BONUS SECTION 9: ABS DIAGNOSIS AND WHEEL SPEED SENSORS

10 Targeted Practice Questions

1. An active wheel speed sensor (Hall effect type) differs from a passive magnetic inductive sensor in that:

A. Active sensors generate their own voltage signal without requiring a power supply, while passive sensors require a 5-volt reference from the ABS module

B. Active sensors require a power supply voltage from the ABS module and produce a clean digital square wave output, while passive sensors generate their own AC sine wave from wheel rotation with no external power needed

C. Active sensors are only used on rear axles and passive sensors are only used on front axles due to the difference in bearing types

D. Active sensors measure wheel deceleration rate rather than wheel speed, providing more precise threshold detection than passive sensors

2. A technician is diagnosing an ABS warning light on a vehicle. A scan tool retrieves a code for left rear wheel speed sensor — signal absent. The technician measures the resistance of the passive magnetic sensor with a multimeter and reads 1,050 ohms. The manufacturer specifies 800–1,200 ohms. Based on this information the technician concludes:

A. The sensor resistance is out of specification and the sensor must be replaced

B. The sensor resistance is within specification — the fault is likely in the wiring harness between the sensor and the ABS module or in the tone ring

C. The sensor is marginal — at the high end of the specification range — and should be replaced as a precaution

D. Resistance testing is not valid for ABS sensors and the sensor must be replaced based on the code alone

3. A wheel speed sensor tone ring is inspected and appears intact with no missing or broken teeth. However, the ABS code returns after clearing. The technician should:

A. Replace the ABS control module since the code is recurring despite a good tone ring

B. Clean the tone ring with brake cleaner and re-inspect since contamination from grease or road debris can simulate a damaged ring

C. Replace the wheel speed sensor since the tone ring is confirmed good and the sensor must be at fault

D. Perform a road test while monitoring live wheel speed data to observe whether the signal dropout is mechanical or intermittent

4. During a road test with a scan tool monitoring live wheel speed data, the left front wheel speed reading is consistently 3–4 mph lower than the other three wheels at all speeds. This reading indicates:

A. The left front wheel has a larger effective rolling diameter than the others due to an incorrect tire size

B. The left front wheel speed sensor is producing a low signal due to excessive air gap between the sensor tip and the tone ring

C. The left front brake caliper is dragging, slowing that wheel slightly compared to the free-rolling wheels

D. Either A or B — both an incorrect tire size and excessive sensor air gap can produce a consistent low reading at a single wheel

5. An ABS modulator (hydraulic control unit) performs three distinct functions during an ABS stop. These three modes are:

A. Apply, hold, and release — the modulator can increase pressure, maintain current pressure, or decrease pressure at each individual wheel circuit independently

B. Sense, compare, and correct — the modulator monitors wheel speed, compares it to calculated vehicle speed, and applies correction pressure to any wheel approaching lockup

C. Pressurize, modulate, and equalize — the modulator builds line pressure, adjusts it for front-rear balance, and equalizes left-right differences during braking

D. Activate, threshold, and recover — the modulator activates ABS, applies threshold pressure to each wheel, and recovers pressure after wheel speed returns to normal

6. A vehicle has an ABS fault code for the right front wheel speed sensor circuit — signal erratic. The sensor produces a clean signal on the scan tool at low speeds but shows dropout at higher speeds. The MOST likely cause is:

A. The ABS control module cannot process high-speed signals and is logging a false fault

B. The sensor's air gap is acceptable at low speeds but becomes excessive at high speeds when centrifugal force deflects the tone ring away from the sensor tip

C. The sensor wiring harness has a chafe or intermittent connection that vibrates open at higher speeds when road and engine vibration increases

D. The tone ring has a single tooth that is slightly smaller than the others, producing a dropout only detectable at high speed where the inter-tooth timing difference is amplified

7. A technician replaces a wheel speed sensor on a vehicle. After replacement, the ABS light remains on. The technician clears the code and performs a road test. The ABS light returns with the same code. The NEXT diagnostic step is:

A. Replace the ABS control module since the code persisted after sensor replacement

B. Verify the replacement sensor is the correct part number and inspect the tone ring for damage that the original sensor fault may have been indicating

C. Perform a voltage drop test on the sensor power supply circuit since the new sensor may be receiving insufficient voltage

D. Check the sensor air gap since improper air gap on the new sensor installation is the most common cause of a repeat code after sensor replacement

8. A vehicle with ABS has an illuminated ABS warning light. The scan tool shows a code for the ABS control module — internal fault. The technician replaces the module with a new unit. After installation, the ABS light remains on. The MOST likely cause is:

A. The new module is also defective and must be exchanged for another unit

B. The replacement module requires programming or initialization with a scan tool before it will function and clear the fault

C. A wiring fault caused the original module failure and has now damaged the replacement module

D. The brake fluid level sensor is feeding a false signal that is keeping the light on independently of the module replacement

9. A passive magnetic wheel speed sensor produces a signal with an amplitude that increases as wheel speed increases. The reason for this is:

A. The ABS control module amplifies the signal as speed increases to improve signal clarity at highway speed

B. Faster wheel rotation causes the tone ring teeth to pass the sensor at a higher rate, generating a stronger magnetic flux change per unit time and increasing the voltage amplitude of the AC output

C. The wheel bearing clearance decreases at higher speeds due to centrifugal force, reducing the air gap and strengthening the magnetic field

D. The ABS module adjusts its sensitivity threshold in proportion to vehicle speed, which is interpreted as a change in sensor output amplitude

10. A scan tool displays wheel speed sensor data showing that one wheel is reading 0 mph while the other three wheels show normal road speed. The ABS has activated. The technician should first determine:

A. Whether the wheel reading 0 mph is actually locked or whether the sensor has simply lost its signal

B. Whether the ABS module has failed and is misreading the wheel speed sensor data

C. Whether the brake fluid pressure is low enough to cause the affected wheel to lock during normal braking

D. Whether the road surface has sufficient friction to allow the ABS system to function as designed

BONUS SECTION 9 — ANSWERS AND EXPLANATIONS

1. B — Active sensors use external power to produce digital output; passive sensors self-generate AC signal — Hall effect (active) sensors contain an integrated circuit that requires a 5-volt or 12-volt supply from the ABS module to operate their internal electronics. They output a clean digital square wave signal. Passive magnetic inductive sensors have no electronics — they rely solely on the moving magnetic field created by the passing tone ring teeth to generate their alternating current output with no external power required.

2. B — Sensor resistance within spec — wiring or tone ring fault likely — The measured resistance of 1,050 ohms falls within the 800–1,200 ohm specification, confirming the sensor coil is electrically intact. A signal-absent code with a good sensor resistance points to the wiring harness — a broken wire, corroded connector, or disrupted circuit path between the sensor and module — or to a mechanical issue with the tone ring preventing signal generation.

3. D — Road test while monitoring live wheel speed data — A code that returns after clearing with a visually intact tone ring requires dynamic diagnosis. Live data monitoring during a road test captures the signal dropout as it happens, revealing whether it is speed-dependent, temperature-related, load-triggered, or associated with a specific road surface. Static tests and visual inspection cannot reveal intermittent faults that only manifest under operating conditions.

4. D — Either incorrect tire size or excessive sensor air gap — Both conditions produce a consistently low wheel speed reading at a single wheel. An incorrect tire size with a smaller rolling circumference generates more wheel revolutions per mile, but the sensor reads more pulses per minute than the other wheels, which would actually appear as a higher reading. An oversized tire would read lower. Excessive air gap weakens the sensor signal, causing the module to miss some pulses, producing a lower apparent speed. Either or both can apply depending on the vehicle history.

5. A — Apply, hold, and release — These three pressure modes are the fundamental operating states of any ABS hydraulic modulator. In apply mode, the solenoid opens the inlet valve and allows master cylinder pressure to increase at the wheel. In hold mode, both valves close and pressure is maintained constant. In release mode, the outlet valve opens and pressure decreases, allowing the wheel to accelerate. The modulator cycles rapidly through these states to keep each wheel at the threshold of lockup.

6. C — Wiring harness intermittent connection — A wheel speed signal that is clean at low speed but drops out at higher speeds is the classic signature of a vibration-sensitive wiring fault. At low speeds, road and drivetrain vibration is minimal and the partially chafed or corroded connection

maintains continuity. At highway speed, increased vibration amplitude opens the marginal connection intermittently, causing the signal dropouts that the ABS module logs as an erratic signal fault.

7. D — Check sensor air gap after installation — The most common installation error when replacing a wheel speed sensor is incorrect air gap between the sensor tip and the tone ring. An air gap that is too large reduces signal amplitude below the ABS module's minimum detection threshold, producing the same code as the original failed sensor despite the new component being electrically good. Verifying the air gap per the manufacturer's specification is the essential first step after any sensor replacement that does not resolve the original code.

8. B — New module requires programming or initialization — Modern ABS control modules contain vehicle-specific calibration data and often require initialization, VIN programming, or a learn procedure after installation. An unprogrammed module will not function correctly and will continue to set fault codes until it has been properly configured with the vehicle's specific software and calibration values using a compatible scan tool or programming interface.

9. B — Higher wheel speed generates stronger magnetic flux change and greater voltage amplitude — A passive magnetic sensor operates on the principle of electromagnetic induction. Each tooth of the tone ring passes the sensor's magnetic tip and disturbs the magnetic field, inducing a voltage pulse. At higher wheel speeds, teeth pass more rapidly, causing more frequent and slightly more abrupt magnetic field changes per unit time. This produces voltage pulses with a higher amplitude in addition to the expected increase in frequency.

10. A — Determine if the wheel is actually locked or if the sensor has lost signal — A wheel reading 0 mph while the vehicle is moving at road speed could mean two very different things: the wheel has actually locked up and stopped rotating, or the wheel speed sensor has lost its signal and the module is displaying zero because it receives no pulses. Determining which condition is present — through visual inspection, drag marks on the road, wheel temperature, or scan tool comparison with adjacent wheel data — is essential before any further diagnosis or repair.