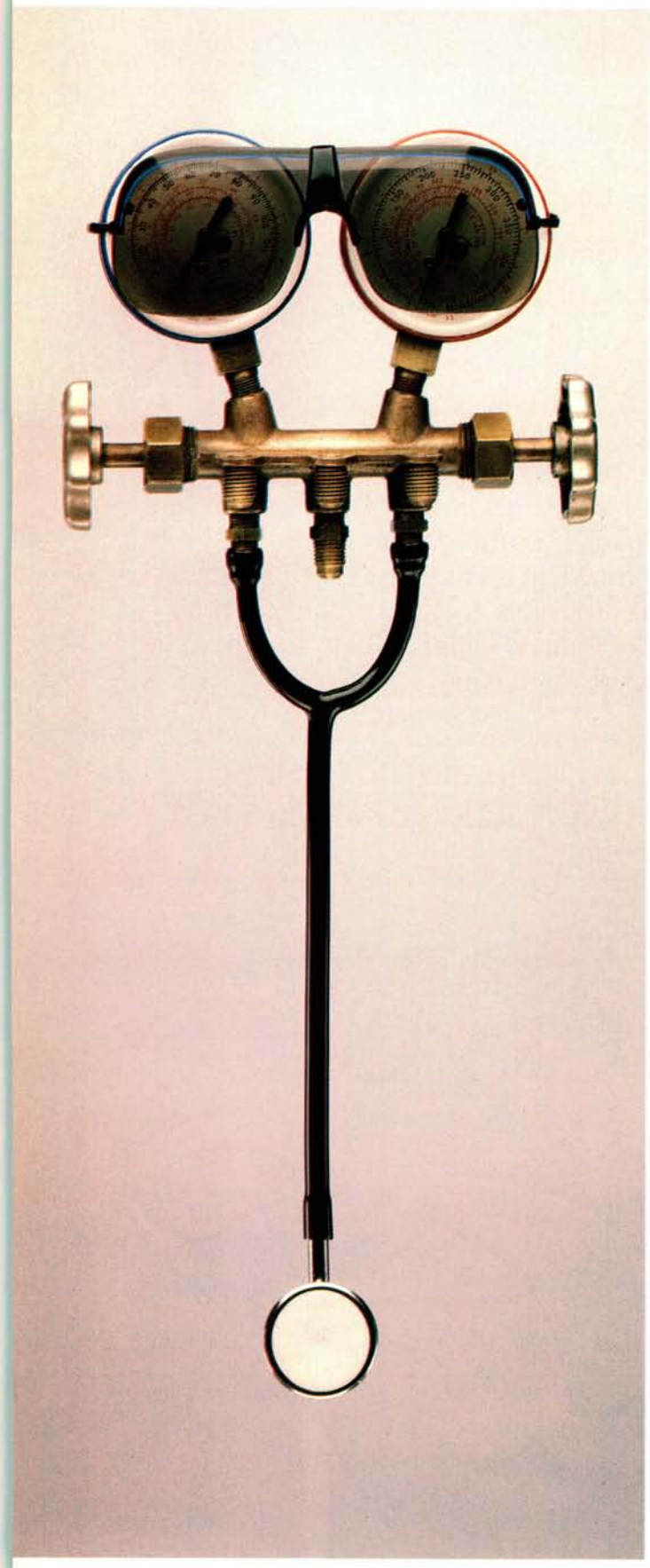


Dr. Cool Manifold Gauge Checkup

It's air conditioning check up time, and we've asked the noted manifold gauge specialist, Dr. Cool, to join us for a discussion of manifold gauge readings.

There's a lot to be learned from the readings on those gauges when you start writing prescriptions for ailing air conditioners. Think of those gauges as a window that lets you see what's happening inside that air conditioning system. Think of them as your eyes and ears when you troubleshoot. True doctors of air conditioning think of them as their stethoscope.

Replacing the Drier

Before Dr. Cool takes us through a photo sequence highlighting the interpretation of different readings, we ought to stop for a moment and discuss the effects of moisture in an air conditioning system.

A number of problems are caused when refrigerant in a closed air conditioning system becomes contaminated with water. When you discuss the health of any air conditioning system, death is spelled m-o-i-s-t-u-r-e. R-12 and moisture DO mix. Unfor-

tunately, the moisture in the system causes any number of problems. The first, most immediate problem is caused when that moisture freezes, blocking lines. Secondly, that mixture makes an acid that will eat away at the components in the system, causing leaks.

If you have any reason to suspect that a system is suffering from moisture contamination, replace the receiver-drier. Even if everything seems to be working well with the old drier, don't be fooled. Even a partially saturated drier will reduce the system's efficiency at high ambient temperatures, and shorten component life.

What Are Normal Pressures?

Before we can decide whether or not our readings are normal, we have to establish just what normal means.

These charts will help.

Pressure/temperature relationship

Low pressure gauge reading	Evaporator Temperature °F
10	2
12	6
14	*10*
16	*14*
18	*18*
20	*20*
22	*22*
24	*24*
26	*27*
28	*29*
30	*32*
35	36
40	42
45	48
50	53
55	58
60	62
65	66
70	70

Some of you may already be familiar with the information contained in these charts. The first chart shows us that there is a direct relationship between the readings we get on the low side gauge, and the temperature of the evaporator. The areas we've highlighted in blue represent the pressures and corresponding temperatures that will give us good cooling from the evaporator.

Notice how closely the pressure readings on the low side correspond to evaporator temperature in degrees Fahrenheit. It's almost a one to one proposition.

Don't just look at the thermometer hanging on the wall above your tool box and decide that that is ambient temperature. Ambient temperatures should be checked about two inches in front of the condenser inlet. Also observe the following test conditions when using this chart:

- The system should be fully charged (not overcharged).
- The compressor clutch needs to be engaged, with the cooling intensity level set for maximum cooling and the blower fan running at high speed.
- The engine should be run at fast idle. Manufacturers suggest different engine speeds, but most will fall in a range of 1200-2500 RPM. Check the manual for your car, and the air conditioning system it uses, for specific engine speeds.
- The engine cooling fan needs to run to draw air through the condenser.
- The car should not be sitting in direct sunlight.
- Open one or both of the car doors.

Ambient Temperature °F	High pressure gauge reading
60	95—115
65	105—125
70	115—135
75	130—150
80	*150—170*
85	*165—185*
90	*175—195*
95	*185—205*
100	*210—230*
105	*230—250*
110	*250—270*
115	265—285
120	280—310

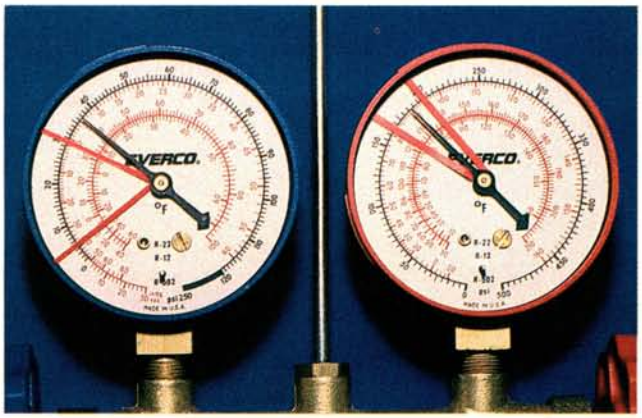
As you can see, there's a relationship between temperature and pressure on the high side as well. A 30 degree increase in ambient temperature means a potential increase of 120 PSI on the high side of the system, with no correction for increases in relative humidity.

These charts do not show any adjustment for changes in relative humidity. Increases in relative humidity will drive high side readings even higher.

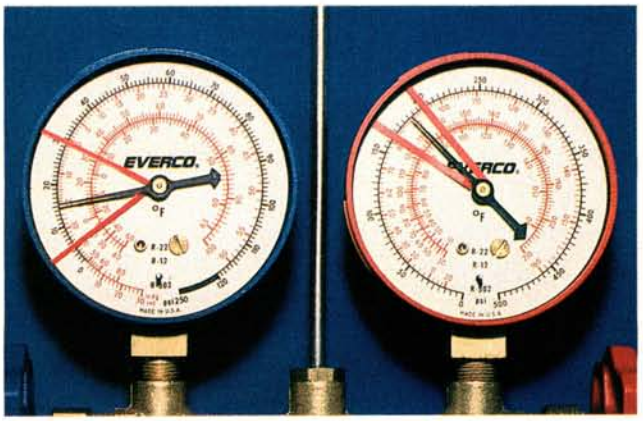
With these qualifications in mind, we've marked out some areas on our manifold gauges as "normal." These are normal for an imaginary system at a given ambient temperature. Use them only as general reference starting points.

The variations we've marked indicate readings above or below normal for this given system. They give us clues about possible malfunctions or obstructions in this particular air conditioning system.

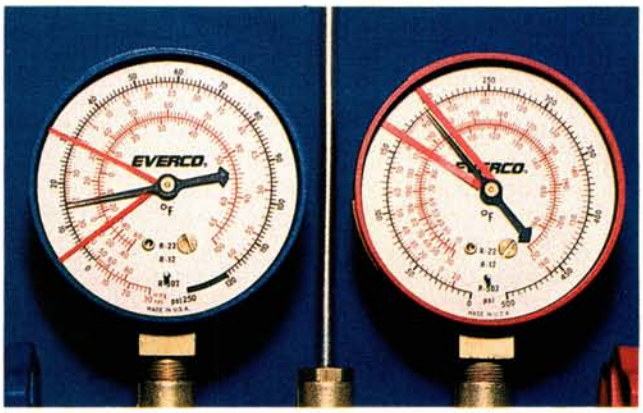
—By Ralph Birnbaum



Complaint: Big temperature swings. Air is cool with compressor engaged. Blows warm air before cooling again.
Gauge Readings: Low side cycles at higher than normal readings. High side is normal.
Additional Symptoms: Long compressor off periods at high ambient temperatures.
Causes: A defective or improperly adjusted temperature (or pressure) sensing switch is not cycling the compressor often enough.
Cure: Make sure the capillary sensing tube for the thermoswitch is properly installed. Switches on some models are adjustable. Adjust if possible. If the switch is bad, replace it. If you install a new switch, be careful to properly position the temperature sensing capillary tube and insert the tube to the proper depth in the evaporator.



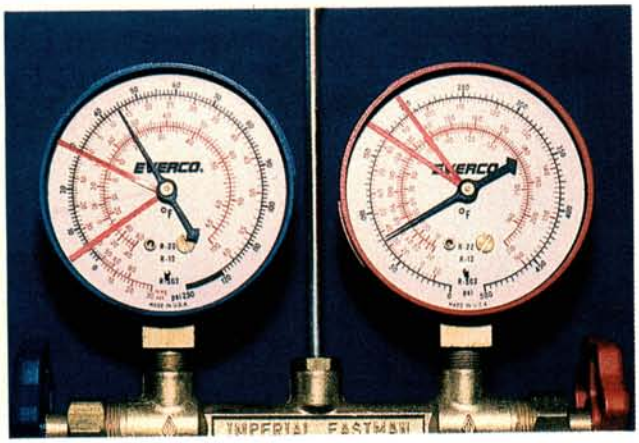
Complaint: Insufficient cooling.
Gauge Readings: Normal.
Additional Symptoms: None. System checks out okay otherwise. This includes proper operation of the heat control valve and air-mix doors.
Cause: This system may have just enough moisture in it to keep it from cooling properly, but not enough to cause freezing at the expansion valve. If the system was not properly evacuated at the last service, small amounts of moisture may have been trapped in the system.
Cure: Replace the receiver drier, evacuate, and recharge.



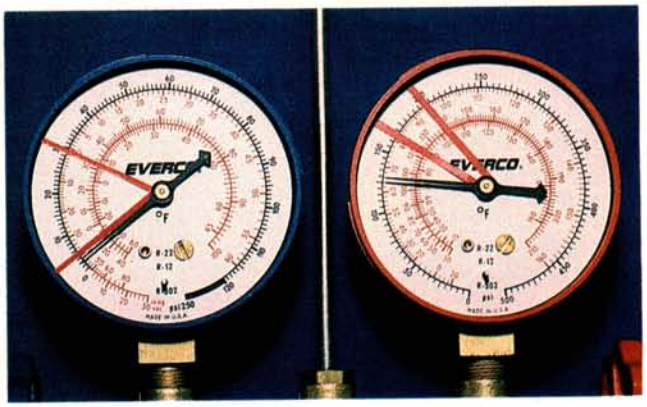
Complaint: Intermittent cooling.
Gauge Readings: Both high and low readings may be normal.
Additional Symptoms: Problem occurs only during very humid weather conditions. Ice or frosted mist may come from the ducts.
Causes: The evaporator is icing up. The customer may be selecting a combination of the coldest temperature setting and a slow blower speed under high humidity conditions. Humid air is cycled through the evaporator at slow speeds. As this humid air is drawn through the evaporator coils, it freezes. Air flow through the evaporator is restricted, and cooling stops. A higher blower speed or slightly warmer temperature setting would cure things. Another possibility is a partially plugged evaporator drain that allows moisture to back up in the evaporator housing.

Complaint: Intermittent cooling.
Gauge Readings: Low side very low, or reading a vacuum. High side lower than normal to normal.
Additional Symptoms: Unit cools properly when first started, but low side reading drops off suddenly and cooling stops. The symptoms are more noticeable as outside temperatures rise. Sight glass may be clear or slightly cloudy.
Cause: Expansion valve freezes. There is too much moisture in the system. Hotter ambient temperatures cause the receiver drier to release moisture which freezes in the expansion valve.
Cure: If there is this much moisture in the system, the receiver drier is saturated. Replace the drier. Evacuate, and recharge system.

Complaint: Insufficient cooling.
Gauge Readings: Low side very low, or reading a vacuum. High side lower than normal.
Additional Symptoms: Sight glass clear. Air conditioner does not cool even when first started.
Cause: Expansion valve stuck closed or completely clogged with debris. Either that or the capillary sensing tube has lost its charge.
Cure: Replace expansion valve if it's bad, or clean debris from valve. Flush system, replace drier, evacuate, and recharge.

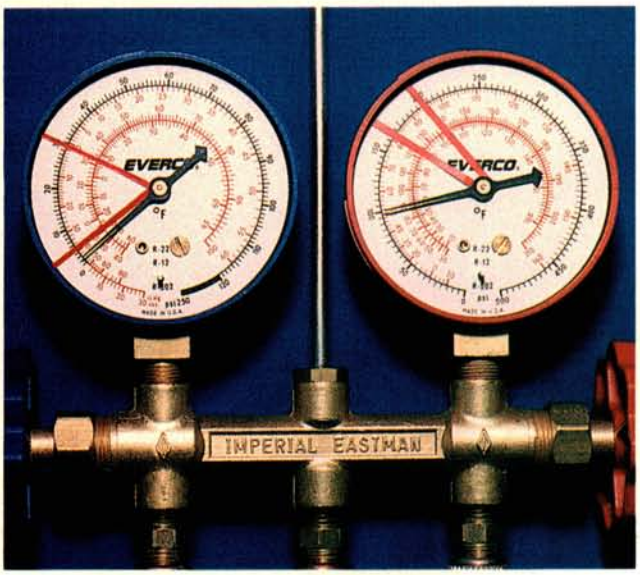


Complaint: Insufficient cooling.
Gauge Readings: Low side is higher than normal. High side is lower than normal. High and low side readings are almost the same.
Additional Symptoms: Suction and discharge lines are almost the same temperature.
Causes: The compressor drive belt is loose, or maybe the belt is tight enough but the compressor clutch is slipping. Check to be sure there are a full 12.5 volts at the compressor hot wire. Another, separate possibility is that the compressor has a mechanical malfunction. Either a reed valve is not sealing, the piston on a piston style compressor has a hole in it, or the compressor has an internal leak.
Cure: Adjust the belt. Check the voltage to the clutch. Check the clutch itself. If the compressor is leaking internally, repair or replace it. Flush out any debris, replace the drier, evacuate, and recharge.

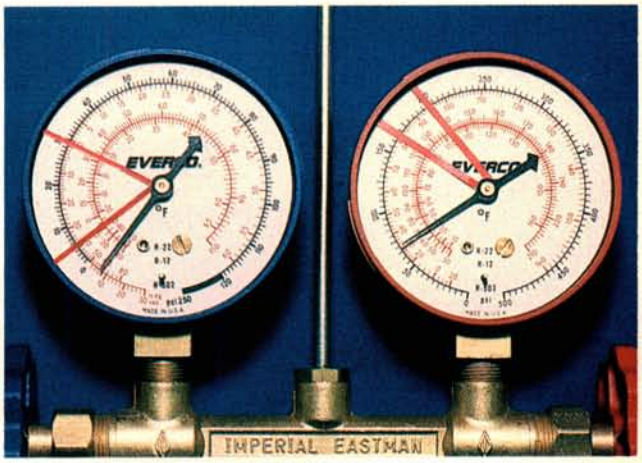


Complaint: Insufficient cooling.
Gauge Readings: Low side very low but not vacuum. High side low.
Additional Symptoms: Liquid lines or receiver drier cool to the touch or frozen.
Cause: Restriction in high side. Either a liquid hose is blocked, or the receiver drier is clogged. If the blockage is very near the compressor discharge, the high side reading may be normal to high.
Cure: Locate blockage. Sweating or frost will occur just after the blockage. Replace blocked line and receiver drier as well. If the system contains debris, flush it first with a flushing agent specifically designed for that purpose. Evacuate and recharge system.

Complaint: No cooling.
Gauge Readings: Both low and high side readings are very high.
Additional Symptoms: Sight glass may be clear or have bubbles depending on pressures. High side compressor line is hot to the touch.
Causes: For any number of reasons, the condenser temperature is too high. Or the system is overcharged.
Cure: Look for anything that prevents proper cooling of the condenser, such as: blocked cooling fins in the radiator or condenser, a slipping fan clutch or inoperative electric cooling fan, a slipping fan/alternator belt. Some electric cooling fans operate at two speeds. They run slower for normal engine cooling, and at a higher speed when the heat from the condenser is added to the cooling system's load. A stuck engine thermostat or other reason for engine overheating can also cause this condition.



Complaint: Insufficient cooling.
Gauge Readings: Low side lower than normal but not vacuum. High side lower than normal.
Additional Symptoms: Bubbles in sight glass.
Cause: Low refrigerant charge.
Cure: Repair leaks. Evacuate and recharge system.



Complaint: No cooling.
Gauge Readings: Low side reads vacuum. High side very low.
Additional Symptoms: Very few bubbles, or sight glass is empty.
Cause: Very low charge, very large leak.
Cure: Repair hole. Evacuate and recharge system. If the system has been run this way for any period of time, suspect a moisture saturated receiver drier and replace it at this time.