

LUBRICATION SYSTEM

REFER TO 2L, 3L ENGINE REPAIR MANUAL
(Pub. No. RM123E)

NOTE: The following pages contain only the points which differ from the above listed manual.

	Page
DESCRIPTION	LU-2
OIL PRESSURE CHECK	LU-4
REPLACEMENT OF ENGINE OIL AND OIL FILTER	LU-5
OIL COOLER AND RELIEF VALVES (2L-T)	LU-7

LU

LUBRICATION SYSTEM – Description

A fully pressurized, fully filtered lubrication system has been adopted for this engine.



LUBRICATION SYSTEM – Description**LU-3**

A pressure feeding lubrication system has been adopted to supply oil to the moving parts of this engine. The lubrication system consists of an oil pan, oil pump, oil filter and other external parts which supply oil to the moving parts in the engine block. The oil circuit is shown in the illustration at the top of the previous page. Oil from the oil pan is pumped up by the oil pump. After it passes through the oil filter, it is fed through the various oil holes in the crankshaft and cylinder block. After passing through the cylinder block and performing its lubricating function, the oil is returned by gravity to the oil pan. A dipstick on the center left side of the cylinder block is provided to check the oil level.

OIL PUMP

The oil pump pumps up oil from the oil pan and sends it under pressure to the various parts of the engine. An oil strainer is mounted in front of the inlet to the oil pump to remove impurities. The oil pump itself is a trochoid type pump, which uses a drive rotor and driven rotor inside the pump body. When the drive rotor rotates, the driven rotor rotates in the same direction. The axis of the drive rotor shaft is different from the center of the driven rotor, so when both rotors rotate, the space between the two rotors changes. Oil is drawn in when the space widens and is discharged when the space becomes narrow.

OIL PRESSURE REGULATOR (RELIEF VALVE)

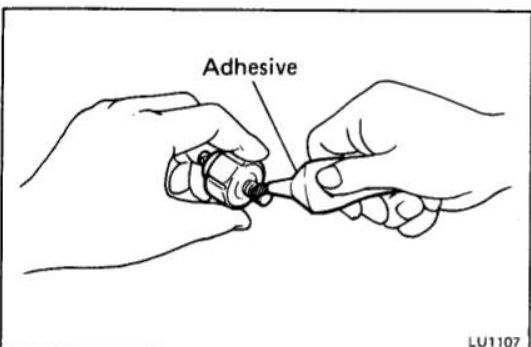
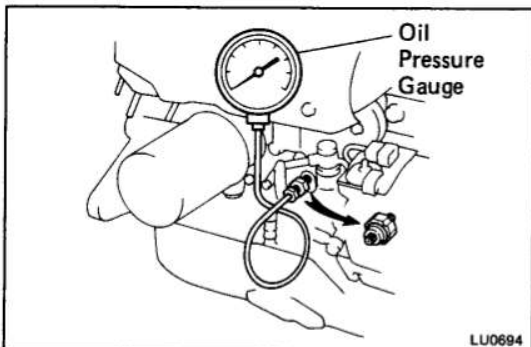
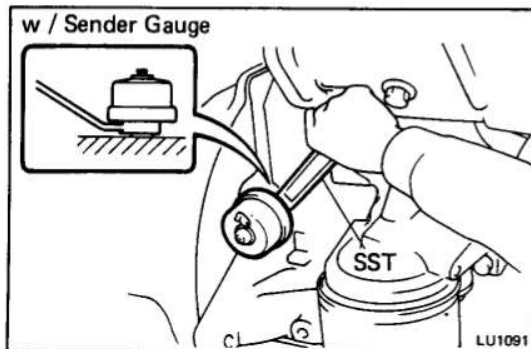
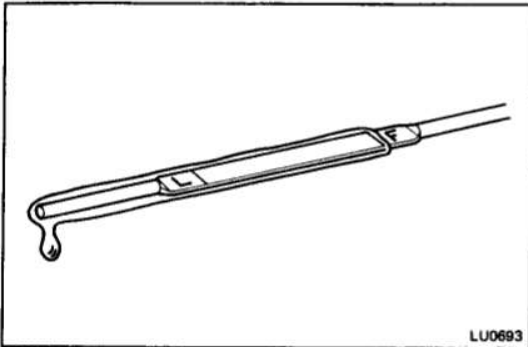
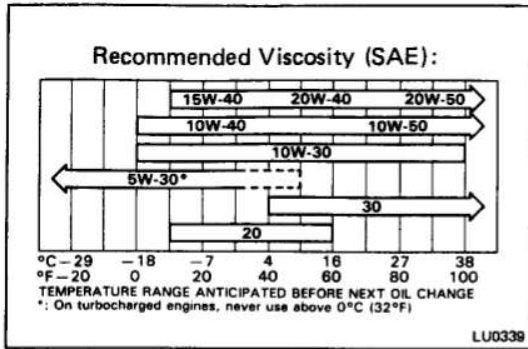
At high engine speeds, the oil pump supplies more oil to each part that is necessary. For this reason, an oil pressure regulator which works to prevent oversupply of oil is installed on the oil pump. During normal oil supply, a coil spring and valve keep the by-pass closed, but when too much oil is being supplied, the pressure becomes extremely high, overpowering the force of the spring and opening the valves. This allows the excess oil to flow through the valve and return to the inlet of the oil pump.

OIL FILTER

There are two types of oil filter, a full flow type and a by-pass element type. A full flow type has a relief valve built into the paper filter element. Particles of metal from wear, airborne dirt, carbon and other impurities can get in the oil during use and could cause accelerated wear or seizing if allowed to circulate through the engine. The oil filter, integrated into the oil line, removes these impurities as the oil passes through it. The filter is mounted outside the engine to simplify replacement of the filter element. A relief valve is also included ahead of the filter element to relieve the high oil pressure in case the filter element becomes clogged with impurities. The relief valve opens when the oil pressure overpowers the force of the spring. Oil passing through the relief valve bypasses the oil filter and flows directly into the main oil hole in the engine.

LU-4

LUBRICATION SYSTEM – Oil Pressure Check



OIL PRESSURE CHECK

1. CHECK ENGINE OIL QUALITY

Check the oil for deterioration, entry of water, discoloring or thinning.

If the quality is poor, replace the oil.

(2L-T)

- Use API grade CD or better and recommended viscosity oil.

(3L)

- Use API grade CC, CD or better and recommended viscosity oil.

2. CHECK ENGINE OIL LEVEL

The oil level should be between the "L" and "F" marks on the dipstick.

If low, check for leakage and add oil up to "F" mark.

NOTICE: Do not fill with engine oil above the "F" mark.

3. REMOVE OIL PRESSURE SWITCH OR SENDER GAUGE

HINT (w/ Sender gauge): Use SST.

SST 09027-12140

4. INSTALL OIL PRESSURE GAUGE

5. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

6. CHECK OIL PRESSURE

Oil pressure:

At idling 0.3 kg/cm² (4.3 psi, 29 kPa)
or more

At 3,000 rpm 3.0 – 5.5 kg/cm²
(43 – 78 psi, 294 – 539 kPa)

7. REMOVE OIL PRESSURE GAUGE

8. REINSTALL OIL PRESSURE SWITCH OR SENDER GAUGE

Apply adhesive to two or three threads.

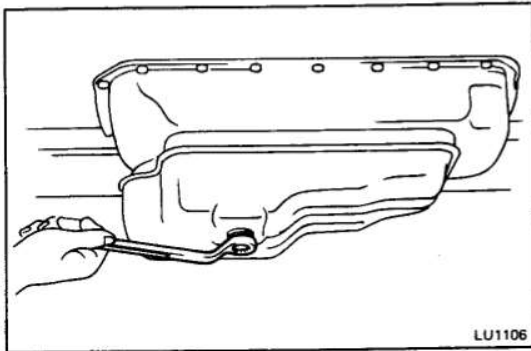
Adhesive: Part No. 08833-00080, THREE BOND 1344, LOCTITE 242 or equivalent

9. START ENGINE AND CHECK FOR LEAKS

REPLACEMENT OF ENGINE OIL AND OIL FILTER

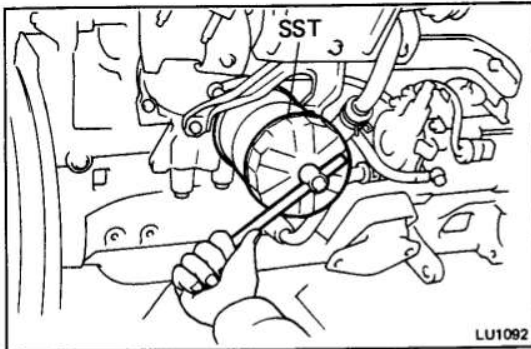
CAUTION:

- Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer. Adequate means of skin protection and washing facilities should be provided.
- Care should be taken, therefore, when changing engine oil, to minimize the frequency and length of time your skin is exposed to used engine oil. Protective clothing and gloves, that cannot be penetrated by oil, should be worn. The skin should be thoroughly washed with soap and water, or use waterless hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.
- In order to preserve the environment, used oil and used oil filters must be disposed of only at designated disposal sites.



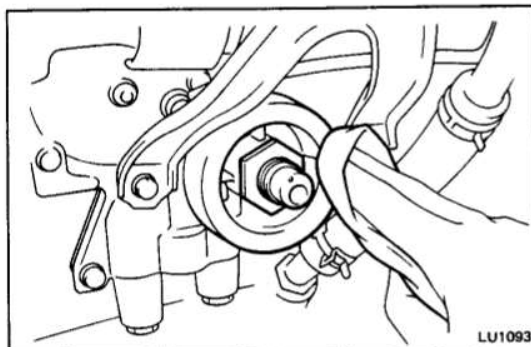
1. DRAIN ENGINE OIL

- (a) Remove the oil filler cap.
- (b) Remove the oil drain plug, and drain the oil into a container.

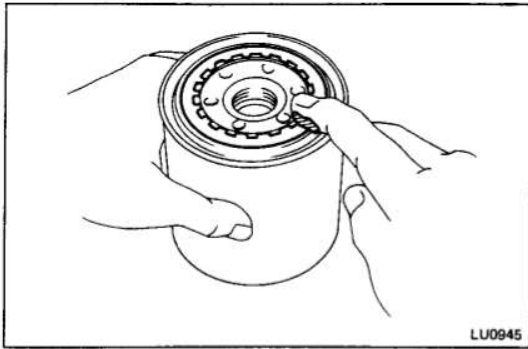


2. REPLACE OIL FILTER

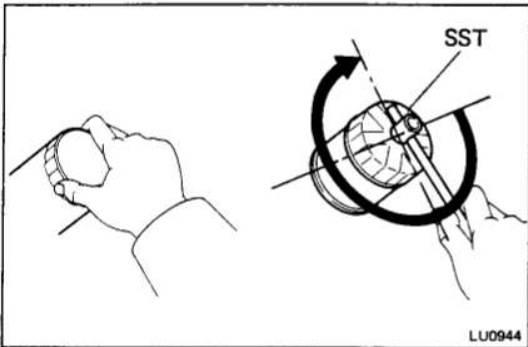
- (a) Using SST, remove the oil filter.
SST 09228-10001 (w/ By-pass element type)
09228-40011 (Full flow type)



- (b) Clean and check the oil filter installation surface.

LU-6**LUBRICATION SYSTEM – Replacement of Engine Oil and Oil Filter**

(c) Apply clean engine oil to the gasket of a new oil filter.



(d) Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.

(e) Using SST, tighten it additional 3/4 turn.

SST 09228-10001 (w/ By-pass element type)
09228-44011 (Full flow type)

3. FILL WITH ENGINE OIL

(a) Clean and install the oil drain plug with a new gasket.

Torque: 400 kg-cm (29 ft-lb, 39 N-m)

(b) Fill with new engine oil (API grade CC (3L only), CD or better and recommended viscosity oil).

Capacity:

liters (US qts, Imp. qts)

Item		w/ Oil filter change	w/o Oil filter change	Dri fill
LJ	2L-T	6.7 (7.1, 5.9)	5.7 (6.0, 5.0)	7.4 (7.8, 6.5)
	3L	6.7 (7.1, 5.9)	5.7 (6.0, 5.0)	7.4 (7.8, 6.5)
LN	2L-T	6.8 (7.2, 6.0)	5.8 (6.1, 5.1)	7.5 (7.9, 6.6)
	3L	5.8 (6.1, 5.1)	4.8 (5.1, 4.2)	6.5 (6.9, 5.7)

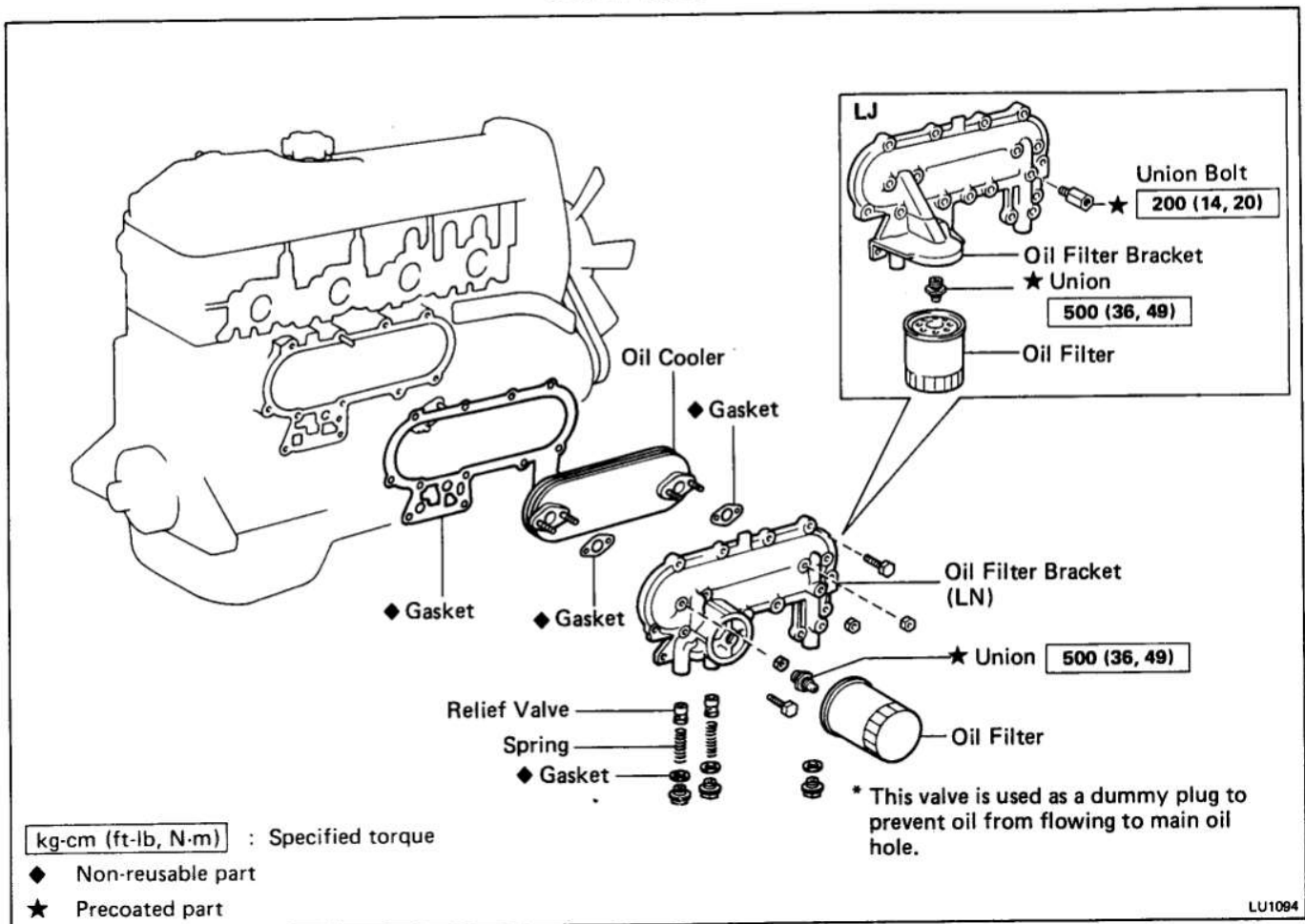
(c) Reinstall the oil filler cap.

4. START ENGINE AND CHECK FOR LEAKS**5. RECHECK ENGINE OIL LEVEL (See page LU-4)**

LUBRICATION SYSTEM — Oil Cooler and Relief Valves (2L-T)

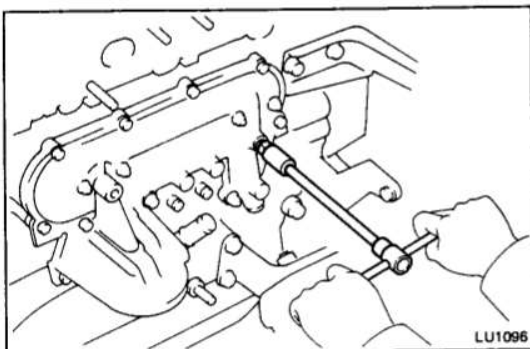
LU-7

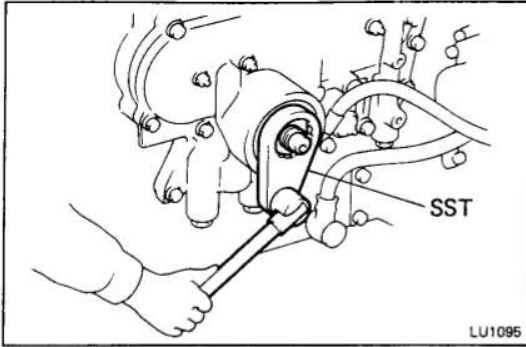
OIL COOLER AND RELIEF VALVES (2L-T) COMPONENTS



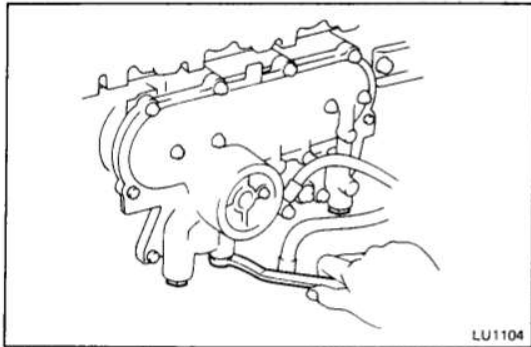
REMOVAL OF OIL COOLER AND RELIEF VALVES

1. DRAIN ENGINE COOLANT (See page CO-4)
2. REMOVE TURBOCHARGER
(See steps 2 to 7 on pages TC-10 and 11)
3. (Austria)
REMOVE EGR VALVE, PIPE, VALVE ADAPTOR AND CONTROL VALVE ASSEMBLY
(See step 11 on page EM-37)
4. REMOVE EXHAUST MANIFOLD
(See step 13 on page EM-38)
5. REMOVE ALTERNATOR
6. (LJ)
REMOVE UNION BOLT
7. REMOVE OIL FILTER (See page LU-5)



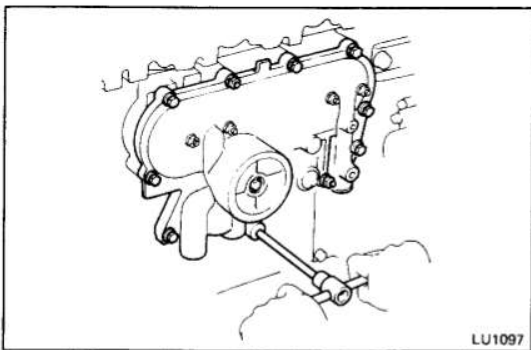
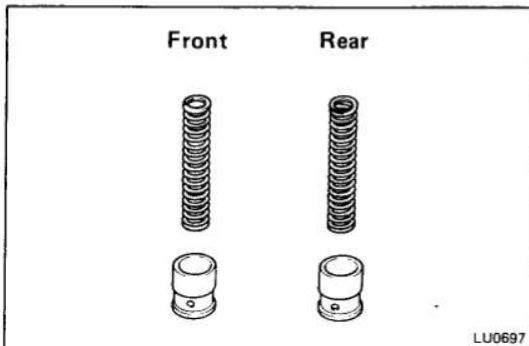
LU-8**LUBRICATION SYSTEM – Oil Cooler and Relief Valves (2L-T)****8. REMOVE UNION**

Using SST, remove the union.
SST 09326-20011

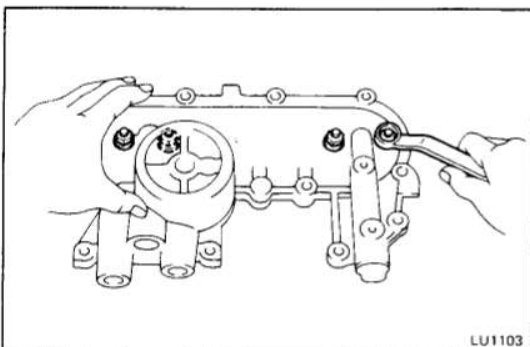
**9. REMOVE RELIEF VALVES**

Remove the plug, gasket, spring and relief valve. Remove the two relief valves.

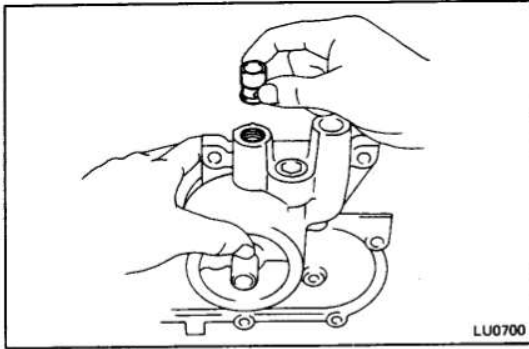
HINT: Arrange the spring and relief valves in correct order.

**10. REMOVE OIL COOLER AND OIL FILTER BRACKET ASSEMBLY**

Remove the nine bolts (LN) or ten bolts (LJ), two nuts, the oil cooler, filter bracket assembly and gasket.

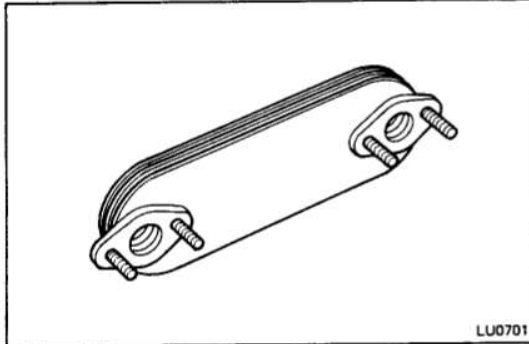
**11. SEPARATE OIL COOLER AND OIL FILTER BRACKET**

Remove the four nuts, the oil cooler and two gaskets from the filter bracket.

LUBRICATION SYSTEM – Oil Cooler and Relief Valves (2L-T)**LU-9****INSPECTION OF OIL COOLER AND RELIEF VALVES****1. INSPECT RELIEF VALVE**

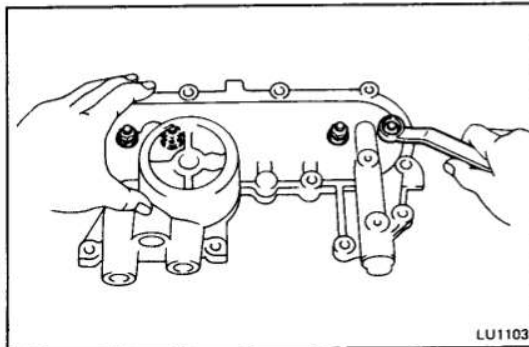
Coat the valve with engine oil and check that it falls smoothly into the oil filter bracket by its own weight.

If not, replace the relief valve. If necessary, replace the oil filter bracket.

**2. INSPECT OIL COOLER**

Check the oil cooler for damage or clogging.

If necessary, replace the oil cooler.

**INSTALLATION OF OIL COOLER AND RELIEF VALVES**

(See page LU-7)

1. ASSEMBLE OIL COOLER AND OIL FILTER BRACKET

Install new gaskets and the oil cooler to the filter bracket with the four nuts.

Torque: 145 kg-cm (10 ft-lb, 14 N-m)

2. INSTALL OIL COOLER AND OIL FILTER BRACKET ASSEMBLY

Install a new gasket, the oil cooler and filter bracket assembly with the nine bolts (LN) or ten bolts (LJ) and two nuts.

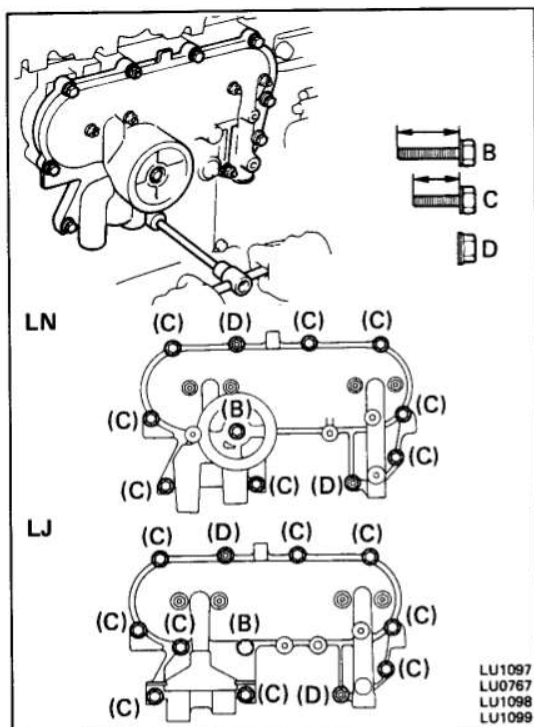
Torque: Bolt 195 kg-cm (14 ft-lb, 19 N.m)

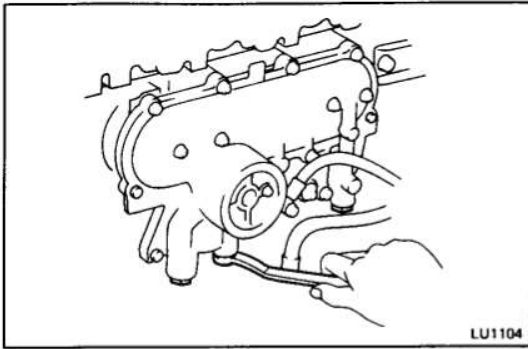
Nut 210 kg-cm (15 ft-lb, 21 N.m)

HINT: The bolt lengths for bolt types B and C shown in the illustration are:

B 35 mm (1.38 in.)

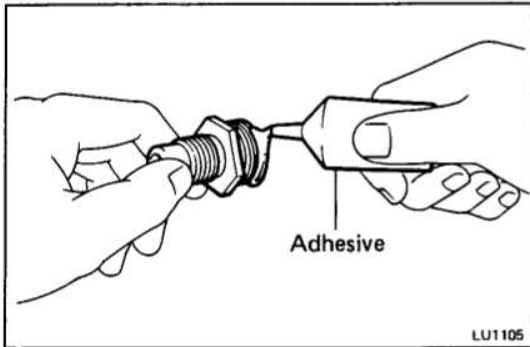
C 25 mm (0.98 in.)



LU-10**LUBRICATION SYSTEM – Oil Cooler and Relief Valves (2L-T)****3. INSTALL RELIEF VALVES**

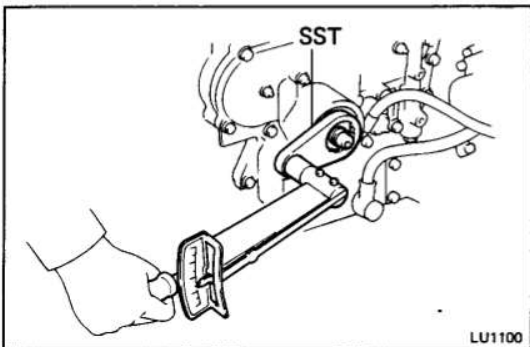
Install the relief valve, spring and a new gasket with the plug. Install the two relief valves.

Torque: 370 kg-cm (27 ft-lb, 36 N-m)

**4. INSTALL UNION**

(a) Apply adhesive to two or three threads (oil cooler side of the union).

Adhesive: Part No. 08833-00070, THREE BOND 1324 or equivalent

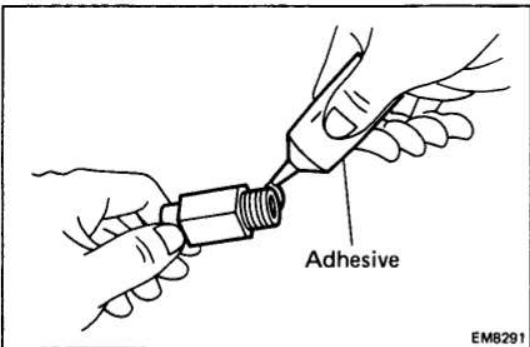


(b) Using SST, install and torque the union.

SST 09326-20011

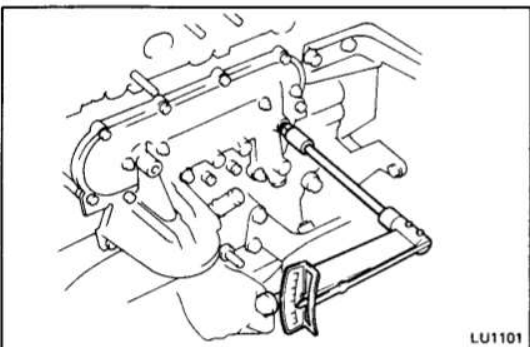
Torque: 430 kg-cm (31 ft-lb, 42 N-m)

HINT: Use a torque wrench with a fulcrum length of 300 mm (11.81 in.).

5. INSTALL OIL FILTER (See page LU-5)**6. (LJ) INSTALL UNION BOLT**

(a) Apply adhesive to two or three threads of the union bolt.

Adhesive: Part No. 08833-00070, THREE BOND 1324 or equivalent



(b) Install and torque the union bolt.

Torque: 200 kg-cm (14 ft-lb, 20 N-m)

7. INSTALL ALTERNATOR**Torque:**

12 mm head bolt 130 kg-cm (9 ft-lb, 12 N·m)
14 mm head bolt 510 kg-cm (37 ft-lb, 50 N·m)

8. INSPECT DRIVE BELTS

(See step 3 on page CH-3)

9. INSTALL EXHAUST MANIFOLD

(See step 6 on page EM-43)

10. (Austria)

**INSTALL EGR VALVE, PIPE, VALVE ADAPTOR AND
CONTROL VALVE ASSEMBLY**

(See step 8 on page EM-44)

11. INSTALL TURBOCHARGER

(See steps 3 to 8 on pages TC-13 and 14)

12. FILL WITH ENGINE COOLANT (See page CO-5)**13. START ENGINE AND CHECK FOR LEAKS****14. CHECK ENGINE OIL LEVEL (See page LU-4)**

