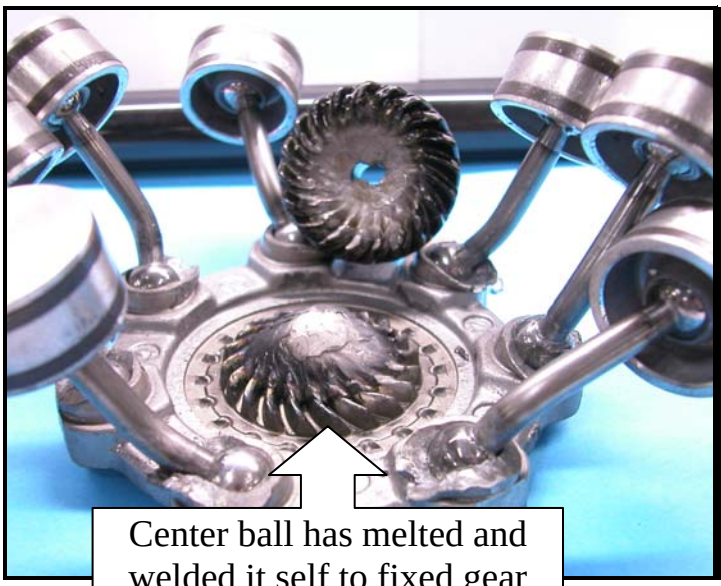
Refrigerant not only cools the vehicle interior but it also provides necessary cooling of the compressor. As each ounce of refrigerant is lost the compressor runs hotter and hotter. The photos below are examples of how refrigerant loss/overheating effect the compressor.

Oil after extended use should be clear. In this particular example the compressor had 150,000 miles when removed. As long as the system is operating normally, has a full refrigerant charge and is free of contamination, no oil degradation will occur.

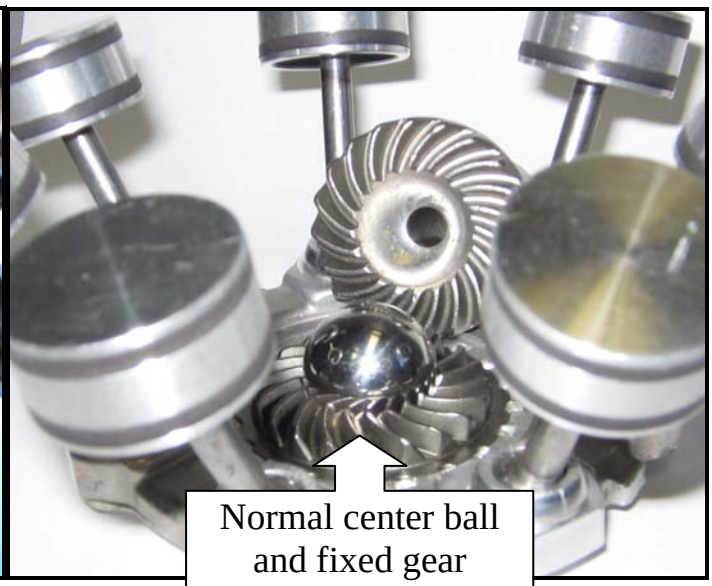
This example is from a compressor exposed to either partial loss of charge or high discharge pressures. Once the cause of high temperature is corrected the compressor and system should function normally.

Black oil results from extreme compressor overheating from loss of refrigerant charge. Normally contamination in the form of metal bits will be found in black oil and it is critical that the system be flushed before installing the new compressor.

Without adequate refrigerant charge the internal components will actually melt



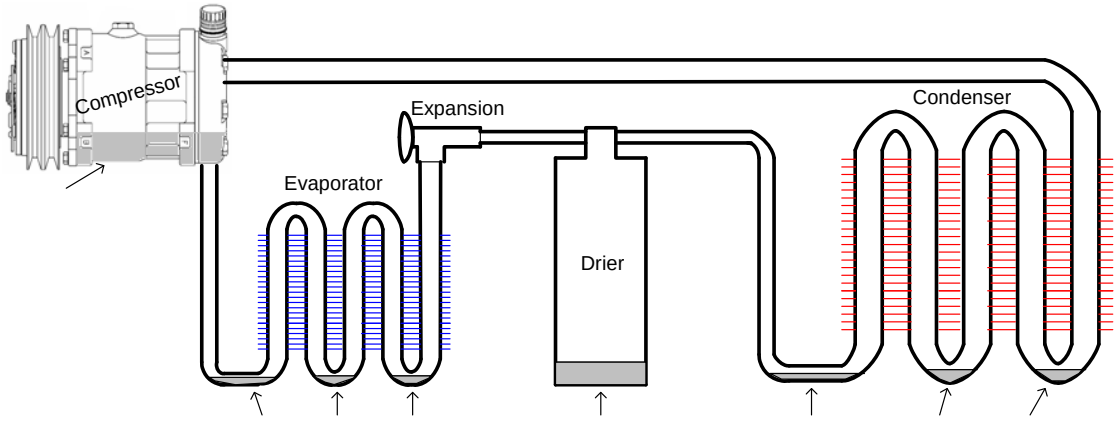
Center ball has melted and welded it self to fixed gear due to loss of refrigerant



Normal center ball and fixed gear

System Oil Amount

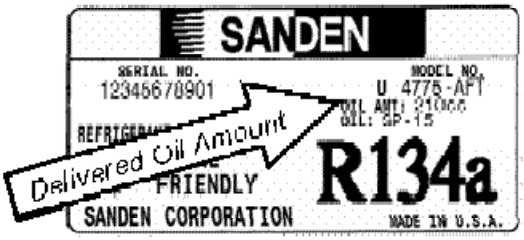
Oil circulates with the refrigerant during operation. During off periods oil will settle in all system components with more collecting in cool components like evaporators and suction lines.



During shut down oil settles through out the system collecting in all components

Oil Replacement during service activities

When replacing a system component or oil the goal is to restore to the original factory oil amount. This amount can be found on the compressor label. Use the chart below as a guide for restoring oil quantities when replacing system components.



Component	Typical Oil Amount Large Truck		Typical Oil Amount Passenger Car	
	fl. oz.	cc	fl. oz.	cc
Major System Leak Suction Line To Rear Evaporator Accumulator	3	88	1.5	44
Condenser Evaporator	2	60	1	30
Receiver Drier Minor System Leak Suction Line To Front Evaporator Other Hoses or Hard Lines	1	30	.5	15
Compressor	Equal to amount drained from old compressor			

Example

Large truck with no leak requires new compressor, suction hose and drier.

Drain oil from old compressor = 3 oz
Oil lost from old suction hose = 1oz (from table)
Oil remaining in old drier = 1oz (from table)
Amount to added 5 oz

Note: New compressors are delivered with full oil charge. It will be necessary to add or subtract from the delivered oil amount so the total in the compressor **equals the amount to be added**.

Example—If the new compressor contains 8 oz (240 cc) you must drain 3 oz so the total in the compressor is **5 oz.**