Figure 107-1  On most vehicles equipped with ABS, the amber ABS and red BRAKE warning lamp should come on as a bulb check when the ignition is first switched on.

Figure 107-2  A thorough visual inspection should include carefully inspecting around the electrohydraulic unit for signs of obvious problems or the installation of aftermarket devices such as alarm systems.
TECH TIP: Quick and Easy Wheel Speed Sensor Diagnosis

A fault in a wheel speed sensor (WSS) is a common ABS problem. A quick and easy test that works on most Bosch ABS systems (and perhaps others) involves the following steps:

STEP 1: Hoist the vehicle safely.

STEP 2: Turn the ignition on (engine off).

STEP 3: Spin a tire by hand as fast as possible.

STEP 4: The ABS amber warning light should come on, indicating that a speed was detected but not by all the wheel speed sensors.

STEP 5: Turn the ignition off to reset the ABS warning light.

STEP 6: Repeat the test on each of the remaining wheels.

If any wheel fails to turn on the ABS light, carefully inspect the wheel speed sensor for proper resistance and the tone ring and wiring. If the ABS light is on all the time and does not reset when the ignition is turned off, the problem is not caused by a wheel speed sensor.

FREQUENTLY ASKED QUESTION: What’s That Noise and Vibration?

Many vehicle owners and service technicians have been disturbed to hear and feel an occasional groaning noise. It is usually heard and felt through the vehicle after first being started and driven. Because it occurs when first being driven in forward or reverse, many technicians blame the transmission or related driveline components. This is commonly heard on many ABS vehicles as part of a system check. As soon as the ABS controller senses speed from the wheel speed sensors after an ignition cycle, the controller will run the pump either every time or whenever the accumulator pressure is below a certain level. This can occur while the vehicle is being backed out of a driveway or being driven forward because wheel sensors can only detect speed—not direction. Before serious and major repairs are attempted to “cure” the noise, make sure that it is not the normal ABS self-test activation sequence of events.

Figure 107-3 General Motors diagnostic connector on a pre-1996 vehicle. Flash codes are available by using a jumper wire to ground (terminal A) to terminal H.
Connecting a jumper wire from the diagnostic connector to ground. The exact location of the diagnostic connector varies with the exact vehicle make and year.

Chrysler diagnostic connector location varies with the model and year.

REAL WORLD FIX: RWAL Diagnosis
The owner of an S-10 pickup truck complained that the red brake warning lamp on the dash remained on even when the parking brake was released. The problem could be one of the following:
1. A serious hydraulic problem
2. Low brake fluid
3. A stuck or defective parking brake switch
4. If the brake lamp is dim, RWAL trouble is indicated.

The technician found that the brake lamp was on dimly, indicating that an antilock braking problem was detected. The first step in diagnosing an antilock braking problem with a dash lamp on is to check for stored trouble codes. The technician used a jumper between terminals A and H on the DLC (ALCL), and four flashes of the brake lamp indicated a code 4.

Checking a service manual, code 4 was found to be a grounded switch inside the hydraulic control unit. The hardest part about the repair was getting access to, and the replacement of, the defective (electrically grounded) switch. After bleeding the system and a thorough test drive, the lamp sequence and RWAL functioned correctly.
REAL WORLD FIX

The Nervous Taurus

A customer complained that, sometimes during normal braking, the ABS would be activated just before coming to a stop. However, the ABS light did not come on. The service technician was able to duplicate the condition and there were no DTCs stored. Using a scan tool to monitor the wheel speed sensors, the technician discovered that the left front wheel speed was slightly different than the others. A thorough visual inspection revealed that the tone wheel (sensor ring) was cracked. This crack created a different signal to the ABS controller than the other wheels and the controller activated the ABS as it would normally—that is, why there were no DTCs.

Other things that could have caused this problem, which is often called “false modulation,” include a bent wheel, mismatched tire sizes, or metal debris around the sensor.
REAL WORLD FIX: The Mystery ABS Amber Warning Light

The owner of an Acura Legend complained to a service technician that the ABS warning light would come on but only while driving down from a parking garage. When the driver turned off the ignition and restarted the engine, the ABS amber light was not on and did not come on again until the vehicle was again driven down the spiral parking garage ramp. The service technician used a scan tool and found that no DTCs had been stored.

NOTE: Some ABS systems will not retain a DTC unless the problem is currently present and the ABS amber warning light is on.

All of the brakes were in excellent condition, but the brake fluid level was down a little. After topping off the master cylinder with clean DOT 3 brake fluid, the vehicle was returned to the customer with the following information:

• The ABS amber warning light may have been triggered by the brake fluid level switch. While driving down the steep parking garage ramp, the brake fluid moved away from the fluid level sensor.

NOTE: While the brake fluid level sensor normally would turn on the red brake warning light, in some systems it turns on the amber ABS light if the brake fluid falls below a certain level in the ABS reservoir.

• The difference in wheel speed between the outboard and the inboard wheels could have triggered a fault code for a wheel speed sensor during the drive down the spiral parking garage ramp.

TECH TIP: Sometimes It Pays to Look at the Entire Vehicle

There are often strange electrical problems that can occur including false DTCs or intermittent operation of an anti-lock brake system (ABS). Sometimes it’s easier to determine the root of the problem by looking at the entire vehicle. Here are some telltale signs that a vehicle may have been in a flood or in deep water.

• Mud, silt, or caked dust under the dash and inside the doors
• Corroded electrical connectors at the computer, fuse box, or ABS controller
• Visible water line in the doors or behind panels
• Rust in abnormal places such as seat springs or brackets behind the dash
• Moisture in lenses
• Musty smell and/or strong air freshener smell
• Powdery corrosion on aluminum parts such as intake manifold and inside the throttle bore
• Rust or moisture inside electrical switches or relays
• Areas that are normally dusty such as an ashtray or glove box are very clean
Figure 107-9  A typical wheel speed sensor. When a tooth on the sensor ring is close to the sensor, the strength of the magnetic field is stronger because the metal of the tooth conducts magnetic lines of force better than air. When the tooth moves away, the magnetic field strength is reduced. It is this changing magnetic field strength that produces the changing voltage. Frequency of the signal is determined by the speed of the rotating sensor.

Figure 107-10  Measuring the resistance of a wheel speed sensor.

Figure 107-11  A scope can be used to check for proper operation of a wheel speed sensor.
Figure 107-12 A broken tooth on a wheel speed sensor tone ring shows on the scope trace as a missing wave.

Figure 107-13 Use a nonmagnetic brass or plastic feeler gauge to check wheel speed sensor gap. A metal gauge would be attracted by the magnet in the sensor and would produce a drag on the gauge as it is moved between the sensor and the tone ring. This drag could be interpreted as a correct clearance reading.

Figure 107-14 (a) Always use a nonferrous (brass or plastic) feeler (thickness) gauge when measuring the gap between the toothed ring and the wheel speed sensor.
Sometimes a sensor is equipped with a paper spacer that is the exact thickness of the spacing required between the toothed ring and the sensor. If equipped, the sensor is simply installed with the paper touching the toothed wheel. A typical gap ranges from 0.020 to 0.050 in. (0.5 to 1.3 mm).

**TECH TIP: Space Saver Spare Tire May Trigger Wheel Speed Fault Code**

If a vehicle has been using a small space saver-type spare tire, then the difference in outside diameter may trigger a wheel speed sensor diagnostic trouble code (DTC) and turn on the amber ABS warning lamp. Try to find out from the customer if they had driven on a spare tire before replacing a wheel speed sensor based on a stored DTC.

**CHART 107–1**

![Chart 107–1](image-url)
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>Left Sensor Signal Strength</td>
<td>Check sensor connections and wiring.</td>
</tr>
<tr>
<td>1001</td>
<td>Right Sensor Signal Strength</td>
<td>Check sensor connections and wiring.</td>
</tr>
<tr>
<td>1002</td>
<td>Front Speed Sensor Signal Strength</td>
<td>Check sensor connections and wiring.</td>
</tr>
<tr>
<td>1003</td>
<td>Rear Speed Sensor Signal Strength</td>
<td>Check sensor connections and wiring.</td>
</tr>
<tr>
<td>1004</td>
<td>Left Wheel Speed Sensor Signal Strength</td>
<td>Check sensor connections and wiring.</td>
</tr>
<tr>
<td>1005</td>
<td>Right Wheel Speed Sensor Signal Strength</td>
<td>Check sensor connections and wiring.</td>
</tr>
<tr>
<td>1006</td>
<td>Front Speed Sensor Signal Strength</td>
<td>Check sensor connections and wiring.</td>
</tr>
<tr>
<td>1007</td>
<td>Rear Speed Sensor Signal Strength</td>
<td>Check sensor connections and wiring.</td>
</tr>
</tbody>
</table>

CHART 107–1 (continued)