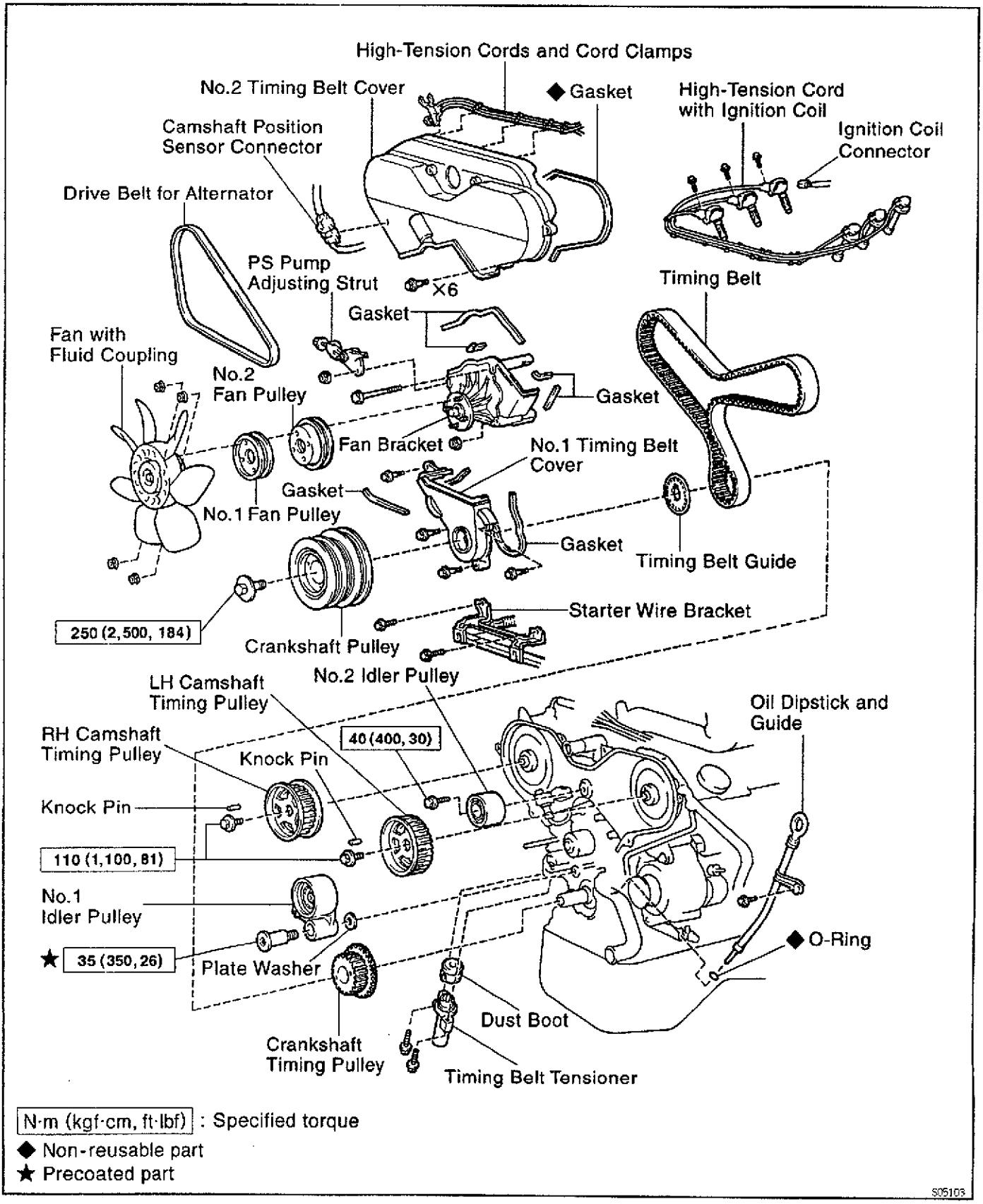
# CYLINDER HEAD
## COMPONENTS REMOVAL AND INSTALLATION

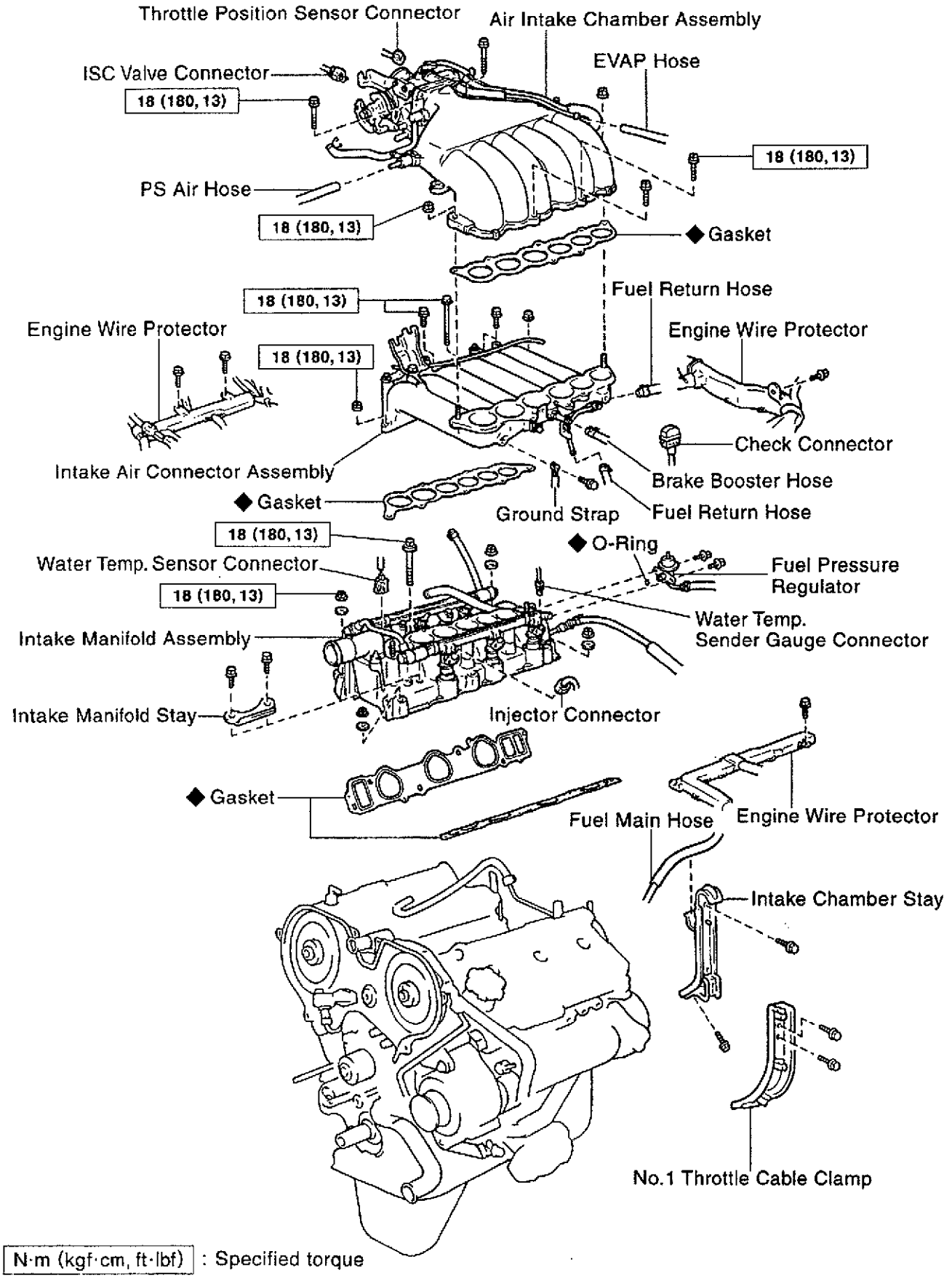
EG7BW-01

EG




N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
★ Precoated part

S05103

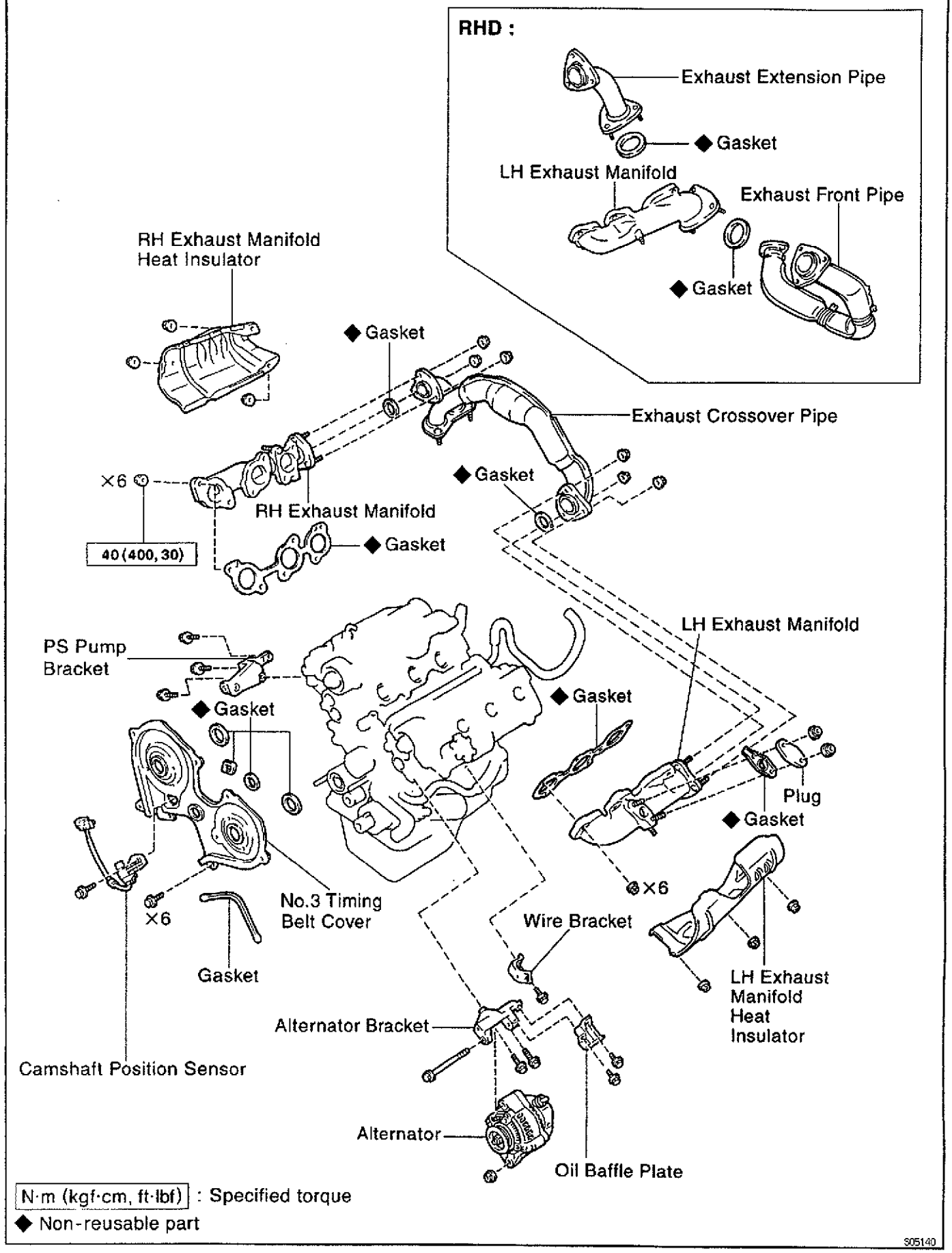



N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

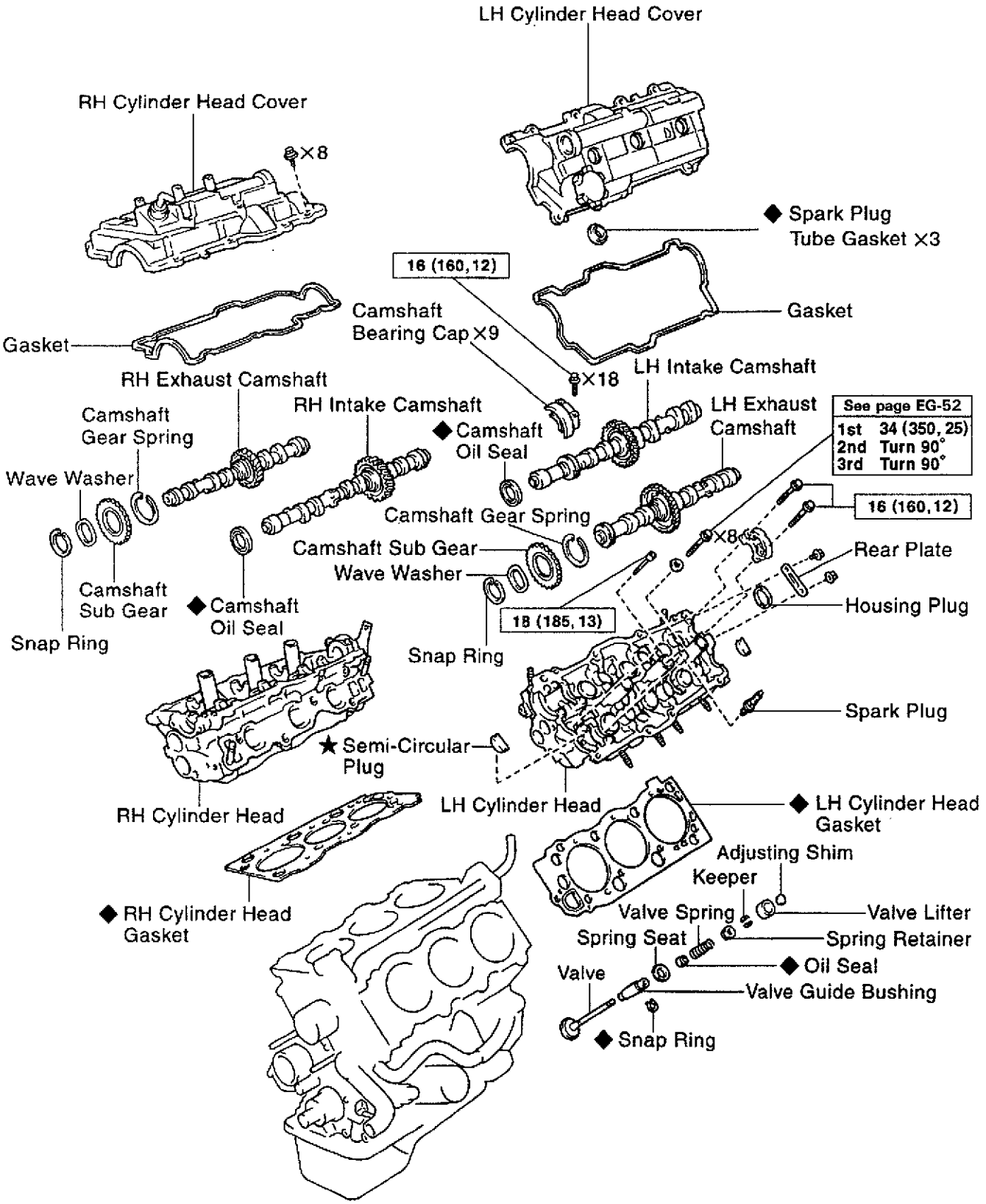
305139

EG




N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part

S05140




S02363

N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

★ Precoated part

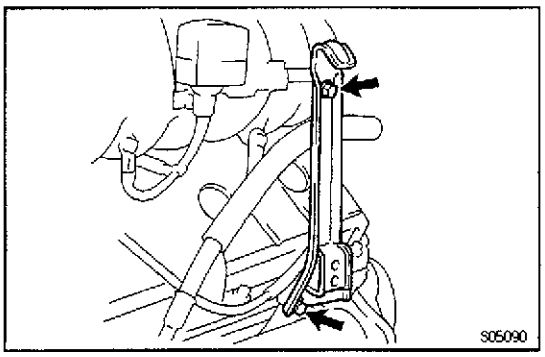
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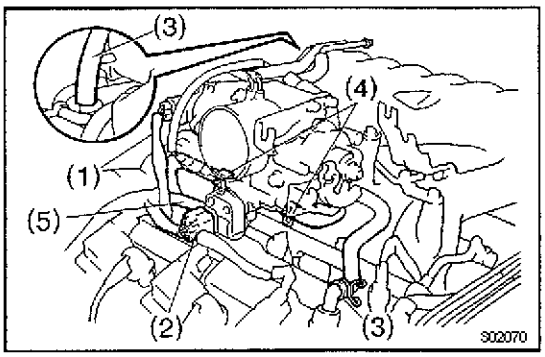
# CYLINDER HEADS REMOVAL

1. **DRAIN ENGINE COOLANT**
2. **REMOVE TIMING BELT**
   **(See timing belt removal)**
3. **REMOVE HIGH–TENSION CORDS WITH IGNITION COILS AND SPARK PLUGS**
   **(See ignition coils removal in Ignition System)**

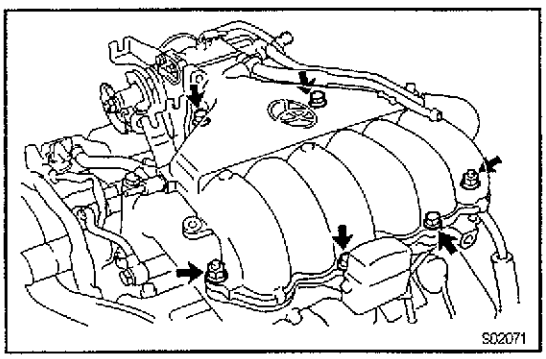
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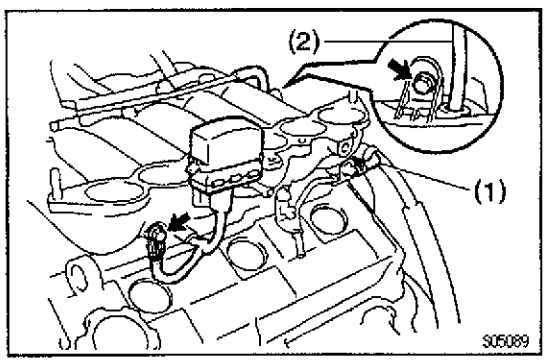

4. **REMOVE INTAKE CHAMBER STAY**
(a) Remove the 2 bolts and No.1 throttle cable clamp.
(b) Remove the 2 bolts and intake chamber stay.



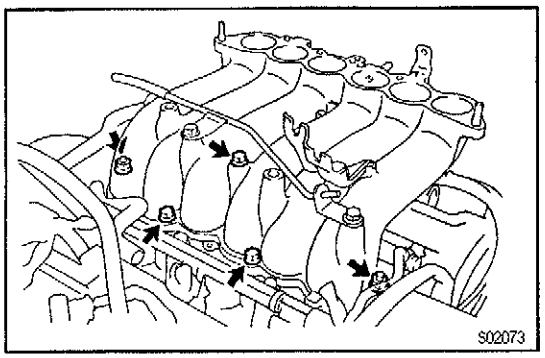

5. **REMOVE AIR INTAKE CHAMBER ASSEMBLY**
(a) Disconnect these connectors and these hoses:
   (1) Throttle position sensor connector
   (2) ISC valve connector
   (3) 2 PCV hoses
   (4) 2 water bypass hoses
   (5) Air assist hose from throttle body




(b) Remove the 4 bolts, 2 nuts, the air intake chamber assembly and gasket.

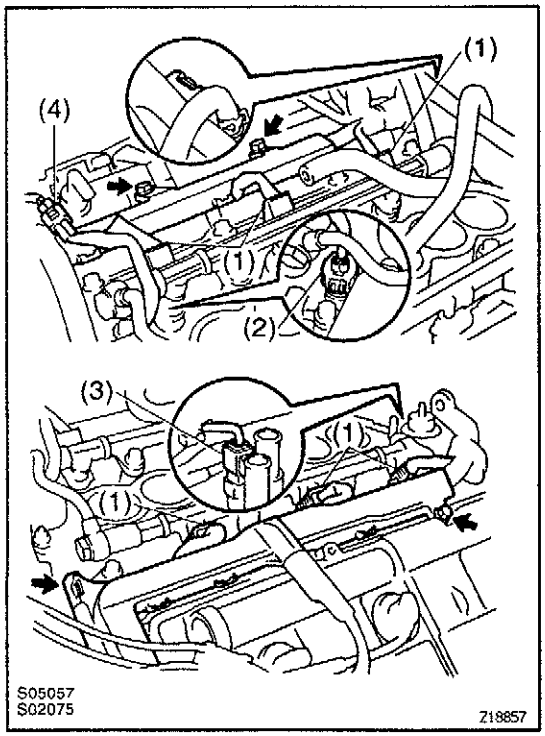



6. **REMOVE INTAKE AIR CONNECTOR**
(a) Remove the bolt and disconnect the engine wire.
(b) Disconnect these hoses:
   (1) Fuel return hose
   (2) Vacuum hose from the fuel pressure regulator
(c) Remove the bolt and disconnect the ground strap from the intake air connector.
(d) Disconnect the check connector from the bracket.




(e) Remove the 3 bolts and 2 nuts, then intake air connector and gasket.



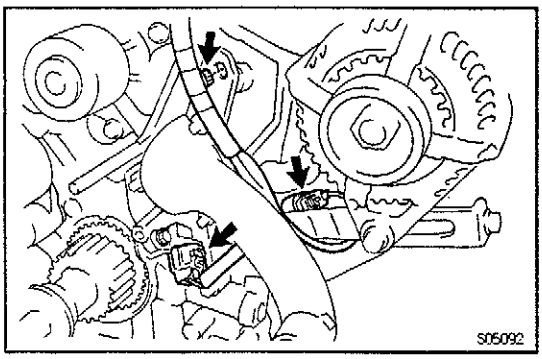



**7. DISCONNECT ENGINE WIRE PROTECTOR**

(a) Disconnect these connectors:
  (1) 6 injector connectors
  (2) Water temperature sensor connector
  (3) Water temperature sender gauge connector
  (4) Knock sensor connector

(b) Disconnect the 2 engine wire clamps.

(c) Remove the 3 bolts, and disconnect the engine wire protector from the cylinder head.

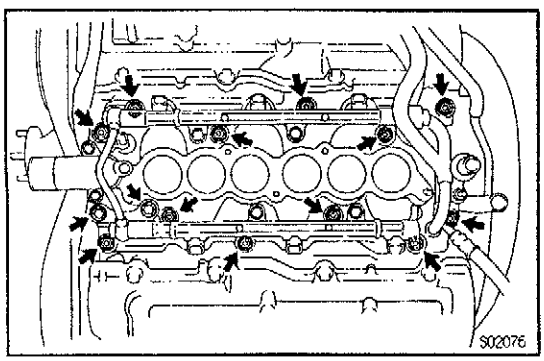



(d) Disconnect the engine wire clamp from engine.

(e) Disconnect these connectors:
  (1) Crankshaft position sensor connector
  (2) Oil pressure switch connector

**8. REMOVE FUEL PRESSURE REGULATOR**

**(See fuel pressure regulator removal in EFI System)**

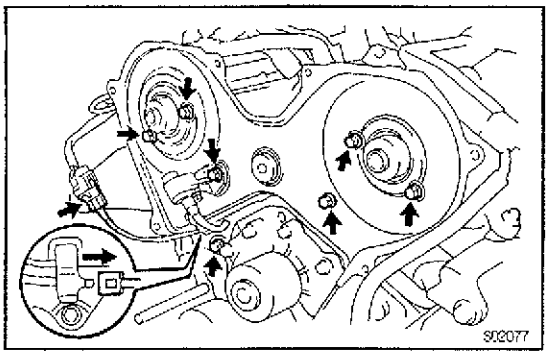



**9. REMOVE INTAKE MANIFOLD ASSEMBLY**

(a) Remove the 2 bolts and intake manifold stay.

(b) Remove the 8 bolts, 4 nuts, 4 plate washers, intake manifold, delivery pipes and injectors assembly and 2 gaskets.

EG




**10. REMOVE CAMSHAFT POSITION SENSOR**

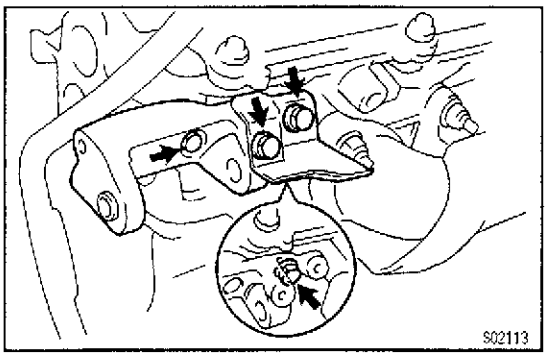
(a) Disconnect the camshaft position sensor connector.
(b) Disconnect the clamp from the No.3 timing belt cover.
(c) Remove the bolt and camshaft position sensor.

**11. REMOVE NO.3 TIMING BELT COVER**

Remove the 6 bolts and timing belt cover.

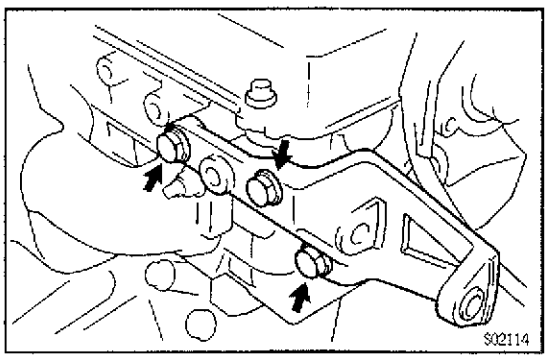
**12. REMOVE ALTERNATOR**

**(See alternator removal in Charging System)**




**13. REMOVE ALTERNATOR BRACKET**

(a) Remove the 2 bolts and oil baffle plate.
(b) Remove the 2 bolts and alternator bracket.




**14. REMOVE PS PUMP BRACKET**

Remove the 3 bolts and PS pump bracket.

**15. LHD:**

**REMOVE EXHAUST CROSSOVER PIPE**

Remove the 6 nuts, crossover pipe and 2 gaskets.

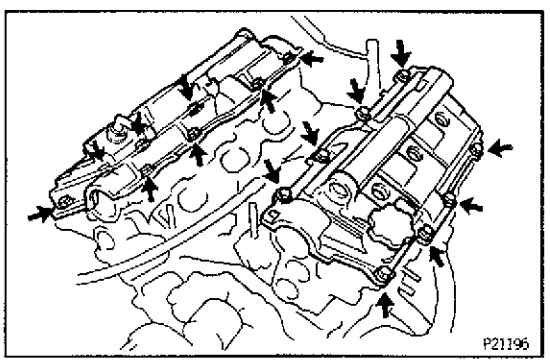
**RHD:**

**REMOVE EXHAUST EXTENSION PIPE AND EXHAUST FRONT PIPE NO.2**

(a) Remove the 3 nuts, exhaust extension pipe and gasket.
(b) Remove the 3 nuts, exhaust pipe No.2 and gasket.

**16. REMOVE EXHAUST MANIFOLDS**

(a) Remove the 6 nuts and exhaust manifold heat insulators.
(b) Remove the 12 nuts, exhaust manifolds and gaskets.



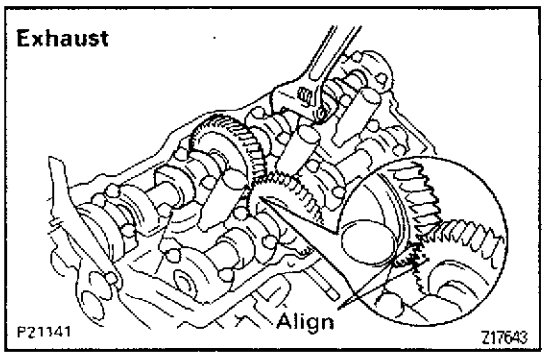

**17. REMOVE CYLINDER HEAD COVERS**

Remove the 8 bolts, seal washers, cylinder head cover and gasket. Remove the 2 cylinder head covers.

## 18. REMOVE CAMSHAFTS OF RH CYLINDER HEAD

**NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, these steps should be carried out.**

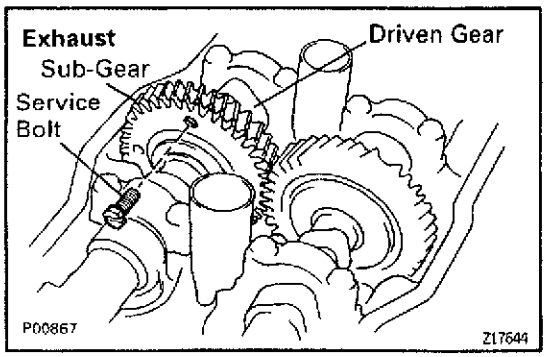





**A. Exhaust**

(a) Boring the service bolt hole of the driven sub—gear upward by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.

(b) Align the timing marks (2 dot marks) of the camshaft drive and driven gears by turning the camshaft with a wrench.

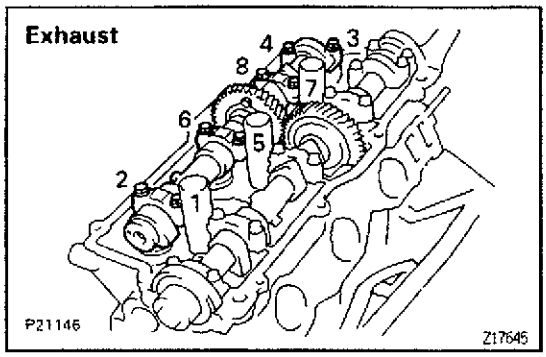



(c) Secure the exhaust camshaft sub—gear to the main gear with a service bolt.

Recommended service bolt:

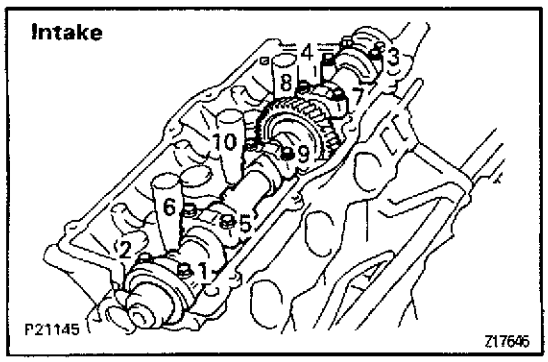
| | |
|---|---|
| Thread diameter | 6 mm |
| Thread pitch | 1.0 mm |
| Bolt length | 16 — 20 mm |

HINT: When removing the camshaft, make sure that the torsional spring force of the sub—gear has been eliminated by the above operation.




(d) Uniformly loosen and remove the 8 bearing cap bolts, in several passes, in the sequence shown.

(e) Remove the 4 bearing caps and exhaust camshaft.




**B. Intake**

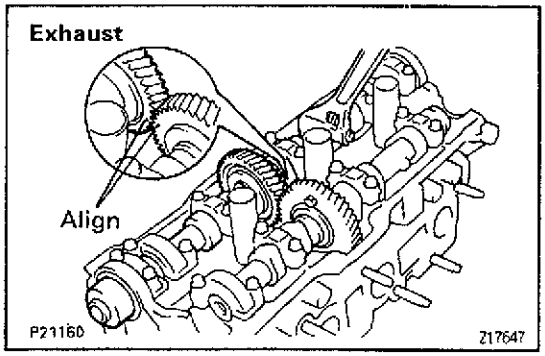
(a) Uniformly loosen and remove the 10 bearing cap bolts, in several passes, in the sequence shown.

(b) Remove the 5 bearing caps, oil seal and intake camshaft.

EG

## 19. REMOVE CAMSHAFTS OF LH CYLINDER HEAD

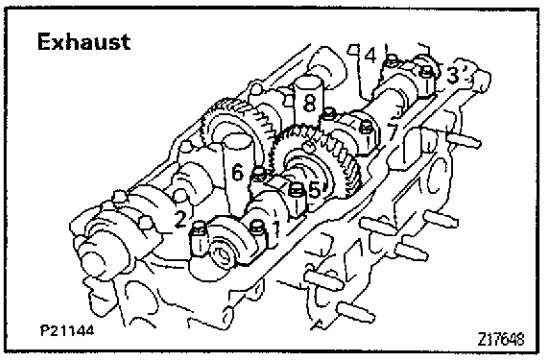
**NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, these steps should be carried out.**




**A. Exhaust**

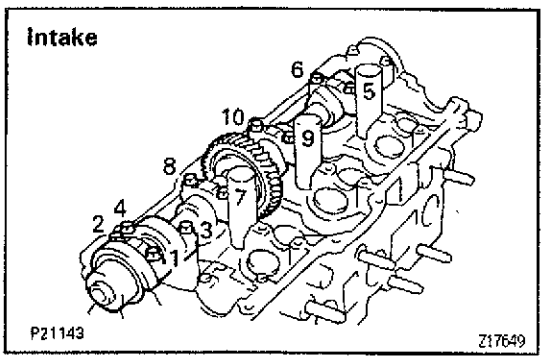
(a) Align the timing marks (1 dot mark) of the camshaft drive and driven gears by turning the camshaft with a wrench.

(b) Secure the exhaust camshaft sub—gear to the main gear with a service bolt (See step (c) in step A in step 18).




(c) Uniformly loosen and remove the 8 bearing cap bolts, in several passes, in the sequence shown.

(d) Remove the 4 bearing caps and exhaust camshaft.



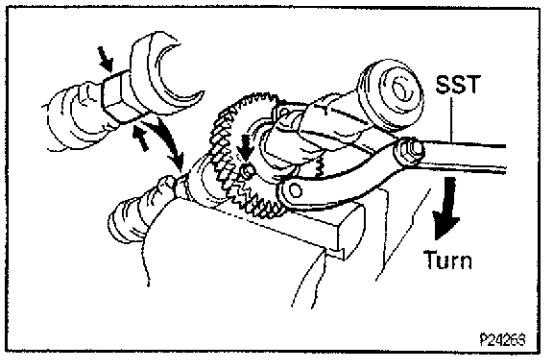

**B. Intake**

(a) Uniformly loosen and remove the 10 bearing cap bolts, in several passes, in the sequence shown.

(b) Remove the 5 bearing caps, oil seal and intake camshaft.

HINT:

- Arrange the camshafts in the correct order.
- Arrange the bearing caps in the correct order.



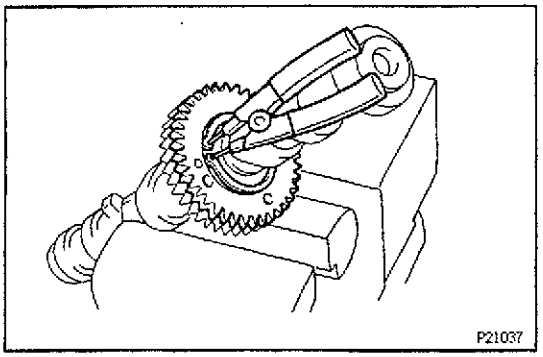

## 20. DISASSEMBLE EXHAUST CAMSHAFTS

(a) Mount the hexagonal wrench head portion of the camshaft in a vise.

**NOTICE: Be careful not to damage the camshaft.**

(b) Using SST, turn the sub—gear clockwise and remove the service bolt.

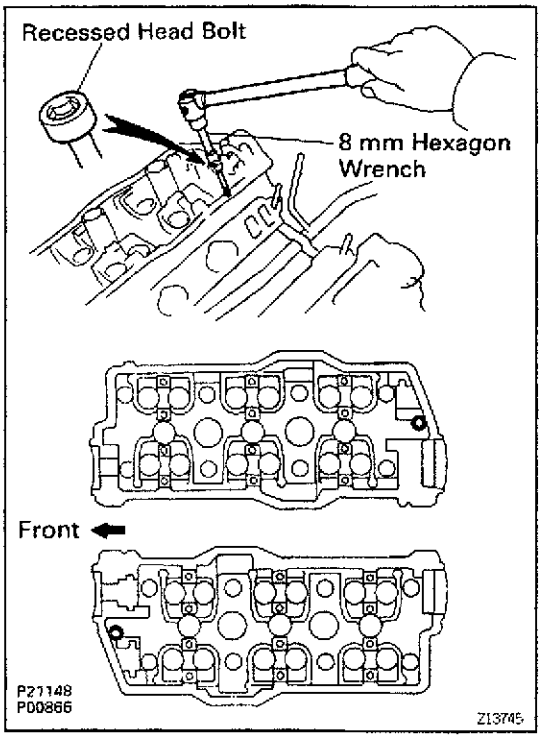
SST 09960—10010 (09962—01000, 09963—00600)




(c) Using snap ring pliers, remove the snap ring.
(d) Remove these parts:
- Wave washer
- Camshaft sub—gear
- Camshaft gear spring

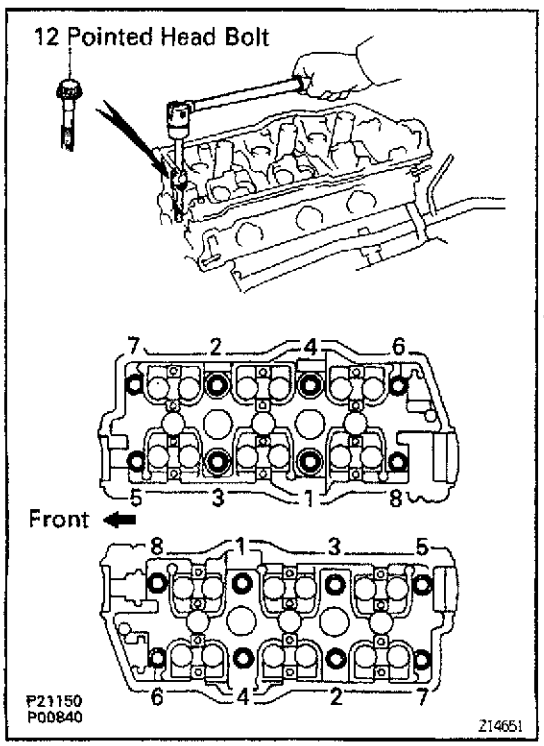
HINT: Arrange the camshaft sub—gears and gear springs (RH and LH side).

EG




**21. REMOVE CYLINDER HEADS**

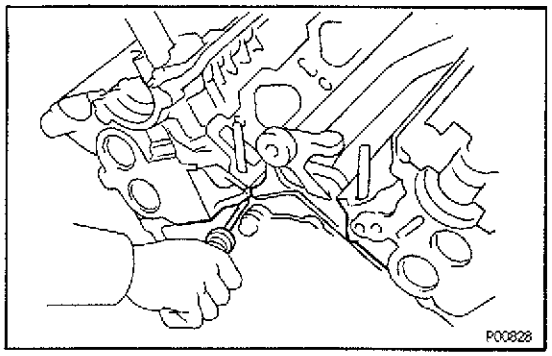
(a) Remove the bolt and disconnect the ground strap.
(b) Using an 8 mm hexagon wrench, remove the cylinder head (recessed head) bolt on each cylinder head, then repeat for the other side, as shown.




(c) Uniformly loosen and remove the 8 cylinder head (12 pointed head) bolts on each cylinder head, in several passes, in the sequence shown, then repeat for the other side, as shown. Remove the 16 cylinder head bolts and plate washers.

**NOTICE: Head warpage or cracking could result from removing bolts in an incorrect order.**

EG

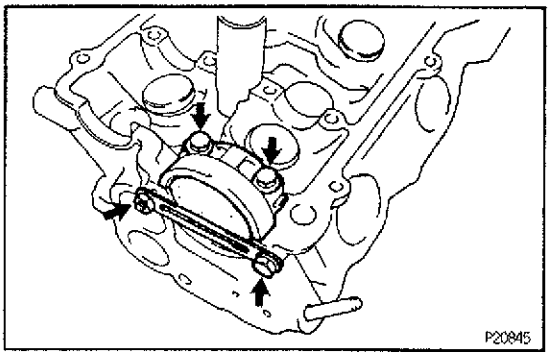



(d) Lift the cylinder head from the dowels on the cylinder block and place the 2 cylinder heads on wooden blocks on a bench.
HINT:
- If the cylinder head is difficult to lift off, pry between the cylinder head and cylinder block with a screwdriver.
- Arrange the cylinder heads in the correct order.

**NOTICE: Be careful not to damage the contact surfaces of the cylinder head and cylinder block.**

## CYLINDER HEADS DISASSEMBLY

EG5YD-03

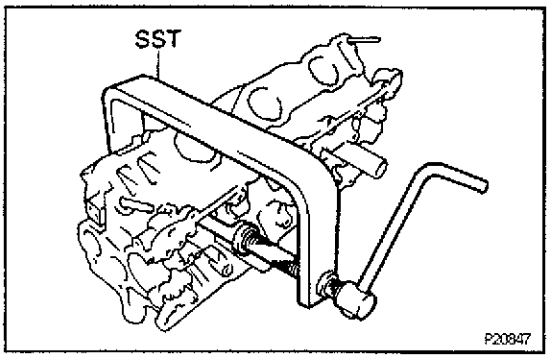



**1. REMOVE CAMSHAFT HOUSING PLUGS**

(a) Remove the bolt, nut, cylinder head rear plate and ground strap.
(b) Remove the 2 bolts and camshaft bearing cap.
(c) Remove the housing plug.

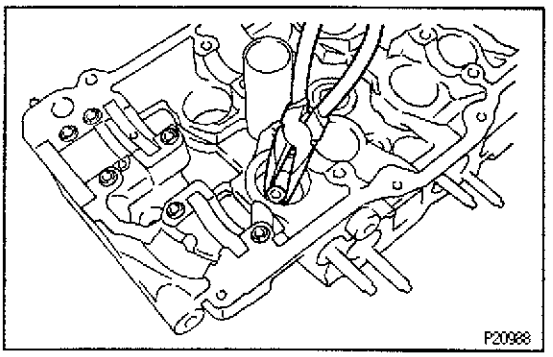
**2. REMOVE VALVE LIFTERS AND SHIMS**

Pull out the valve lifter and shim by hand.
HINT: Arrange the valve lifters and shims in correct order.

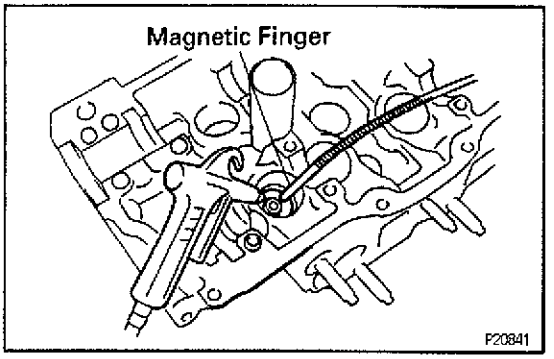



**3. REMOVE VALVES**

(a) Using SST, compress the valve spring and remove the 2 keepers.
SST 09202–70020
(b) Remove these parts:
- Spring retainer
- Valve spring
- Valve

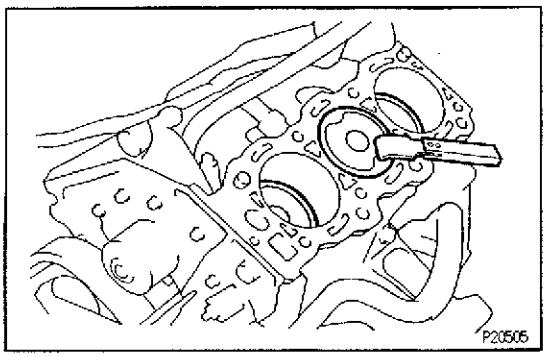



(c) Using needle–nose pliers, remove the oil seal.




(d) Using compressed air and a magnetic finger, remove the spring seat by blowing air.
HINT: Arrange the valves, valve springs, spring seats and spring retainers in the correct order.

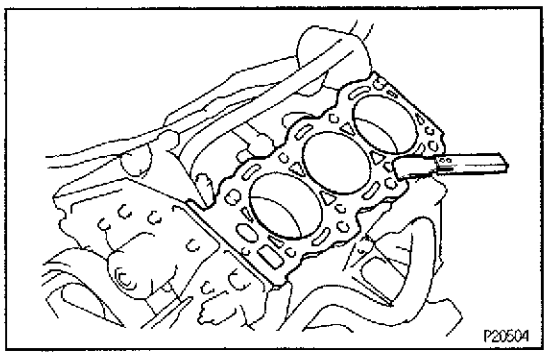
EG7BY-01




## CYLINDER HEADS COMPONENTS INSPECTION AND REPAIR

### 1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

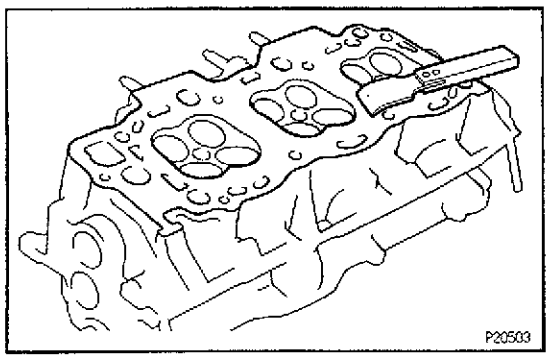
(a) Turn the crankshaft and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surfaces.




(b) Using a gasket scraper, remove all the gasket material from the cylinder block surfaces.

(c) Using compressed air, blow carbon and oil from the bolt holes.

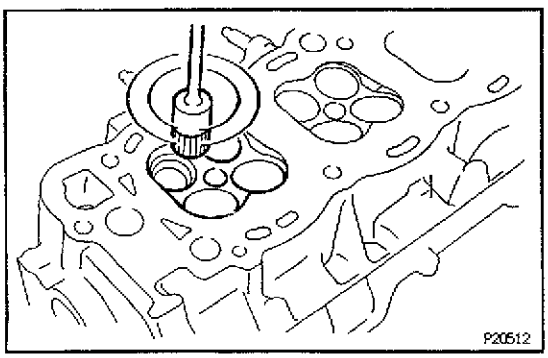
**CAUTION: Protect your eyes when using high — compressed air.**




### 2. REMOVE GASKET MATERIAL

Using a gasket scraper, remove all the gasket material from the cylinder block contact surface.

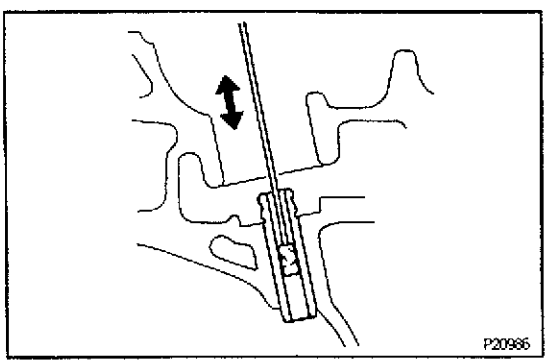
**NOTICE: Be careful not to scratch the cylinder block contact surfaces.**




### 3. CLEAN COMBUSTION CHAMBERS

Using a wire brush, remove all the carbon from the combustion chambers.

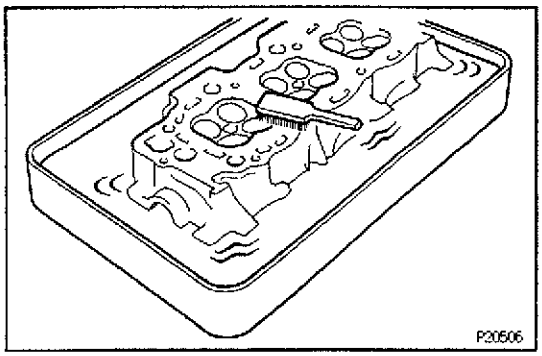
**NOTICE: Be careful not to scratch the cylinder block contact surfaces.**




### 4. CLEAN VALVE GUIDE BUSHINGS

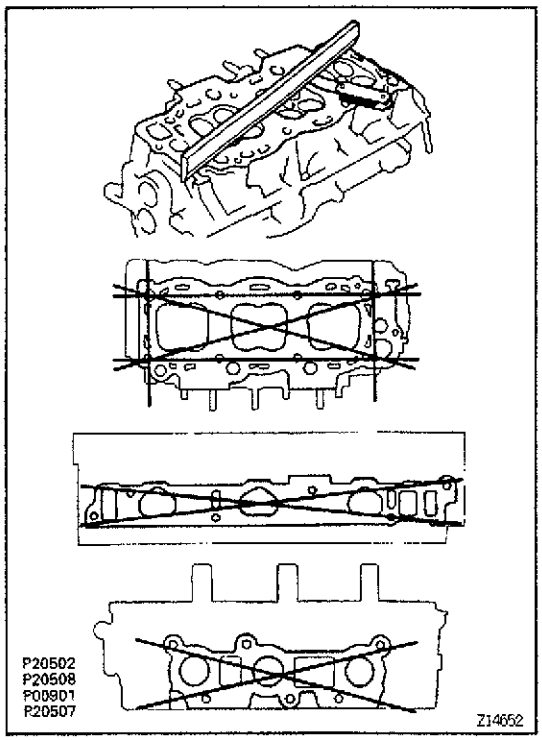
Using a valve guide bushing brush and solvent, clean all the guide bushings.

EG




**5. CLEAN CYLINDER HEADS**

Using a soft brush and solvent, thoroughly clean the cylinder heads.



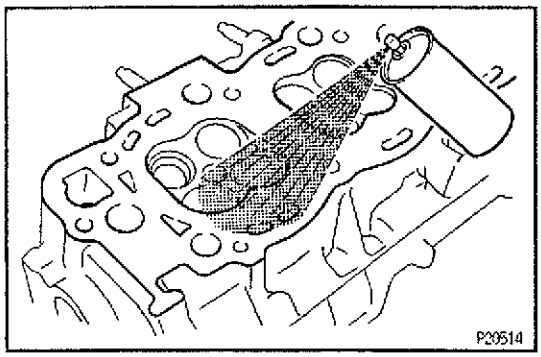

**6. INSPECT FOR FLATNESS**

Using precision straight edge and feeler gauge, measure the surfaces contacting the cylinder block and manifolds for warpage.

**Maximum warpage:**

**0.10 mm (0.0039 in.)**

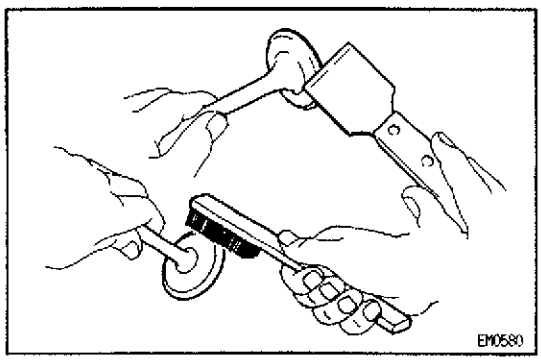
If warpage is greater than the maximum, replace the cylinder head.




**7. INSPECT FOR CRACKS**

Using a dye penetrant, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.

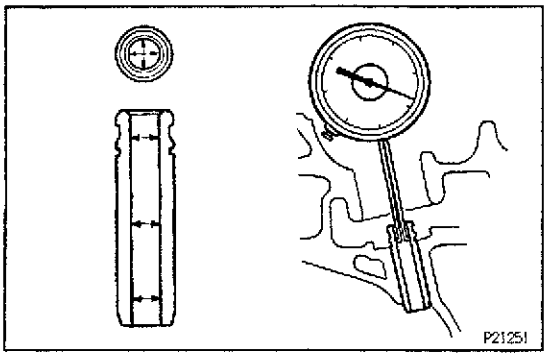
If cracked, replace the cylinder head.




**8. CLEAN VALVES**

(a) Using a gasket scraper, chip off any carbon from the valve head.

(b) Using a wire brush, thoroughly clean the valve.



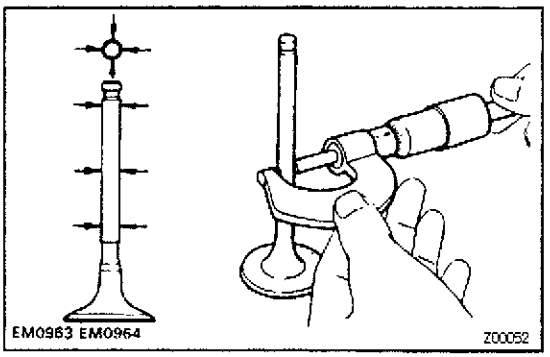

**9. INSPECT VALVE STEMS AND GUIDE BUSHINGS**

(a) Using a caliper gauge, measure the inside diameter of the guide busing.

**Bushing inside diameter:**

**6.010 — 6.030 mm (0.2366 — 0.2374 in.)**






(b) Using a micrometer, measure the diameter of the valve stem.

**Valve stem diameter:**

**Intake**

**5.970 — 5.985 mm (0.2350 — 0.2356 in.)**

**Exhaust**

**5.965 — 5.980 mm (0.2348 — 0.2354 in.)**

(c) Subtract the valve stem diameter measurement from the guide bushing inside diameter measurement.

**Standard oil clearance:**

**Intake**

**0.025 — 0.060 mm (0.0010 — 0.0024 in.)**

**Exhaust**

**0.030 — 0.065 mm (0.0012 — 0.0026 in.)**

**maximum oil clearance:**

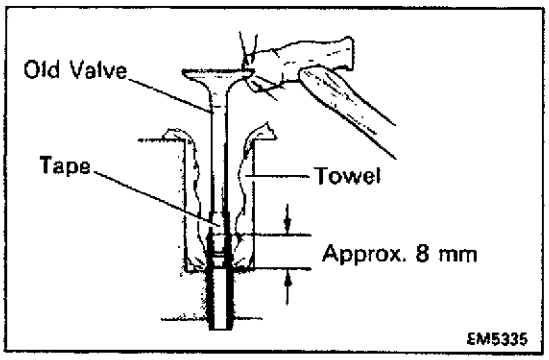
**Intake**

**0.08 mm (0.0031 in.)**

**Exhaust**

**0.10 mm (0.0039 in.)**

If the clearance is greater than the maximum, replace the valve and guide bushing.



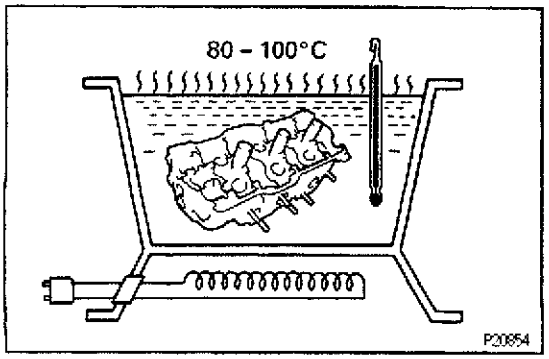

**10. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS**

(a) w/ Snap ring:

Insert an old valve wrapped with tape into the valve guide bushing, and break off the valve guide bushing by hitting it with a hammer. Remove the snap ring.

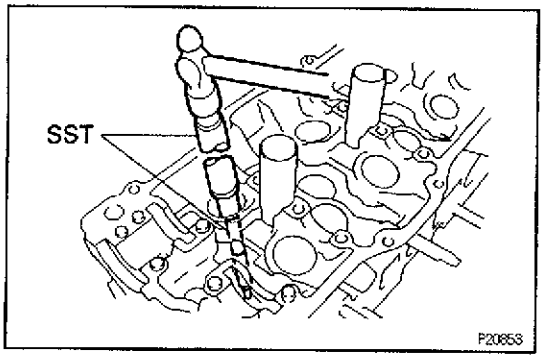
HINT: Wrap the tape approx. 8 mm (0.31 in.) from the valve stem end.

**NOTICE: Be careful not to damage the valve lifter hole.**

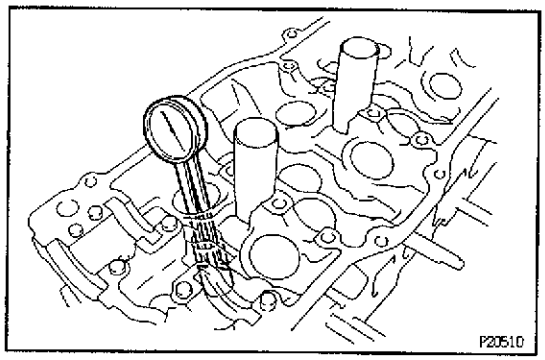



(b) Gradually heat the cylinder head to 80 — 100°C (176 — 212°F).

EG




(c) Using SST and a hammer, tap out the guide bushing.
SST 09201—10000 (09201—01060),
09950—70010 (09951—07150)



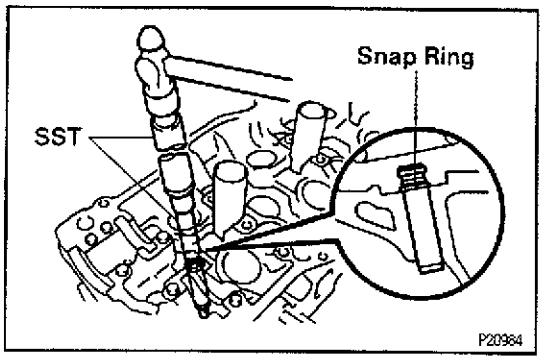

(d) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

Both intake and exhaust

| Bushing bore diameter mm (in.) | Bushing size |
|---|---|
| 10.985 – 11.027 (0.4325 – 0.4341) | Use STD |
| 11.050 – 11.077 (0.4350 – 0.4361) | Use O/S 0.05 |

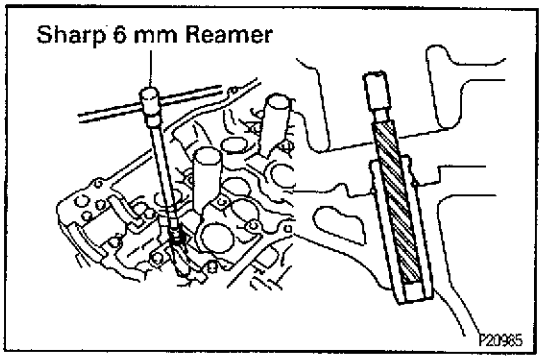
V06270

(e) Select a new guide bushing (STD size or O/S 0.05).
If the bushing bore diameter of the cylinder head is greater than 11.027 mm (0.4341 in.), machine the bushing bore to these dimension:
**11.050 — 11.077 mm (0.4350 — 0.4361 in.)**
If the bushing bore diameter of the cylinder head is greater than 11.077 mm (0.4361 in.), replace the cylinder head.

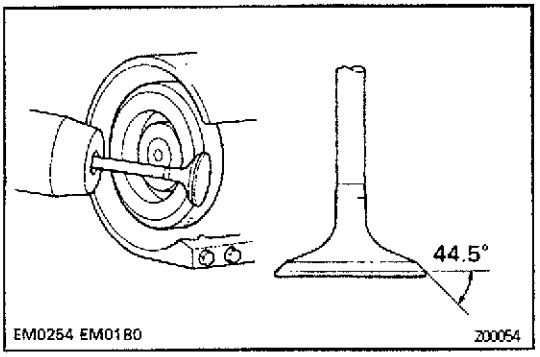



(f) Gradually heat the cylinder head to 80 — 100°C (176 — 212°F).

(g) Using SST and a hammer, tap in a new guide bushing until the snap ring makes contact with the cylinder head.
SST 09201—10000 (09201—01060),
09950—70010 (09951—07150)




(h) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See step 9) between the guide bushing and valve stem.




## 11. INSPECT AND GRIND VALVES

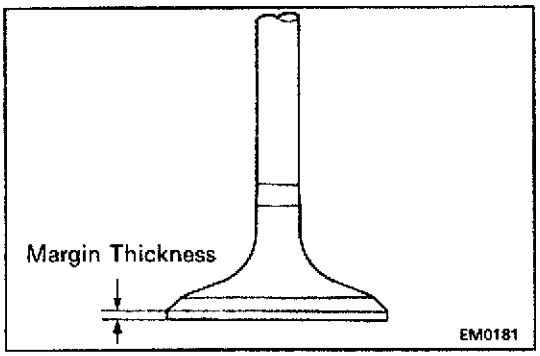
(a) Grind the valve enough to remove pits and carbon.

(b) Check that the valve is ground to the correct valve face angle.

**Valve face angle:**

**44.5°**






(c) Check the valve head margin thickness.

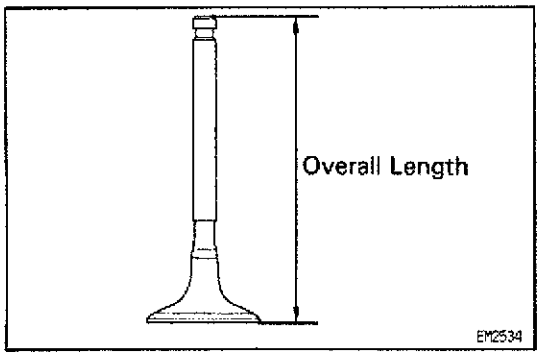
**Standard margin thickness:**

**1.0 mm (0.039 in.)**

**Minimum margin thickness:**

**0.5 mm (0.020 in.)**

If the margin thickness is less than the minimum, replace the valve.




(d) Check the valve overall length.

**Standard overall length:**

**Intake**

**95.15 mm (3.7461 in.)**

**Exhaust**

**94.90 mm (3.7362 in.)**

**Minimum overall length:**

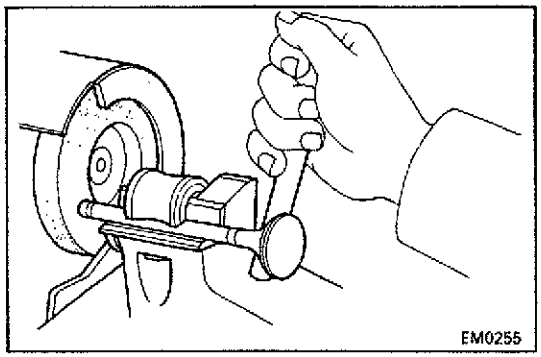
**Intake**

**94.60 mm (3.7244 in.)**

**Exhaust**

**94.40 mm (3.7165 in.)**

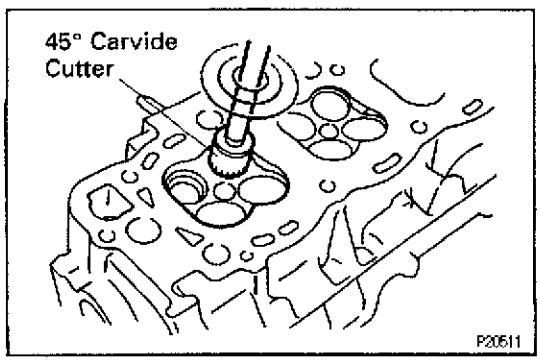
If the overall length is less than the minimum, replace the valve.




(e) Check the surface of the valve stem tip for wear.

If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

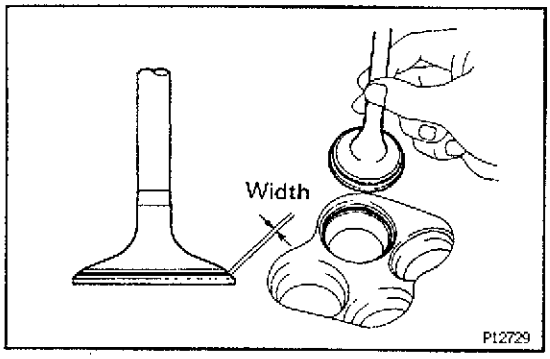
**NOTICE: Do not grind off more than the minimum.**




## 12. INSPECT AND CLEAN VALVE SEATS

(a) Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.

EG



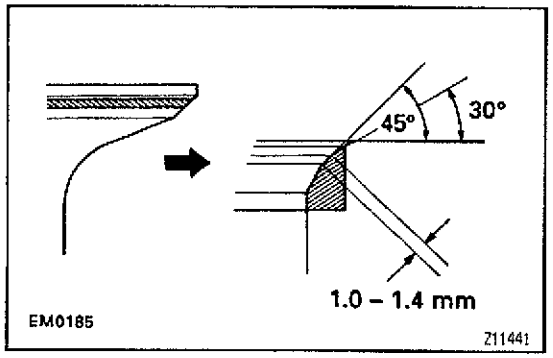

(b) Check the valve seating position.
Apply a thin coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate the valve.

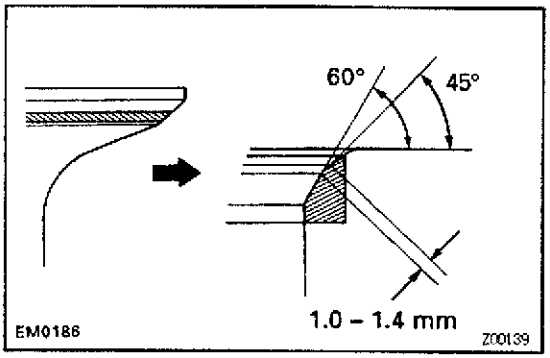
(c) Check the valve face and seat for the following:
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with these width.

**1.0 – 1.4 mm (0.039 – 0.055 in.)**

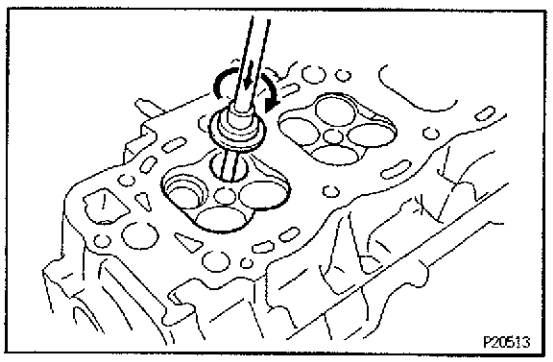
If not, correct the valve seats as follows:

(1) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.



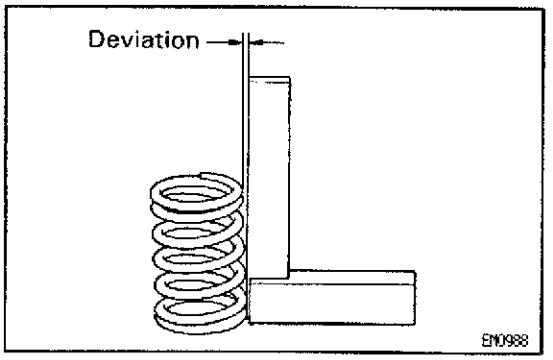




(2) If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.




(d) Hand–lap the valve and valve seat with an abrasive compound.

(e) After hand–lapping, clean the valve and valve seat.



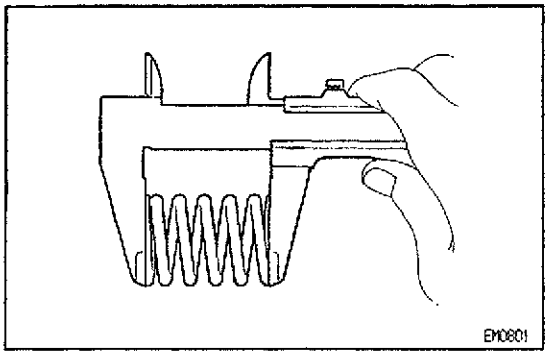

## 13. INSPECT VALVE SPRINGS

(a) Using a steel square, measure the squareness of the valve spring.

**Maximum deviation:**

**2.0 mm (0.079 in.)**

If deviation is greater than the maximum, replace the valve spring.



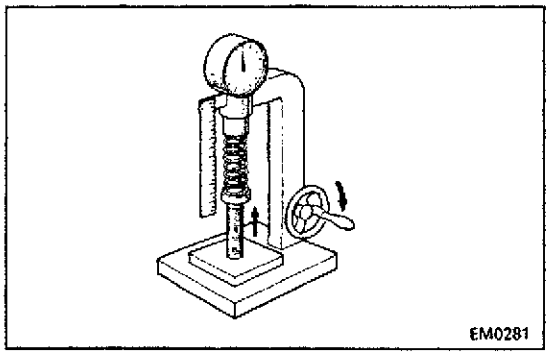

(b) Using vernier calipers, measure the free length of the valve spring.

**Free length:**

**44.78 mm (1.7630 in.)**

If the free length is not as specified, replace the valve spring.





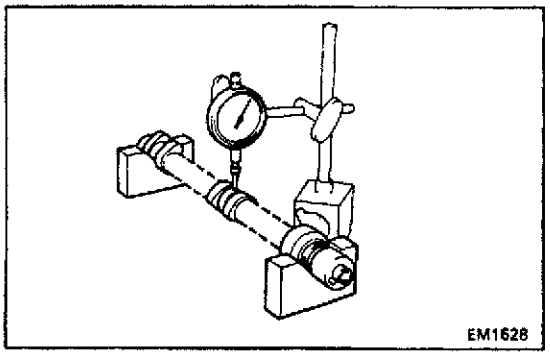

(c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

**Installed tension:**

**At 33.3 mm (1.311 in.):**

**186 — 206 N (19.0 — 21.0 kgf, 41.9 — 46.3 lbf)**

If the installed tension is not as specified, replace the valve spring.




## 14. INSPECT CAMSHAFT FOR RUNOUT

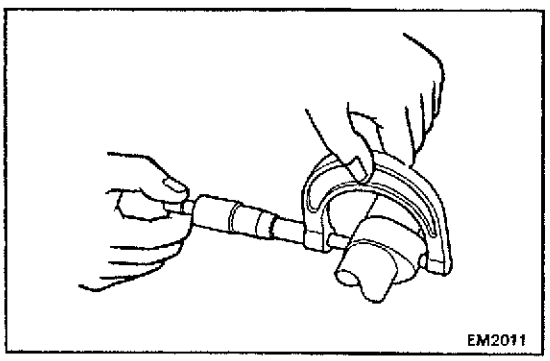
(a) Place the camshaft on V—blocks.

(b) Using a dial indicator, measure the circle runout at the center journal.

**Maximum circle runout:**

**0.06 mm (0.0024 in.)**

If the circle runout is greater than the maximum, replace the camshaft.




## 15. INSPECT CAM LOBES

Using a micrometer, measure the cam lobe height.

**Standard cam lobe height:**

**Intake**

**42.31 — 42.41 mm (1.6657 — 1.6697 in.)**

**Exhaust**

**41.96 — 42.06 mm (1.6520 — 1.6559 in.)**

**Minimum cam lobe height:**

**Intake**

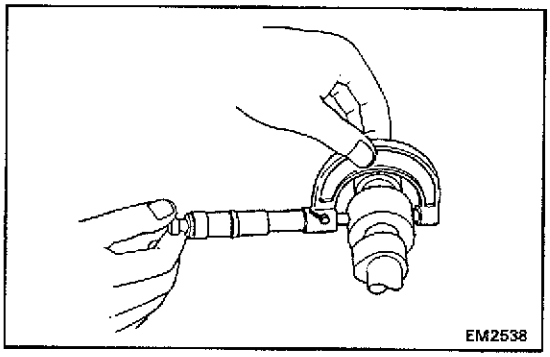
**42.16 mm (1.6598 in.)**

**Exhaust**

**41.81 mm (1.6461 in.)**

If the cam lobe height is greater than the maximum, replace the camshaft.

EG



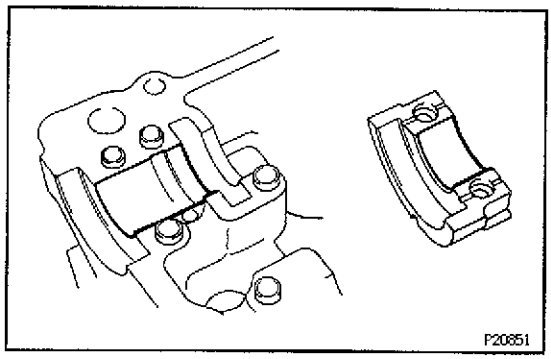

### 16. INSPECT CAMSHAFT JOURNALS

Using a micrometer, measure the journal diameter.

**Journal diameter:**

**26.949 – 26.965 mm (1.0610 – 1.0616 in.)**

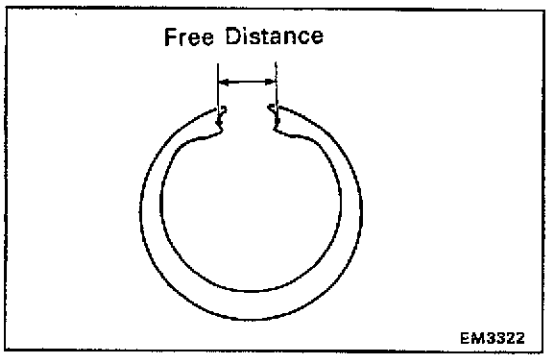
If the journal diameter is not as specified, check the oil clearance.




### 17. INSPECT CAMSHAFT BEARINGS

Check the bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps and cylinder head as a set.



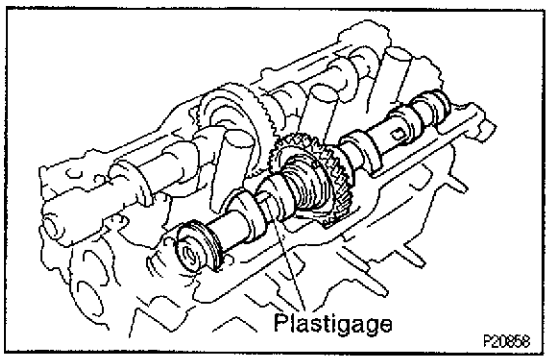

### 18. INSPECT CAMSHAFT GEAR SPRING

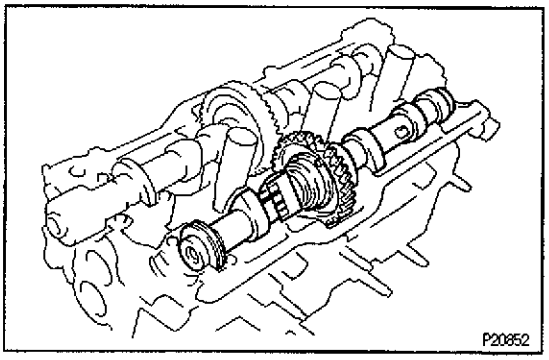
Using vernier calipers, measure the free distance between the spring ends.

**Free distance:**

**18.2 – 18.8 mm (0.712 – 0.740 in.)**

If the free distance is not as specified, replace the gear spring.




### 19. INSPECT CAMSHAFT JOURNAL OIL CLEARANCE

(a) Clean the bearing caps and camshaft journals.

(b) Place the camshafts on the cylinder head.

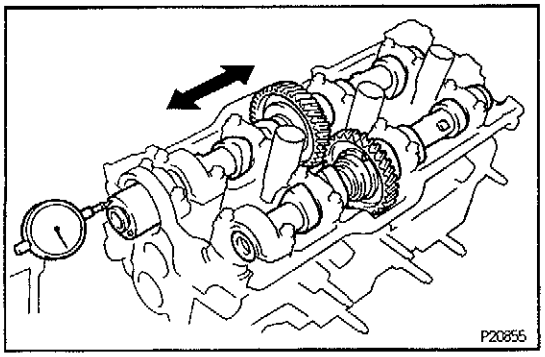
(c) Lay a strip of Plastigage across each of the camshaft journals.

(d) Install the bearing caps.
(See installation in cylinder head)
**Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)**
**NOTICE: Do not turn the camshaft.**

(e) Remove the bearing caps.

(f) Measure the Plastigage at its widest point.
**Standard oil clearance:**
**0.035 – 0.072 mm (0.0014 – 0.0028 in.)**
**Maximum oil clearance:**
**0.10 mm (0.0039 in.)**
If the oil clearance is greater than the maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

(g) Completely remove the Plasitgage.




### 20. INSPECT CAMSHAFT THRUST CLEARANCE

(a) Install the camshafts.
(See installation in cylinder head)

(b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

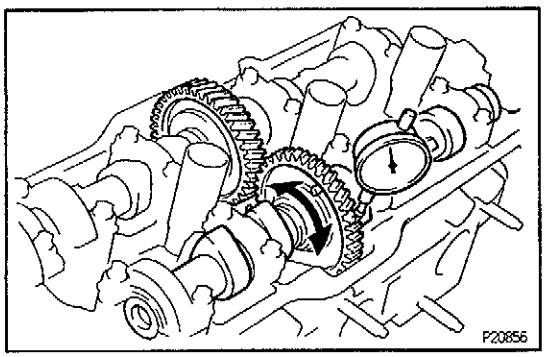
**Standard thrust clearance:**

**0.033 — 0.080 mm (0.0013 — 0.0031 in.)**

**Maximum thrust clearance:**

**0.12 mm (0.0047 in.)**

If the thrust clearance is greater than the maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.




### 21. INSPECT CAMSHAFT GEAR BACKLASH

(a) Install the camshafts without installing the exhaust camshaft sub—gear.
(See installation in cylinder head)

(b) Using a dial indicator, measure the backlash.

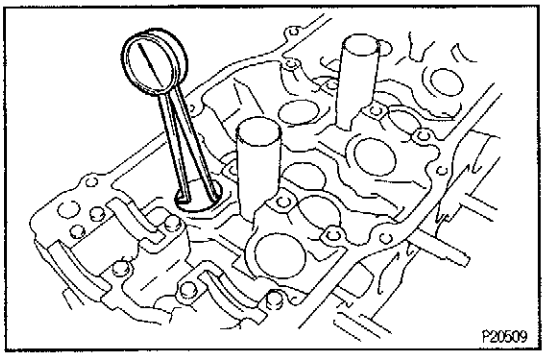
**Standard backlash:**

**0.020 — 0.200 mm (0.0008 — 0.0079 in.)**

**Maximum backlash:**

**0.30 mm (0.0188 in.)**

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




### 22. INSPECT VALVE LIFTERS AND LIFTER BORES

(a) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.

**Lifter bore diameter:**

**31.000 — 31.018 mm (1.2205 — 1.2212 in.)**

(b) Using a micrometer, measure the lifter diameter.

**Lifter diameter:**

**30.966 — 30.976 mm (1.2191 — 1.2195 in.)**

(c) Subtract the lifter diameter measurement from the lifter bore diameter measurement.

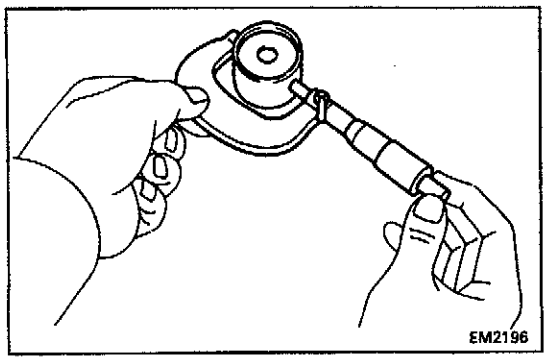
**Standard oil clearance:**

**0.024 — 0.052 mm (0.0009 — 0.0020 in.)**

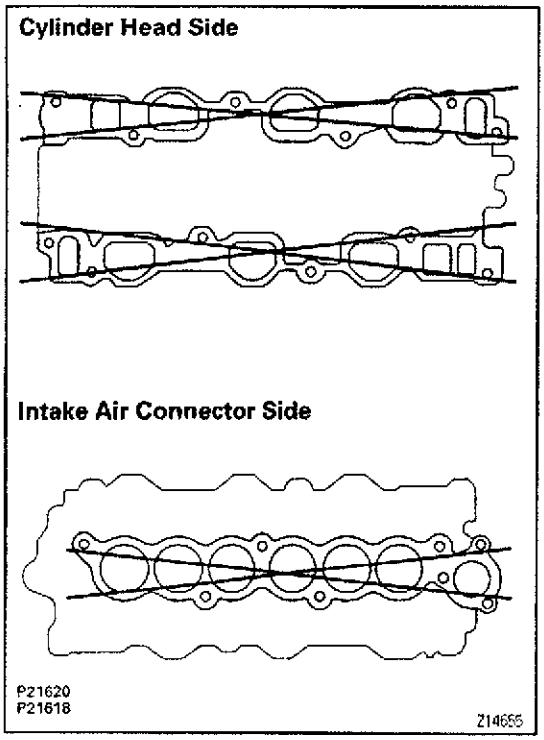
**Maximum oil clearance:**

**0.08 mm (0.0031 in.)**

If the oil clearance is greater than the maximum, replace the lifter. If necessary, replace the cylinder head.



EG




**23. INSPECT INTAKE MANIFOLD, EXHAUST MANIFOLDS, AIR INTAKE CHAMBER AND INTAKE AIR CONNECTOR**

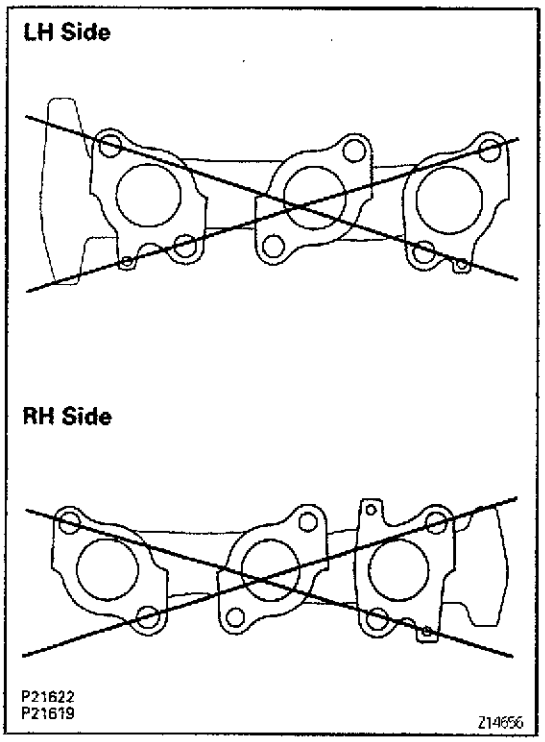
(a) Intake Manifold:

Using precision straight edge and thickness gauge, measure the surfaces contacting the cylinder head and intake air connector for warpage.

**Maximum warpage:**

**0.10 mm (0.0039 in.)**

If warpage is greater than the maximum, replace the intake manifold.



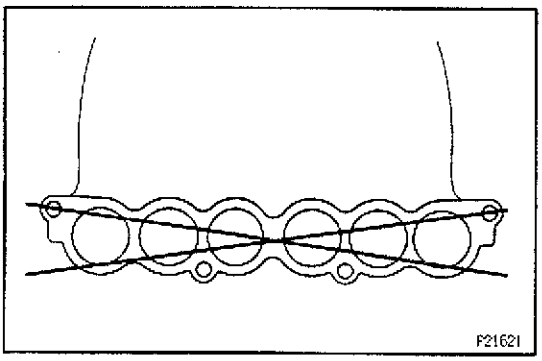

(b) Exhaust Manifolds:

Measure the surfaces contacting the cylinder head for warpage.

**Maximum warpage:**

**1.00 mm (0.0394 in.)**

If warpage is greater than the maximum, replace the exhaust manifold.



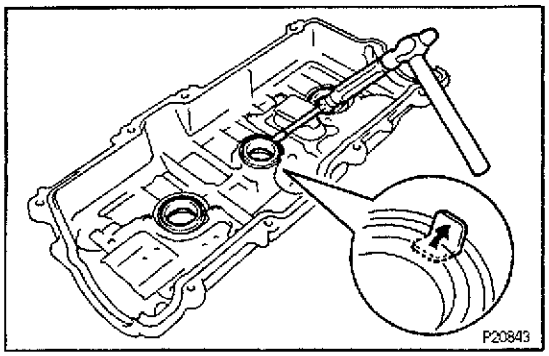

(c) Air intake chamber and intake air connector:

Measure the surfaces contacting the intake manifold and intake air connector for warpage.

**Maximum warpage:**

**0.10 mm (0.0039 in.)**

If warpage is greater than the maximum, replace the air intake chamber or intake air connector.

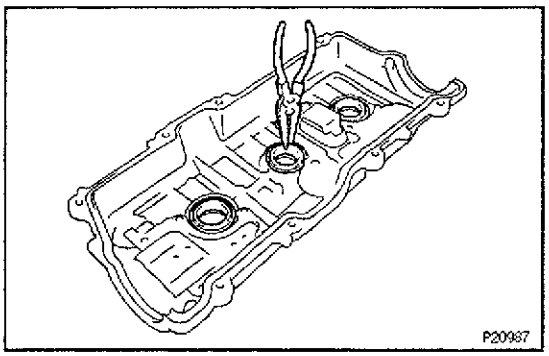



**24. IF NECESSARY, REPLACE SPARK PLUG TUBE GASKETS**

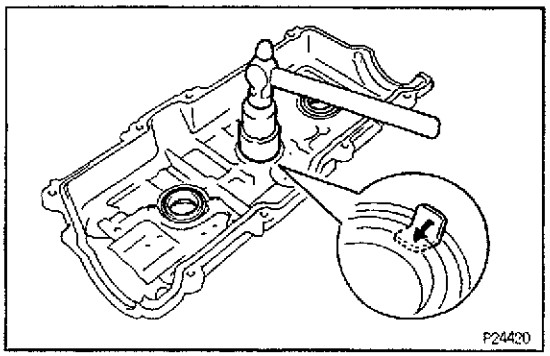
(a) Bend up the tab on the ventilation baffle plate which prevents the gasket from the slipping out.

(b) Using a screwdriver and hammer, tap out the gasket.
**NOTICE: Do not scratch or damage the joint of the cylinder head cover.**






(c) Using needle—nose pliers, pry out the gasket.




(d) Using a 32 mm socket wrench and hammer, tap in a new gasket until its surface is flush with the upper edge of the cylinder head cover.

(e) Apply a light coat of MP grease to the gasket lip.

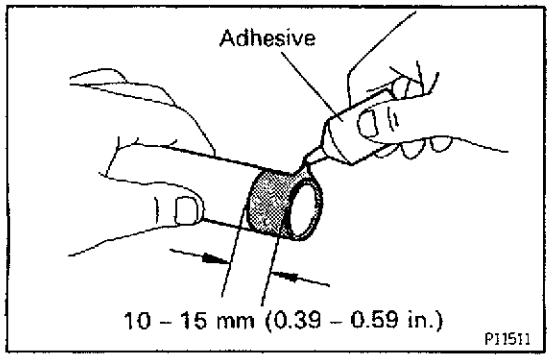
(f) Return the ventilation plate tab to its original position.

## CYLINDER HEADS ASSEMBLY

EG50G-06

HINT:

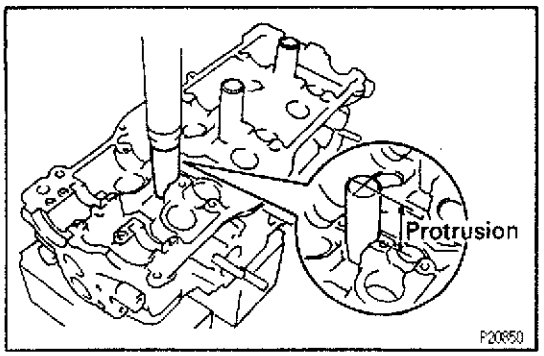
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.



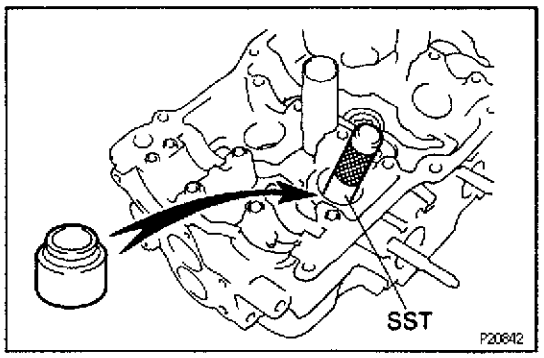

**1. INSTALL SPARK PLUG TUBES**

HINT: When using a new cylinder head, spark plug tubes must be installed.

(a) Apply adhesive to the end of the spark plug tube.
**Adhesive:**
**Part No. 08833–00070, THREE BOND 1324 or equivalent**

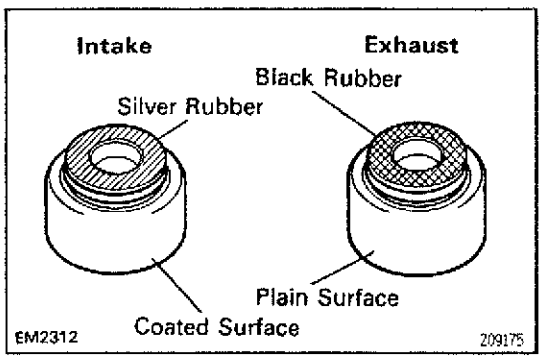



(b) Using a press, press in a new spark plug tube until there is 49.0 – 49.4 mm (1.929 – 1.945 in.) protruding from the camshaft bearing cap installation surface of the cylinder head.
**NOTICE: Avoid pressing a new spark plug tube in too far by measuring the amount of the protrusion while pressing.**

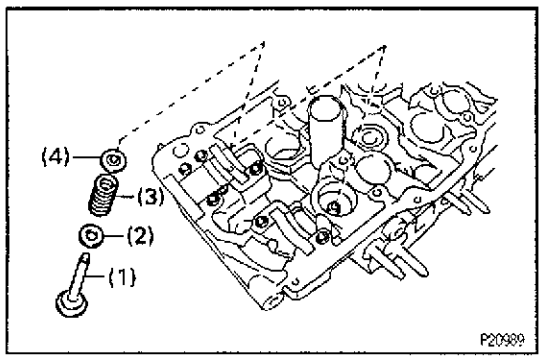



## 2. INSTALL VALVES

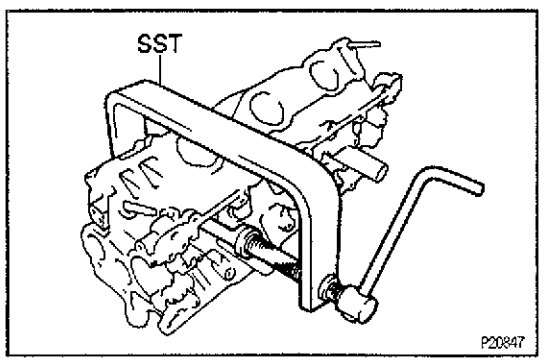
(a) Using SST, push in a new oil seal.
SST 09201–41020



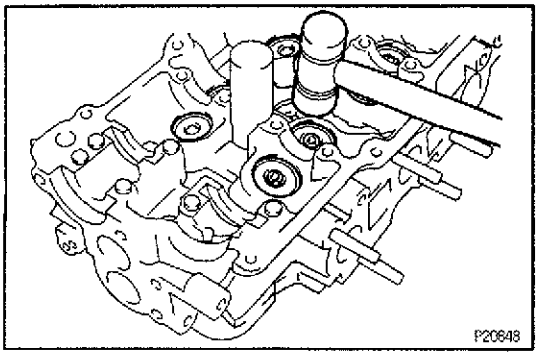

HINT: The intake valve oil seal is silver and the exhaust valve oil seal is black.




(b) Install these parts:
(1) Valve
(2) Spring seat
(3) Valve spring
(4) Spring retainer




(c) Using SST, compress the valve spring and place the 2 keepers around the valve stem.
SST 09202–70020



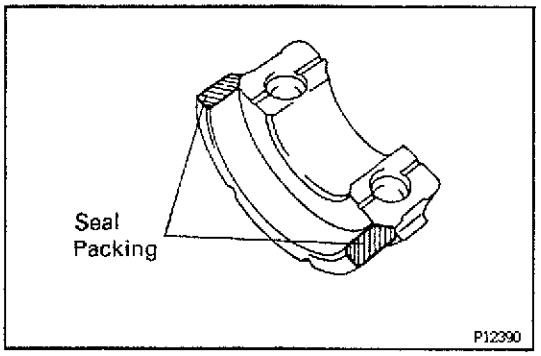

(d) Using a plastic—faced hammer, lightly tap the valve stem tip to ensure a proper fit.

**3. INSTALL VALVE LIFTERS AND SHIMS**

(a) Install the valve lifter and shim.

(b) Check that the valve lifter rotates smoothly by hand.





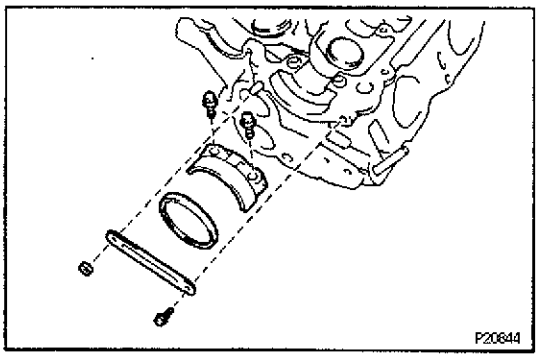

**4. INSTALL CAMSHAFT HOUSING PLUGS**

(a) Remove any old packing (FIPG) material.

(b) Apply seal packing to the bearing cap as shown.

**Seal packing:**

**Part No. 08826—00080 or equivalent**




(c) Place a new housing plug in position on the cylinder head, facing the cup side inward.

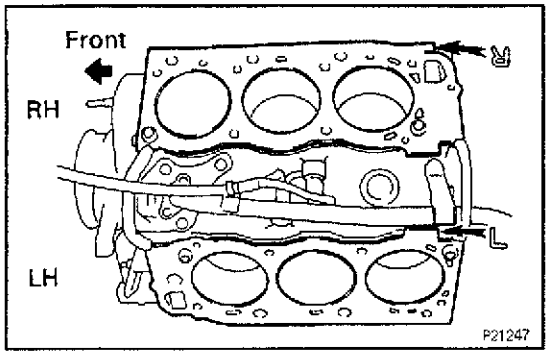
(d) Install the camshaft bearing cap with the 2 bolts.

**Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)**

(e) Install the rear plate, ground strap with the bolt and nut.

**Torque: 8 N·m (80 kgf·cm, 71 in.·lbf)**

EG




# CYLINDER HEADS INSTALLATION

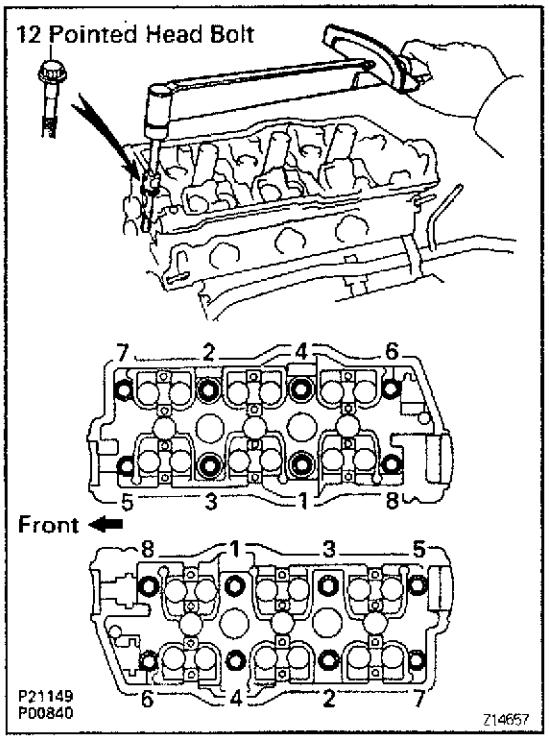
EG78Z-01

## 1. PLACE CYLINDER HEAD ON CYLINDER BLOCK

(a) Place 2 new cylinder head gaskets in position on the cylinder block.

**NOTICE: Be careful of the installation direction.**

(b) Place the 2 cylinder heads in position on the cylinder head gaskets.




## 2. INSTALL 12 POINTED HEAD CYLINDER HEAD BOLTS

HINT:

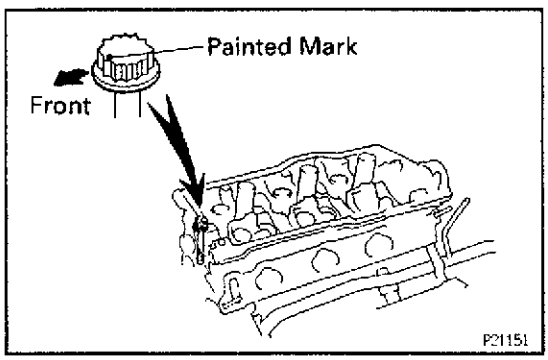
- The cylinder head bolts are tightened in 2 progressive steps (steps (b) and (d)).
- If any bolt is broken or deformed, replace it.

(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

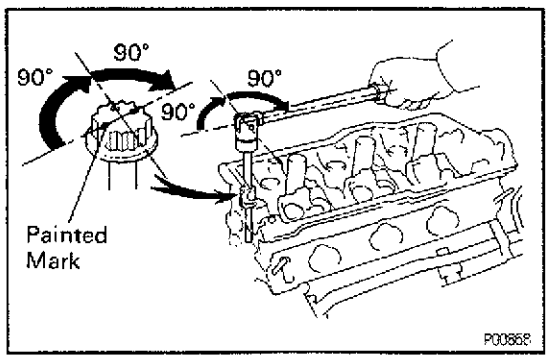
(b) Install and uniformly tighten the cylinder head bolts on each cylinder head, in several passes, in the sequence shown, then repeat for the other side, as shown.

**Torque: 34 N·m (350 kgf·cm, 25 ft·lbf)**

If any of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.



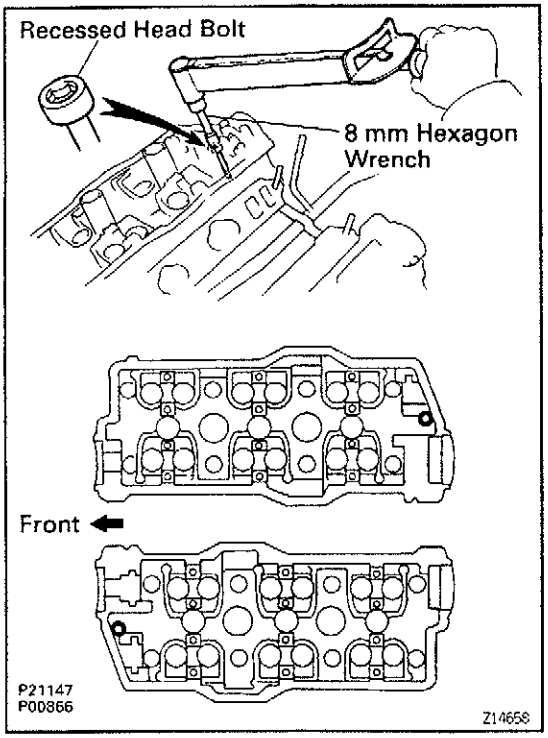

(c) Mark the front of the cylinder head bolt head with paint.




(d) Retighten the cylinder head bolts by 90° in the numerical order shown.

(e) Retighten the cylinder head bolts by an additional 90°.

(f) Check that the painted mark is now facing rearward.




### 3. INSTALL RECESSED HEAD CYLINDER HEAD BOLTS

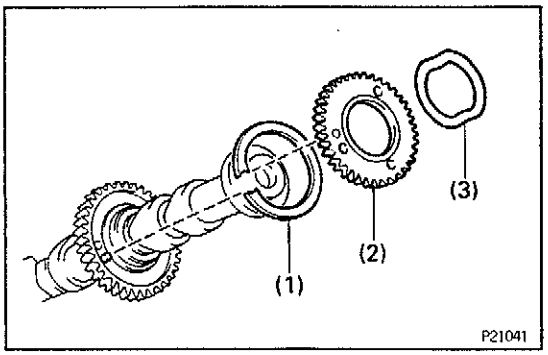
(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

(b) Using an 8 mm hexagon wrench, install the cylinder head bolt on each cylinder head, then repeat for the other side, as shown.

**Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)**

### 4. CONNECT GROUND STRAP

Install the bolt and connect the ground strap.




### 5. ASSEMBLE EXHAUST CAMSHAFTS

(a) Mount the hexagonal wrench head portion of the camshaft in a vise.

**NOTICE: Be careful not to damage the camshaft.**

(b) Install these parts:

(1) Camshaft gear spring

(2) Camshaft sub—gear

HINT: Attach the pins on the gears to the gear spring ends.

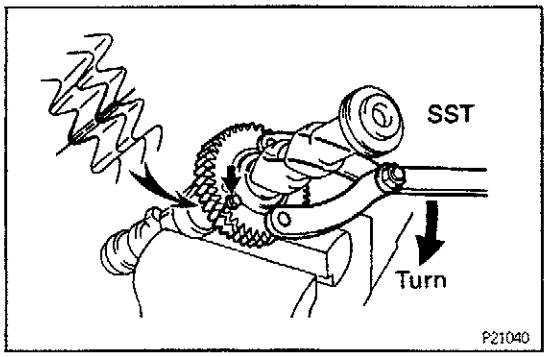
(3) Wave washer

(c) Using snap ring pliers, install the snap ring.

(d) Using SST, align the holes of the camshaft main gear and sub—gear by turning camshaft sub—gear clockwise, and temporarily install a service bolt.

SST 09960—10010 (09962—01000, 09963—00600)

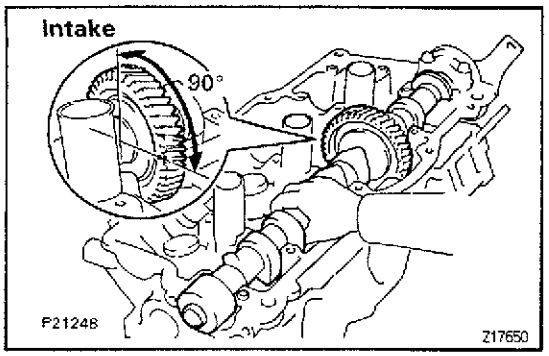
(e) Align the gear teeth of the main gear and sub—gear, and tighten the service bolt.




### 6. INSTALL CAMSHAFTS OF RH CYLINDER HEAD

**NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, these steps should be carried out.**

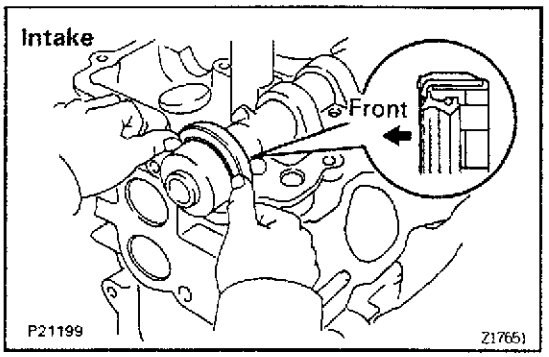
EG




**A. Intake**

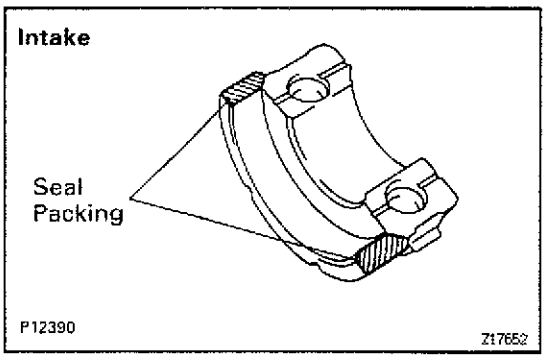
(a) Apply new engine oil to the thrust portion and journal of the camshaft.

(b) Place the intake camshaft at 90° angle of timing mark (2 dot marks) on the cylinder head.




(c) Apply MP grease to a new oil seal lip.

(d) Install the oil seal to the camshaft.

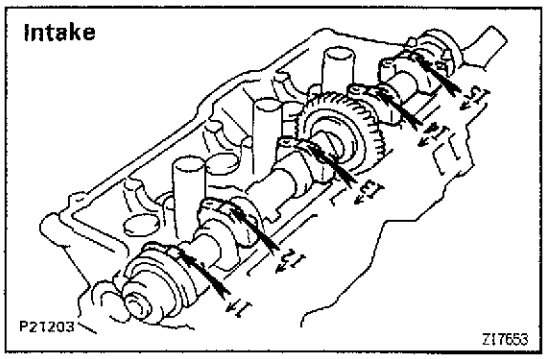



(e) Remove any old packing (FIPG) material.

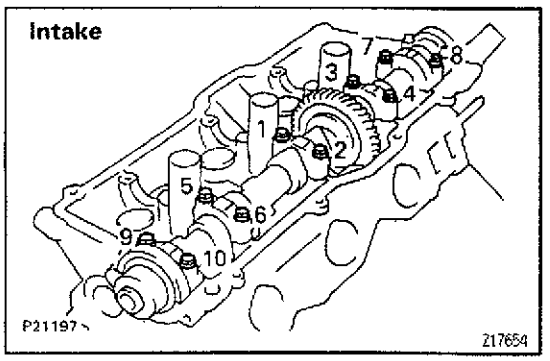
(f) Apply seal packing to the No.1 bearing cap as shown.

**Seal packing:**

**Part No. 08826–00080 or equivalent**



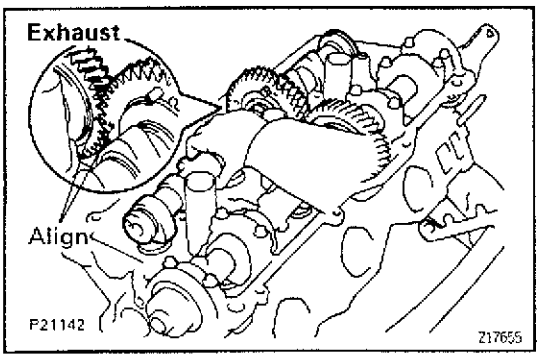

(g) Install the 5 bearing caps in their proper locations.




(h) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

(i) Install and uniformly tighten the 10 bearing cap bolts, in several passes, in the sequence shown.

**Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)**



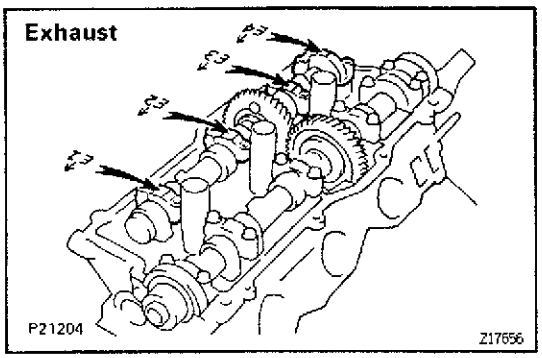

**B. Exhaust**

(a) Apply new engine oil to the thrust portion and journal of the camshaft.

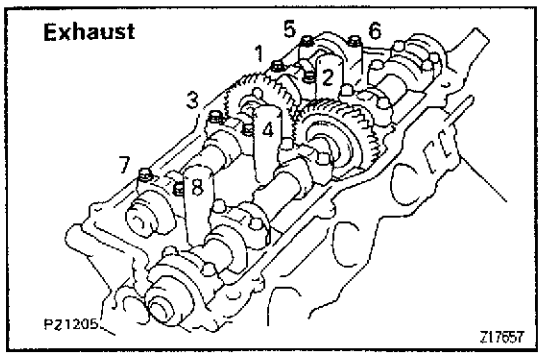
(b) Align the timing marks (2 dot marks) of the camshaft drive and driven gears.

(c) Place the exhaust camshaft on the cylinder head.






(d) Install the 4 bearing caps in their proper locations.




(e) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

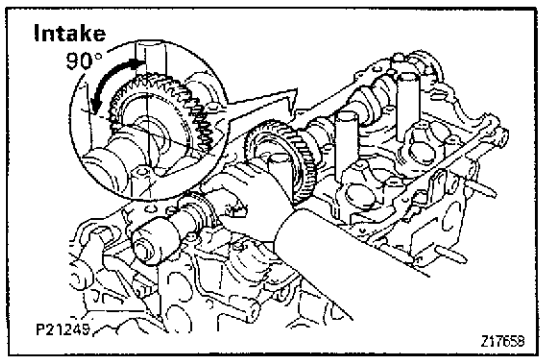
(f) Install and uniformly tighten the 8 bearing cap bolts, in several passes, in the sequence shown.
**Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)**

(g) Remove the service bolt.

(h) Align the timing marks (1 dot mark) of the camshaft drive and driven gears by turning the camshaft with a wrench.

## 7. INSTALL CAMSHAFTS OF LH CYLINDER HEAD

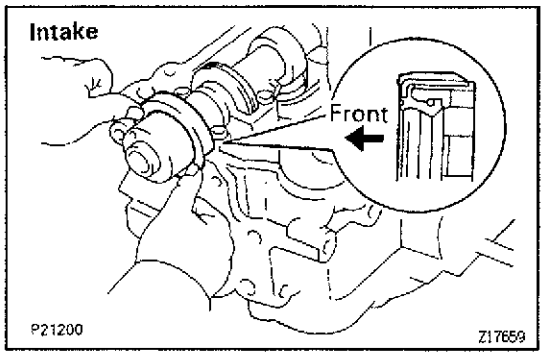
**NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, these steps should be carried out.**



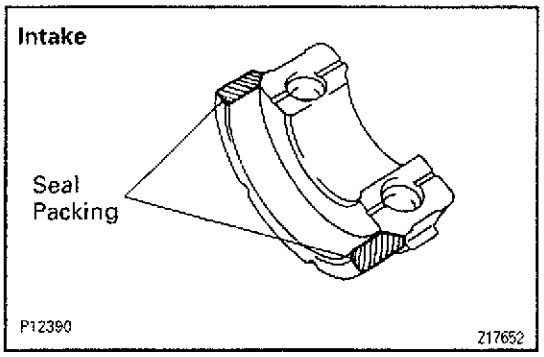

**A. Intake**

(a) Apply new engine oil to the thrust portion and journal of the camshaft.

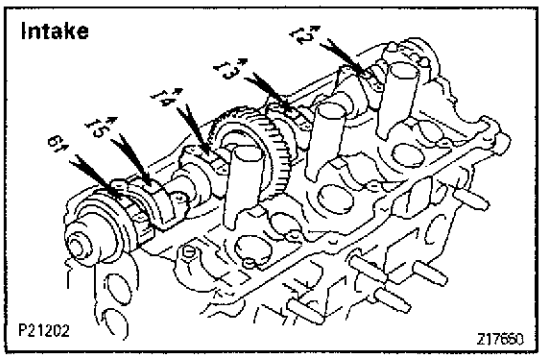
(b) Place the intake camshaft at 90° angle of timing mark (1 dot mark) on the cylinder head.



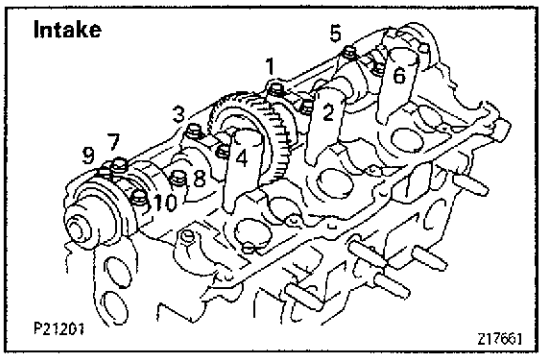

(c) Apply MP grease to a new oil seal lip.
(d) Install the oil seal to the camshaft.



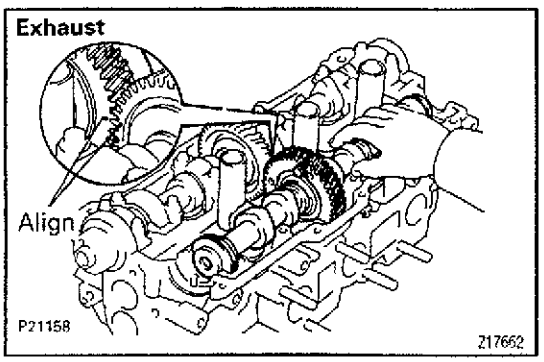

(e) Remove any old packing (FIPG) material.
(f) Apply seal packing to the No.1 bearing cap as shown.
**Seal packing:**
**Part No. 08826—00080 or equivalent**



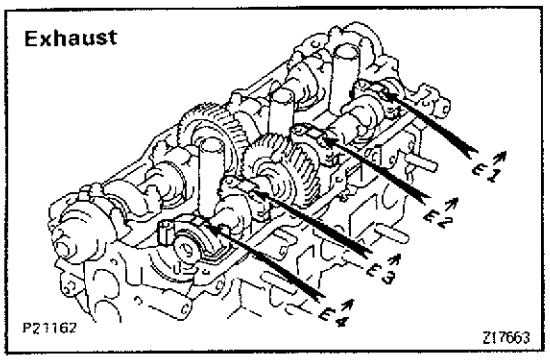

(g) Install the 5 bearing caps in their proper locations.



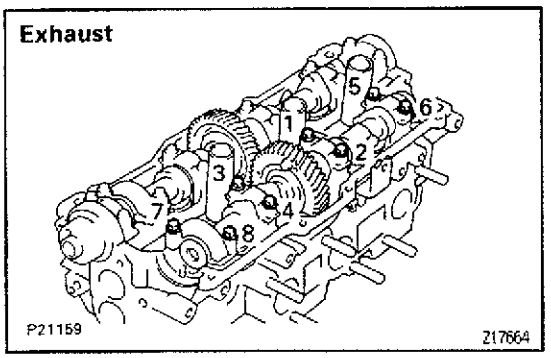

(h) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
(i) Install and uniformly tighten the 10 bearing cap bolts, in several passes, in the sequence shown.
**Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)**




**B. Exhaust**
(a) Apply new engine oil to the thrust portion and journal of the camshaft.
(b) Align the timing marks (1 dot mark) of the camshaft drive and driven gears.
(c) Place the exhaust camshaft on the cylinder head.




(d) Install the 4 bearing caps in their proper locations.

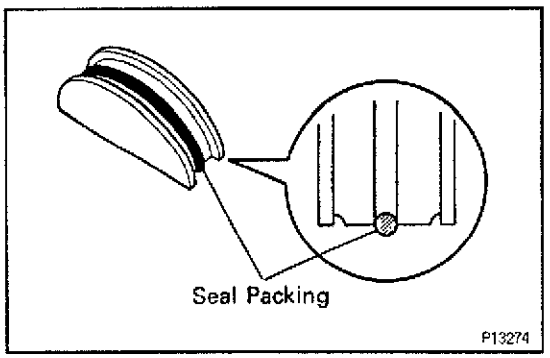



(e) Apply a light coat of engine oil on the threads and under the heads of bearing cap bolts.

(f) Install and uniformly tighten the 8 bearing cap bolts, in several passes, in the sequence shown.
**Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)**

(g) Remove the service bolt.

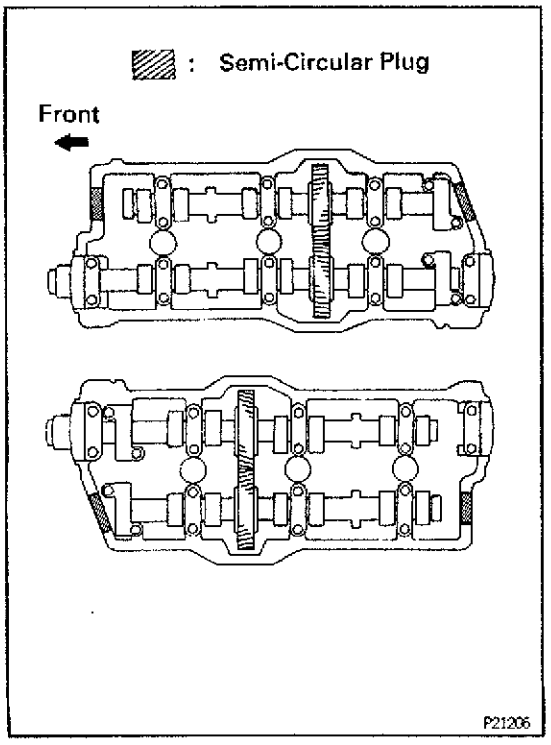
**8. CHECK AND ADJUST VALVE CLEARANCE**
**(See valve clearance)**



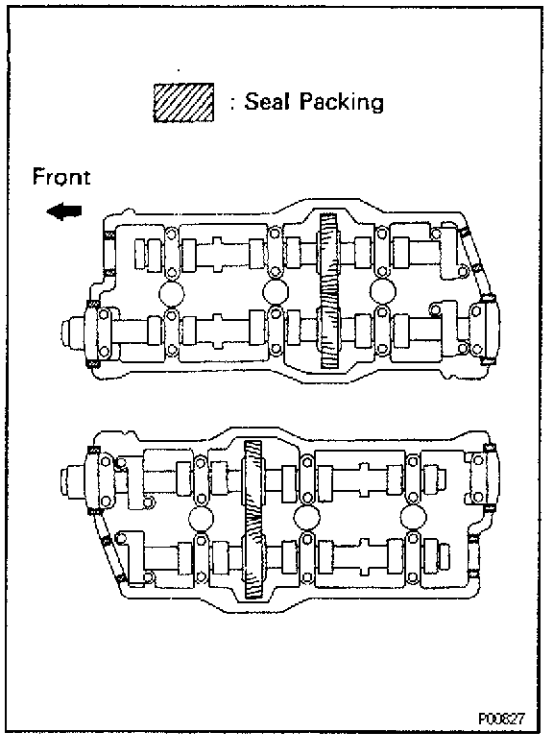

**9. INSTALL SEMI—CIRCULAR PLUGS**

(a) Remove any old packing (FIPG) material.

(b) Apply seal packing to the semi—circular plug grooves.
**Seal packing:**
**Part No. 08826—00080 or equivalent**




(c) Install the 4 semi — circular plugs to the cylinder heads.



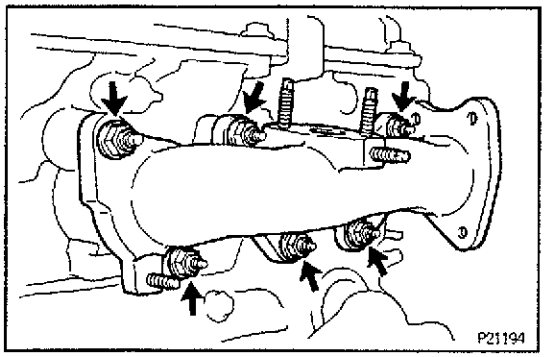

EG

## 10. INSTALL CYLINDER HEAD COVERS

(a) Apply seal packing to the cylinder heads as shown in the illustration.
**Seal packing:**
**Part No. 08826—00080 or equivalent**

(b) Install the gasket to the cylinder head cover.

(c) Install the cylinder head cover with the 8 bolts. Uniformly tighten the bolts in several passes. Install the 2 cylinder head covers.
**Torque: 6 N·m (60 kgf·cm, 53 in.·lbf)**




## 11. INSTALL EXHAUST MANIFOLDS

(a) Install 2 new gaskets and the exhaust manifolds with the 12 nuts.
**Torque: 40 N·m (400 kgf·cm, 30 ft·lbf)**

(b) Install the exhaust manifold heat insulators with the 6 nuts.
**Torque: 8 N·m (80 kgf·cm, 71 in.·lbf)**

## 12. LHD:

**INSTALL EXHAUST CROSSOVER PIPE**

Install 2 new gaskets and the crossover pipe with the 6 nuts.
**Torque: 45 N·m (450 kgf·cm, 33 ft·lbf)**

**RHD:**

**INSTALL EXHAUST FRONT PIPE NO.2 AND EXHAUST EXTENSION PIPE**

(a) Install a new gasket and the exhaust pipe No.2 with the 3 nuts.
**Torque: 62 N·m (630 kgf·cm, 46 ft·lbf)**

(b) Install a new gasket and the exhaust extension pipe with the 3 nuts.
**Torque: 62 N·m (630 kgf·cm, 46 ft·lbf)**

## 13. INSTALL PS PUMP BRACKET

**Torque: 18.5 N·m (185 kgf·cm, 14 ft·lbf)**

## 14. INSTALL ALTERNATOR BRACKET

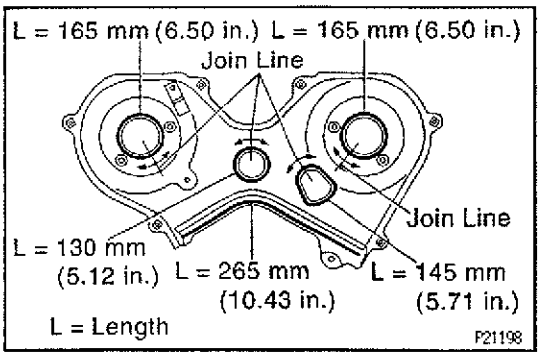
**Torque: 18.5 N·m (185 kgf·cm, 14 ft·lbf)**

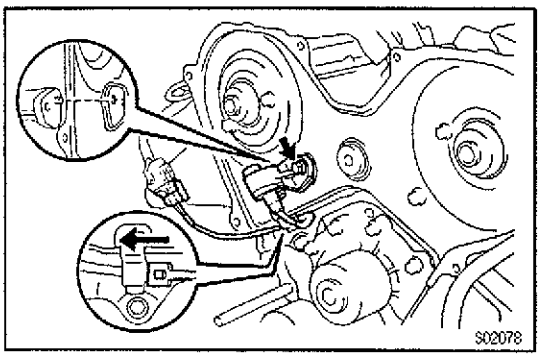
**15. INSTALL ALTERNATOR**
**(See alternator installation in Charging System)**

**16. INSTALL NO.3 TIMING BELT COVER**

(a) Check that the timing belt cover gaskets have no cracks or peeling, etc.
If the gaskets have cracks or peeling etc., replace them using these steps:
- Using a screwdriver and gasket scraper, remove all the old gasket material.
- Thoroughly clean all components to remove all the loose material.
- Remove the backing paper from a new gasket and install the gasket evenly to the part of the timing belt cover shaded black in the illustration.

(b) Install the timing belt cover with the 6 bolts.
**Torque: 9 N·m (90 kgf·cm, 80 in.·lbf)**



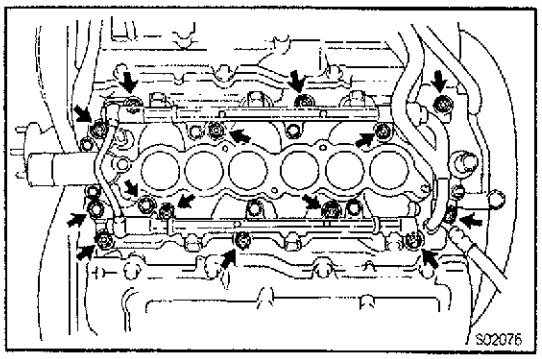




**17. INSTALL CAMSHAFT POSITION SENSOR**

(a) Install the camshaft position sensor with the bolt.
**Torque: 8 N·m (80 kgf·cm, 71 in.·lbf)**
HINT: Match the protrusion of the sensor with the indentation of the RH cylinder head.

(b) Connect the clamp to the No.3 timing belt cover.

(c) Connect the camshaft position sensor connector.




**18. INSTALL INTAKE MANIFOLD ASSEMBLY**

(a) Install 2 new gaskets and the intake manifold, delivery pipe and injectors assembly with the 8 bolts, 4 plate washers and 4 nuts.
**Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)**

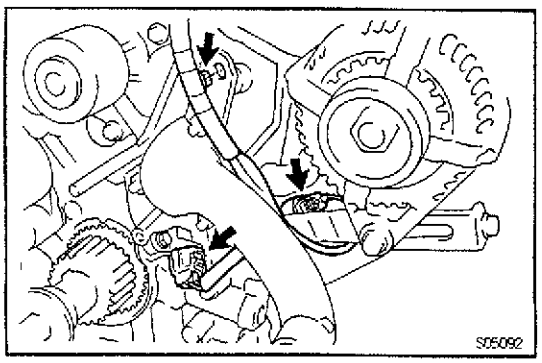
(b) Install the intake manifold stay with the 2 bolts.
**Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)**

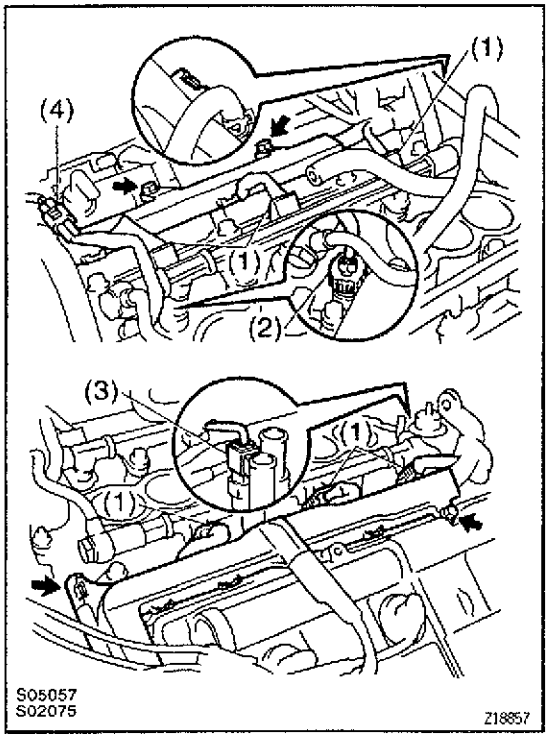
**19. INSTALL FUEL PRESSURE REGULATOR**
**(See fuel pressure regulator installation in EFI System)**

**20. CONNECT ENGINE WIRE PROTECTOR**

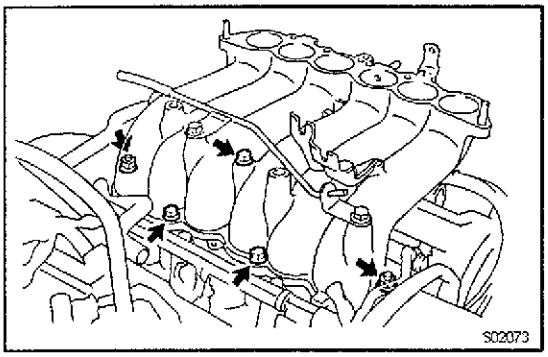
(a) Connect these connectors:
(1) Crankshaft position sensor connector
(2) Oil pressure switch connector

(b) Connect the engine wire clamp.



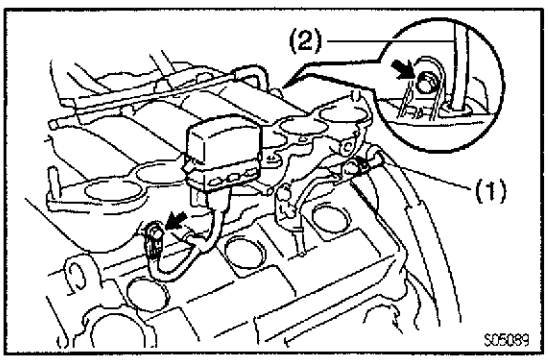



(c) Install the engine wire with the 3 bolts.
(d) Connect the 2 engine wire clamps.
(e) Connect these connectors:
  (1) 6 injector connectors
  (2) Water temperature sensor connector
  (3) Water temperature sender gauge connector
  (4) Knock sensor connector

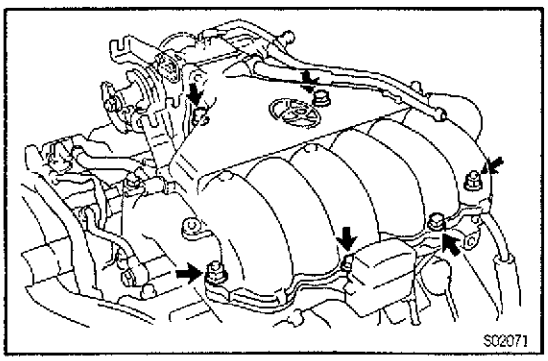



**21. INSTALL INTAKE AIR CONNECTOR**

(a) Install a new gasket and the intake air connector with the 3 bolts and 2 nuts.
**Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)**

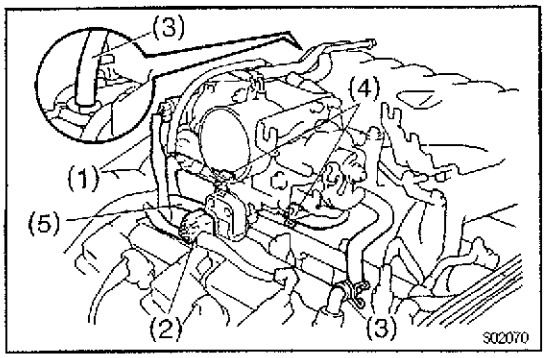



(b) Connect the check connector to the bracket.
(c) Install the ground strap to the intake air connector with the bolt.
(d) Connect these hoses:
  (1) Fuel return hose
  (2) Vacuum hose to the fuel pressure regulator
(e) Install the engine wire with the bolt.



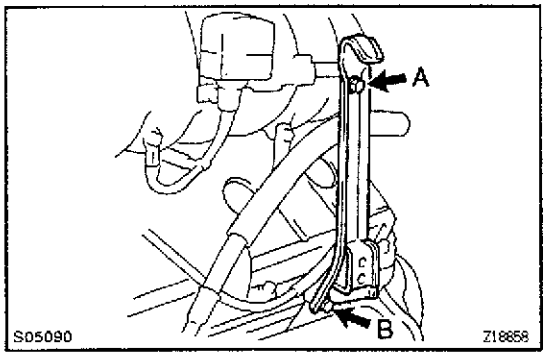

**22. INSTALL AIR INTAKE CHAMBER ASSEMBLY**

(a) Install a new gasket and the air intake chamber assembly with the 4 bolts and 2 nuts.
**Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)**




(b) Connect these hoses and these connectors:
(1) Throttle position sensor connector
(2) ISC valve connector
(3) 2 PCV hoses
(4) 2 water bypass hoses
(5) Air assist hose to throttle body






**23. INSTALL AIR INTAKE CHAMBER STAY**

(a) Install the air intake chamber stay with the 2 bolts.

**Torque:**

**A bolt: 18 N·m (180 kgf·cm, 13 ft·lbf)**

**B bolt: 40 N·m (400 kgf·cm, 30 ft·lbf)**

(b) Install the No.1 throttle cable clamp with the 2 bolts.

**24. INSTALL SPARK PLUGS AND HIGH – TENSION CORDS WITH IGNITION COILS**

**(See ignition coils removal in Ignition System)**

**25. INSTALL TIMING BELT**

**(See timing belt installation)**

**26. FILL WITH ENGINE COOLANT**