SUBARU

Confidence in Motion

Technician Reference Booklet

Air Conditioning Refrigeration Systems

AUTOMOTIVE Youth Educational Systems PROUD PARTNER

WE SUPPORT PROFESSIONAL CERTIFICATION THROUGH THE National Institute for AUTOMOTIVE SERVICE EXCELLENCE

SUBARU UNIVERSITY

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This Technician Reference Booklet (TRB) is designed to be used in a classroom environment or as a guide for self study.
The TRB is not intended to be used as a supplement or substitute for the Subaru Service Manual. Always consult the appropriate Service Manual when performing any diagnostics, maintenance or repair to any Subaru vehicle.

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Table of Contents

Introduction

Heating, ventilation, and air conditioning provide comfort to vehicle occupants and maintains visibility through the vehicle windshields and window glass surfaces.

Hot Car

Perspiration

Comfort is perceived very differently from person to person and is based on the following three external variables:

- Temperature
- Humidity
- Air purity

Cooling

The relationship between temperature and humidity, as perceived by humans, is directly connected to the main process of how a human reduces body temperature, which is evaporation of perspiration.

Relative Humidity

Temperature Check

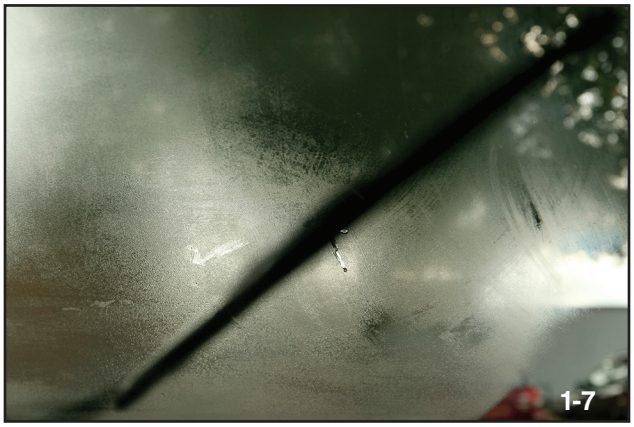
Evaporation of perspiration carries away heat from the body but is affected by the amount of humidity in the atmosphere or relative humidity. Simply stated, the higher the relative humidity, the harder it is to feel comfortable due to the decreased rate of heat transfer. Reducing the humidity through air conditioning increases the body's ability to transfer heat. The rate of heat transfer may be more noticeable than the amount of heat reduction.

Heating

Cold Car in Rain

Comfort based on the desire for heat is also related to temperature and humidity. Higher relative humidity levels increase the transfer of heat except that the humidity is increasing the loss of body heat through conduction. The moisture contacting the body allows heat to transfer from a warm location to a cooler location. Reducing the humidity through air conditioning will decrease the body's rate of heat loss.

Visibility



Interior Condensation

Defogger Operation

Air conditioning improves visibility by removing humidity and controls passenger compartment temperatures. Humidity or moisture will be attracted to cold objects as condensation.

Moisture can be absorbed in many places inside the automobile. Carpets, upholstery, and the interior air will provide a constant source of humidity until all of the moisture has been removed.

Note: Perspiration and respiration from vehicle occupants will also contribute to passenger compartment humidity levels.

As objects cool in the automobile they act as evaporators and the airborne moisture will condense on the objects.

Wet Carpet

Foggy Windshield

As humidity condenses on the windshields and windows, visibility is reduced. The humidity must be removed from the interior or the temperature must be increased so the glass no longer has the ability to condense the airborne moisture.

Exterior Condensation

Clearing Glass

It is also possible to dry out the interior so that temperature can be reduced without having condensation on the inside of the vehicle while creating a condition that begins to condense the moisture on the glass outside the vehicle. This condition can be corrected by redirecting vents or increasing the interior temperature.

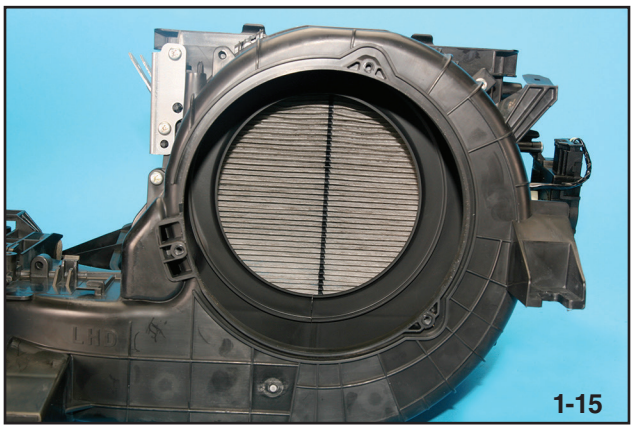
Air Purity

Air purity is mainly sensed by smell but may also be influenced by seasonal allergic conditions.

Pollen Source

Cabin Air Filter, Top View

Cabin air filters can reduce airborne pollen and other particulates that can create sneezing and other allergic symptoms but the cabin air filter must be changed on a regular basis. Odors generating from the air conditioning system itself may be caused by continuous use of re-circulated air or dirty carpets and upholstery.



Cabin Air Filter, Bottom View

Subaru A/C Vent Cleaner

Air conditioning vent and evaporator treatments, such as the Subaru 2 step A/C Vent Cleaner, can reduce these odors.

Summary

Cooling, heating, visibility, air purity, and many other factors must be considered when designing an air conditioning system for a specific vehicle. Each vehicle's air conditioning system may be unique, however the basic operation and diagnostics are the same.

The Basics

What is heat? Heat is transfer of energy from a higher temperature object to a lower temperature object.

Heat Transfer

Heat is not contained in the object and is always in a state of transference. This characteristic is known as thermal equilibrium. A hotter object will always transfer heat to a colder object.

Thermal Equilibrium Process

Humans begin to feel hot when the ambient conditions surrounding them take away the body's ability to dissipate heat.

Everybody is Different

Each person is unique in their base body temperature which can change based on metabolism, fat to muscle ratio, resting or moving state, and physical health. The more heat the body generates, the higher the differential required in temperature from the human body to the surrounding environment.

Heat can be transferred in the following methods:

- **Conduction**

Conduction

Convection

Conduction is the transfer of heat between substances that are in direct contact with each other. The better the conductor, the more rapidly heat will be transferred.

Example; A person sitting on a car seat with a seat heater on.

- **Convection**

Thermal energy is transferred from hot places to cold places by convection. Convection occurs when warmer areas of a liquid or gas rise to cooler areas in the liquid or gas.

Example; Parking a car over a hot asphalt parking lot.

- **Radiation**

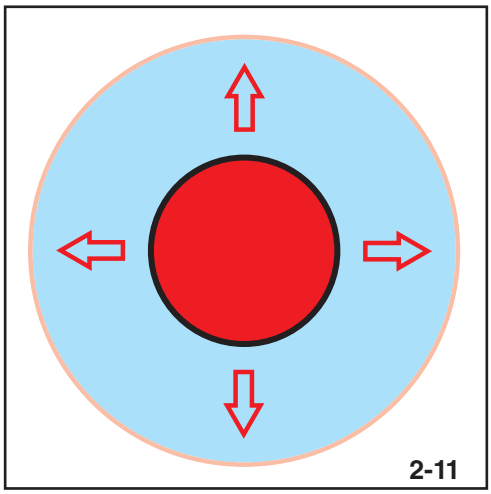
Radiation

Radiation is a method of heat transfer that does not rely upon any contact between the heat source and the heated object as is the case with conduction and convection.

Example; Sunlight shining through the closed windows of a car.

What is cold?

Snow



Energy Transfer

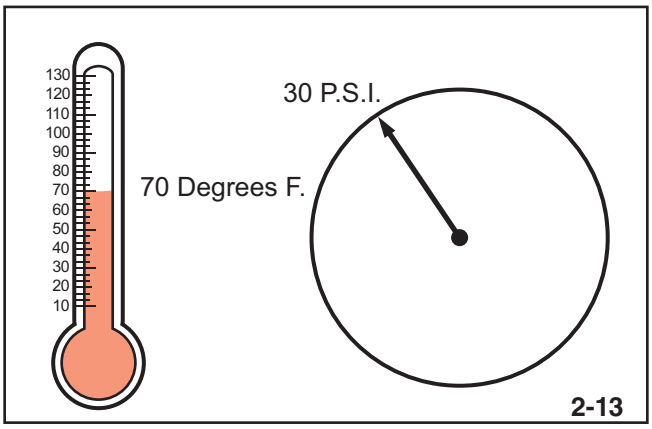
Cold is the absence of heat. Humans begin to feel cold when the ambient surroundings provide an abundance of capability to carry away heat. Keep in mind that everyone is unique, requiring a given amount of cooling, at different body conditions.

Pressure and Temperature

The relationship of temperature and pressure must be understood before understanding of the air conditioning process can begin.

Liquids that have changed their physical state to a gas are affected by temperature. If temperature increases, the pressure of the gas increases.

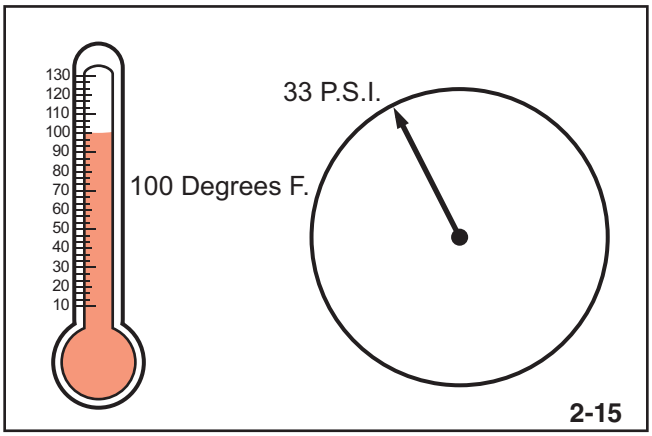
Warm Tire



70° Fahrenheit

For example; if you inflate a tire to 30 P.S.I. at a temperature of 70 degrees Fahrenheit and check the tire pressure again on a 100 degree Fahrenheit day, the tire pressure will have increased to 33 P.S.I. (provided the air in the tire had reached that same temperature).

Hot Tire



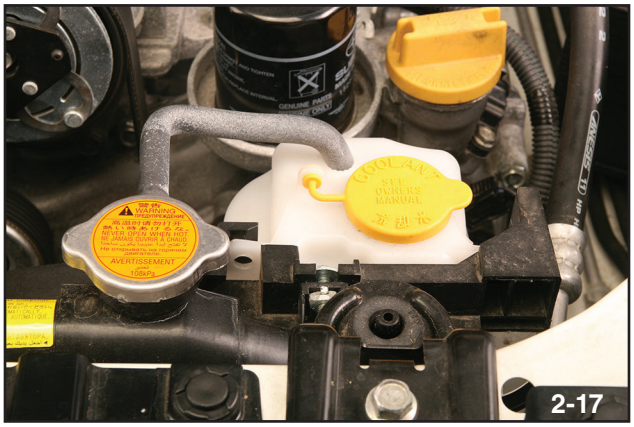
100° Fahrenheit

The opposite is also true, fill the tire on the 100 degree day and check again on a 70 degree day, the tire pressure would have dropped by 3 P.S.I. (In this case the tire is filled with compressed atmospheric air, oxygen and nitrogen).

10 degrees of temperature change affects the contained atmospheric pressure by 1 P.S.I. Each gas or blended gas is affected by temperature range and the amount of change will differ based on the characteristics of that gas.

Liquids change to a gas at a given temperature. Water for example; changes to a gas at 212 degrees Fahrenheit at sea level or with a pressure of 14.7 P.S.I..

Radiator Cap

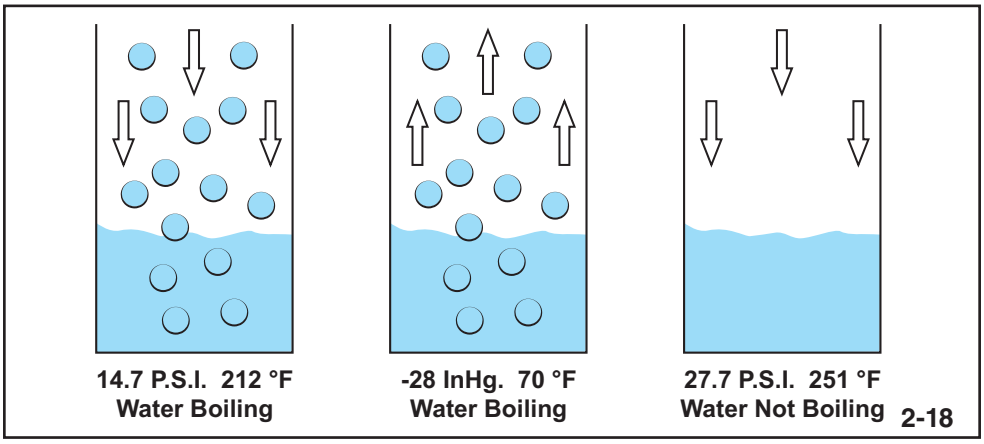


Coolant Reservoir

Increasing the pressure applied against the water increases the temperature required to change it to gas. For example a 13 pound radiator cap increases the boiling point by 39 degrees (3 degrees per pound of pressure).

As the engine coolant temperature reduces, a vacuum forms as the pressure reduces. The coolant reservoir is at atmospheric pressure and pushes the coolant into the negative pressure area of the radiator.

Placing water in a vacuum would lower the boiling point to room temperature. This allows the vacuum pump to remove moisture from a previously opened A/C system during service and repair work.

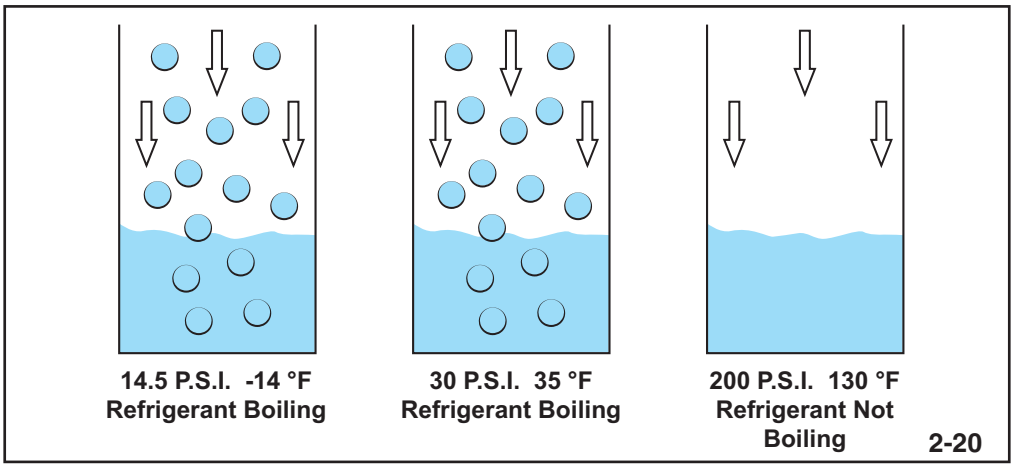


Water Boiling

As a liquid changes to a gas during boiling, heat is carried away and the liquid cools.

Boiling Water

As a gas is cooled down, it changes back to a liquid or condenses.



Refrigerant Boiling

R 134a boils at -26 degrees Fahrenheit. Increased pressure raises the boiling point. Controlling the pressure, controls the boiling point and allows the refrigerant to perform the best heat absorption.

NOTES:

Refrigerant and Refrigerant Cycle

Tetrafluoroethane or R134a is a refrigerant that changes from a liquid to a gas (boils) at -26 degrees Fahrenheit at a pressure of 14.5 pounds per square inch (P.S.I.).

Refrigerant Tank

As with any liquid, the boiling point is affected by the pressure. As the pressure increases, the boiling point increases. The refrigerant must be in a low pressure gas state before it can easily absorb heat. The main idea when designing an AC system to provide cooling is to create an area where the pressure placed against the refrigerant allows the liquid to change to a gas at a temperature that provides the best cooling.

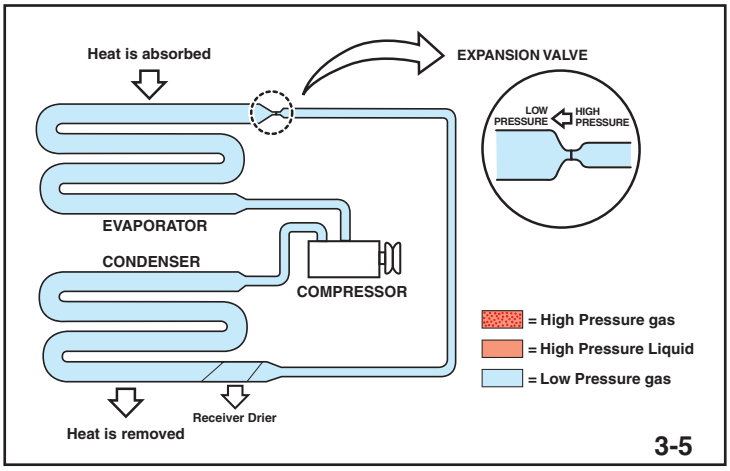
Low Side Pressure

High Side Pressure

A typical low pressure value on a Subaru vehicle is approximately 30 P.S.I.. This allows the refrigerant to boil at approximately 14 degrees Fahrenheit. This is cold enough to allow cooling to take place. The refrigerant in a low pressure gas form must also be returned to a high pressure liquid state. This allows the heat absorbed by the refrigerant gas to be easily removed and allows the refrigerant cycle to repeat. A typical high pressure value for Subaru vehicles is 200 P.S.I.. A pressure this high will create a temperature of at least 120 degrees (increasing the pressure increases the temperature), this adds to the heat that was absorbed by the refrigerant while in the gas state. The boiling point will increase high enough at this temperature to allow the refrigerant to condense or change back to a liquid and the cycle repeats.

Air Conditioning Refrigeration Systems

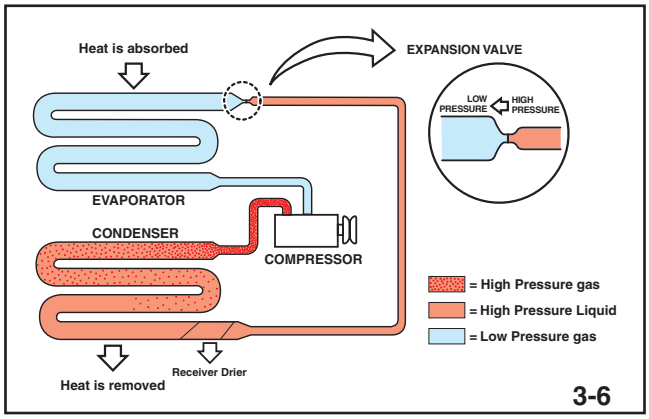
The refrigerant plumbing and related parts form a closed circuit that controls the phase state of the refrigerant. The refrigerant must change from a liquid to gas and back to a liquid to allow the refrigeration cycle to occur. The volume of the refrigerant plumbing and related parts is approximately 3 times larger than the normal refrigerant charge. This allows all refrigerant in the system to exist in a gas state when the compressor is off (at ambient temperatures above -26 degrees F.).



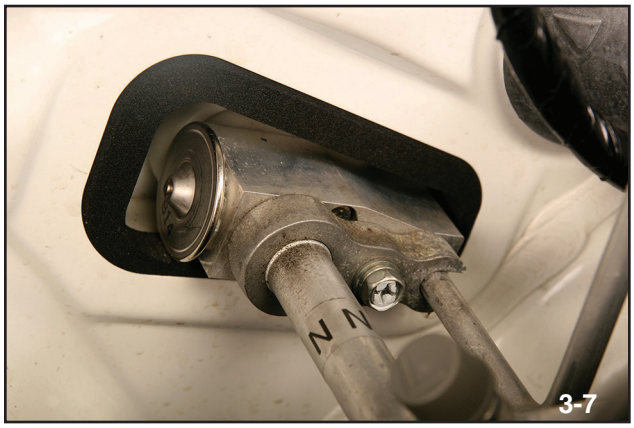
A/C System Off

When the compressor is turned on, refrigerant gas is compressed and begins to build pressure between the compressor and the expansion valve.

As the pressure builds, the refrigerant begins to change to a liquid. During the change of phase state, the refrigerant is cooled by air passing through the condenser which assists with changing the gas to a liquid (affects the boiling point).



A/C System in Operation



Expansion Valve

The refrigerant flows through the receiver drier which removes moisture and contaminants. This action opposes refrigerant flow and contributes to the increase in pressure.

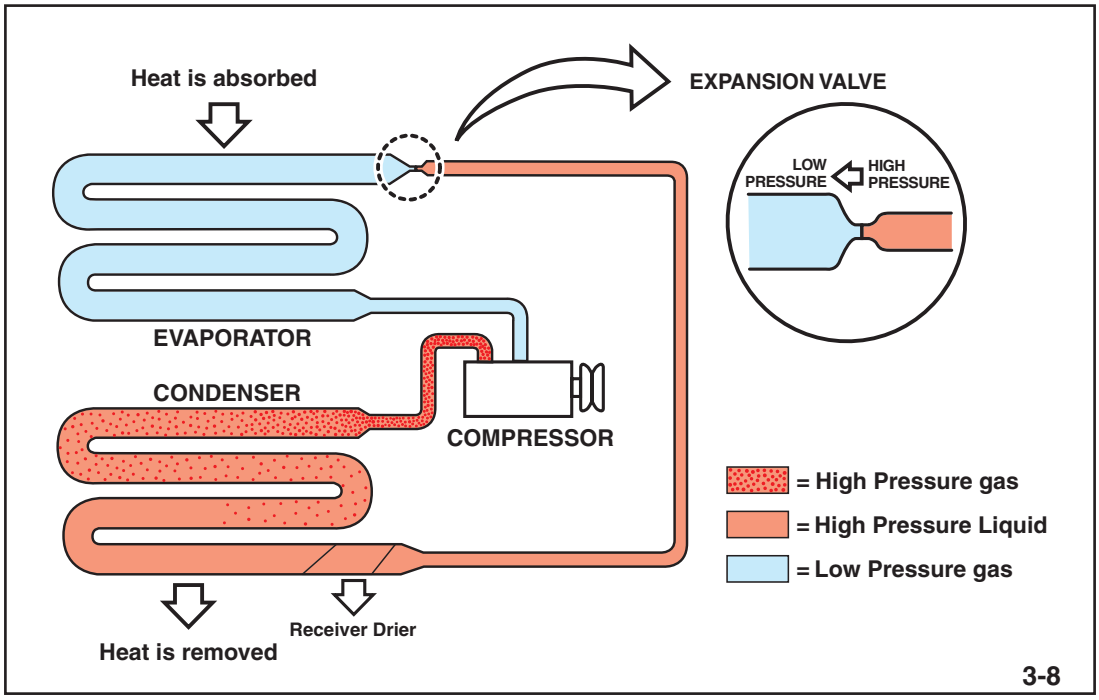
Refrigerant exits the receiver drier as a liquid and flows to the expansion valve, which is the dividing point between the high pressure side and the low pressure side of the air conditioning plumbing.

All plumbing from the outlet side of the compressor to the inlet of the expansion valve is the high pressure side. All plumbing from the outlet side of the expansion valve to the inlet to the compressor is the low pressure side

At this point in the refrigerant cycle, (inlet side of the expansion valve), the refrigerant is at approximately 200 P.S.I., a liquid, and has a temperature of approximately 120 degrees Fahrenheit.

The expansion valve meters the refrigerant into the evaporator. The evaporator is a large looping heat exchanger that provides enough internal space for the pressure to drop. The huge pressure drop produces a large decrease in temperature.

The liquid refrigerant begins to change to a gas and circulates through the evaporator. The larger space also allows the refrigerant flow to slow, which assists with absorbing more heat. Expansion valve metering is controlled by the outlet temperature of the refrigerant as it exits the evaporator. The sensing control is built inside the expansion valve.



Expansion Valve Operation

At this point in the refrigerant cycle (between the inlet pipe of the evaporator and the suction side of the compressor), the refrigerant is at approximately 30 P.S.I., a gas, and has changed in temperature from 14 degrees Fahrenheit at the inlet of the evaporator to 60 degrees Fahrenheit at the outlet of the evaporator.

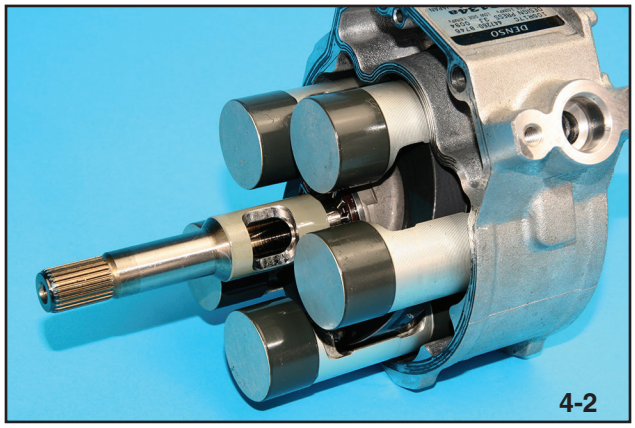
The compressor's intake and discharge strokes provide the force needed to maintain refrigerant flow through the evaporator.

NOTES:

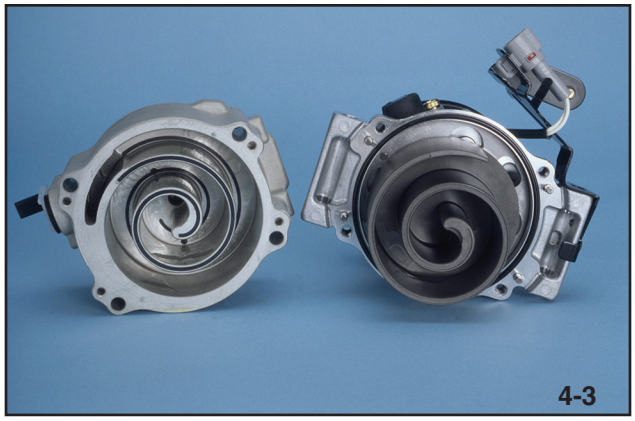
Component Parts

Compressor

The compressor of any A/C system is designed to move refrigerant. Construction and design of compressors have changed many times over the years; however, moving refrigerant from a low pressure area to a high pressure area has been the objective of each design. In addition to moving the refrigerant, the compressor assists with establishing the pressures required to allow the basic A/C cycle to operate.

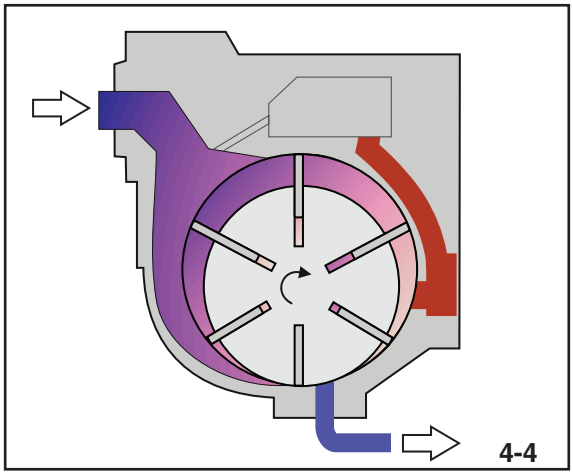


Fixed Displacement, Piston Compressor

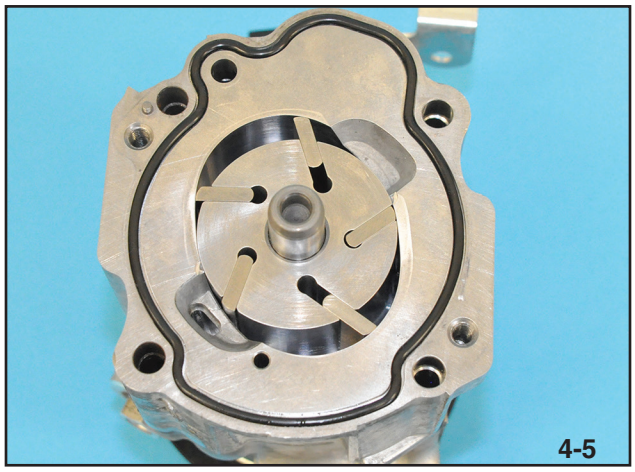


Scroll Compressor

Subaru vehicles have been equipped with fixed displacement compressors, mechanically controlled variable displacement compressors, electrically controlled variable displacement compressors, rotary vein compressors and scroll compressors.



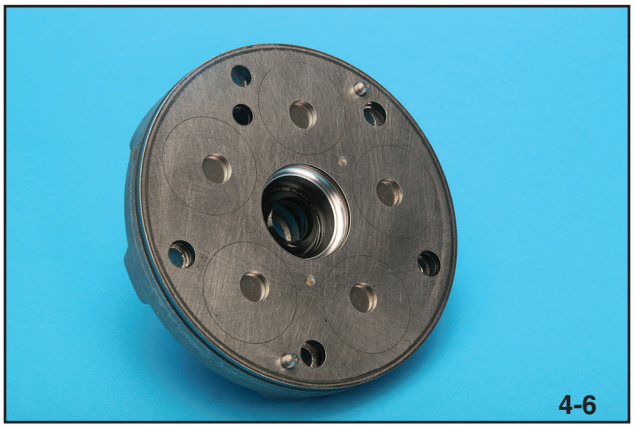
Rotary Vane Compressor (Artwork)



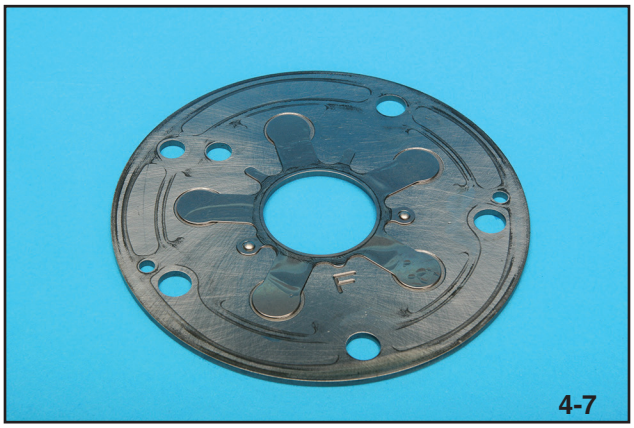
Rotary Vane Compressor

All of these compressors, except the rotary vane compressor, are equipped with a set of reed valves.

The reed valves perform a one way flow control for the suction and discharge strokes of each cylinder of the compressor.

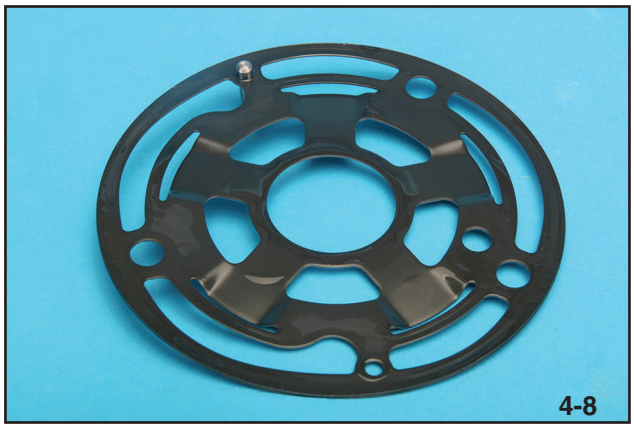


Reed Valve Assembly



Reed Valve Plate

A thin metal strip, limiter, and simple seat make up the reed valve assembly. The reed valve is designed to control the flow of gas. If liquid enters the compressor, the reed valve will be bent or distorted and will never again function properly.



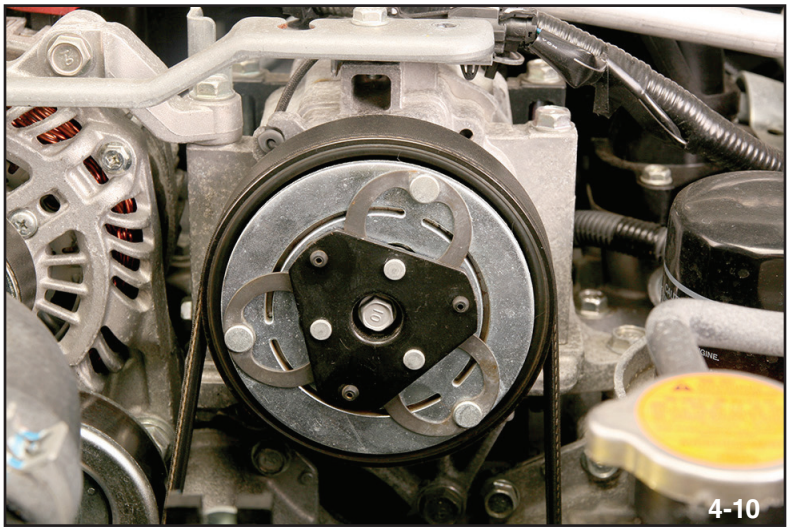
Reed Valve Limiter

The reed valves open when the pressures created by the compressor are stronger than the pressures on the opposite side of the reed valves. For example, if the high side pressure is 150 P.S.I., the compressor will need to generate at least 151 P.S.I. to open the high side reed valve. Higher opposing pressures will require more travel for the piston towards the top of the cylinder. The gas is compressed until it is slightly higher than the pressure in the system. Higher pressures also equate to more required work from the engine to drive the compressor.

Note: Scroll compressors differ in design and only use 2 suction reed valves and 1 discharge reed valve.

Pressure Relief Valve

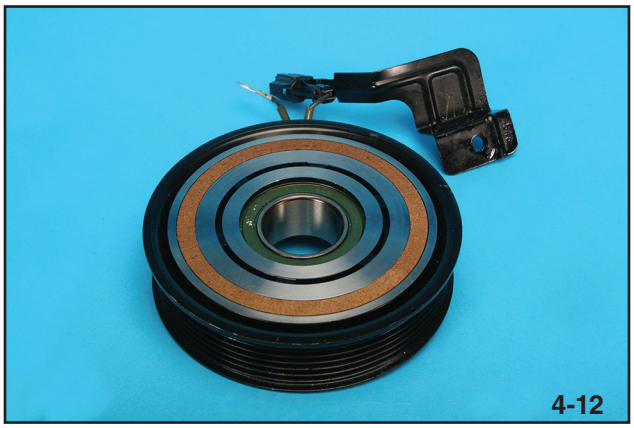
Note: Most compressors are equipped with a high pressure relief valve that will open at approximately 500 P.S.I. and will reseat at approximately 400 P.S.I.



Magnetic Clutch

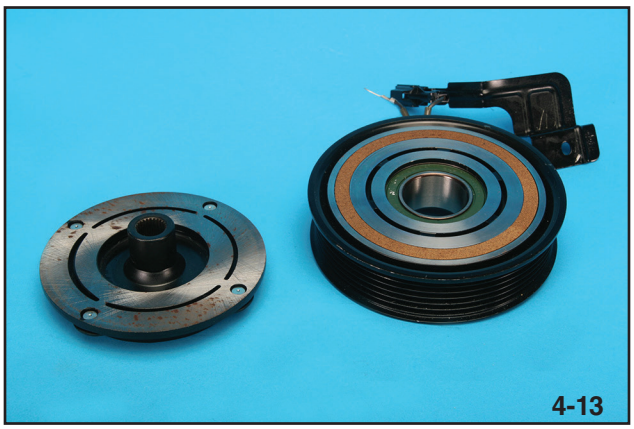
All Subaru compressors except the 2010 and newer Legacy and Outback are equipped with an electromagnetic clutch.

Electromagnet and Idler Pulley



Forward View of Idler Pulley

The engagement of the compressor is controlled by turning on and off an electrical coil that magnetizes the flex plate of the compressor drive hub.



Flex Plate Compressor Drive Hub and Idler Pulley

Compressor Clutch Assembly

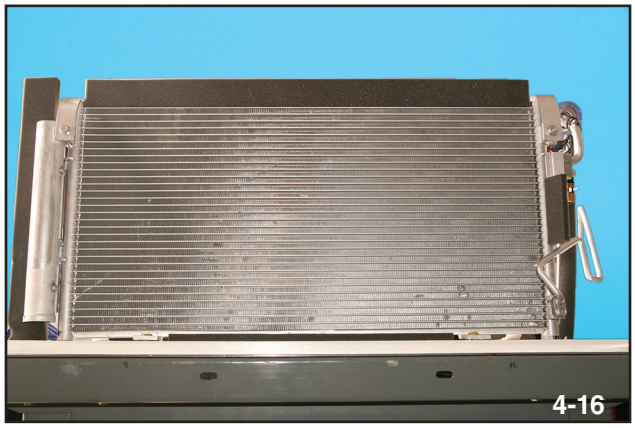
The flex plate pulls into the idler pulley which is driven by the accessory belt. The rotating idler pulley now provides the mechanical power needed to turn the compressor.

Condenser

The condenser is a heat exchanging device that is designed to allow cool air to enter the front and warm to hot air to exit the rear. The air flow can be amplified by the radiator coolant fans.

Refrigerant enters the top of the condenser as a hot gas and flows across the condenser in a parallel pattern.

Condenser in Vehicle



Condenser and Receiver Drier

Multiple sets of 3 rows provide the paths from one side to the other and finally to the receiver drier. Cooling fins are positioned on the outside of the rows to absorb heat from the refrigerant and must be open and clean to allow air to flow through. A restriction in air flow will contribute to elevated high pressures.

The receiver drier is attached to the condenser and is constructed from a cylindrical tank and a bagged desiccant. The desiccant absorbs moisture that could lead to the formation of ice crystals or corrosion. Once saturated, the condenser must be replaced.

The receiver drier also provides a small restriction in the refrigerant flow that allows the initial build up of pressure that changes the refrigerant gas back to liquid. The refrigerant must be in a liquid state before it is routed to the expansion valve.

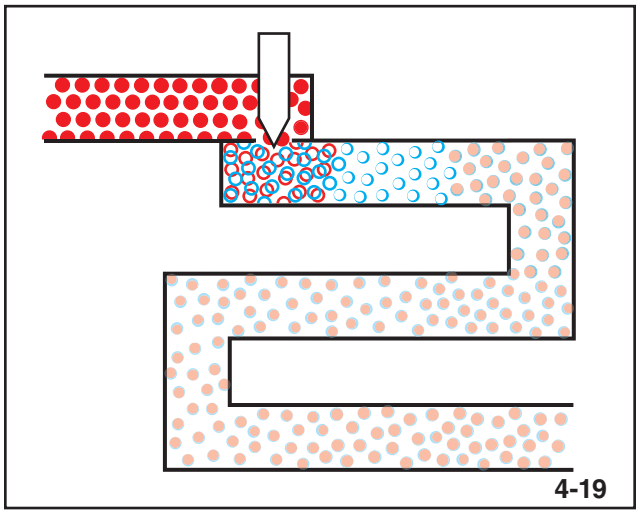
Expansion Valve

The expansion valve receives warm liquid refrigerant. Metering into the evaporator is controlled by a diaphragm filled with an inert gas and a spring loaded valve assembly.

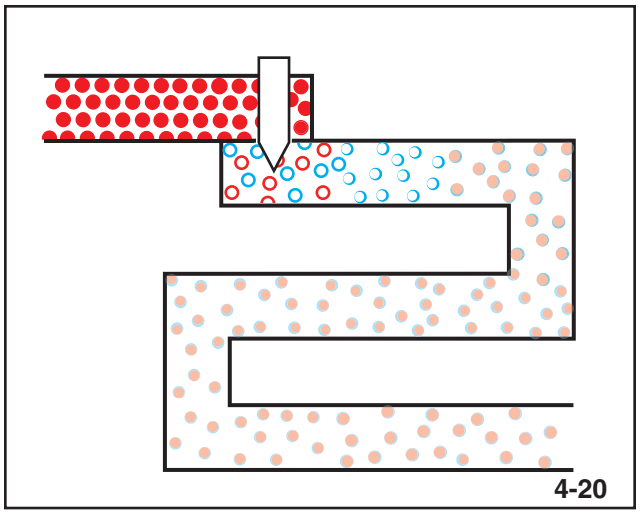
Expansion Valve, Outlet Side

Expansion Valve Inlet Side

The valve is spring loaded to provide minimum flow and gradually opens to the maximum opening as heat from the low side hose connection (outlet of the evaporator) is absorbed by the expansion valve block and is sensed by the diaphragm.



Opened



Closed

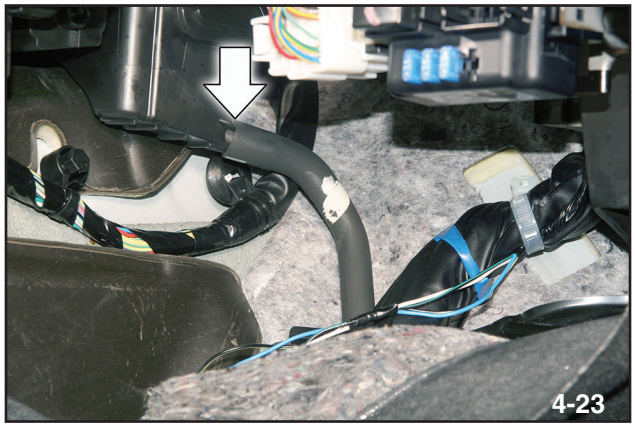
The amount of heat at the outlet side of the evaporator is based from the amount of heat inside the passenger compartment and the amount of heat transfer that has occurred while the refrigerant was in the working area of the evaporator. Larger openings (hot output) create higher amounts of refrigerant metered into the evaporator. As the evaporator outlet temperature reduces, the openings size is reduced, which reduces the amount of refrigerant metered into the evaporator. This reduces the amount of work required from the compressor and engine.

Evaporator

Evaporator

Frost on A/C Lines

The evaporator is a heat exchanging device designed to allow warm humid air to flow into one side and cool dry air to flow out the other. Airflow through the evaporator is controlled by the speed of a blower fan and motor. The warm liquid refrigerant enters the input of the evaporator and begins to expand and boil. The large capacity of the evaporator creates a pressure drop and because the refrigerant is being metered into the evaporator, the pressure remains low by comparison to the high side of the system. The amount of heat absorbed by the refrigerant affects the low side pressure. A very hot car takes time to cool down. The heat is absorbed by the refrigerant in the evaporator slowly and gradually cools down the car. The low side pressure will slowly decrease as the heat is removed from the passenger compartment.



Evaporator Drain Hose

Dripping Water from Evaporator

The heat is carried out of the evaporator and enters the suction side of the compressor which affects the high side pressure. The hot refrigerant gas plus the heat generated from compressing the gas enters the condenser and the cycle repeats.

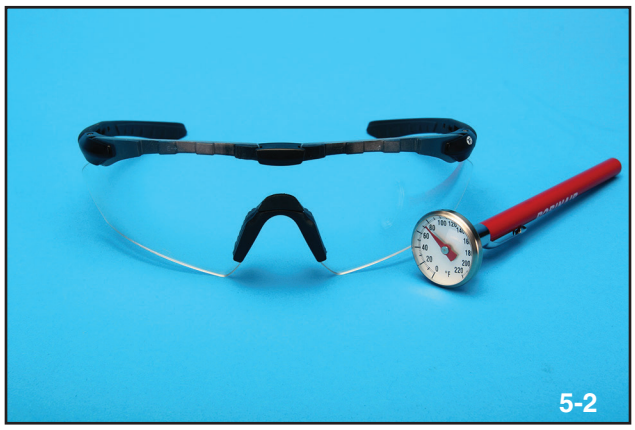
Humidity is removed from air by the cold exterior surface area of the evaporator.

Moisture will condense on the cold surface and drip away from the evaporator housing drain hose.

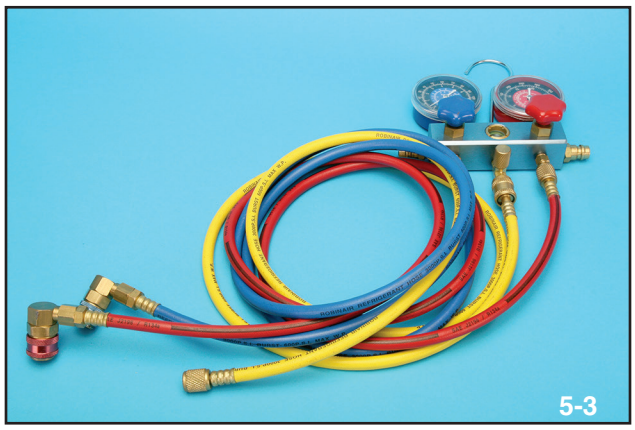
NOTES:

Pressure Diagnostics

Before You Start



Required Tools



Pressure Gauges

Always wear safety glasses and skin protection when diagnosing and servicing A/C systems. Refrigerant and high pressure can cause personal injury.

Before any diagnostics can be performed on the air conditioning system refrigerant cycle, the refrigerant must be identified and checked for sealants. Incorrect refrigerant and sealants will create incorrect pressure values, damage to A/C components, damage to A/C recycling equipment, and possibly lead to personal injury.

First, always check the refrigerant with an approved identifier. The refrigerant currently used in Subaru vehicles must be at least 98 % R134a. If the tested refrigerant does not meet this standard, the refrigerant must be recycled in a dedicated waste refrigerant reclaiming machine.

Next, check the refrigerant for sealants. Sealants are contained in most counter sold, A/C “do it yourself” cans. If sealant is found, reclaim the refrigerant in a dedicated waste refrigerant machine. The contaminated system should also be flushed.

Customer Concern

The correct customer concern or complaint must be documented on the repair order. Teach your service writers to get as much detail as possible. Ask them to include information regarding cooling or heating efficiency, fogging of glass surfaces, noises, and smells. The driving and weather conditions required to duplicate the problem should also be included.

Visual Inspection

Always check the vehicle interior and exterior for possible conditions that could lead to customer concerns. Check weather seals around windows, doors, and gates. Check for wet carpet and upholstery. Have the customer remove any refuse from the vehicle that could lead to offensive odors.

Check blower speed and the cabin air filter.

Visually check the accessory drive belt and the condition of the A/C hoses and service port caps. Check for any concentrated areas of oil and or dust. This may indicate the location of a refrigerant leak.

Check the condition of the radiator coolant fans and condition of the condenser.

Connecting Pressure Gauges to the Vehicle

Verify that all flow control valves are closed.

Refrigerant Pressure Test with Manifold Gauge Set

A: Procedure

1) Place the vehicle in the shade and windless condition.
2) Open the front hood.
3) Connect the manifold gauge set.
4) Open the front windows and close all doors.
5) Increase the engine to 1,500 rpm to 2,500 RPM.
6) Turn the A/C switch to ON.
7) Turn the temperature control dial to MAX COOL position.
8) Turn the FRESH/RECIRC switch to RECIRC position.
9) Turn the fan speed control dial or switch to HI (MAX) position.
10) Read the gauge.

Specification:

Low pressure: 127 — 196 kPa (1.3 — 2.0 kgf/cm2, 18 — 28 psi)

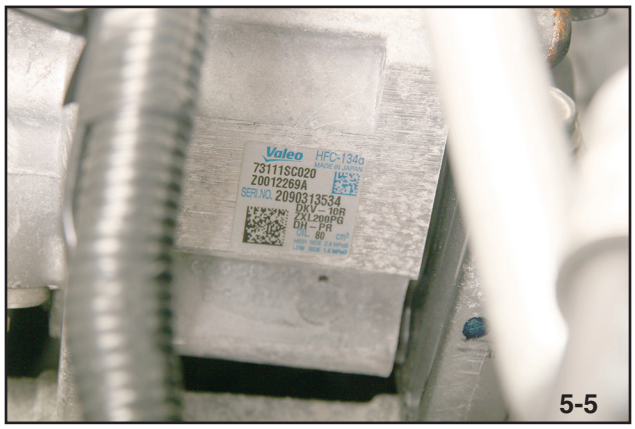
High pressure: 1,471 — 1,667 kPa (15 — 17 kgf/cm2, 213 — 242 psi)

Ambient temperature: 30 — 35°C (86 — 95°F)

Note: The ambient temperature, temperature of the vehicle (engine compartment and passenger compartment), and relative humidity will have an effect on the pressures.

Oils

PAG Oil



Compressor Label

R134a refrigerant systems utilize a poly alkaline glycol or PAG oil to lubricate the moving parts of the air conditioning system. PAG oil is hygroscopic (absorbs water very easily) and changes color to yellow after absorbing water.

PAG oils come in many viscosities and should not be mixed. Always refer to the service manual or the identification label on the compressor for the correct oil type and viscosity.

Adjusting the oil level in the air conditioning system can be confusing. The industry standard is to add 2 ounces of oil if modern condensers are replaced and 2 to 3 ounces for evaporator replacement. If compressors are replaced, drain and measure the oil from the old compressor and confirm the same amount is in the new compressor.

Note: A leaking A/C hose may or may not leak oil. Small leaks usually do not create an oil leak. Larger leaks may have a rapid release of refrigerant which will carry away oil from the system.

Add no more than 1 to 2 ounces for hose replacement.

Note: Perform the following procedure when replacing any component other than the A/C compressor. The procedure should return most of the oil to the compressor.

1) Increase the engine to 1,500 rpm.
2) Turn the A/C switch to ON.
3) Turn the temperature control dial to MAX COOL position.
4) Turn the FRESH/RECIRC switch to RECIRC position.
5) Turn the fan speed control dial or switch to HI (MAX) position.
6) Leave in this condition for 10 minutes.

Note: When evacuating the A/C system, oil may be discharged with the refrigerant. Always check the oil return bottle level before and after the refrigerant evacuation operation. Be sure to add the amount of oil evacuated plus any additional oil recommended for a replacement part.

If an A/C system has been exposed to atmosphere for an extended period of time, the remaining PAG oil in the system will absorb water. The water cannot be separated from the oil and will require flushing of the refrigerant and the oil.

Leak checking

Leak Detector

Leak checking with an electronic leak detector takes patience and understanding of both the A/C system and the leak detector. The A/C system may only leak under certain conditions and leaking refrigerant can be blown around from radiator fan or blower motor operation. When performing leak checks, check all connections, sealing areas and housing at a low pressure (engine off and cool) and high pressure condition (compressor has been active and radiator fans have already cycled).

The leak detector is designed to indicate a leak whenever the sampled air is different than atmospheric. Leaking fluids such as antifreeze and windshield washer fluid can indicate a false leaks.

Low Pressure Service Port

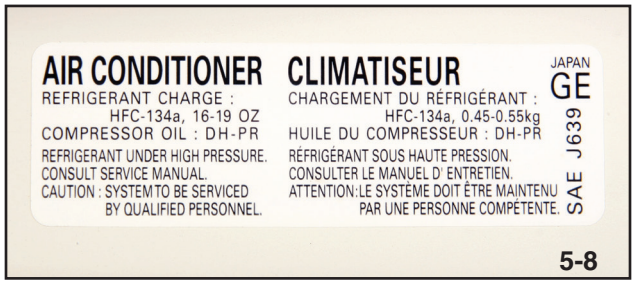
Note: Leaks on the low pressure side maybe easier to locate with the A/C system off or after the system has equalized.

A/C service ports are considered to be secondary seals and a leak will be detected if the caps are removed. Replace the caps if damage or wear is present.

Note: A/C recycling machines are designed to perform vacuum leak checks. This procedure may not detect a small leak that only occurs under high pressure operation. Always double check with an electronic leak detector.

Charging

When charging the A/C system, modern A/C recycling machines charge the A/C system with the engine off. The specified amount of refrigerant required for the system can be found on a label on the hood. Note: Technicians have encountered trouble by not confirming the amount in the service manual. The hood may have been changed from another vehicle, which may have the wrong specification label for the vehicle being serviced.



A/C Label

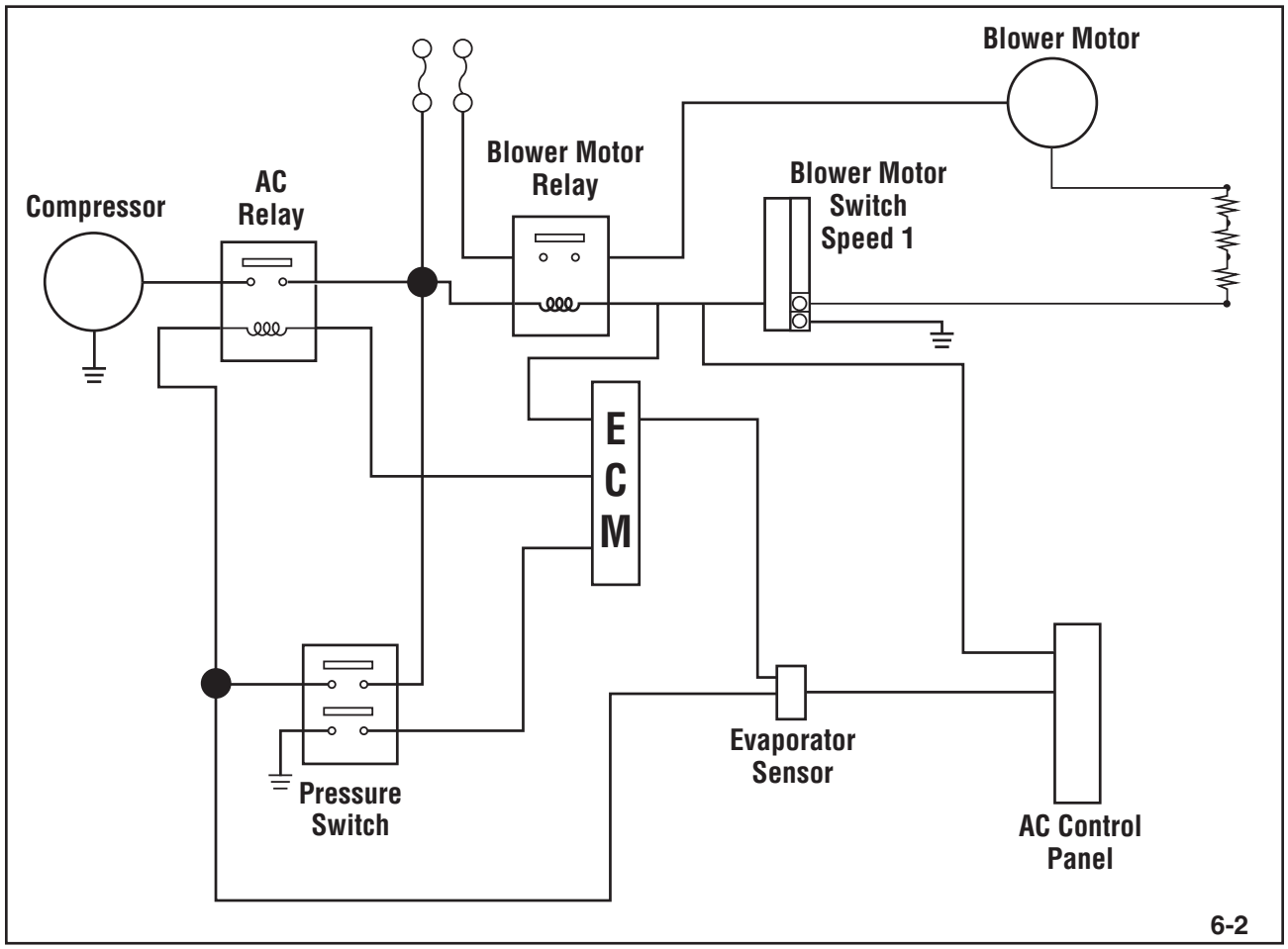
A/C Recycling Machine

A typical refrigerant charge specification for a Subaru vehicle is 16 to 19 ounces. Which is the better amount? If the vehicle is usually operated in a hotter climate, charge the system from the minimum to the middle part of the specification. If operating in colder climates, charge from the middle to the higher end of the specification. By properly charging the system, the A/C system will perform at its best and fuel consumption of the vehicle will be reduced.

NOTES:

Electrical

The electrical circuitry for the air conditioning system must provide the working power for the compressor clutch, sensing switches, blower motor, controlling relays, and input signals to the engine computer.



A/C System Wiring Schematic

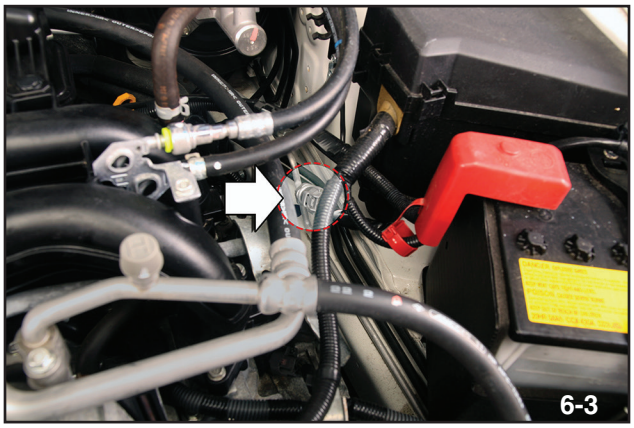
(Example: 2013 Forester, Manual Air Conditioning)

A problem in the circuitry for any of these parts will create a performance issue for the air conditioning system.

Pressure Switch

The Pressure Switch is located on the high pressure line and is threaded onto a fitting made onto the line. Never remove the Pressure Switch while refrigerant is in the A/C system.

Note: There is no service valve under the pressure switch.

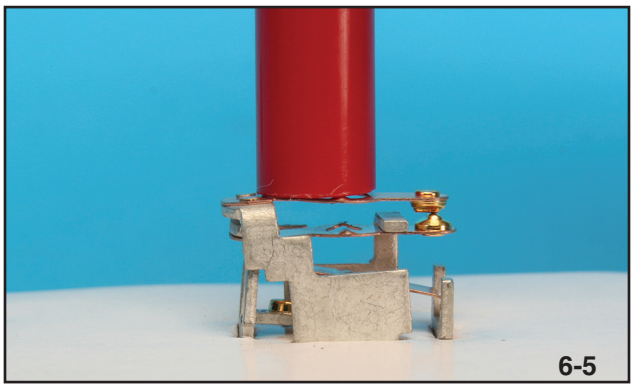


Pressure Switch Location

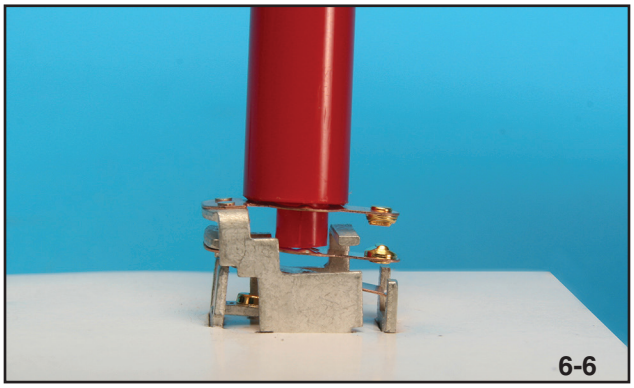
Pressure Switch

The Pressure Switch is a triple diaphragm, 2 switch device, which provides 2 types of control and 1 signal input to the engine computer.

The first control is electrical power supply to the A/C relay and the evaporator switch.



Low Pressure Function

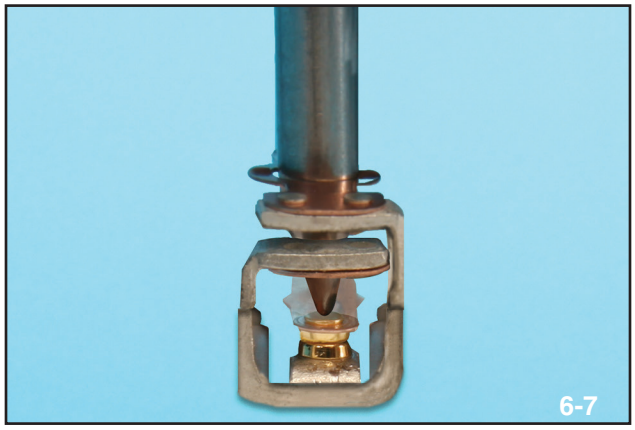


Over Pressure Function

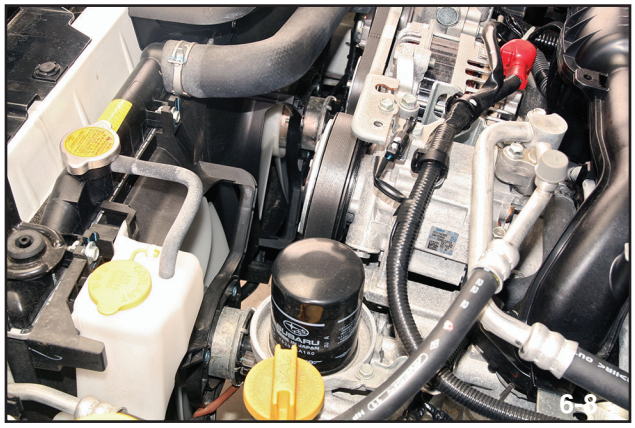
A minimum of 32 P.S.I. is required to close the low pressure switch. Below 32 P.S.I., the low pressure switch will be open and no voltage will exist at the A/C relay coil and the evaporator switch. This protects the A/C system by preventing the compressor from operating when oil cannot be circulated through the system.

The second control is over pressure protection. If the high side pressure exceeds 340 P.S.I. the pressure switch will open and electrical power to the A/C relay and the evaporator switch will be removed. Operating pressures above 340 P.S.I. will reduce cooling performance and possibly damage mechanical parts.

The pressure switch also creates an input signal to the ECM. The second switch in the pressure sensor is named the mid-pressure switch.



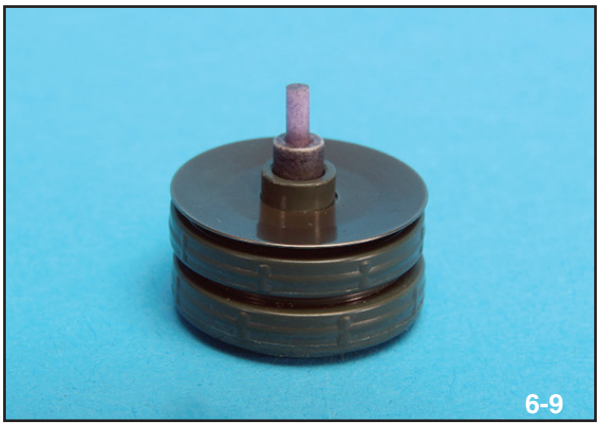
Mid-Pressure Function



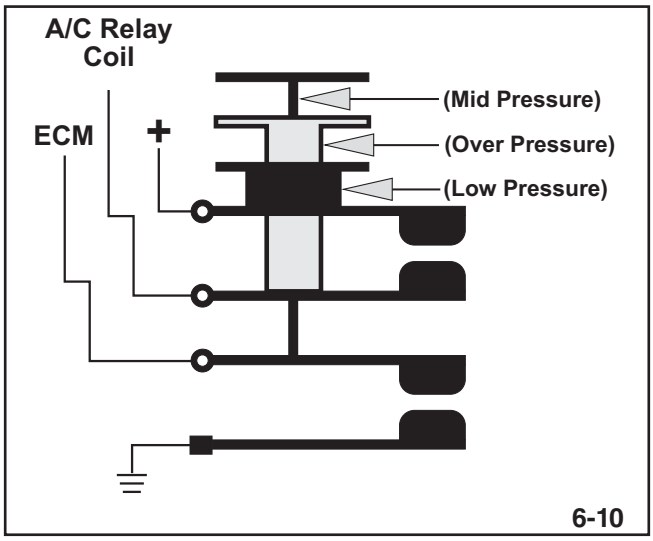
Radiator Fans

When the high side pressure reaches approximately 256 P.S.I., the mid-pressure switch will close and a ground signal will be supplied to the ECM.

The ECM will activate the radiator fans as a result of the signal and the radiator fans will continue to operate until the high side pressure has been reduced to approximately 210 P.S.I..



Pressure Switch Diaphragm

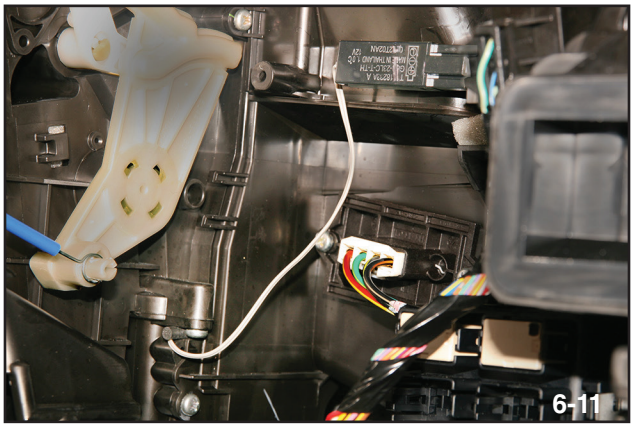


Pressure Switch Schematic

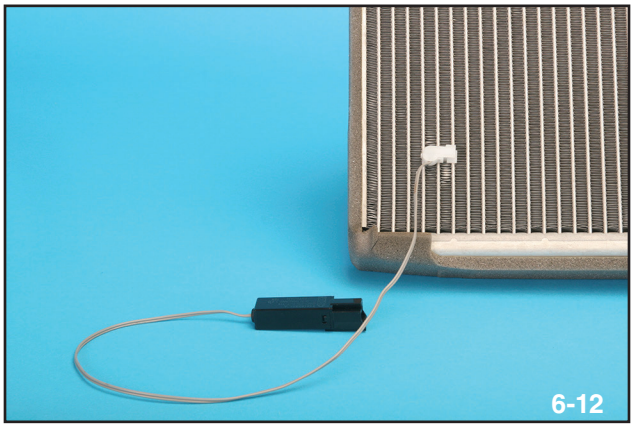
The switches are controlled by refrigerant pressure acting on the pressure diaphragms of the Pressure Switch. Each diaphragm pushes on a post that moves the contact points of the 2 switches. The center post closes the mid-pressure switch, controlling the signal for the radiator fans. The inner post moves the lower contact away from the upper contact of the pressure switch, providing for over pressure control. The outer most post moves the upper contact into the lower contact of the pressure switch, providing minimum pressure control.

Thermo-control Amplifier (Evaporator Switch)

The evaporator switch consists of miniature intergraded circuit board, negative temperature coefficient temperature sensor, and a 3 wire connector.



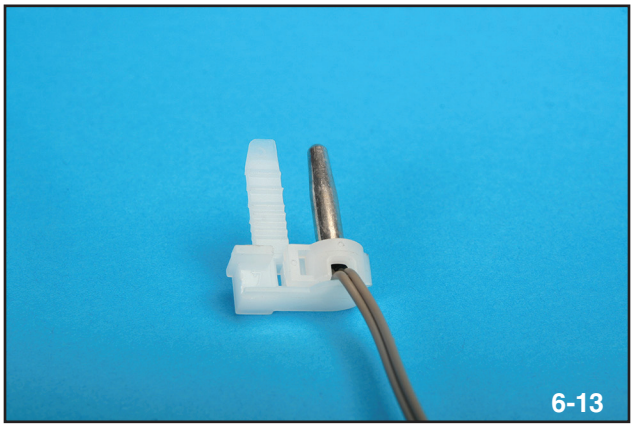
Evaporator Switch Location



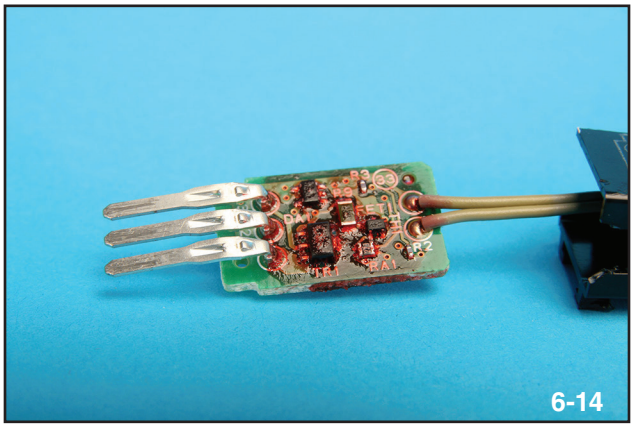
Temperature Sensor Mounted

The temperature sensor is hard wired to the IC board with 2 wires and cannot be tested separately from the evaporator temperature sensor.

During operation the temperature sensor sends a resistance value to the IC board. If the temperature is high, the resistance value is low and increases as the temperature decreases.



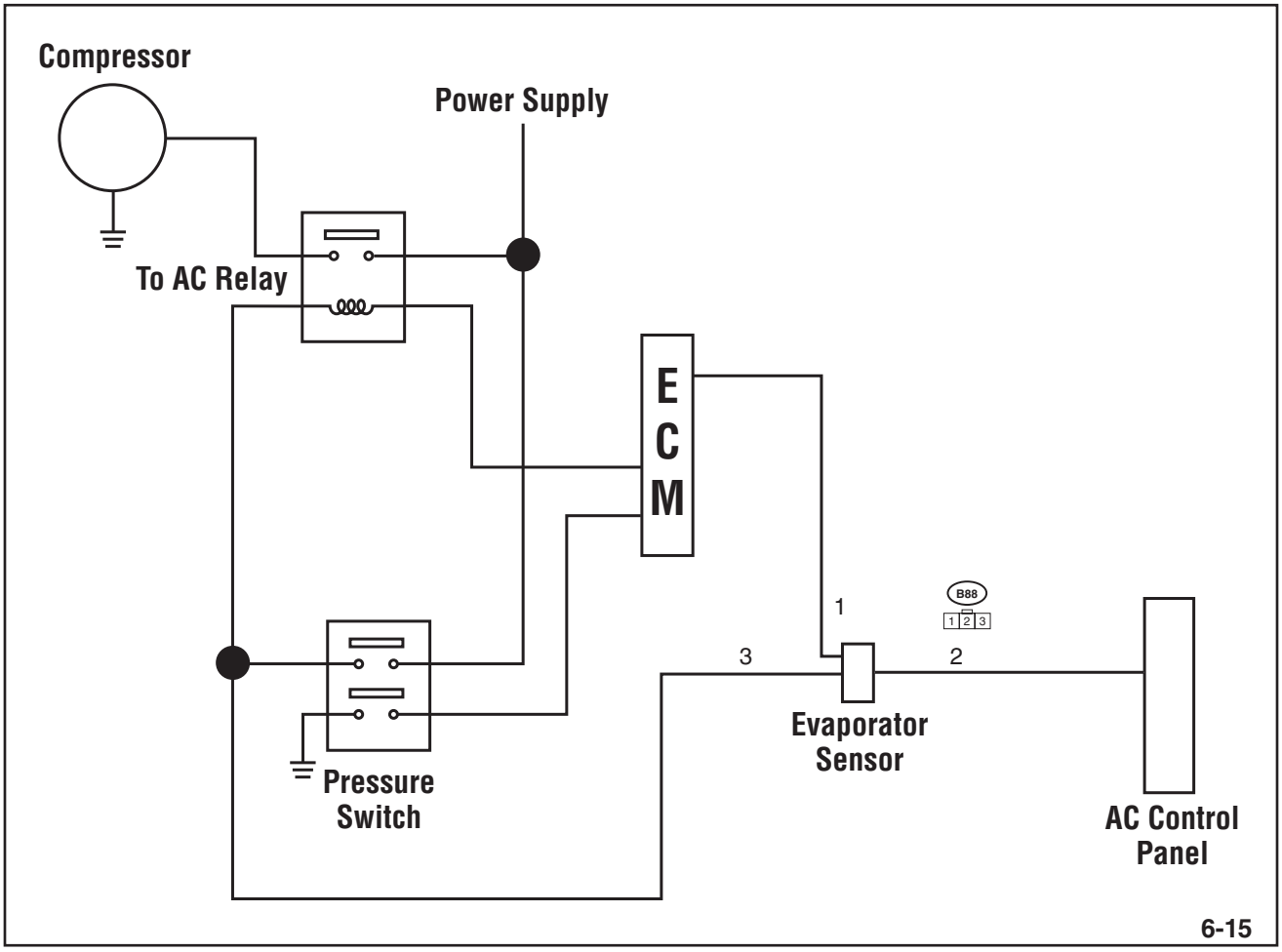
Temperature Sensor



Evaporator Switch IC Board

The IC board evaluates the resistance value and determines when the compressor should be cycled off or on.

Testing of the evaporator switch should be performed by checking the voltage value of the 3 wires.



Evaporator Switch Wiring Schematic

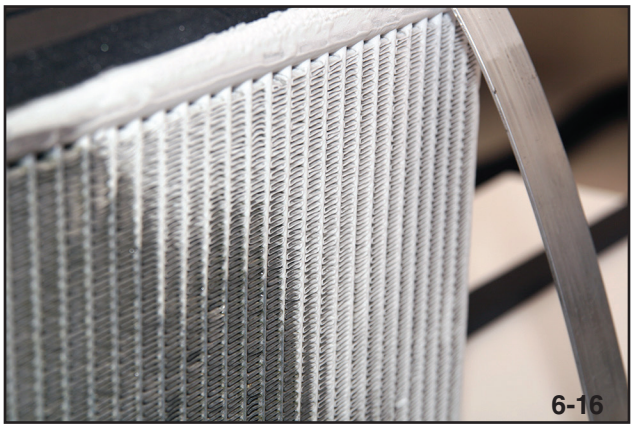
Note: (Example 2013 Forester, Manual Air conditioning)

Terminal 3, in the example provided, provides working power to the IC board and should have battery voltage if the ignition is on and the correct charge of refrigerant exists in the A/C system.

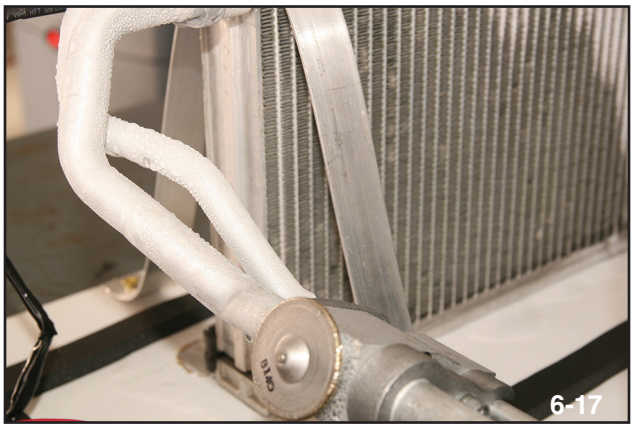
Terminal 2 is the ground for the IC board and is controlled by the A/C switch or A/C control panel. If the A/C has been turned on the voltage value should be near 0 volts, and near battery voltage when the A/C is turned off. (Note: The voltage does not change during compressor cycling).

Terminal 1 is the input signal to the ECM from the Evaporator switch that requests the turn on or turn off signal of the compressor. During compressor on time, the voltage value should be near battery voltage, and during the off time the voltage should be near 0 volts.

Terminal 1 voltage level or input value to the ECM can be correct but may be changing at the incorrect time. This could be caused by a faulty temperature sensor and should be judged based on phenomenon. If the resistance is too low the compressor may never cycle off.



Evaporator Ice Build Up



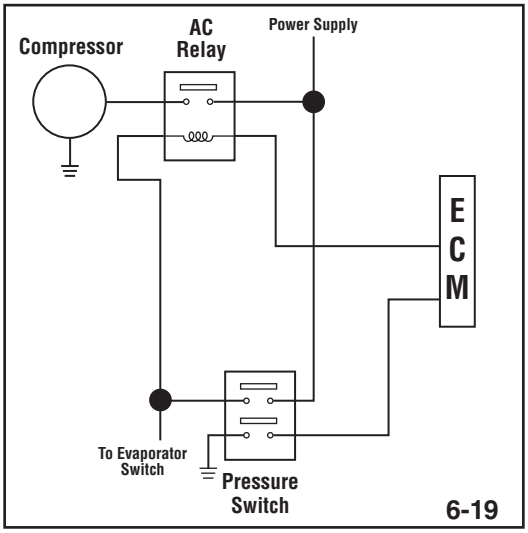
Evaporator Pipes Ice Build Up

Decreased airflow and or vapor exiting the A/C vents are an indicator that the compressor is not cycling correctly. Ice can form in the evaporator if the humidity is high enough and the compressor is incorrectly cycling. This will reduce airflow. As the ice begins to melt, a cold mist or vapor will exit the A/C vents.

If the resistance is too high the compressor may never cycle on. This will create a lack of heat removal.

A/C Relay

A/C Relay



A/C Relay Schematic

The A/C relay is located in the fuse box in the engine compartment.

This makes correct voltage testing of the A/C relay coil difficult. An easier check is to monitor the voltage at the ECM. The A/C relay is controlled by the ECM. If the minimum charge of refrigerant is in the A/C system, the voltage at the ECM for the A/C relay coil will be battery voltage if the AC is not in operation or if the compressor clutch has been cycled off. Near 0 volts will be present if the compressor clutch has been turned on.

TO A: B134

7	6	5	4	3	2	1
17	16	15	14	13	12	11	10	9	8
27	26	25	24	23	22	21	20	19	18
34	33				32	31	30	29	28

TO B: B135

7	6	5	4	3			2	1	
19	18	17	16	15	14	13	12	11	10	9	8
27	26			25	24			23	22	21	20
35	34			33	32			31	30	29	28

TO C: B136

6	5		4	3	2	1		
16	15	14	13	12	11	10	9	8	7
27	26	25	24	23	22	21	20	19	18	17
35	34	33	32	31			30	29	28

TO D: B137

7	6	5	4	3	2	1	
17	16	15	14	13	12	11	10	9	8
25	24			23	22	21	20	19	18
31	30			29	28			27	26

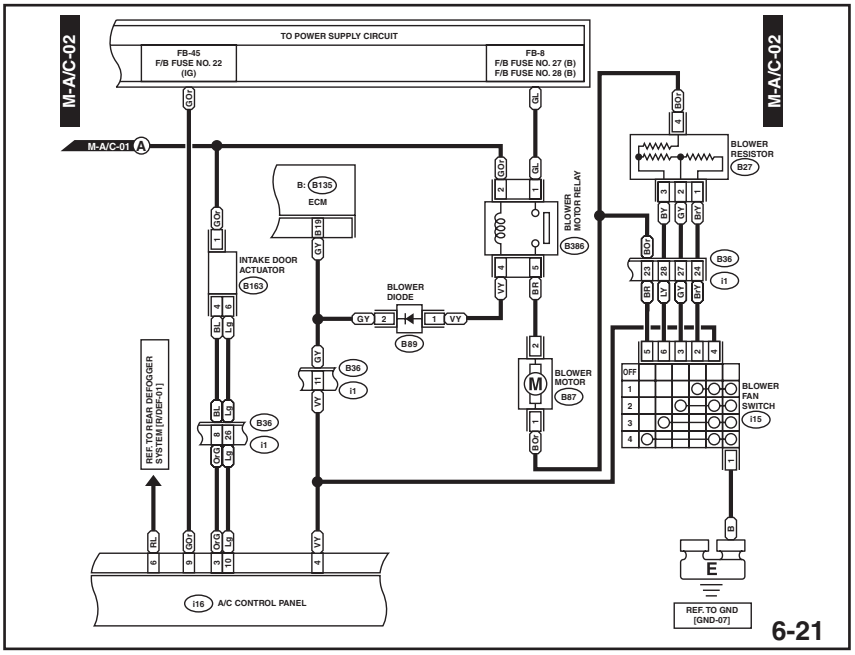
Description	Connector No.	Terminal No.	Signal (V)	
A/C relay control	B135	35	ON: 0.5 or less OFF: 10—13	ON: 0.5 or less OFF: 12—14
A/C switch	B136	29	ON: 10—13 OFF: 0	ON: 12—14 OFF: 0
Blower fan switch	B135	19	ON 0 OFF: 10—13	ON: 0 OFF: 12—14
A/C middle pressure switch	B136	7	ON 0 OFF: 10—13	ON: 0 OFF: 12—14

6-20

ECM I/O Chart

Blower Motor Circuit

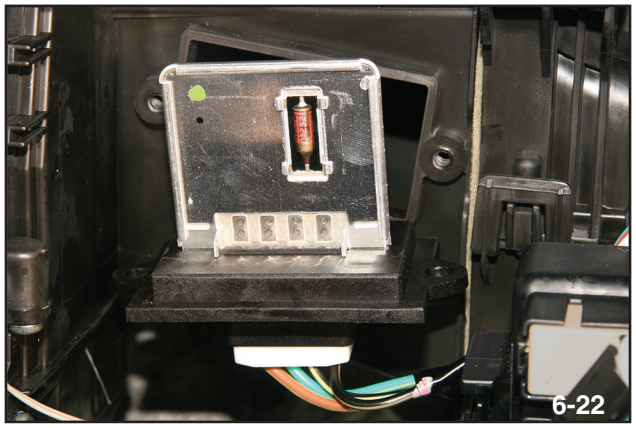
The blower motor circuit operates independently of the refrigerant charge judgment of the pressure sensor. The circuit is constructed with a blower motor, blower motor relay, blower motor switch, and a blower motor resistor.



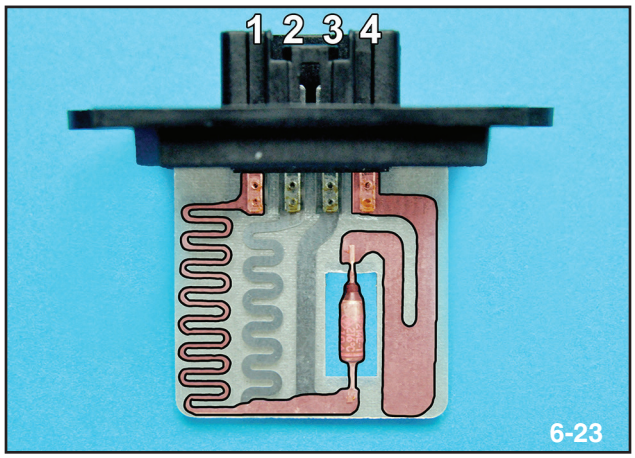
Blower Motor Schematic

Operation of the blower motor switch provides two types of control. The first control is to open or close the ground path of the blower motor relay coil. In the off position the ground path is not available. If speeds 1 through 4 are selected, the path to ground is established and the blower motor relay coil is energized. Power is then routed to the blower motor. The second control of the blower motor switch is to determine where the ground path is established at the blower motor resistor. Blower motor speed 4 totally bypasses all the resistors in the blower motor resistor assembly. Setting 3 routes the power through one resistor, setting 2 routes the power through two resistors, and setting 1 routes the power through three resistors. Each resistor adds a voltage drop that slows down the blower motor.

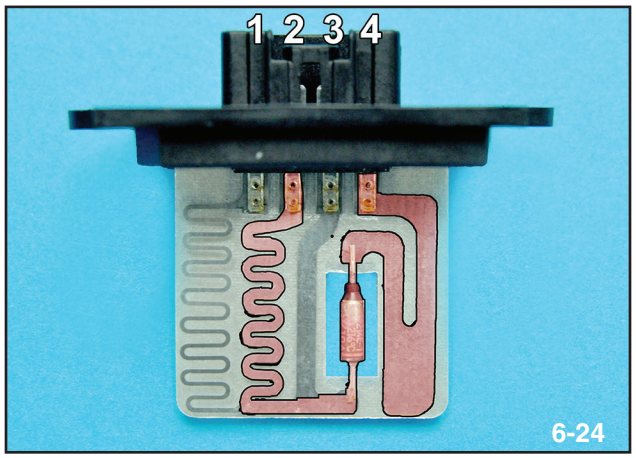
Note: Actual blower motor resistor construction utilizes voltage drop through fixed varying width conductors. This is equivalent to symbols in the wiring schematic.



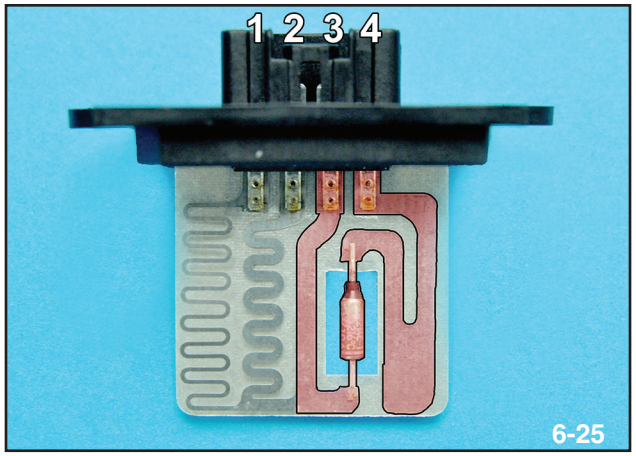
Blower Motor Resistor



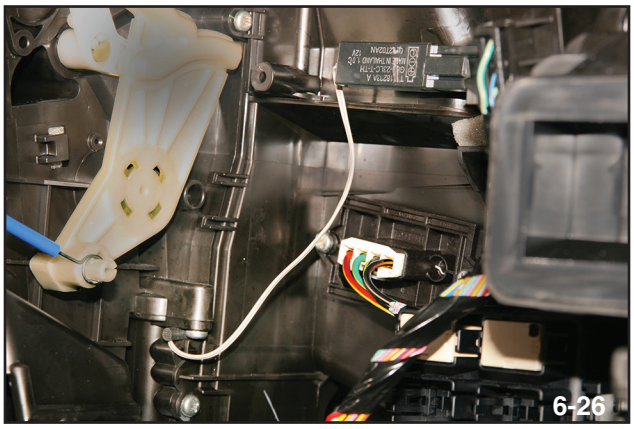
Fan Speed 1



Fan Speed 2

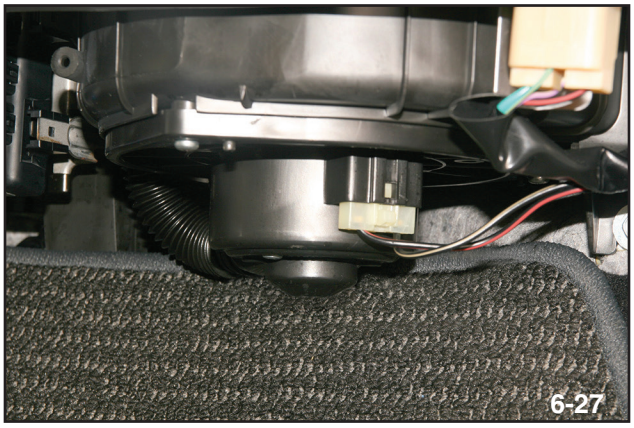


Fan Speed 3

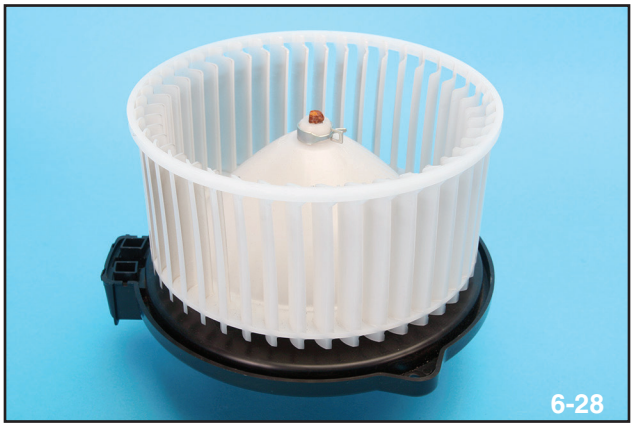


Blower Motor Resistor Location

The blower motor is attached to the blower motor housing, under the glove box. The motor operates a serviceable blower fan assembly that produces the air flow.

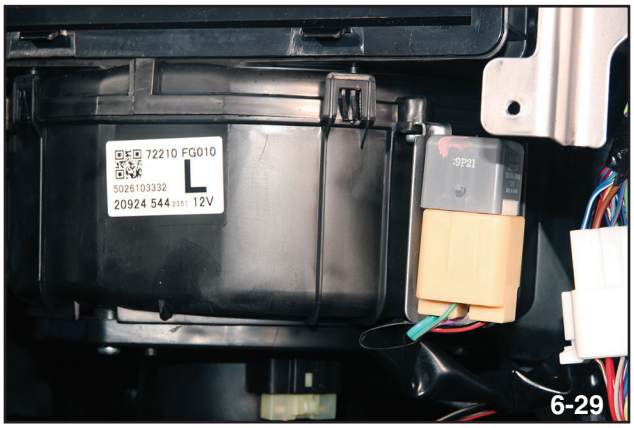


Blower Motor Mounted



Blower Motor

The blower motor relay is attached to the side of the blower motor housing

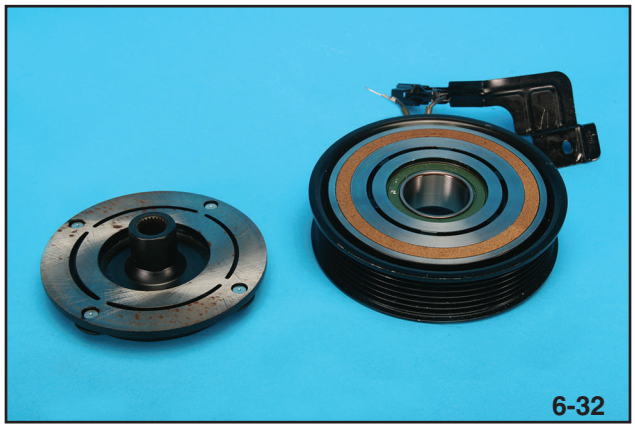


Blower Motor Relay Location

A/C Control Panel

The compressor magnetic clutch consists of an idler pulley, clutch drive plate (splined to the air conditioning compressor crankshaft), and an electromagnet coil.

Electromagnet and Idler Pulley



Flex Plate and Idler Pulley Front View

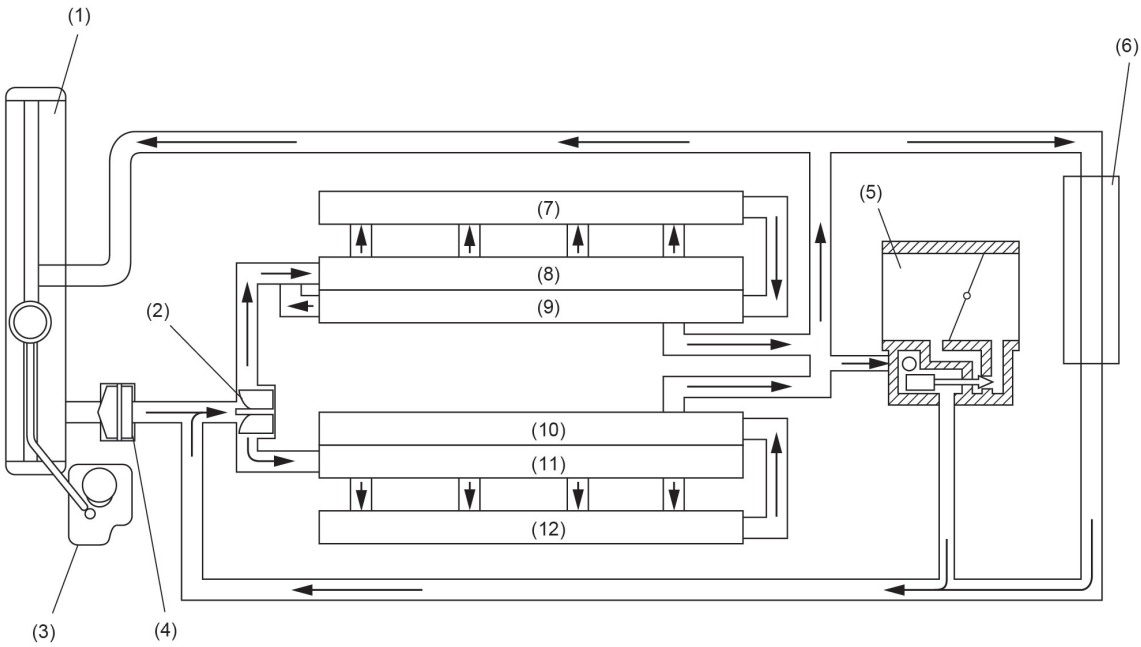
Compressor Clutch Assembly

During operation the mechanical power from the crankshaft pulley and accessory drive belt turns the idler pulley of the air conditioning compressor. The compressor itself will not function until the electrical circuit of the electromagnet coil has been established. The coil takes a small amount of time to become strong enough to pull the clutch flex plate into the idler pulley. As the clutch flex plate makes contact with the idler pulley, mechanical power from the engine begins to turn the air conditioning compressor. The compressor magnetic clutch is used to cycle the mechanical power on and off which allows for temperature control of the evaporator and air conditioning system protection for extreme low and high pressures.

Note: Some air conditioning systems are equipped with a compressor speed sensor that can determine if the accessory drive belt is too loose to operate the air conditioning compressor. If the speed of the compressor and the engine differ too much, the compressor clutch will be turned off.

NOTES:

Heating and Air Flow

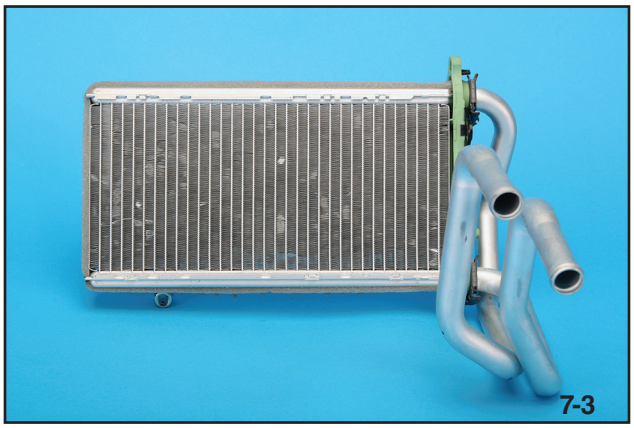


(1) Radiator
(2) Water pump
(3) Engine coolant reservoir tank
(4) Thermostat
(5) Throttle body
(6) Heater core
(7) Cylinder head RH
(8) Cylinder jacket RH
(9) Cylinder block RH
(10) Cylinder block LH
(11) Cylinder jacket LH
(12) Cylinder head LH

7-2

Engine Coolant Circuit

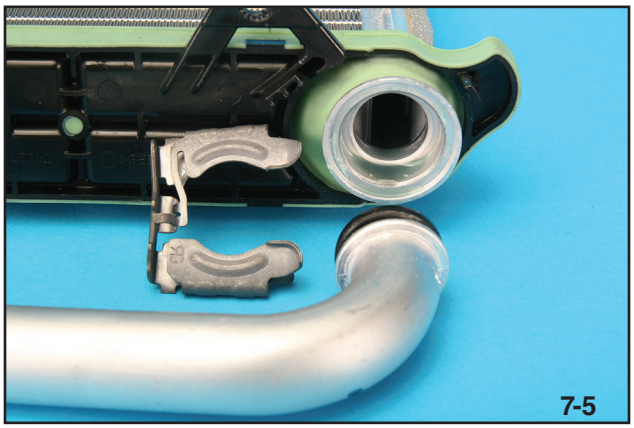
The engine is the heat source for passenger compartment heating. Engine coolant circulates through the engine cooling system, which includes the heater core. The heater core is located inside the heating and cooling unit and is positioned to allow air to flow around the heat exchanging rows of the heater core.



Heater Core

Heater Core Pipes

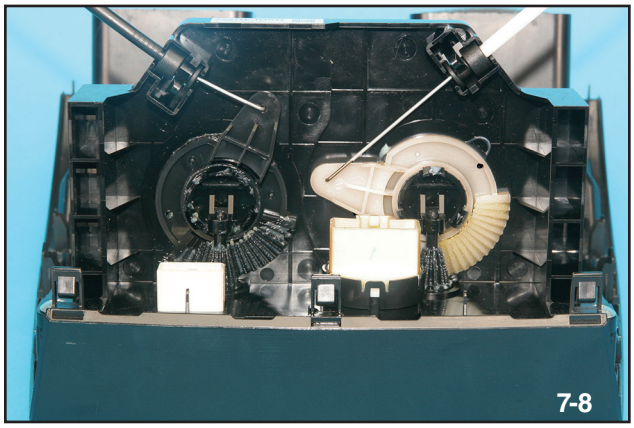
Heat always flows from a warm place to a cooler place. As the air flows around the heater core, heat is absorbed by the cooler air and enters the passenger compartment. Note: Some Subaru vehicles have heater core inlet and outlet pipes that are positioned higher in the vehicle than the radiator cap. This can lead to the formation of air pockets that can reduce or eliminate proper coolant flow through the heater core. Always follow the proper procedure for adjusting the engine coolant level.



Heater Core Pipe Retaining Clips

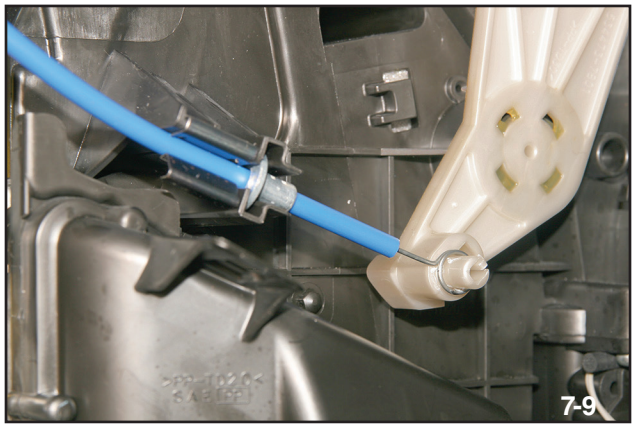
Heater Hoses

A/C Control Panel

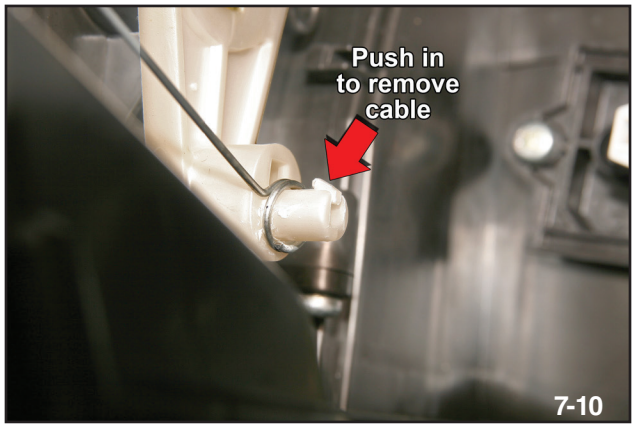


Rear View of Control Panel

The amount of air and the air flow direction is determined by the setting on the control panel. A temperature control cable connected to a set of gears and levers on the heating and cooling unit controls the amount of air that is allowed to flow into the heater core. A mode setting cable connected to another set of gears and levers determines which direction or vent the air flows from into the passenger compartment.

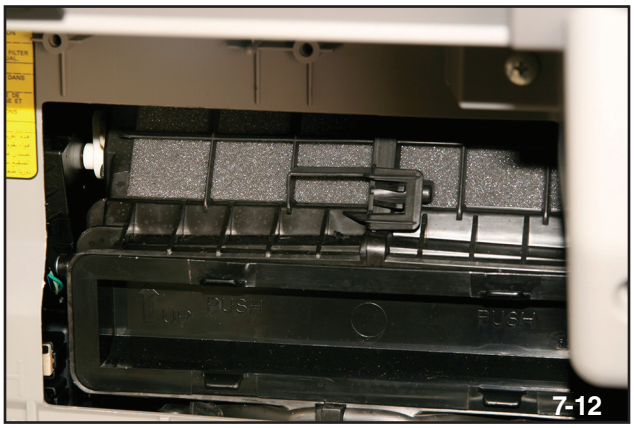


Temperature Control Cable

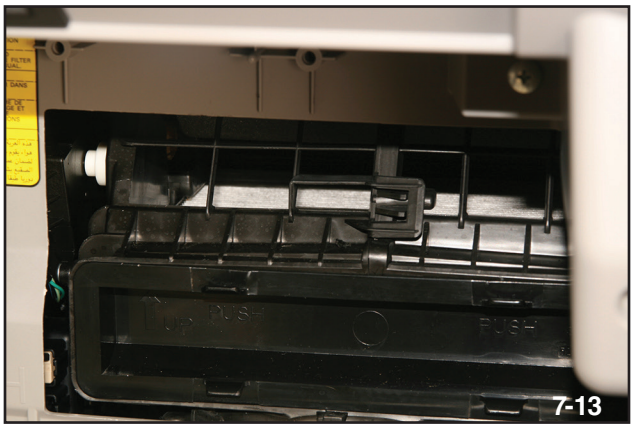


Cable Stay Catch

Heating and Cooling Unit



Fresh Air



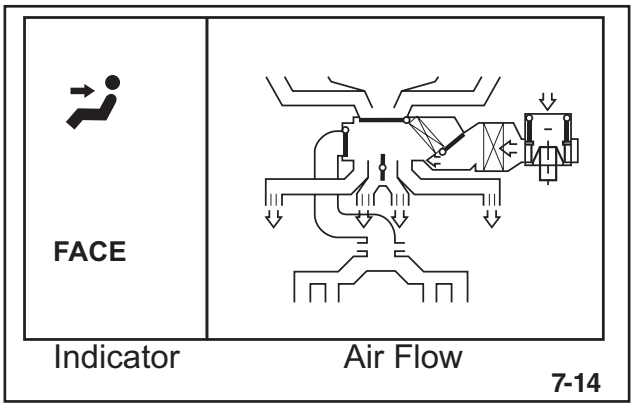
Recirculation

The fresh or recirculated air setting on the control panel allows the control of circulating air that is already in the passenger compartment to re-enter the heating and cooling unit or to allow air from outside the vehicle into the passenger compartment. Front defogger operation always uses fresh air. The fresh air assits with equalizing the condition of the air on the inside and outside of vehicle. This will reduce the moisture absorbing effect on vehicle glass surfaces.

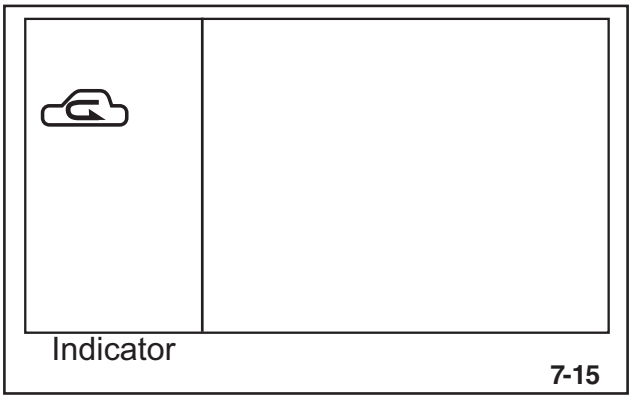
NOTES:

DESIGN FEATURES FOR EACH AIR FLOW MODE

Ventilation (FACE) mode



Face Mode



Fresh / Recirc

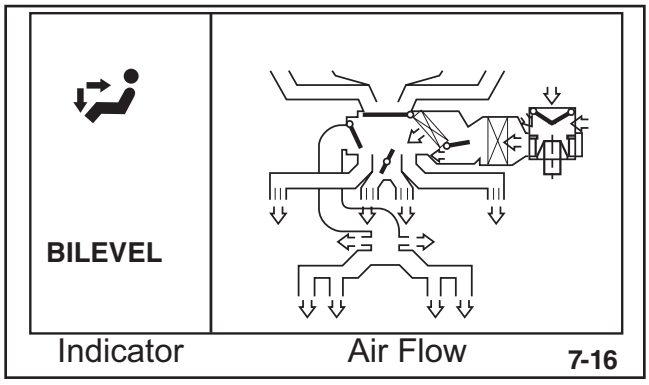
FRESH/RECIRC allows selecting either cabin-air-recirculation or fresh-air-introduction modes.

FRESH/RECIRC is changed each time the switch is pressed.

Indicator ON: cabin air recirculation

Indicator OFF: fresh air introduction

When the air temperature is adjusted, heated air is blown at right angles against the flow of cool air from the evaporator. This allows the air to mix thoroughly.

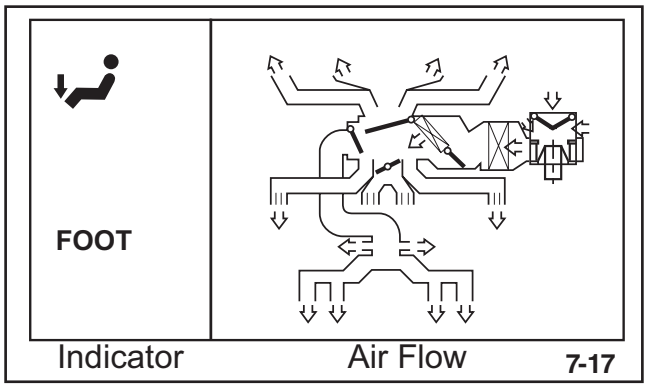


BILEVEL

Foot/face (BILEVEL) mode

The air that has blown through the evaporator is divided into two directions. Part of this air flows through the heater core and becomes warm air. The remainder of the air goes to the outlet as cool air; however, this is mixed with the warm air from the heater core. The mixed air then flows to the ventilation and heater ducts.

Heating (FOOT) mode

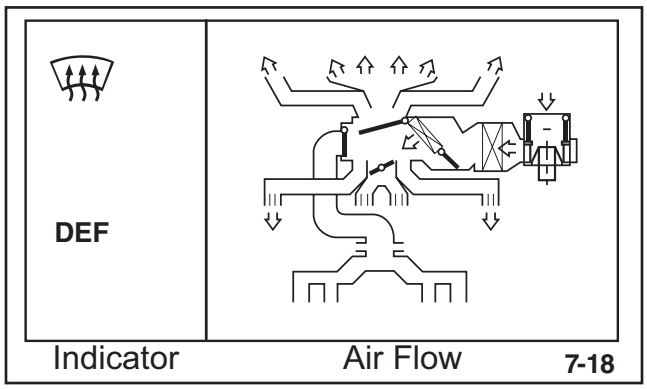


FOOT

The air that has blown through the evaporator is heated at the heater core and then flows to the heater ducts.

To defog the windshield, the defroster door is slightly open and warm air is sent to the defroster (DEF) duct.

The side ventilation grills ventilate air always.



DEF

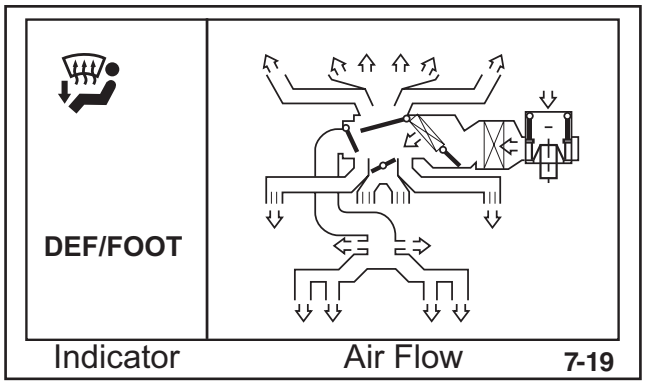
Defroster (DEF) mode

Air passages are designed in such a way that air flow resistance is minimized and defrosting performance is maximized.

The air passages toward the defroster (DEF) outlet are long enough to ensure equal airflow rates at all defroster outlets.

The side ventilation grills ventilate air always.

Defroster (DEF) /Heating (FOOT) mode



DEF / FOOT

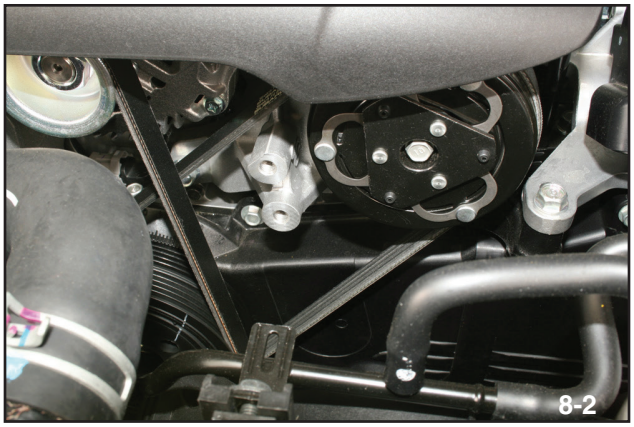
The air from the evaporator flows through the heater core and the warmed air flows to the defroster (DEF) duct and foot duct to defog the windshield while sending warm air to the legs.

The air directed to the defroster duct flows out from the front and side defroster ducts to defog the windows.

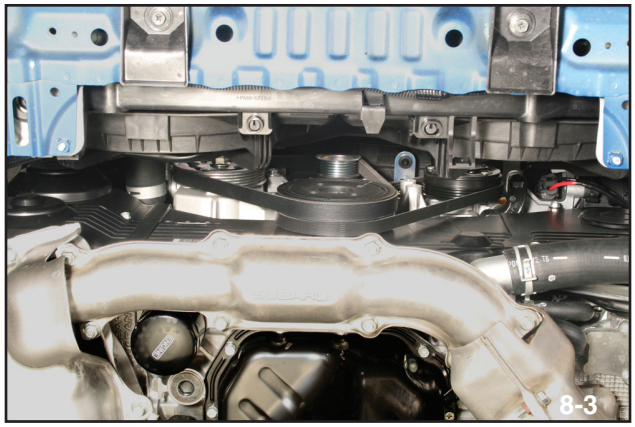
The side ventilation grills ventilate air always.

2.5 Liter Air Conditioning Stretch Belt (2008 to Present)

The air conditioning compressor drive belt is a new stretch type belt. It is designed to be installed to the vehicle only once and must be replaced if it is ever removed. The use of this type belt makes it unnecessary to use a belt tensioner.



Air Conditioning Compressor Belt front View



Air Conditioning Compressor Belt from under car

WRX Engine

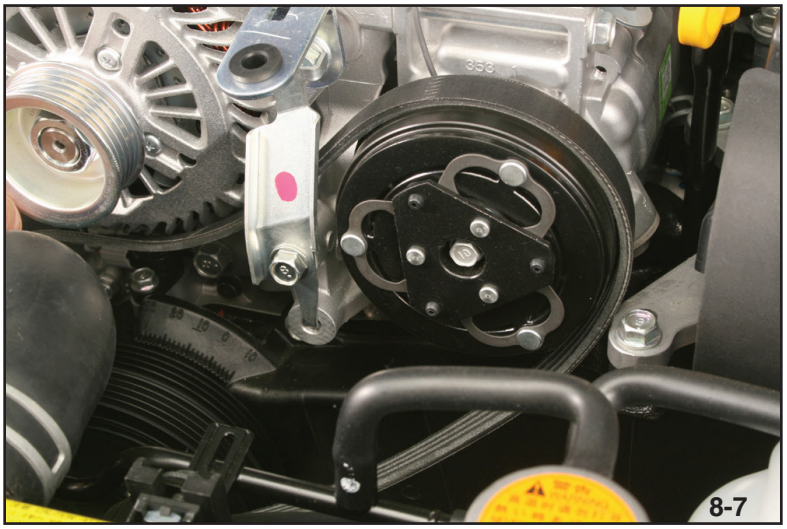
Sedan Engine

Servicing of the belt requires removing of the alternator/power steering belt (this belt has a tensioner) and then cutting the old air conditioner compressor drive belt with wire cutters of a similar tool. (Applicable to both Naturally Aspirated and Turbo models)

Note: Also equipped on some Forester models.

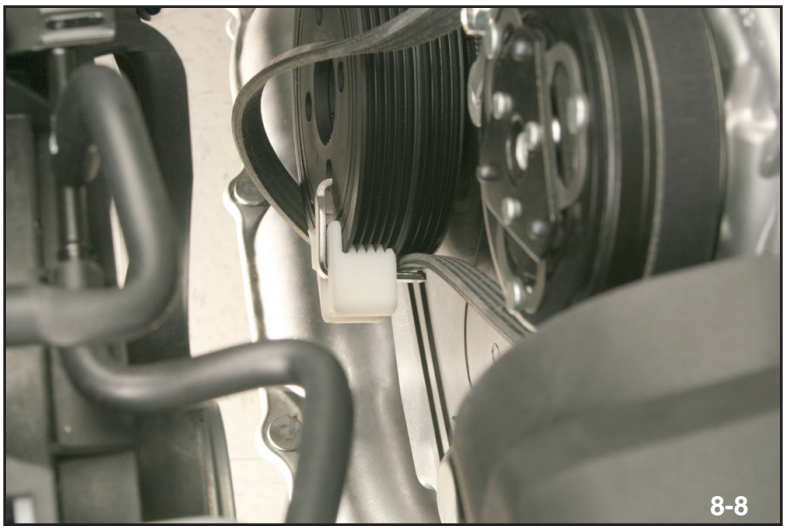
Cutting off Air Conditioning Compressor Belt

The new belt is packaged with the tool needed to install the belt. This tool is designed to be used only once and can be discarded after belt installation.



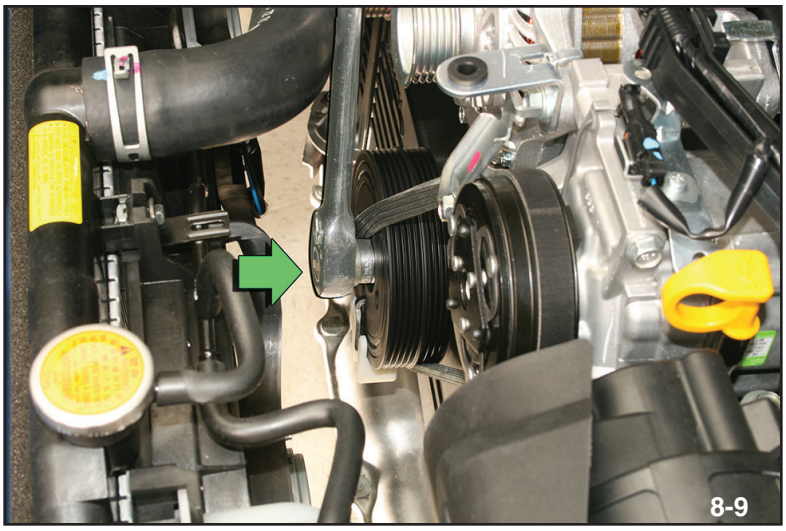
Upper Belt Guide in position

Begin belt installation by routing the new belt around the compressor pulley. Install the upper belt guide with the packaged bolt. Ensure the positioning tab of the upper belt guide is inserted into the lower hole.



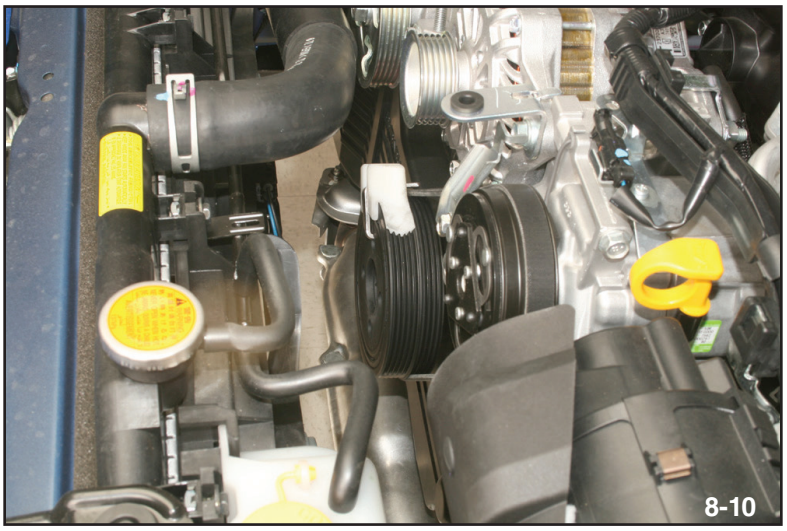
Lower Belt Guide in place with Retaining Clip

Next position the lower belt guide on the crankshaft pulley. The grooves on the bottom of the lower belt guide must rest in the grooves of the crankshaft pulley. The metal retaining clip is then inserted into one of the holes on the front side of the crankshaft pulley. The retaining clip has a short and long side. The longer side is placed over the lower belt guide and over the belt.



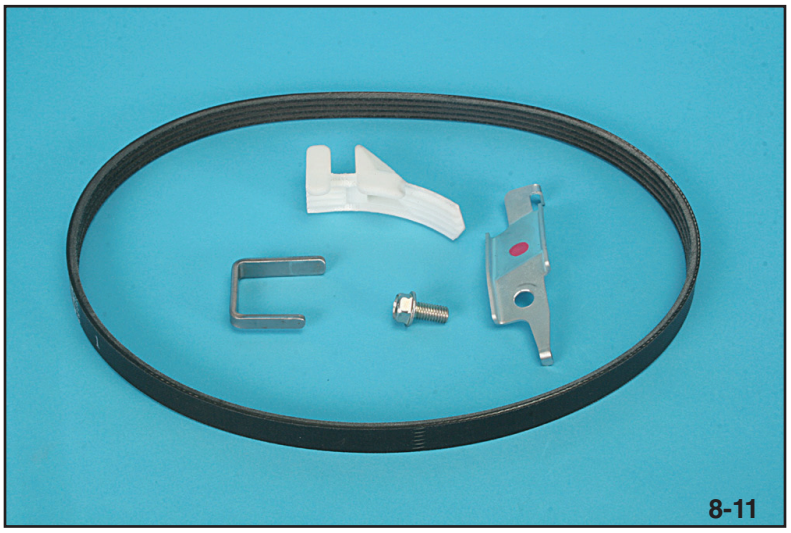
22mm Socket and Ratchet in place

Rotate the crankshaft pulley with a 22mm socket and ratchet until the belt is fully engaged with the grooves on the crankshaft pulley.



Belt Fully Engaged on Crankshaft Pulley

Confirm belt is fully engaged on both pulleys, and remove upper belt guide.



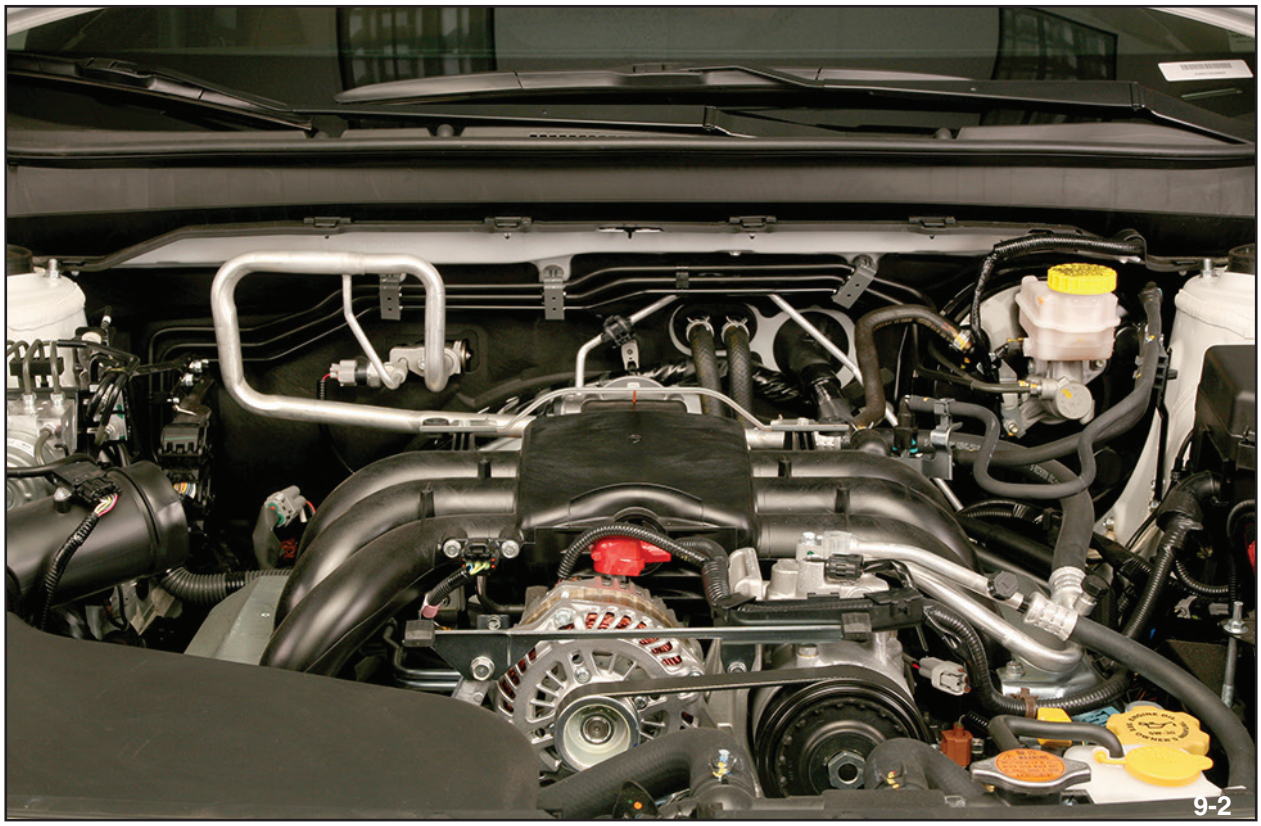
Air Conditioning Compressor Belt Kit

Note: Do not operate vehicles with Clutch-less Compressor when there is no Refrigerant or vacuum is present as this will result in low oil flow.

HFO-1234yf Air Conditioning

Introduction

Beginning with the 2017 model year, certain Subaru vehicles will be equipped with a new air conditioning refrigerant. The new refrigerant, HFO-1234yf has been selected due to its low Global Warming Potential (GWP), pressure characteristics and thermodynamic properties.



New Air Conditioning Hose

The effect of HFO-1234yf on the atmosphere is 97% less than HFC-134a, giving it a GWP of 4 (HFC-134a has a GWP of 1,430).

The new refrigerant has been industry tested and proven to be a high quality refrigerant and a logical replacement for HFC-134a.

Note: All 2017 Legacy and Outback models will be equipped with HFO-1234yf.

WARNING: HFO-1234YF IS LABELED FLAMMABLE. DO NOT EXPOSE HFO-1234YF TO AN OPEN FLAME, IGNITION AND BURNING WILL OCCUR.

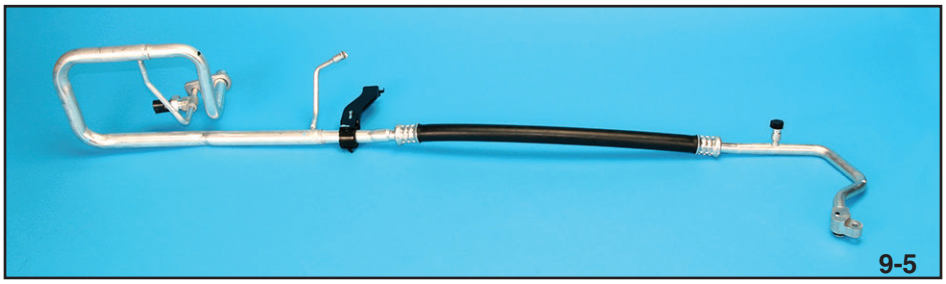
HFO-1234yf Shipping Box

D.O.T. Identification

HFO-1234yf has a very high auto-ignition temperature of 760° degrees Fahrenheit. This means that the new refrigerant will not ignite and burn when sprayed onto a metallic surface of 759° degrees Fahrenheit or less where no flame exists. Engine oil, brake fluid, anti-freeze, and many other usual vehicle liquids in the engine compartment, all have a lower auto-ignition temperature than HFO-1234yf.

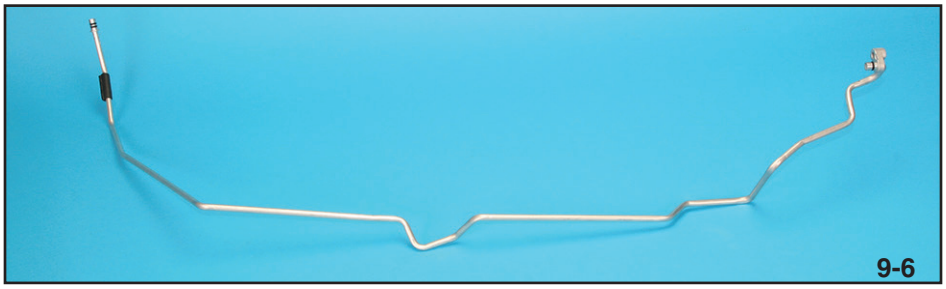
Readers Note: All references to the "low pressure side" in this Technician Reference Booklet are referring to the suction side of the refrigerant system. All references to the "high pressure side" are referring to the discharge side of the refrigerant system.

HFO-1234yf has approximately 5% less cooling efficiency than HFC-134a as a refrigerant. To compensate for this a new air conditioning hose and line are used that allow the returning low pressure gas refrigerant from the evaporator to cool down the warm liquid refrigerant of the high pressure hose before it enters the expansion valve. This new hose/line set is called a Sub Cooler Accelerator (SCX).



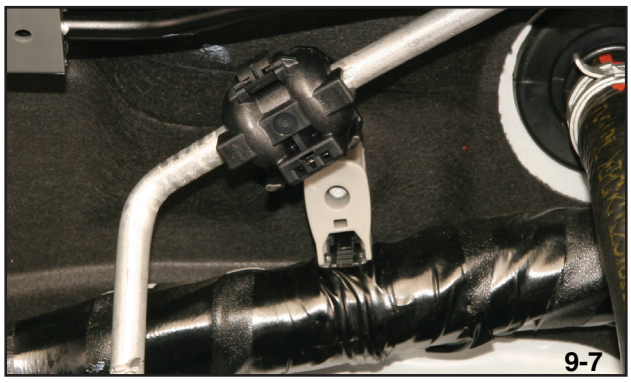
Sub Cooler Accelerator (SCX)

The SCX is constructed with a high pressure hose inlet, non-serviceable pressure switch, high pressure hose outlet, low pressure inlet, and low pressure outlet. The low pressure outlet connects to the low pressure connection at the compressor. The low pressure inlet connects to the outlet side of the expansion valve.



High Pressure Line

The high pressure hose outlet of the SCX is connected to the inlet side of the expansion valve. The high pressure inlet is connected to the condenser high pressure line through the use of a re-usable quick connector.



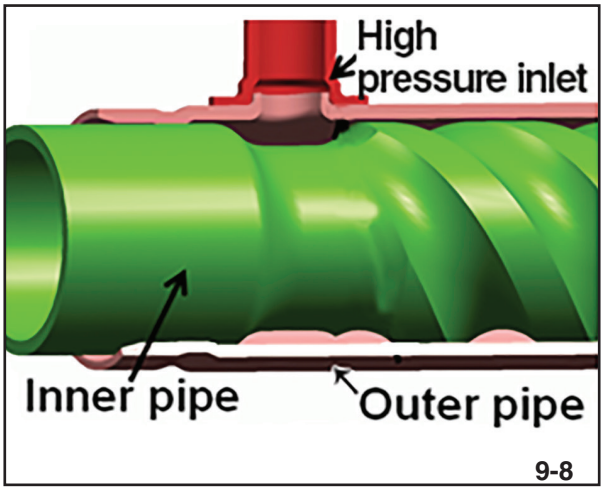
Quick Connector

Caution: Evacuate the A/C system. before removing the quick connector.

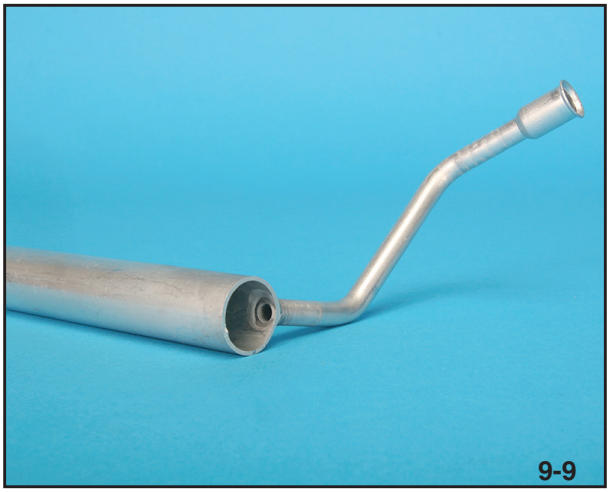
Note: Replace any O-ring exposed during diagnostic or repair procedures of the A/C system..

Sub Cooler Accelerator (SCX)

The SCX internal construction provides a heat exchange process by spiraling the warm refrigerant liquid from the condenser over the top of the returning refrigerant. This improves the efficiency of the refrigeration process by approximately 10 %.

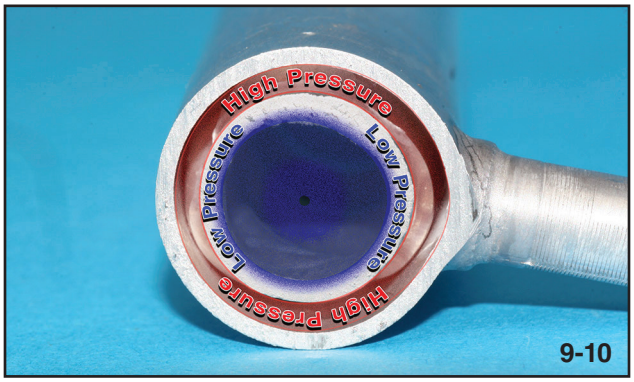


SCX Artwork

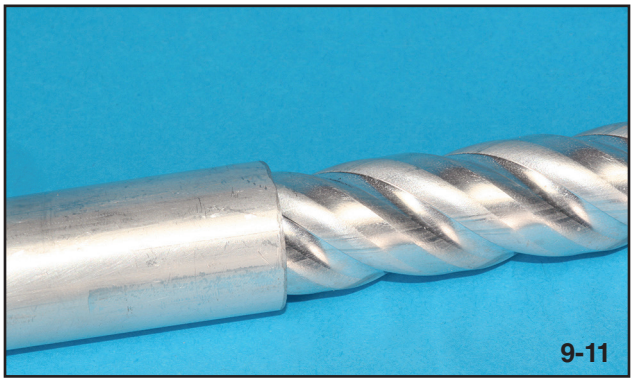


High Pressure Inlet

The use of the spirals provides more contact surface than a straight hose or pipe and promotes a better heat exchange between the high and low pressure.



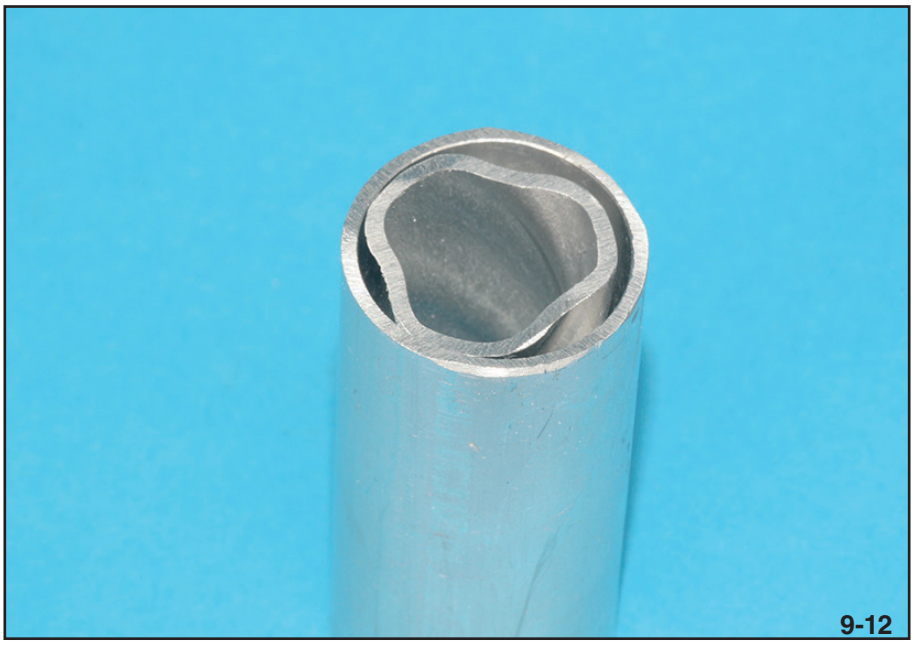
SCX Internal View



SCX Inner and Outer Pipes

The end of the SCX is brazed closed to separate the high and low pressure sides of the refrigerant system. **The end has been cut away for the pictures above**.

The warm high pressure liquid refrigerant enters the SCX and begins to flow around an inner pipe which is carrying low pressure gas refrigerant back to the compressor from the evaporator. By comparison, the low pressure gas refrigerant is cold and removes heat from the high pressure liquid refrigerant.



Heat Exchange Area

The heat exchange area of the SCX, between the inner and outer pipe, is a constricted space where debris may collect if a catastrophic failure of the compressor occurs. This would create problems with heat removal and normal refrigerant flow.

The high pressure outlet and the low pressure inlet side of the SCX are brazed closed to separate the two sides.

High Pressure Outlet and Low Pressure Inlet

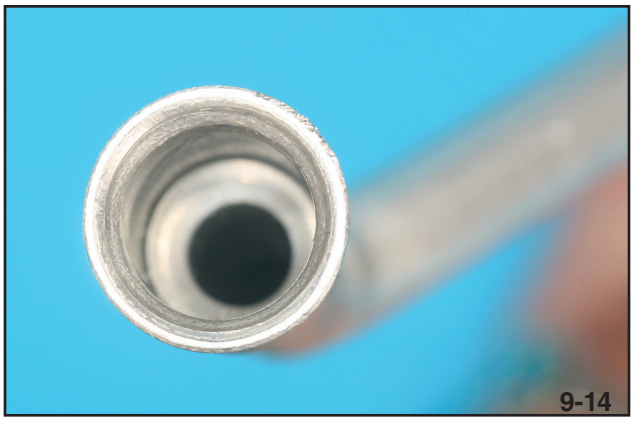
Note: The SCX pictured above has been cut for photography.

A failure of the pressure switch requires replacement of the SCX hose assembly.

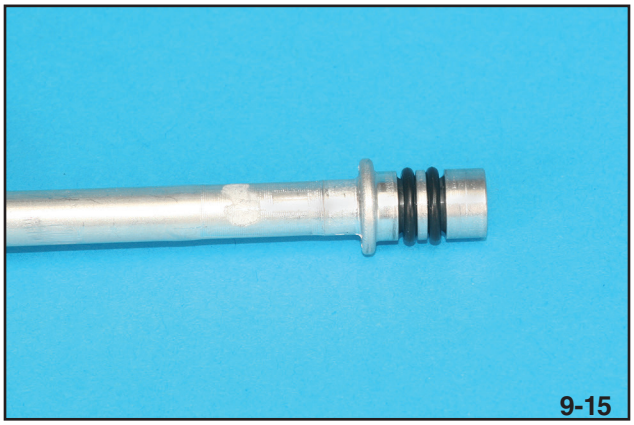
Quick Connector

The quick connector allows for the separation of the condenser high pressure line and the SCX. The high pressure inlet of the SCX is trumpet shaped to guide the end of the condenser high pressure line into place.

Note: The refrigerant must be evacuated from the air conditioning system before removing the quick connector.

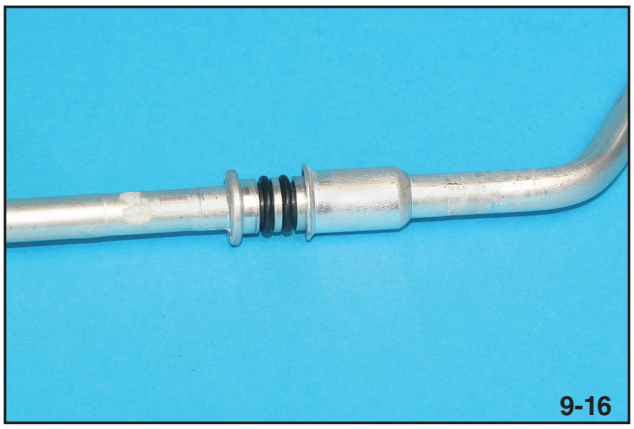


SCX High Pressure Inlet

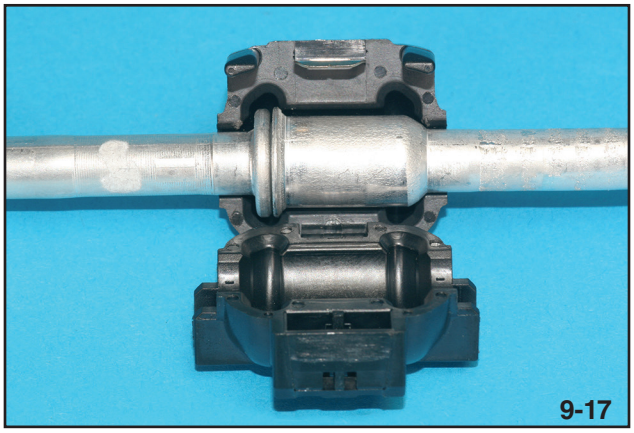


High Pressure O-rings

Two non-reusable O-rings seal the two pieces together. Lubricate new O-rings with the new refrigerant oil, ND-oil 12.



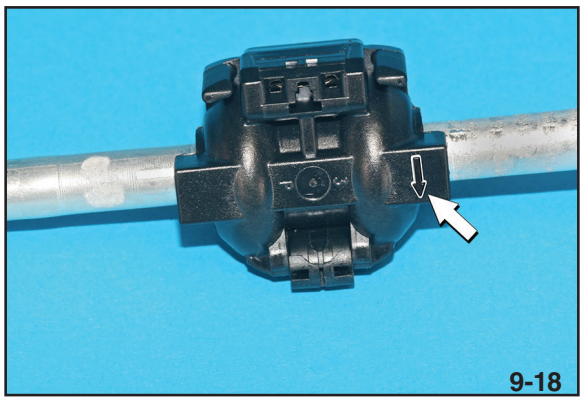
Seating O-rings



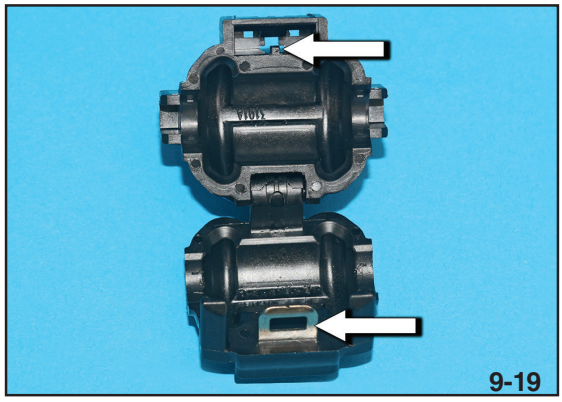
Positioning Quick Connector

The quick connector shape and locking mechanism prevent the two pieces from separating under pressure.

The quick connector is non-directional, however, an arrow is embossed on the engine compartment side of the quick connector that corresponds to the arrow printed on the label of the quick connector release tool.

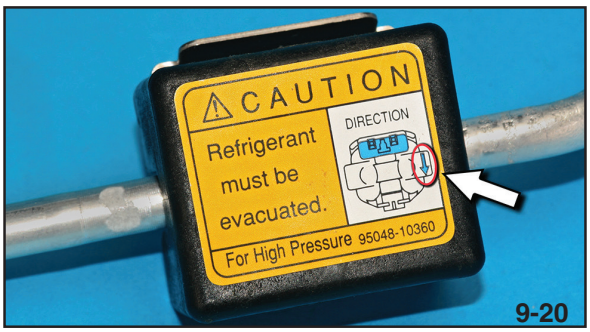


Quick Connector Latched

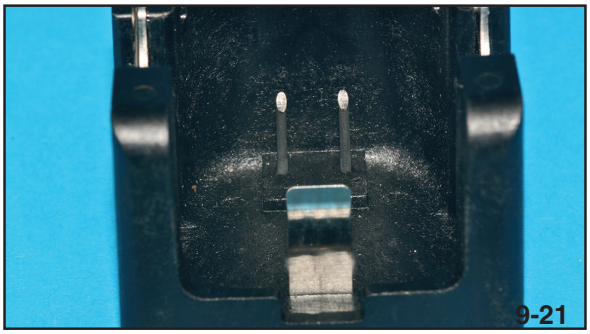


Quick Connector Latch

During latching of the quick connector during installation, the metal latch of the lower side as pictured, engages with the plastic locking tab of the upper half. During removal, the two metal pins of the quick connector release tool, protrude through the quick connector and lift the metal latch off the plastic locking tab.

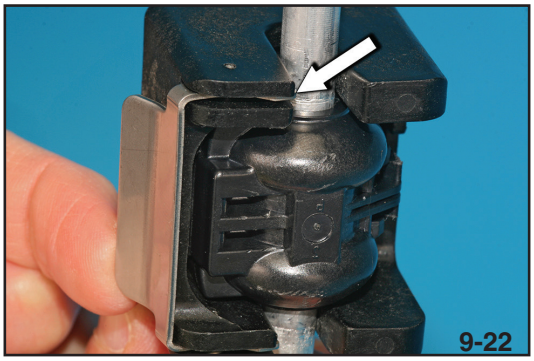


73499XA00A Release Tool



Release Tool Pins

The quick connector release tool must be fully seated into the quick connector before the metal latch is fully lifted off the plastic tab. This is accomplished with the metal seating lever.



Release Tool Seating Lever

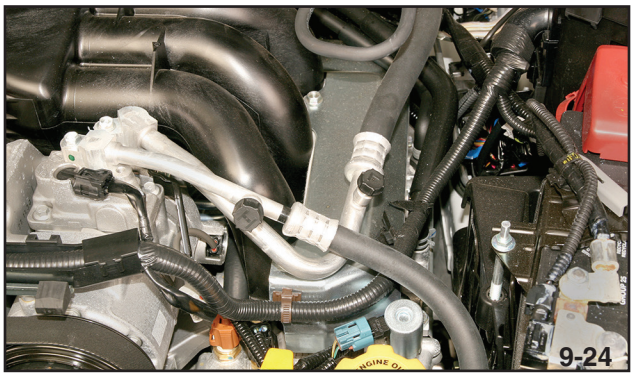
Refer to the Subaru Service Manual for more details on the operation of the quick connector release tool.

Air Conditioning Refrigeration Systems

Servicing

Servicing air conditioning systems using HFO-1234yf refrigerant requires new tools and oil. All refrigerant pressure gauge hoses for the new refrigerant are identified with a black stripe and marked with J2888 running down the length of the hose (the stripe may be intermittent).

Hose Identification



Service Ports

Note: Low pressure service port cap profile is very small. Do not drop cap when servicing the A/C system..

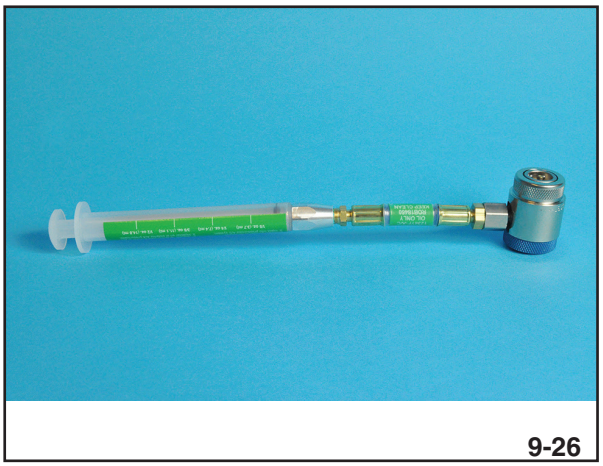
The low pressure hose will be blue with a black stripe and the high pressure hose will be red with a black stripe. The service ports have been changed and have a unique shape, and purpose built for HFO-1234yf. All HFO-1234yf refrigerant tanks are white with a red band.

The new refrigerant (HFO-1234yf) and new refrigerant oil (ND-Oil 12) will be available through the Subaru of America parts department. Consult the service manual for the correct amounts of oil to add during component replacement. A new tool, ROBINAIR® 18640 1234yf Oil Injector is available to add refrigerant oil to a charged system. Follow the instructions included with the tool for the correct procedure to add oil.

New Air Conditioning Recycling Machine

An HFO-1234yf recycling machine will become an essential tool for all retailers. The ROBINAIR® 1234-6 or equivalent must be in place in the retailer by July 1, 2016.

ROBINAIR® Refrigerants Recycling Machine



Oil Injector

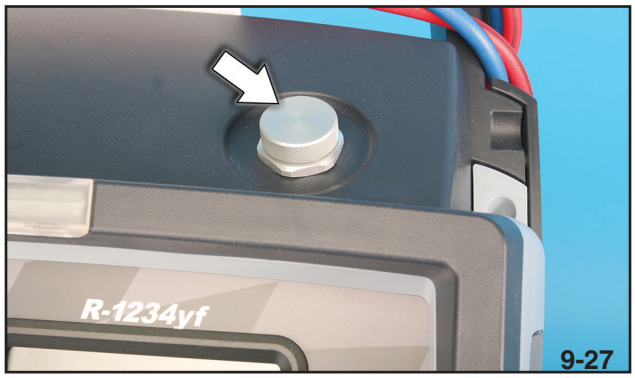
ROBINAIR® Model AC1234-6

This machine is designed and certified to SAE J2843 HFO-1234yf Recovery / Recycling / Recharging Equipment for Flammable Refrigerants for Mobile Air Conditioning Systems. The machine is designed to recover and recycle R1234yf refrigerant, evacuate air after the system has been open, and recharge refrigerant. The new regulations require that a refrigerant identifier be part of the equipment which prevents recycling or evacuation of contaminated refrigerant.

Read all instructions included with new machine before using.

IMPORTANT INFORMATION

Caution: The machine is programmed to run the setup procedure as outlined here. To prevent personal injury, DO NOT operate the machine without the oil fill port plug installed, because the vacuum pump is pressurized during normal operation.



Vacuum Pump Fill Port Plug

Vacuum Pump Oil Level Indicator

Check vacuum pump oil level before turning on the machine. Add oil only when the machine is off.

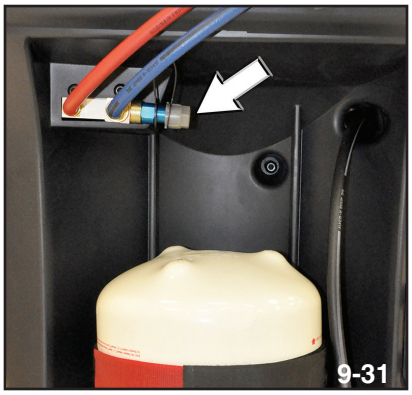
Note: The ROBINAIR® 1234-6 will identify the refrigerant of the vehicle being serviced during all procedures. This includes; diagnostic pressure checks, evacuation, and re-charging. The identification procedure cannot be circumvented. If contaminated refrigerant is detected, a separate evacuation machine and storage tank must be used to clear the ROBINAIR® 1234-6 and the subject vehicle.

HFO-134a & HFO-1234yf Infrared Leak Detector (22791)

Note: According to SAE J2913 a new leak detector is required for the new refrigerant. ROBINAIR 22791 is available to order through the normal Subaru tools program (Bosch). This leak detector detects HFO-1234yf and HFC-134a at the newly established leak parameters and chareteristics of the new refrigerant.

Note: HFO 1234yf must be at least 98% pure before the ROBINAIR® 1234-6 will recycle the refrigerant in a vehicle.

Contaminated Refrigerant Recovery Machine



Contaminated Refrigerant Recovery Machine Connection Port

Contaminated Refrigerant Recovery Tank

Note: Recovery tanks for contaminated refrigerant are gray with a black top.

Note: The ROBINAIR® 1234-6 will only fully charge the A/C system. after introducing a small charge (15% of total charge selected) that allows for manual and automatic leak checks. During this leak check cycle the temperature of the vehicle needs to be within 41 degrees Fahrenheit (5° degrees c) of the ROBINAIR® 1234-6. Temperature affects pressure. If the vehicle is colder than the machines temperature, the pressure may drop after the initial leak check charge and create a false result due to the dropping pressure. This would trigger a gross refrigerant leak indicator on the 1234-6 and stop the refrigerant charging procedure.

ROBINAIR® 1234-6 operational summary as follows:

1. Identification
2. Evacuation
3. Vacuum
4. Vacuum leak check
5. Leak check charge
6. Evacuation
7. Vacuum
8. Vacuum leak check
9. Full charge

This cycle of operation cannot be circumvented.

Registering the 1234-6

Register the Machine

When the Product Activation Screen appears on the display, follow on-screen prompts to register the machine.

1. Open a web browser on a personal computer. Enter the web address shown in the Activation Process screen on the AC 1234-6 machine.

   Enter your user name and password, and log into the website.

   If you are a first-time user, click the REGISTER button to create a user name and password.

2. On the AC 1234-6 machine, press ***OK***. The machine displays fields for the product activation key and an activation code.

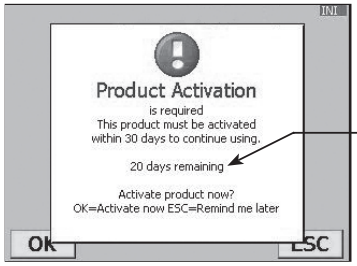
3. Enter the product activation key into the correct field on the web page. This generates an activation code.

4. Enter the activation code into the field on the AC 1234-6 display and press ***OK***.

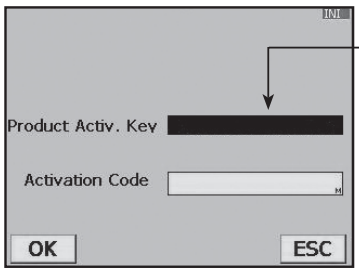
   Note: Capitalization is required.

5. Record the product activation key and code on a piece of paper and file it in a secure place.

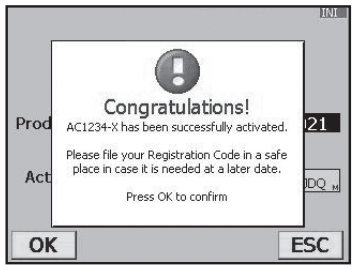
6. Press ***OK***. The AC1234-6 has been activated.



Failure to register and activate the AC1234-6 within 30 days of initial startup will cause the machine to lock out and no longer function.



The Product Activation Key will be displayed in this field.



9-33

Note: Alpha and numeric characters are entered on the display of the ROBINAIR® 1234-6 by using the keypad on the machine's front cover. Press a key one or multiple times until the number or letter (including upper or lower case) is displayed. Then wait a few seconds until the entry automatically sets. The next character can then be selected.

Pressures

The operating refrigerant pressures of vehicles equipped with HFO-1234yf are similar to those of current HFC-134a systems, however, certain operating characteristics may lead to incorrect diagnostics unless the following is understood.

- Hot or warm car idling low side pressure is higher due to the increased heat load from the SCX. Comparison tests resulted in the following: HFC-134a 30 to 35 p.s.i. and HFO-1234yf 35 to 40 p.s.i..

  Identical vehicle platforms were used for the testing at the same time, parked side by side.

- High speed radiator fan operating time for high refrigerant pressures is greatly reduced due to the use of the SCX. The high side pressure is reduced by the cooling effect of the SCX and the radiator fans pulling air through the condenser. (High side Pressures will rise and fall faster on a hot or warm car).

- Equalization time of the low and high sides of the refrigerant system, after the engine is turned off, is greatly reduced due to the SCX. The cooling effect of the SCX reduces the temperature of the high side liquid refrigerant and heats up the cooler low side gas refrigerant. The interaction of the two sides equalizes the pressures much faster than the current HFC-134a system.

2017 Impreza Air Conditioning

The 2017 Impreza will have two air conditioning systems available. Both systems utilize R-134a refrigerant. The Manual Air Conditioning system is equipped with a Scroll Compressor and the Automatic Air Conditioning system is equipped with a clutch-less Variable Displacement Compressor.

Variable Displacement Compressor

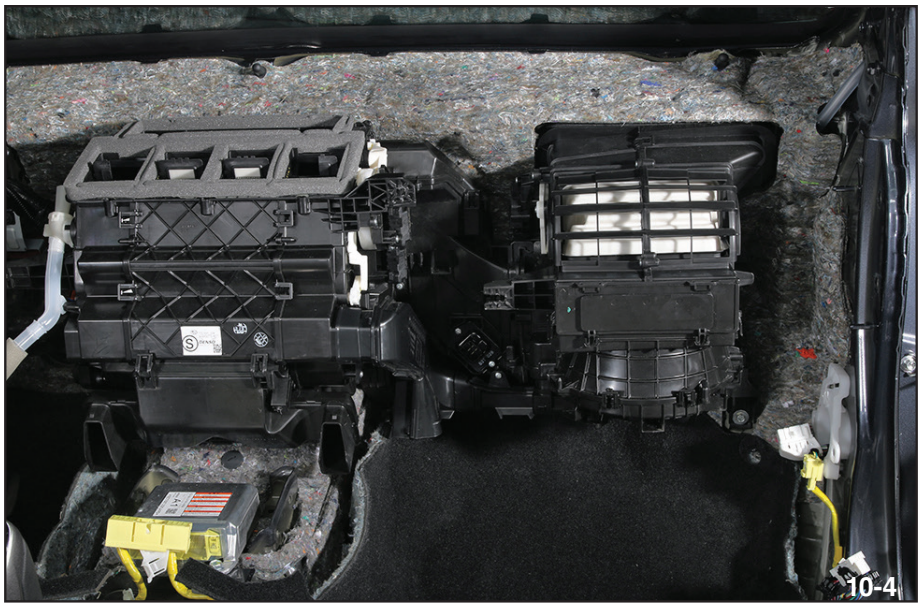
Air Conditioning Label (Auto A/C Model)

Diagnostics through the Subaru Select Monitor are available for the Automatic Air Conditioning system.

Note: The Automatic Air Conditioning system compressor control is the same as the current Legacy and Outback.

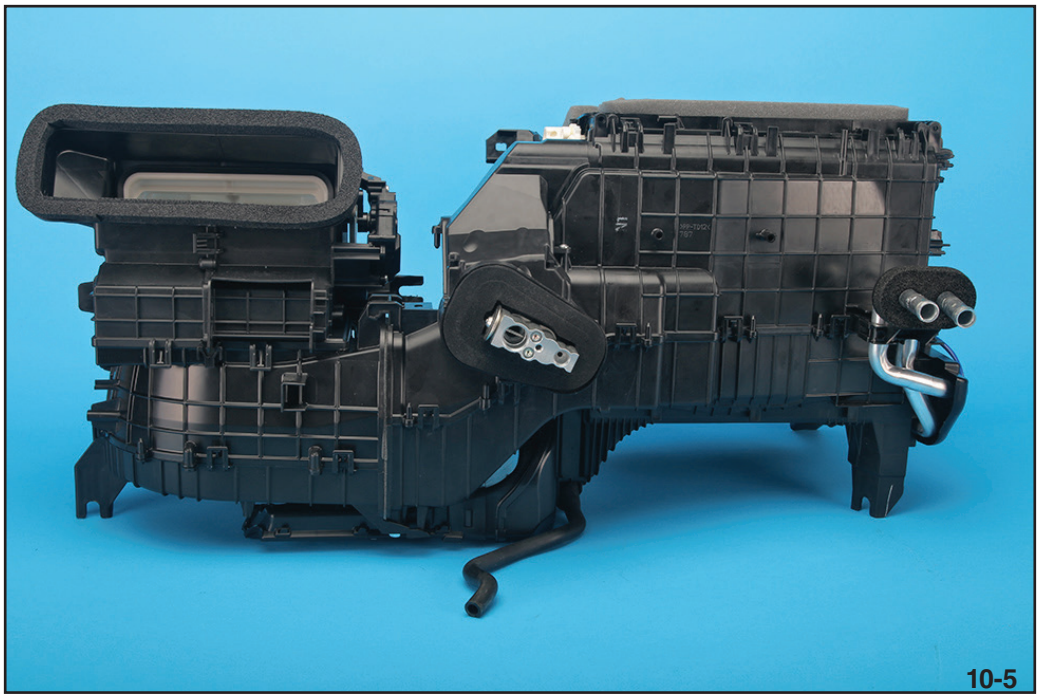
Note: Check the Owner's Manual for a list of new voice recognition commands on vehicles equipped with the new Generation 3 head unit.

The heater box and blower motor housing and vent layout for the new Impreza provides optimum air temperature control and air distribution.



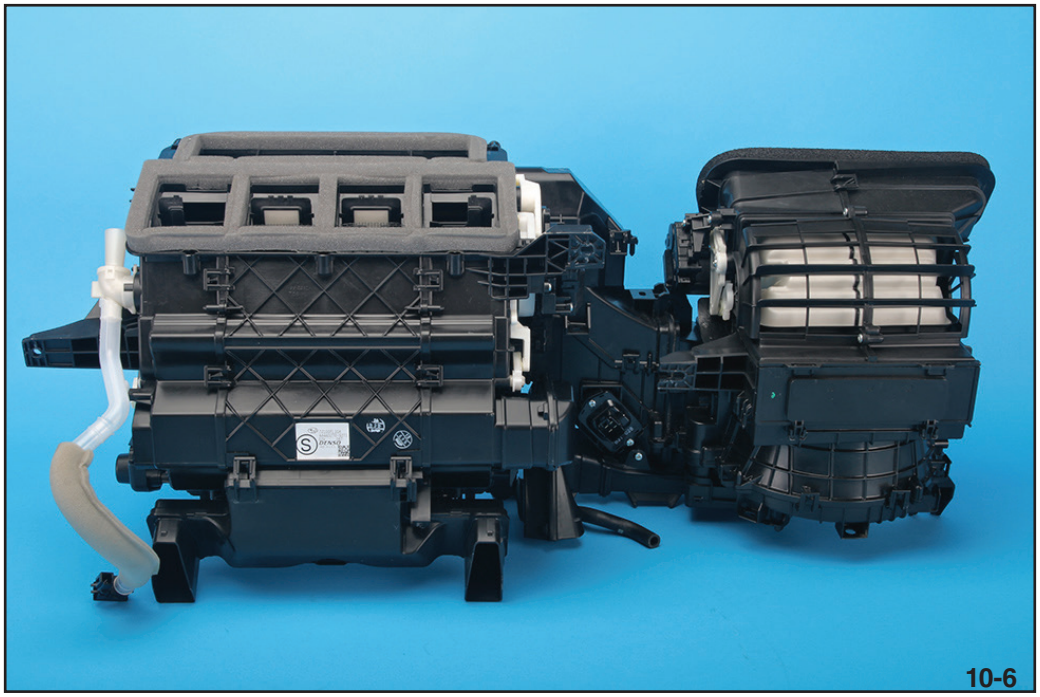
Heater Box and Blower Motor Housing Assembly

The new interior design of the Impreza makes it necessary to remove the dash and steering support beam before the heater core or air conditioning evaporator can be removed from the vehicle.



Heater Box and Blower Motor Housing Assembly Bulkhead View

Consult the Service Manual before performing any work on these components.



Heater Box and Blower Motor Housing Assembly Passenger Compartment View

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