

Subaru Engine Repair

The engine lubrication system includes many small passages. Dirty or contaminated engine oil may contain microscopic particles that can clog these passages. If the oil supply to the hydraulic lash adjusters (HLAs) on the 2.2 liter SOHC engine is blocked by this debris, oil pressure and supply to the HLAs will drop. A ticking noise from one or more HLA may result. This article addresses the procedure from disassembling the rocker assemblies and HLAs to examine for blockage or other damage.

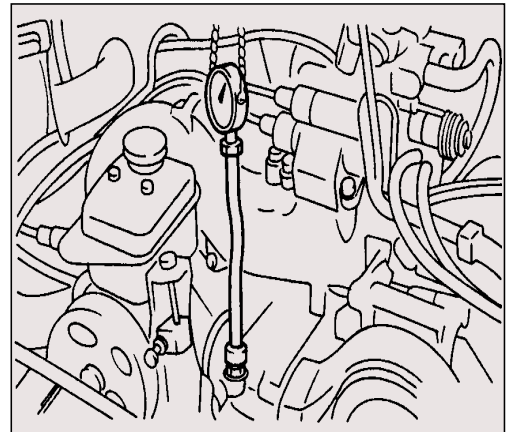
Engine Oil Pressure Measurement

Low oil pressure may also cause noisy HLAs. Use the following procedure to measure the oil pressure before further disassembly.

Remove the generator from its bracket. Disconnect the connector and terminal from the generator. Remove the v-belt cover. Loosen the lock bolt and slider bolt, and remove the generator v-belt. Remove the generator lock bolt. Remove the generator bolt. Disconnect the connector from the oil pressure switch. Remove the oil pressure switch from the engine cylinder block. Connect the oil pressure gauge hose to the engine block. Start the engine, and measure the oil pressure.

Oil pressure: 98 kPa (14 psi) or more at 800 rpm
294 kPa (43 psi) or more at 5,000 rpm

Caution: If the oil pressure is out of specification, check the oil pump, oil filter and lubrication line. If the oil pressure warning light is turned ON and oil pressure is in specification, replace the oil pressure switch.



Measuring Oil Pressure

Note: The specified data is based on an engine oil temperature of 80°C (176°F).

After measuring oil pressure, reinstall the oil pressure switch.

Tightening torque: 25 ± 3 Nm
(2.5 ± 0.3 kg-m, 18.1 ± 2.2 ft-lb)

Install the generator and v-belt in the reverse order of removal, and adjust the v-belt deflection.

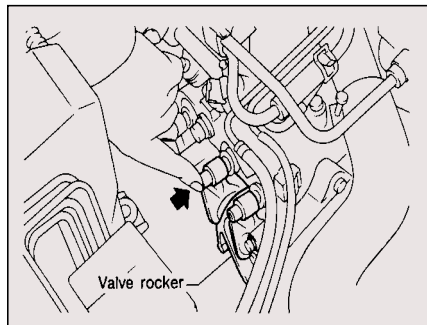
Hydraulic Lash Adjuster Inspection

Disconnect the blow-by hose from the rocker cover. Remove the spark plug wire terminals. Remove the left and right rocker covers.

Caution: Before removing the left rocker cover, disconnect the battery cables and the generator cable.

Manually push the valve rocker (at lash adjuster location) to check that there is no air in it.

Note: When air is in the lash adjuster, the valve rocker moves when pushed with fingers.



Measuring Lash

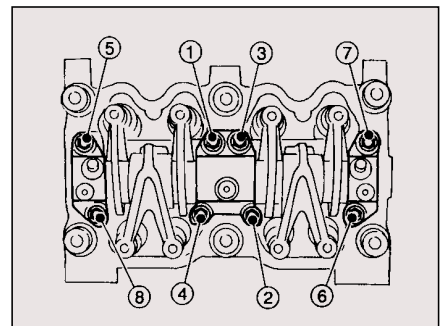
If air is in lash adjuster, remove the valve rocker assembly from the engine and bleed air completely.

Lash Adjuster Air Bleeding

Remove the valve rocker assembly. Remove bolts 1 through 4 in numerical sequence.

Caution: Leave two or three threads of bolt 1 engaged to retain the valve rocker assembly.

Equally loosen bolts 5 through 8 all the way, being careful that the knock pin is not gouged. Manually remove the lash adjusters where air is trapped.

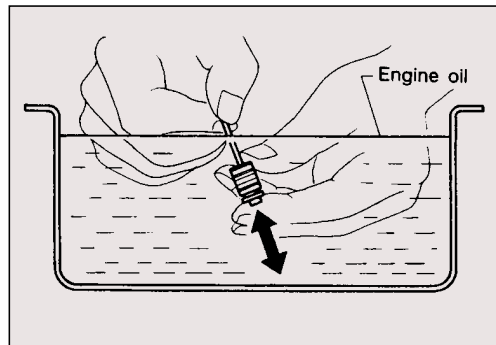


Bolt Removal Sequence

Caution: If a lash adjuster is difficult to remove manually, use pliers. Be careful not to scratch the lash adjuster.

Bleed air from hydraulic lash

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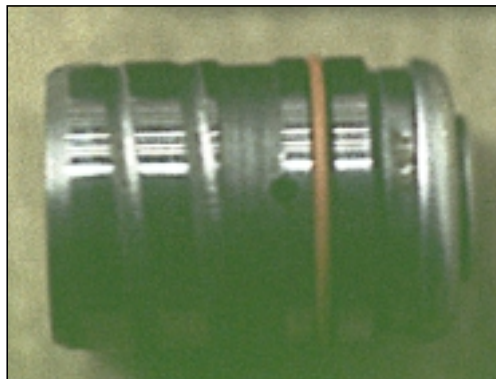


Bleeding HLA

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Engine Oil Pressure Measurement

Low oil pressure may also cause noisy HLAs. Use the following procedure to measure the oil pressure before further disassembly.



Collapsed HLA

Remove the generator from its bracket. Disconnect the connector and terminal from the generator. Remove the v-belt cover. Loosen the lock bolt and slider bolt, and remove the generator v-belt. Remove the generator lock bolt. Remove the generator

bolt. Disconnect the connector from the oil pressure switch. Remove the oil pressure switch from the engine cylinder block. Connect the oil pressure gauge hose to the engine block. Start the engine, and measure the oil pressure.

Oil pressure: 98 kPa (14 psi) or more at 800 rpm
294 kPa (43 psi) or more at 5,000 rpm

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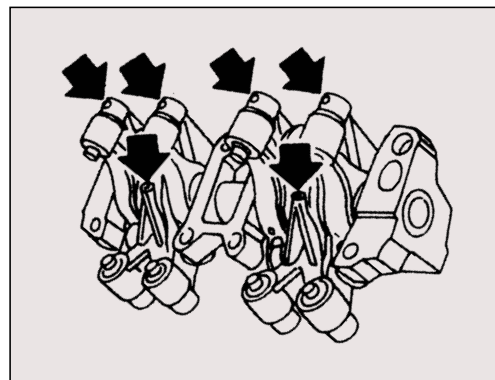
After measuring oil pressure, reinstall the oil pressure switch.

Tightening torque: 25 ±3 Nm (2.5 ±0.3 kg-m, 18.1 ±2.2 ft-lb)

Install the generator and v-belt in the reverse order of removal, and adjust the v-belt deflection.

Hydraulic Lash Adjuster Inspection

Disconnect the blow-by hose from the rocker cover. Remove the spark plug wire terminals. Remove the left and right



Rocker Air Vent Holes

rocker covers.

Caution: Before removing the left rocker cover, disconnect the battery cables and the generator cable.

Manually push the valve rocker (at lash adjuster location) to check that

Caution: Do not remove a valve lash adjuster unless it requires air bleeding or replacement. If a valve lash adjuster is hard to remove by hand, use pliers. Be careful not to scratch the valve lash adjuster. Dip the lash adjuster in engine oil after removal.

Valve Rocker Arm

Measure the inside diameter of the valve rocker arm and the outside diameter of the valve rocker shaft, and determine the difference between the two (= oil clearance).

Clearance between arm and shaft:
Standard: 0.020-0.054 mm
 (0.0008-0.0021 in)
Limit: 0.10 mm (0.0039 in)

If the oil clearance exceeds specifications, replace the valve rocker arm or shaft.

Note: Replace valve rocker arm or shaft, whichever shows greater amount of wear.

Rocker arm inside diameter:
 22.020-22.041 mm (0.8669 - 0.8678 in)
Rocker shaft diameter: 21.987-22.000 mm (0.8656 - 0.8661 in)

Measure the inside diameter of the rocker shaft support and the outside diameter of the valve rocker shaft, and determine the difference between the two (= oil clearance).

Clearance between support and shaft:
Standard: 0.005-0.039 mm
 (0.0002 - 0.0015 in)
Limit: 0.05 mm (0.0020 in)

If the oil clearance exceeds specifications, replace the rocker

shaft support or shaft.

Note: Replace the rocker shaft support or shaft, whichever shows a greater amount of wear.

Rocker shaft support inside diameter: 22.005-22.026 mm (0.8663-0.8672 in)
Rocker shaft diameter: 21.987-22.000 mm (0.8656-0.8661 in)

If the cam or valve contact surface of valve rocker arm is worn or dented excessively, replace the valve rocker arm. Check that valve rocker arm roller rotates smoothly. If not, replace the valve rocker arm.

Valve Rocker Shaft

Visually check the oil relief valve of shaft end for any of the following abnormalities:

- Breaks in check ball body

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- Foreign particles caught in valve spring
- Oil leakage at check ball

Caution: Repair or replace valve rocker shaft as necessary.

After bleeding air from the hydraulic lash adjuster, position the hydraulic lash adjuster in the valve rocker arm while dipping in engine oil.

Caution: Fill the rocker arm oil reservoir chamber with engine oil. Install a new hydraulic lash adjuster O-ring, being careful not to scratch it. Do not attempt to rotate the hydraulic lash adjuster during installation.

Arrange the valve rocker arms, springs and shaft supports in assembly order and insert the valve rocker shaft. Ensure that the cutout portion of rocker shaft faces oil holes in the shaft supports.

Caution: The valve rocker arms, rocker shaft and shaft supports have identification marks. Ensure parts with same markings are properly assembled.

Install the valve rocker shaft securing bolts while aligning shaft lock” holes with bolts.

Valve Rocker Assembly Installation

Temporarily and equally tighten bolts 1 through 4. Do not allow knock pin to catch valve rocker assembly. Tighten bolts 5 through 8 to specified torque. Tighten bolts 1 through 4 to specified torque.

Tightening torque: $12 \pm 1 \text{ Nm}$ ($8.7 \pm 0.7 \text{ ft-lb}$)

Install the rocker covers.

Tightening torque: $5 \pm 1 \text{ Nm}$ ($3.6 \pm 0.7 \text{ ft-lb}$)

Reconnect the harness connectors, hoses, etc, to their positions.

Engine Diagnostics

Note: The following diagnostics pertain to the 2.2 liter engine only.

Valvetrain Noise (clacking sound)

Operate the engine for approximately one (1) hour before diagnosing HLAs as the problem.

If the rocker shaft relief valves are plugged, the rocker shaft oil pressure will increase during low engine temperature operation. This could result in the HLAs being forced part way out of the rocker arm sockets. A clacking sound may be produced which is similar to collapsed HLAs. Engine misfire may also occur during this condition.

If the relief valves will not hold pressure, the HLAs may collapse, again producing a clacking sound.

Timing Marks

There are two timing marks on both the cam pulleys and the crankshaft pulley, a notch and an arrow. Align the notch on the outer rim of each camshaft pulley with the notch on the inner cam cases. Align the notch on the rear flange of the crankshaft sprocket with the notch on the oil pump housing.

Mark the belt at the three timing notches. This will make reinstallation much easier and also ensures proper placement of the belt between the left and right cam pulleys.

Mark the belt rotation direction. The belt must be reinstalled to rotate in same direction.

Note: New belts will have the timing marks printed on the belt as well as arrows indicating direction of rotation.

Rocker Arm Component Inspection and Servicing Notes

Remove the valve rocker cover bolts and the valve rocker cover. Then remove the eight rocker shaft assembly retaining bolts and the rocker shaft assembly.

Note: Remove the rocker assembly slowly to prevent binding against the mounting dowels.

Use a small screwdriver to remove the HLA from the rocker socket. Do not damage the O-rings or the machined surfaces when removing the HLAs. To

check the HLAs for proper operation, squeeze the HLA between your thumb and finger. The HLA should not compress, it should not be spongy.

Place the HLA in a clean 12 mm socket. The socket serves as an oil reservoir. Add engine oil to the socket. Use a small Allen wrench or paper clip to depress the check ball. Depress and release the HLA plunger while you hold the check ball open. This purges the air from the HLA and fills the HLA with oil. It usually requires only one stroke to fill the HLA. Store the HLAs in engine oil for later reassembly.

Note: Partially filled HLAs will result in noisy operation of the valve train for approximately one hour. To test, squeeze the HLA between your thumb and finger. If the HLA is spongy, repeat the fill

process. If the HLA can not be pumped to a firm condition, replace it.

Assemble the rocker shaft components, rocker arms, spring washers, and the rocker shaft supports. Lubricate shaft and rocker arms with oil.

Note: The rockers and supports should be returned to their original position on the shaft. The cut out portion of the rocker shaft must face the oil hole in the rocker support. The spring washers must be properly located on the shaft. Always replace any deformed spring washers.

Lock the rocker shaft in the proper position with the two retaining bolts. Then fill the HLA sockets with engine oil.

Press the HLAs (by hand) into

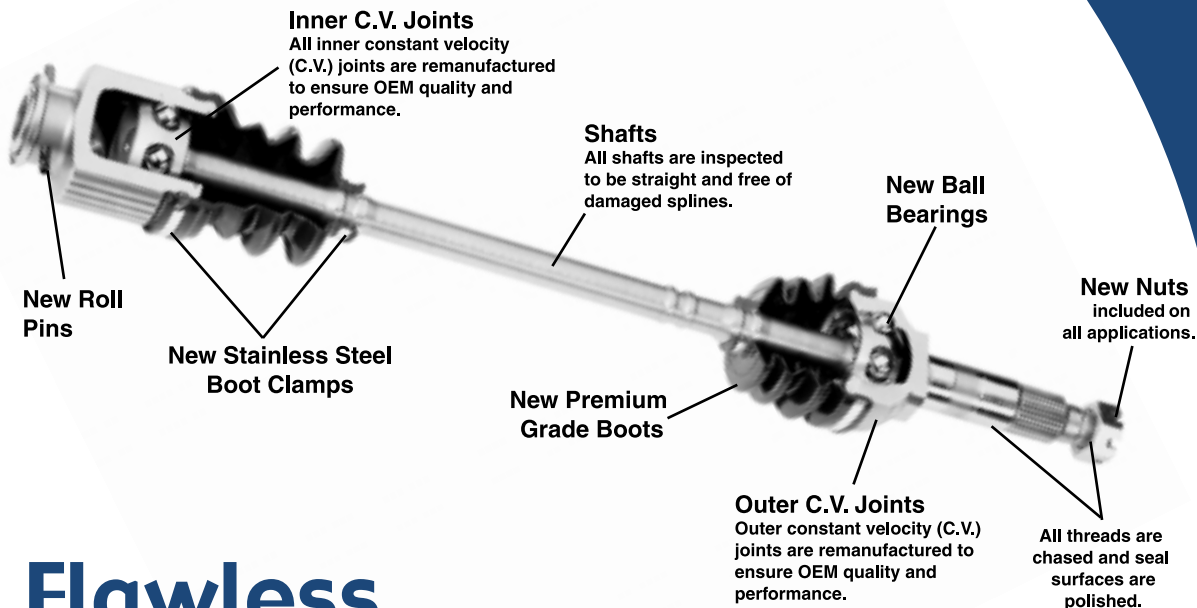
the rockers to install the HLAs in the rocker arms. Some oil will drain from the bleed hole. Press the HLA until the O-ring seats. Install the remaining HLAs. Be sure to check for spongy HLAs during installation.

Note: The HLA O-rings should always be replaced when the HLAs are reinstalled.

Look for leakage from the tensioner rod and seal area. Slight traces of oil at rod oil seal does not indicate a problem.

Inspect the rocker arms for damage. Also inspect the rocker arm bearing surface for wear. Replace the rocker arm if bearing wear is excessive.

Finally, inspect the rocker arm cam contact surface. Replace the rocker arm(s) when they are scored or gouged.



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