ABS
Anti-lock Braking System

Starting MY 1985
Objectives

At the end of this presentation, you should be able to:

1. Explain the function of and purpose for ABS
2. Describe the customer interface with ABS
3. List the hydraulic and electronic components used for ABS
4. Explain the difference between the two types of wheel speed sensors
5. Describe what happens in the “Pressure Hold” phase of ABS control.
6. Describe what happens in the “Pressure Release” phase of ABS control
7. Locate background and diagnostic information concerning ABS
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Purpose of ABS

Automatic, electronic regulation of brake pressure to prevent the wheels from locking up during braking. Driver maintains the ability to steer vehicle.
Driving with ABS

• When vehicle first exceeds 5mph after a start-up, a self-test is performed. With foot on brake pedal, a pulsation will be felt.

• Driver applies brakes:
  – If wheels do not approach lock-up, then ABS is not activated and brakes function as in a non-ABS vehicle.
  – As vehicle is braked, ABS may be able to prevent wheel lock-up by simply holding the brake fluid pressure from going any higher. The driver would not sense this stage of control.
  – If driver feels brake pedal pulsate, then ABS is reducing brake fluid pressure in order to insure that wheels continue rotate. This action may be accompanied by pump noise.

• Remember! ABS gives the driver the ability to steer the vehicle in an emergency braking situation.
ABS Malfunction Indicator Lamp (MIL)

- Illuminated in key position 2
- Goes out with engine running
- Illuminated when a fault is present
- Will indicate low available voltage (< 10.5 V)
- Flickering off and on while engine is running indicates a voltage supply problem
ABS – Hydraulic Components

- Brake calipers
- Lines / hoses
- Master cylinder
- Hydraulic control unit
Hydraulic Control Unit

Motor: A7/3m1
Pumps: A7/3p1-p2
Solenoid valves: A7/3y6-y23
Pressure sensor: B34

HA: Rear brake circuit  VA: Front brake circuit
HL: Rear left (brake)   VL: Front left (brake)
HR: Rear right (brake)  VR: Front right (brake)
ABS - Electronic Components

- Stop lamp switch (S9/1)
- Wheel speed sensors (L1-L4)
  - Inductive (early vehicles)
  - Active (late model vehicles)
  - Note: VSS = Vehicle Speed Sensor
- Electronic control unit (N47)
- Hydraulic control unit (A7)
- Return pump relay (K40)
- Malfunction Indicator Lamp
Inductive Wheel Speed Sensor

When an inductive pickup is used: AC voltage is created when teeth move through the Magnetic field surrounding the sensor.
Active Wheel Speed Sensor

A newer version sensor:
Magnetic field near sensor alternates N-S-N… Sensor is a switch with voltage supplied to it. A DC square wave is created as switch is turned on and off. Frequency increases with wheel speed.

Elastomer plastic containing magnets
Effects of Unequal VSS Output

• ABS MIL will illuminate after driving
• Caused by:
  – Tire sizes that do not match factory specifications
  – Tire circumferences unequal

• Normal braking without ABS intervention is still possible
Hydraulic Control Unit (A7)

- Electric motor and pumps
- Solenoid valves
- Pressure sensor
- Electronic control module

Located in engine compartment
Normal Braking Mode

HL - Rear left
HR - Rear right
VL - Front left
VR - Front right

No wheel speed difference.
Pressure created by driver operation of the master cylinder.
ABS Control Mode: “Pressure Hold”

(Example shown - RF wheel)

Vehicle Speed Signal indicates wheel is about to lock. Pressure still applied, but can’t increase because ABS control module has activated valve y8.
ABS Control Mode: “Pressure Release”

To *reduce* pressure at locking wheel (the wheel that has stopped spinning):

**ABS control module:**
- Activates return pump
- Activates Valve y8 so no more pressure can be applied
- Activates valve y9 so pressure at brake can be reduced

These valves can be pulsed very rapidly. You can feel this stage of operation through the brake pedal.
ABS Block Diagram

Circuit 30 & 15
Circuit 31
Terminal 61
Stop lamp switch S9/1
Left Front VSS
Right Front VSS
Rear VSS

ABS Control Unit

Return pump relay K40/?
Hydraulic control unit A7/?
CAN-C (VSS on earlier models)
ABS MIL
Diagnostic line to X11/4 (K-line)