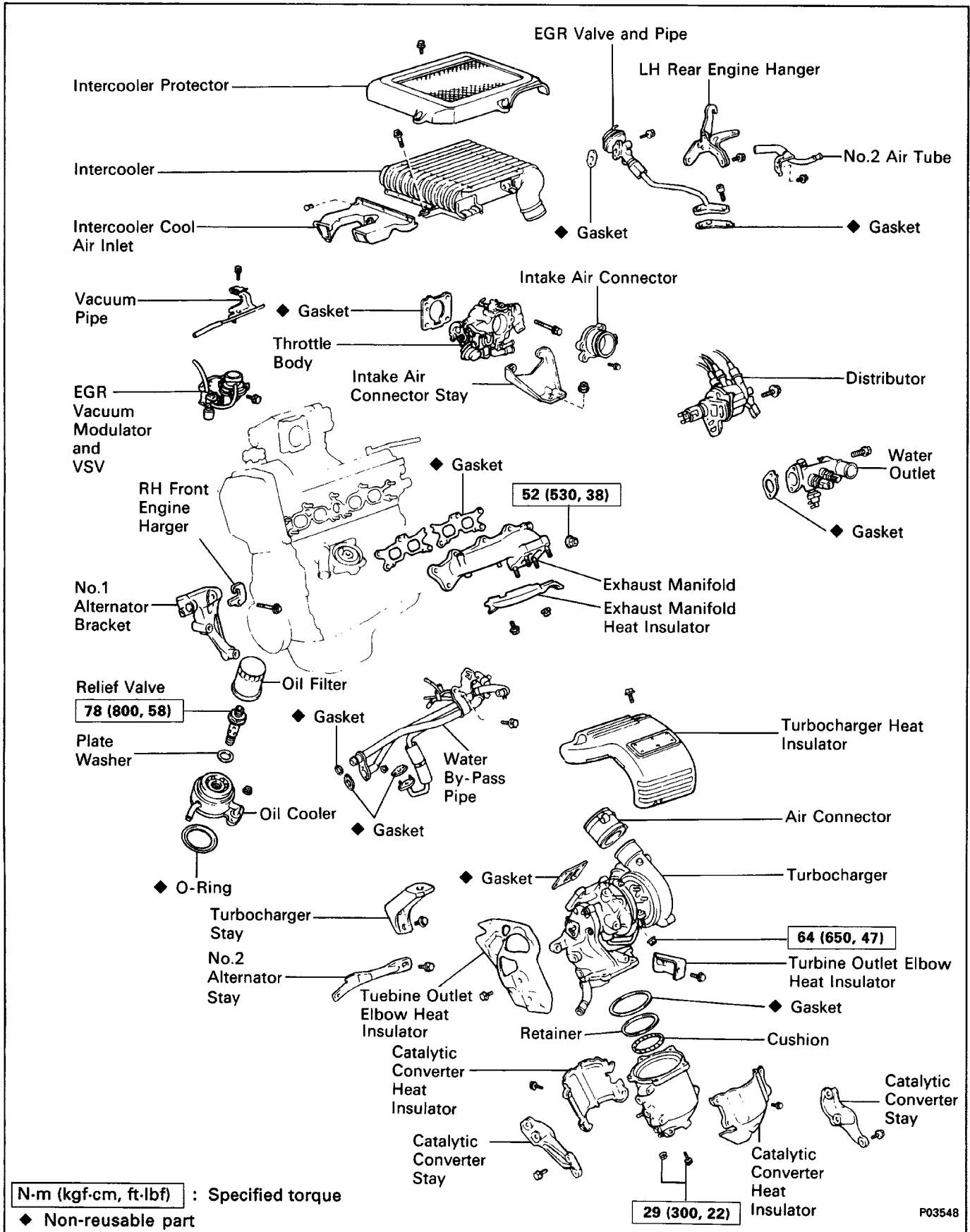
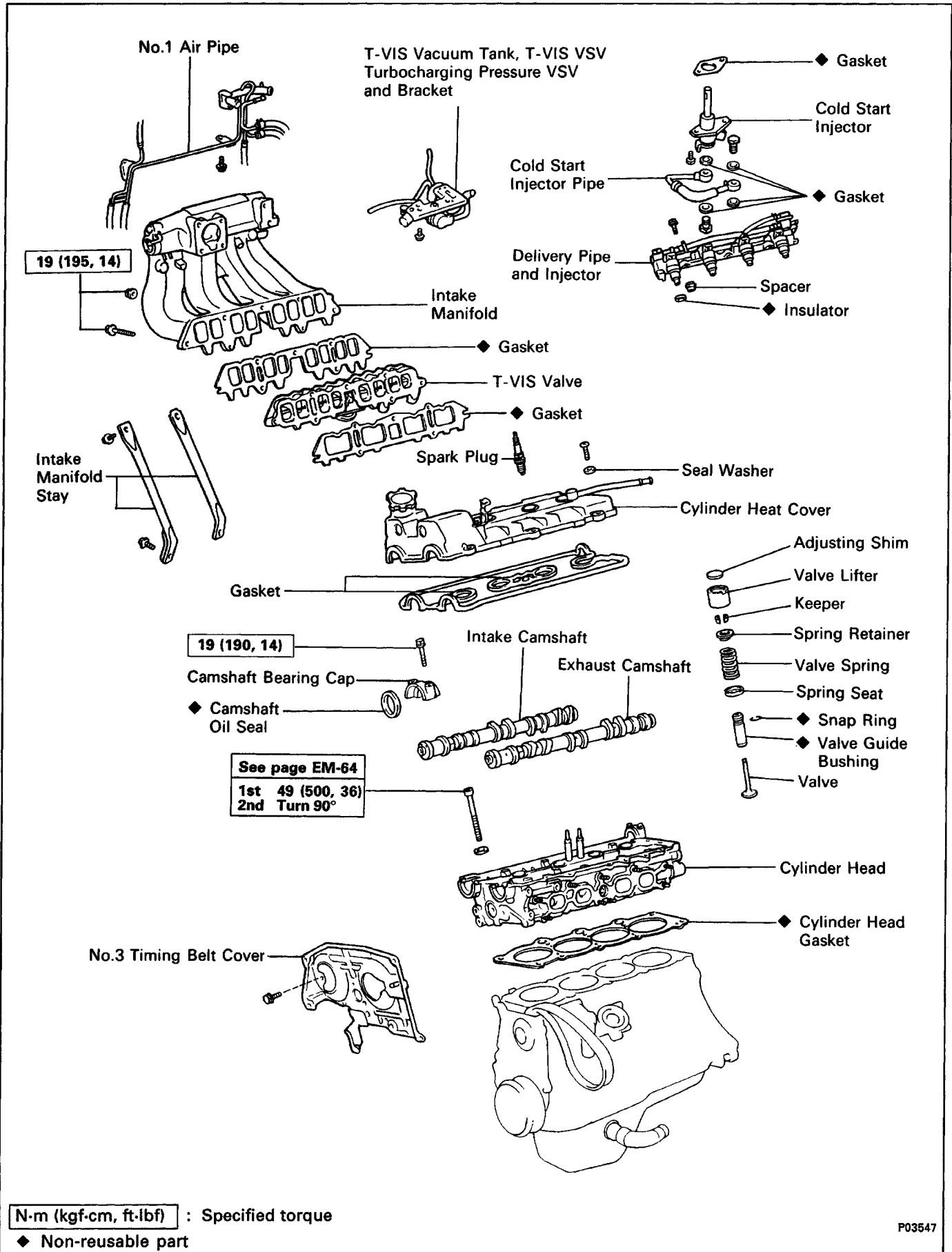


CYLINDER HEAD (3S-GTE) COMPONENTS



COMPONENTS (Cont'd)



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

◆ Non-reusable part

REMOVAL OF CYLINDER HEAD

(See pages [EM-116](#) and 117)

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (-) terminal cable is disconnected from the battery.

2. DRAIN ENGINE COOLANT (See page [CO-6](#))

3. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY

4. REMOVE AIR CLEANER CAP

(See step 7 on page [EM-224](#))

5. REMOVE INTERCOOLER

(See steps 13 to 15 on pages [TC-9](#) and 20)

6. REMOVE ALTERNATOR (See page [CH-7](#))

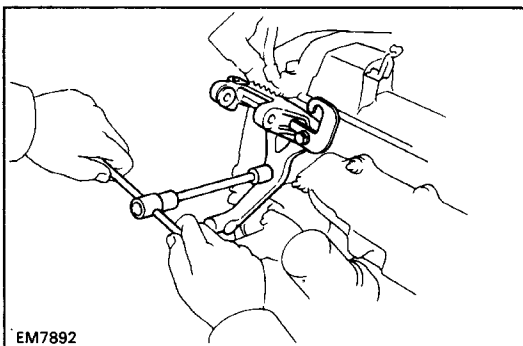
7. REMOVE ENGINE UNDER COVER

8. REMOVE SUSPENSION LOWER CROSSMEMBER

(See step 33 on page [EM-228](#))

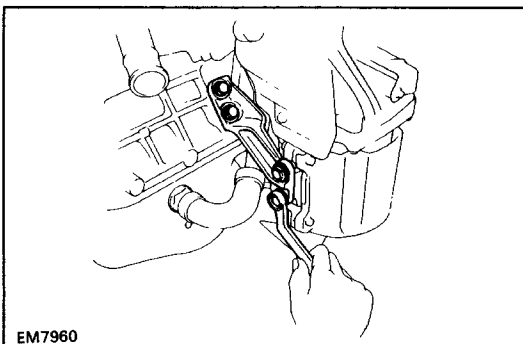
9. REMOVE FRONT EXHAUST PIPE

(See step 34 on page [EM-229](#))



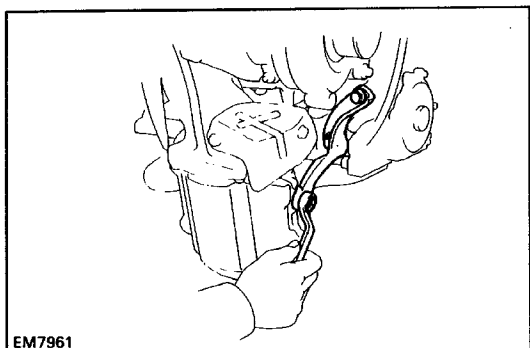
10. REMOVE RH FRONT ENGINE HANGER AND NO.1 ALTERNATOR BRACKET

Remove the three bolts, engine hanger and alternator bracket.

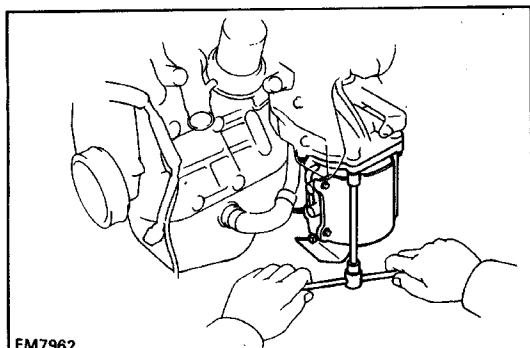


11. REMOVE CATALYTIC CONVERTER

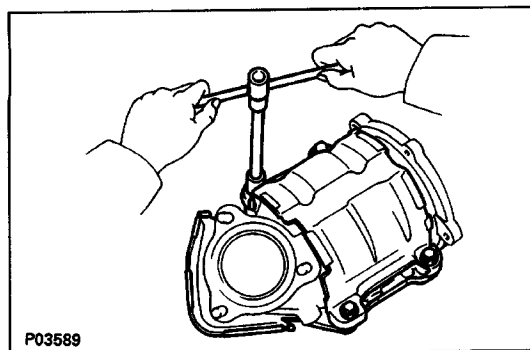
(a) Remove the four bolts and RH converter stay.



(b) Remove the three bolts and LH converter stay.



(c) Remove the three bolts, two nuts and catalytic converter. Remove the gasket, retainer and cushion.



(d) Remove the five bolts and front heat insulator.

(e) Remove the four bolts and rear heat insulator.

12. REMOVE TURBOCHARGER

(See steps 16 to 21 on pages [TC-10](#) and 11)

13. REMOVE THROTTLE BODY

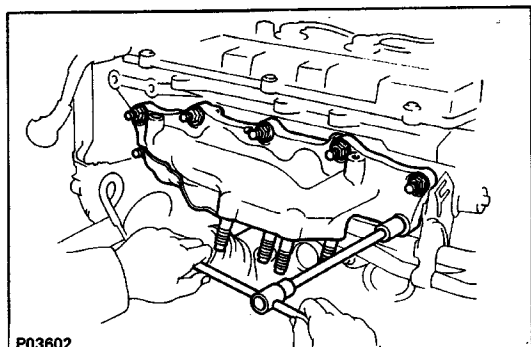
(See steps 5 to 8, 10 and 11 on pages [FI-194](#) and 195)

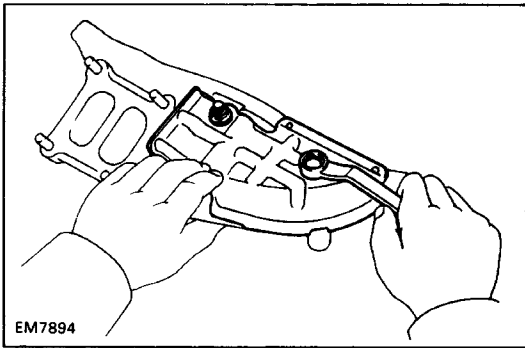
14. REMOVE COLD START INJECTOR

(See steps 2 to 4 on pages [FI-146](#) and 147)

15. REMOVE EXHAUST MANIFOLD

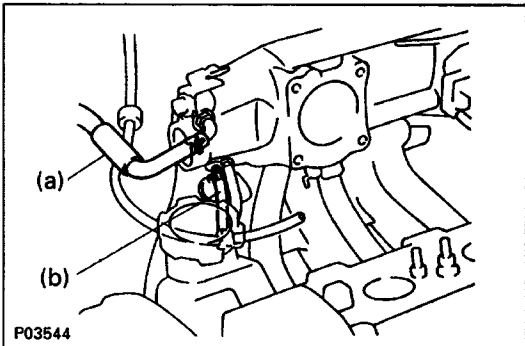
(a) Remove the nine nuts, exhaust manifold and gas ket.





(b) Remove the bolt, nut and heat insulator.

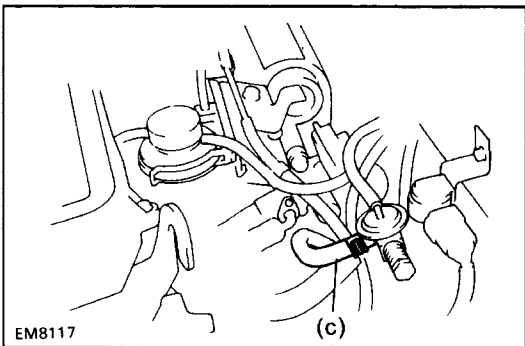
16. REMOVE DISTRIBUTOR (See page IG-26)



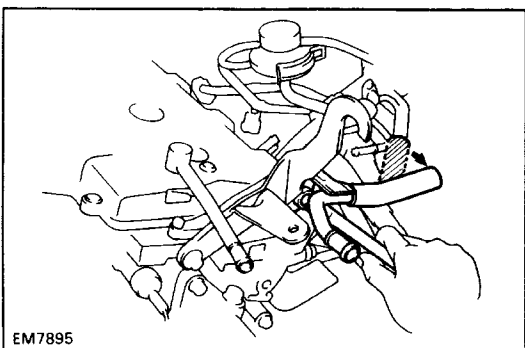
17. DISCONNECT HOSES

(a) Brake booster vacuum hose from intake manifold

(b) Turbocharging pressure sensor hose from intake manifold



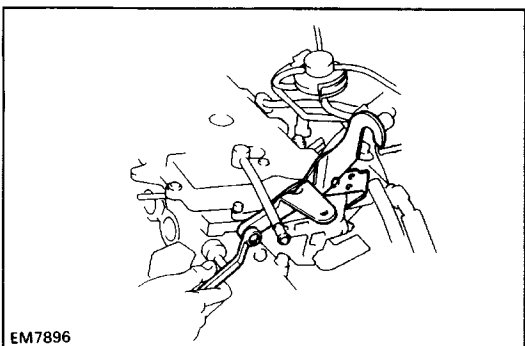
(c) A/C ASV air hose from No.1 air tube



18. REMOVE NO.2 AIR TUBE

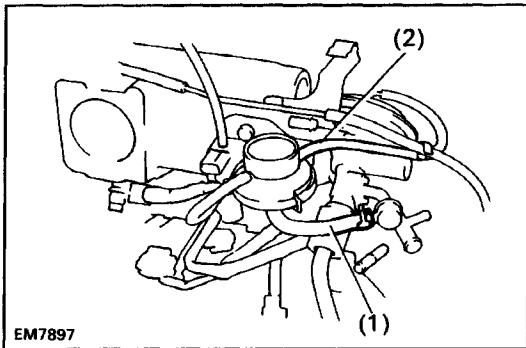
(a) Disconnect the air hose from the No.1 air tube.

(b) Remove the bolt and No.1 air tube.



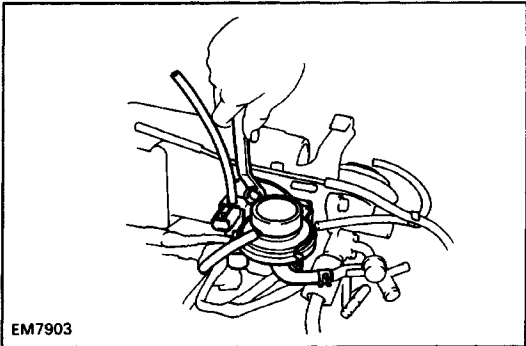
19. REMOVE LH ENGINE HANGER

Remove the two bolts and engine hanger.

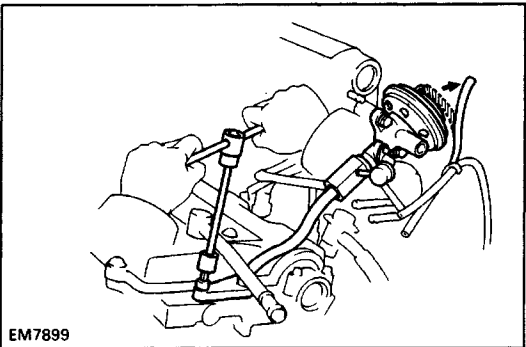


20. REMOVE EGR VACUUM MODULATOR AND VSV

- (a) Disconnect the EGR VSV connector.
- (b) Disconnect the following hoses:
 - (1) Vacuum hose from EGR valve
 - (2) Vacuum hose from EGR vacuum modulator

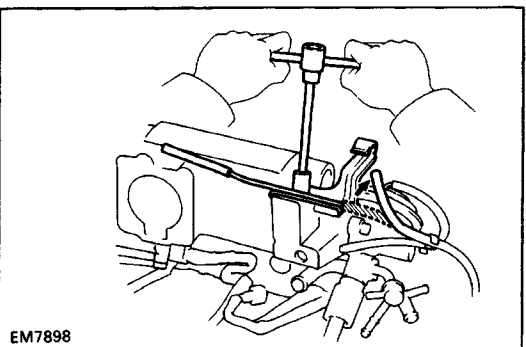


- (c) Remove the bolt, vacuum modulator and VSV assembly.



21. REMOVE EGR VALVE AND PIPE

- (a) Disconnect the vacuum hose from the EGR valve.
- (b) Remove the four bolts, the EGR valve, pipe assembly and two gaskets.

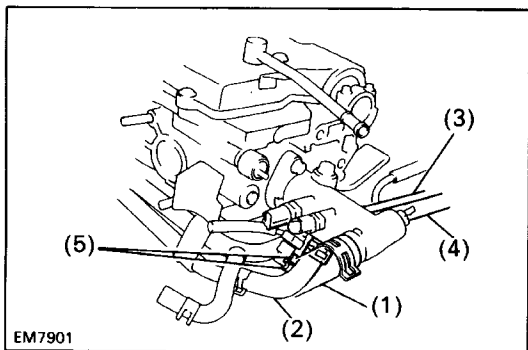


22. REMOVE VACUUM PIPE

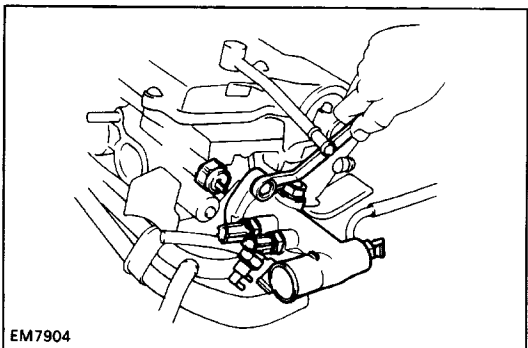
- (a) Disconnect the vacuum hose from the vacuum pipe.
- (b) Remove the bolt and vacuum pipe.

23. REMOVE WATER OUTLET

- (a) Disconnect the following connectors:
 - Water temperature sender gauge connector
 - Water temperature sensor connector
 - Cold start injector time switch connector



- (b) Disconnect the following hoses:
- (1) Upper radiator hose
 - (2) Water by-pass hose from water by-pass pipe
 - (3) Water by-pass pipe hose from ISC valve
 - (4) Heater water hose
 - (5) Two EVAP VSV vacuum hoses

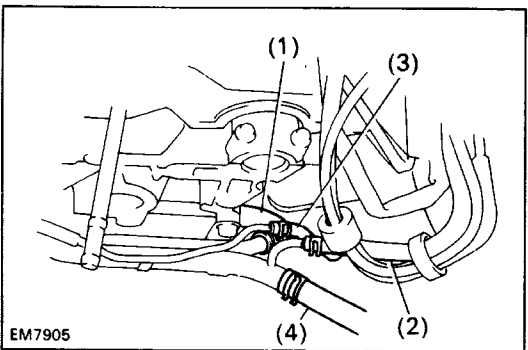


- (c) Remove the two bolts, water outlet and gasket.

24. REMOVE OIL PRESSURE SWITCH

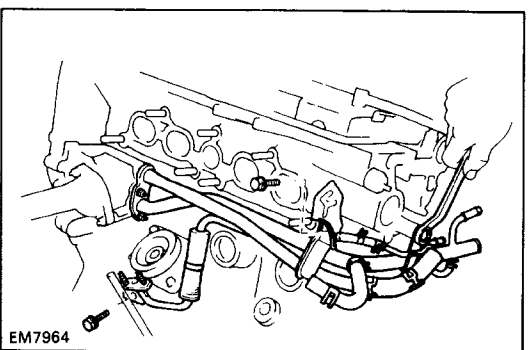
25. REMOVE OIL COOLER

(See steps 4 to 6 on pages [LU-24](#) and [25](#))

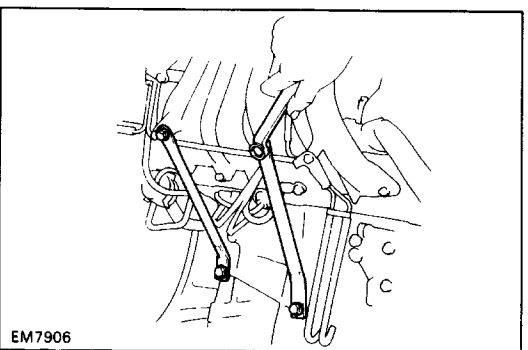


26. REMOVE WATER BY-PASS PIPE

- (a) Disconnect the following hoses:
- (1) Water by-pass hose from cylinder block
 - (2) Water by-pass hoses from No.1 air tube
 - (3) Vacuum hose from turbocharging pressure VSV
 - (4) Heater water hose

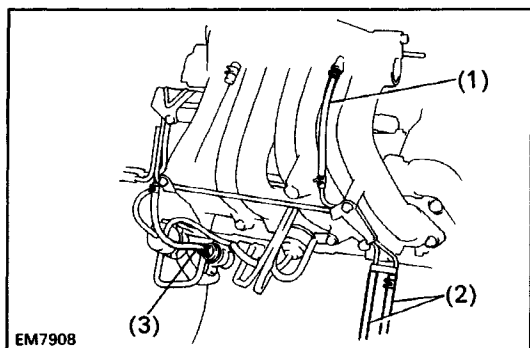


- (b) Remove the two bolts, two nuts, water by-pass pipe, gasket and O-ring.



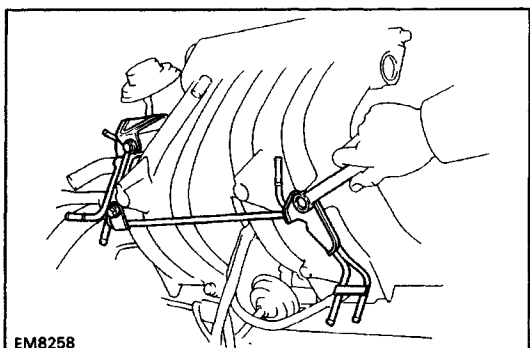
27. REMOVE INTAKE MANIFOLD STAYS

Remove the two bolts and manifold stay. Remove the two manifold stays.



28. REMOVE NO.1 AIR TUBE

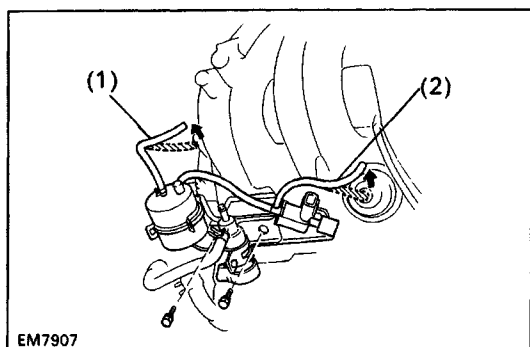
- (a) Disconnect the following hoses:
- (1) Vacuum hose from intake manifold
 - (2) Two PS vacuum hoses
 - (3) Vacuum hose from turbocharging pressure VSV



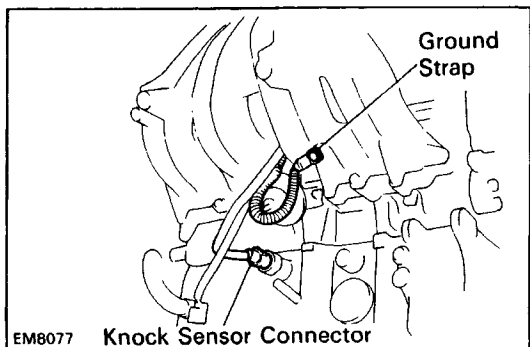
- (b) Remove the three bolts and air tube.

29. REMOVE T-VIS VACUUM TANK, T-VIS VSV, TURBOCHARGING PRESSURE VSV AND BRACKET

- (a) Disconnect the following connectors:
- T-VIS VSV connector
 - Turbocharging pressure VSV connector



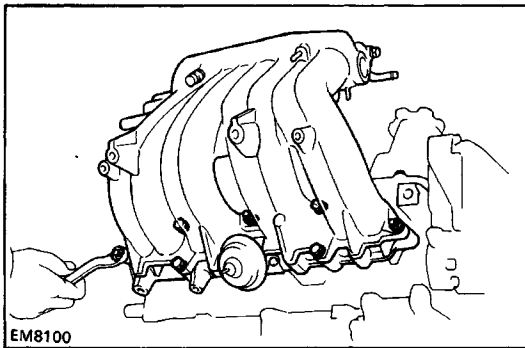
- (b) Disconnect the following hoses:
- (1) Vacuum hose (from T-VIS VSV) from T-VIS actuator
 - (2) Vacuum hose (from T-VIS vacuum tank) from intake manifold
- (c) Remove the two bolts, the T-VIS vacuum tank, T-VIS VSV, turbocharging pressure VSV and bracket assembly.



30. REMOVE INTAKE MANIFOLD AND T-VIS VALVE

- (a) Remove the bolt, and disconnect the ground strap.
- (b) Disconnect the knock sensor connector.

EM8077 Knock Sensor Connector



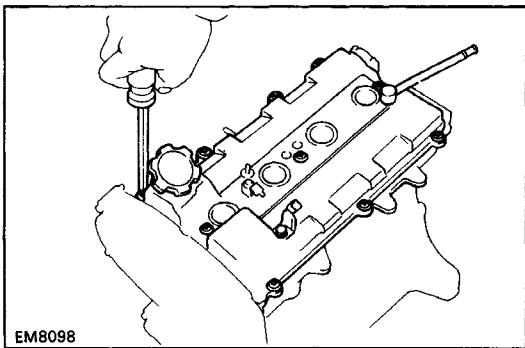
(c) Remove the four bolts, three nuts, intake manifold, T-VIS VSV and two gaskets.

31. REMOVE CHARCOAL CANISTER

(See step 20 on page [EM-226](#))

32. REMOVE DELIVERY PIPE AND INJECTORS

(See steps 8 to 14 on pages [FI-161](#) and 162)



33. REMOVE CYLINDER HEAD COVER

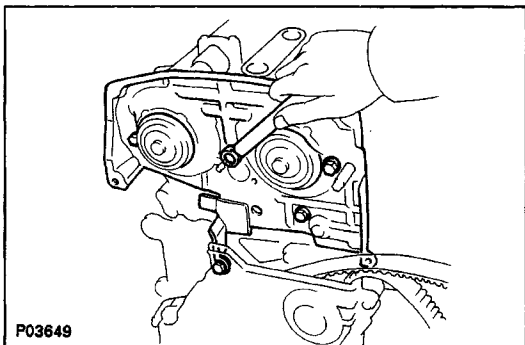
Remove the ten screws, seal washers, head cover and two gaskets.

34. REMOVE CAMSHAFT TIMING PULLEYS

(See steps 15 to 19 on pages [EM-48](#) and 49)

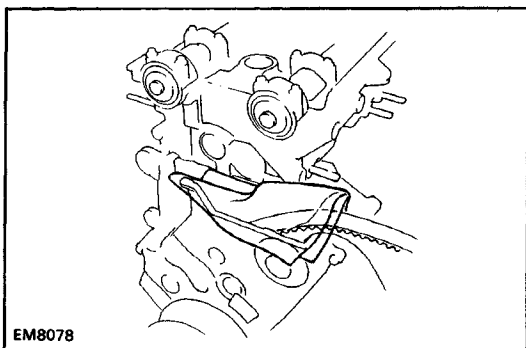
35. REMOVE NO.1 IDLER PULLEY

(See step 24 on page [EM-51](#))



36. REMOVE NO.3 TIMING BELT COVER

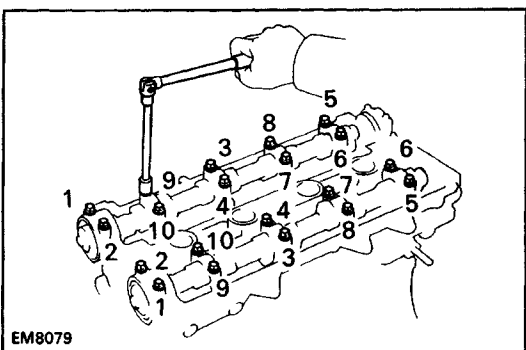
Remove the five bolts and timing belt cover.



EM8078

NOTICE:

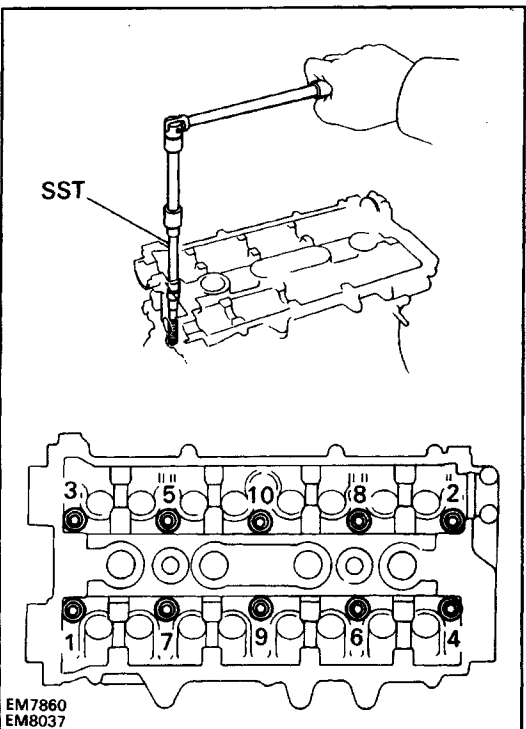
- Support the timing belt, so that the meshing of the crankshaft timing pulley and timing belt does not shift.
- Be careful not to drop anything inside the timing belt cover.
- Do not allow the timing belt to come into contact with oil, water or dust.



EM8079

37. REMOVE CAMSHAFTS

Uniformly loosen and remove the ten bearing cap bolts in several passes in the sequence shown, and remove the five bearing caps, oil seal and camshaft. Remove the intake and exhaust camshafts.

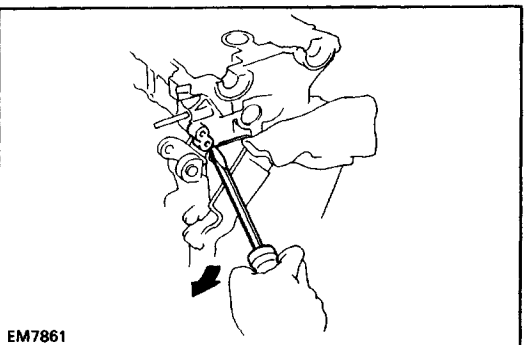
EM7860
EM8037**38. REMOVE CYLINDER HEAD**

- (a) Using SST, uniformly loosen and remove the ten cylinder head bolts in several passes in the sequence shown.

SST 09043-38100

NOTICE: Cylinder head warpage or cracking could result from removing in incorrect order.

- (b) Remove the ten plate washers.



EM7861

- (c) Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

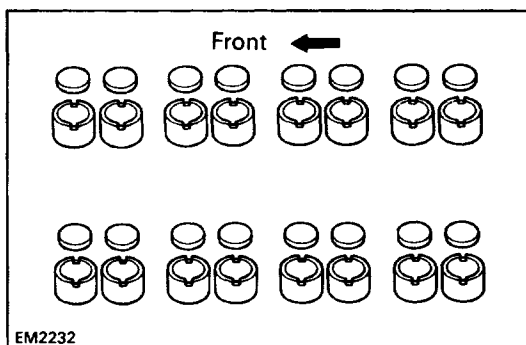
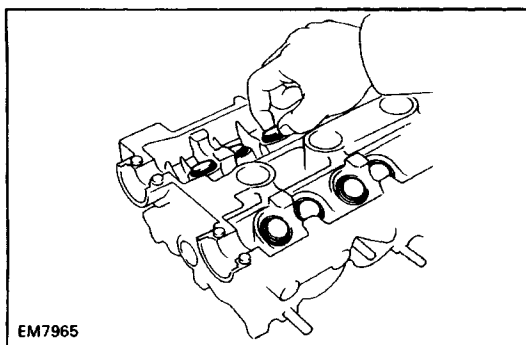
[HINT: If the cylinder head is difficult to lift off, pry between the cylinder head and cylinder block with a screwdriver.

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

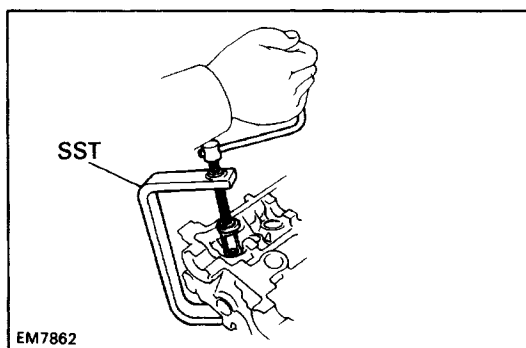
DISASSEMBLY OF CYLINDER HEAD

(See page EM-117)

1. REMOVE VALVE LIFTERS AND SHIMS



HINT: Arrange the valve lifters and shims in correct order.

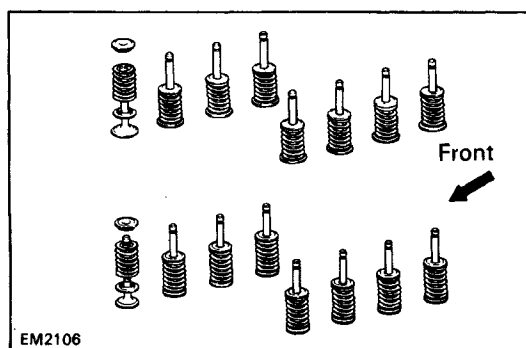


2. REMOVE VALVES

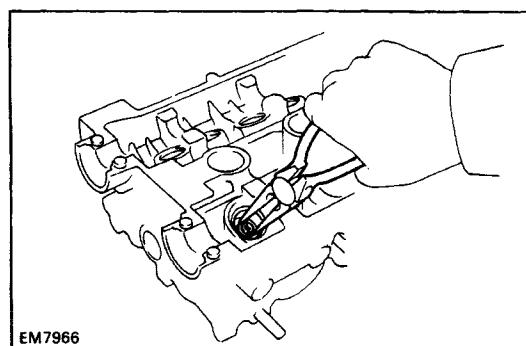
(a) Using SST, compress the valve spring and remove the two keepers.

SST 09202-70010

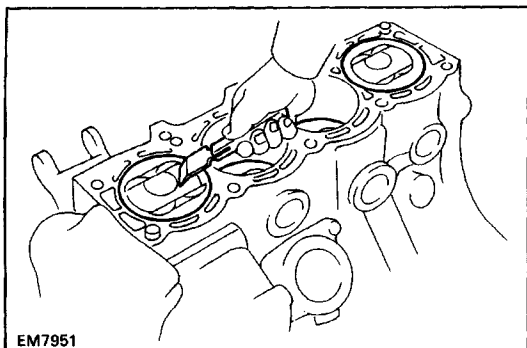
(b) Remove the spring retainer, valve spring, valve and spring seat.



HINT: Arrange the valves, valve springs, spring seats and spring retainers in correct order.



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

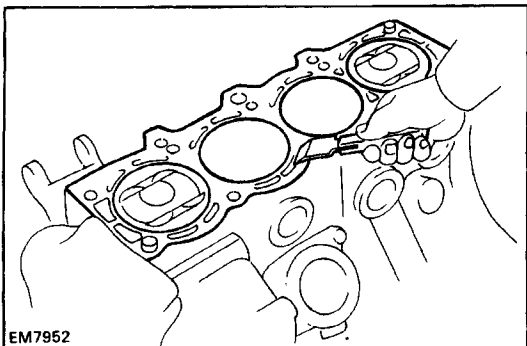


EM7951

INSPECTION, CLEANING AND REPAIR OF CYLINDER HEAD COMPONENTS

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 surface.

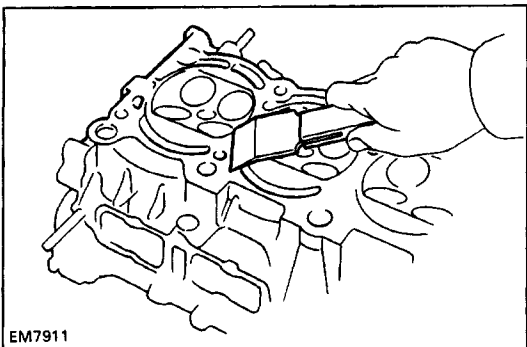


EM7952

- (b) Using a gasket scraper, remove all the gasket material from the surface contacting the cylinder head.

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

CAUTION: Protect your eyes when using high-compressed air.



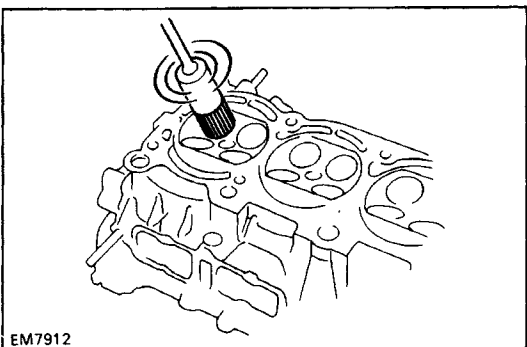
EM7911

2. CLEAN CYLINDER HEAD

A. Remove gasket material

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

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

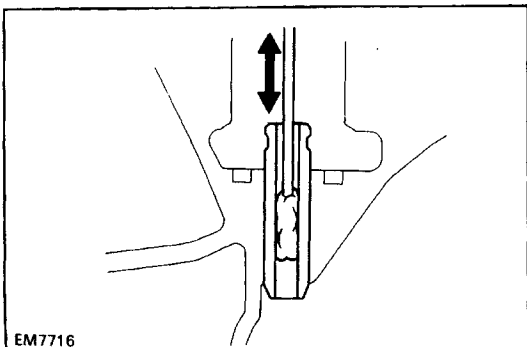


EM7912

6. Clean combustion chambers

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

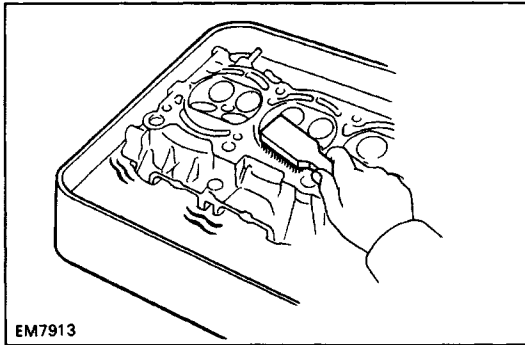
NOTICE: Be careful not to scratch the cylinder block contact surface.



EM7716

C. Clean valve guide bushings .

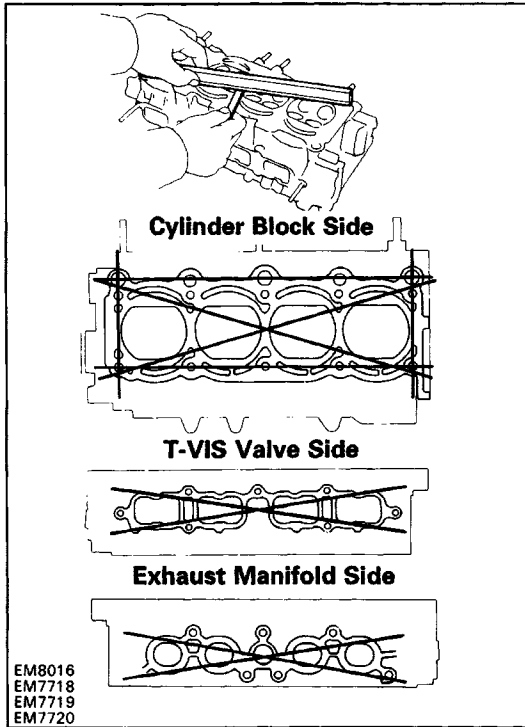
Using a valve guide bushing brush and solvent, clean all the guide bushings.



EM7913

D. Clean cylinder head

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

EM8016
EM7718
EM7719
EM7720

3. INSPECT CYLINDER HEAD

A. Inspect for flatness

Using precision straight edge and feeler gauge, measure the surfaces contacting the cylinder block, T-VIS valve and exhaust manifold for warpage.

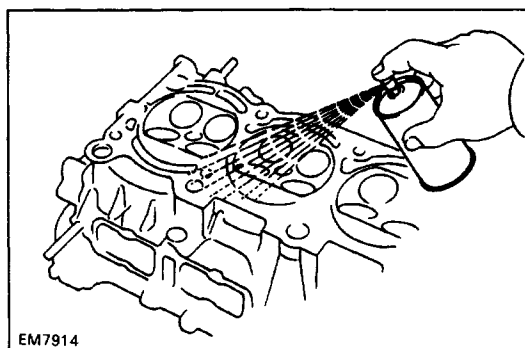
Maximum warpage:

Cylinder block side 0.20 mm (0.0079 in.)

T-VIS valve side 0.20 mm (0.0079 in.)

Exhaust manifold side 0.30 mm (0.0118 in.)

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

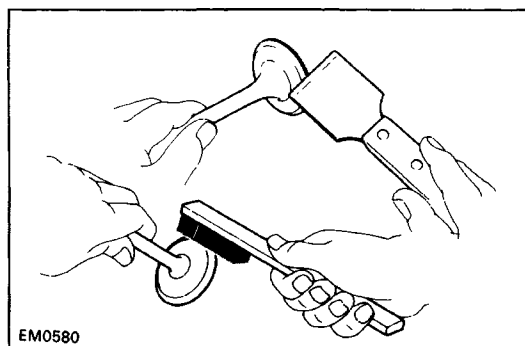


EM7914

B. Inspect for cracks

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

If cracked, replace the cylinder head.

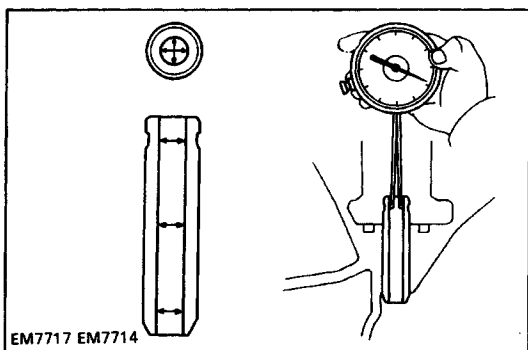


EM0580

4. CLEAN VALVES

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

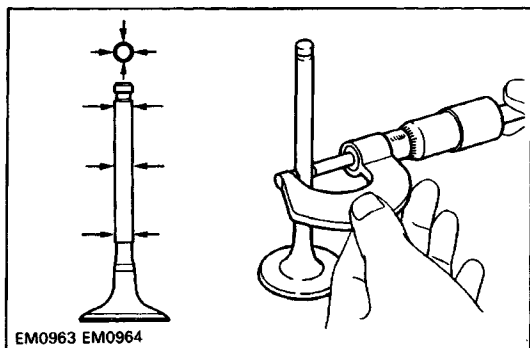
(b) Using a wire brush, thoroughly clean the valve.

5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:

6.000 – 6.018 mm (0.2362 – 0.2369 in.)



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

Valve stem diameter:

**Intake 5.960 – 5.975 mm
(0.2346 – 0.2352 in.)**

**Exhaust 5.955 – 5.970 mm
(0.2344 – 0.2350 in.)**

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

Standard oil clearance:

**Intake 0.025 – 0.058 mm
(0.0010 – 0.0023 in.)**

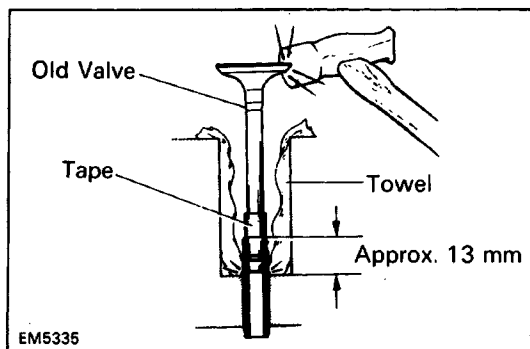
**Exhaust 0.030 – 0.063 mm
(0.0012 – 0.0025 in.)**

Maximum oil clearance:

Intake 0.08 mm (0.0031 in.)

Exhaust 0.10 mm (0.0039 in.)

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

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

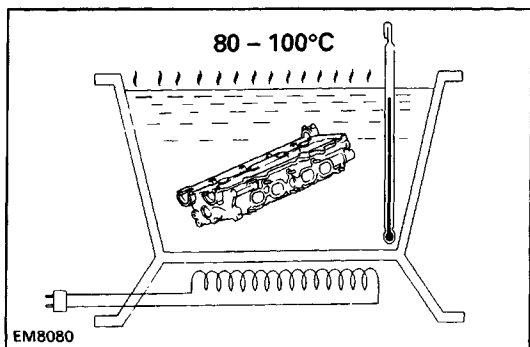
- (a) (w/ Snap Ring)

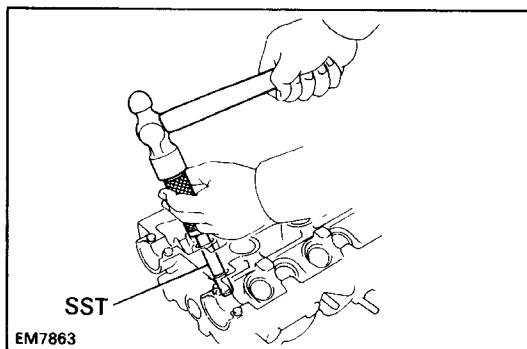
Insert an old valve wrapped with tape into the valve guide bushing, and break off the valve guide bushing by hitting it with a hammer. Remove the snap ring.

HINT: Wrap the tape approx. 13 mm (0.51 in.) from the valve stem end.

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

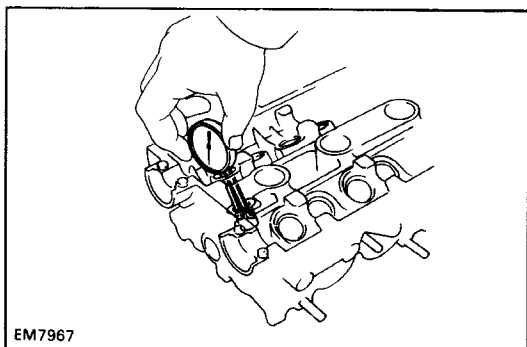
- (b) Gradually heat the cylinder head to 80– 100°C (176 – 212°F).





(c) Using SST and a hammer, tap out the guide bushing.

SST 09201-70010



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

Both intake and exhaust

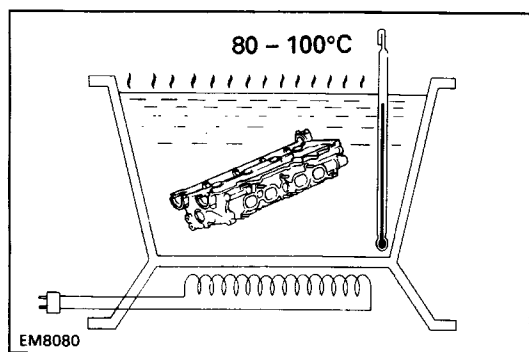
Bushing bore diameter mm* (in.)	Bushing size
10.988 - 11.006 (0.4326 - 0.4333)	Use STD
11.038 - 11.056 (0.4346 - 0.4353)	Use O/S 0.05

(e) Select a new guide bushing (STD or O/S 0.05).

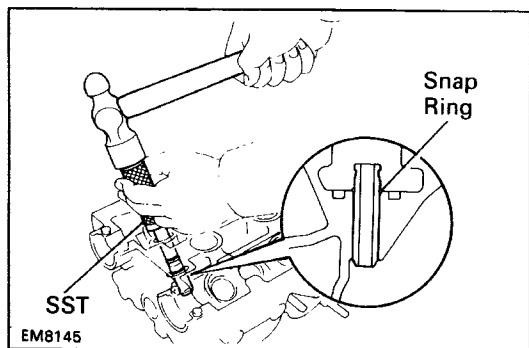
If the bushing bore diameter of the cylinder head is greater than 11.006 mm (0.4333 in.), machine the bushing bore to the following dimension:

11.038 - 11.056 mm (0.4346 - 0.4353 in.)

If the bushing bore diameter of the cylinder head is greater than 11.056 mm (0.4353 in.), replace the cylinder head.

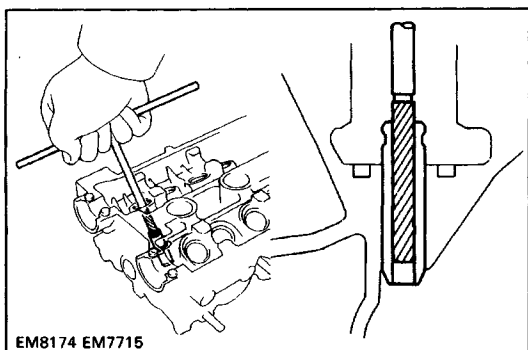


(f) Gradually heat the cylinder head to 80-100°C (176-212°F).

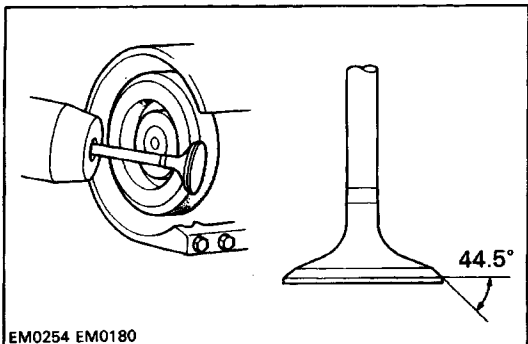


(g) Using SST and a hammer, tap in a new guide bushing until the snap ring makes contact with the cylinder head.

SST 09201-70010



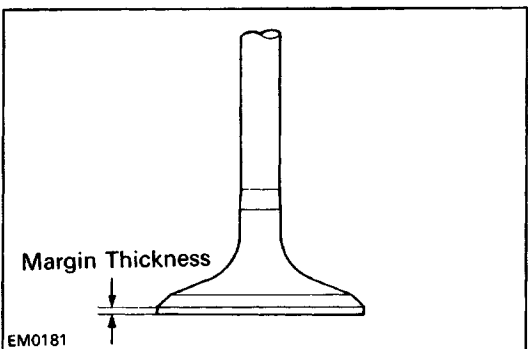
- (h) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page EM-129) between the guide bushing and valve stem.



7. INSPECT AND GRIND VALVES

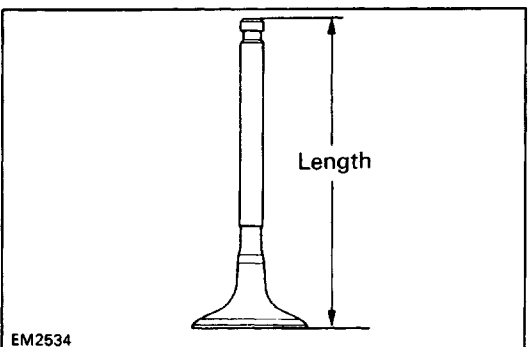
- (a) Grind the valve enough to remove pits and carbon.
 (b) Check that the valve is ground to the correct valve face angle.

Valve face angle: 44.5°



- (c) Check the valve head margin thickness.
Standard margin thickness: 0.8 –1.2 mm
(0.031 – 0.047 in.)

Minimum margin thickness: 0.5 mm (0.020 in.)
 If the margin thickness is less than minimum, replace the valve.



- (d) Check the valve overall length.

Standard overall length:

Intake 100.50 mm (3.9567 in.)

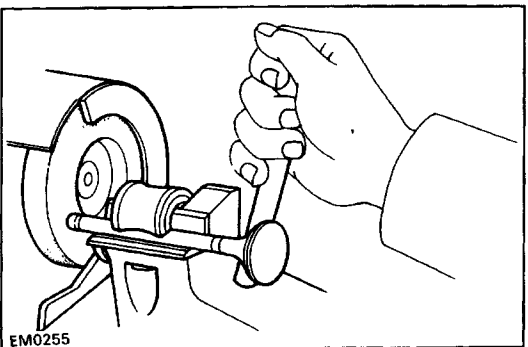
Exhaust 99.55 mm (3.9193 in.)

Minimum overall length:

Intake 99.80 mm (3.9291 in.)

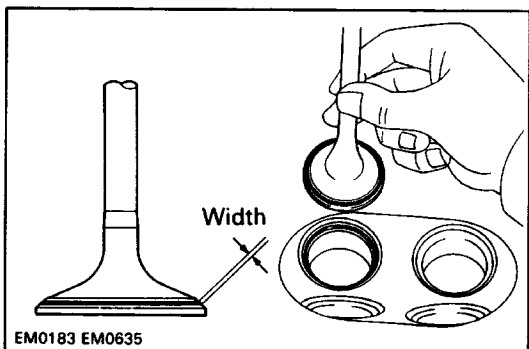
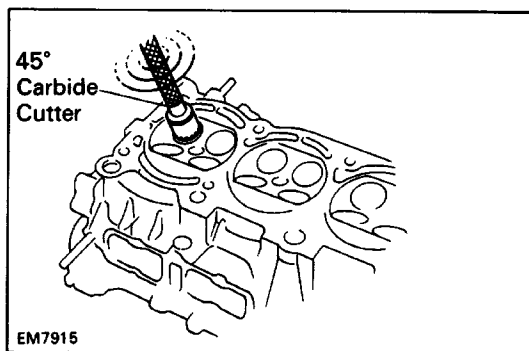
Exhaust 98.85 mm (3.8977 in.)

If the overall length is less than 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 minimum.

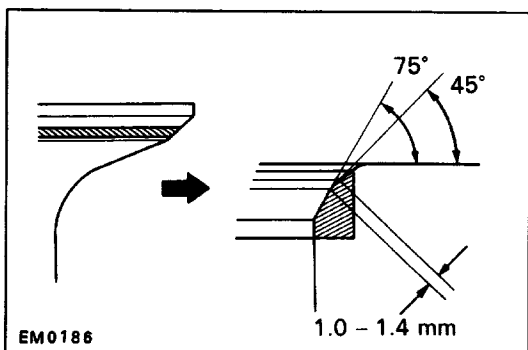
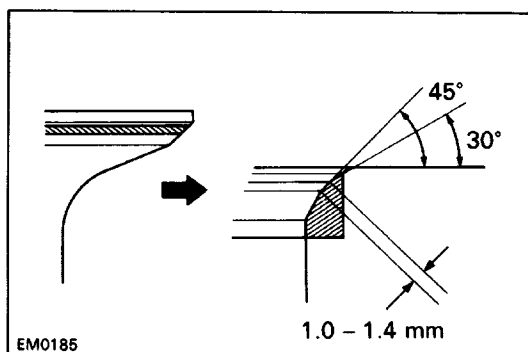


8. INSPECT AND CLEAN VALVE SEATS

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

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

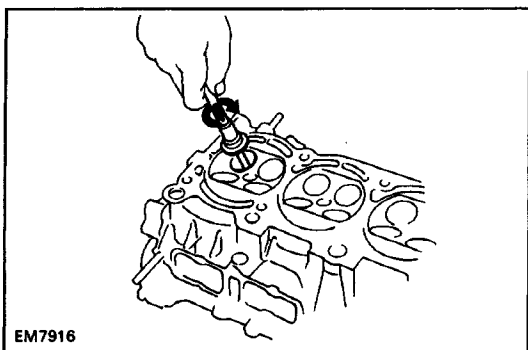
- (c) Check the valve face and seat for the following:
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
 - If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
 - Check that the seat contact is in the middle of the valve face with the following width: **1.0 – 1.4 mm (0.039 – 0.055 in.)**



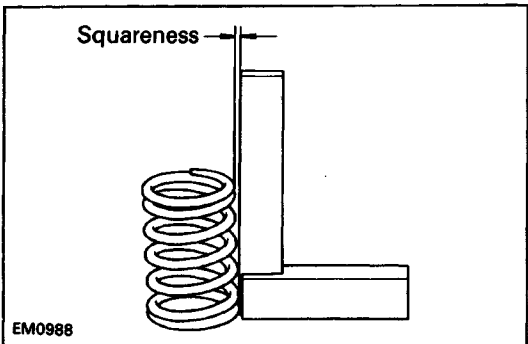
If not, correct the valve seats as follows:

- (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 75° 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.

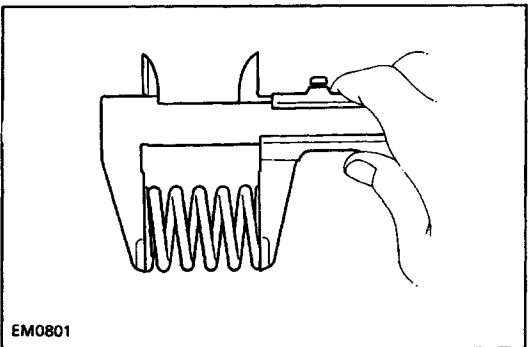


9. INSPECT VALVE SPRINGS

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

Maximum squareness: 2.0 mm (0.079 in.)

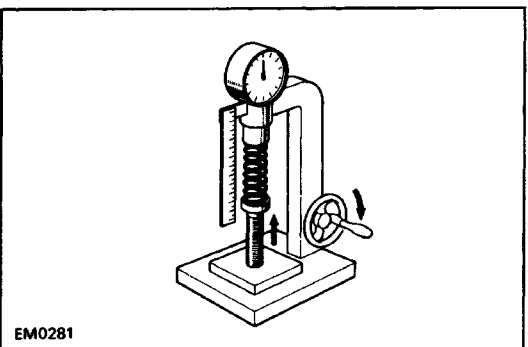
If the squareness is greater than maximum, replace the valve spring.



- (b) Using a vernier caliper, measure the free length of the valve spring.

Free length: 44.43 mm (1.7492 in.)

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

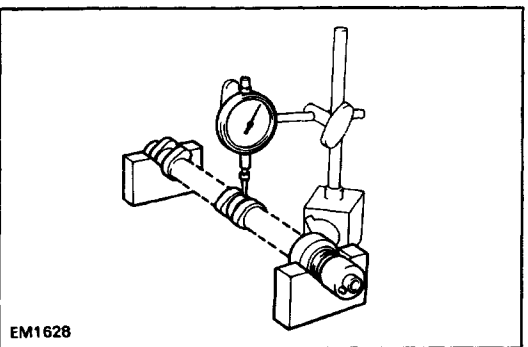


- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:

**201 – 236 N (20.5 – 24.1 kgf, 45.2 – 53.1 lbf)
at 34.4 mm (1.354 in.)**

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



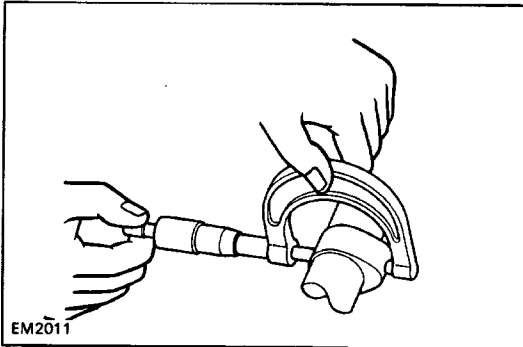
10. INSPECT CAMSHAFTS AND BEARINGS

A. 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 maximum, replace the camshaft.

**B. Inspect cam lobes**

Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

Intake	41.010 – 41.110 mm (1.6146 – 1.6185 in.)
Exhaust	41.090 – 41.190 mm (1.6177 – 1.6217 in.)

Minimum cam lobe height:

Intake	39.90 mm (1.5709 in.)
Exhaust	39.98 mm (1.5740 in.)

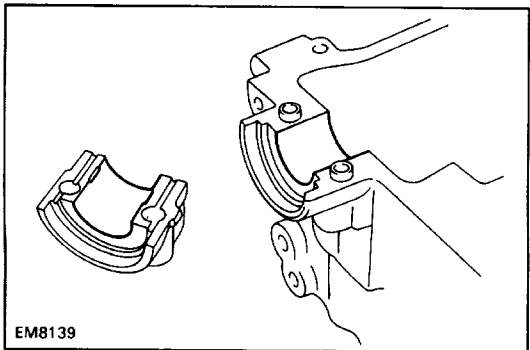
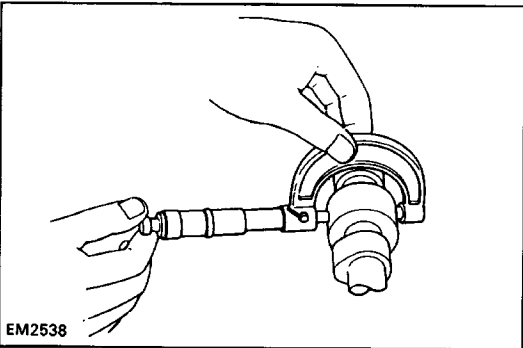
If the cam lobe height is less than minimum, replace the camshaft.

C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

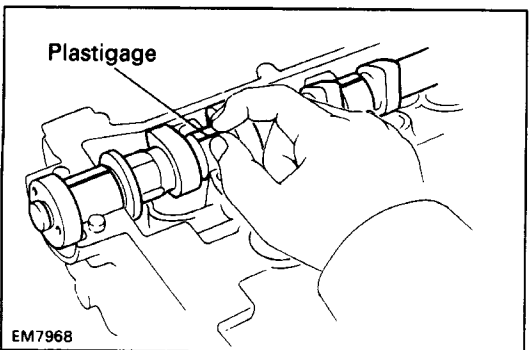
Journal diameter: 26.959 – 26.975 mm
(1.0614 – 1.0620 in.)

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

**D. 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.

**E. Inspect camshaft journal oil clearance**

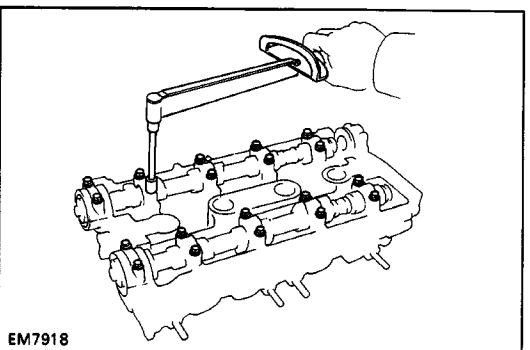
- Clean the bearing caps and camshaft journals.
- Place the camshafts on the cylinder head.
- Lay a strip of Plastigage across each of the camshaft journals.

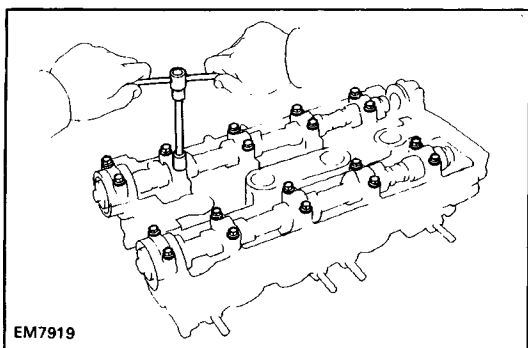
- Install the bearing caps.

(See step 2 on page [EM-141](#))

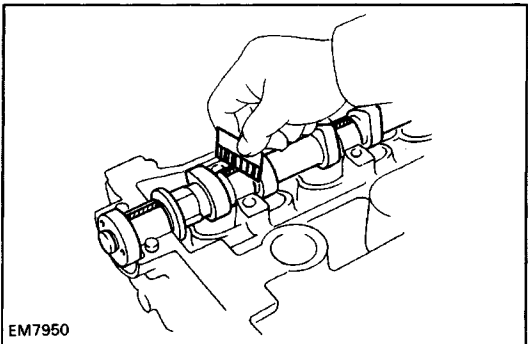
Torque: 19 N·m (190 kgf·cm, 14 ft·lbf)

NOTICE: Do not turn the camshaft.





(e) Remove the bearing caps.



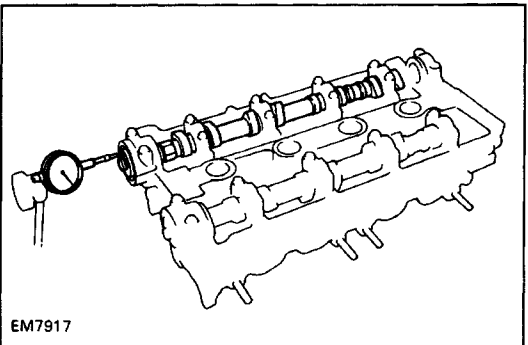
(f) Measure the Plastigage at its widest point.

**Standard oil clearance: 0.025 – 0.062 mm
(0.0010 – 0.0024 in.)**

Maximum oil clearance: 0.08 mm (0.0031 in.)

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

(g) Completely remove the Plastigage.



F. Inspect camshaft thrust clearance

(a) Install the camshafts.

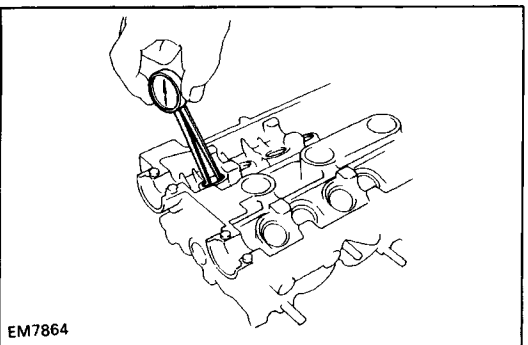
(See step 2 on page [EM-141](#))

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

**Standard thrust clearance: 0.120 – 0.240 mm
(0.0047 – 0.0094 in.)**

Maximum thrust clearance: 0.30 mm (0.0118 in.)

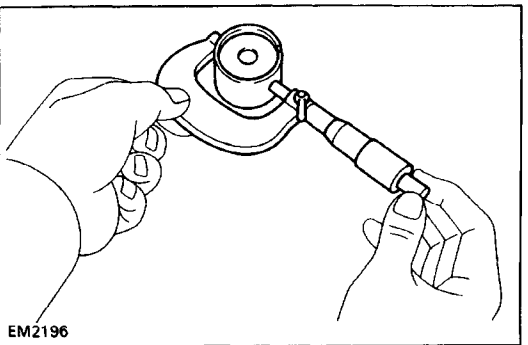
If the thrust clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.



11. INSPECT VALVE LIFTERS AND LIFTER BORES

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

**Lifter bore diameter: 37.000 – 31.021 mm
(1.2205 – 1.2213 in.)**



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

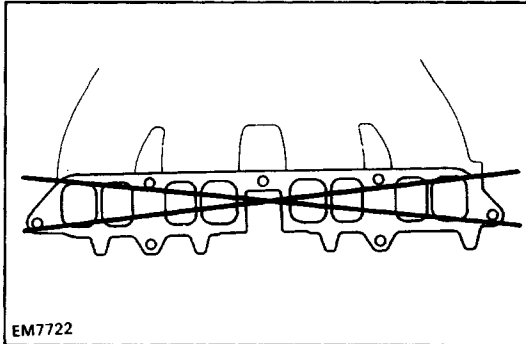
**Lifter diameter: 30.975 – 30.985 mm
0.2195 – 1.2199 in.)**

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

**Standard oil clearance: 0.015 – 0.046 mm
(0.0005 – 0.0018 in.)**

Maximum oil clearance: 0.07 mm (0.0028 in.)

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



EM7722

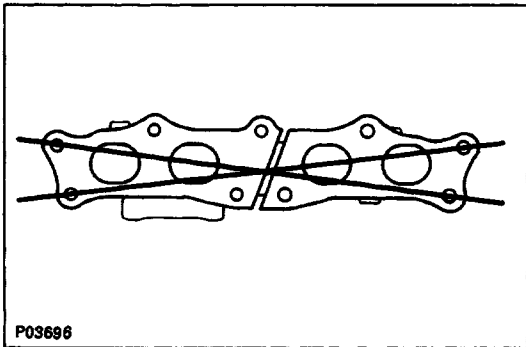
12. INSPECT MANIFOLDS

(Intake manifold)

Using precision straight edge and feeler gauge, measure the surface contacting the T-VIS valve for warpage.

Maximum warpage: 0.20 mm (0.0079 in.)

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



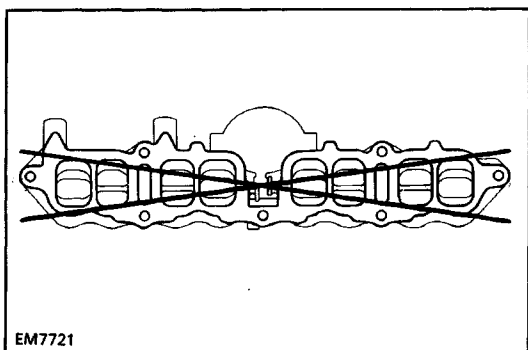
P03696

(Exhaust manifold)

Using precision straight edge and feeler gauge, measure the surface contacting the cylinder head for warpage.

Maximum warpage: 0.20 mm (0.0079 in.)

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



INSPECTION OF TOYOTA-VARIABLE INDUCTION SYSTEM (T-VIS) COMPONENTS

1. INSPECT T-VIS VALVE

A. Inspect for flatness

Using precision straight edge and feeler gauge, measure the surfaces contacting the cylinder head and intake manifold for warpage.

Maximum warpage: 0.20 mm (0.0079 in.)

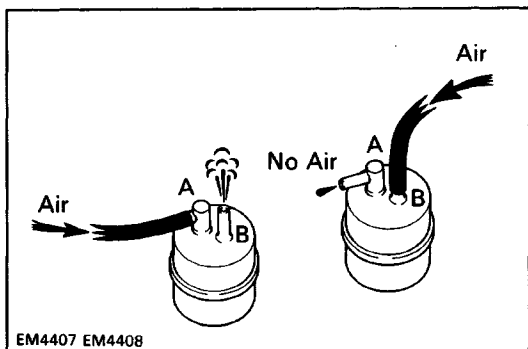
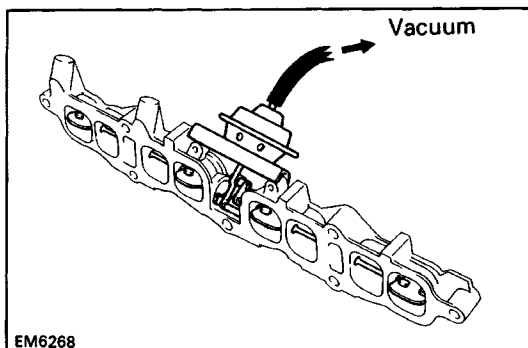
If warpage is greater than maximum, replace the T-VIS valve.

B. Inspect for operation

(a) With 53.3 kPa (400 mmHg, 15.75 in.Hg) of vacuum applied to the actuator, check that the control valve moves smoothly to the fully closed position.

(b) With the vacuum released, check that the control valve fully opens quickly.

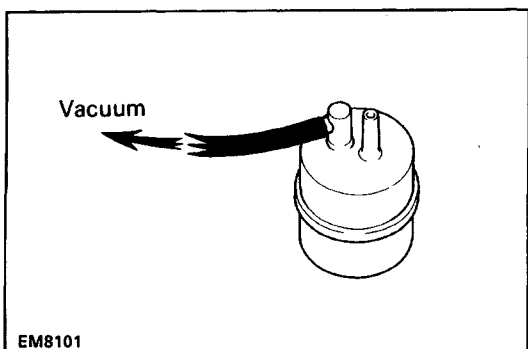
If operation is not as specified, replace the T-VIS valve.



2. INSPECT VACUUM TANK

(a) Check that air flows from ports A to B.

(b) Check that air does not flow from ports B to A.



(c) Apply 67.7 kPa (500 mmHg, 19.69 in.Hg) of vacuum to port A, and check that there is no change in vacuum after one minute.

If operation is not as specified, replace the vacuum tank.

3. INSPECT T-VIS VSV (See page [FI-203](#))

ASSEMBLY OF CYLINDER HEAD

(See page [EM-117](#))

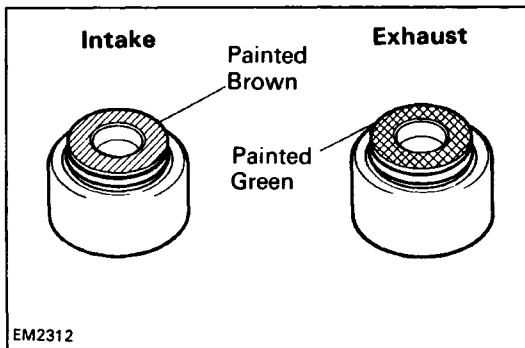
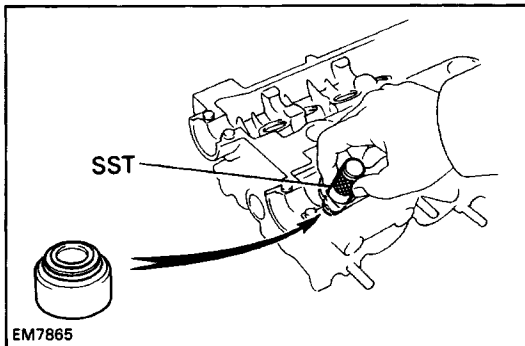
HINT:

- 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.

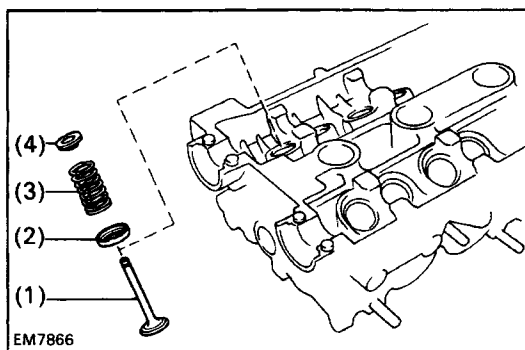
1. INSTALL VALVES

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

SST 09201-41020

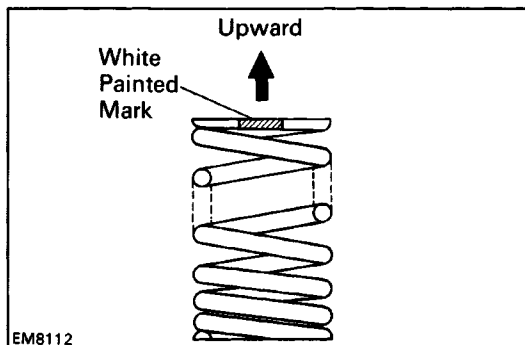


HINT: The intake valve oil seal is brown and the exhaust valve oil seal is black.

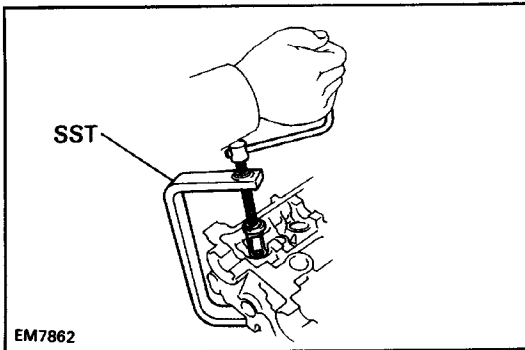


(b) Install the following parts:

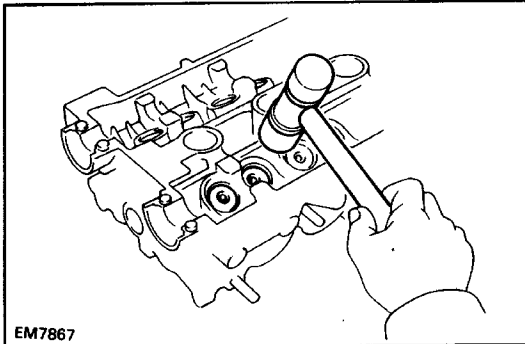
- (1) Valve
- (2) Spring seat
- (3) Valve spring
- (4) Spring retainer



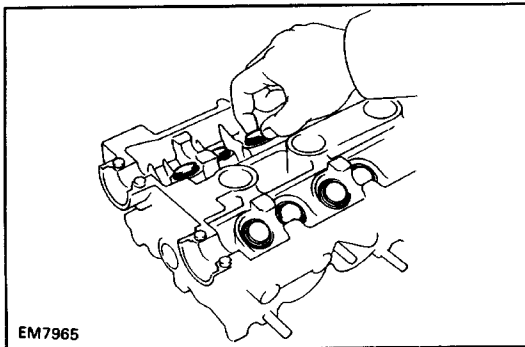
HINT: Install the valve spring, facing the white painted mark upward.



- (c) Using SST, compress the valve spring and place the two keepers around the valve stem.
SST 09202-70010

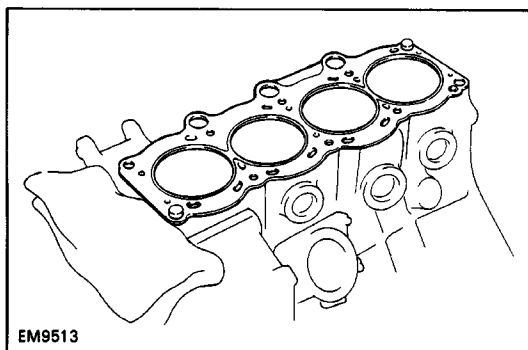


- (d) Using a plastic-faced hammer, lightly tap the valve stem tip to assure proper fit.



2. INSTALL VALVE LIFTERS AND SHIMS

- (a) Install the valve lifter and shim.
(b) Check that the valve lifter rotates smoothly by hand.



INSTALLATION OF CYLINDER HEAD

(See pages EM-116 and 117)

1. INSTALL CYLINDER HEAD

A. Place cylinder head on cylinder block

- (a) Place a new cylinder head gasket in position on the cylinder block.

NOTICE: Be careful of the installation direction.

- (b) Place the cylinder head in position on the cylinder head gasket.

B. Install cylinder head bolts

HINT:

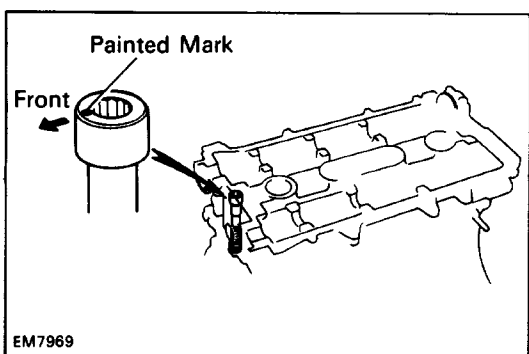
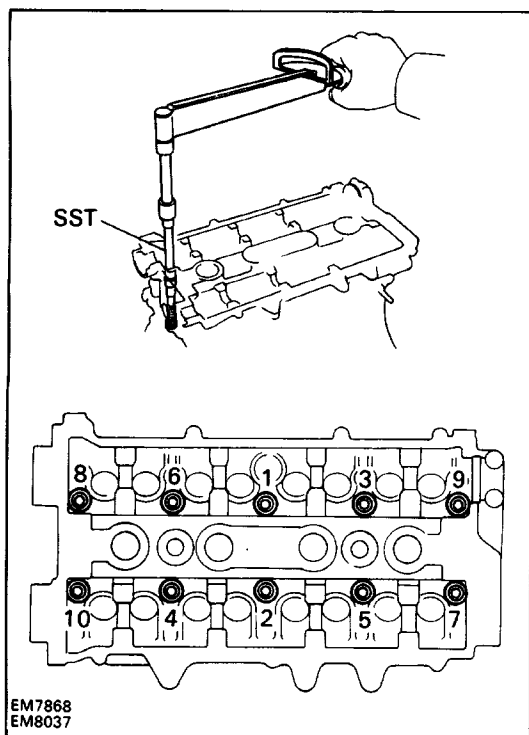
- The cylinder head bolts are tightened in two progressive steps (steps (b) and (d)).
- If any cylinder head bolt is broken or deformed, replace it.

- (a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
- (b) Install the plate washer to each cylinder head bolt.
- (c) Using SST, install and uniformly tighten the ten cylinder head bolts in several passes in the sequence shown.

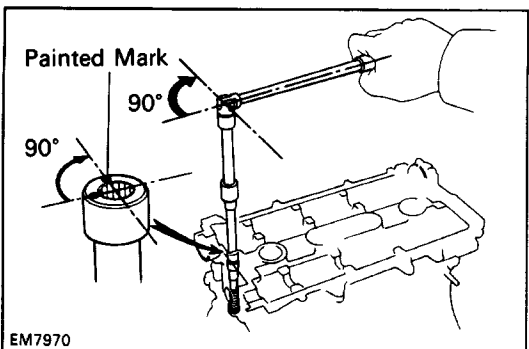
SST 09043-38100

Torque: 49 N-m (500 kgf-cm, 36 ft-lbf)

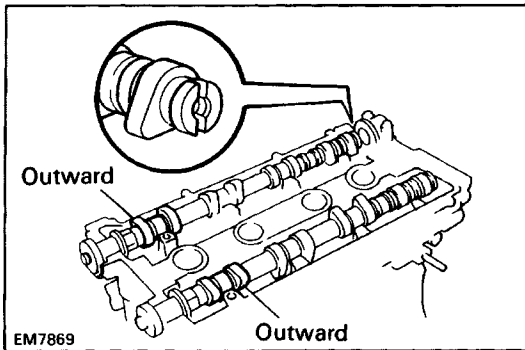
If any one of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.



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

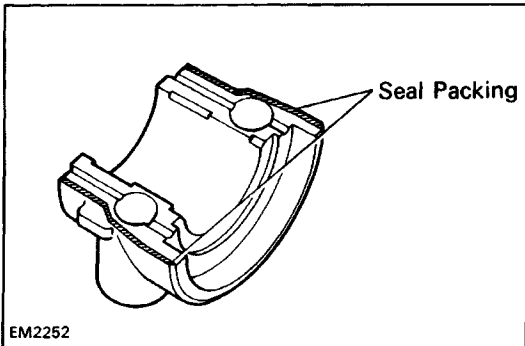


- (e) Retighten the cylinder head bolts 90° in the numerical order shown.
- (f) Check that the painted mark is now at a 90° angle to front.



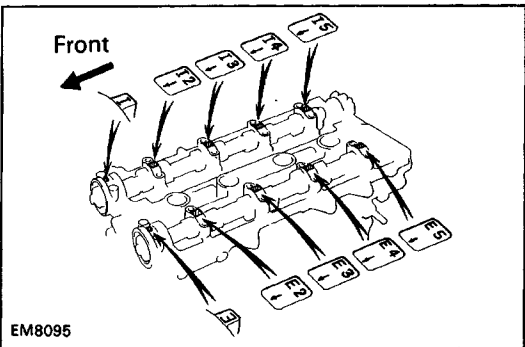
2. INSTALL CAMSHAFTS

- (a) Place the camshaft on the cylinder head with the No.1 cam lobe facing outward as shown.

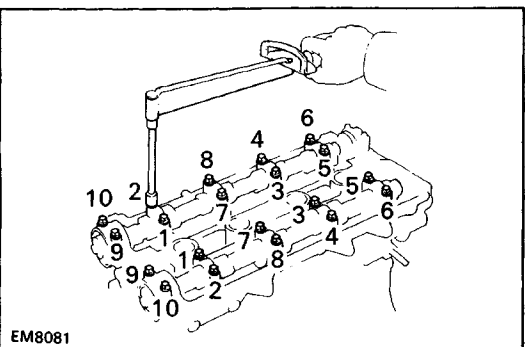


- (b) Apply seal packing to the No.1 bearing cap as shown.

Seal packing: Part No. 08826-00080 or equivalent



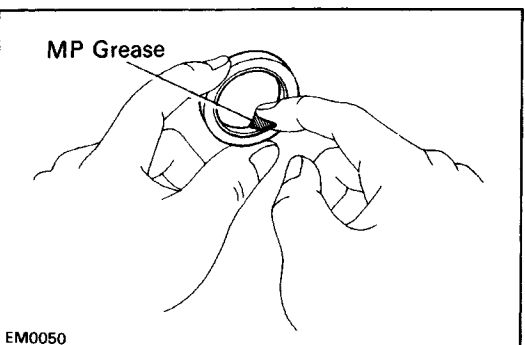
- (c) Install the bearing caps in their proper locations. HINT: Each bearing cap has a number and front mark.



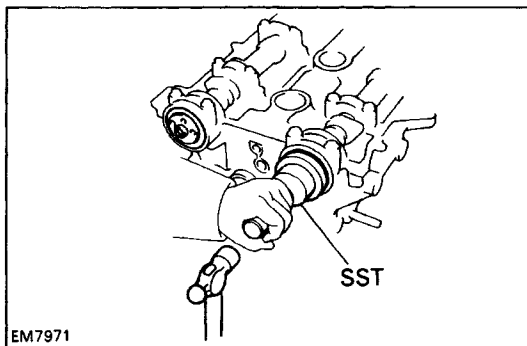
- (d) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

- (e) Install and uniformly tighten the ten bearing cap bolts on one side in several passes in the sequence shown.

Torque: 19 N-m (190 kgf-cm, 14 ft-lbf)



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



(g) Using SST, tap in the two camshaft oil seals.
SST 09223-50010

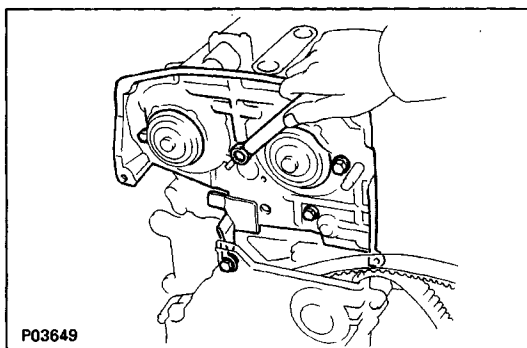
3. ADJUST VALVE CLEARANCE (See page [EM-17](#))

Turn the camshaft and position the cam lobe upward, check and adjust the valve clearance.

Valve clearance (Cold):

Intake 0.15 – 0.25 mm (0.006 – 0.010 in.)

Exhaust 0.28 – 0.38 mm (0.011 – 0.015 in.)



4. INSTALL NO.3 TIMING BELT COVER

Install the No.3 belt cover with the five bolts.

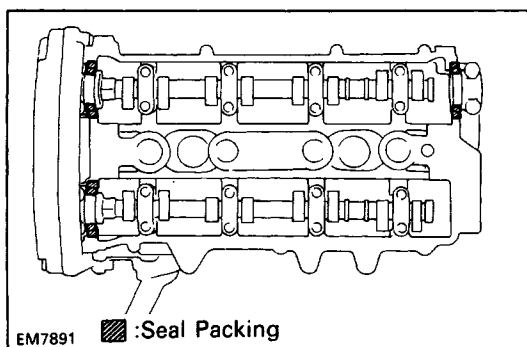
Torque: 8.8 N-m (90 kgf-cm, 78 in-lbf)

5. INSTALL NO.1 IDLER PULLEY

(See step 4 on page [EM-55](#))

6. INSTALL CAMSHAFT TIMING PULLEYS

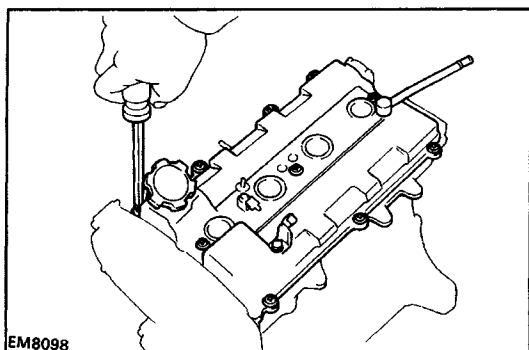
(See steps 9 to 15 on pages [EM-56](#) to 60)



7. INSTALL CYLINDER HEAD COVER

(a) Apply seal packing to the cylinder head as shown in the illustration.

Seal packing: Part No. 08826-00080 or equivalent

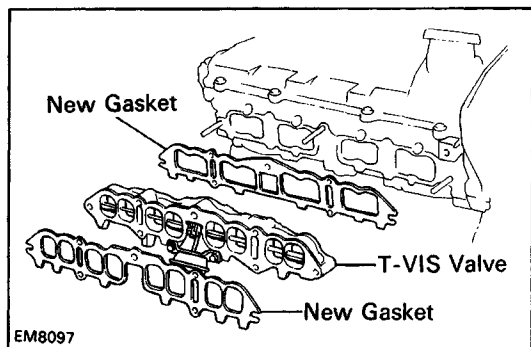


- (b) Install the two gaskets to the head cover.
- (c) Install the head cover with the twelve seal washers and screws. Uniformly tighten the screws in several passes.

Torque: 2.5 N-m (25 kgf-cm, 21 in-lbf)

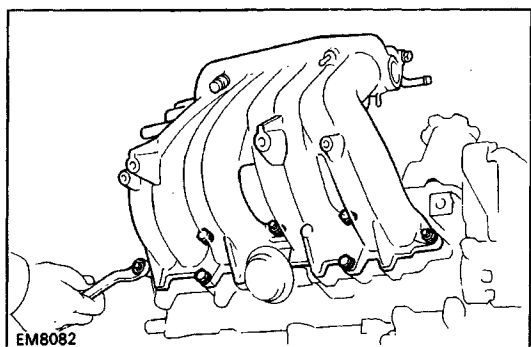
8. INSTALL DELIVERY PIPE AND INJECTORS (See steps 2 to 8 on pages [FI-166](#) to 168)

9. INSTALL CHARCOAL CANISTER (See step 32 on page [EM-264](#))



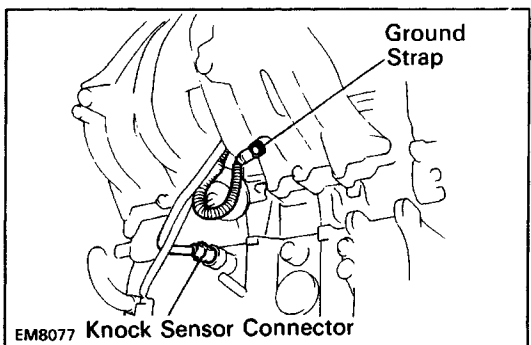
10. INSTALL T-VIS VALVE AND INTAKE MANIFOLD

- (a) Place a new gasket, the T-VIS valve and the other new gasket on the cylinder head.

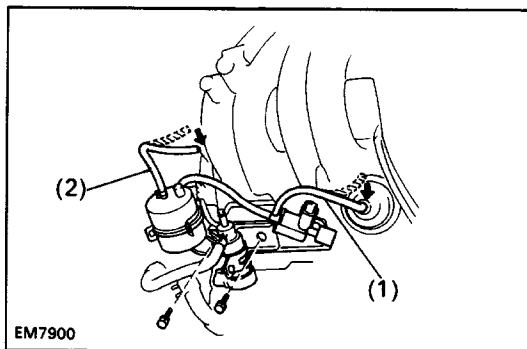


- (b) Install the intake manifold with the four bolts and three nuts. Uniformly tighten the bolts and nuts in several passes.

Torque: 19 N-m (195 kgf-cm, 14 ft-lbf)

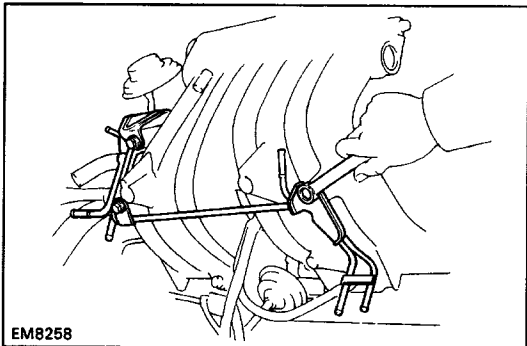


- (c) Connect the knock sensor connector.
- (d) Connect the ground strap with the bolt.



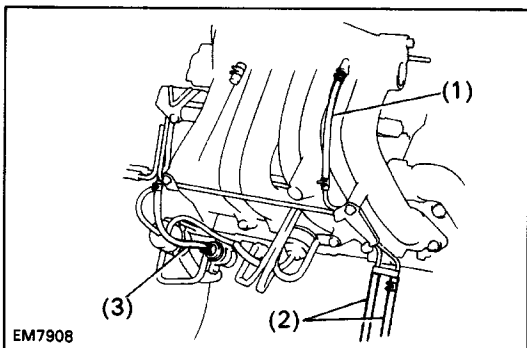
11. INSTALL T-VIS VACUUM TANK, T-VIS VSV, TURBOCHARGING PRESSURE VSV AND BRACKET

- (a) Install the T-VIS vacuum tank, T-VIS VSV, turbocharging pressure VSV and bracket assembly with the two bolts.
- (b) Connect the following hoses:
 - (1) Vacuum hose (from T-VIS VSV) to T-VIS actuator
 - (2) Vacuum hose (from T-VIS vacuum tank) to intake manifold

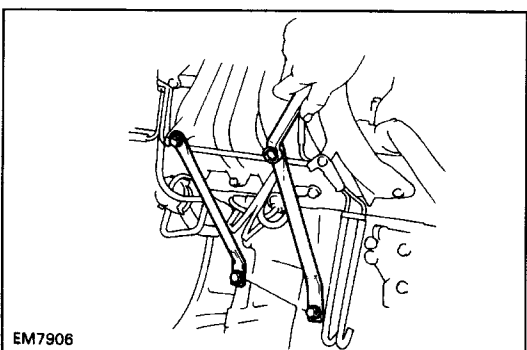


12. INSTALL NO.1 AIR TUBE

- (a) Install the air tube with the three bolts.



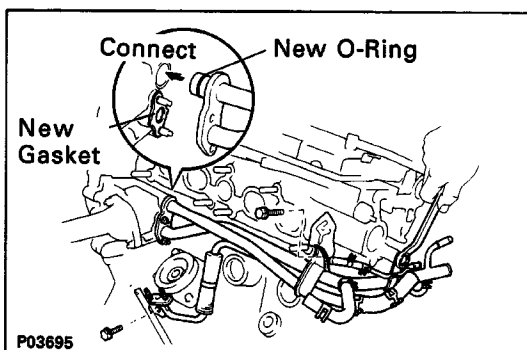
- (b) Connect the following hoses:
 - (1) Vacuum hose to intake manifold
 - (2) Two PS vacuum hoses
 - (3) Vacuum hose to turbocharging pressure VSV



13. INSTALL INTAKE MANIFOLD STAYS

Install the manifold stay with the two bolts. Alternately tighten the bolts. Install the two manifold stays.

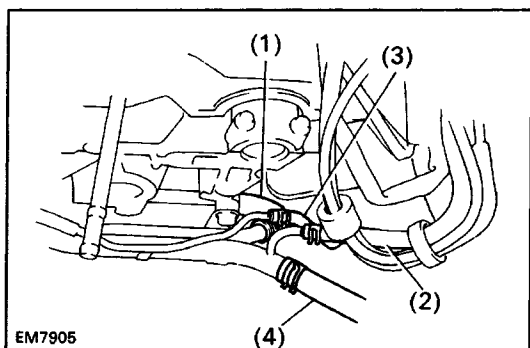
Torque: 25 N-m (260 kgf-cm, 19 ft-lbf)



14. INSTALL WATER BY-PASS PIPE

- (a) Install a new O-ring to the pipe.
- (b) Apply soapy water on the O-ring.
- (c) Install a new gasket to the water pump.
- (d) Install the water by-pass pipe with the two nuts and two bolts.

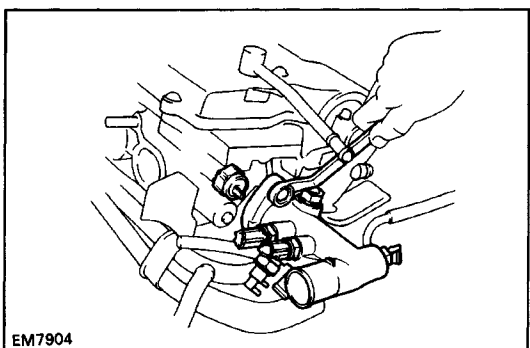
Torque: 7.8 N-m (80 kgf-cm, 69 in-lbf)



- (e) Connect the following hoses:
- (1) Water by-pass hose to cylinder block
 - (2) Water by-pass hoses to No.1 air tube
 - (3) Vacuum hose to turbocharging pressure VSV
 - (4) Heater water hose

15. INSTALL OIL COOLER

(See steps 2 to 4 on pages [LU-26](#) and [27](#))



16. INSTALL OIL PRESSURE SWITCH

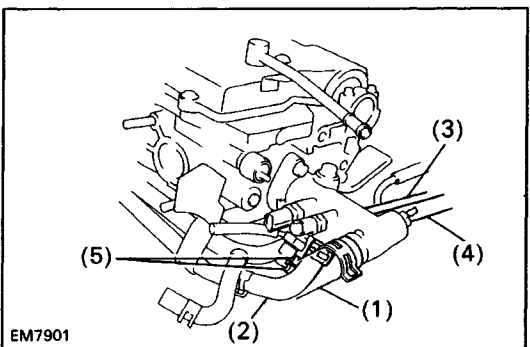
Apply adhesive to two or three threads.

Adhesive: Part No. 08833-00080, THREE BOND 1324 or equivalent

17. INSTALL WATER OUTLET

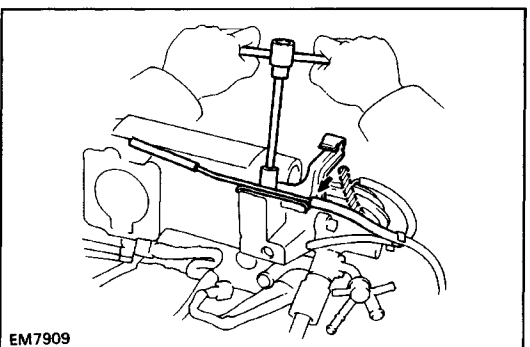
- (a) Install a new gasket and the water outlet with the two bolts.

Torque: 39 N-m (400 kgf-cm, 29 ft-lbf)



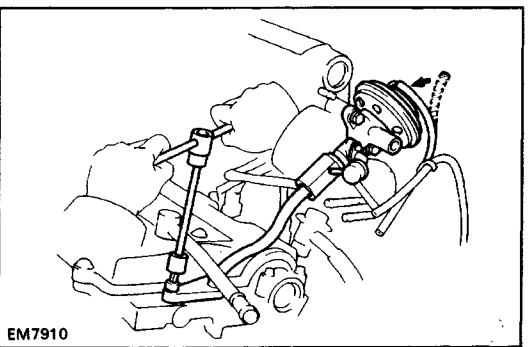
- (b) Connect the following hoses:

- (1) Upper radiator hose
- (2) Water by-pass hose to water by-pass pipe
- (3) Water by-pass pipe hose to ISC valve
- (4) Heater water hose
- (5) Two EVAP VSV vacuum hoses



18. INSTALL VACUUM PIPE

- (a) Install the vacuum pipe with the bolt.
 (b) Connect the vacuum hose to the vacuum pipe.



19. INSTALL EGR VALVE AND PIPE

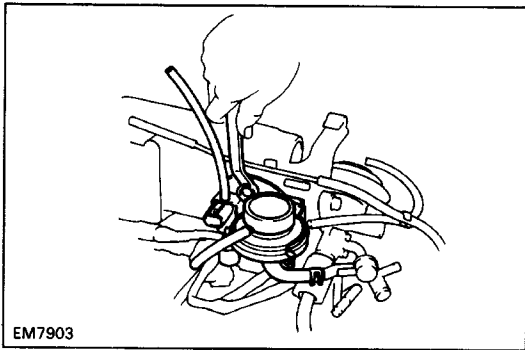
- (a) Install two new gaskets, the EGR valve and pipe assembly with the four bolts. Alternately tighten the bolts.

Torque:

To cylinder head 25 N-m (260 kgf-cm, 19 ft-lbf)

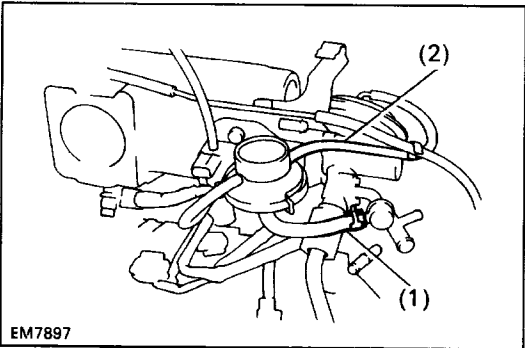
To intake manifold 19 N-m (195 kgf-cm, 14 ft-lbf)

- (b) Connect the vacuum hose to the EGR valve.

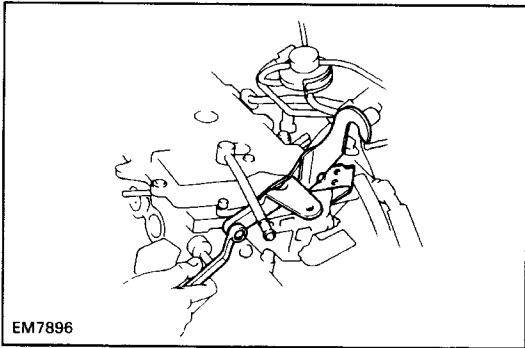


20. INSTALL EGR VACUUM MODULATOR AND VSV

- (a) Install the EGR vacuum modulator and VSV assembly with the bolt.



- (b) Connect the following hoses:
 (1) Vacuum hose to EGR valve
 (2) Vacuum hose to EGR vacuum modulator
 (c) Connect the EGR VSV connector.

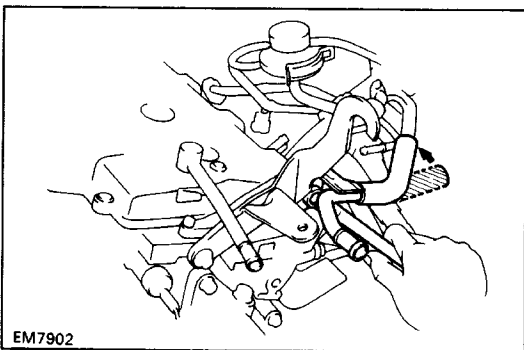


21. INSTALL LH ENGINE HANGER

Install the LH engine hanger and reservoir tank with the two bolts. Alternately tighten the bolts.

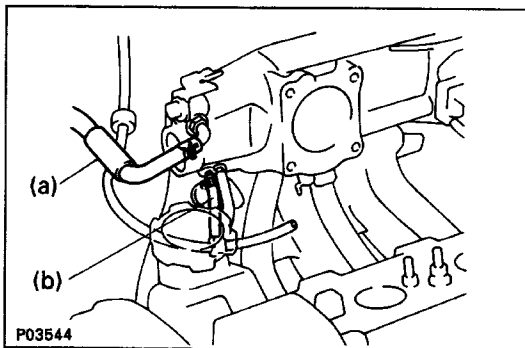
Torque:

- 12 mm head bolt 19 N-m (195 kgf-cm, 14 ft-lbf)
 14 mm head bolt 39 N-m (400 kgf-cm, 29 ft-lbf)



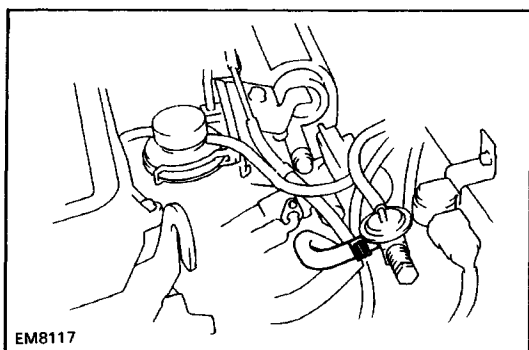
22. INSTALL NO.2 AIR TUBE

- (a) Install the air tube with the bolt.
 (b) Connect the air hose to the No.1 air tube.



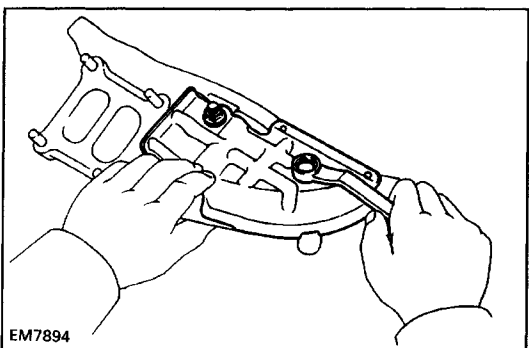
23. CONNECT HOSES

- (a) Brake booster vacuum hose to intake manifold
 (b) Turbocharging pressure sensor hose to intake manifold



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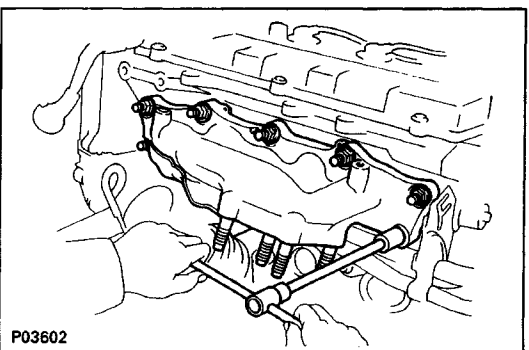
(c) A/C ASV air hose to No.1 air tube

24. INSTALL DISTRIBUTOR (See page IG-28)

EM7894

25. INSTALL EXHAUST MANIFOLD

(a) Install the heat insulator with the bolt and nut.



P03602

(b) Install a new gasket and the exhaust manifold with the nine nuts. Uniformly tighten the nuts in several passes.

Torque: 52 N-m (530 kgf-cm, 38 ft-lbf)**26. INSTALL COLD START INJECTOR**

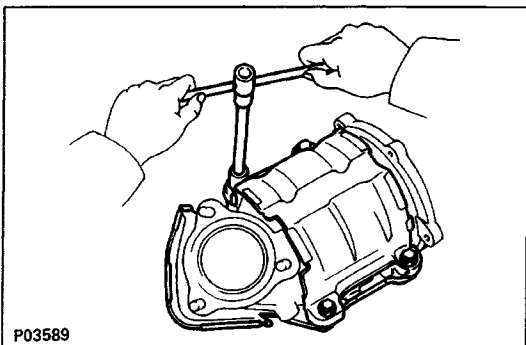
(See steps 1 to 3 on page FI-148)

27. INSTALL THROTTLE BODY

(See steps 2, 3 and 5 to 8 on pages FI-197 and 198)

28. INSTALL TURBOCHARGER

(See steps 5 to 10 on pages TC-15 to 17)

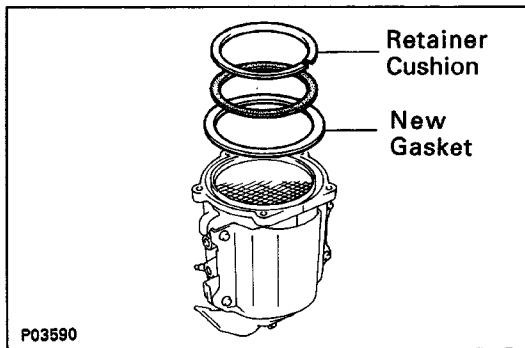


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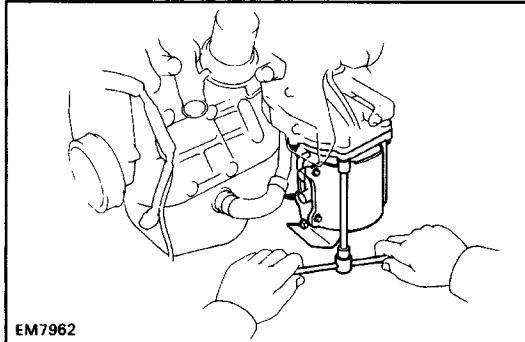
29. INSTALL CATALYTIC CONVERTER

(a) Install the front heat insulator with the five bolts.

(b) Install the rear heat insulator with the four bolts.

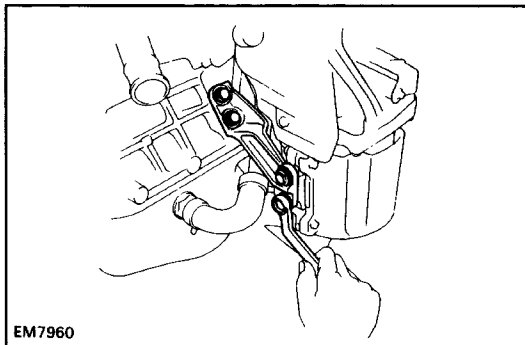


- (c) Place a new gasket, the cushion and retainer on the catalytic converter.



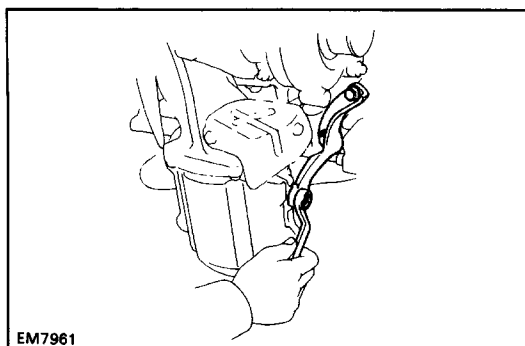
- (d) Install the catalytic converter with the three bolts and two nuts.

Torque: 29 N-m (300 kgf-cm, 22 ft-lbf)



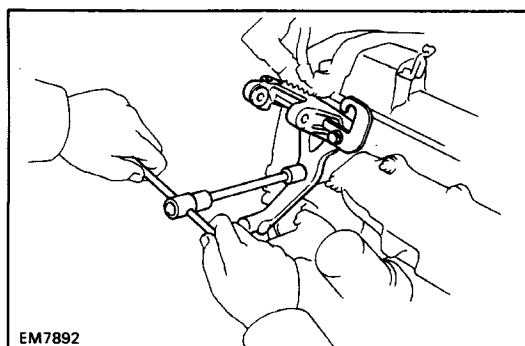
- (e) Install the RH converter stay with the four bolts. Alternately tighten the bolts.

Torque: 59 N-m (600 kgf-cm, 43 ft-lbf)



- (f) Install the LH converter stay with the three bolts. Alternately tighten the bolts.

Torque: 59 N-m (600 kgf-cm, 43 ft-lbf)



30. INSTALL NO.1 ALTERNATOR BRACKET AND RH FRONT ENGINE HANGER

Install the alternator bracket and engine hanger with the three bolts.

Torque: 39 N-m (400 kgf-cm, 29 ft-lbf)

31. **INSTALL FRONT EXHAUST PIPE**
(See step 18 on page [EM-261](#))
32. **INSTALL SUSPENSION LOWER CROSSMEMBER**
(See step 19 on page [EM-262](#))
33. **INSTALL ALTERNATOR** (See page [CH-23](#))
34. **INSTALL INTERCOOLER**
(See steps 11 to 13 on page [TC-17](#))
35. **INSTALL AIR CLEANER CAP**
(See step 44 on page [EM-117](#))
36. **INSTALL ACCELERATOR CABLE, AND ADJUST IT**
37. **FILL WITH ENGINE COOLANT** (See page [CO-6](#))
Capacity (w/ Heater):
6.5 liters (6.9 US qts, 5.7 Imp. qts)
38. **START ENGINE AND CHECK FOR LEAKS**
39. **ADJUST IGNITION TIMING** (See page [IG-29](#))
Ignition timing:
10° BTDC @ idle
(w/ Terminals TO and E1 connected)
40. **PERFORM ROAD TEST**
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.
41. **RECHECK ENGINE COOLANT AND OIL LEVELS**