

SERVICE MANUAL

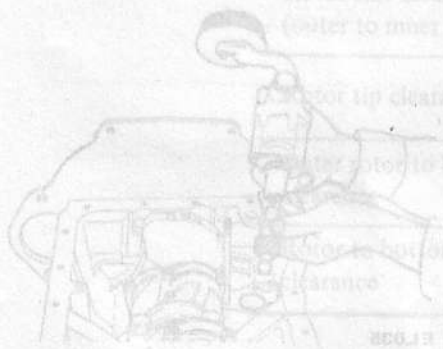
MODEL J13, J15 & J16 SERIES ENGINES

1. Drive spindle
2. Gasket
3. Oil pump body
4. Oil pump
5. Oil pump

1. Drain engine oil
2. Remove oil pan
3. Remove oil pump body with drive spindle assembly

INSTALLATION

1. Using a new gasket, install oil pump and drive spindle assembly to cylinder block with bolts and nut.



2. Install oil pan with a new gasket in place on cylinder block.

1. Remove pump cover, clean pump housing and pump housing cover.
2. Remove regulating cap, regulating valve and spring.
3. Remove oil strainer from pump cover.
4. Assemble oil pump in the reverse order of disassembly.

SECTION EL

ENGINE LUBRICATION SYSTEM

EL

ENGINE LUBRICATION SYSTEM EL-2

SERVICE DATA AND SPECIFICATIONS EL-5

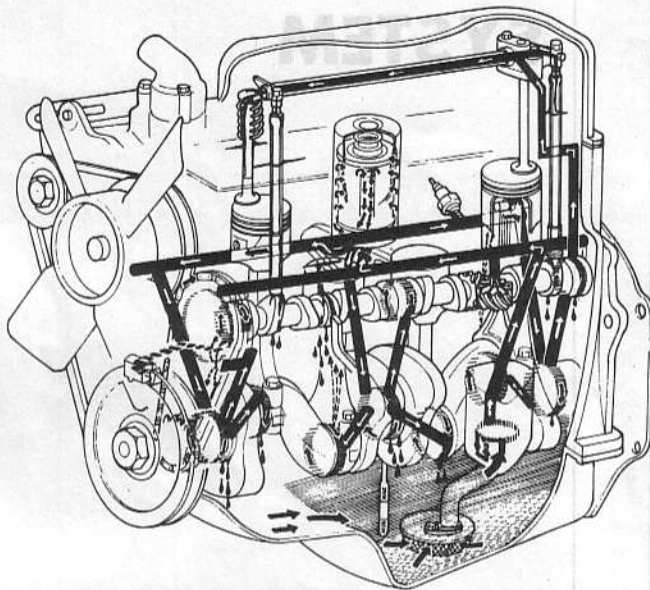
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ENGINE LUBRICATION SYSTEM

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EL034

Fig. EL-1 Lubricating circuit

LUBRICATION CIRCUIT

The pressure lubrication of the engine is accomplished by a trochoid-type oil pump. This pump draws the oil through the oil strainer into the pump housing and then forces it through the full-flow type oil filter into the main oil gallery. A portion of the oil is supplied to all crankshaft bearings, and is fed to the connecting rod bearings through the drilled passages in the crankshaft. Oil injected from jet holes on connecting rods lubricates the cylinder walls and piston pins. Camshaft bearing lubrication is made by carrying oil through oil passages from the crankshaft bearing.

Timing chain and chain tensioner receive lubrication from the oil jet and an additional oil passage diverged from the front crankshaft bearing. Lubri-

cant is delivered to the oil gallery in the rocker shaft from the rear crankshaft bearing.

The valve mechanism, push rods and valves, is lubricated through oil passages in rocker arms. Cam profiles of the camshaft is lubricated down along push rods. Lubricating oil then returns to the oil pan.

OIL PUMP

The oil pump is bolted to the bottom of the cylinder block and driven by the oil pump drive spindle assembly which is driven by the helical gear on the camshaft.

The oil pump assembly consists of an oil pressure regulating valve and

outer and inner rotors.

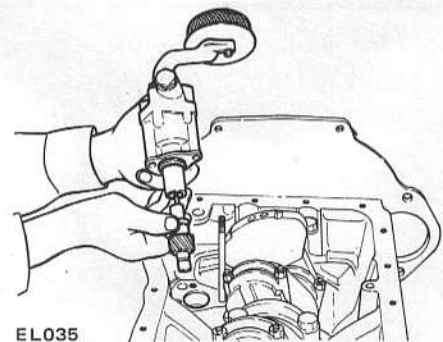
The spring-loaded oil pressure regulating valve limits the oil pressure to a maximum of 5.8 kg/cm² (82.5 psi) at 2,200 rpm.

REMOVAL

1. Drain engine oil.
2. Remove oil pan.
3. Remove oil pump body with drive spindle assembly.

INSTALLATION

1. Using a new gasket, install oil pump and drive spindle assembly to cylinder block with bolts and nut.



EL035

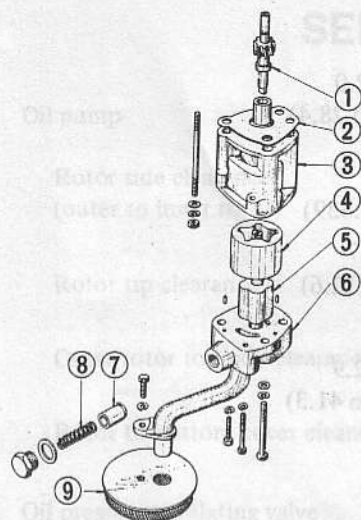
Fig. EL-2 Installing oil pump

2. Install oil pan with a new gasket in place on cylinder block.

DISASSEMBLY AND ASSEMBLY

1. Remove pump cover, attaching bolts and slide out pump rotors.
2. Remove regulating cap, regulating valve and spring.
3. Remove oil strainer from pump cover.
4. Assemble oil pump in the reverse order of disassembly.

INSPECTION



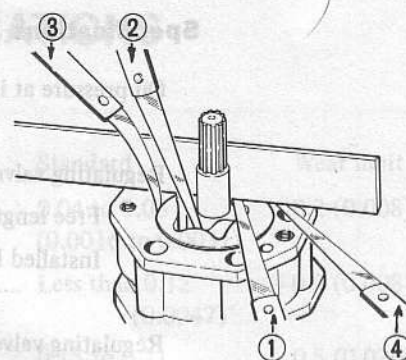
EL036

- 1 Drive spindle
- 2 Gasket
- 3 Oil pump body
- 4 Outer rotor
- 5 Inner rotor and shaft
- 6 Oil pump cover
- 7 Regulator valve
- 8 Regulator spring
- 9 Oil strainer

Fig. EL-3 Oil pump

Wash all parts in cleaning solvent and dry with compressed air. Use a brush to clean the inside of pump housing and pressure regulating valve chamber. Be sure all dirt and metal particles are removed.

1. Inspect pump body and cover for cracks or excessive wear.
2. Inspect pump rotors for damage or excessive wear.
3. Check inner rotor shaft for looseness in pump body.
4. Inspect regulating valve for wear or scoring.
5. Check regulating spring to see that it is not worn on its side or collapsed.
6. Check regulating valve for free operation in the bore.
7. Using a feeler gauge, check tip clearance and outer rotor-to-body clearances shown in Figure EL-4.



EL013

- 1 Side clearance
- 2 Tip clearance
- 3 Outer rotor to body clearance
- 4 Rotor to bottom cover clearance

Fig. EL-4 Checking rotor clearances

8. Place a straight edge across the face of pump as shown in Figure EL-4. Check side clearance (outer to inner rotor) and gap between body and straight edge.

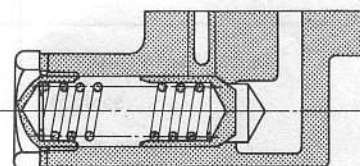
		Standard	Wear limit
Rotor side clearance (outer to inner rotor)	mm (in)	0.04 to 0.08 (0.0016 to 0.0031)	0.2 (0.008)
Rotor tip clearance	mm (in)	Less than 0.12 (0.0047)	0.2 (0.008)
Outer rotor to body clearance	mm (in)	0.15 to 0.21 (0.0059 to 0.0083)	0.5 (0.020)
Rotor to bottom cover clearance	mm (in)	Less than 0.04 (0.0016)	0.2 (0.008)

Note: Outer and inner rotors are not serviced separately.

If oil pump body is damaged or worn, replace the entire oil pump assembly.

OIL PRESSURE REGULATING VALVE

The oil pressure regulating valve is not adjustable. At the released position, the valve permits the oil to by-pass through the passage in the pump cover to the inlet side of the pump. Check regulating valve spring to ensure that spring tension is correct.



EL037

Fig. EL-5 Regulating valve

Specifications

Oil pressure at idling	kg/cm ² (psi)	1.0 to 2.0 (14.2 to 28.4)
Regulating valve spring		
Free length	mm (in)	46.7 (1.839)
Installed length/load	mm/kg (in/lb)	39.0/5.7 (1.535/12.6)
Regulating valve opening pressure	kg/cm ² (psi)	2.8 to 2.9 (39.8 to 41.3)

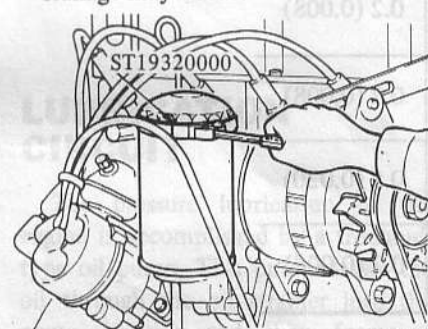
OIL FILTER

The oil filter is of a cartridge type. The oil filter element should be replaced every 9,000 km (6,000 miles) of operation, with the use of Oil Filter Wrench ST19320000.

When removing an oil filter, loosen it after stopping engine about several minutes to drain out the oil from oil filter to oil pan.

When installing an oil filter, fasten it on cylinder block by hand.

Note: Do not overtighten filter, or oil leakage may occur.



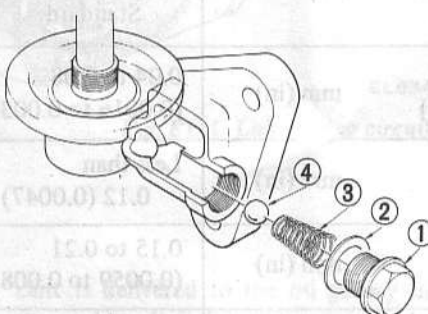
EL038

Fig. EL-6 Removing oil filter

OIL PRESSURE RELIEF VALVE

The relief valve, located in the oil filter bracket, by-passes the oil into the main gallery when the oil filter element is excessively clogged.

With drain plug removed, check valve for operation. Inspect for a cracked or broken valve. If replacement is necessary, remove valve and install a new one.



- 1 Drain plug
- 2 Washer
- 3 Valve spring
- 4 Valve

EL039

Fig. EL-7 Relief valve

OIL PRESSURE WARNING SWITCH

The oil warning switch is located on right hand rear of cylinder block and wired to the oil pressure warning light in the instrument cluster.

The warning light glows whenever the oil pressure drops below 0.2 to 0.4 kg/cm² (2.8 to 5.7 psi).

Prior to installing switch to cylinder block, be sure to apply conductive sealer to threads of new switch.

SERVICE DATA AND SPECIFICATIONS

Oil pump

		Standard	Wear limit
Rotor side clearance (outer to inner rotor)	mm (in)	0.04 to 0.08 (0.0016 to 0.0031)	0.2 (0.008)
Rotor tip clearance	mm (in)	Less than 0.12 (0.0047)	0.2 (0.008)
Outer rotor to body clearance	mm (in)	0.15 to 0.21 (0.0059 to 0.0083)	0.5 (0.020)
Rotor to bottom cover clearance	mm (in)	Less than 0.04 (0.0016)	0.2 (0.008)

Oil pressure regulating valve

Oil pressure at idling	kg/cm ² (psi)	1.0 to 2.0 (14.2 to 28.4)
Regulating valve spring:		
Free length	mm (in)	46.7 (1.839)
Installed length/load	mm/kg (in/lb)	39.0/5.7 (1.535/12.6)
Regulating valve opening pressure	kg/cm ² (psi)	2.8 to 2.9 (39.8 to 41.3)

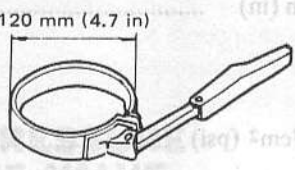
Tightening torque

Oil pump mounting bolts	kg-m (ft-lb)	1.5 to 2.0 (11 to 14)
Oil pump cover bolts	kg-m (ft-lb)	1.0 to 1.5 (7.2 to 11)
Regulating valve cap nut	kg-m (ft-lb)	4 to 5 (29 to 36)
Oil pan mounting bolts	kg-m (ft-lb)	0.5 to 1.0 (3.6 to 7.2)

TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Oil leakage	Damaged or cracked body cover. Oil leakage from gasket. Oil leakage from regulator valve. Oil leakage from blind plug.	Replace. Replace. Tighten or replace. Replace.
Decreased oil pressure	Leak of oil in engine oil pan. Dirty oil strainer. Damaged or worn pump rotors. Defective regulator. Use of poor quality engine oil.	Correct. Clean or replace. Replace. Replace. Replace.
Warning light remains "on" - engine running	Decreased oil pressure. Oil pressure switch unserviceable. Electrical fault.	Previously mentioned. Replace. Check circuit.
Noise	Excessive backlash in pump rotors.	Replace.

SPECIAL SERVICE TOOLS

No.	Tool number & tool name	Description Unit: mm (in)	For use on	Reference page or figure No.
	ST19320000 Oil filter wrench	This tool is used to take oil filter out of place. In tightening the filter, do not use this tool to prevent excess tightening.  120 mm (4.7 in) SE197	All models	Fig. EL-6

Condition	Probable cause	Correction
Oil leakage	- Loose or cracked body cover. - Oil leakage from gasket. - Oil leakage from regulator valve. - Oil leakage from blind plug.	- Replace. - Replace. - Tighten or replace. - Replace.
Decreased oil pressure	- Leak of oil in engine oil pan. - Dirty oil strainer. - Damaged or worn pump rotors. - Defective pressure sensor. - Use of poor quality engine oil.	- Correct. - Clean or replace. - Replace. - Replace. - Replace.
Warning light remains "on" - engine running	- Decreased oil pressure. - Oil pressure switch inoperative. - Pressure switch.	- Previously mentioned. - Replace. - Check circuit.
Note	Excessive backlash in pump rotor.	Replace.