LEAK DETECTION METHODS

Leak Detection
- Potential Leak Areas
- Smoke Machine
- Ultrasonic Leak Detection

PROBLEMATIC LEAK AREAS
Leaks include the loss of any gases or liquids. The following are some common leak areas:
- EVAP system
- A/C systems
- Intake vacuum
- Engine oil
- Engine coolant
- Transmission
- Transfer case
- Differential
- Power steering
- Fuel
- Turbocharger

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**SMOKE MACHINE**

The smoke machine is designed to help locate leaks in the intake, exhaust, crankcase, cooling system, and other components. In order to have successful results, all ports must be effectively blocked. Special tools are available for blocking ports.

Use the regulator to set the test pressure. Do not use a pressure that is greater than the system would normally encounter. The flow control valve regulates the air pressure flow rate and controls smoke induction.

**ULTRASONIC LEAK DETECTION**

Ultrasonic technology instruments can pinpoint a variety of automotive leaks. Most ultrasonic leak detectors work with any type of gas, including refrigerant, compressed air, nitrogen, or a vacuum.

The leak detector translates the ultrasonic sound to a lower frequency so you can hear it through headphones. As you get closer to the leak, the sound gets louder and the LED display indicates that you are in the proximity of a leak. As you work, decrease the sensitivity to pinpoint the exact location of the leak.

**HEAD GASKET LEAK TESTING**

Head gaskets can fail in different ways, depending on application. Symptoms may include an external coolant leak, internal coolant leak, external oil leak, or oil leaking into the coolant. A failed head gasket can also leak compression into the coolant jackets, between adjacent cylinders, or to the outside of the engine.

**Detect a leak** To determine if there are compression gases leaking into the cooling system, remove the radiator cap (with a cold engine) and look for bubbles while an assistant cranks the engine. Bubbles indicate a leak between a cylinder and a water jacket.

**Test for CO₂** Use equipment that can detect CO₂ to determine if the head gasket is leaking.

To perform a CO₂ test:

1. Lower the coolant level in the recovery bottle or the radiator to allow room for CO₂ to build up.
2. Fill the test cylinder to the line with the special fluid.
3. With the engine running, place the tester over the mouth of the radiator or pressure tank.
4. Pump the bulb several times to draw gases from above the coolant into the fluid. Make sure not to pump any coolant into the tester. If CO₂ is present, the fluid will change to a yellow color.

An electronic CO₂ tester “sniffs” for the presence of CO₂. When testing, run the engine at 2,500 rpm for one minute and then shut it off. Slowly remove the radiator cap and hold the probe over the opening (but do not touch the coolant). An audible beep indicates the presence of CO₂.

**Check for Hydrocarbon** Use the exhaust gas analyzer to measure for hydrocarbon (HC) in the coolant. With the engine running, remove the radiator cap and hold the analyzer’s wand over the coolant (but do not touch the coolant). Read the meter for the amount of HC sampled. A leaking head gasket typically reads over 200 PPM HC.

**Monitor Temperature & Pressure** Leaking compression or combustion into the cooling system results in a rapid increase of cooling system pressure. Use a cooling system pressure tester to monitor temperature and pressure. Install an adaptor in place of the radiator cap and attach the tool to the adaptor. Attach a pressure gauge to the tool and install a thermometer through the opening and into the coolant.

With the engine running, observe the pressure gauge and thermometer readings. If there is an increase in pressure without an increase in temperature, the head gasket may be leaking.
Crankcase Oil Leaks

If the engine is leaking a high volume of oil, certain areas are likely exposed to high oil pressure, including:
- Front crank seal
- Oil pressure sending unit
- Oil cooler lines
- Rear main seal
- Turbo feed

Find the Source Use a special UV fluorescent dye along with a UV blue light and yellow glasses, to help locate the leak. Pour the dye into a bottle of oil and add the oil to the engine. Run the engine for several minutes, and then use the light and glasses to find the leak.

Another method is to pressurize the crankcase with air. Use the smoke machine and regulate the air pressure to between 1 to 3 psi (6.9 to 20.7 kPa). The air hose is typically attached to the dipstick tube. Use a spray bottle with soapy water or a leak detection solution to spray the suspected areas. You can also use an ultrasonic leak detector.

A/C Leak Detection

Detect a Leak Many manufacturers install fluorescent dye into their air conditioning (A/C) systems during production. In addition, some brands of R-134a (refrigerant) may have a dye already mixed in. If not already installed, the dye can be injected into the system. Pinpoint the leaks by looking for the bright yellow-green glow of the fluorescent dye under a UV lamp. Since more than one leak can exist, inspect each component, line, and fitting in the system.

Find the Source A/C leaks can be located by introducing CO₂ into the system. By using CO₂, the air conditioning system can be safely pressurized up to 200 psi. This allows very small CO₂ molecules, under greater pressure, out of the leak site.

To isolate the exact location of the leak, spray specifically formulated foam onto the suspect area. The foam changes color from a pinkish-red to yellow, pinpointing the source of the leak.

Ultrasonic leak detectors can also be used to locate a refrigerant leak. These units detect the sound of a turbulent gas leak rather than the gas itself.

Evap System Leak Detection

The smoke machine is the most common method for locating a leak in the evaporative (EVAP) emission system. Some EVAP systems have a green test port for connecting the EVAP leak testing equipment, which requires a special adapter. If a test port is not provided, connect the smoke machine to the canister fresh air filter hose or use a fuel filler cap adaptor.

Detect a Leak To determine if there is an EVAP system leak, use the smoke machine to pressurize the system (do not introduce smoke at this time). With the vent and purge valves commanded closed, the system should build pressure. Most machines have a flow meter that identifies the size of the leak. If there is no leak, the flow ball will fall to the bottom. If there is a leak, the ball will indicate the approximate size of the leak.

Fuel filler cap adapters are needed to make additional connections for the EVAP leak detection equipment.
**TECH TIPS**

- Ultrasonic leak detection equipment can also be used to locate wind noise in the vehicle.
- Cavitation in the cylinder wall may eventually eat through to the water jacket and allow coolant to enter the crankcase. When testing for a leak, the position of the piston may actually cover the hole and not indicate a leak at that time. Rotate the engine and retest to ensure there are no leaks.
- Head gasket leaks can be hard to detect. Engine temperature can affect when the leak becomes evident. Be sure to test under different engine temperatures.
- To locate leaks at the A/C compressor, disconnect the electric cooling fan and turn on the A/C system. This will increase the system pressure. Shut the engine off and use the sniffer around the front seal area of the compressor.
- If the scan tool will not allow for EVAP system vent and/or purge valve activation, access the solenoid and use a fused jumper wire to ground the control circuit at the connector.
- Try to prevent making any smoke machine connections at EVAP system quick connects. Doing this may mask the leak location or create a leak. Enter at the most non-intrusive place on the system, typically the fresh air filter. Use a filler cap adapter after you have confirmed the cap is not the cause of the leak.
- Do not use smoke until it is confirmed there actually is a leak.
- Nitrogen is the safest gas used to propel smoke into the system. If shop air is used, sparks and open flames can cause the vapors to ignite.
- If the filler neck enters the side of the fuel tank, fuel may be higher than the neck. This can absorb the smoke and not allow for the detection of leaks.
- When smoke testing, leave the vent open and apply the smoke. This will make the vent valve easy to locate for future testing. Then use the scan tool to command the vent closed, and monitor to see if the smoke is completely shut off. If any amount of smoke seeps out, the vent valve is leaking.

**VACUUM LEAK DETECTION**

The ultrasonic leak detector can be used to locate the source of a vacuum leak. When checking for vacuum leaks around the intake manifold, you will also hear noise from valves and other components. Vacuum leak sounds will be constant while those generated by valves are rhythmic. To eliminate mechanical noise, an option is to pressurize the system with nitrogen. Move the probe slowly around the suspect areas.

**REVIEW QUESTIONS**

1. Leak determination of the head gasket is being discussed. Technician A says that if the block test fluid turns yellow, this indicates the presence of CO₂. Technician B says that when using an electronic CO₂ tester, the probe needs to be immersed into the coolant. Who is correct?
   a. Technician A  
   b. Technician B  
   c. Both Technician A and Technician B  
   d. Neither Technician A nor Technician B

2. Technician A says that the ultrasonic leak detector detects the presence of a gas. Technician B says to change the sensitivity of the tool as you work toward the leak. Who is correct?
   a. Technician A  
   b. Technician B  
   c. Both Technician A and Technician B  
   d. Neither Technician A nor Technician B

3. Technician A says to pressurize the crankcase to 20 psi (1.4 Bar) to locate an oil leak. Technician B says that the vent and purge valves need to be open when pressure testing the EVAP system. Who is correct?
   a. Technician A  
   b. Technician B  
   c. Both Technician A and Technician B  
   d. Neither Technician A nor Technician B