

HFC-134a Air Conditioning Service & Testing

Subaru air conditioning systems are designed to provide many years of service, with a minimal amount of technician involvement. However, in the event of an accident or other unplanned occurrence, service to the air conditioning system may be required. The following service and testing procedures should be used to diagnose, service and repair Subaru air conditioning systems filled with HFC-134a refrigerant.

Safety Precautions

Component parts of the cooling system, refrigerant, compressor oil, and other parts are not the same for the HFC-134a system and the older CFC-12 system. Do not interchange parts or liquid.

Vehicles with HFC-134a air conditioning systems, use only HFC-134a parts that are indicated on a label attached to the vehicle. Before performing any maintenance, verify the type of air conditioning system installed in the vehicle.

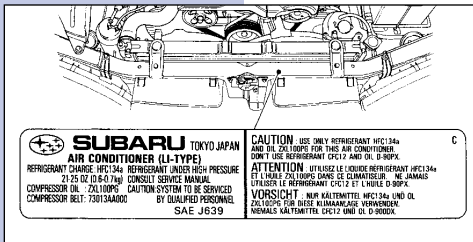
Compressor Oil

Do not use any compressor oil that is not specifically designated for the HFC-134a air conditioning system; only use ZX1100PG. Also, do not use HFC-134a compressor oil in the CFC-12 air conditioning system. If compression oils are mixed, poor lubrication will result and the compressor itself may be damaged.

Because HFC-134a compressor oil is very hygroscopic (easily absorbs moisture), when parts of the air conditioning system are being removed, quickly install a blind plug to prevent contact with the outside air. Also, always make sure that the service container for compressor oil is tightly closed except when in use. Store compressor oil in a tightly closed steel container.

Refrigerant

Do not put CFC-12 refrigerant into a HFC-134a air conditioning system. Also, do not put HFC-134a refrigerant into a CFC-12 air conditioning system. If the wrong refrigerant is used, poor lubrication will result and the compressor itself may be destroyed.



Handling of Refrigerant

Because refrigerant boils at approximately -30°C (-22°F) at sea level, it is cold enough to give you severe frostbite. Always wear goggles to protect your eyes and gloves to protect your hands.

Also, even under the pressures normally found in CFC-12 containers, refrigerant will boil with the addition of heat. This could raise the pressure inside the container to a dangerous level.

Never expose a can of HFC-134a to direct sunlight, or to temperatures over 40°C (104°F). One more thing to remember about HFC-134a is that when it is exposed to an open flame or to hot metal, it forms phosgene, a deadly gas. Do not discharge HFC-134a into the atmosphere on purpose. Always read and follow the precautions on the HFC-134a bottle.

Basic Information

1. The combination of moisture and refrigerant forms acid, therefore, moisture should not be allowed to enter the refrigerant.
2. Refrigerant oil readily absorbs moisture, therefore, keep refrigerant oil containers tightly capped.
3. The process of evacuating the system is performed to remove small amounts of moisture. This is accomplished by lowering the pressure inside the system, which allows the moisture to boil off, in much the same way that a pot of water will boil away to nothing given enough time. The evacuation process does not suck the moisture out of the system.
4. A minimum level of vacuum must be reached to satisfactorily evacuate the system. This minimum level of vacuum depends on the temperature inside the system. The chart below shows the level of vacuum required to boil water at various temperatures.

Additionally, the vacuum level shown on a gauge will read approximately 4 kPa (25 mm Hg, 1 in Hg) less for each 304.8 m (1,000 ft) above sea level, due to the decrease in atmospheric pressure at altitude.

Vacuum level required to boil water (at sea level)

Temperature °C (°F)	Vacuum kPa (mm Hg, in Hg)
1.7 (35)	100.9 (757, 29.8)
7.2 (45)	100.6 (754, 29.7)
12.8 (55)	99.9 (749, 29.5)
18.3 (65)	99.2 (744, 29.3)
23.9 (75)	98.5 (739, 29.1)
29.4 (85)	97.2 (729, 28.7)
35 (95)	95.8 (719, 28.3)

O-ring Connections

The following points should be kept in mind when assembling O-ring connections:

- Avoid unnecessary handling and contact of O-rings with your hands, since even clean fingers contain body acids, which can contaminate the O-ring surface.
- Do not handle O-rings with gloves, shop towels, etc., since lint particles may cling to the O-ring, possibly causing a leak upon assembly.
- Always lubricate O-rings before assembly to allow the O-ring to seat itself properly.
- Be certain to use torque wrenches when tightening O-ring fittings, because overtightening can not only damage the O-ring, but it can distort the tube end as well.

Remove Protective Seals

Just prior to making the connection, remove the protective seals.

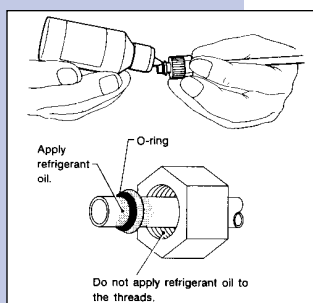
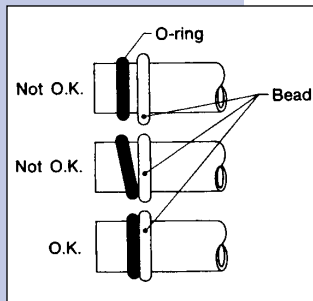
Caution: If for any reason you have to stop before making a connection, recap the tube, component or fitting.

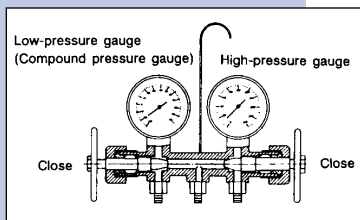
Visually inspect the O-ring surface, the O-ring mating surface, the threads and the connection points. If a defective part is found, replace it. The O-ring must sit square against the tube bead. If necessary, slide the O-ring into proper position with clean hands.

Lubricate the Components

For lubrication of the components, use only refrigerant oil as described in the appropriate service manual. Apply oil from an oil squirt gun or other closed container. Do not use your finger to spread the oil over the O-ring.

Apply a small amount of refrigerant oil to the top and sides of the O-ring. The area covered by oil should include the O-ring and the tube bead.





Discharge the System

Caution: The following points should be kept in mind when discharging the system.

- Be certain that goggles and gloves are worn.
- Connect refrigerant recovery system to manifold gauge set and remove recycle refrigerant from A/C system.

Connecting the Manifold Gauge Set

1. Close the high and low side manifold valves.
2. Turn the A/C system ON and turn the ignition switch OFF.
3. Attach the high- and low-pressure manifolds to the high and low service ports on the vehicle.

Prepare for Discharging

Connect the center manifold hose to the refrigerant recovery system to recycle refrigerant.

Evacuating & Charging

The following points should be kept in mind when evacuating and charging with a manifold gauge set.

1. Be certain that goggles and gloves are worn.
2. If bulk refrigerant (30 lb) canister is used, be certain to weigh the charge amount carefully, using the correct equipment, to avoid overcharging the system.
3. The charging procedure described in this section begins by charging liquid refrigerant into the high-pressure side of the system with the engine off. The procedure is completed by charging refrigerant vapor into the low-pressure side of the system with the engine running.

Caution: Never open the high-pressure manifold valve when the engine is running.

Connect the Gauge Set

1. Close the high- and low-pressure manifold valves.
2. Attach the low-pressure manifold hose to the low-pressure service port on the vehicle. Check the low-pressure gauge. If more than 10 psi is indicated, discharge the system prior to charging.
3. Attach the high-pressure manifold

hose to the high pressure service port on the vehicle.

4. Connect the center hose from the manifold to the vacuum pump.
5. Turn on the vacuum pump.
6. Slowly open the low-pressure manifold valve.
7. When the low-pressure gauge reaches approximately 66.43 kPa (498.3 mm Hg, 19.62 in Hg), slowly open the high pressure manifold valve.
8. Maintain a minimum vacuum level of 100.56 kPa (754.4 mm Hg, 29.70 in Hg) for a minimum of 15 minutes on a new system or 30 minutes for an in-service system.

Note: The gauge will read 4 kPa (25 mm Hg, 1 in Hg) less for every 304.8 m (1,000 ft) above sea level.

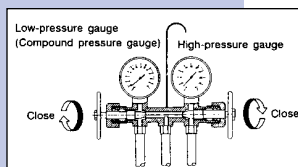
Perform a Vacuum Leak Test

1. After 15 minutes (or more) of evacuation, close the high-pressure manifold valve.
2. Close the low-pressure manifold valve.
3. Turn off the vacuum pump.
4. Note the low side gauge reading.
5. After 5 minutes, re-check the low-pressure gauge reading. If the vacuum level has changed more than 4 kPa (25 mm Hg, 1 in Hg), perform an HFC-134a leak test. If the vacuum reading is about the same as noted in step 4, continue to step 6.
6. Carefully attach the can tap to the refrigerant can by following the can tap manufacturer's instructions.
7. Disconnect the center manifold hose from the vacuum pump and connect the hose to the tap valve.
8. If a 13.6 kg (30 lb) container of refrigerant is used a weight scale will be needed. This scale is to determine the amount of refrigerant that is used.

Connect the center hose from the manifold to the valve. Place the 13.6 kg (30 lb) container on the scale, valve end down.

Purge the Center Hose

1. Verify that all three hose connections are tight at the manifold gauge set.
2. Open the valve on the HFC-134a source.



3. With safety equipment in place (goggles and gloves), use extreme caution and loosen the center hose connection at the manifold and allow the HFC-134a to escape for no more than two or three seconds, then quickly retighten the hose fitting at the manifold.

Initial Charging Through the High Side

1. Connect a tachometer to the engine.
2. With the engine off, start charging by slowly opening the high-pressure manifold valve.

Note: The initial charge rate can be increased by immersing the can in lukewarm (below 100 degrees F) water for a short time.

Check the Gauge Readings

When both the high- and low-pressure gauge readings are about equal, or the HFC-134a source is empty, or the system has been filled to specifications, close the high-pressure manifold valve.

Add Additional Cans

If the HFC-134a source is exhausted, first close the high-pressure manifold valve, second, close the can tap valve, then slowly purge the refrigerant from the service hose by loosening the fitting at the can tap. Repeat the steps as necessary.

Complete Charging Through the Low Side

1. Verify that the high-pressure manifold valve is closed (should have already been closed).
2. Verify that the low-pressure manifold valve is closed (should have already been closed).
3. With the A/C switch off and the windows rolled down, start the engine and run at idle rpm.
4. Set the A/C controls on maximum cool and set the blower speed on the highest setting.
5. Quickly turn the A/C switch on-off-on-off a few times to prevent initial compressor damage due to "load shock." Finish this operation with the A/C switch in the ON position.
6. Raise engine rpm to approximately 1,500 rpm.

Charge the System

1. With the refrigerant source connected and the service hose purged, slowly open the low-pressure manifold valve, while checking the low-pressure gauge reading.

Caution: The refrigerant source must be positioned for vapor (valve up).

2. Keep the low side pressure below 276 kPa (2.81 kg/c m², 40 psi) by using the low-pressure manifold valve to regulate the flow of refrigerant into the system.
3. When the system is fully charged, close the low-pressure manifold valve.
4. Close the valve at the refrigerant source.

Complete All System Checks

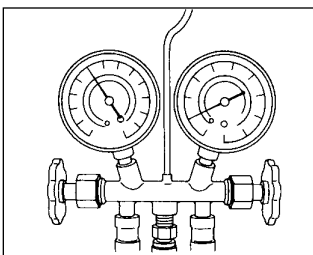
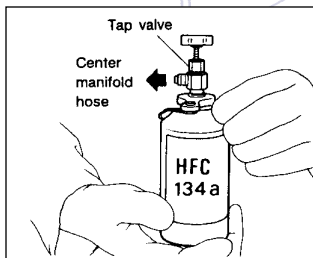
1. Evaluate the system performance (refer to performance testing section).
2. Perform leak detection test.

Caution: Always perform leak checking in an environment free of refrigerant pollution. Do not disconnect the high- or low-pressure hoses from the vehicle before leak checking.

Leak Testing

The following points should be kept in mind when conducting a refrigerant leak test:

1. The A/C system to be tested must have an adequate refrigerant charge to begin with.
2. The area where the leak test is conducted must be free of wind and drafts, with still air being the ideal condition.
3. The atmosphere where the leak test is conducted must be free of refrigerant contamination.
4. Operate the A/C system for approximately 10 minutes, then turn the engine off and begin the leak test.
5. Refrigerant gas is heavier than air, therefore always hold the probe below the connection being tested.
6. When checking for a leak along a length of hose or tube, the leak detector probe must be moved slowly, approximately 25 mm (1 in) per second, making sure probe does not come in contact with the component being tested.



- When checking for a leak at a certain point, the leak detector probe must be held at that point for at least 5 seconds.

Check the System Pressure

With gauges connected to the A/C system, operate the A/C and confirm that the high side pressure is above 690 kPa (7.03 kg/c m², 100 psi). If not, evacuate and charge the system before leak checking (refer to evacuation and charging sections).



Clean Connections Before Testing

Before testing, use a clean shop towel to wipe off refrigerant oil, dirt, or foreign material from all of the connections and components to be tested.

Note: Since refrigerant oil absorbs refrigerant, excess oil on or near a connection may falsely signal a leak.

Calibrate Leak Detector

Refer to the manufacturer's instructions for the particular type of detector used and calibrate the instrument.

Caution: Always make sure that the probe tip filter is clean and free of contamination.

Leak Test - High-Pressure Side

Operate the A/C system for approximately 10 minutes, then turn the engine off and begin the leak test.

- Begin at the connection of the high-pressure tube to the evaporator, and work your way along the high-pressure side of the system to the compressor. There are three places to check on each tube connection.
- Check the area.
 - Check the area where the fitting joins the tube.
 - Check the area where the two parts of the fitting join each other.
 - Check the area where the nut joins the tube.
- Check the area of the sight glass and pressure switch (dual switch), and also check the seams of the receiver drier.
- Check the connections of the tubes to the condenser, and also check any welded joints on the condenser.

Caution: An oily area on the fins of the condenser may indicate a leak.

- Check the area where the hoses attach to the compressor.
- Check around the machined portions of the compressor (where the compressor sections join each other).
- If equipped, check the thermal limiter on the compressor housing.
- Check the compressor shaft seal by probing near the center of the compressor clutch pulley.

Note: Some shaft seals have a very slight amount of normal leakage [approximately 28 g (1.0 oz) per year].

Leak Test - Low-Pressure Side

- Begin at the connection of the low-pressure tube to the evaporator, and work your way along the low-pressure of the system to the compressor. There are three places to check on each tube connection.
- Check the area.
 - Check the area where the fitting joins the tube.
 - Check the area where the two parts of the fitting join each other.
 - Check the area where the nut joins the tube.

Lubrication

System Oil Stabilization

Prior to opening the refrigerant system for repairs (except compressor seizure) the system must be stabilized for correct oil replenishment.

Follow these procedures:

- Engine speed set to 1,500 rpm
- A/C ON
- Air source to recirculate
- Blower in 4th or high speed position
 - Make sure the air entering the evaporator is above 26.7°C (80°F).
 - The discharge (high) side pressure must be above 588 kPa (6 kg /cm², 85 psi).
- Operate the A/C for 10 minutes.

System Discharge

Slowly, discharge the system starting with the high-pressure side until the pressure drops below 345 kPa (3.52 kg/c m², 50 psi), then open the low-pressure side.

