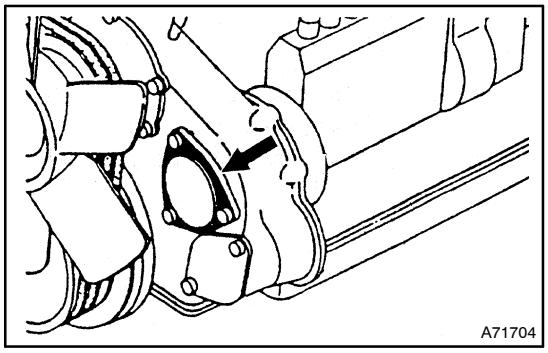
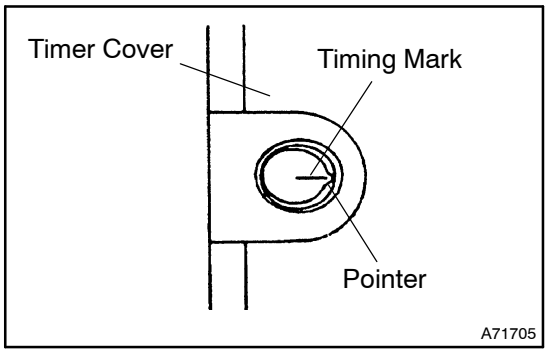
14144–01

OVERHAUL



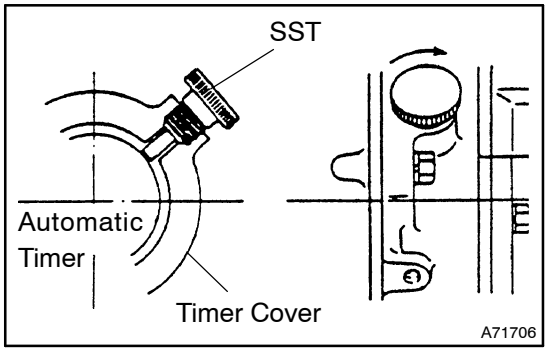
1. REMOVE BEARING HOLDER CASE OR SEAL PLATE



2. REMOVE INJECTION PUMP ASSY

(a) Remove the inspection hole dust cover of the timer.

(b) Turn the crankshaft clockwise viewed from the timing gear cover, in order to align the injection timing mark.



(c) Using SST, lock the automatic timer.
SST S0951–22100

NOTICE:

Do not loosen the injection pump drive gear fitting bolts.

(d) Remove the injection pump assy together with the timer cover.

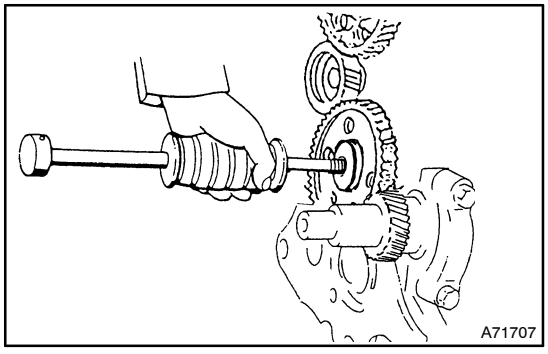
3. REMOVE CRANKSHAFT PULLEY

4. REMOVE OIL PAN SUB–ASSY

5. REMOVE OIL STRAINER SUB–ASSY

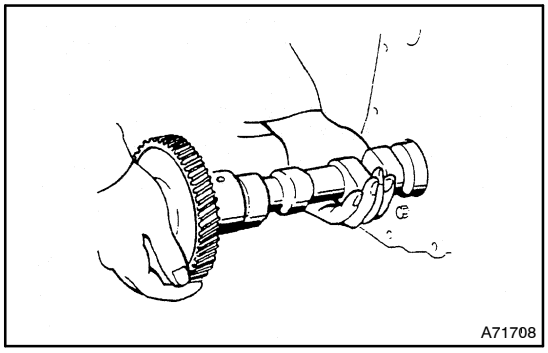
6. REMOVE OIL PUMP ASSY

7. REMOVE TIMING GEAR COVER



8. REMOVE IDLE GEAR SHAFT

(a) Using a sliding hammer, drive out the idle gear shaft.

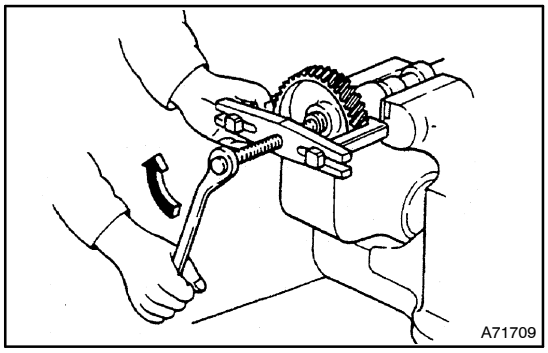


9. REMOVE CAMSHAFT AND TIMING GEAR ASSY

(a) Remove the thrust plate set bolts, and pull out the camshaft together with the gear.

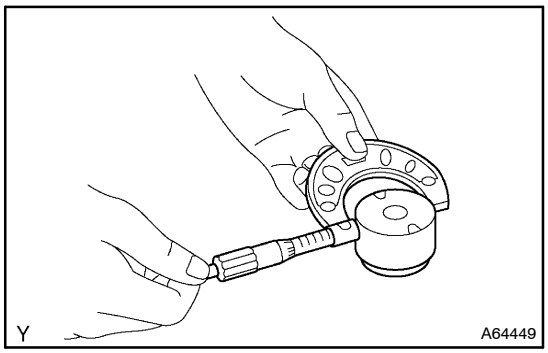
NOTICE:

Pull out the camshaft by slowly turning it, so as not to damage the bearings.



10. REMOVE CAMSHAFT TIMING GEAR

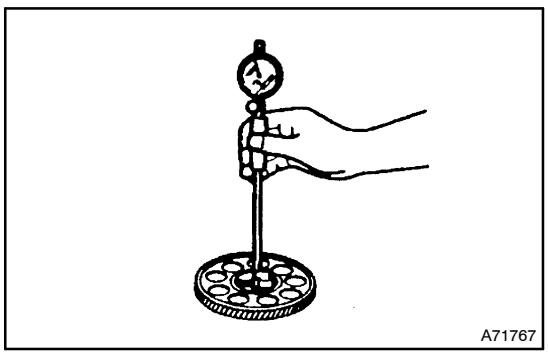
(a) Mount the camshaft with a vice through wooden plates.
(b) Remove the bolt and plate washer.
(c) Using a gear puller, remove the gear.



11. INSPECT OIL CLEARANCE BETWEEN IDLE GEAR AND SHAFT

(a) Using a micrometer, measure the diameter of the idle gear shaft.

Standard shaft diameter:
49.950 – 49.975 mm (1.9665 – 1.9675 in.)



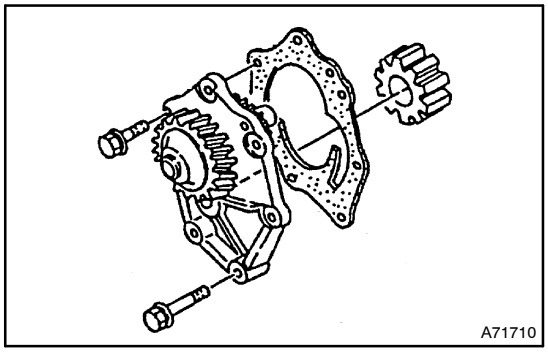
(b) Using a cylinder gauge, measure the inside diameter of the idle gear bush.

Standard inside diameter:
50.000 – 50.025 mm (1.9685 – 1.9695 in.)

(c) Subtract the diameter measurement of the idle gear shaft from the inside diameter measurement of the idle gear bush.

Standard oil clearance:
0.025 – 0.075 mm (0.0010 – 0.0030 in.)
Maximum oil clearance: 0.10 mm (0.0039 in.)

If the oil clearance is greater than the maximum, replace the idle gear shaft and/or idle gear bush.


A71710

12. INSTALL OIL PUMP ASSY

(a) Apply oil to the pump case and bearings of the block before installing the oil pump.

HINT:

If no oil is applied, oil suction failure may be caused at start–up, which results in seizure and abnormality.

(b) To prevent misalignment of the gasket, apply engine oil to the gasket matching face of the block. Then, place and fix the gasket.

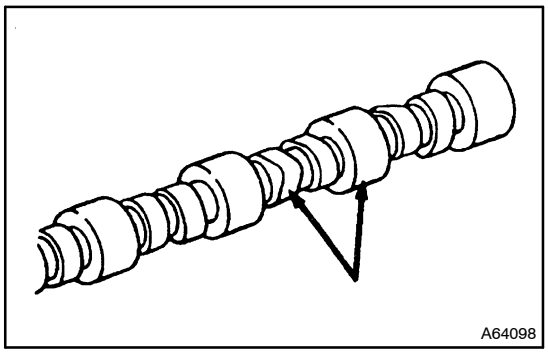
(c) Tighten the oil pump mounting bolts provisionally in the order as shown in the illustration. Then retighten them.

Torque: 22.5 N·m (230 kgf·cm, 17 ft·lbf)

(d) Check that the gear rotates smoothly by hand after the installation.

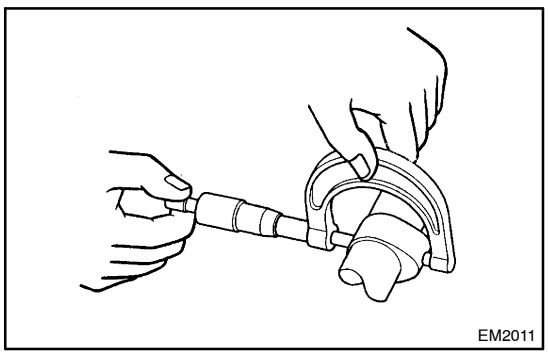
HINT:

Be sure to observe the tightening order of the bolts, otherwise the oil pump will be damaged.


A64098

13. INSPECT CAMSHAFT

(a) Visually check the camshaft surface for wear and scratches.


EM2011

(b) Using a micrometer, measure the cam lobe height.

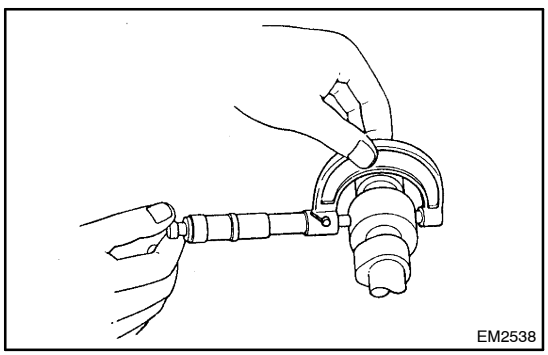
Standard cam lobe height:

Intake	49.435 mm (1.9463 in.)
Exhaust	49.493 mm (1.9485 in.)

Minimum cam lobe height:

Intake	48.90 mm (1.9252 in.)
Exhaust	48.95 mm (1.9272 in.)

If the lobe height is less than the minimum, replace the camshaft.


EM2538

(c) Measure the oil clearance of the camshaft journal.

(1) Using a micrometer, measure the journal diameter of the camshaft.

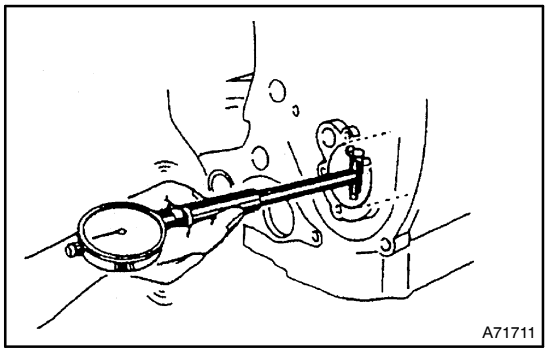
Standard journal diameter:

No. 1	56.95 – 56.97 mm (2.2421 – 2.2429 in.)
No. 2	56.75 – 56.77 mm (2.2342 – 2.2350 in.)
No. 3	56.55 – 56.57 mm (2.2264 – 2.2272 in.)

Minimum journal diameter:

No. 1	56.85 mm (2.2382 in.)
No. 2	56.65 mm (2.2303 in.)
No. 3	56.45 mm (2.2224 in.)

If the diameter is less than the minimum, replace the camshaft bearing.


A71711

(2) Using a cylinder gauge, measure the inside diameter of the camshaft bearing.

Standard inside diameter:

No. 1	57.00 – 57.07 mm (2.2441 – 2.2468 in.)
No. 2	56.80 – 56.87 mm (2.2362 – 2.2390 in.)
No. 3	56.60 – 56.67 mm (2.2283 – 2.2311 in.)

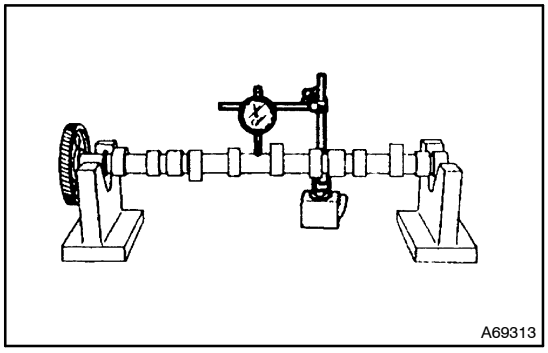
If the oil clearance is greater than the maximum, replace the camshaft or camshaft bearing.

(d) Subtract the journal diameter measurement of the camshaft from the inside diameter measurement of the camshaft bearing.

(1) Calculate the oil clearance from the above measurement.

Standard oil clearance:
0.030 – 0.120 mm (0.0012 – 0.0047 in.)
Maximum oil clearance: 0.15 mm (0.0059 in.)

If the oil clearance is greater than the maximum, replace the camshaft or camshaft bearing.

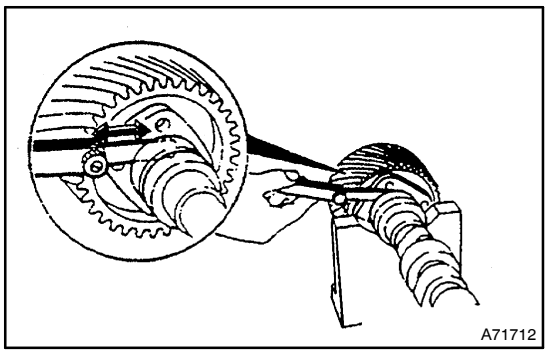

A69313

(e) Inspect the camshaft for bend.

(1) Place the camshaft on V–blocks.
(2) Using a dial gauge, measure the bend at the center journal.

Maximum bend: 0.05 mm (0.0020 in.)

If the bend is greater than the maximum, replace the camshaft.

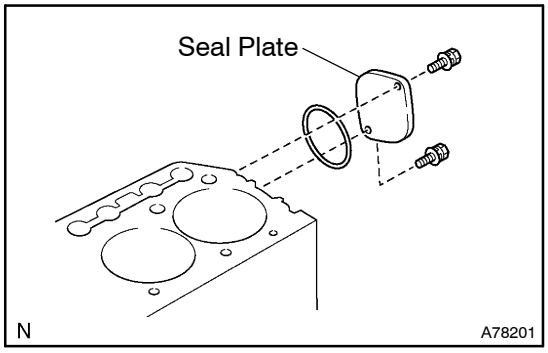

A71712

(f) Inspect the camshaft thrust clearance.

(1) Using a feeler gauge, measure the clearance between the camshaft and thrust plate.

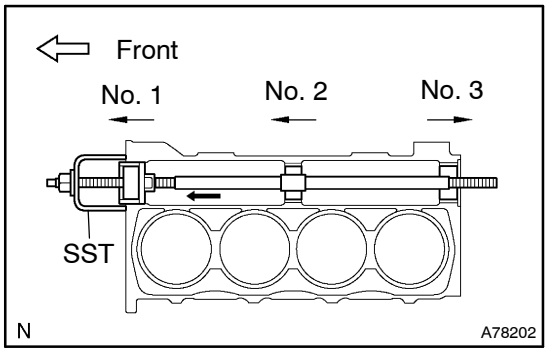
Standard thrust clearance:
0.10 – 0.18 mm (0.0039 – 0.0071 in.)
Maximum thrust clearance: 0.30 mm (0.0118 in.)

If the thrust clearance is greater than the maximum, replace the thrust bearing and/or gear.



14. REPLACE CAMSHAFT BEARING

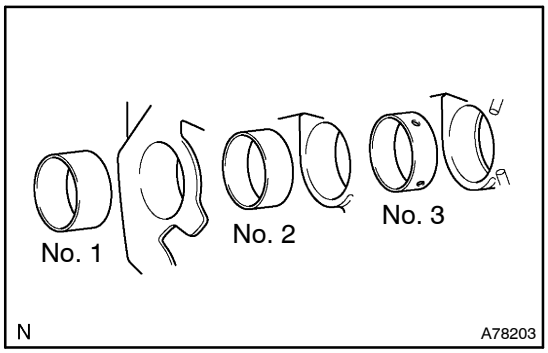
(a) Remove the 2 bolts, seal plate and O–ring.



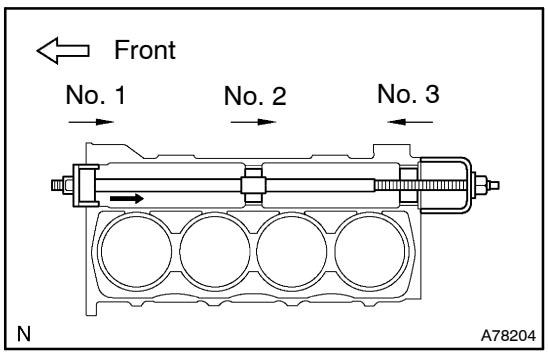
(b) Using SST, remove the bearings.
SST 09215–00013 (09215–00461)

HINT:

- Pull out the No. 1 bearing toward the front.
- Pull out the No. 2 bearing toward the front.
- Pull out the No. 3 bearing toward the rear.



(c) Using SST, install new bearings.
(1) No. 3 bearing only:
Align the oil holes of the bearing with the oil holes of the cylinder block.

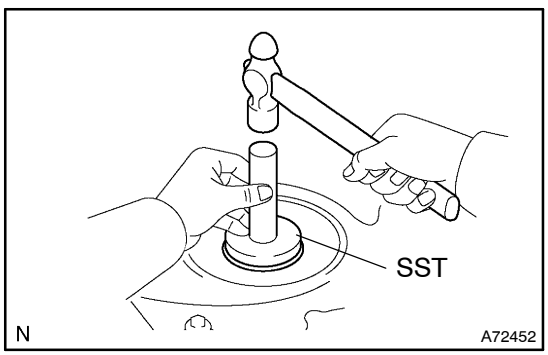


(2) Using SST, install the bearings.
SST 09215–00013 (09215–00461)

HINT:

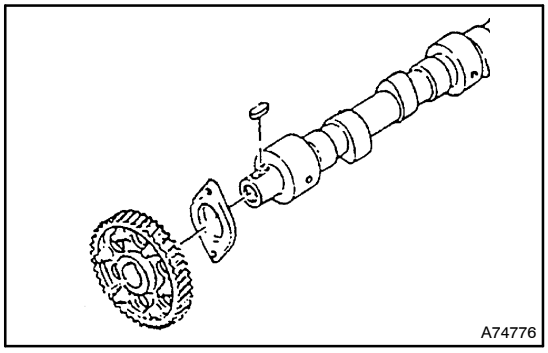
- Push in the No. 3 bearing from the rear.
- Push in the No. 2 bearing from the front.
- Push in the No. 1 bearing from the front.

(d) Recheck the camshaft oil clearance (See step 13 (c)).
(e) Install a new O–ring and the seal plate with the 2 bolts.



15. REPLACE ENGINE FRONT OIL SEAL

(a) Using a screwdriver, pry out the oil seal.
(b) Using SST and a hammer, tap in a new oil seal.
SST 09950–60020 (09951–00750), 09950–70010 (09951–07100)

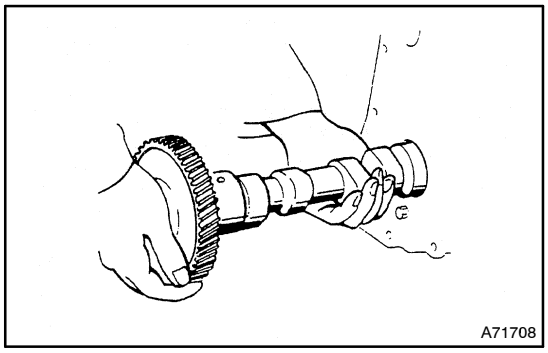


16. INSTALL CAMSHAFT TIMING GEAR

(a) Install the thrust plate and timing gear to the camshaft.

HINT:

Heat the gear in hot water (approx. 200°C (392°F)), then using a press, install the gear to the camshaft.



17. INSTALL CAMSHAFT AND TIMING GEAR ASSY

(a) Lubricate all the journals of the camshaft.

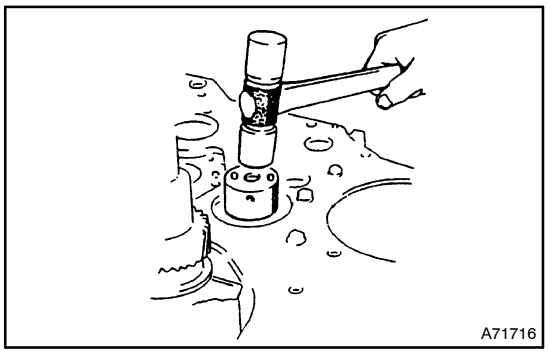
(b) Insert the camshaft into the cylinder block.

NOTICE:

Insert the camshaft while slowly turning it, so that the bearing will not be damaged.

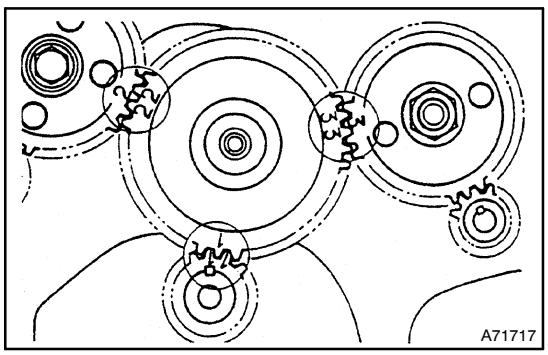
(c) Tighten the 2 bolts of the thrust plate.

Torque: 24.5 N·m (250 kgf·cm, 18 ft·lbf)



18. INSTALL IDLE GEAR NO.1

(a) Install the idle gear shaft through the thrust plate so that the lubrication hole faces downward.



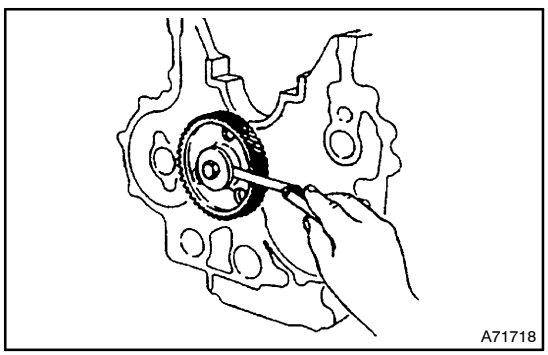
(b) Install the idle gear.

HINT:

- Apply engine oil to the contact surface of the idle gear and idle gear shaft before the installation.
- Be sure that the timing marks of the crankshaft timing gear, camshaft timing gear, injection pump drive gear and idle gear are aligned correctly.

(c) Tighten the mounting bolts of the idle gear shaft.

Torque: 137.3 N·m (1,400 kgf·cm, 101 ft·lbf)



19. INSPECT IDLE GEAR NO. 1 THRUST CLEARANCE

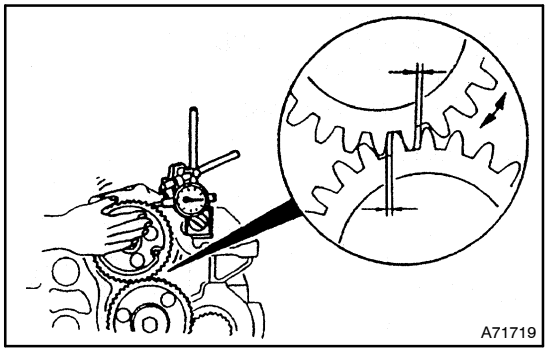
(a) Using a feeler gauge, measure the clearance between the idle gear and thrust bearing.

Standard thrust clearance:

0.040 – 0.100 mm (0.0016 – 0.0039 in.)

Maximum thrust clearance: 0.15 mm (0.0059 in.)

If the thrust clearance is greater than the maximum, replace the thrust bearing.



20. INSPECT TIMING GEAR BACKLASH

(a) Using a dial gauge, measure the backlash between the gears.

Standard backlash:

Crankshaft timing gear x Idle gear	0.068 – 0.194 mm (0.0027 – 0.0076 in.)
Idle gear x Injection pump drive gear	0.065 – 0.232 mm (0.0026 – 0.0091 in.)
Idle gear x Oil pump drive gear	0.065 – 0.182 mm (0.0026 – 0.0072 in.)
Camshaft timing gear x Oil pump drive gear	

Maximum backlash: 0.30 mm (0.0118 in.)

If the backlash is greater than the maximum, replace the gear.

21. INSTALL TIMING GEAR COVER
22. INSTALL OIL PUMP ASSY
23. INSTALL OIL STRAINER SUB–ASSY
24. INSTALL OIL PAN SUB–ASSY
25. INSTALL CRANKSHAFT PULLEY
26. INSTALL INJECTION PUMP ASSY
27. INSTALL BEARING HOLDER CASE OR SEAL PLATE