

# ENGINE LUBRICATION SYSTEM

# 2-4

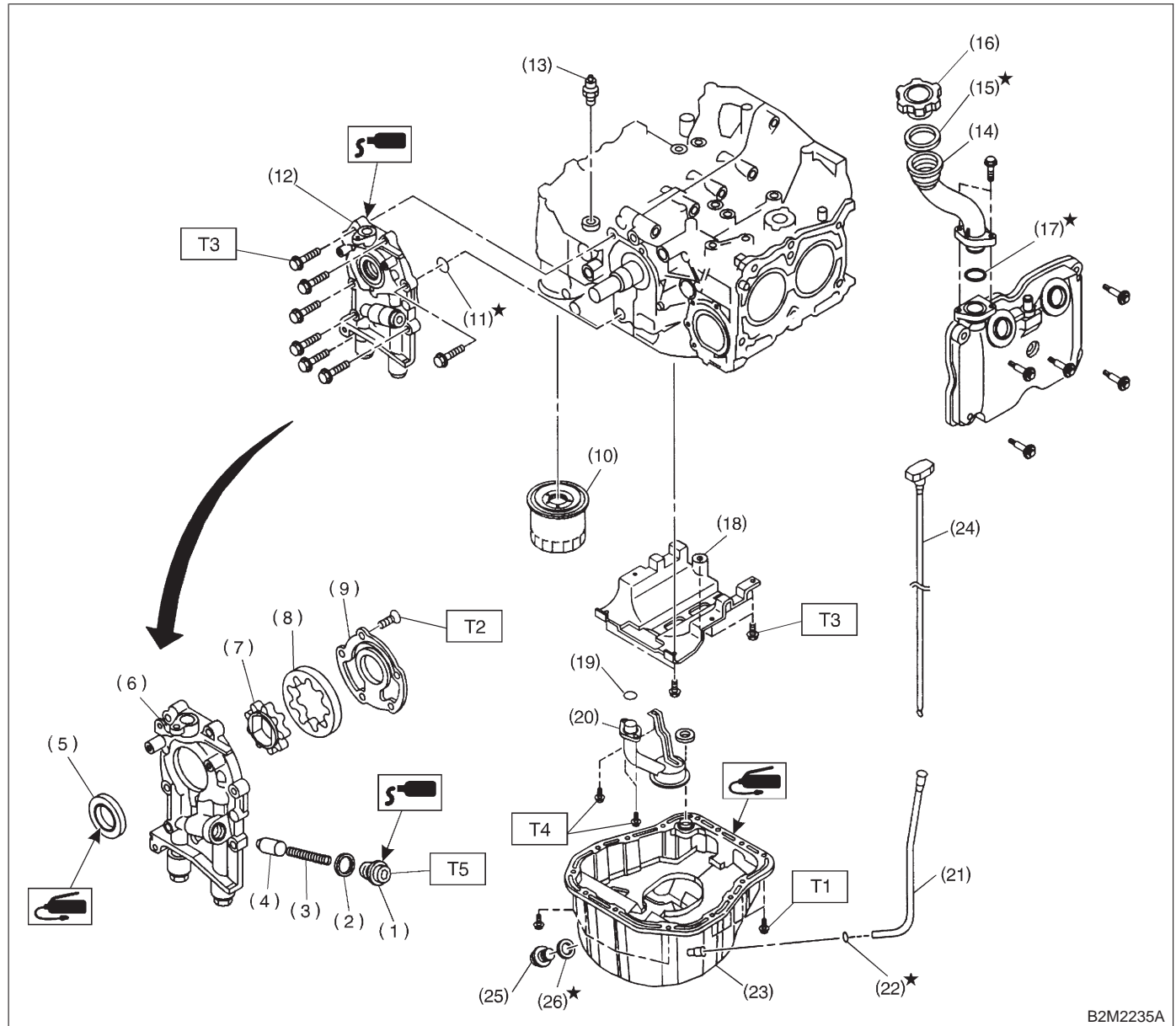
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## 1. Specifications

Lubrication method					Forced lubrication			
Oil pump	Pump type				Trochoid type			
	Number of teeth		Inner rotor		9			
			Outer rotor		10			
	Outer rotor diameter × thickness				78 × 9 mm (3.07 × 0.35 in)			
	Tip clearance between inner and outer rotor		STANDARD		0.04 — 0.14 mm (0.0016 — 0.0055 in)			
			LIMIT		0.18 mm (0.0071 in)			
	Side clearance between inner rotor and pump case		STANDARD		0.02 — 0.07 mm (0.0008 — 0.0028 in)			
			LIMIT		0.15 mm (0.0059 in)			
	Case clearance between outer rotor and pump case		STANDARD		0.10 — 0.175 mm (0.0039 — 0.0069 in)			
			LIMIT		0.20 mm (0.0079 in)			
	Capacity at 80°C (176°F)	600 rpm	Discharge	- pressure	98 kPa (1.0 kg/cm <sup>2</sup> , 14 psi) or more			
				- quantity	2200 cc	4.2 ℓ (4.4 US qt, 3.7 Imp qt)/min.		
			5,000 rpm		Discharge	- quantity	2500 cc	4.6 ℓ (4.9 US qt, 4.0 Imp qt)/min.
				- pressure			294 kPa (3.0 kg/cm <sup>2</sup> , 43 psi) or more	
	Relief valve operation pressure				2200 cc	490 kPa (5.0 kg/cm <sup>2</sup> , 71 psi)		
2500 cc					588 kPa (6.0 kg/cm <sup>2</sup> , 85 psi)			
Oil filter	Type				Full-flow filter type			
	Filtration area				1,000 cm <sup>2</sup> (155 sq in)			
	By-pass valve opening pressure				156 kPa (1.6 kg/cm <sup>2</sup> , 23 psi)			
	Outer diameter × width				80 × 70 mm (3.15 × 2.76 in)			
	Oil filter to engine thread size				M 20 × 1.5			
Relief valve (on rocker shaft) operation pressure					69 kPa (0.7 kg/cm <sup>2</sup> , 10 psi)			
Oil pressure switch	Type				Immersed contact point type			
	Working voltage — wattage				12 V — 3.4 W or less			
	Warning light activation pressure				14.7 kPa (0.15 kg/cm <sup>2</sup> , 2.1 psi)			
	Proof pressure				More than 981 kPa (10 kg/cm <sup>2</sup> , 142 psi)			
Oil capacity (at replacement)					4.0 ℓ (4.2 US qt, 3.5 Imp qt)			

## 1. Lubrication System



B2M2235A

- |                         |                            |
|-------------------------|----------------------------|
| (1) Plug                | (13) Oil pressure switch   |
| (2) Washer              | (14) Oil filler duct       |
| (3) Relief valve spring | (15) O-ring                |
| (4) Relief valve        | (16) Oil filler cap        |
| (5) Oil seal            | (17) O-ring                |
| (6) Oil pump case       | (18) Baffle plate          |
| (7) Inner rotor         | (19) O-ring                |
| (8) Outer rotor         | (20) Oil strainer          |
| (9) Oil pump cover      | (21) Oil level gauge guide |
| (10) Oil filter         | (22) O-ring                |
| (11) O-ring             | (23) Oil pan               |
| (12) Oil pump ASSY      | (24) Oil level gauge       |

- |                   |
|-------------------|
| (25) Drain plug   |
| (26) Metal gasket |

### **Tightening torque: N-m (kg-m, ft-lb)**

**T1: 5 (0.5, 3.6)**

**T2:  $5^{+1}_{-0}$  ( $0.5^{+0.1}_{-0}$ ,  $3.6^{+0.7}_{-0}$ )**

**T3: 6.4 (0.65, 4.7)**

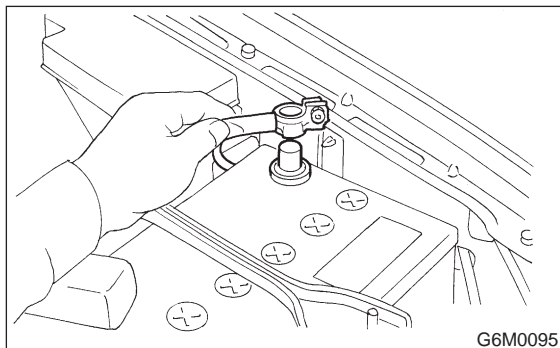
**T4: 10 (1.0, 7.2)**

**T5:  $44.1 \pm 3.4$  ( $4.5 \pm 0.35$ ,  $32.5 \pm 2.5$ )**

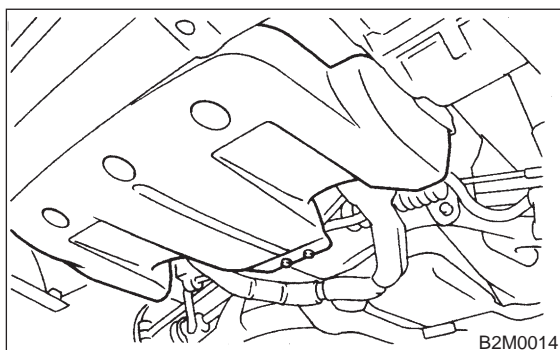
## 1. Oil Pump

### A: REMOVAL

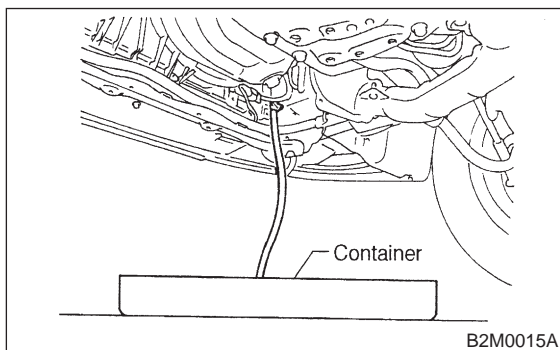
- 1) Disconnect battery ground cable.



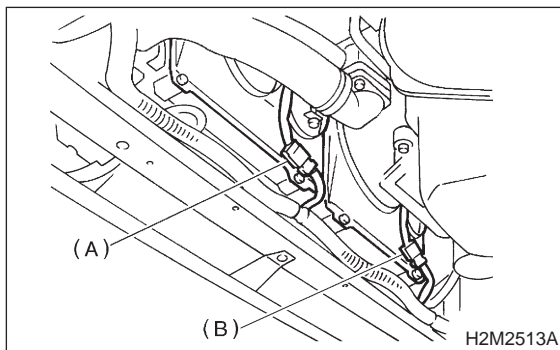
- 2) Lift-up the vehicle.  
3) Remove under cover.



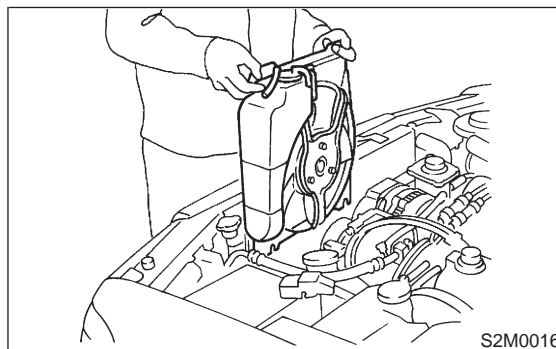
- 4) Drain coolant. <Ref. to 2-5 [W1A0].>



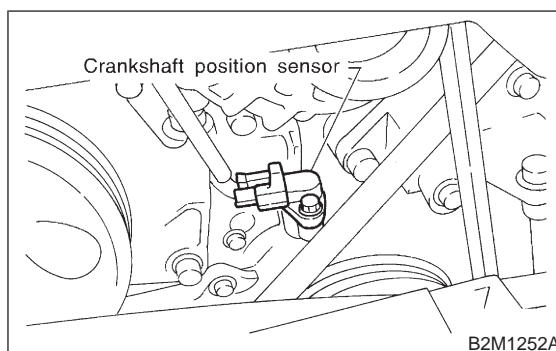
- 5) Disconnect connectors from radiator main fan (A) and sub fan (B) motors.



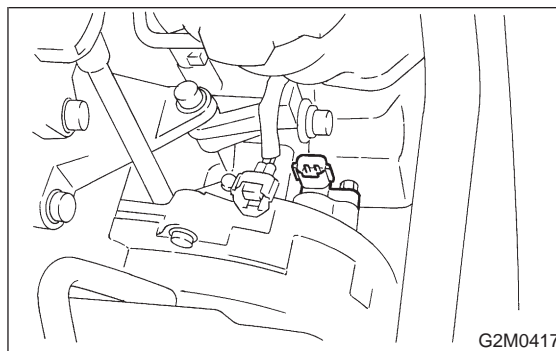
- 6) Lower the vehicle.  
7) Remove radiator main fan and sub fan assemblies. <Ref. to 2-5 [W7A0].>



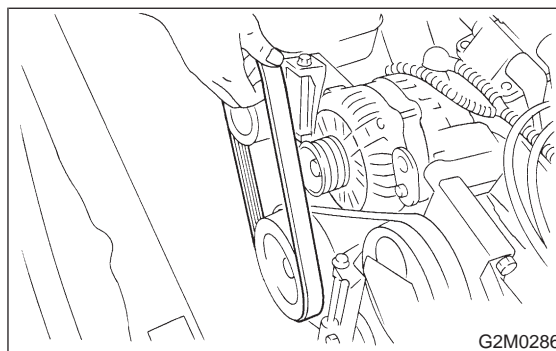
- 8) Remove crankshaft position sensor.



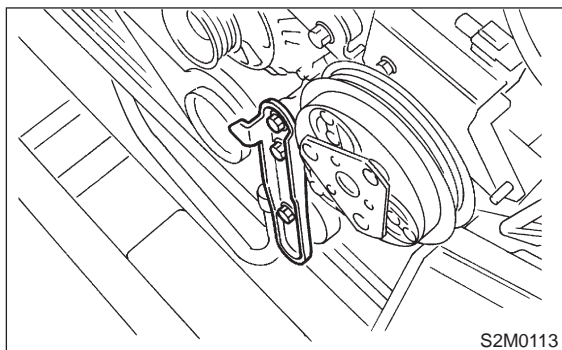
- 9) Remove camshaft position sensor.



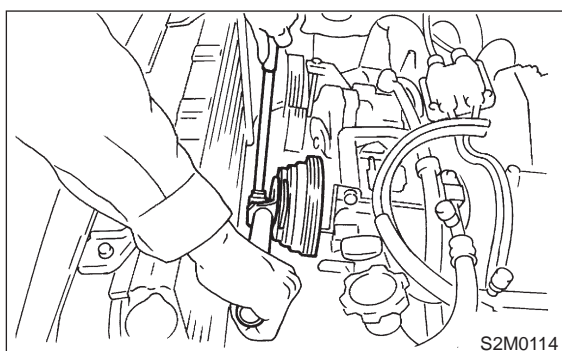
- 10) Remove V-belts. <Ref. to 1-5 [G200].>



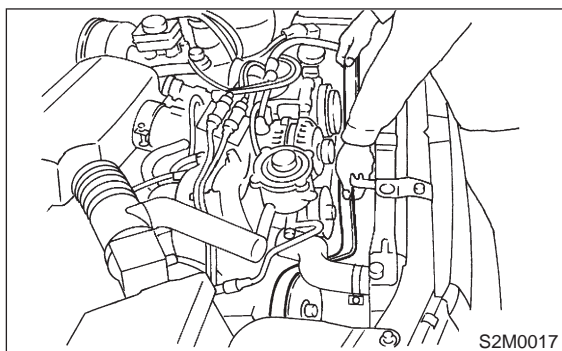
- 11) Remove rear side V-belt tensioner.



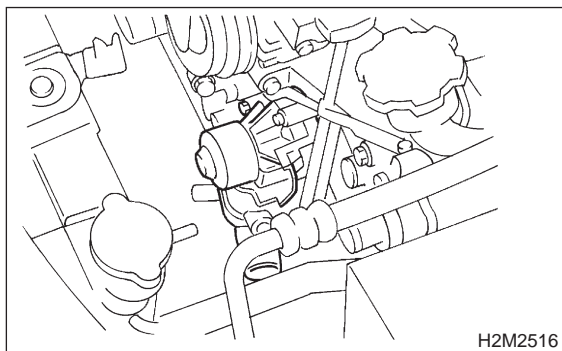
- 12) Remove crankshaft pulley by using ST.  
ST 49997700 CRANKSHAFT PULLEY  
WRENCH



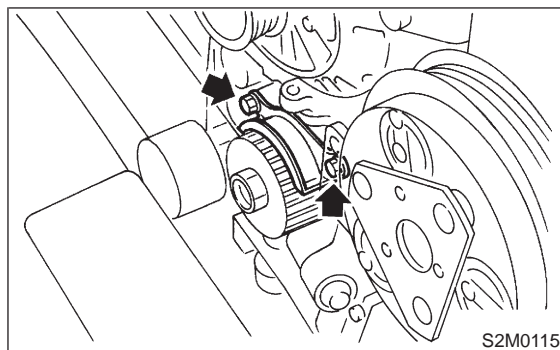
- 13) Remove timing belt.  
<Ref. to 2-3 [W2A0].>



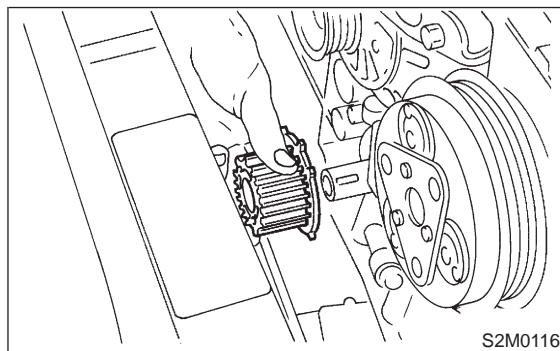
- 14) Remove water pump. <Ref. to 2-5 [W2A0].>



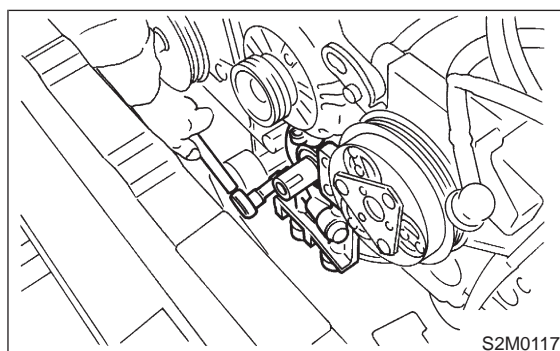
- 15) Remove timing belt guide. (MT vehicles only)



- 16) Remove crankshaft sprocket.

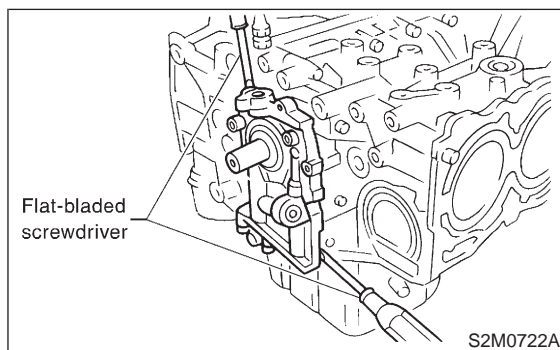


- 17) Remove bolts which install oil pump onto cylinder block.



- 18) Remove oil pump by using flat bladed screwdriver.

**CAUTION:**  
Be careful not to scratch mating surfaces of cylinder block and oil pump.



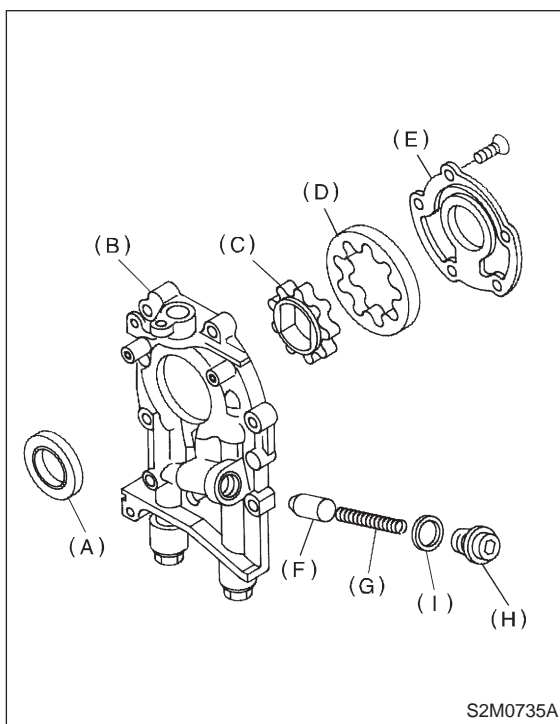
## B: DISASSEMBLY

Remove screws which secure oil pump cover and disassemble oil pump.

Inscribe alignment marks on inner and outer rotors so that they can be replaced in their original positions during reassembly.

### CAUTION:

**Before removing relief valve, loosen plug when removing oil pump from cylinder block.**



- (A) Oil seal
- (B) Pump case
- (C) Inner rotor
- (D) Outer rotor
- (E) Pump cover
- (F) Relief valve
- (G) Relief spring
- (H) Plug
- (I) Washer

## C: INSPECTION

### 1. TIP CLEARANCE

Measure the tip clearance of rotors. If the clearance exceeds the limit, replace rotors as a matched set.

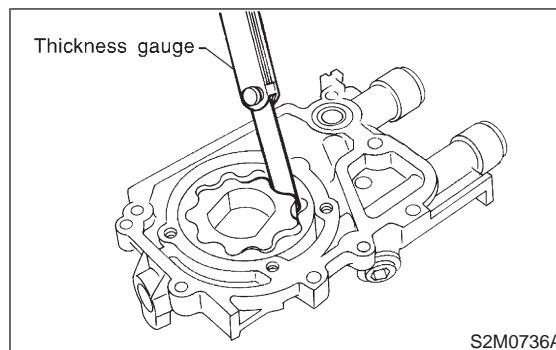
#### Tip clearance:

##### Standard

**0.04 — 0.14 mm (0.0016 — 0.0055 in)**

##### Limit

**0.18 mm (0.0071 in)**



### 2. CASE CLEARANCE

Measure the clearance between the outer rotor and the cylinder block rotor housing. If the clearance exceeds the limit, replace the rotor.

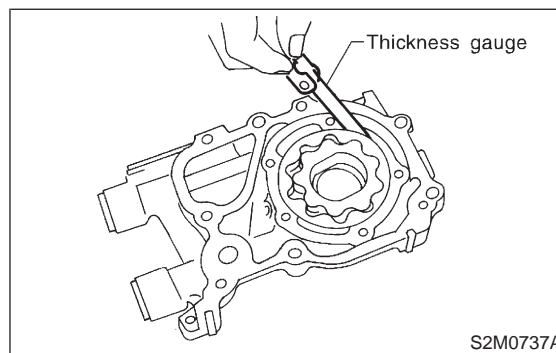
#### Case clearance:

##### Standard

**0.10 — 0.175 mm (0.0039 — 0.0069 in)**

##### Limit

**0.20 mm (0.0079 in)**



## 3. SIDE CLEARANCE

Measure clearance between oil pump inner rotor and pump cover. If the clearance exceeds the limit, replace rotor or pump body.

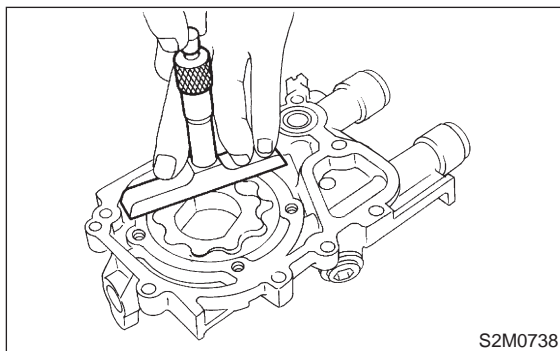
**Side clearance:**

**Standard**

**0.02 — 0.07 mm (0.0008 — 0.0028 in)**

**Limit**

**0.15 mm (0.0059 in)**



## 4. OIL RELIEF VALVE

Check the valve for fitting condition and damage, and the relief valve spring for damage and deterioration. Replace the parts if defective.

**Relief valve spring:**

**Free length; 71.8 mm (2.827 in)**

**Installed length; 54.7 mm (2.154 in)**

**Load when installed; 77.08 N (7.86 kg, 17.33 lb)**

## 5. OIL PUMP CASE

Check the oil pump case for worn shaft hole, clogged oil passage, worn rotor chamber, cracks, and other faults.

## 6. OIL SEAL

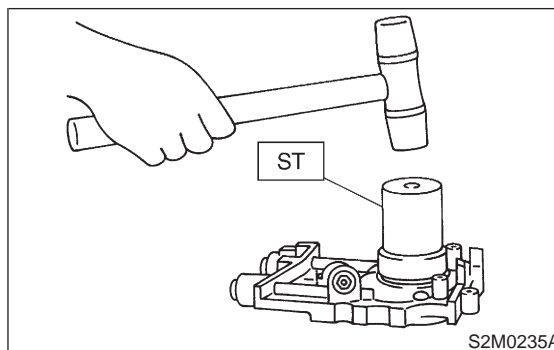
Check the oil seal lips for deformation, hardening, wear, etc. and replace if defective.

## D: ASSEMBLY

- 1) Install front oil seal by using ST.  
ST 499587100 OIL SEAL INSTALLER

**CAUTION:**

**Use a new oil seal.**

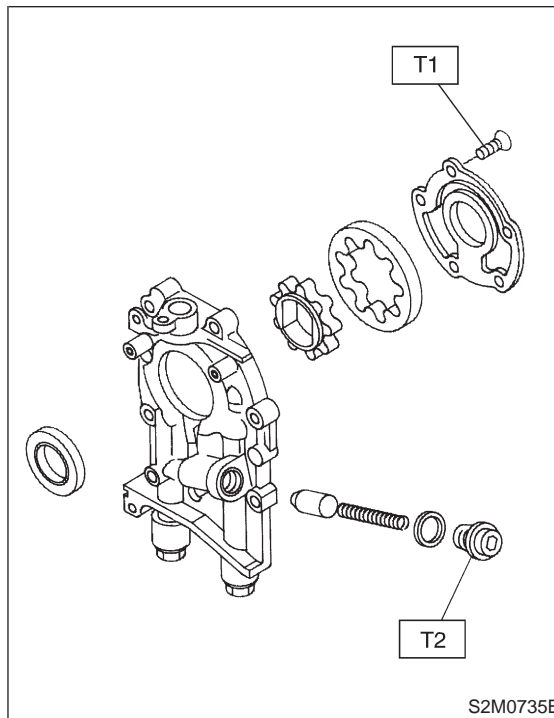


- 2) Install inner and outer rotors in their original positions.
- 3) Install oil relief valve and relief spring.
- 4) Install oil pump cover.

**Tightening torque:**

**T1: 5 — 6 N·m (0.5 — 0.6 kg·m, 3.6 — 4.3 ft·lb)**

**T2: 40.7 — 47.6 N·m (4.15 — 4.85 kg·m, 30.0 — 35.1 ft·lb)**





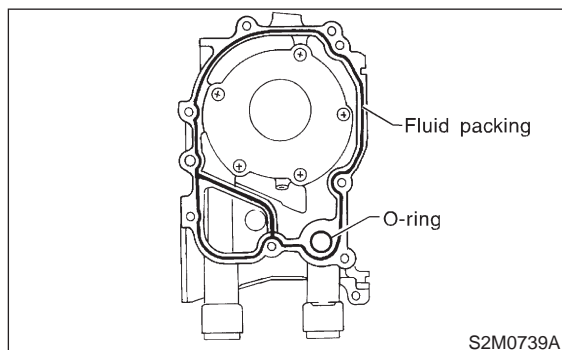
**E: INSTALLATION**

Installation is in the reverse order of removal.  
Observe the following:

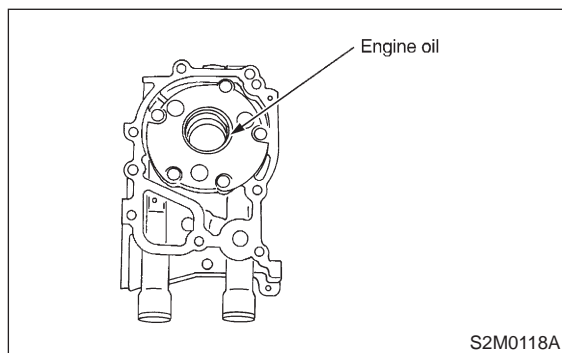
- 1) Apply fluid packing to matching surfaces of oil pump.

**Fluid packing:**

**THREE BOND 1215 or equivalent**



- 2) Replace O-ring with a new one.
- 3) Apply a coat of engine oil to the inside of the oil seal.



- 4) Be careful not to scratch oil seal when installing oil pump on cylinder block.
- 5) Position the oil pump, aligning the notched area with the crankshaft, and push the oil pump straight.

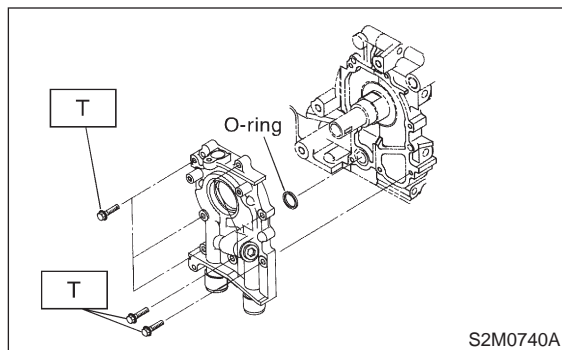
**CAUTION:**

**Make sure the oil seal lip is not folded.**

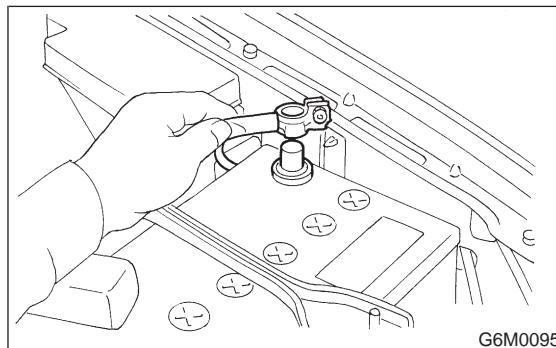
- 6) Install oil pump.

**Tightening torque:**

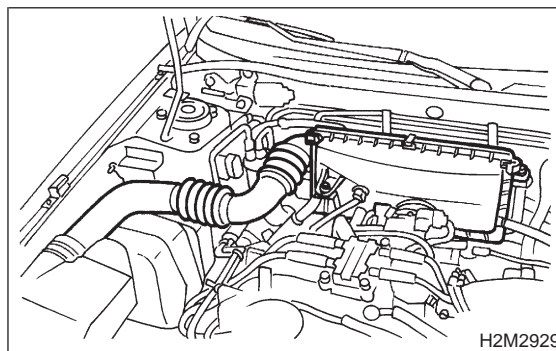
**6.4 N·m (0.65 kg·m, 4.7 ft·lb)**

**2. Oil Pan and Oil Strainer****A: REMOVAL**

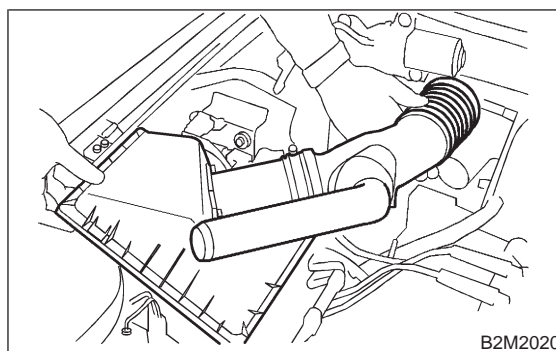
- 1) Disconnect battery ground cable.



- 2) Remove front wheels.
- 3) Remove air intake duct and air cleaner assembly. (2200 cc California spec. vehicles) <Ref. to 2-7 [W1A1].>

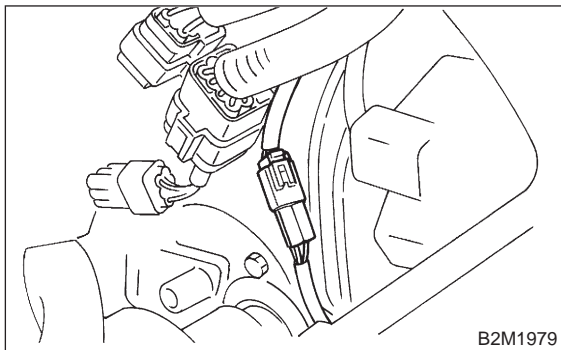


- 4) Remove air intake duct and air cleaner upper cover. (Except 2200 cc California spec. vehicles) <Ref. to 2-7 [W1A2].>

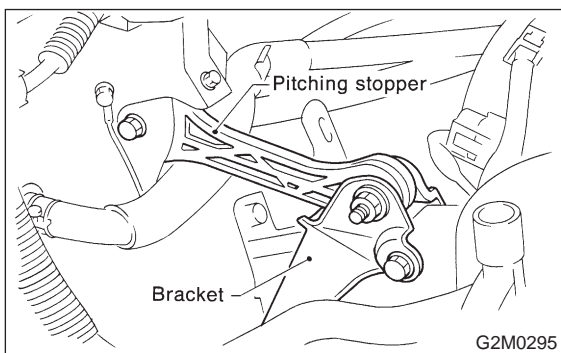




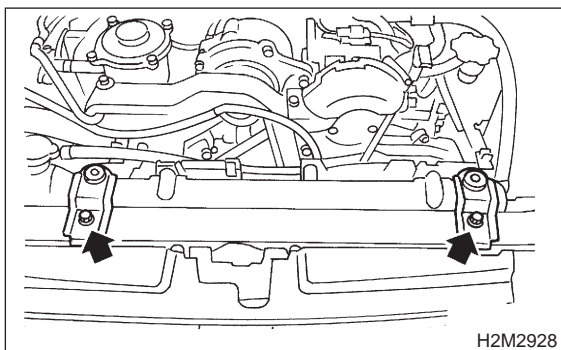
5) Disconnect front oxygen sensor connector.



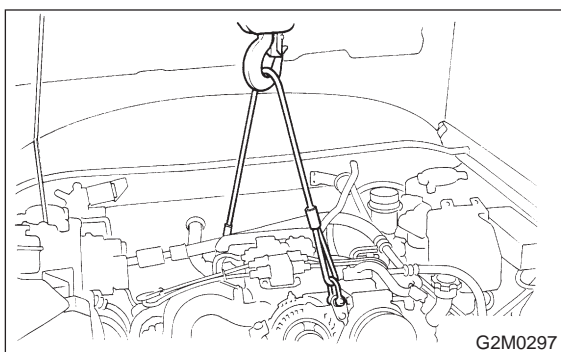
6) Remove pitching stopper.



7) Remove radiator upper bracket.



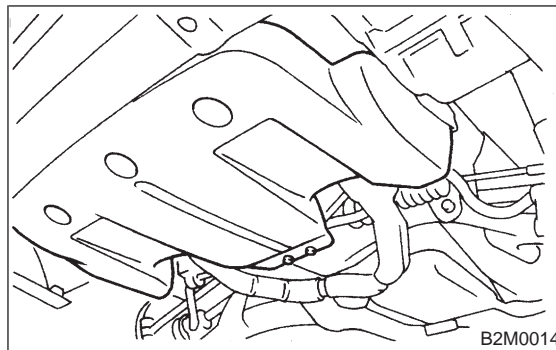
8) Support engine with a lifting device and wire ropes.



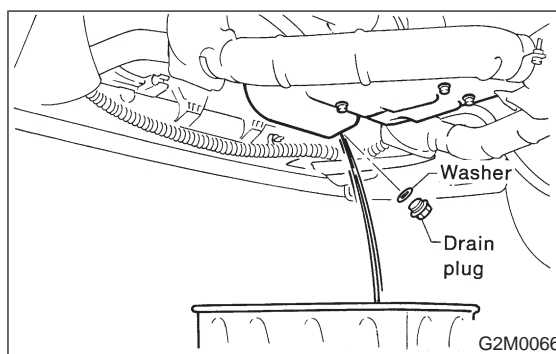
9) Lift-up the vehicle.

**CAUTION:**  
At this time, raise up wire ropes.

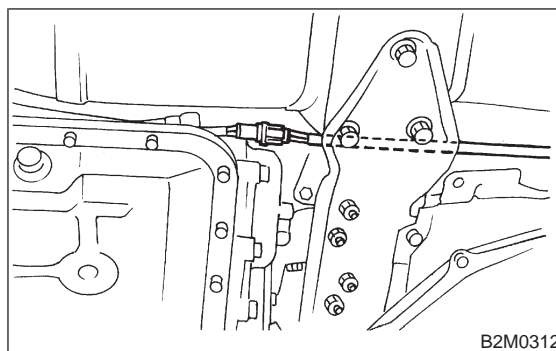
10) Remove under cover.



11) Drain engine oil.  
Set container under the vehicle, and remove drain plug from oil pan.



12) Disconnect connector from rear oxygen sensor.

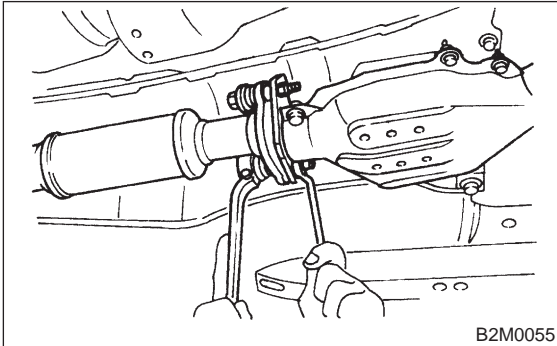


13) Remove front and center exhaust pipe assembly.

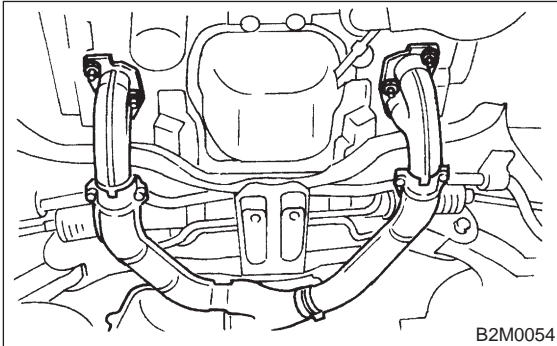
- (1) Separate front and center exhaust assembly pipe from rear exhaust pipe.

**CAUTION:**

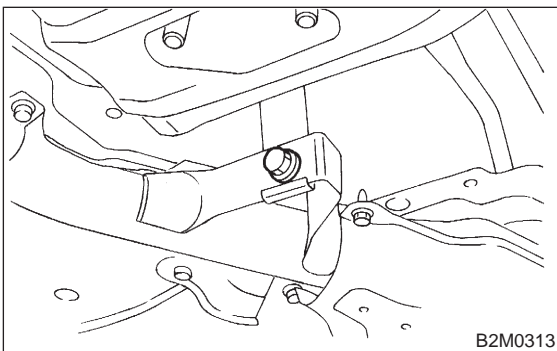
**Be careful, exhaust pipe is hot.**



- (2) Remove front and center exhaust pipe assembly from engine.

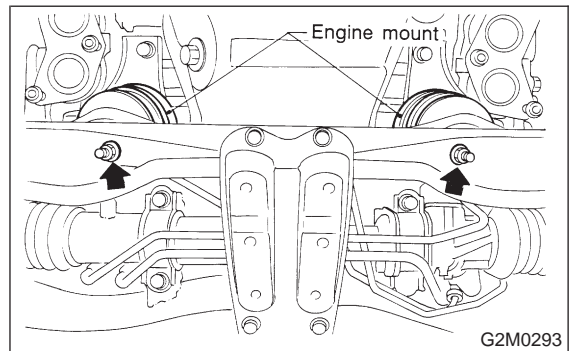


- (3) Remove front and center exhaust pipe assembly from hanger bracket.

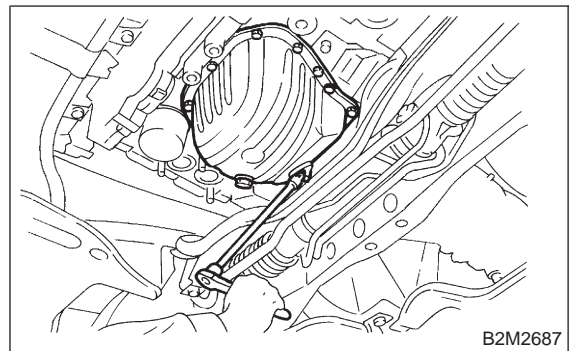


- (4) Remove bolt which installs front and center exhaust pipe assembly on bracket.

- 14) Remove nuts which install front cushion rubber onto front crossmember.



- 15) Remove bolts which install oil pan on cylinder block while raising up engine.

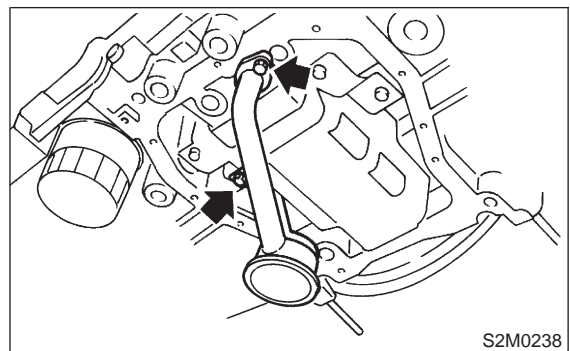


- 16) Insert oil pan cutter blade between cylinder block-to-oil pan clearance.

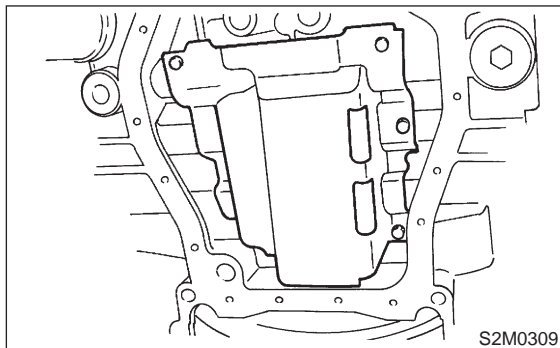
**CAUTION:**

**Do not use a screwdriver or similar tool in place of oil pan cutter.**

- 17) Remove oil strainer.



- 18) Remove baffle plate.



## B: INSPECTION

By visual check make sure oil pan, oil strainer and baffle plate are not damaged.

## C: INSTALLATION

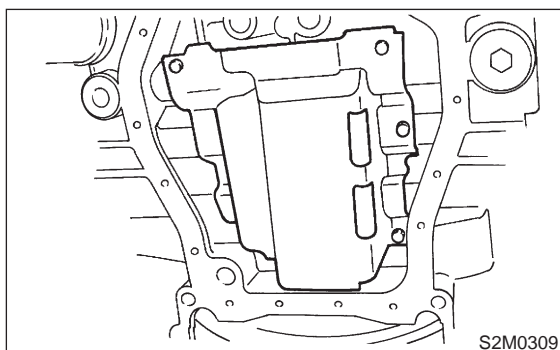
### CAUTION:

Before installing oil pan, clean sealant from oil pan and engine block.

- 1) Install baffle plate.

### Tightening torque:

**6.4 N-m (0.65 kg-m, 4.7 ft-lb)**



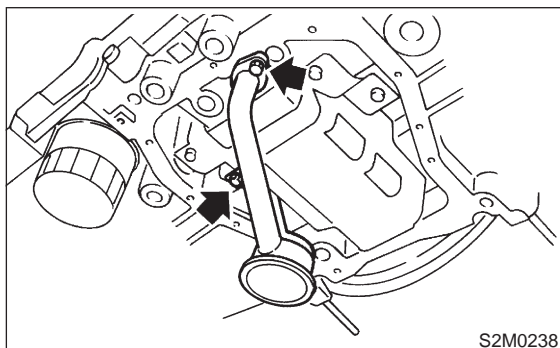
- 2) Install oil strainer onto baffle plate.

### CAUTION:

Replace O-ring with a new one.

### Tightening torque:

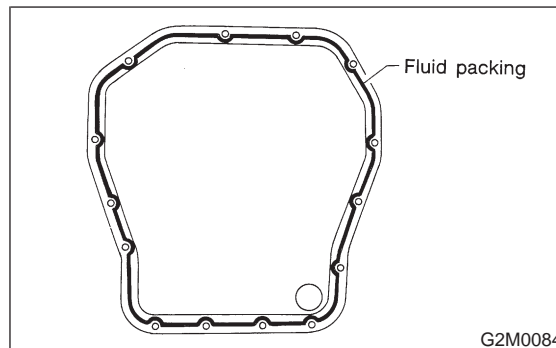
**10 N-m (1.0 kg-m, 7.2 ft-lb)**



- 3) Apply fluid packing to mating surfaces and install oil pan.

### Fluid packing:

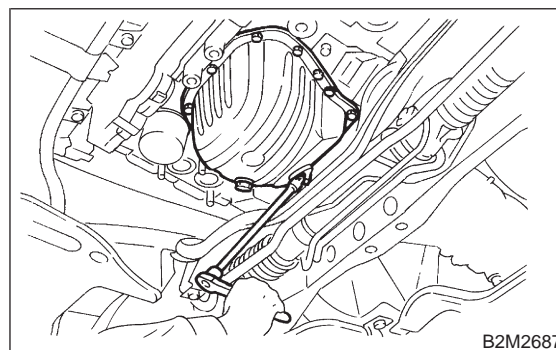
**THREE BOND 1215 or equivalent**



- 4) Tighten bolts which install oil pan onto engine block.

### Tightening torque:

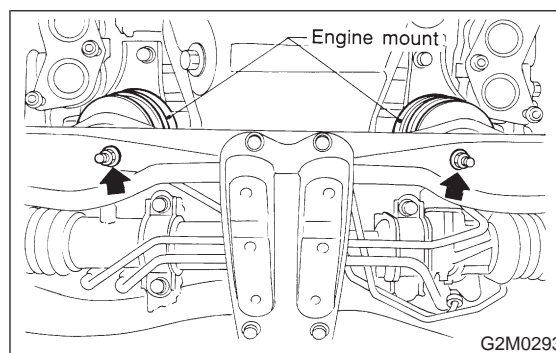
**5 N-m (0.5 kg-m, 3.6 ft-lb)**



- 5) Lower engine onto front crossmember.  
6) Tighten nuts which install front cushion rubber onto front crossmember.

### Tightening torque:

**69±15 N-m (7.0±1.5 kg-m, 51±11 ft-lb)**



7) Install front and center exhaust pipe assembly.

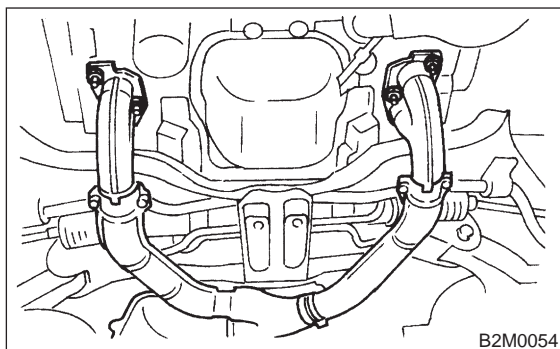
**CAUTION:**

**Always use the new gaskets.**

- (1) Place front and center exhaust pipe assembly on bracket.
- (2) Tighten nuts which install front and center exhaust pipe assembly on engine.

**Tightening torque:**

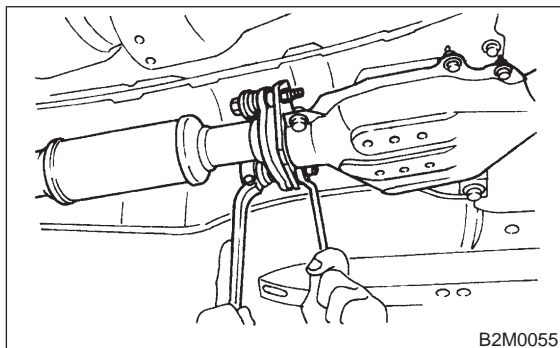
**$30 \pm 5 \text{ N}\cdot\text{m}$  ( $3.1 \pm 0.5 \text{ kg}\cdot\text{m}$ ,  $22.4 \pm 3.6 \text{ ft}\cdot\text{lb}$ )**



- (3) Tighten nuts which install front and center exhaust pipe assembly to rear exhaust pipe.

**Tightening torque:**

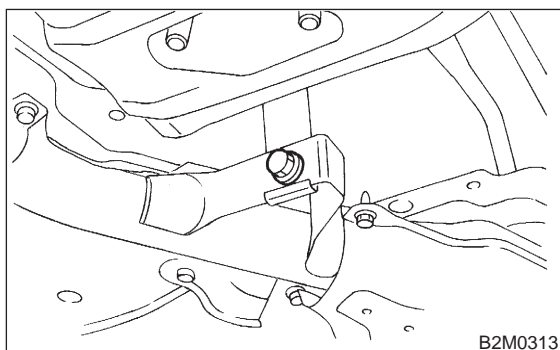
**$18 \pm 5 \text{ N}\cdot\text{m}$  ( $1.8 \pm 0.5 \text{ kg}\cdot\text{m}$ ,  $13.0 \pm 3.6 \text{ ft}\cdot\text{lb}$ )**



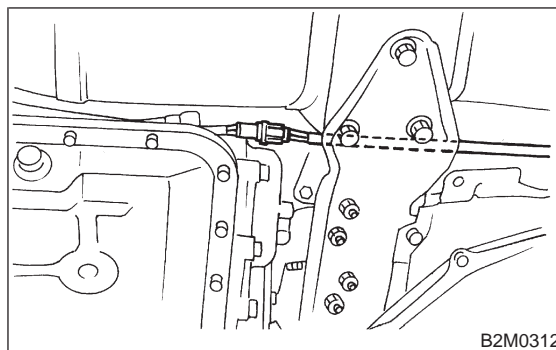
- (4) Tighten bolt which installs front and center exhaust pipe assembly on bracket.

**Tightening torque:**

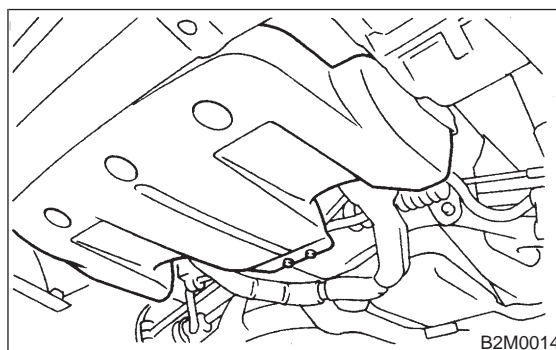
**$24 \pm 3 \text{ N}\cdot\text{m}$  ( $2.4 \pm 0.3 \text{ kg}\cdot\text{m}$ ,  $17.4 \pm 2.2 \text{ ft}\cdot\text{lb}$ )**



8) Connect connector to rear oxygen sensor.



9) Install under cover.

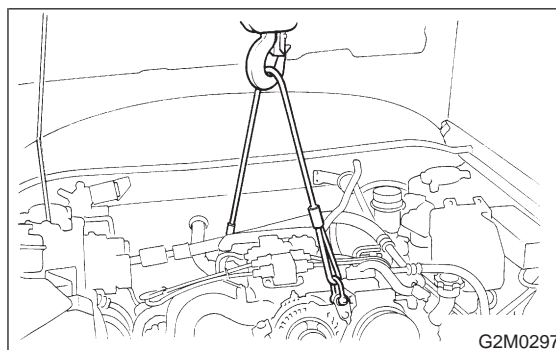


10) Lower the vehicle.

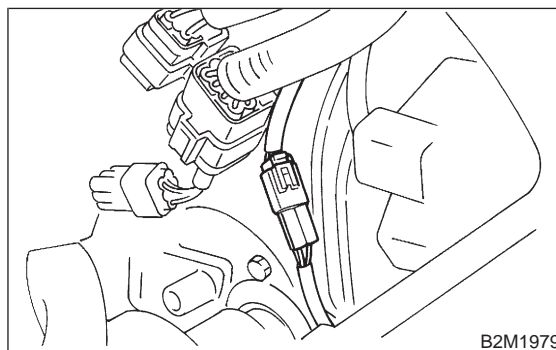
**CAUTION:**

**At this time, lower lifting device and release steel cables.**

11) Remove lifting device and steel cables.



12) Connect connector to front oxygen sensor.

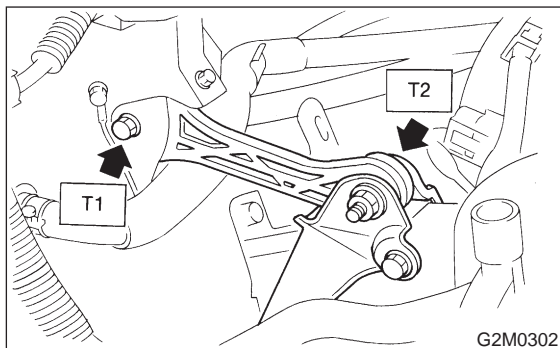


13) Install pitching stopper.

**Tightening torque:**

**T1:  $49 \pm 5$  N·m ( $5.0 \pm 0.5$  kg·m,  $36.2 \pm 3.6$  ft·lb)**

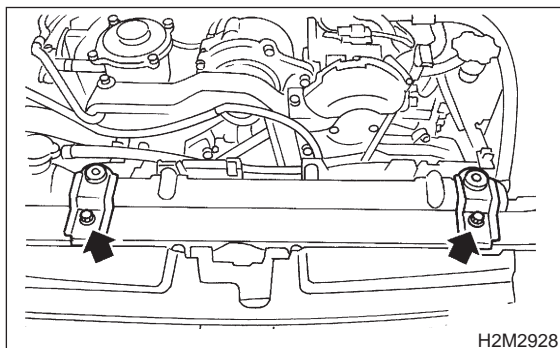
**T2:  $57 \pm 10$  N·m ( $5.8 \pm 1.0$  kg·m,  $42 \pm 7$  ft·lb)**



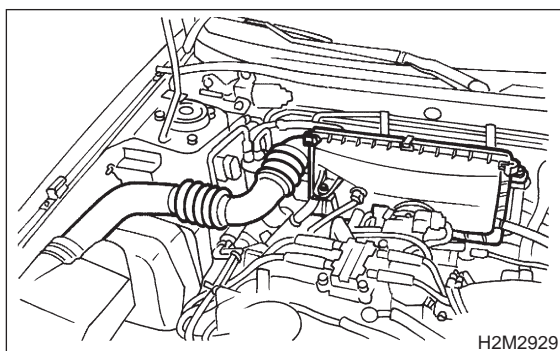
14) Install radiator upper brackets.

**Tightening torque:**

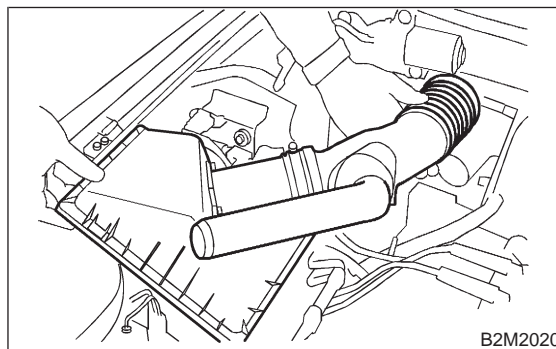
**$18 \pm 5$  N·m ( $1.8 \pm 0.5$  kg·m,  $13 \pm 4$  ft·lb)**



15) Install air intake duct and air cleaner assembly. (2200 cc California spec. vehicles) <Ref. to 2-7 [W1A1].>



16) Install air intake duct and air cleaner upper cover. (Except 2200 cc California spec. vehicles) <Ref. to 2-7 [W1A2].>



17) Fill engine oil through filler pipe up to upper point of level gauge. <Ref. to 1-5 [G4A0].>

**Engine oil capacity:**

**Upper level; 4.0 ℓ (4.2 US qt, 3.5 Imp qt)**

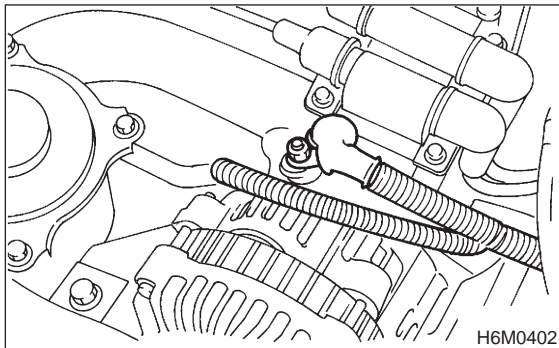
**Lower level; 3.0 ℓ (3.2 US qt, 2.6 Imp qt)**



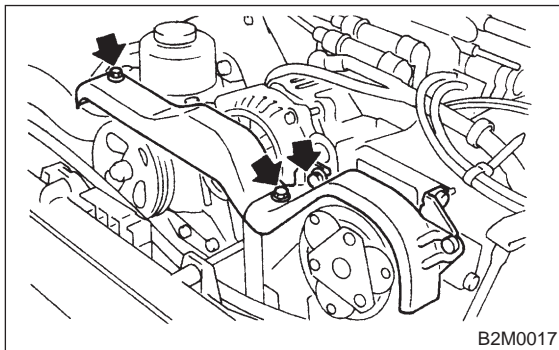
### 3. Oil Pressure Switch

#### A: REMOVAL

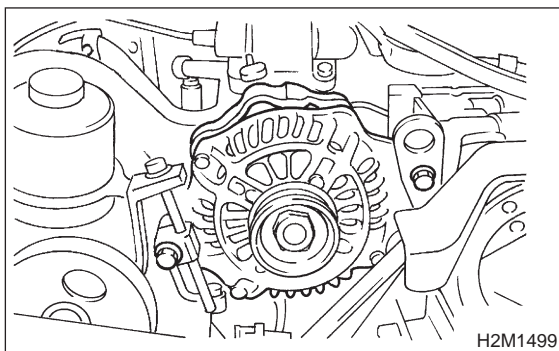
- 1) Remove alternator from bracket.
  - (1) Disconnect connector and terminal from generator.



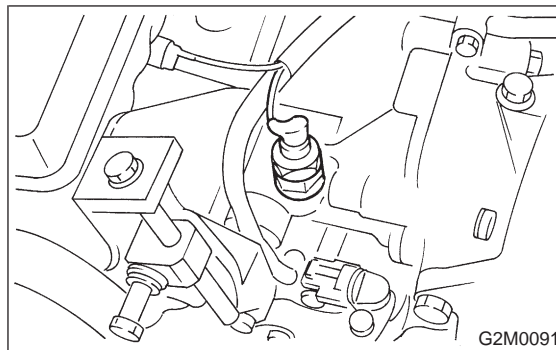
- (2) Remove V-belt cover.



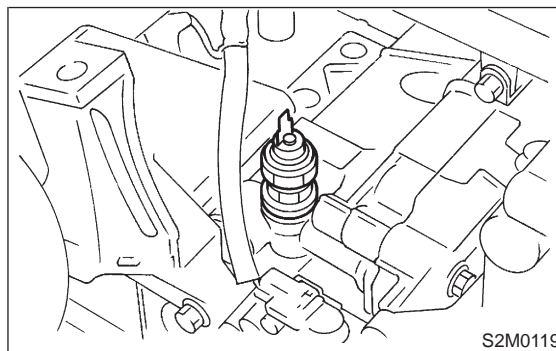
- (3) Loosen lock bolt and slider bolt, and remove front side V-belt.
  - (4) Remove bolts which install generator on bracket.



- 2) Disconnect terminal from oil pressure switch.



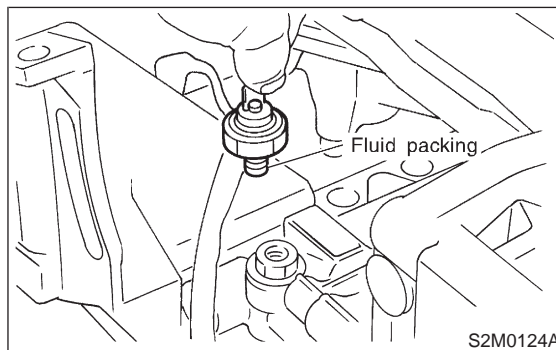
- 3) Remove oil pressure switch.



#### B: INSTALLATION

- 1) Apply fluid packing to oil pressure switch threads before installation.

**Fluid packing:**  
**THREE BOND 1215 or equivalent**

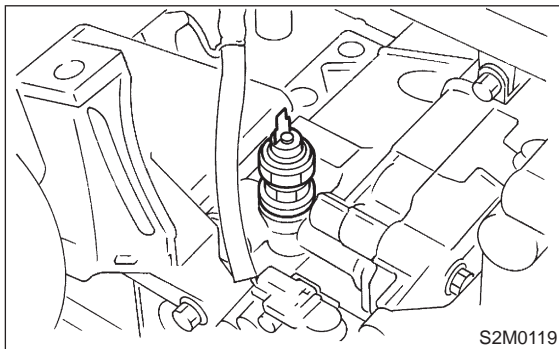




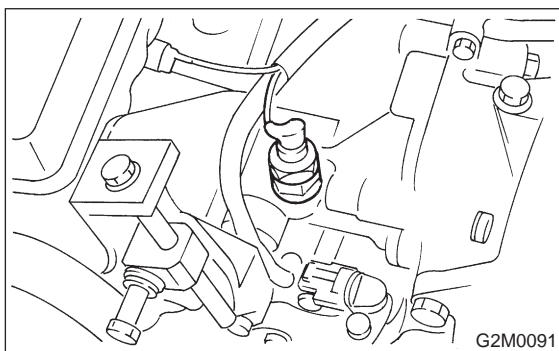
2) Install oil pressure switch onto engine block.

**Tightening torque:**

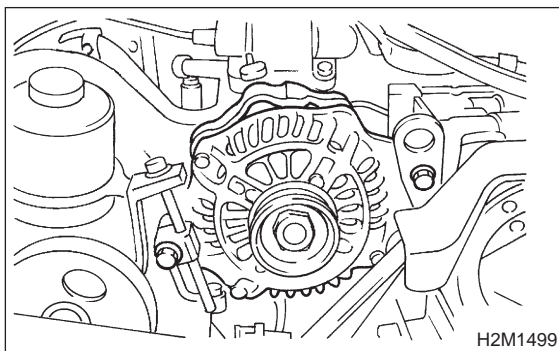
**$25 \pm 3 \text{ N}\cdot\text{m}$  ( $2.5 \pm 0.3 \text{ kg}\cdot\text{m}$ ,  $18.1 \pm 2.2 \text{ ft}\cdot\text{lb}$ )**



3) Connect terminal of oil pressure switch.

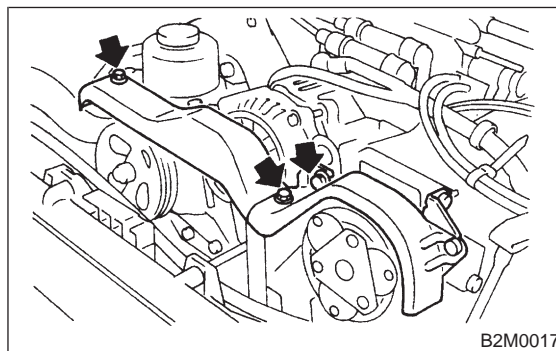


4) Install generator on bracket and temporary tighten installing bolts.

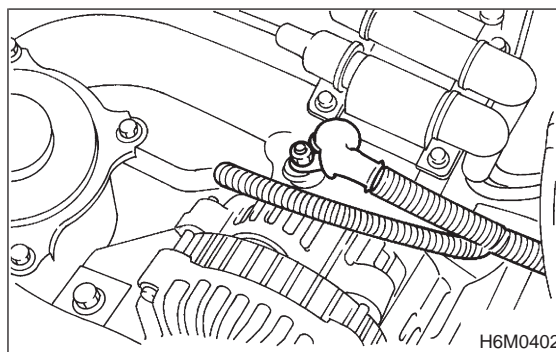


5) Install front side V-belt and adjust it. <Ref. to 1-5 [G200].>

6) Install V-belt cover.



7) Connect connector and terminal to generator.



## 1. Engine Lubrication System Trouble in General

### NOTE:

Before troubleshooting, make sure that the engine oil level is correct and no oil leakage exists.

Trouble	Possible cause		Corrective action
1. Warning light remains on.	1) Oil pressure switch failure	Cracked diaphragm or oil leakage within switch	Replace.
		Broken spring or seized contacts	Replace.
	2) Low oil pressure	Clogged oil filter	Replace.
		Malfunction of oil by-pass valve of oil filter	Clean or replace.
		Malfunction of oil relief valve of oil pump	Clean or replace.
		Clogged oil passage	Clean.
		Excessive tip clearance and side clearance of oil pump rotor and gear	Replace.
		Clogged oil strainer or broken pipe	Clean or replace.
	3) No oil pressure	Insufficient engine oil	Replenish.
		Broken pipe of oil strainer	Replace.
		Stuck oil pump rotor	Replace.
2. Warning light does not go on.	1) Burn-out bulb		Replace.
	2) Poor contact of switch contact points		Replace.
	3) Disconnection of wiring		Repair.
3. Warning light flickers momentarily.	1) Poor contact at terminals		Repair.
	2) Defective wiring harness		Repair.
	3) Low oil pressure		Check for the same possible causes as listed in 1.—2)