Bendix® WS-24™ AntiLock Wheel Speed Sensor

*FIGURE 1 - **WHEEL SPEED SENSORS AND CONNECTORS***

DESCRIPTION

The WS-24™ wheel speed sensor is an electromagnetic device used to obtain vehicle speed information for an antilock controller. When the wheel rotates, the sensor and an exciter ring (sometimes called a “rotor” or “tone” wheel) generate a simple AC signal. This signal is sent to the controller, which analyzes the data and commands the antilock system accordingly.

Specifically, the speed sensor consists of a coil, pole piece, and magnet. The exciter is a steel ring or gear-like device that has regularly spaced high and low spots called "teeth." The sensor is mounted in a fixed position, while the exciter is installed on a rotating member so that its "teeth" move, in close proximity, past the tip of the sensor.

The WS-24™ sensor is available in both straight and right angle versions, to accommodate axle/wheel space limitations. (See Figure 1.)

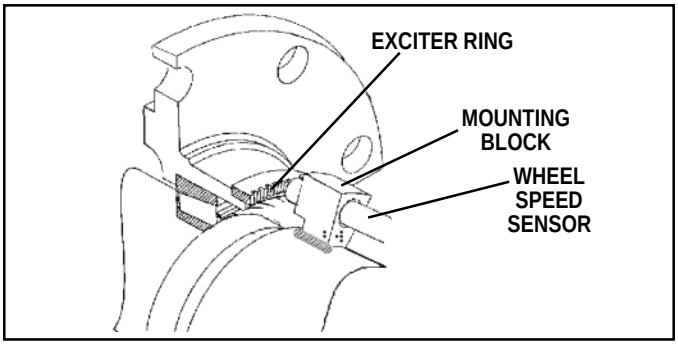

*FIGURE 2 - **WHEEL END ABS COMPONENTS***

OPERATION

The sensor's magnet and pole piece form a magnetic field. As an exciter tooth passes by the sensor, the magnetic field is altered, which generates AC voltage in the sensor coil. Each time an exciter tooth and its adjacent space move past the tip of the sensor, an AC voltage "cycle" is generated.

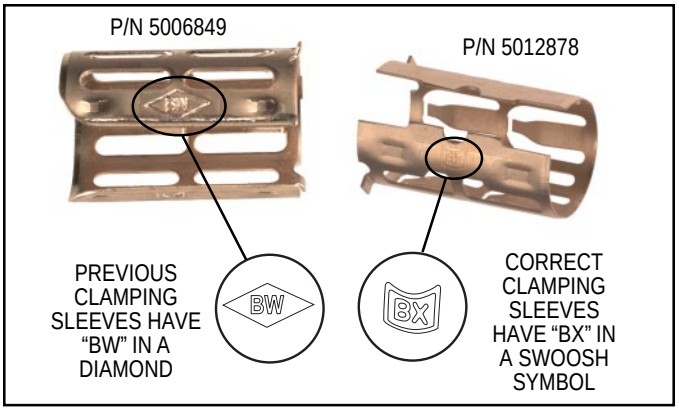

FIGURE 3 - ***CLAMPING SLEEVES***

The number of AC cycles per revolution of the vehicle's wheel depends on the number of teeth in the exciter, which is programmed into the antilock controller. Using the programmed data, the controller can calculate "vehicle speed" by analyzing the frequency of AC cycles sent by the speed sensor. (The frequency of AC cycles is directly proportional to wheel speed.) See Figure 4.

AC voltage is also proportional to speed, but voltage is not used to determine speed. It is only an indication of AC signal strength. The amount of AC voltage generated by a specific speed sensor depends on the distance, or "gap" between the tip of the sensor and the surface of the exciter. Voltage increases as the sensor gap decreases.

Typically, the WS-24™ sensor is installed in mounting blocks that are welded to the axle housing. (See Figure 2.) WS-24™ wheel speed sensors are protected by a stainless steel sheath. They are designed to be used with beryllium-copper clamping sleeves (sometimes referred to as a "retainer bushing", "friction sleeve" or "clip") (See Figure 3). The clamping sleeve provides a friction fit between the mounting block bore and the WS-24™ sensor.

Please note that WS-24™ wheel speed sensors must use clamping sleeve p/n 5012878 instead of p/n 5006849 (used for previous wheel speed sensors). Always use correct clamping sleeves to avoid problems associated with reduced retention force, such as sensor movement and resulting ABS trouble codes.

The friction fit allows the WS-24™ sensor to "slide" back and forth under force but to retain its position when the force is removed.

When the WS-24™ sensor is inserted all the way into the mounting block and the wheel is installed on the axle, the hub exciter contacts the sensor, which pushes the sensor back. Also, normal bearing play will "bump" the sensor away from the exciter. The combination of these two actions will establish a running clearance or air gap between the sensor and exciter.

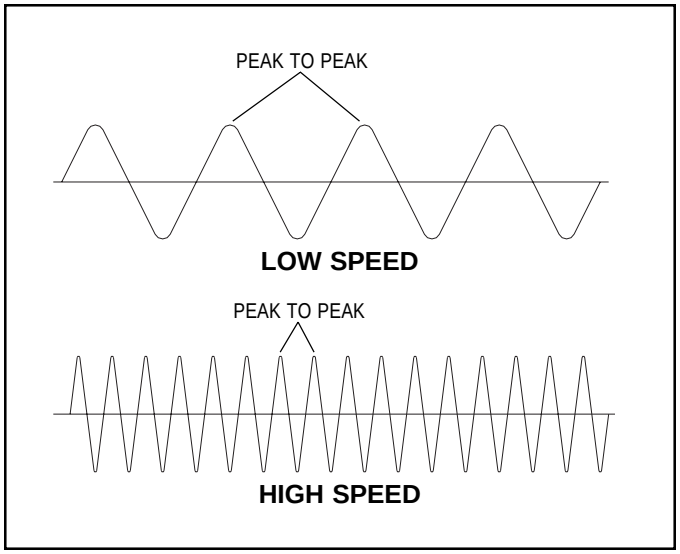

FIGURE 4 - ***SPEED SENSOR VOLTAGE CYCLE OUTPUT***

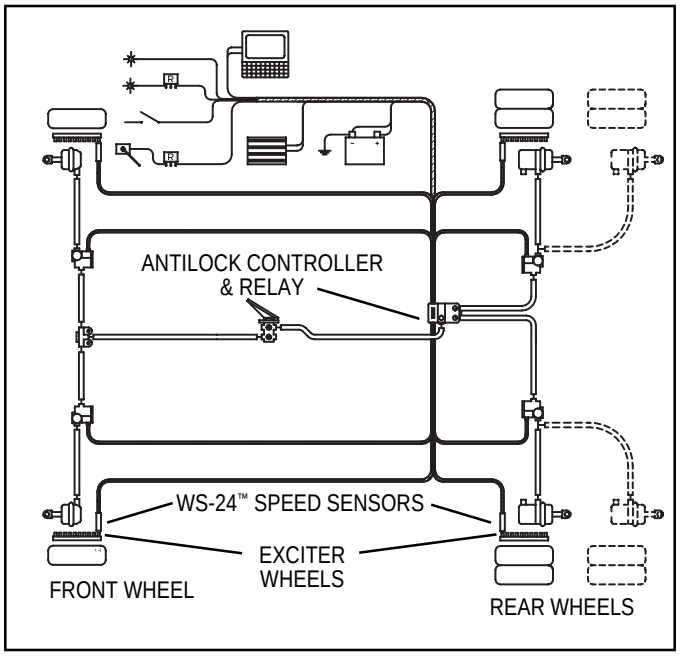

FIGURE 5 - **TYPICAL ANTILOCK SYSTEM**

TECHNICAL INFORMATION

Electrical connector	2 Pin.
Sensor resistance	1500-2500 ohms
Output voltage	At a minimum of 100Hz (approximately 7 mph) the sensor output across the leads should be 0.400 VAC.
Sensor gap	0 to 0.015 inch.
Sensor body	Outer diameter is 0.627 inch.
Normal resistance range across pins at room temperature	1500-2000 Ohms. (Note: Previous model WS-20™ sensor was rated at 2000-2500 Ohms.)

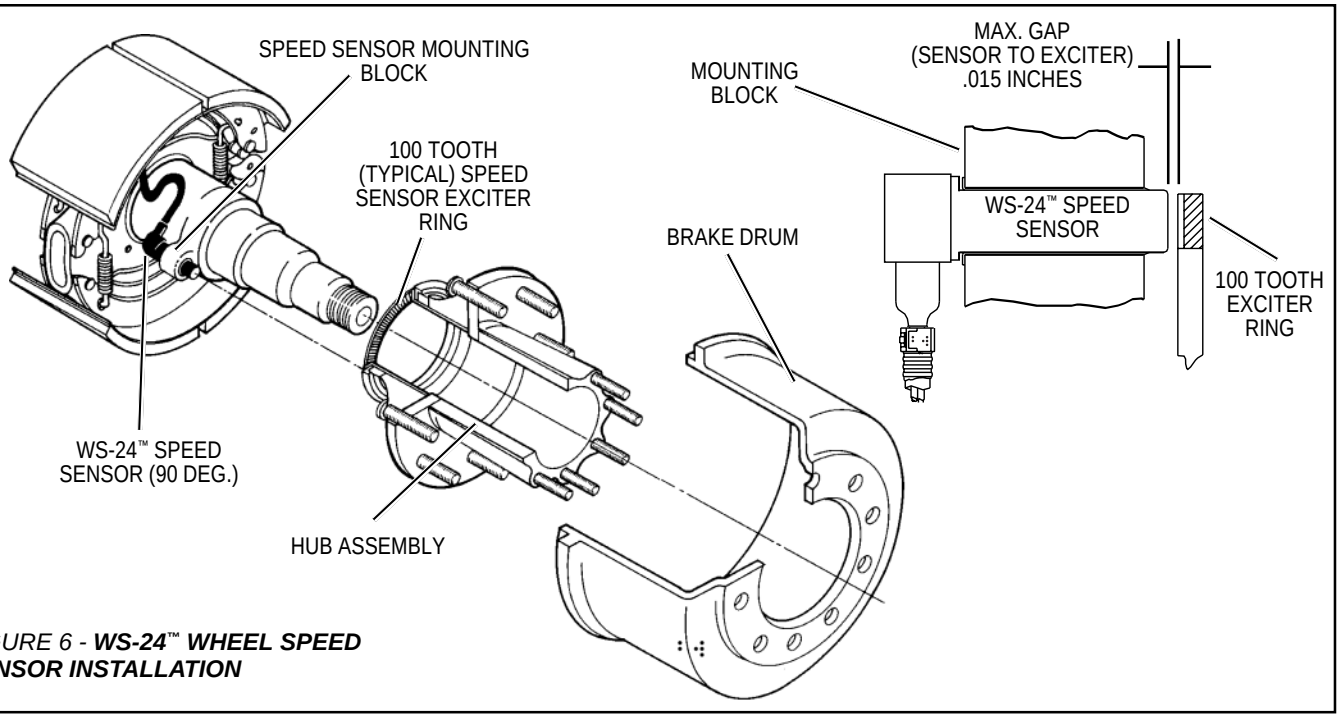

FIGURE 6 - ***WS-24™ WHEEL SPEED SENSOR INSTALLATION***

PREVENTIVE MAINTENANCE

1. Every 3 months; 25,000 miles; 900 operating hours; or during the vehicle chassis lubrication interval, make the visual inspections noted in "SERVICE CHECKS" below.
2. Every 12 months; 100,000 miles; or 3600 operating hours, perform the OPERATIONAL TEST in this manual.

SERVICE CHECKS

Check all wiring and connectors. Make sure connections are free from visible damage.

Examine the sensor. Make sure the sensor, mounting bracket, and foundation brake components are not damaged. Repair/replace as necessary.

WARNING! PLEASE READ AND FOLLOW THESE INSTRUCTIONS TO AVOID PERSONAL INJURY OR DEATH:

When working on or around a vehicle, the following general precautions should be observed at all times.

1. **Park the vehicle on a level surface, apply the parking brakes, and always block the wheels. Always wear safety glasses.**
2. **Stop the engine and remove ignition key when working under or around the vehicle. When working in the engine compartment, the engine should be shut off and the ignition key should be removed. Where circumstances require that the engine be in operation, EXTREME CAUTION should be used to prevent personal injury resulting from contact with moving, rotating, leaking, heated or electrically charged components.**
3. **Do not attempt to install, remove, disassemble or assemble a component until you have read and thoroughly understand the recommended procedures. Use only the proper tools and observe all precautions pertaining to use of those tools.**
4. **If the work is being performed on the vehicle's air brake system, or any auxiliary pressurized air systems, make certain to drain the air pressure from all reservoirs before beginning ANY work on the vehicle. If the vehicle is equipped with an AD-IS™ air dryer system or a dryer reservoir module, be sure to drain the purge reservoir.**
5. **Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.**
6. **Never exceed manufacturer's recommended pressures.**
7. **Never connect or disconnect a hose or line containing pressure; it may whip. Never remove a component or plug unless you are certain all system pressure has been depleted.**
8. **Use only genuine Bendix® replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.**
9. **Components with stripped threads or damaged parts should be replaced rather than repaired. Do not attempt repairs requiring machining or welding**

unless specifically stated and approved by the vehicle and component manufacturer.

10. **Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.**
11. **For vehicles with Antilock Traction Control (ATC), the ATC function must be disabled (ATC indicator lamp should be ON) prior to performing any vehicle maintenance where one or more wheels on a drive axle are lifted off the ground and moving.**

REMOVAL

1. Unplug the cable assembly connector from its lead. Lift the lock tab and pull on the connector until it disengages.
2. Gently pry the sensor and clamping sleeve from the mounting block.

INSPECTION

Look for any visible damage to the sensor, cable assembly, connector, mounting block, and foundation brake. Repair or replace any damaged components. Make sure the block is securely attached to the axle housing.

SENSOR INSTALLATION

1. For increased corrosion protection we recommend that a high-temperature rated silicon- or lithium-based grease be applied to the interior of the mounting block, the sensor, and to a new clamping sleeve.
2. Install the new clamping sleeve fully into the block, with the retaining tabs toward the inside of the vehicle.
3. Gently push (DO NOT STRIKE) the sensor into the mounting block hole until it bottoms out on the face of the tone ring. Secure the cable lead wire to the knuckle/axle housing 3-6 inches from the sensor.
4. Apply a moderate amount of dielectric non-conductive grease to both the sensor connector and harness connector.
5. Engage the connectors, and push together until the lock tab snaps into place.

NOTE: It is important for the wheel bearings to be adjusted per the manufacturer's recommendations. Excessive wheel end play can result in antilock function shutdown in cases where the sensor is pushed too far away from the tone ring.

ELECTRICAL TESTING

1. Before testing the speed sensor, its location on the vehicle should be confirmed using the Troubleshooting or Start Up procedure for the specific antilock controller in use. (See the Service Data Sheet for the antilock controller for this procedure.)
2. Proceed to the sensor in question and inspect its wiring connector. Disconnect the connector and test the resistance between the pins ON THE SENSOR.

Normal resistance range across pins at room temperature should be 1500-2000 Ohms. (Note: Previous model WS-20™ sensor was rated at 2000-2500 Ohms.)

Individually test the resistance of each pin to vehicle ground and note there is NO CONTINUITY.

If the resistance readings are as shown, the wire harness leading to the modulator may require repair or replacement. Before attempting repair or replacement of the wire harness, refer to the test procedures specified for the antilock controller in use for possible further testing that may be required to substantiate the wire harness problem. If the resistance values are NOT AS STATED, replace the sensor.

Resistance could be as low as 1100 Ohms or as high as 3300 Ohms if wheel end has recently been exposed to extreme temperature.

OPERATIONAL TESTING

To test sensor operation, one of two tests can be done.

TEST 1

Drive the vehicle in a safe area to a minimum speed of 15 mph. Be sure to apply the vehicle brakes several times. Then stop the vehicle and check the LED display on the Bendix controller. If the dash light is out and the sensor LED(s) are not illuminated, the sensor is installed properly.

TEST 2

Disconnect the connector from the sensor's socket or from the attached lead. Raise the vehicle wheel so it rotates easily. Connect a volt-Ohm meter (set to read Volts AC) to the pins on the sensor or lead and spin the wheel. If the wheel is spun at 1/2 revolution per second the reading should be greater than 0.250 VAC.

If the sensor fails to operate as described, check the wiring from the controller to the sensor. Make sure all connectors are properly and tightly installed. Check for frayed or damaged wires and check and/or reset the sensor air gap (distance from sensor tip to exciter ring) as described in this manual. For additional troubleshooting information, see the troubleshooting procedure for the specific antilock system in use.