

insider info.

Identifying ABS Systems

Since its first introduction, Subaru has utilized a variety of different ABS systems. Each of the systems have different diagnostic and/or service procedures, therefore, it is important that you are able to identify which system you are dealing with.

The 90-94 Model Year Legacy vehicles had three different types of ABS. They were Nippon, Bosch (known as ABS-2S) and the ABS-2E system.

The Nippon system has the brake lines coming into the top of the unit and is distinctive due to the fact that it has brake bleeder nipples on the top of the hydraulic unit cylinder head. The Bosch system looks very similar to the Nippon, with the brake lines coming in the top of the unit, but the lines are in a more square pattern and there are no brake bleeders on the cylinder head. Both of these systems have no long-term memory (once you turn the key off, all codes are erased from memory) and can display only one diagnostic code at a time from the LED on the computer under the passenger's seat.



ABS 2E

The ABS-2E system can be identified by the fact that the brake lines come into the top of the hydraulic unit with all four pipes in a straight line. This system can display three diagnostic codes at a time from the dash light and has a long-term memory. The computer is also under the passenger seat.

None of these systems (Nippon, Bosch nor the ABS-2E) communicate with the Select Monitor.

The 1995 model year and later Legacy, Forester and Impreza vehi-

cles have four different types of ABS systems. The ABS-2B system, the ABS/TCS system, the ABS 5.3 system and the ABS 5.3i system.

The ABS-2E system is the same as for the earlier Legacy vehicles. The brake lines enter the top of the hydraulic unit all in a straight line and the computer displays only three codes at a time on the dash light with no available Select Monitor communication. The computer is under the passenger's seat.

The ABS/TCS system was used on 1995 front wheel drive Legacy automatics with traction control and for that year only. The hydraulic unit has two brake lines coming in the top and two in the side. This system does communicate with the Select Monitor and it has a long-term memory. The computer is under the passenger's seat.



ABS 5.3

The ABS 5.3 system has the motor for the hydraulic unit sticking straight up with two brake lines going in the top of the unit and four out the side. This system does communicate with the Select Monitor. The computer is to the right of



ABS 5.3i

the glove box in Legacy vehicles and to the left of the steering column in Impreza vehicles.

The ABS 5.3i system has the motor for the hydraulic unit in a horizontal position and the four brake lines coming into the top of the unit in the shape of a square. The system does communicate with the Select Monitor and has a long-term memory. The computer is part of the hydraulic unit.

ABS/TCS Code 57

After alternator replacement, if you encounter a vehicle that begins to display an ABS/TCS Code 57 during subsequent engine starting, the situation may be due to the sensitivity of the ABS/TCS control unit. The alternator circuit, through the low brake fluid monitoring circuit, is used to tell the ABS/TCS control unit the engine is running. If the ABS/TCS control unit is

overly sensitive to changes in this circuit, Code 57 may be produced when the vehicle is started. The rapidity with which the ignition key is turned on influences whether the code is produced or not. If the key is turned on very quickly, the code may show up. If it is turned on more slowly, the code will not show up. Code 57 can be eliminated either by slowing down how fast the operator turns the ignition key or by replacing the ABS/TCS control unit with a unit that is specially designed to be more tolerant to changes on that circuit.

ABS 5.3i ABS Warning Light Operation

Similar to an Airbag Control Unit Connector, the ABS 5.3i Control Unit connector has a shorting clip that shorts two harness wires together whenever the connector is

disconnected from the Anti-lock Brake System Control Module and Hydraulic Unit. Shorting these two wires together will turn on the ABS warning light, warning the driver that the ABS is not functional.

ABS System Check

The ABS Electronic Control Unit checks all system components, including the Hydraulic Control Unit, each time the vehicle is started. When the Hydraulic Control Unit is operating during this checking period, the owner/technician may hear a noise/buzzing coming from the engine compartment. They may also feel the brake pedal pulsating slightly if their foot is on the brake pedal. This pulsating of the brake pedal may be more noticeable when backing down a slight grade (sloping driveway). It may also be felt when moving forward. The check is not performed

Continued next page

insider info.

until a speed sensor input is received by the ABS Electronic Control Unit. This is a normal function and no repairs should be attempted.

Brake Judder And Noise

A special grease, P/N K0777YA010, is available for brake judder and noise complaints. The grease has good durability against heat and water when compared to PBC grease. It should be applied between the brake pad and the shim. The grease has been added production and is included in genuine Subaru brake pad kits.



Brake Grease with Shims

There are two important things to remember when addressing brake judder and noise complaints:

1. Use an "on the car" type brake lathe to cut the rotors and adjust lateral run-out of the machine to less than .002 inch.
2. Don't replace or cut the rotor in case of a brake noise condition. Replace the brake pads and apply the new brake grease between the brake pad and shim only.

Brake Noise...What Is Normal?

One of the most common concerns that any vehicle owner perceives as a problem is brake noise when stopping the vehicle. Industry-wide, the question pops up: "What is considered to be an 'acceptable' level of brake noise?"

The disc brake systems used on vehicles today are designed and developed to meet many different, but very strict requirements. This must be accomplished while providing an optimum level of performance under a wide range of vehicle and environmental operating conditions.

The brake pads selected must be a balanced choice. There is a fine line between a quiet brake pad and one that will provide optimum performance under extreme braking conditions. Consequently, when a change is made in the pad formulation (whether it is meant to provide longer pad life, shorter stopping distances, noise reduction or a change in pedal effort), a trade-off must be made in one area or another. An example of pad formulation change would be the industry's switch from asbestos to semi-metallic brake linings.

Brake friction materials generate noise and heat in order to dissipate energy, a necessary physical reaction. When this occurs, brake dust and vibration of the brake pad within the caliper is generated. These factors can be changed by other environmental and road conditions such as ambient temperature, moisture, road salt, mud, etc.

It is important to remember that all brakes make noise. The frequency at which the noise becomes audible to us will vary. Any effort to eliminate an intermittent brake noise, which is considered normal, is usually temporary at best. This is not to say, however, that all brake noises should arbitrarily be considered normal. Brake noise should be diagnosed as outlined in the appropriate model year service manual.

ABS-2E Control Units and ABS Code 23

If you are working on a vehicle that displays a continuous and immediate ABS warning light (even after trying to clear codes), has no codes in memory (even though the ABS light is on) until the vehicle is driven, and records a code 23 (left front wheel sensor) after driving, check to see if anyone has previously worked on the ABS system and could possibly have installed the incorrect ABS computer.

The ABS-2E system has different computers for two and all wheel drive vehicles. The terminal locations in the harness for the left front wheel sensor differ between two and all wheel drive vehicles. If the incorrect computer is

installed, the computer does not look at the correct wires for the signal coming from the wheel sensor, resulting in the ABS light and code 23. Check your parts catalog information for the correct part number application. The notes identify which is for two or all wheel drive vehicles.

5.3 ABS System Component Relocation

Due to wiring changes associated with the 5.3 ABS system, the ABS components on some 1996 and later Subaru Legacy vehicles have been relocated (vehicles produced after November 1995). Among the relocated components are the ABS Control Unit, Cruise Control Unit, LSi Security Module, and Transmission Control Unit.

The ABS Control Unit has been relocated to the right of the glove box. This is the area where the

Cruise Control Unit was previously located. The cruise control module is now located under the driver's side dash, left of the steering column, near the TCU (Transmission Control Unit) location. This is also the new location for installing the cruise control computer during a dealer installed cruise installation. The bracket mounting the module also has changed. The LSi security module has been relocated behind the radio on the passenger's side.

The Transmission Control Unit is still located near the steering column. It has just been moved a little closer to the engine compartment bulkhead.

Note: These relocations only apply to vehicle equipped with ABS 5.3 wiring. Other vehicles will have the components in the locations where you are accustomed to finding them.

Intermittent Wheel Sensor Codes In Early Legacy ABS Systems (Non-ABS-2E)

Accumulations of metal filings, road dirt, mud, etc., on individual wheel speed sensors can cause wheel sensor codes to be reported by the ABS control unit and light the dashboard ABS light. This can occur especially after fairly rapid maneuvering of the vehicle to the left right at moderate speeds (i.e., tight S-turn exit ramps or parking lot maneuvering). Before extensive testing or replacement of these components, check and clean these areas. Examine the air gap and the condition of the tone wheels and test drive the vehicle. If the code reappears, continue your diagnosis. If it does not, cleaning may have repaired the condition.

Continued next page

insider info.

1996 Subaru Legacy Equipped With ABS 5.3 System

1996 Subaru Legacy models equipped with the new ABS 5.3 system have the ABS electronic control unit located behind the glove box and not under the passenger seat as on other Subaru Legacy models.

The 5.3 system is also compatible with the Subaru Select Monitor, which allows you to access trouble codes when diagnosing the system.

Before searching for the electronic control unit, determine which system is installed in the vehicle. One way of telling is by looking at the Hydraulic Control Unit on the 5.3 system (still located behind the right front headlight). It is noticeably different from the Hydraulic Control Units used on previous systems.

The ABS 5.3 system was first installed in Subaru Legacy vehicles starting with late October/early November 1995 production.

ABS/TCS Equipped Legacy Vehicles

On FWD Subaru Legacy vehicles equipped with the ABS/TCS system, one of the following conditions may cause the BRAKE and ABS/TCU warning lights on the dash to light: low brake fluid level or alternator not charging. These conditions will also cause the ABS system to revert to a conventional braking system.

Low Brake Fluid Level This will cause the ABS to shut down because the system believes there is insufficient fluid in the brake system to allow the ABS system to operate properly.

Alternator Not Charging The ABS system uses the alternator output signal to tell the ABS control unit the car is running, so the ABS control unit needs the alternator output signal to turn the system on. If there is no output from the alternator, the ABS control unit never turns the system on so it won't work.

Brake Fluid Basics

There are three types of brake fluid: DOT 3, DOT 4 and DOT 5. Incorrect brake fluid application may result in degraded braking performance as well as

system component damage. The more commonly used DOT 3 and 4 brake fluids are of the polyglycol variety, while DOT 5 is silicone based. Subaru recommends only DOT 3 or 4 brake fluid.

Polyglycol-based fluid is hygroscopic, which means it absorbs moisture from the air. This quality allows any moisture absorption to be dispersed throughout the system, eliminating any concentration of water that could lead to localized corrosion.

This characteristic, however, has its disadvantages. Over time, the level of moisture absorption may reach as much as 7-8 percent, which causes the fluid to become contaminated. This condition will drastically reduce the boiling point of the brake fluid, and lower the temperature at which it evaporates. Once vapor has formed, pockets of air are created in the hydraulic lines, causing brake pedal travel to increase. This is due to the fact that the air must first be compressed before any fluid starts to move. The minimum boiling point established for DOT 3 fluid is 401° F, while DOT 4 is 446° F.

Silicone brake fluid, classified as DOT 5, can be easily identified by its purple color. Silicone does not absorb water but rather repels it. This means there is no contamination from moisture absorption and less chance of internal corrosion. In addition, silicone-based brake fluid has a boiling point of over 500 degrees.

In order to realize the benefits of DOT 5 brake fluid, the system must contain 100 percent silicone-based fluid. This means that DOT 5 brake fluid cannot be installed in a system already using DOT 3 or DOT 4. Because these different types of fluid will not mix, all of the polyglycol-based fluid will be concentrated into one part of the system. At this point, any moisture that is present in the fluid cannot be dispersed through the system. This localized moisture concentration will certainly cause problems.

It is nearly impossible to remove all the brake fluid from a system, and even with power bleeding — 2-3 percent of the old fluid will remain. Since the two types of brake fluid are not compatible, stick with Subaru's DOT 3 or 4 recommendations.