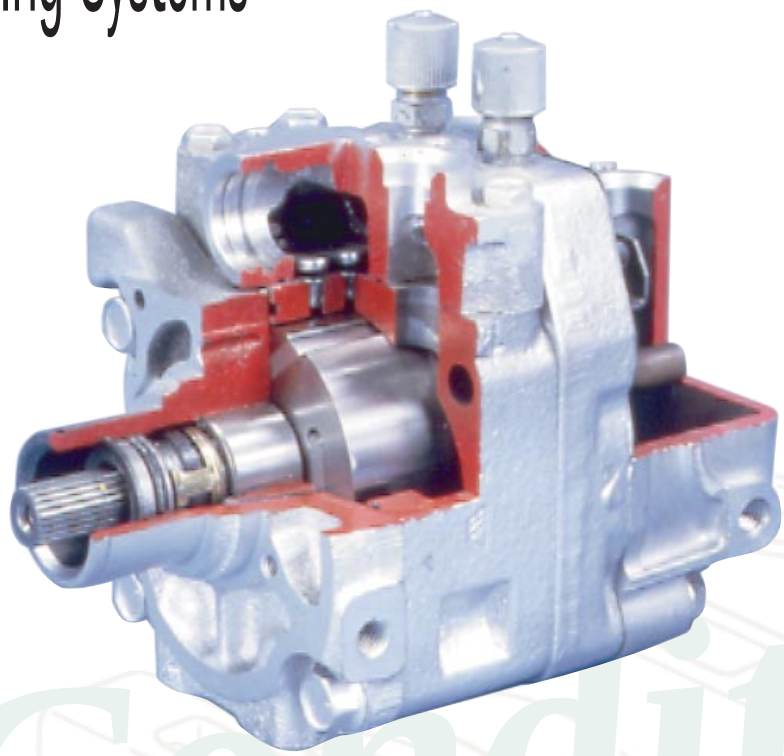
Subaru Air Conditioning Systems



Over the years, Subaru air conditioning systems have taken many different shapes and sizes, from full manual, cable and vacuum-controlled systems like those found on Loyale models, to the fully automatic electronically controlled systems employed by the SVX and some Legacy models. Because of this great diversity in Subaru air conditioning systems, it would be impossible to tell you everything there is to know about every single Subaru air conditioning system in this edition of *The End Wrench.*

Introduction

What we will do instead is to give you a cross-section summary of recent Subaru air conditioning systems. We'll show you what's unique and different about each system, and describe the best troubleshooting and repair strategies for these systems.

In compliance with government requirements, all Subaru vehicles manufactured within the past few years are equipped with R-134a air conditioning systems. But there are still a large percentage of Subaru vehicles on the road with R-12 refrigerant in their A/C sytems. We'll explain how to safely handle R-12 and R-134a refrigerants, and we'll also explain your repair and retrofit options when a Subaru equipped with an R-12 air conditioning system comes to your shop for repairs.

Air Flow System

The purpose of the air flow system is to provide air to the heating, ventilation, defroster, and air conditioning systems.

Control of the air flow is accomplished by four types of systems which are Subaru model specific:

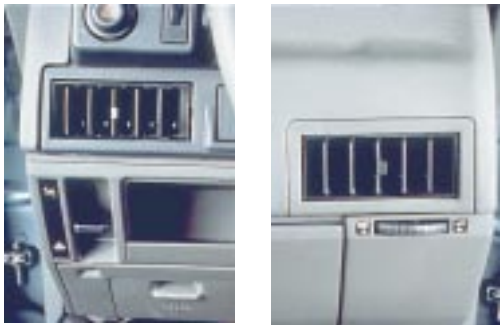
1. Manual cable - Justy
2. Manual cable / vacuum -Loyale
3. Manual cable / electric - Legacy, Impreza, and XT
4. Automatic electric - SVX

The mode selector controls the routing of air to the defroster, heater core, air conditioning evaporator, and the outlet ducts. The temperature control lever adjusts the temperature of the air admitted to the passenger compartment and regulates the flow of air through the heater core via the air mix doors. The fan switch controls the speed of the fan and thus the volume of air that flows through the evaporator and heater cores.

Loyale vehicles have vent control levers which are not a part of the mode selector switch. These are manually adjusted by the driver and passenger to admit or restrict the flow of outside air through side vent outlets.

The Legacy and the Impreza have eight position mode panels while the Loyale and XT have six button panels. The additional VENT mode supplies outside air to the passenger compartment through the dash vents. The flow of vent air may be increased by using the fan, and heated by increasing the temperature control setting. The DEF / HEAT mode switches the A / C compressor ON and supplies air flow to the defrost and floor outlets. The remaining mode switches operate similar to other Subaru A / C system controls.

The air flow unit used on Legacy vehicles equipped with manual A / C systems is similar to the unit used on Automatic Climate Control equipped vehicles.



"L" Series Air Flow System Controls

Vent Switches

Legacy/Impreza Mode Panel

Loyale Vacuum System (Mode Control)

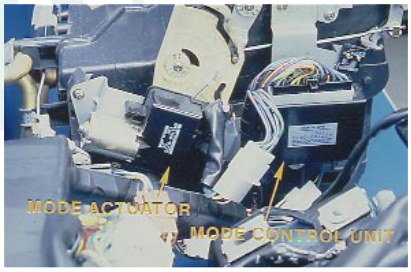
Only Loyale vehicles use a manually actuated vacuum operated system to control the position of the mode and circulation shutter actuators.

The vacuum system operates the air flow shutters in all Loyale vehicles. Check vacuum to the shutter actuators if the defroster, floor vents, or fresh air vents do not operate properly. The vacuum system also provides vacuum to the FICD diaphragm based upon FICD solenoid signal, if so equipped.

XT Mode Control System

In XT vehicles, the electrical mode control system operates the various mode shutters and doors.

Electric motors control the operation of the air flow shutters in the XT. The motors operate the shutter actuators through a gear drive and linkage assembly. If the flow of air through the defroster, floor vents, or other vents is insufficient, check operation of the shutter actuators and switches.



Electrical System Operation

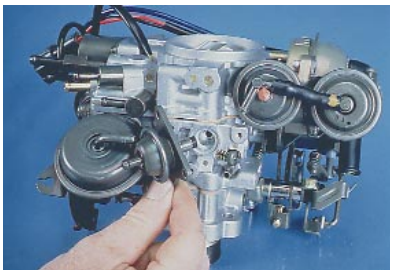
A/C Cut System

This system is installed on many 1987 and later model year automatic transaxle equipped Subaru vehicles. The purpose of the A / C cut system is to improve engine performance during full throttle acceleration. Refer to the chart to determine component application for the various models listed.

Note: All sequential MFI equipped vehicles feature A/C cut systems.

			Components						
Model	Fuel System	Trans	A/C Cut Unit	K/D SW.	K/D Relay	A/C Cut Relay	ECM	TPS	Map
XT / XT6 / "L"	MFI	4EAT				●	●	●	
"L"	MFI TBI	3AT			●	●	●	●	
Legacy SVX Justy Impreza	MFI	ALL				●	●	●	
Justy	Carb	ECVT				●	●		
"L" / HB	Carb	3AT	●	●					●

A/C Cut System



Bypass Adjusting Screw
(ECVT)

Fast Idle Control Device (A/C Idle Air Control)

On manual transaxle equipped Justy vehicles, the FICD is incorporated in the idle-up system. Proper adjustment and operation is outlined in Service Bulletins 02-70-89 and 02-72-89.

On ECVT equipped carbureted vehicles an air/fuel bypass control system performs the FICD function. The ECVT air bypass control system consists of an air bypass valve, an adjusting screw, and an air bypass solenoid. The system is designed to increase idle speed whenever the A/C relay is activated by supplying additional air/fuel into the intake manifold.

Bypass air enters through the air horn on the secondary side.

The airflow is regulated by an adjusting screw. When the bypass valve opens, bypass air/fuel enters the manifold below the secondary throttle plate.

When the adjusting screw is turned clockwise, bypass air/fuel is reduced and the idle speed is lowered. When the adjusting screw is turned counter clockwise, bypass air/fuel is increased and the idle speed is increased.

Note: Always refer to the appropriate Justy model year Subaru Service Manual sections 2-2 and 2-6 for the proper ECVT FICD adjustment procedures and specifications.

TBI system equipped Loyale vehicles control the FICD function through the ECM, the idle air control valve (IAC), and the A/C switch. The air conditioning ON/OFF switch is an input to the ECM. The ECM operates the idle air control valve (IAC) to adjust the idle speed to compensate for the increased compressor load. No adjustment is required.

On all model year Loyale and XT MFI vehicles, an FICD solenoid incorporated in the throttle body provides the increase in idle speed. The throttle body includes an adjustment screw for adjusting the FICD specification.

All Legacy, SVX and XT6 vehicles use an idle air control valve to provide the FICD function. The valve opens a port during A/C operation which admits additional air into the induction system.

Impreza vehicles use a solenoid which initially compensates for the increased compressor load when the air conditioning system is switched ON. The A/C IAC then compensates to maintain engine speed at target RPM.

Note: The Impreza FICD solenoid is set at the factory and should not require adjustment. Any changes to the adjustment can affect driveability and vehicle emissions during cold engine operation.

Justy MFI vehicles increase idle speed by admitting additional air into the air collector assembly through the FICD solenoid which is opened by a signal from the MFI control unit.

TBI (IAC)

MFI/TBI FICD Operation

A/C Idle Air Systems

Impreza FICD

Troubleshooting and Servicing

Six Step Troubleshooting

The following six step method of troubleshooting will save time and effort in the diagnosis and analysis of air conditioning problems. It provides a logical approach to solving the problem, not just treating the symptoms. The steps are as follows:

1. *Verify the problem (Operational check)*
   Check that the problem does exist.
   Are components inoperable or malfunctioning?
2. *Determine related symptoms (Operational check)*
   Identify other symptoms that exist.
   Are other circuits and components affected?
   Do the related symptoms always occur with the primary symptom?
3. *Isolate the problem*
   Use the split half technique, the wiring diagrams, the troubleshooting trees, appropriate model year service manuals, and manufacturer's manuals to locate the problem.
4. *Identify the cause of the problem*
   Is a circuit grounded?
   Proper vacuum not available?
   Belt alignment and / or tension improperly adjusted, or is a component defective?
5. *Repair and/or replace*
   Defective wiring, vacuum lines, and components as required.
   Confirm proper adjustment of components as required.
6. *Verify operation*
   Check the system to verify that the problem has been solved.
   Ensure that all system components operate properly under standard operating conditions according to technical specifications.
   Also check related systems for proper operation.

Quick Touch Method

An important step in troubleshooting air conditioning systems is to use the quick touch method. Very briefly touch the components and tubing on the high side and the low side of the system. High side components should feel warm or hot to touch, while the low side components should feel cool to the touch. Exercise caution when performing this procedure on high side of the system. The tubing and components may be hot enough to cause minor burns. Do not touch or hold for extended periods of time.

Note: If a component on the high side of the system located before the Thermal Expansion Valve is cool or cold, this is an indication of a restriction.

Quick Touch Method

Servicing

Manifold Gauges

The manifold gauges measure the pressures of the low side or suction side and the high side or discharge side of the system. The gauges are calibrated in "psi for pressure" and "inches of mercury for vacuum". Note that zero (0) psi is equal to sea level or 14.7 psi, or the pressure at the altitude level at which the gauge is being used.

The gauge set consists of the valve body, the connectors for the low pressure, charge or evacuation, and high pressure hoses, and the gauges. The service valves are infinitely adjustable between fully open and fully closed.


Manifold Gauges

To connect the manifold gauge set to the system:

1. Fully close both of the manifold valves.
2. Remove the compressor service valve caps.
3. Connect the high and low pressure hoses to the service valves.

Note: Some refrigerant gas will be discharged as the hoses are connected to the service valves. This is normal, however, you should attempt to connect the hoses as quickly as possible to prevent excess refrigerant loss and air from entering the system.

Note: Start vehicle engine and follow the directions concerning idle speed, etc., contained in the appropriate model year Subaru Service Manual.

Note: Federal Law requires that all A/C service hoses be equipped with check valves at or near the service hose connections. These check valves prevent refrigerant in the hoses from escaping to the atmosphere.

To disconnect the gauge set from service valves:

1. Quickly disconnect the charging hoses from the service valves.
2. Always disconnect the low side while the engine is running.
3. Disconnect the high side with the engine OFF and after the pressure has stabilized.

Manifold gauge interpretation takes some practice and must be completed with consideration of the other symptoms and potential problems that have been identified in the system.

Precautions

1. Wear protective clothing and eyewear, do not allow skin to come in direct contact with refrigerant.
2. Do not store or allow refrigerant containers to exceed 52 degrees C. (126 degrees F.)
3. Do not use refrigerant in confined spaces with poor ventilation.
4. Do not use R-12 refrigerant in the presence of an open flame.
5. Do not steam clean system.
6. Do not drop refrigerant containers or otherwise cause the container to rupture.
7. Follow proper procedure while connecting/ disconnecting hoses of manifold gauges, vacuum pump, oil separator, and charging systems.
8. Open and close manifold gauge valves carefully.
9. Exercise caution while working around drive belts, pulleys, and other moving components of an operating air conditioning system.
10. Ensure the proper level and type of compressor oil in system.

Note: Do not introduce compressed air into R-134a components.

General Preparations

Always conduct a visual inspection of the air conditioning system to identify any damage, excessive wear, refrigerant leaks (oil residue), improper belt adjustment, improper pulley alignment, and plugged condenser cooling fins.

Note: Never use water to clean the condenser or radiator fins. Using compressed air is the approved method.

Observe the refrigerant flow through the receiver / dryer sight glass (if equipped), use the correct gauges to check all systems, verify all system components and controls are operable, check for loose fittings, replace defective, worn, or damaged drive belts, and repair system leaks.

Note: The use of the sight glass alone to determine system charge level can be misleading. Normally operating and correctly charged variable displacement compressors and R-134a systems will have bubbles showing in the sight glass under certain conditions.

Discharging

Caution: Refrigerant R-12 has been identified as a compound which causes damage to the ozone layer. It is unlawful to discharge R-12 into the atmosphere. Subaru of America encourages you to handle R-12 in a responsible and safe manner, and according to Federal EPA guidelines and any local and state regulations. Always follow approved recovery / recycling procedures and utilize approved recovery / recycling equipment.

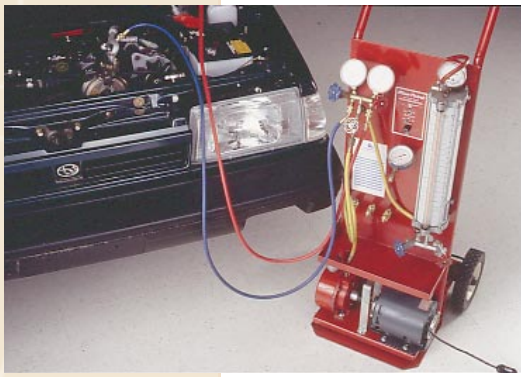
Discharging and recovery of the system refrigerant is required before replacement of major components of the system. It is also required when the system has a leak, or for the replacement of refrigerant oil. Discharging and recovery of the system refrigerant is the first step in preparing for major servicing, repair, or replacement of components; the second step is evacuation.

Evacuating

Evacuating the system removes air and moisture from the system. Discharge and recover the system refrigerant first; then follow the steps listed below to evacuate the system:

- Fully close both valves of the manifold gauge set.
- Connect a vacuum pump to the center charging hose of the manifold gauge set.
- Start the vacuum pump.
- Open the low- and high pressure valves slowly.
- When the pressure reading has reached approximately 29.00 in Hg, fully close both valves.
- Stop the vacuum pump.
- Wait 10 minutes, the pressure reading should not change. If it changes, there is a leak in the system.

Note: Certain types of system leaks such as loose fittings may not be discovered using this method. Always recheck the system with a leak detector after the system is charged.



Evacuating The System

Elevation m (ft)	*Vacuum of System mm Hg, in Hg*
0 (0)	710 27.95
300 (1,000)	685 26.97
600 (2,000)	660 25.98
900 (3,000)	635 25.00

Note: Values show readings of the low-pressure gauge.

Elevation/Pressure Relationship

Charging

Charging the system is required after servicing, repair or replacement of system components, or to locate a leak when there is no refrigerant in the system. Follow the steps listed below to charge the system:

- Leak detection of a pressurized system is required to locate an otherwise unidentifiable leak in a discharged system or when the system was dicharged/evacuated for repairs.
- The proper procedure is to:
  - Connect the manifold gauges or ACR-4 to the system.
  - Attach the center charging hose to the refrigerant source.
  - Charge the system initially with .5 -.75 lbs (0.226-0.34 kg).

Note: Refer to the appropriate model year Subaru Service Manual or air conditioning manufacturer's instructions for charging details, pressures, and system capacities. Use an electronic leak detector such as a pump-style halogen dual-gas type.

Charging/Leak Detection

- If a leak is detected, recover the remaining refrigerant and repair the leak.
- If no leak is detected, continue charging the system.
- When charging of the system has been completed, close the manifold gauge valves, and manually rotate the compressor several turns to distribute any trapped refrigerant oil before the clutch is engaged.
- Check again for refrigerant leaks with an approved leak detector.
- Conduct a performance test.
- Upon successful completion of the performance test, disconnect the high and low-pressure hoses from the service valves.
- Replace the valve caps to the service valves.

Refrigerant is colorless and odorless. You must use a leak detector to locate a leak and determine the size of the problem.

Use of a halogen pump style electronic leak detector is recommended over other types of detectors. Electronic leak detectors usually buzz or squeal in the presence of refrigerant. Always follow the leak detector manufacturer's instructions for proper use. It is Subaru policy to not use flame-type detectors, because harmful gasses may be emitted when using these types of detectors.

Oil Discharging and Refill Procedure

Discharge the compressor oil when the quality of the refrigerant oil is unsatisfactory or for repair of the compressor. Turn the compressor upside down, and pour the oil out of the compressor. Most compressors drain oil from both the inlet and outlet ports. The DIESEL KIKI variable displacement compressor drains (and fills) oil through a drain plug hole located in the center of the case. Always refer to the appropriate model year Subaru Service Manuals and the A/C manufacturer's instructions. Be sure to record the amount of oil discharged.


Oil Discharging

Note: New compressors contain enough oil for a complete dry system. When replacing a new compressor on an existing system, the old compressor must be drained and the oil quantity measured. Then drain the new compressor and measure the amount of oil. Refill the new compressor with the same quantity of oil as was removed from old compressor.

Oil Refill

Fill the compressor with the proper amount of the correct type refrigerant oil. Use of the incorrect type of compressor oil may result in damage to the compressor. Refer to Subaru Service Bulletin number 10-37-84, dated 12-12-84, for compressor oil specifications for Matsushita (Panasonic), Hitachi, Lone Star and other compressor types. Always manually rotate the compressor several turns to confirm proper operation after filling with refrigerant oil.

Note: The variable displacement Calsonic and DIESEL KIKI compressors may only be filled with special V-5 compressor oil, (D-9OPX). Any contamination with other types of compressor oils will cause compressor damage. Never substitute or cross-contaminate R-12 compatible compressor oil with R-134a compatible compressor oil.

Refer to the Oil Charge Table found in Section 4-7 of the appropriate model year Service Manual. This can be a useful tool to determine the proper procedure to follow and to determine the amount of refrigerant oil to add or replace to the compressor after servicing, repairing, or replacing major system components. Always manually rotate the compressor several turns to confirm proper operation.

Performance Testing

Test Conditions

- The vehicle must be indoors or in the shade.
- Doors should be closed, all windows open.
- Hood open.
- Connect the manifold gauge.
- Set the mode switch to the A/C MAX position. (On variable displacement compressor system set the A/C controls to high blower and normal A/C.)

Note: When servicing variable displacement compressors refer to Service Bulletin, 10-52-89, dated 07-28-89, for complete compressor diagnostic information.

- Set the temperature control to COLD.
- Start the engine and idle at 1,500 RPM.
- Operate for approximately 10 minutes, then observe the high and the low pressure levels.

An essential step of the performance test is measuring the temperature of the inlet air at the blower and the temperature of the outlet air at the vent grills. The temperature difference should be within specifications for the system. System temperatures will vary with changing conditions, such as high ambient air temperature, humidity, and altitude.

Temperature Measurement

Performance Test Results

Standard Compressor Systems

❶ System performs to specifications; test complete

❷ Higher than normal pressures indicate:
- —Restriction of air across condenser
- —Defective cooling fan(s)
- —Refrigerant overcharge
- —Restriction in system
- —Air in system
- —Moisture in system

❸ Lower than normal pressures indicate:
- —System is undercharged
- —Compressor is defective

❸ Lower than normal pressures indicate:
- —Compressor has shifted to minimum stroke
  - • Stop engine
  - • Wait ten (10) minutes, retest
- —System is undercharged
  - • "Clunking" sound is normal while charging system
- —Compressor is defective

—System is undercharged, or
—Compressor is NOT changing to minimum stroke

❹ Switch system "ON" and "OFF"

❺ If high and low side pressures remain equal
- —Extreme System undercharge, or
- —Defective compressor

Note: The clutches on the variable displacement Calsonic and DIESEL KIKI compressors are not serviceable. Always refer to the current Subaru Service Bulletins for possible future changes to this procedure.

Variable Displacement Compressor Systems

❶ System performs to specifications, test complete

❷ Higher than normal pressures indicate:
- —Restriction of air across condenser
- —Defective cooling fan(s)
- —Refrigerant overcharge
- —Restriction in system
- —Air in system
- —Moisture in system

Control Valve Testing—Variable Displacement Compressor

❶ Bring compressor to the minimum stroke position
- —Open hood and windows
- —Set engine speed to fast idle
- —Set blower speed to low
- —Set A/C control to A/C MAX

❷ Suction pressure should be 25-35 psi

Note: When inlet air temperature to evaporator is "LOW", the discharge pressure may appear to be excessively "LOW" and bubbles may be seen in sight glass. This condition is normal.

❸ Lower than normal pressure indicates:

Related Air Conditioning Service Bulletins

Number	Date	Title	Remarks
15-42-87	05-18-87	Accessory A/C Justy S0A332A105	
15-44-87	05-26-87	Accessory AC (S0A332A1 05)	Install on (4EAT)
02-70-89	08-24-89	Idle Speed Adjustment Procedure for MT/ECVT	
02-72-89	05-07-86	Idle Speed Adjustment Procedure for MT/ECVT	Addendum to Service Bulletin #02-70-89
10-49-88	08-04-88	Fresh/Circ Air Lever Not Holding Position	
10-50-89	05-29-89	Heater Gears (87-89 'L' Series)	
10-51-89	05-29-89	Compressor Oil (Legacy)	
10-52-89	07-28-89	V-5 Compressor & A/C System Service Information	
10-53-89	10-18-89	A/C System Servicing	
10-55-90	01-29-90	Discontinued Shorting Loop For A/C Cut Relay	
10-56-90	01 -29-90	Heater Gears - '87 to '89 'L' Series & XT Models	

Number	Date	Title
10-57-90	05-29-90	A/C Compressor Inspection
10-58-90	05-30-90	Thermoprotector Service Procedure
10-59-90	07-06-90	Thermoprotector Testing Procedure Clarification
10-60-90	08-14-90	Automatic Climate Control Diagnostic Information
10-61-91	07-02-91	Removal and Recycling of Refrigerant R-1 2
10-62-91	09-20-91	Wynn's Justy A/C SOA329A110 & S0A329A112
10-63-93	04-12-93	R-134a Refrigerant Handling Procedures
10-64-93	11-08-93	Heater Vent Door Binding Or Leaking Air
10-65-94	03-08-94	Proper Oils For Subaru A/C Systems
10-66-94	06-17-94	R-12 and R-134a Air Conditioning System Handling Procedures
10-67-94	11-11-94	Clicking Noise From The Heater Mode Door Actuator
10-68-96R	07-01-98	Air Conditioning Retrofit Procedures R-12 to R-134a