Figure 65-1 Some heater hoses are best inspected by hoisting the vehicle and inspecting them from underneath the vehicle as shown.

TECH TIP: Use the Same Length Heater Hoses

Heater hoses are designed to supply warm coolant from the engine’s cooling system to the small radiator called the heater core inside the vehicle. Because the heater hoses attach to the engine and the engine moves on its mounts during operation, the heater hoses are long enough to allow the engine to move without causing stress to be applied to the heater core. The extra length also helps to prevent engine vibration from being transmitted to the heater core and the interior of the vehicle. When replacing heater hoses, always use the old hoses as a guide and use the same length hoses. Also, route the replacement hoses in the same manner as originally designed, again, to help reduce the stress to the heater core.
TECH TIP: Check the Air Dam If Overheating Occurs

The air dam under the front of the vehicle is designed to force air to flow upward and through the radiator rather than travel underneath the vehicle. If this air dam is broken or damaged due to contact with a parking block or other object, the engine may overheat.

Figure 65-2 (a) A typical automotive air-conditioning service machine that is capable of handling both CFC-12 and HFC-134a systems.

Figure 65-2 (b) HFC-134a systems use quick-disconnect fittings that are larger than those used for CFC-12 systems.
Refrigerant oil must be retrieved and measured when the refrigerant is recovered from the system.

A rubber O-ring is used to indicate the level of refrigerant oil already in the container. The exact same amount of refrigerant oil must be installed as was removed when the system is recharged.

O-rings are usually made of neoprene rubber or highly saturated nitriles (HSN) to withstand high temperatures and flexing. O-rings should be changed during a retrofit procedure.
**SAFETY TIP**

*Refrigerant Can Be Hazardous*

Always wear safety glasses and protective gloves when servicing any automotive air-conditioning system. If any refrigerant escapes, it can cause skin to freeze or cause blindness if liquid refrigerant were to get into the eyes.
Figure 65-7 The service cap O-ring becomes the primary seal if the service valve leaks.

Figure 65-8 A depressor pin on the gauge set opens the Schrader valve when the connection is almost completely tightened. This prevents accidental refrigerant discharge.

TECH TIP: Use a Micron Vacuum Gauge for Best Results

A typical vacuum gauge reads in inches of Mercury (in. Hg) and the recommended vacuum level needed to remove moisture from the system is considered to be 29 in. Hg or less. However, many experts recommend using a vacuum gauge that measures the amount of air remaining in the system. This type of gauge measures vacuum in microns. A micron is one millionth of a meter and there are about 760,000 microns of air at atmospheric pressure. A vacuum reading of 29.72 in. Hg is about 500 microns. Many experts recommend that the micron level be 50 or less for best results. This is particularly important when evacuating a dual-climate control system where two evaporators are used and there are long lengths of refrigerant lines.  SEE FIGURE 65-9.
Figure 65-9  An air-conditioning vacuum gauge that reads in microns.

Figure 65-10  A typical under-hood sticker that identifies the refrigerant and the amount needed to charge the system in kilograms (0.96 kg is equal to 2.14 pounds).

Figure 65-11  A temperature and humidity gauge is a useful tool for air-conditioning work. The higher the relative humidity, the more difficult it is for the air-conditioning system to lower the temperature inside the vehicle.
REAL WORLD FIX: The Cadillac Story

When servicing an older Cadillac equipped with an automatic air-conditioning system (C-68), it was discovered that the compressor would not engage. The vehicle owner stated that a message had been warning him that the system was low on charge. The technician tightened a slightly loose Schrader valve and then added about one pound of R-12 to the system, yet the controller (computer) would not engage the clutch. The technician then remembered that if a diagnostic trouble code (DTC) has been set, the computer will not allow the compressor clutch to be engaged. This is a precaution to prevent possible compressor damage if the system is low on charge and not able to transfer the lubricating refrigerant oil through the system that the compressor needs for lubrication. The technician disconnected the negative (-) battery cable and waited several minutes and then reconnected it. After starting the engine and turning on the A/C controls, the compressor clutch engaged and the service technician was able to complete charging the system.

TECH TIP: Because It Fits, Does Not Mean It Is Correct!

Many air-conditioning systems use orifice tubes that look similar if not identical. They are usually color coded for identification. Always use the recommended orifice tube for the vehicle you are servicing. Some examples of the various colors and sizes available include:

<table>
<thead>
<tr>
<th>Make</th>
<th>Color</th>
<th>Orifice Size (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cityplex purple</td>
<td>0.0605</td>
<td></td>
</tr>
<tr>
<td>Ford red</td>
<td>0.0605</td>
<td></td>
</tr>
<tr>
<td>Ford orange</td>
<td>0.0560</td>
<td></td>
</tr>
<tr>
<td>Ford brown</td>
<td>0.0470</td>
<td></td>
</tr>
<tr>
<td>Ford green</td>
<td>0.0505</td>
<td></td>
</tr>
<tr>
<td>GM yellow</td>
<td>0.0605</td>
<td></td>
</tr>
</tbody>
</table>

Figure 65-12 (a) When a system is retrofitted from CFC-12 to HFC-134a, the proper service fittings must be used to help ensure that cross-contamination does not occur.
Figure 65-12 (b)  An under-hood sticker is also installed indicating that the system was retrofitted to HFC-134a and when it was done and by whom.

Figure 65-13 A special tool is needed to remove and install the magnetic clutch on the air-conditioning compressor.

**TECH TIP: An Additional Filter Is Insurance**

If the air-conditioning compressor is found to be damaged mechanically, many experts recommend that an additional filter be installed in the refrigerant line to trap any debris that may have gotten into the system. This additional filter will help prevent the new compressor from being harmed by the debris as it circulates through the system.
Figure 65-14  A fin comb is used to straighten the fins on the condenser to help increase airflow and heat transfer.

TECH TIP: Might as Well Do It Now
Whenever an evaporator is being replaced, many service technicians also recommend that the heater core also be replaced. This is especially true if the vehicle had a neglected cooling system. Most heater cores are close to or even have to be removed to replace an evaporator. The only additional cost to the vehicle owner is the cost of the heater core itself.

Figure 65-15  Always be sure that the service valves are snug before evacuating the system. They are a common place for refrigerant leaks.