

ENGINE MECHANICAL

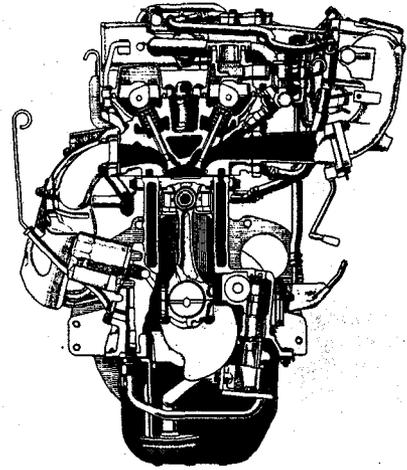
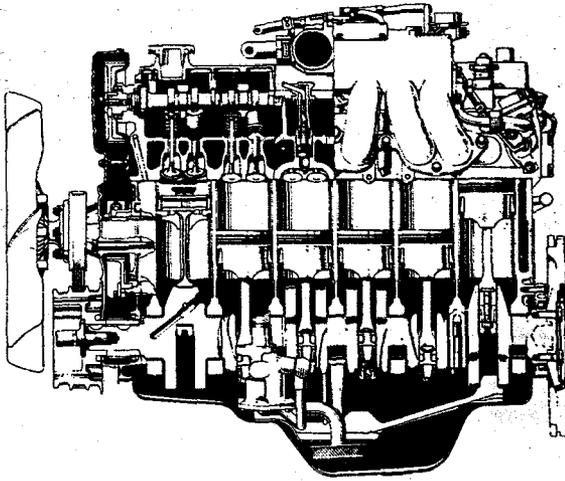
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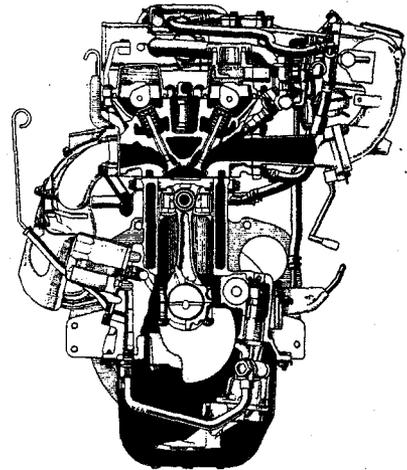
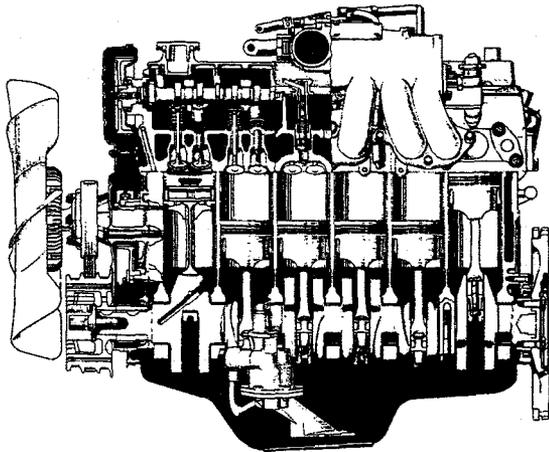
DESCRIPTION

The 7M-GE and 7M-GTE engines are an in-line 6-cylinder 3.0 liter DOHC 24 valve engine.

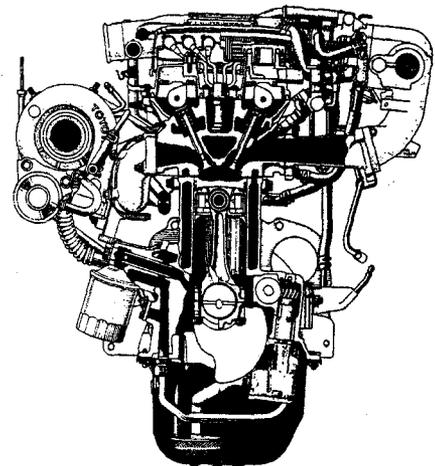
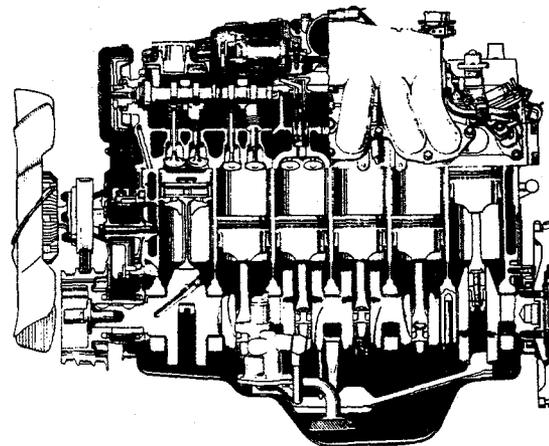
7M-GE (MA)



7M-GE (MS)



7M-GTE



The 7M-GE, 7M-GTE engines are an in-line 6-cylinder engine with the cylinders numbered 1-2-3-4-5-6 from the front. The crankshaft is supported by 7 bearings specified by the inside of the crankcase. These bearings are made of kelmet.

The crankshaft is integrated with 8 weights which are cast along with it for balancing. Oil holes are built into the crankshaft for supplying oil to the connecting rods, pistons and other components.

These engine's ignition order is 1-5-3-6-2-4. The cylinder head is made of aluminum alloy, with a cross flow type intake and exhaust layout and with pent roof type combustion chambers. The spark plugs are located in the center of the combustion chambers.

Exhaust and intake valves are equipped with irregular pitch springs with symmetrical ends made of oil tempered silicon chrome steel wire which are capable of following the valves even at high engine speeds.

Both the exhaust side cam shaft and the intake side cam shaft are driven by a single timing belt. The cam journal is supported at 7 places between the valve lifters of each cylinder and on the cylinder head of front end. Lubrication of the cam journal and cam is accomplished by oil being supplied through the oiler port in the center of the camshaft.

Adjustment of the valve clearance is done by means of an outer shim type system, in which valve adjusting shims are located above the valve lifters. This permits replacement of the shims without removal of the camshafts.

The resin timing belt cover is made in 2 pieces.

Pistons are made of highly temperature-resistant aluminum alloy, and depressions are built into the piston head to prevent interference with valves.

Piston pins are the full-floating type, with the pins fastened to neither the piston boss nor the connecting rods. Instead, snap rings are fitted on both ends of the pins, preventing the pins from falling out.

The No. 1 compression ring is made of stainless steel and the No. 2 compression ring is made of cast iron. The oil ring is made of a combination of stainless steel. The outer diameter of each piston ring is slightly larger than the diameter of the piston and the flexibility of the rings allows them to hug the cylinder walls when they are mounted on the piston. Compression rings No. 1 and No. 2 work to prevent the leakage of gas from the cylinder and the oil ring works to scrape oil off the cylinder walls to prevent it from entering the combustion chamber.

The cylinder block is made of cast iron. It has 6 cylinders which are approximately 1.6 times the length of the piston stroke. The top of the cylin-

ders is closed off by the cylinder head and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder block contains a water jacket, through which coolant is pumped to cool the cylinders.

The oil pan is bolted onto the bottom of the cylinder block. The oil pan is an oil reservoir made of pressed steel sheet. A dividing plate is included inside the oil pan to keep sufficient oil in the bottom of the pan even when the vehicle is tilted. This dividing plate also prevents the oil from making waves when the vehicle is stopped suddenly and thus shifting the oil away from the oil pump suction pipe.

TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Engine overheats	Cooling system faulty Incorrect ignition timing	Troubleshoot cooling system Reset timing	CO-4 EM-17
Engine will not crank or cranks slowly	Starting system faulty	Troubleshoot starting system	ST-2
Engine will not start/ hard to start (cranks OK)	<p>Vacuum leaks</p> <ul style="list-style-type: none"> ● PCV hoses ● (w/ EGR) EGR valve ● Intake manifold ● Air intake chamber ● Throttle body ● ISC valve <p>Pulling in air between air flow meter and throttle body</p> <p>Ignition problems</p> <ul style="list-style-type: none"> ● Ignition coil ● Igniter ● (7M-GE) Distributor (7M-GTE) Cam position sensor <p>High-tension cord disconnected or broken</p> <p>No fuel supply to injector</p> <ul style="list-style-type: none"> ● No fuel in tank ● Fuel pump not working ● Fuel filter clogged ● Fuel line clogged or leaking <p>EFI system problems</p> <p>ISC system problem</p> <p>Spark plugs faulty</p> <p>Low compression</p>	<p>Repair as necessary</p> <p>Repair as necessary</p> <p>Perform spark test</p> <p>Inspect cord</p> <p>Troubleshoot EFI system</p> <p>Repair as necessary</p> <p>Check ISC system</p> <p>Inspect plugs</p> <p>Check compression</p>	<p>FI-96, 98</p> <p>IG-5, 12</p> <p>IG-6, 13</p> <p>FI-12</p> <p>FI-108</p> <p>IG-7</p> <p>EM-26, 27</p>
Rough idle, stalls or misses	<p>Vacuum leaks</p> <ul style="list-style-type: none"> ● PCV hoses ● (w/ EGR) EGR valve ● Intake manifold ● Air intake chamber ● Throttle body ● ISC valve <p>Pulling in air between air flow meter and throttle body</p> <p>Incorrect idle speed</p> <p>Incorrect ignition timing</p> <p>Ignition problems</p> <ul style="list-style-type: none"> ● Ignition coil ● Igniter ● (7M-GE) Distributor (7M-GTE) Cam position sensor <p>High-tension cord faulty</p> <p>EFI system problems</p>	<p>Repair as necessary</p> <p>Check ISC system</p> <p>Reset timing</p> <p>Perform spark test</p> <p>Inspect cord</p> <p>Repair as necessary</p>	<p>FI-96, 98</p> <p>FI-108</p> <p>EM-17</p> <p>IG-5, 12</p> <p>IG-6, 13</p>

TROUBLESHOOTING (Cont'd)

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses (cont'd)	Spark plugs faulty Engine overheats Low compression	Inspect plugs Check cooling system Check compression	IG-7 CO-4 EM-26, 27
Engine hesitates/ poor acceleration	Vacuum leaks <ul style="list-style-type: none"> ● PCV hoses ● (w/ EGR) EGR valve ● Intake manifold ● Air intake chamber ● Throttle body ● ISC valve Pulling in air between air flow meter and throttle body Incorrect ignition timing Emission control system problem (cold engine) <ul style="list-style-type: none"> ● (w/ EGR) EGR system always on High-tension cord faulty Fuel system clogged Air cleaner clogged EFI system problems Spark plugs faulty Engine overheats Low compression	Repair as necessary Repair as necessary Reset timing Check EGR system Inspect cord Check fuel system Check air cleaner Repair as necessary Inspect plugs Check cooling system Check compression	FI-96, 98 EM-17 IG-6, 1 FI-73 EM-7 IG-7 CO-4 EM-26, 27
Engine diesels (runs after ignition switch is turned off)	EFI system problems	Repair as necessary	
Muffler explosion (after fire) on deceleration only	Deceleration fuel cut system always off	Check EFI (fuel cut) system	FI-128
Muffler explosion (after fire) all the time	Air cleaner clogged EFI system problem Incorrect ignition timing	Check air cleaner Repair as necessary Reset timing	EM-7 EM-17
Engine backfires	Vacuum leak <ul style="list-style-type: none"> ● PCV hoses ● (w/ EGR) EGR valve ● Intake manifold ● Air intake chamber ● Throttle body ● ISC valve Pulling in air between air flow meter and throttle body EFI system problem Insufficient fuel flow Incorrect ignition timing Carbon deposits in combustion chambers	Check hoses and repair as necessary Repair as necessary Repair as necessary Troubleshoot fuel system Reset timing Inspect cylinder head	FI-96, 98 EM-17 EM-37

TROUBLESHOOTING (Cont'd)

Problem	Possible cause	Remedy	Page
Excessive oil consumption	Oil leak PCV line clogged Piston rings worn or damaged Valve stem and guide worn Valve stem seal worn	Repair as necessary Check PCV system Check rings Check valves Check seals	EM-65 EM-37 EM-37
Poor fuel economy	Fuel leak Air cleaner clogged Incorrect ignition timing EFI system problems <ul style="list-style-type: none"> ● Injector faulty ● Deceleration fuel cut system faulty Idle speed too high Spark plugs faulty EGR system always on Low compression Tires improperly inflated Clutch slips Brakes drag	Repair as necessary Check air cleaner Reset timing Repair as necessary Check ISC system Inspect plugs Check EGR system Check compression Inflate tires to proper pressure Troubleshoot clutch Troubleshoot brakes	EM-7 EM-17 FI-108 IG-7 EM-26, 27
Unpleasant odor	Incorrect idle speed Incorrect ignition timing Vacuum leaks <ul style="list-style-type: none"> ● PCV hoses ● (w/ EGR) EGR valve ● Intake manifold ● Air intake chamber ● Throttle body EFI system problems	Check ISC system Reset timing Repair as necessary Repair as necessary	FI-108 EM-17

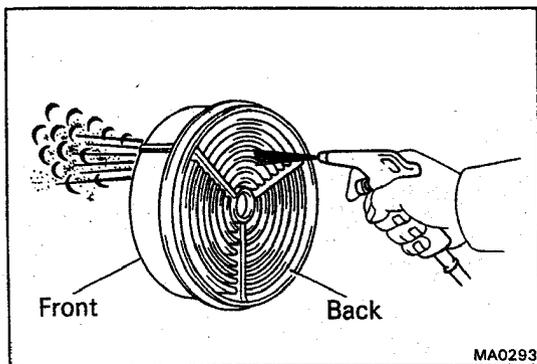
ENGINE TUNE-UP

INSPECTION OF ENGINE COOLANT

(See page CO-5)

INSPECTION OF ENGINE OIL

(See page LU-5)



INSPECTION OF AIR FILTER

- (a) Visually check that the air cleaner element is not excessively dirty, damaged or oily.
- (b) Clean the element with compressed air. First blow from back side thoroughly. Then blow off the front side of the element.

INSPECTION OF BATTERY

(See page CH-3)

INSPECTION OF HIGH-TENSION CORDS

(See pages IG-6, 13)

INSPECTION OF SPARK PLUGS

(See pages IG-7 to 9)

INSPECTION OF DRIVE BELT

(See page CH-4)

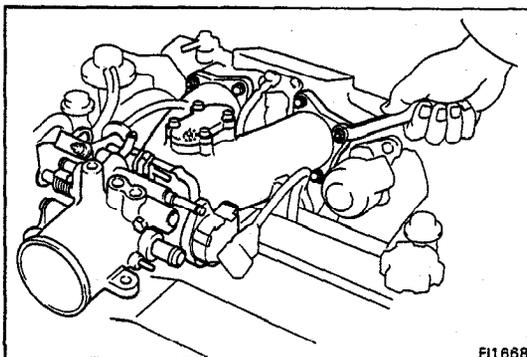
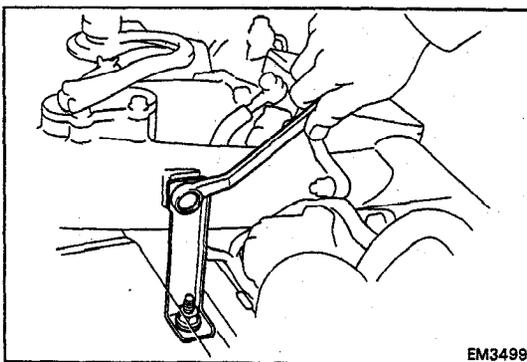
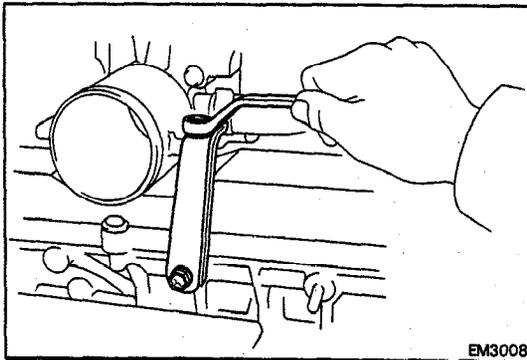
INSPECTION AND ADJUSTMENT OF VALVE CLEARANCE

NOTE: Check and adjust the valve clearance while the engine is cold.

(7M-GE)

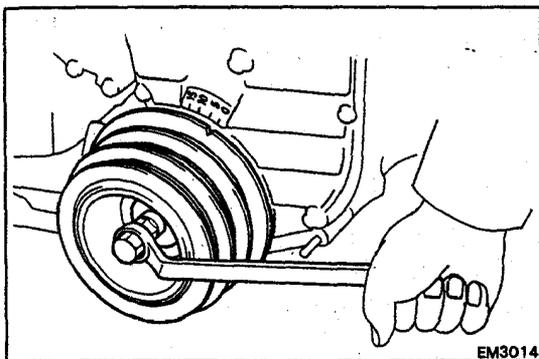
1. REMOVE AIR INTAKE CONNECTOR

- (a) Remove the PCV pipe.
- (b) (ex. MS RHD)
Disconnect the accelerator connecting rod.
- (c) Disconnect the water by-pass hoses from the throttle body.
- (d) Disconnect following hoses:
 - (w/ EGR)
VSV hose (for EGR)
 - (w/ TWC)
BVSV hose
 - (w/ EGR)
EGR vacuum modulator hoses
 - No.7 air hose
- (e) Disconnect the throttle position sensor connector.
- (f) Remove the throttle body bracket(s).



- (g) Remove the air intake connector bracket mounting bolts.
- (h) Remove the four bolts, two nuts, air intake connector and gasket.

2. REMOVE CYLINDER HEAD COVERS (See pages EM-59, 60)

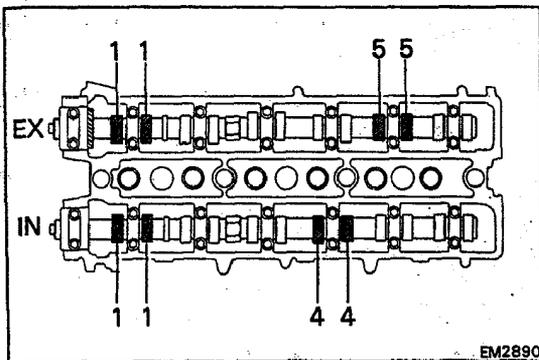


3. MEASURE VALVE CLEARANCE

(a) Set No.1 cylinder to TDC/compression.

- Turn the crankshaft pulley and align its groove with the "O" mark on the No.1 timing belt cover.
- Check that the valve lifters on the No.1 cylinder are loose and valve lifters on the No.6 cylinder are tight.

If not, turn the crankshaft pulley one complete revolution.

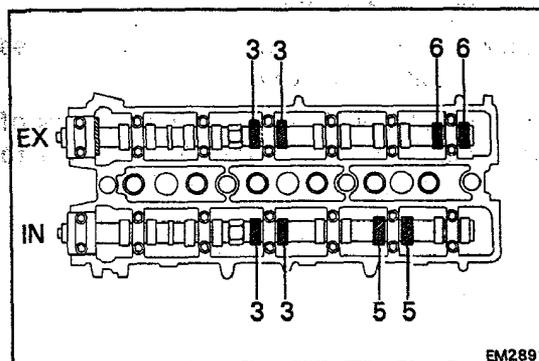


(b) Measure the clearance of No.1 (IN) and No.4 (IN) and No.1 (EX) and No.5 (EX) valves.

- Measure only those valves indicated in the figure.
- Record the measurements which are out of specification. They will be used later to determine the required replacement shims.

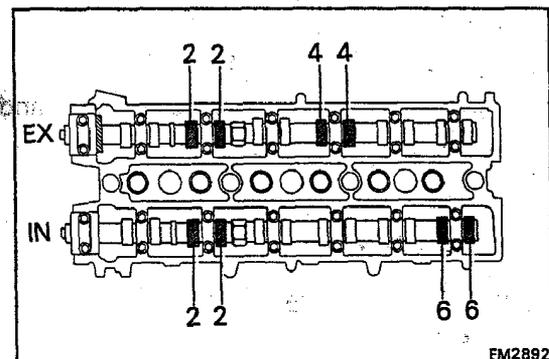
Valve clearance (Cold):

Intake 0.15 – 0.25 mm (0.0059 – 0.0098 in.)
 Exhaust 0.20 – 0.30 mm (0.0079 – 0.0118 in.)



(c) Turn the crankshaft pulley 2/3 revolution (240°) and measure the clearance of No.3 (IN) and No.5 (IN) and No.3 (EX) and No.6 (EX) valves.

- Check that the valve lifters on the No.3 cylinder are loose.
- Measure only those valves indicated in the figure.
- Record the measurements which are out of specification. They will be used later to determine the required replacement shims.



(d) Turn the crankshaft pulley 2/3 revolution (240°) and measure the clearance of No.2 (IN) and No.6 (IN) and No.2 (EX) and No.4 (EX) valves.

- Check that the valve lifters on the No.2 cylinder are loose.
- Measure only those valves indicated in the figure.
- Record the measurements which are out of specification. They will be used later to determine the required replacement shims.

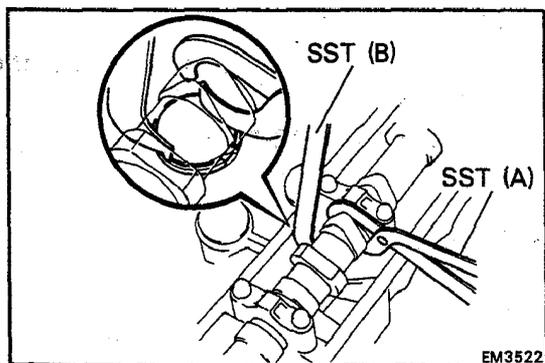
4. ADJUST VALVE CLEARANCE

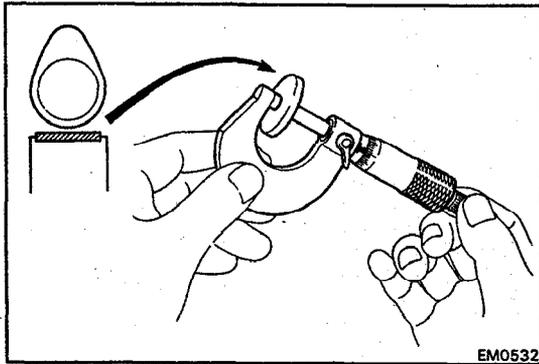
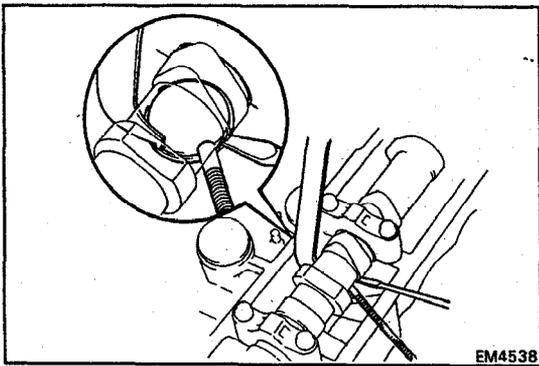
(a) Remove the adjusting shim.

- Turn the crankshaft pulley to position the lobe on the adjusting valve camshaft upward.
- Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

SST 09248-55010

NOTE: Before pressing down the valve lifter, position the notch toward the spark plug.





- Remove the adjusting shim with a small screwdriver and magnetic finger.

(b) Determine the replacement shim size by using the following (Formula or Chart).

- Using a micrometer, measure the thickness of the shim which was removed.
- Calculate the thickness of the new shim so the valve clearance comes within specified value.

T Thickness of shim used

A Valve clearance measured

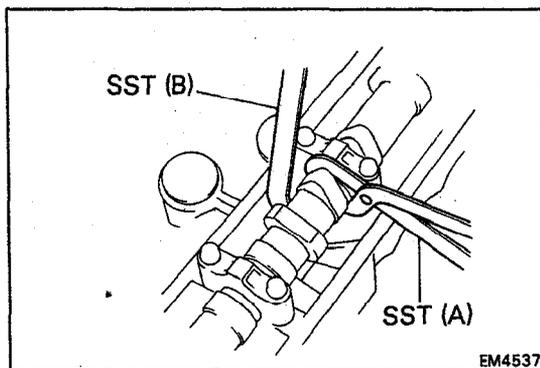
N Thickness of shim new

Intake $N = T + (A - 0.20 \text{ mm (0.0079 in.)})$

Exhaust $N = T + (A - 0.25 \text{ mm (0.0098 in.)})$

- Select a new shim with a thickness as close as possible to the calculated value.

NOTE: Shims are available in 17 sizes, in increments of 0.050 mm (0.0020 in.), from 2.500 mm (0.0984 in.) to 3.300 mm (0.1299 in.).



(c) Install a new adjusting shim.

- Place a new adjusting shim on the valve lifter.
- Using SST (A), press down the valve lifter and remove SST (B).

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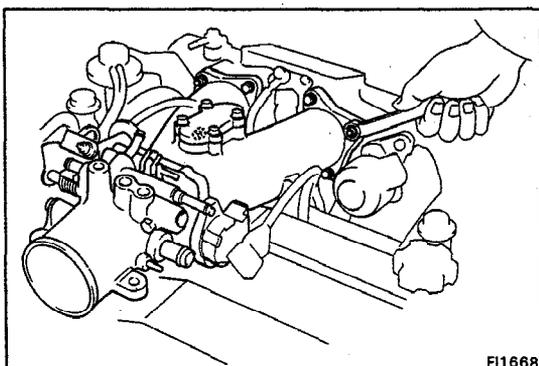
5. RECHECK VALVE CLEARANCE

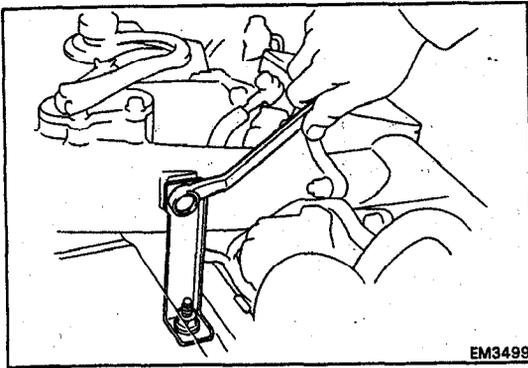
6. INSTALL CYLINDER HEAD COVERS (See pages EM-59, 60)

7. INSTALL AIR INTAKE CONNECTOR

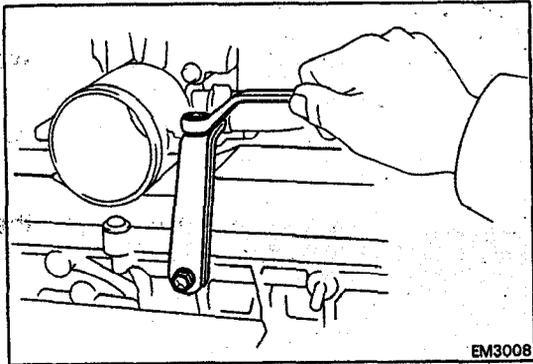
- (a) Install a new gasket and air intake connector with the four bolts and two nuts.

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

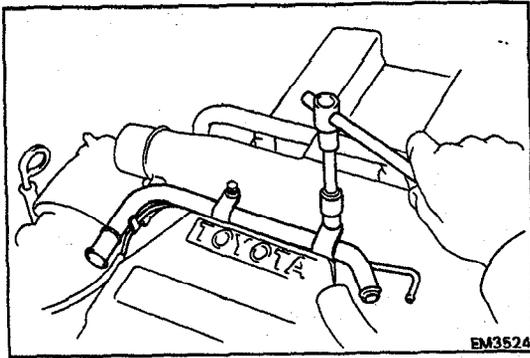




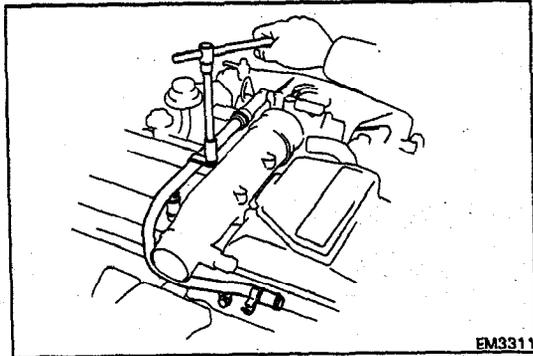
- (b) Install the air intake connector bracket mounting bolts.



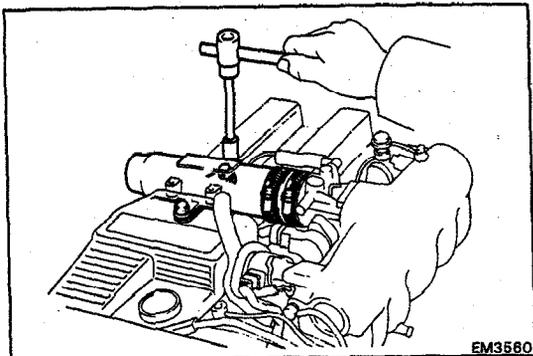
- (c) Install the throttle body bracket(s).
- (d) Connect the throttle position sensor connector.
- (e) Connect following hoses:
- No.7 air hose
 - (w/ EGR)
EGR vacuum modulator hoses
 - (w/ TWC)
BVSV hose
 - (w/ EGR)
VSV hose (for EGR)
- (f) Connect the water by-pass hoses.
- (g) (ex. MS RHD)
Connect the accelerator connecting rod.
- (h) Install the PCV pipe.

**(7M-GTE)****1. REMOVE ISC PIPE**

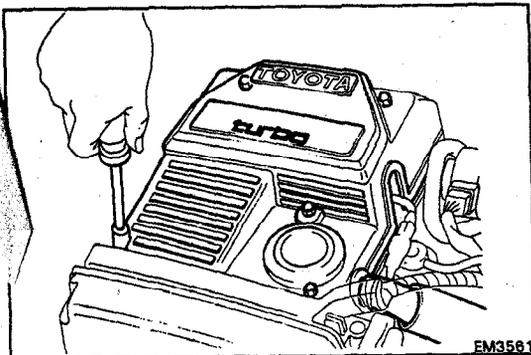
- (a) Disconnect the hoses from the ISC pipe.
- (b) Remove the two bolts and ISC pipe.

**2. REMOVE PCV PIPE WITH HOSES**

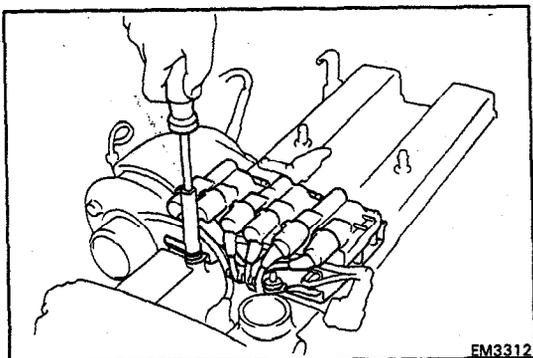
- (a) Disconnect the oxygen sensor wire from the two clamp.
- (b) Disconnect the No.4 PCV hose from the PCV pipe.
- (c) Remove the two bolts.
- (d) Disconnect the PCV pipe with hoses from the cylinder head covers and throttle body.

**3. REMOVE INTAKE AIR CONNECTOR**

- (a) Disconnect the air valve hose from the intake air connector.
- (b) Loosen the clamp and remove the two bolts.
- (c) Remove the intake air connector.

**4. REMOVE IGNITION COVER**

- (a) Remove the oil filler cap.
- (b) Remove the five nuts and ignition coil cover.

**5. REMOVE IGNITION COIL WITH BRACKET**

- (a) Disconnect the connector and ground strap.
- (b) Remove the nut.
- (c) Remove the No.1 and No.2 high-tension cords from the ignition coil and clamp.
- (d) Remove the ignition coil with bracket and high-tension cords.
- (e) Remove the No.1 and No.2 high-tension cords from the spark plugs.

6. REMOVE CYLINDER HEAD COVERS

- (a) Remove the accelerator link.
- (b) Disconnect the No.3 PCV hose.
- (c) Remove the cylinder head covers.

7. MEASURE VALVE CLEARANCE
(See step 3 on page EM-9)**8. ADJUST VALVE CLEARANCE**
(See step 4 on pages EM-9, 10)**9. RECHECK VALVE CLEARANCE****10. INSTALL CYLINDER HEAD COVERS**
(See pages EM-59, 60)**11. INSTALL IGNITION COIL WITH BRACKET**

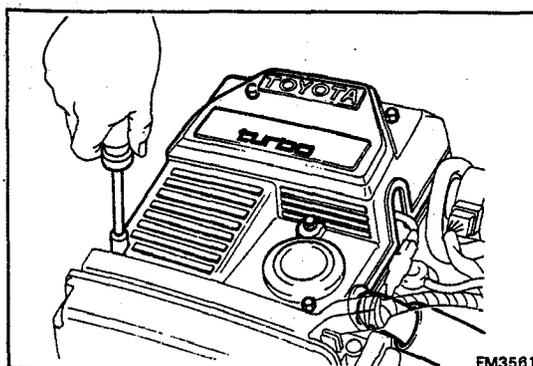
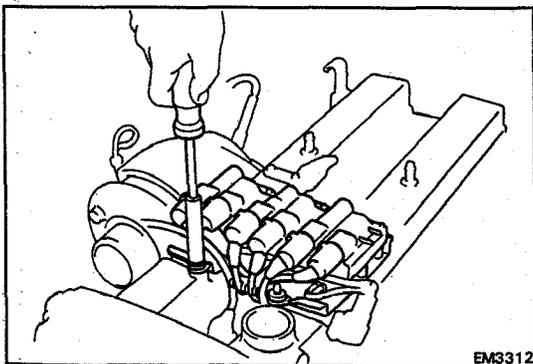
- (a) Install the No.1 and No.2 high-tension cords to spark plugs.
- (b) Install the ignition coil with bracket and high-tension cord. (See page IG-15)
- (c) Install the No.1 and No.2 high-tension cords to ignition coil and clamp.

- (d) Install and torque the nut.

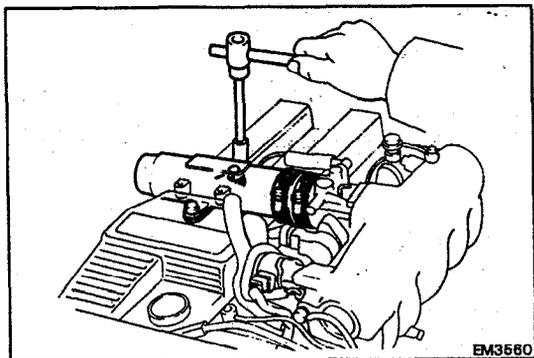
Torque: 55 Kg-cm (48 in.-lb, 5.4 N·m)

NOTE: Do not over tighten the nut.

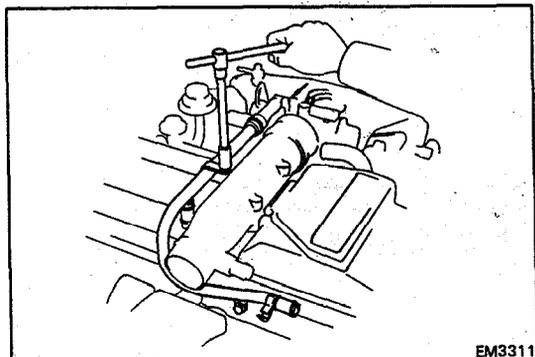
- (e) Connect the ground strap and connector.

**12. INSTALL IGNITION COIL COVER**

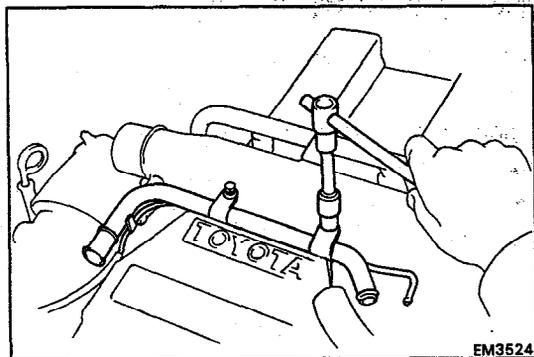
- (a) Install the ignition coil cover with the five nuts.
- (b) Install the oil filler cap.

**13. INSTALL INTAKE AIR CONNECTOR**

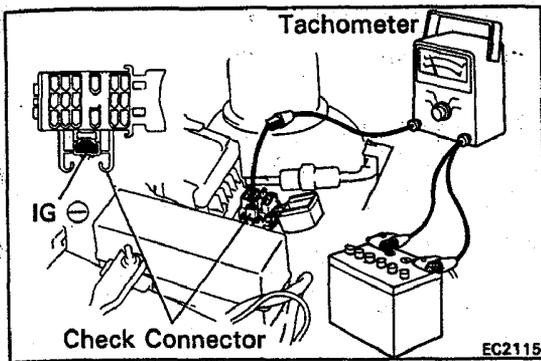
- (a) Install the intake air connector to throttle body.
- (b) Install and tighten the two nuts.
- (c) Tighten the clamp.
- (d) Connect the air valve hose to intake air connector.

**14. INSTALL PCV PIPE WITH HOSES**

- (a) Install the PCV pipe with hoses to the throttle body and cylinder head covers.
- (b) Install and tighten the two bolts.
- (c) Connect the No.4 PCV hose to the PCV pipe.
- (d) Connect the oxygen sensor wire to the two clamps.

**15. INSTALL ISC PIPE**

- (a) Install the ISC pipe with the two bolts.
- (b) Connect the hoses to the ISC pipe.



INSPECTION AND ADJUSTMENT OF IGNITION TIMING

1. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

2. CONNECT TACHOMETER AND TIMING LIGHT TO ENGINE

Connect the tachometer positive terminal to the check connector terminal IG ⊖.

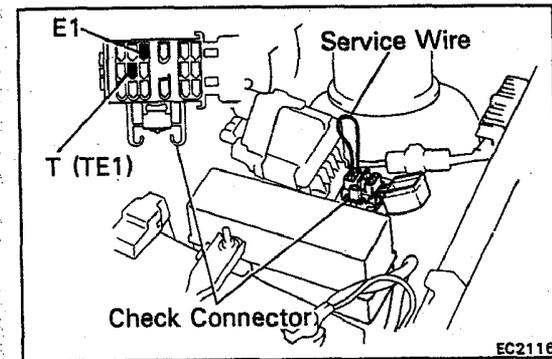
CHECK CONNECTOR LOCATION:

See pages FI-110, 111

CAUTION:

- Never allow the tachometer terminal to touch ground as it could result in damage to the igniter and/or ignition coil.
- As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of your unit before using.

NOTE (7M-GTE): Connect the timing light pickup to the No.6 cylinder high-tension cord.



3. CHECK IGNITION TIMING

- (a) Using a service wire, short terminals T (MA) or TE1 (MS) and E1 of the check connector.

CHECK CONNECTOR LOCATION:

See pages FI-110, 111

- (b) Check the idle speed.

Idle speed:

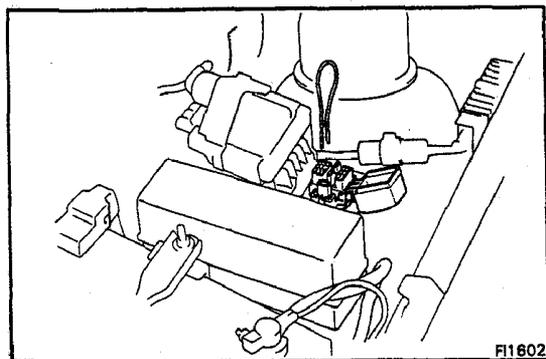
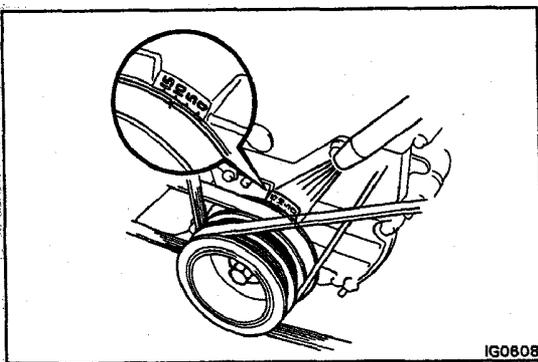
7M-GE	w/ TWC	700 rpm
	w/o TWC	800 rpm
7M-GTE		800 rpm

- (c) Using a timing light, check the ignition timing.

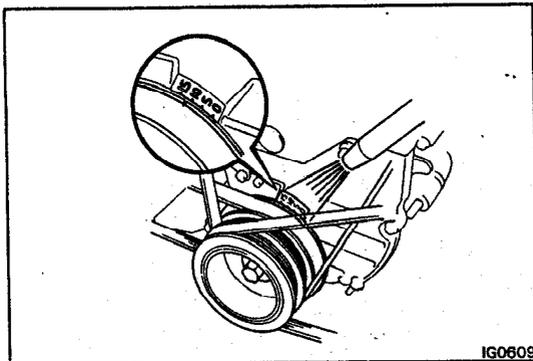
Ignition timing: 10° BTDC @ idle
[w/ short-circuited T (TE1) and E1 and Transmission in "N" range]

If necessary, loosen the distributor (7M-GE) or cam position sensor (7M-GTE) bolt and turn the distributor (cam position sensor) to align the marks. Recheck the timing after tightening the distributor (cam position sensor).

Torque: 140 kg-cm (10 ft-lb, 14 N·m)



- (d) Unshort the check connector.



4. FURTHER CHECK IGNITION TIMING

Check that the ignition timing advances.

Ignition timing:

7M-GE 10 – 13° BTDC @ idle

7M-GTE More than 12° BTDC @ idle

5. DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE

INSPECTION AND ADJUSTMENT OF IDLE MIXTURE (w/o TWC)

1. INITIAL CONDITIONS

- Air cleaner installed
- Normal engine operating temperature
- All pipes and hoses of air intake system connected
- All accessories switched off
- All vacuum lines properly connected
- EFI system wiring connectors fully plugged
- Ignition timing set correctly
- Transmission in N range

2. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

3. CONNECT TACHOMETER TO ENGINE (See page EM-17)

4. CHECK IDLE SPEED

Idle speed: 800 rpm

5. INSPECT AND ADJUST IDLE CO CONCENTRATION

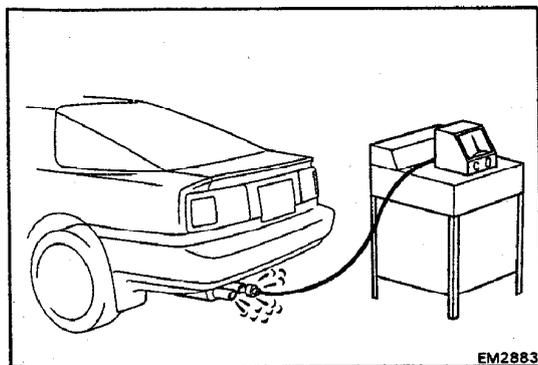
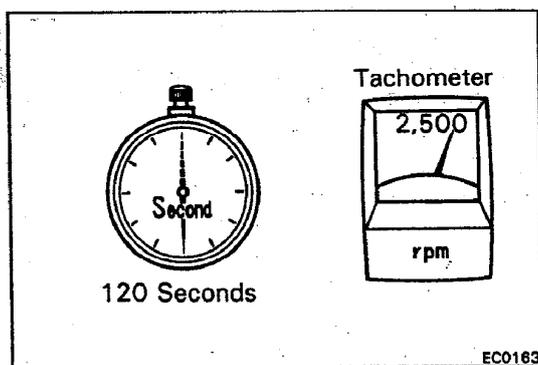
CAUTION:

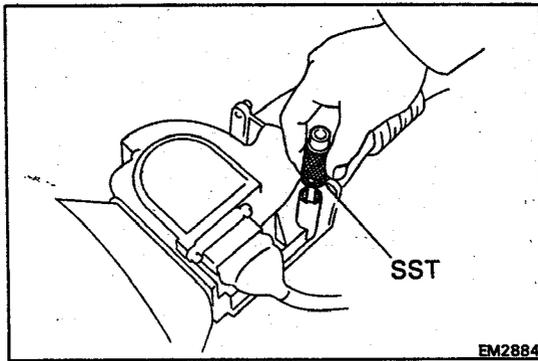
- Always use a CO meter when adjusting the idle mixture. It is not necessary to adjust with the idle mixture adjusting screw in most vehicles if they are in good condition. If a CO meter is not available, **DO NOT ATTEMPT TO ADJUST WITH THE SCREW.**
- If a CO meter is not available and it is absolutely necessary to adjust with the idle mixture adjusting screw, or if the air flow meter is replaced, use the alternative method.

A. METHOD WITH CO METER

- Check that the CO meter is properly calibrated.
- Race the engine for approx. 120 seconds at approx. 2,500 rpm before measuring the concentration.
- Wait 1 – 3 minutes after racing the engine to allow the concentration to stabilize.
- Insert a testing probe at least 40 cm (1.3 ft) into the tailpipe, and measure the concentration with a short time.

Idle CO concentration: $1.0 \pm 0.5 \%$





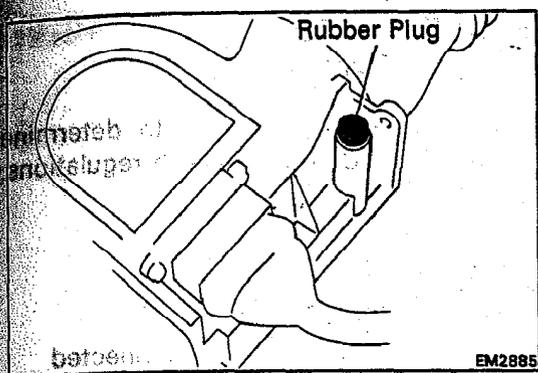
If the CO concentration is not as specified, adjust the idle mixture by turning the idle mixture adjusting screw with SST.

SST 09243-00020

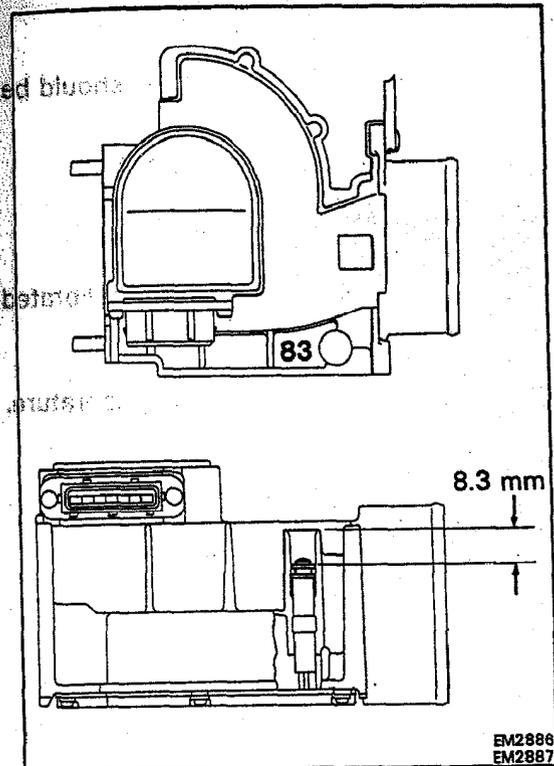
- If the CO concentration is within specification, this adjustment is complete.
- If the CO concentration cannot be corrected by idle mixture adjustment, see the table below for other possible causes.

Troubleshooting

HC	CO	SYMPTOMS	CAUSES
High	Normal	Rough idle	<ol style="list-style-type: none"> 1. Faulty ignition: <ul style="list-style-type: none"> ● Incorrect timing ● Fouled, shorted or improperly gapped plugs ● Open or crossed high-tension cords ● Cracked distributor cap 2. Incorrect valve clearance 3. Leaky EGR valve 4. Leaky intake and exhaust valves 5. Leaky cylinder
High	Low	Rough idle (Fluctuating HC reading)	<ol style="list-style-type: none"> 1. Vacuum leak: <ul style="list-style-type: none"> ● Vacuum hose ● EGR valve ● Intake manifold (Air intake chamber) ● Throttle body ● Cylinder head gasket ● Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	<ol style="list-style-type: none"> 1. Restricted air filter 2. Faulty EFI system: <ul style="list-style-type: none"> ● Faulty pressure regulator ● Clogged fuel return line ● Faulty air flow meter ● Defective water temp. sensor ● Defective air temp. sensor ● Faulty ECU ● Faulty injector ● Faulty cold start injector ● Faulty throttle position sensor



- (e) Reinstall the rubber plug into the hole of the idle mixture adjusting screw.



B. ALTERNATIVE METHOD

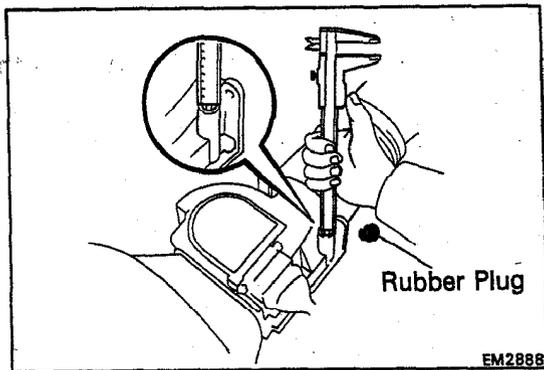
NOTE:

- This method is to be used ONLY when it is absolutely necessary to adjust the idle mixture screw or if the air flow meter is replaced without the aid of a CO meter.
- The inscribed number shows the depth of the idle mixture screw positioned for presetting.

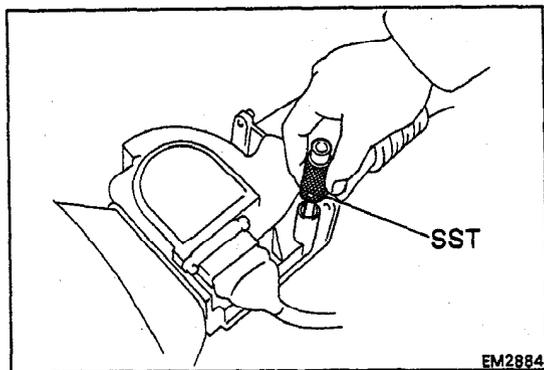
Example: Inscribed number depth
83 → 8.3 mm (0.326 in.)

Depths over 10 mm with a decimal point are abbreviated.

Example: Inscribed number depth
15 → 11.5 mm (0.453 in.)



- (a) Remove the rubber plug from the air flow meter.
(b) Measure the depth of the idle mixture adjusting screw with vernier calipers.



- (c) Adjust the depth of idle mixture adjusting screw by turning the screw with SST.

SST 09243-00020

- (d) Reinstall the rubber plug into the hole of the idle mixture adjusting screw.

INSPECTION OF IDLE HC/CO CONCENTRATION (w/ TWC)

NOTE: This check method is used only to determine whether or not the idle HC/CO complies with regulations.

1. INSTALL CONDITIONS

- (a) Air cleaner installed
- (b) Normal engine operating temperature
- (c) All pipes and hoses of intake system connected
- (d) All accessories switches off
- (e) All vacuum lines properly connected

NOTE: All vacuum hoses for EGR system etc. should be properly connected

- (f) EFI system wiring connectors fully plugged
- (g) Ignition timing set correctly
- (h) Transmission in "N" range
- (i) Tachometer and HC/CO meter at hand and calibrated

2. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

3. CONNECT TACHOMETER TO ENGINE

(See page EM-17)

4. CHECK IDLE SPEED

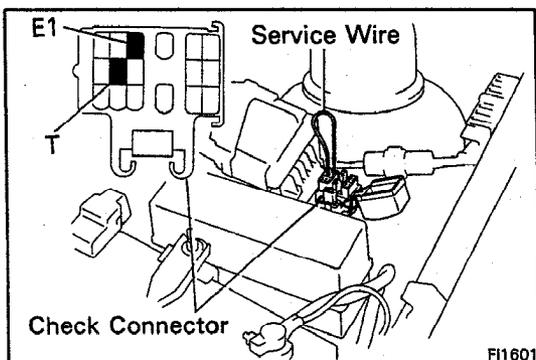
Idle speed:

7M-GE	700 rpm
7M-GTE	800 rpm

5. CHECK OXYGEN SENSOR OPERATION

- (a) Using a service wire, short terminals T and E1 of the check connector.

CHECK CONNECTOR LOCATION: See page FI-110

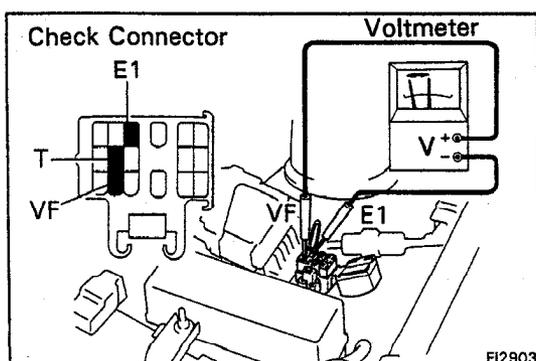


- (b) Connect the positive (+) probe of a voltmeter to terminal VF of the check connector, and negative (-) probe to terminal E1.
- (c) Hold the engine speed at 2,500 rpm for approx. 2 minutes.
- (d) Then, maintaining engine at 2,500 rpm, count how many times needle of voltmeter fluctuates between 0 and 5 V.

Minimum needle fluctuation:

8 times for every 10 seconds

If the fluctuation is less than minimum, check the air induction system for leakage. If necessary, see EFI SYSTEM.



6. RACE ENGINE AT 2,500 RPM APPROX. 2 MINUTES
7. INSERT TESTING PROBE OF HC/CO METER INTO TAIL PIPE AT 40 cm (1.3 ft)
8. MEASURE HC/CO CONCENTRATION AT IDLE

Wait at least one minute before measuring to allow the concentration to stabilize.

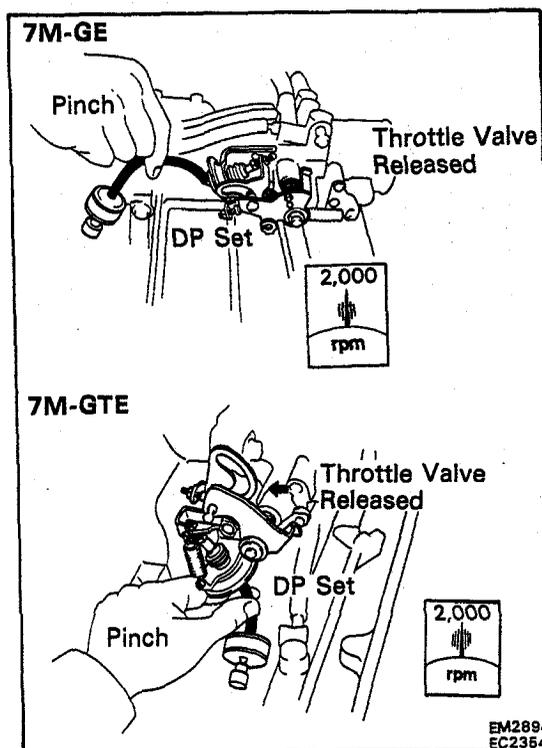
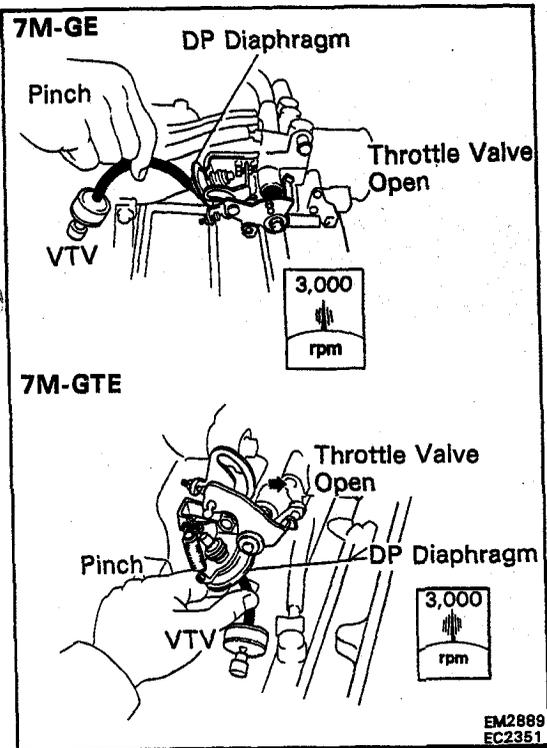
Complete the measuring within three minutes.

Idle CO concentration: 0 – 0.5 %

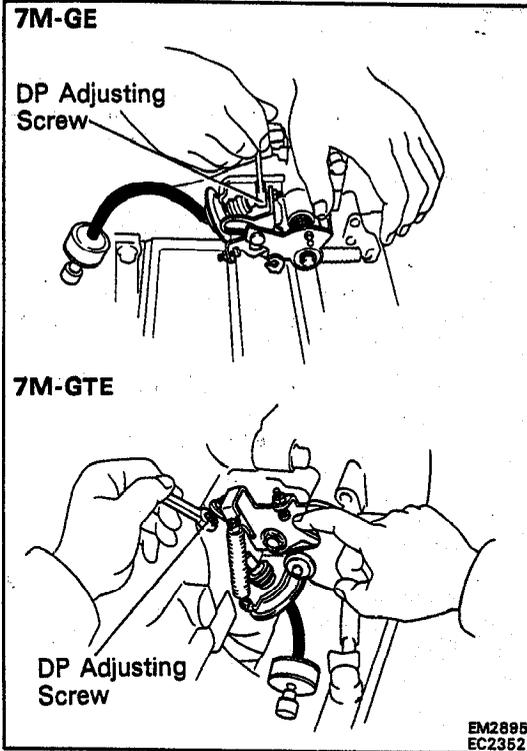
If the CO/HC concentration does not conform to your regulations, see the table in page EM-20 for possible causes.

INSPECTION AND ADJUSTMENT OF DASH POT (DP) SYSTEM

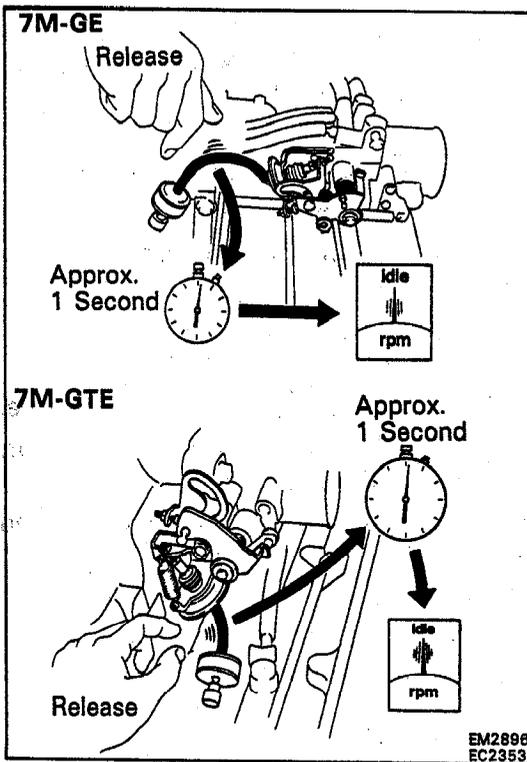
1. WARM UP ENGINE
2. CONNECT TACHOMETER TO ENGINE
(See page EM-17)
3. CHECK IDLE SPEED
4. INSPECT AND ADJUST DP SETTING SPEED
 - (a) Maintain the engine speed at 3,000 rpm.
 - (b) Pinch the vacuum hose between the DP and VTV.



- (c) Release the throttle valve.
 - (d) Check that the DP is set.
- DP setting speed: 2,000 rpm**

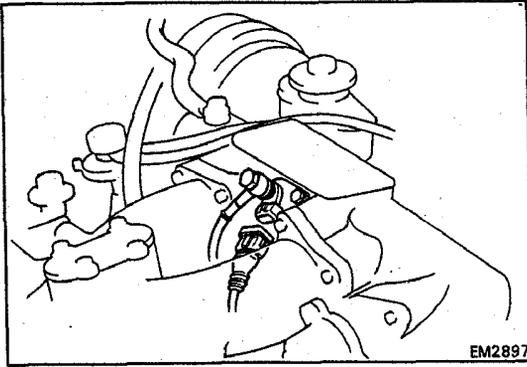


If not at specified speed, adjust with the DP adjusting screw.



5. CHECK OPERATION OF VTV

- (a) Set the DP speed in the same procedure as above; (a) to (c).
- (b) Release the pinched hose and check that the engine returns to idle speed in approx. 1 second.



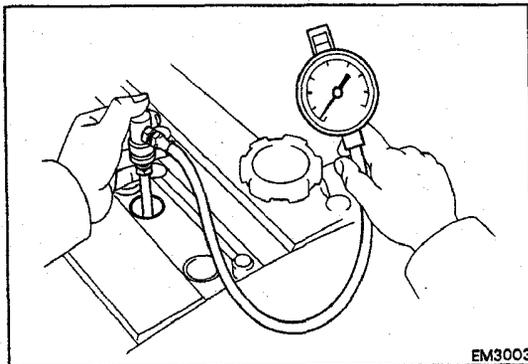
EM2897

COMPRESSION CHECK

NOTE: If there is lack of power, excessive oil consumption or poor fuel mileage, measure the cylinder compression pressure.

(7M-GE)

1. **WARM UP ENGINE**
2. **DISCONNECT COLD START INJECTOR CONNECTOR**
3. **DISCONNECT SOLENOID RESISTOR CONNECTOR**
4. **DISCONNECT DISTRIBUTOR CONNECTOR**
5. **REMOVE THROTTLE BODY**
 - (a) Remove the PCV hose.
 - (b) Disconnect the water by-pass hoses and plug the hose end.
 - (c) Disconnect following hoses:
 - (w/ EGR)
VSV hoses
 - (w/ TWC)
BVSV hoses
 - (w/ EGR)
EGR vacuum modulator hoses
 - No.7 air hose
 - (d) Disconnect the throttle position sensor connector.
 - (e) Remove the throttle body bracket(s).
 - (f) Remove the four bolts, throttle body and gasket.
6. **REMOVE SPARK PLUGS (See page IG-7)**
7. **CHECK CYLINDER COMPRESSION PRESSURE**



EM3003

- (a) Insert a compression gauge into the spark plug hole.
- (b) While cranking the engine with the starter motor, measure the compression pressure.

NOTE: Always use a fully charged battery to obtain an engine revolution of more than 250 rpm.

- (c) Repeat steps (a) through (b) for each cylinder.

Compression pressure:

11.0 kg/cm² (156 psi, 1,079 kPa) or more

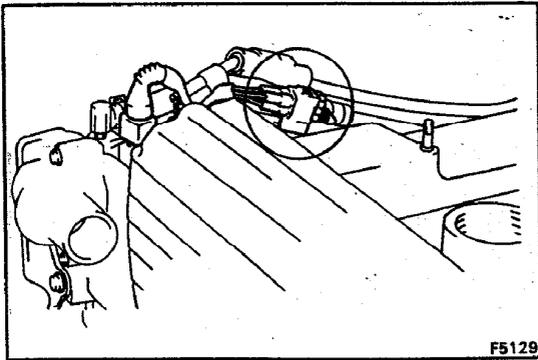
Minimum pressure:

9.0 kg/cm² (128 psi, 883 kPa)

Difference between each cylinder:

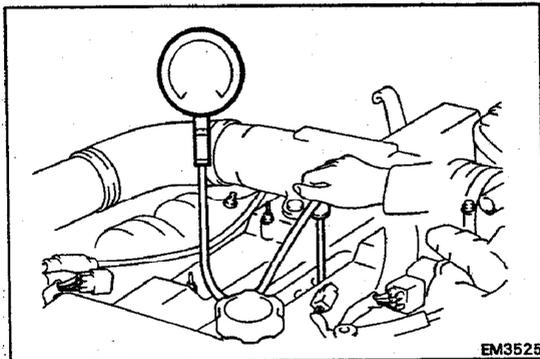
1.0 kg/cm² (14 psi, 98 kPa) or less

- (d) If cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (b) for the cylinder with low compression.
 - If adding oil helps the compression, chances are that the piston rings and/or cylinder bore are worn or damaged.
 - If pressure stays low, a valve may be sticking or seating improperly, or there may be leakage past

**(7M-GTE)**

1. WARM UP ENGINE
2. DISCONNECT SOLENOID RESISTOR CONNECTOR
3. DISCONNECT CAM POSITION SENSOR CONNECTOR

4. REMOVE NO.1 AIR CLEANER HOSE
5. REMOVE PCV PIPE
6. REMOVE IGNITION COIL
(See steps 4, 5 on page EM-12)
7. REMOVE SPARK PLUGS (See page IG-12)



8. CHECK CYLINDER COMPRESSION PRESSURE
(See step 7 on page EM-26)

Compression pressure:

10.0 kg/cm² (142 psi, 981 kPa) or more

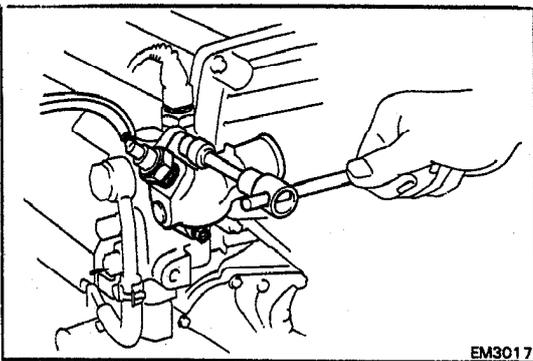
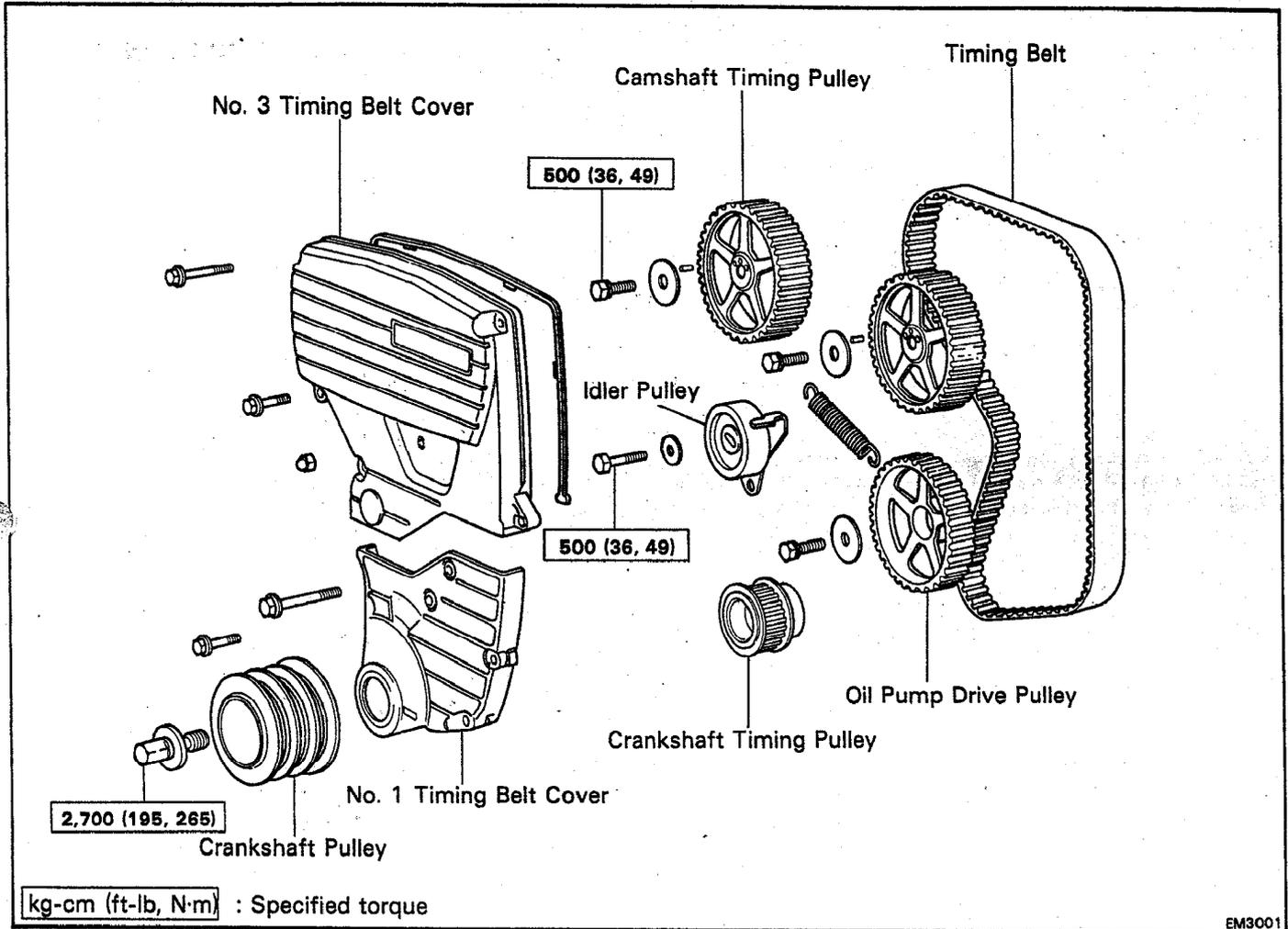
Minimum pressure:

9.0 kg/cm² (128 psi, 883 kPa)

Difference between each cylinder:

1.0 kg/cm² (14 psi, 98 kPa) or less

TIMING BELT COMPONENTS



REMOVAL OF TIMING BELT

1. REMOVE SPARK PLUGS

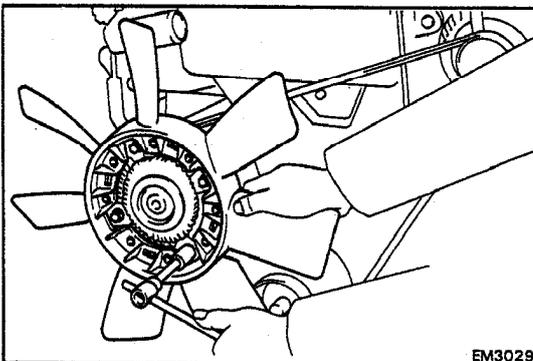
2. REMOVE WATER OUTLET

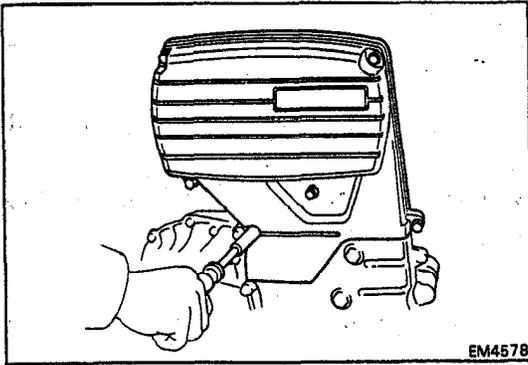
Remove the two bolts, water outlet and thermostat with gasket.

**3. (with A/C)
REMOVE A/C BELT**

4. REMOVE FAN AND ALTERNATOR DRIVE BELT

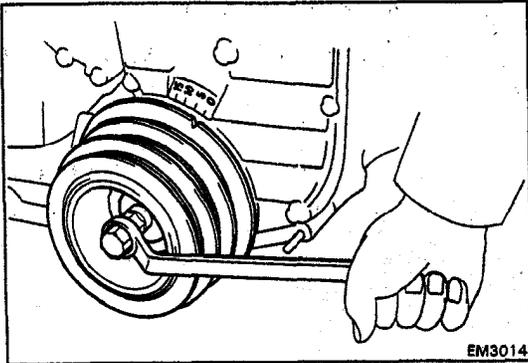
5. REMOVE PS BELT





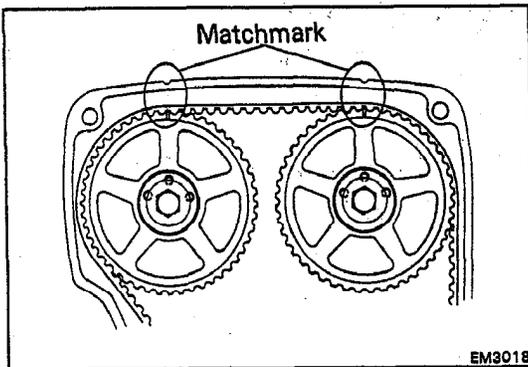
6. REMOVE NO.3 TIMING BELT COVER

Remove the five bolts, nut and No.3 timing belt cover with the gasket.



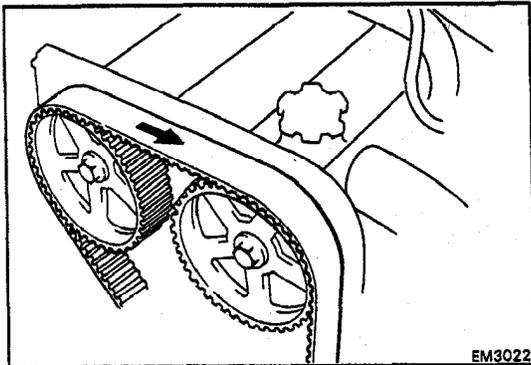
7. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley and align its groove with the "0" mark on the No.1 timing belt cover.



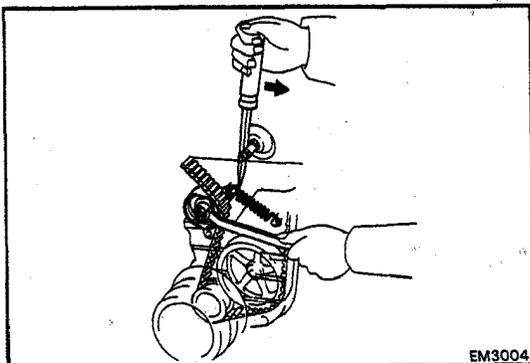
(b) Check that the matchmarks on the camshaft timing pulleys and No.2 timing belt cover are aligned.

If not, turn the crankshaft pulley one complete revolution.



8. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEYS

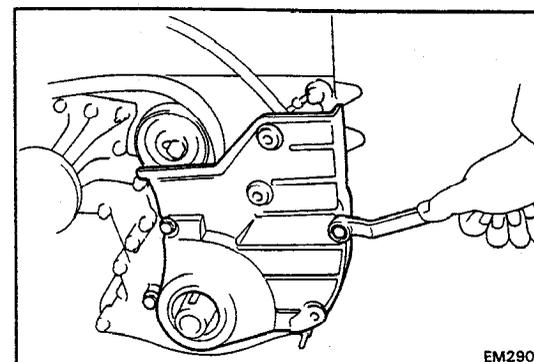
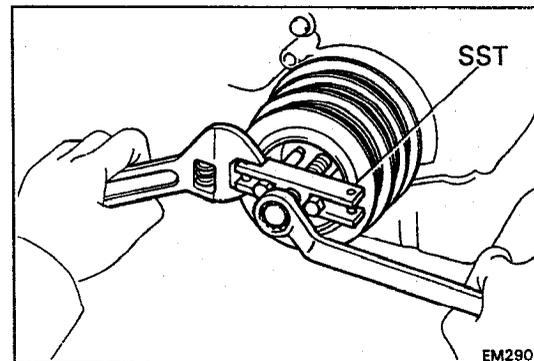
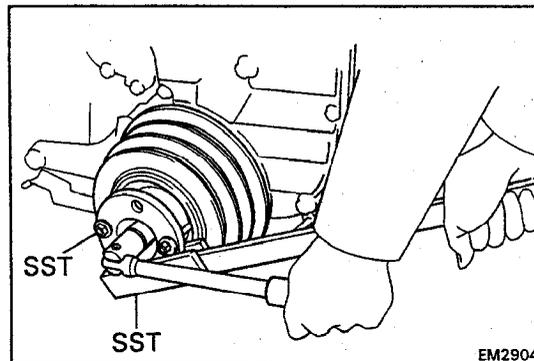
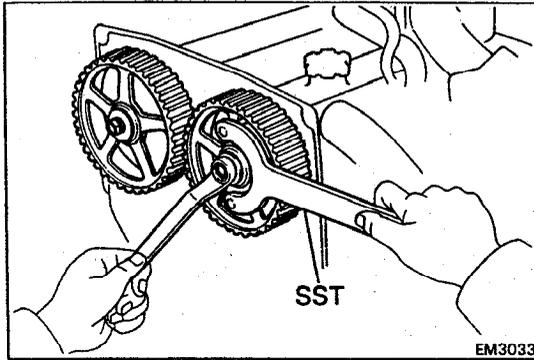
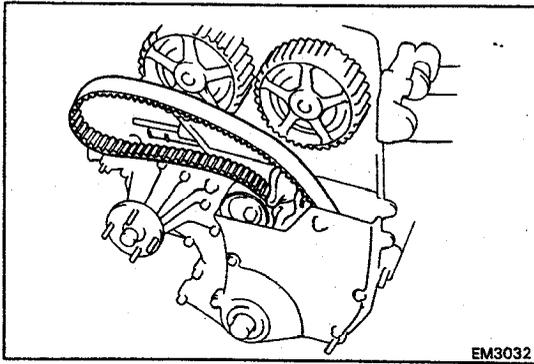
NOTE: If reusing the timing belt, draw a direction arrow on the belt (in direction of engine revolution).



(a) Loosen the idler pulley bolt and shift it left as far as it will go with a screwdriver and wrench.

(b) Temporarily tighten the set bolt and then relieve the timing belt tension.

(c) Remove the belt from the camshaft timing pulley.

**NOTE:**

- Support the belt so 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 belt to come into contact with oil, water and dust.

9. REMOVE CAMSHAFT TIMING PULLEYS

Using SST to hold the pulley, remove the pulley bolt, timing pulley and match pin.

SST 09278-54012

CAUTION: Do not make use of the timing belt tension when removing and installing the pulley set bolts.

10. REMOVE CRANKSHAFT PULLEY

- (a) Using SST to hold the crankshaft pulley, loosen the pulley bolt.

SST MA 09213-70010 and 09330-00021
MS 09213-54014 and 09330-00021

- (b) Remove SST and pulley bolt.

- (c) Using SST, remove the pulley.

SST 09213-31021

11. REMOVE PS AIR PIPE**12. REMOVE NO.1 TIMING BELT COVER**

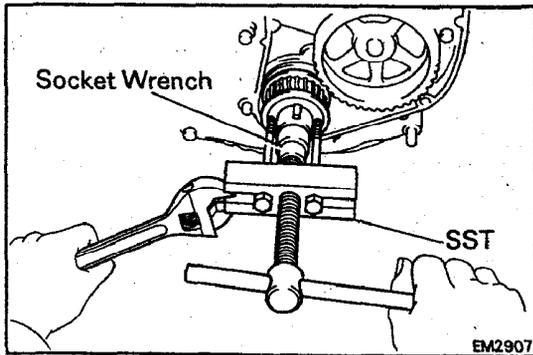
(with A/C)

Remove the nine bolts, nut, A/C idler pulley bracket, compressor bracket and No.1 timing belt cover.

(without A/C)

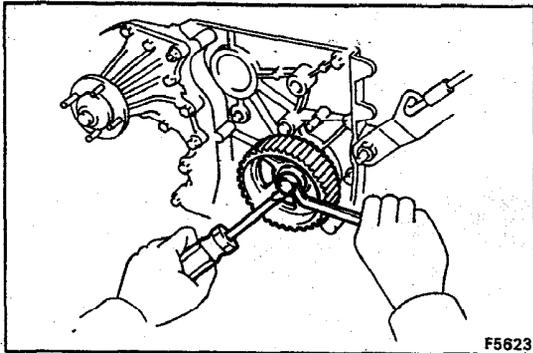
Remove the six bolts, No.1 timing belt cover.

13. REMOVE TIMING BELT**14. REMOVE IDLER PULLEY AND TENSION SPRING**

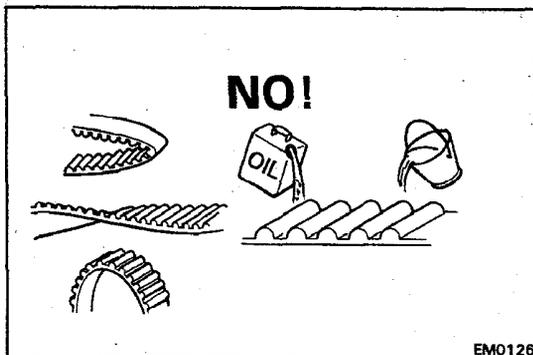
**15. REMOVE CRANKSHAFT TIMING PULLEY**

Using SST and a socket wrench, remove the crankshaft timing pulley.

SST 09213-60017

**16. REMOVE OIL PUMP DRIVE PULLEY**

Using a screwdriver to hold the pulley, remove the pulley bolt and pulley.

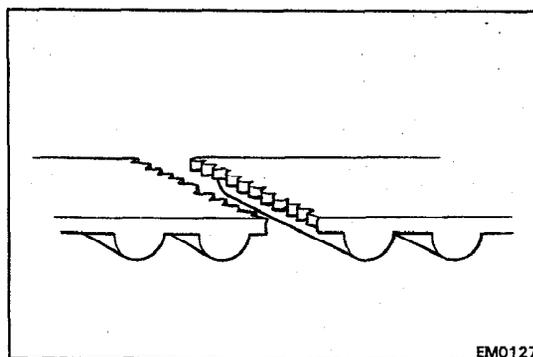
**INSPECTION OF COMPONENTS****1. INSPECT TIMING BELT****CAUTION:**

- Do not bend, twist or turn the belt inside out.
- Do not allow the belt to come into contact with oil, water or steam.
- Do not utilize belt tension when installing or removing the set bolt of the camshaft timing pulley.

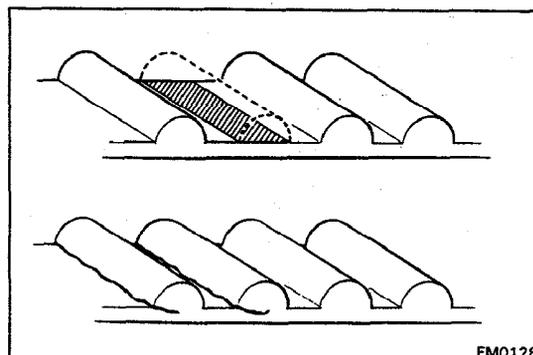
If there are defects as shown in the figures. Check the following points and replace the timing belt if necessary.

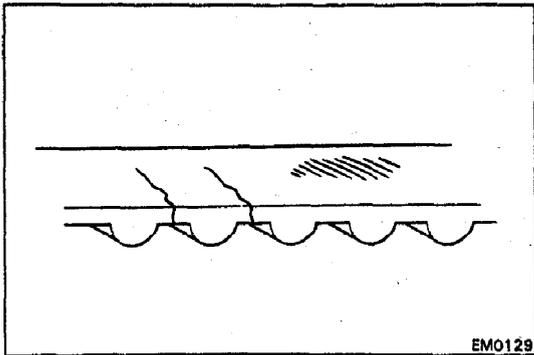
(a) Premature parting

- Check for proper installation.
- Check the timing belt cover gasket for damage and proper installation.

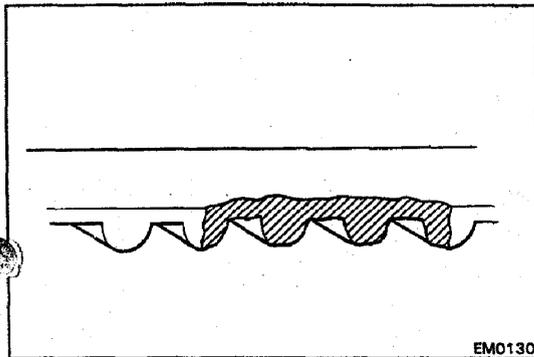


- (b) If the belt teeth are cracked or damaged, check to see if the camshaft is locked.**

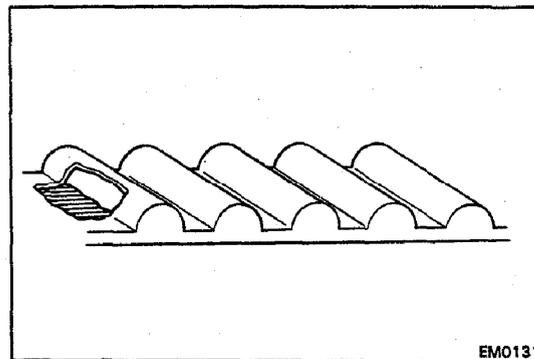




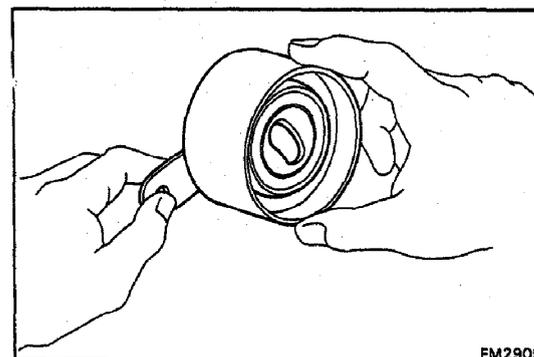
- (c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on one side of the idler pulley lock.



- (d) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.



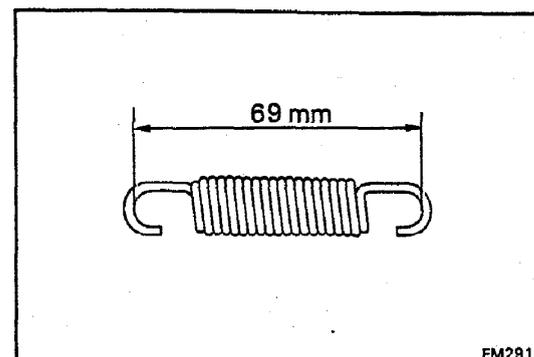
- (e) If there is noticeable wear on the belt teeth, check the timing belt cover gasket for damage and check for foreign materials on the pulley teeth.



2. INSPECT IDLER PULLEY

Check the turning smoothness of the timing belt idler pulley.

If necessary, replace the idler pulley.

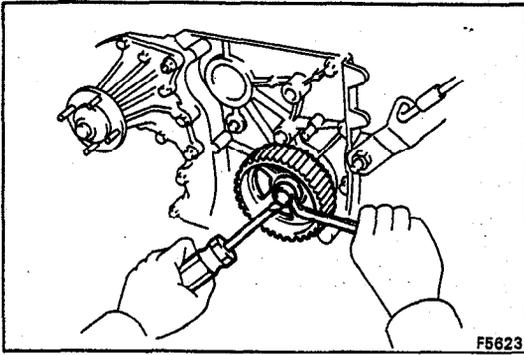


3. INSPECT TENSION SPRING

Check the free length of the spring.

Free length: 69 mm (2.72 in.)

If not as specified, replace the spring.



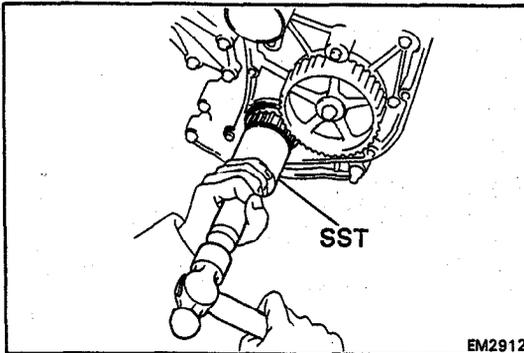
INSTALLATION OF TIMING BELT

(See page EM-28)

1. INSTALL OIL PUMP PULLEY

Using a screwdriver to hold the pulley, install and torque the pulley bolt.

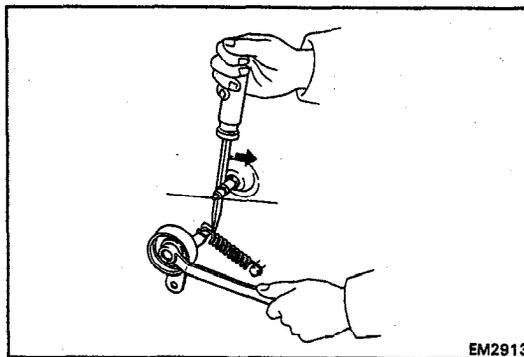
Torque: 220 kg-cm (16 ft-lb, 22 N·m)



2. INSTALL CRANKSHAFT TIMING PULLEY

Using SST and a hammer, drive in the pulley.

SST 09214-60010

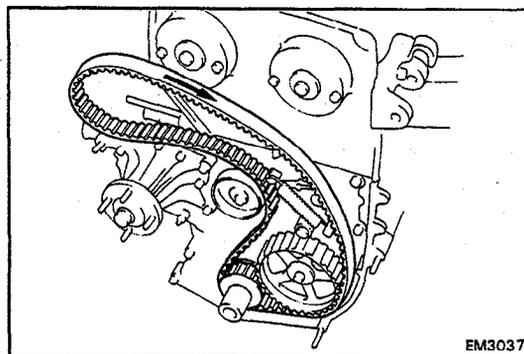


3. TEMPORARILY INSTALL IDLER PULLEY AND TENSION SPRING

(a) Install the idler pulley and tension spring.

(b) Pry the pulley toward the left as far as it will go and temporarily tighten it.

NOTE: Remove any oil or water on the idler pulley and keep it clean.

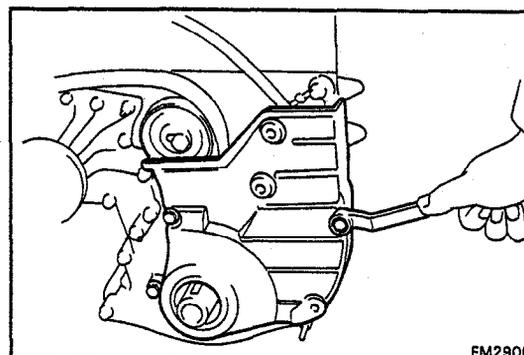


4. TEMPORARILY INSTALL TIMING BELT

CAUTION: The engine should be cold.

NOTE: If reusing the timing belt, install it with the rotation direction mark pointing in the same direction as before disassembly.

Install the timing belt on the crankshaft timing pulley, oil pump drive pulley and idler pulley.



5. INSTALL NO.1 TIMING BELT COVER

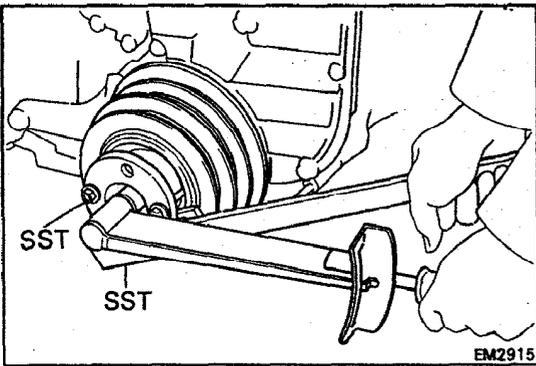
(with A/C)

Install the No.1 timing belt cover, A/C compressor bracket and idler pulley bracket with the nine bolts and nut.

(without A/C)

Install the No.1 timing belt cover with the six bolts.

6. INSTALL PS AIR PIPE



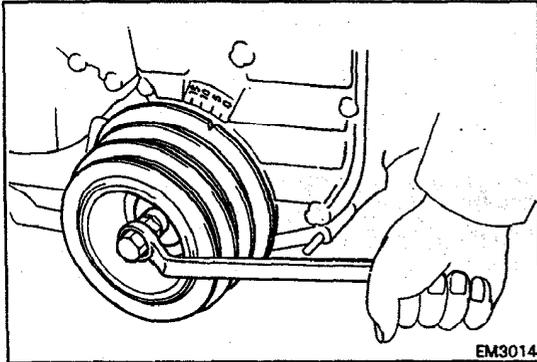
7. INSTALL CRANKSHAFT PULLEY

- Align the pulley set key with the key groove of the pulley.
- Install the pulley.
- Using SST to hold the crankshaft pulley, install and torque the pulley bolt.

SST MA 09213-70010 and 09330-00021

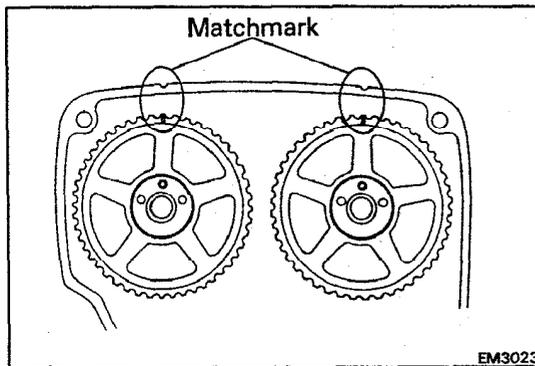
MS 09213-54014 and 09330-00021

Torque: 2,700 kg-cm (195 ft-lb, 265 N·m)



8. SET NO.1 CYLINDER TO TDC/COMPRESSION OF CRANKSHAFT

Turn the crankshaft pulley and align its groove with the "O" mark on the No.1 timing belt cover.

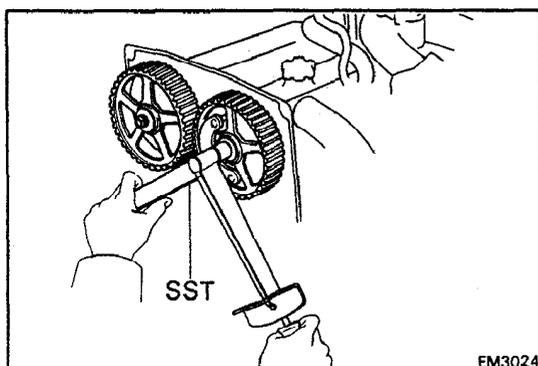


9. INSTALL CAMSHAFT TIMING PULLEYS

- Align the timing pulley matchmark with the No.2 timing belt cover matchmark.
- Install the timing pulley.
- Install the pin into the middle hole.

NOTE:

- When replacing the camshaft or the camshaft timing pulley:
Align the center holes of the camshaft and timing pulleys, as shown in the illustration and insert the straight pin.
 - When reusing the camshaft or camshaft timing pulleys:
Check that the straight pin hole position is in the same position it was at disassembly, insert the straight pin.
- Install the pulley bolt.

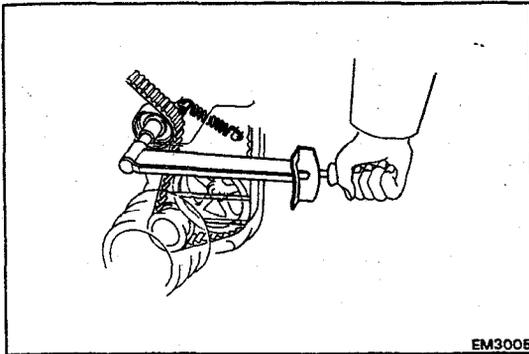


- Using SST to hold the pulley, torque the pulley bolt.

SST 09278-54012

Torque: 500 kg-cm (36 ft-lb, 49 N·m)

- Check that the matchmarks on the camshaft timing pulley are aligned with those on the No.2 timing belt cover.

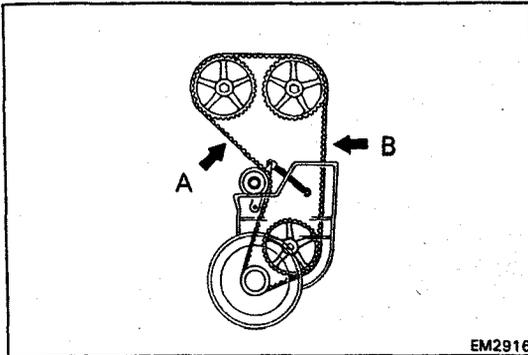


EM3005

10. INSTALL TIMING BELT

- (a) Install the timing belt to the IN side and EX side.
- (b) Loosen the idler pulley bolt, and torque the idler pulley bolt.

Torque: 500 kg-cm (36 ft-lb, 49 N·m)

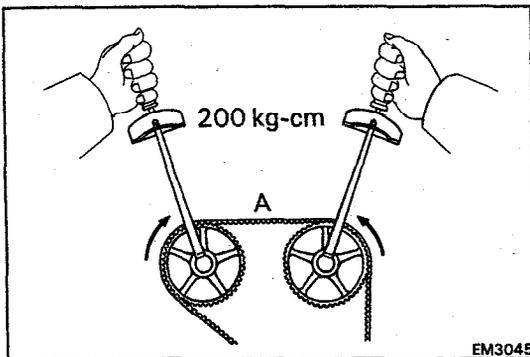


EM2916

NOTE: Make sure that the timing belt tension at A is equal to that at B.

If not, readjust with the idler pulley.

- (c) Turn the crankshaft pulley two revolutions clockwise from TDC to TDC.
- (d) Check that the matchmark on the camshaft timing pulley are aligned with those on the No.2 timing belt cover.

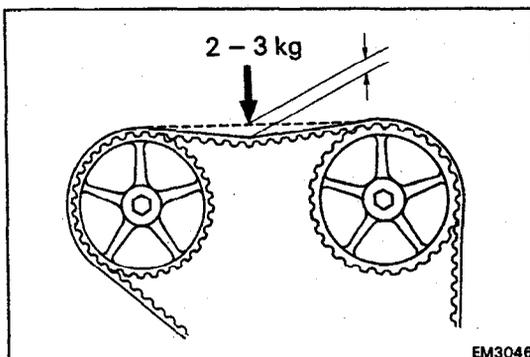


EM3045

11. CHECK TIMING BELT TENSION

- (a) Turn both the intake and exhaust camshaft pulleys inward at the same time to slacken the timing belt at position A.

Turning torque: 200 kg-cm (14 ft-lb, 20 N·m)



EM3046

- (b) Measure the timing belt deflection as shown.

Belt deflection at 2 – 3 kg (4.4 – 6.6 lb, 20 – 29 N):

Cold Used belt 5 – 7 mm (0.20 – 0.28 in.)

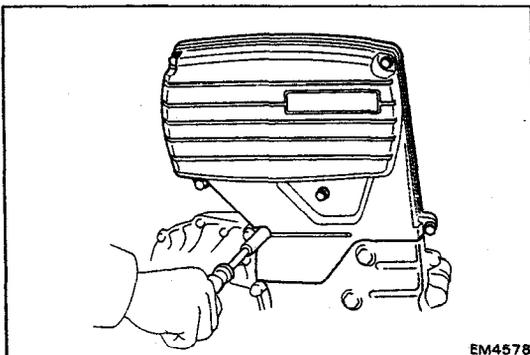
New belt 4 – 6 mm (0.16 – 0.24 in.)

Hot (Reference) 3 – 5 mm (0.12 – 0.20 in.)

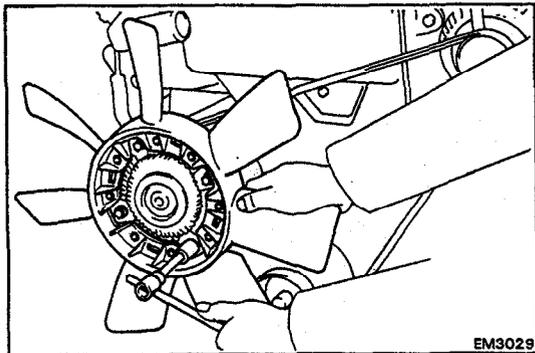
If the measurement is not within specification, adjust by the idler pulley.

12. INSTALL NO.3 TIMING BELT COVER

Install a gasket and the belt cover with the five bolts and nut.

13. INSTALL PS BELT

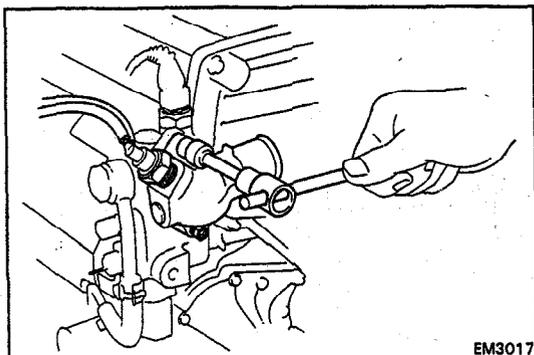
EM4578



14. INSTALL ALTERNATOR DRIVE BELT AND FAN

Torque: Fan 55 kg-cm (48 in.-lb, 5.4 N-m)
 Adjusting bolt 130 kg-cm (9 ft.-lb, 13 N-m)

**15. (with A/C)
 INSTALL A/C BELT**



16. INSTALL WATER OUTLET

Install the thermostat with a new gasket and water outlet with the two bolts.

**17. INSTALL SPARK PLUGS
 (See page IG-7)**

18. ADJUST DRIVE BELTS

Install and adjust the drive belts.

Drive belt deflection with 10 kg or 22 lb:

New belt

A	10	–	12 mm (0.39 – 0.47 in.)
B	7	–	8 mm (0.28 – 0.31 in.)
C	MA	7	– 9.5 mm (0.28 – 0.374 in.)
	MS	7.5	– 9.5 mm (0.295 – 0.374 in.)

Used belt

A	15	–	17 mm (0.59 – 0.67 in.)
B	9	–	11 mm (0.35 – 0.43 in.)
C	MA	10.5	– 12 mm (0.413 – 0.47 in.)
	MS	10	– 13 mm (0.39 – 0.51 in.)

(Reference)

Using SST, check the drive belt tension.

SST A 09216-00020

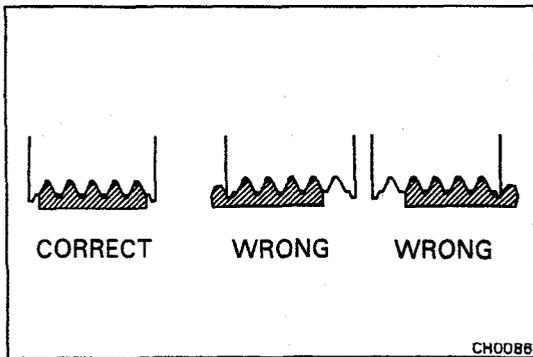
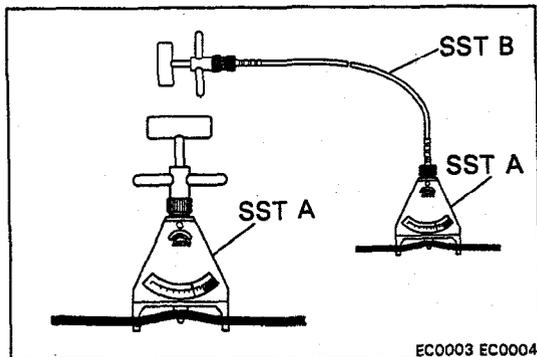
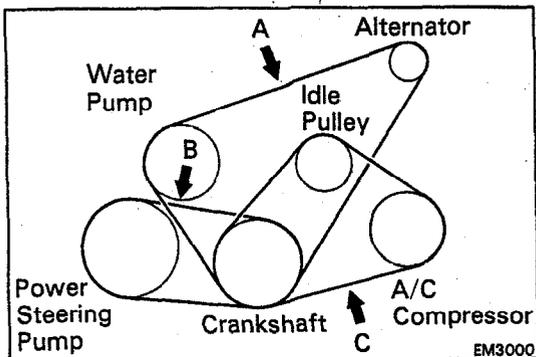
SST B 09216-00030

Drive belt tension:

New belt	A	70 – 80 kg
	B	55 – 65 kg
	C	53 – 77 kg
Used belt	A	30 – 45 kg
	B	25 – 40 kg
	C	30 – 40 kg

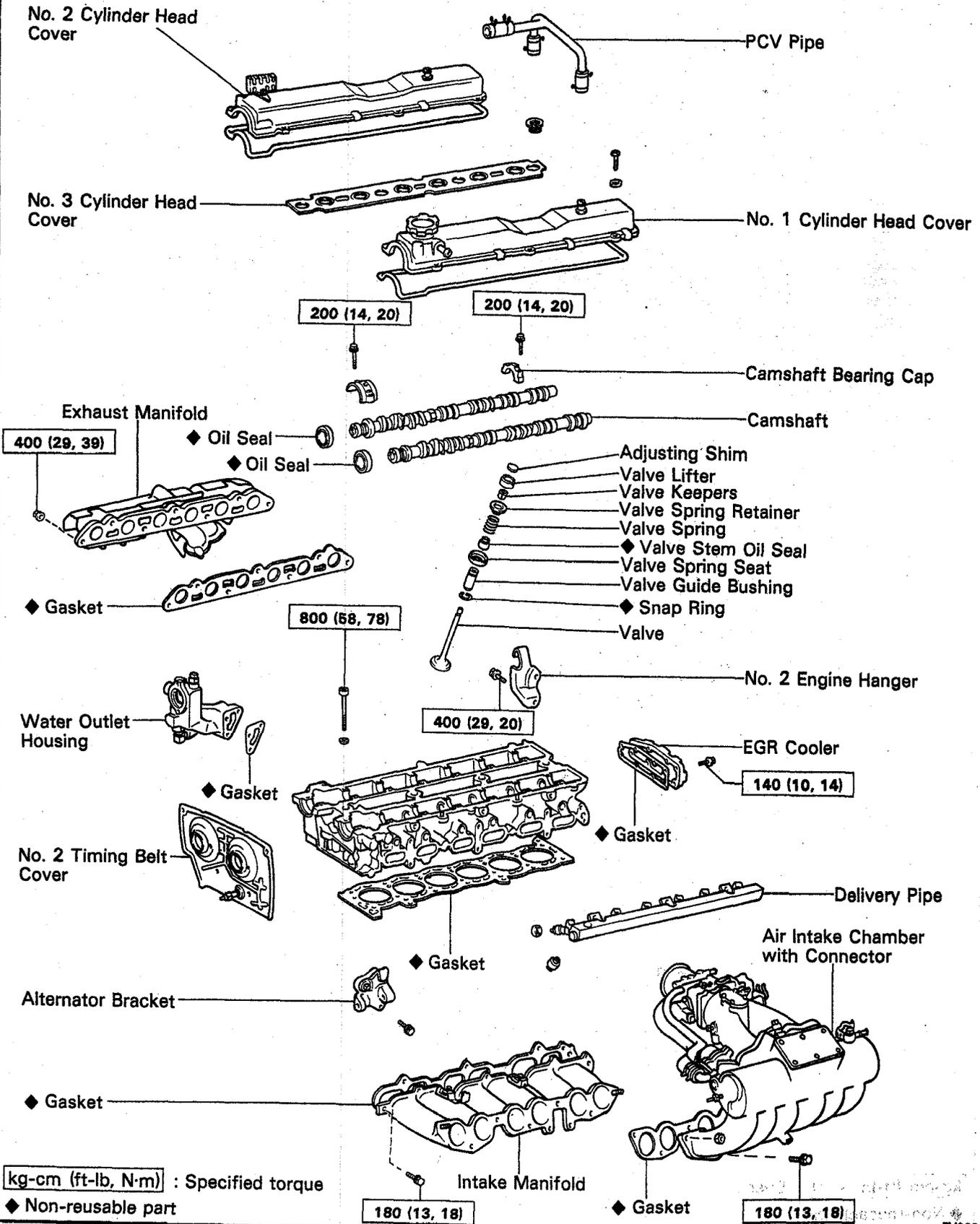
NOTE:

- “New belt” refers to a belt which has been used less than 5 minutes on a running engine.
- “Used belt” refers to a belt which has been used on a running engine for 5 minutes or more.
- After installing the drive belt, check that it fits properly in the ribbed grooves.
- Check by hand to confirm that the belt has not slipped out of the groove on the bottom of the crank pulley.
- After installing the belt, run the engine for approx. 5 minutes and then recheck the deflection.



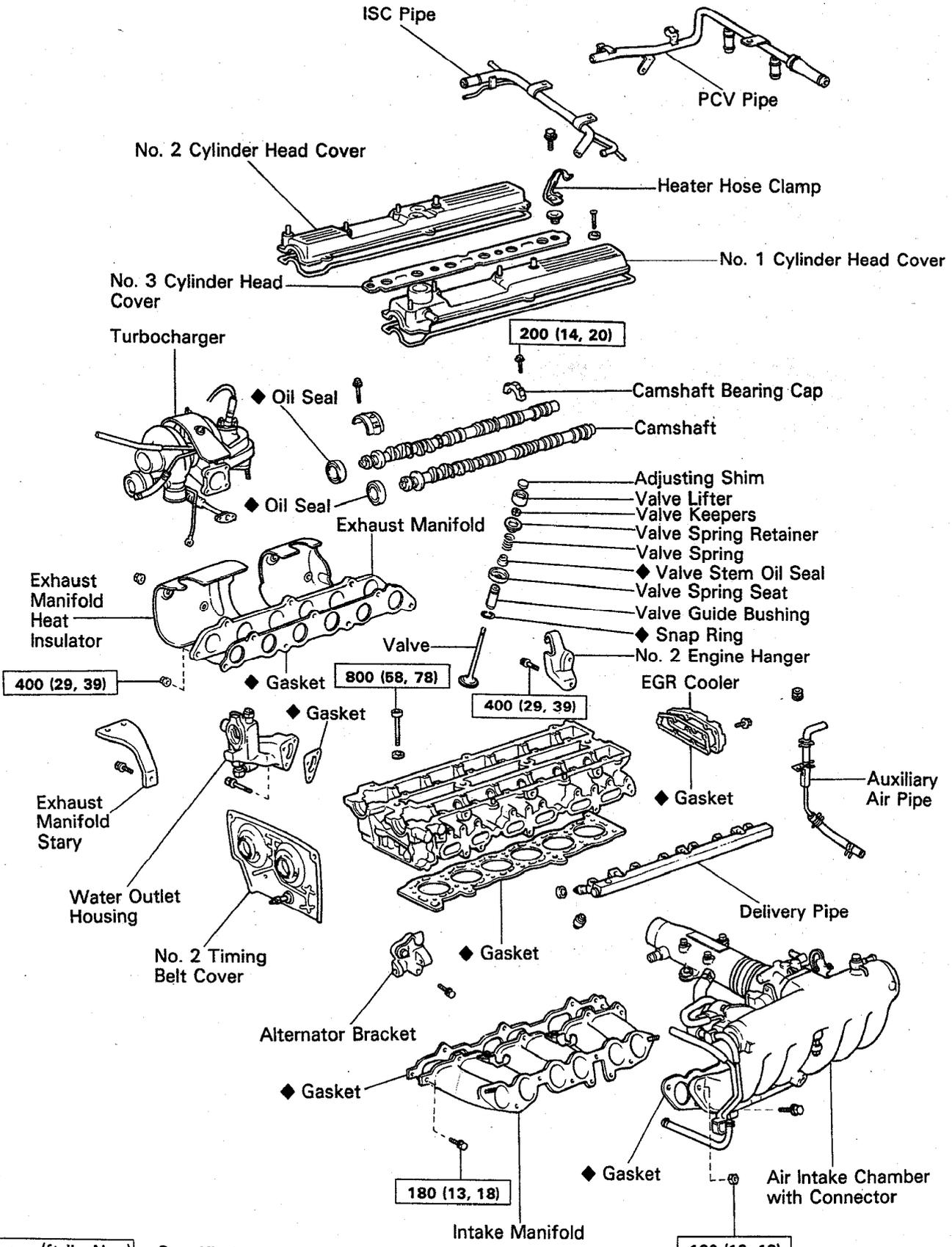
CYLINDER HEAD COMPONENTS

7M-GE



COMPONENTS (Cont'd)

7M-GTE



kg-cm (ft-lb, N-m) : Specified torque

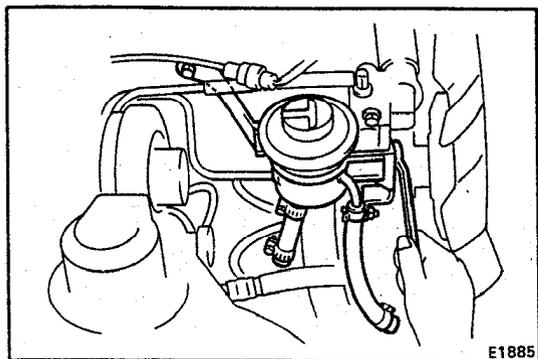
◆ Non-reusable part

REMOVAL OF CYLINDER HEAD

(See pages EM-37, 38)

1. REMOVE ALTERNATOR

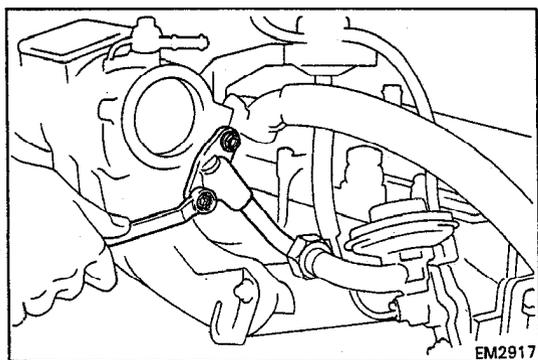
- (a) Disconnect the No.3 PCV hose.
- (b) Remove the drive belt.
- (c) Remove the alternator and adjusting bar.

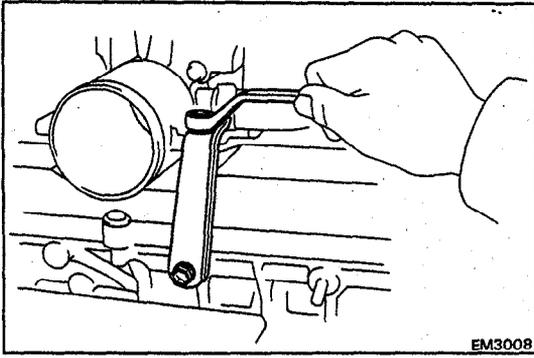
**2. (7M-GTE)
REMOVE PS RESERVOIR TANK**

Remove the two bolts, nut and reservoir tank with bracket.

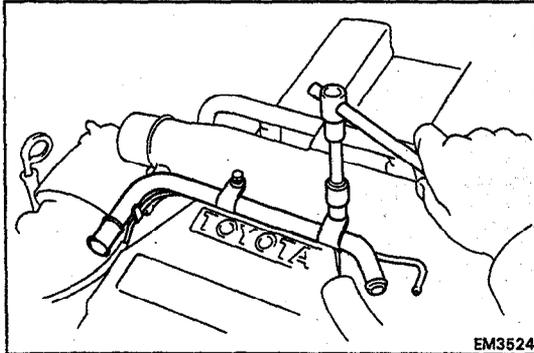
**3. (7M-GTE)
REMOVE CAM POSITION SENSOR****4. REMOVE AIR INTAKE CHAMBER WITH CONNECTOR**

- (a) Remove the PCV pipe.
- (b) Disconnect following connectors:
 - (7M-GE)
Cold start injector connector
 - Throttle position sensor connector
 - ISC valve connector
- (c) Disconnect following hoses:
 - BVSV hose from throttle body
 - EGR hoses from throttle body
 - Vacuum transmitting pipe hose from intake chamber
 - Pressure regulator hose
 - VSV (for fuel pressure up) hoses
 - (7M-GE)
Diaphragm hose
- (d) Disconnect following hoses:
 - (7M-GTE)
Auxiliary air pipe hose from vacuum transmitting pipe hose
 - No.1 water by-pass hose from ISC valve
 - (7M-GE)
No.3 water by-pass hose from throttle body
 - (7M-GTE)
No.3 water by-pass hose from water by-pass pipe
- (e) (w/ EGR)
Remove the EGR pipe mounting bolts.
- (f) Remove the manifold stay mounting bolts.

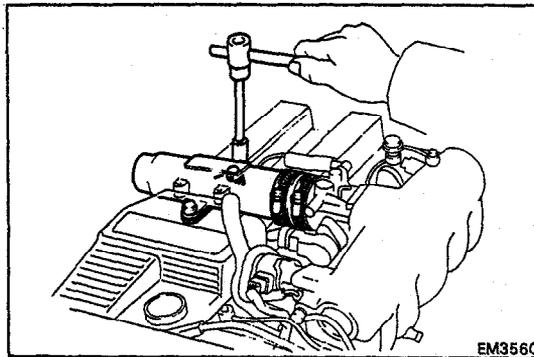




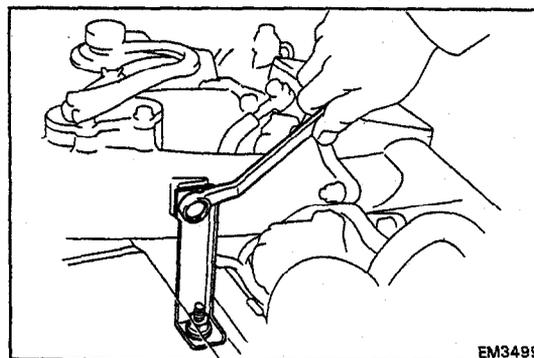
- (g) (7M-GE)
Remove the throttle body bracket(s).



- (7M-GTE)
Remove the ISC pipe.



- (h) (7M-GTE)
Remove the air intake connector mounting bolt.

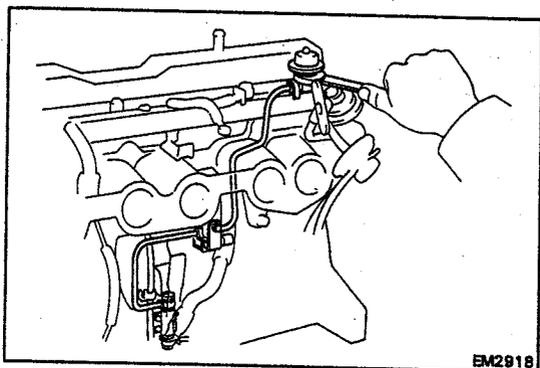


- (i) (7M-GE)
Remove the air intake connector bracket mounting bolts.
- (j) Remove the cold start injector tube.
- (k) Remove the EGR vacuum modulator from the bracket.
- (l) Disconnect the engine wire from the clamps of intake chamber.
- (m) Remove the two nuts, five bolts, vacuum transmitting pipes and intake chamber with connector and gasket.
- (n) (7M-GTE)
Disconnect the cold start injector connector.

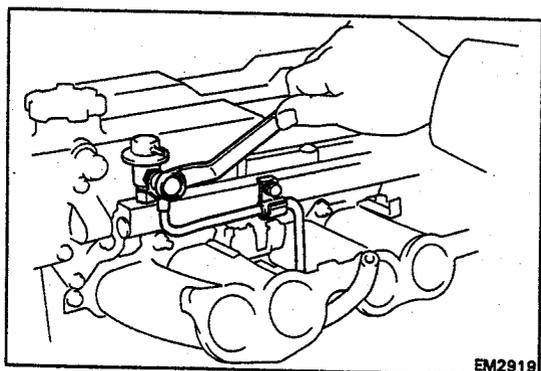
5. (7M-GTE)
REMOVE IGNITION COIL WITH BRACKET
(See steps 5 and 6 on pages EM-12, 13)

6. REMOVE ENGINE WIRE

- (a) Disconnect following wires:
- (w/ TWC)
Oxygen sensor connector
 - Oil pressure sender gauge connector
 - Water temp. sensor connector
 - Water temp. sender gauge connector
 - Cold start injector time switch connector
 - Distributor connector
 - Injector connectors
 - Three VSV connectors
 - Knock sensor connectors
 - Ground strap from intake manifold
- (b) Remove the engine wire from the each clamps.



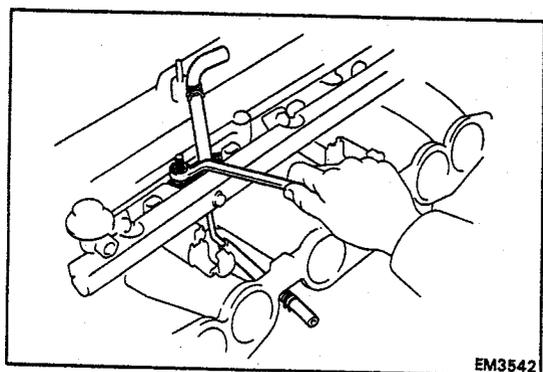
EM2918

7. REMOVE PULSATION DAMPER, VSV AND NO.1 FUEL PIPE

EM2919

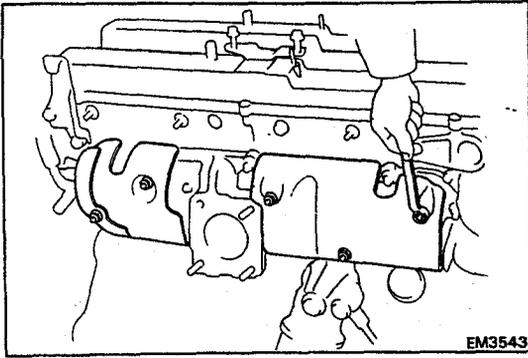
8. REMOVE NO.2 FUEL PIPE

- (a) Disconnect the fuel hose from the No.2 fuel pipe.
- (b) Remove the bolt, union bolt, No.2 fuel pipe and gaskets.



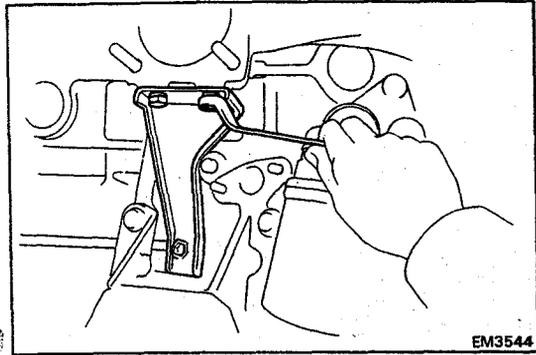
EM3542

**9. (7M-GTE)
REMOVE AUXILIARY AIR PIPE****10. (7M-GE)
REMOVE HIGH-TENSION CORDS AND DISTRIBUTOR****11. (7M-GE)
REMOVE OIL DIPSTICK****12. (7M-GTE)
REMOVE TURBOCHARGER
(See steps 5 to 7 and 9 to 15 on pages TC-10 to 12)**

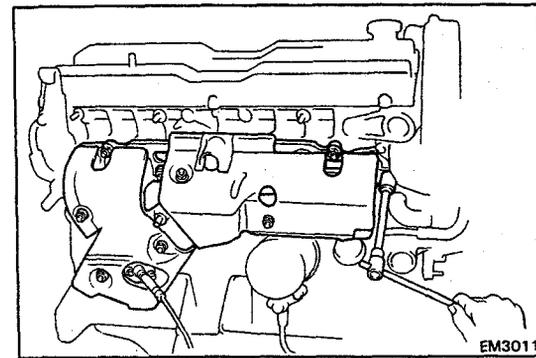


13. REMOVE EXHAUST MANIFOLD

- (a) (7M-GTE)
Remove the five nuts and heat insulators.



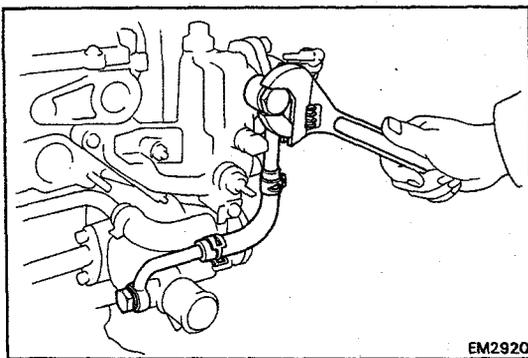
- (b) (7M-GTE)
Remove the three bolts and exhaust manifold stay.



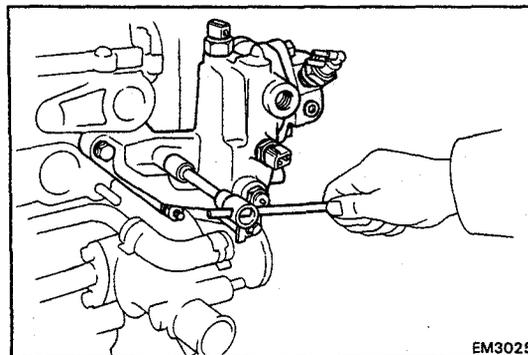
- (c) Remove the seven nuts, exhaust manifold and gasket.

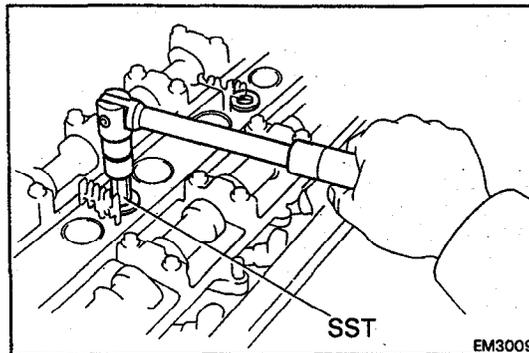
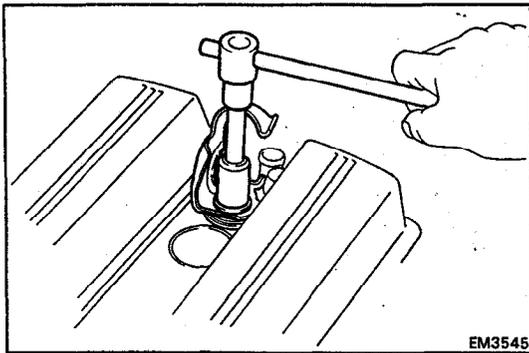
14. REMOVE WATER OUTLET HOUSING

- (a) (7M-GE)
Remove the union bolts, union with No.4 water by-pass hose and gaskets.
- (b) Disconnect the No.6 water by-pass hose from the water by-pass pipe.



- (c) Remove the bolt, two nuts, water outlet housing and gasket.



**15. REMOVE CYLINDER HEAD COVERS**

- (a) (LHD)
Remove the accelerator link.
- (b) (MA)
Remove the heater hose clamp.
- (c) Remove the No.1 and No.2 cylinder head covers.

(d) Using SST, remove the No.3 cylinder head cover.
SST 09923-00010

16. REMOVE SPARK PLUGS

(See page IG-7)

17. REMOVE TIMING BELT AND CAMSHAFT TIMING PULLEYS

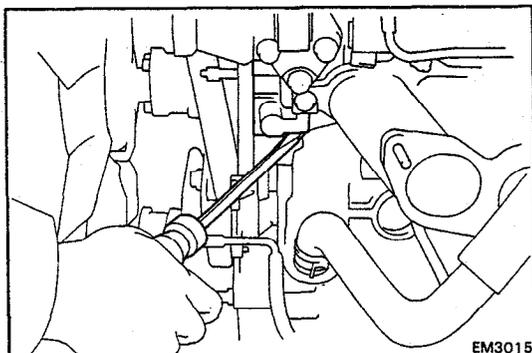
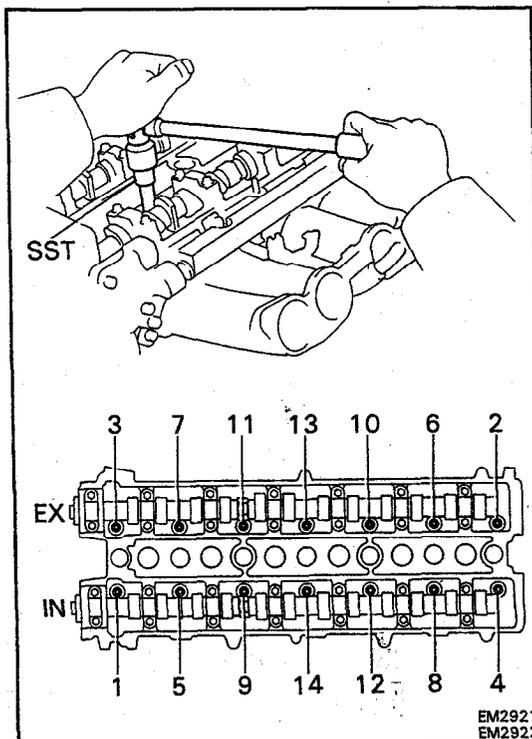
(See steps 4 and 6 to 9 on pages EM-28 to 30)

18. REMOVE CYLINDER HEAD

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

SST 09043-38100

CAUTION: Head warpage or cracking could result from removing in incorrect order.



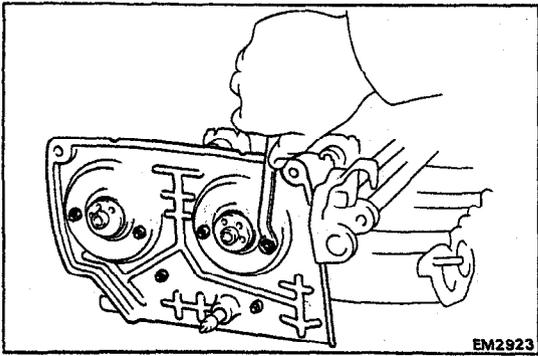
- (b) Lift the cylinder head from the dowels on the cylinder block.

- (c) Place the head on wooden blocks on a bench.

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

CAUTION:

- Be careful not to damage the cylinder head and block surface on the cylinder and head gasket side.
- Be careful not to damage the VSV.

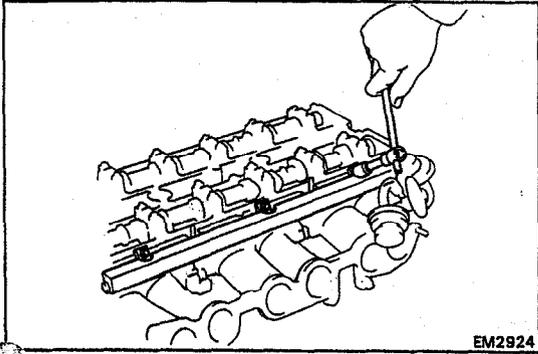


EM2923

DISASSEMBLY OF CYLINDER HEAD

(See pages EM-37, 38)

1. REMOVE NO.2 TIMING BELT COVER
2. REMOVE ALTERNATOR BRACKET



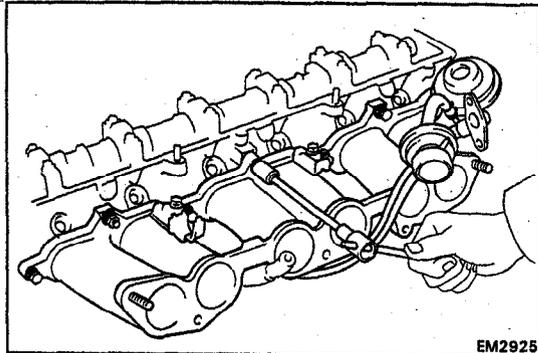
EM2924

3. REMOVE DELIVERY PIPE WITH INJECTORS

(a) Remove the three bolts, and then remove the delivery pipe with the injectors.

NOTE: When removing the delivery pipe, be careful not to drop the injectors.

(b) Remove the six insulators and three spacers from the cylinder head.



EM2925

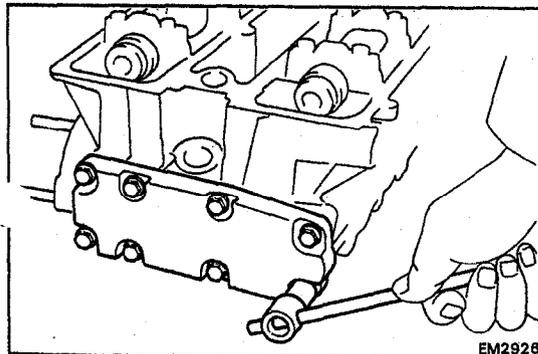
4. REMOVE INTAKE MANIFOLD

(w/ EGR)

Remove the four nuts, seven bolts, EGR valve, VSV, intake manifold and gasket.

(w/o EGR)

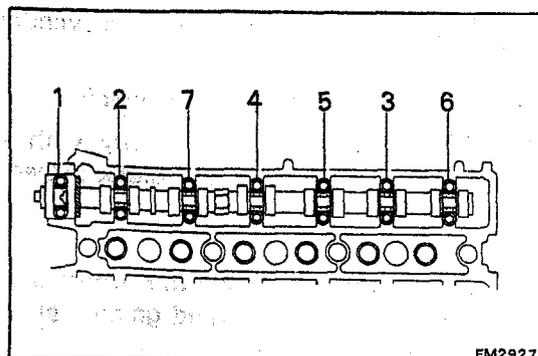
Remove the four nuts, seven bolts, VSV, intake manifold and gasket.



EM2926

5. REMOVE NO.2 ENGINE HANGER AND GROUND STRAP
6. REMOVE HEATER UNION

7. (w/ EGR)
REMOVE EGR COOLER

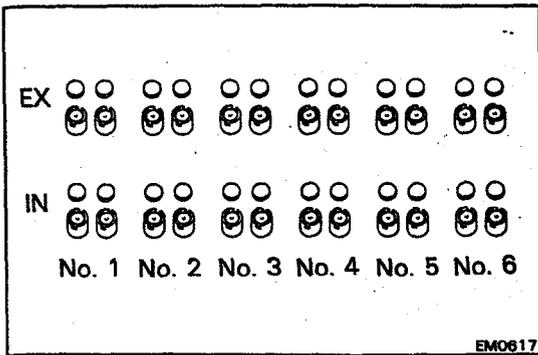


EM2927

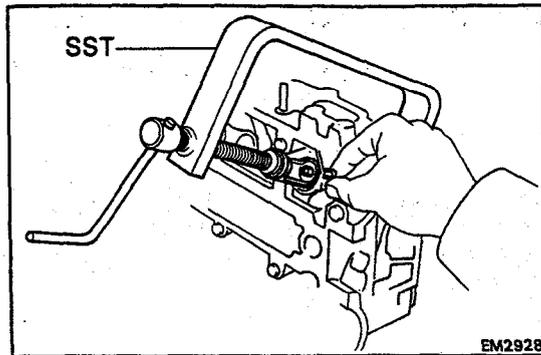
8. REMOVE BEARING CAPS AND CAMSHAFTS

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

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

**9. REMOVE VALVE LIFTERS WITH SHIMS**

Arrange the valve lifters and shims in order.

**10. REMOVE VALVES**

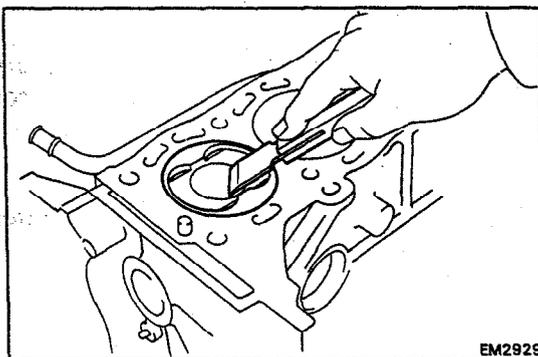
- (a) Using SST, press the valve spring and remove the two keepers.

SST 09202-70010

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

- (c) Pry out the oil seal.

NOTE: Arrange the valves, seats, valve springs and retainers in order.

**INSPECTION, CLEANING AND REPAIR OF CYLINDER HEAD COMPONENTS****1. CLEAN TOP OF PISTONS AND TOP OF CYLINDER BLOCK**

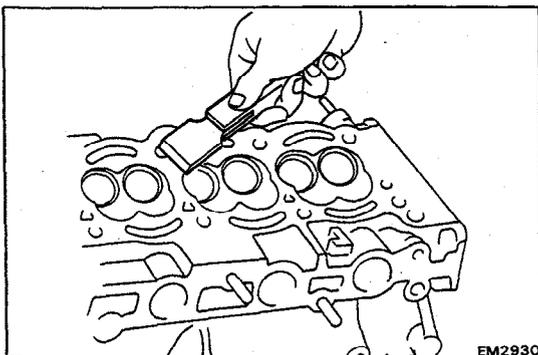
- (a) Turn the crankshaft and bring each piston to top dead center. Using a gasket scraper, remove all the carbon from the piston tops.
- (b) Using a gasket scraper, remove all gasket material from the top of the block. Blow carbon and oil from the bolt holes.

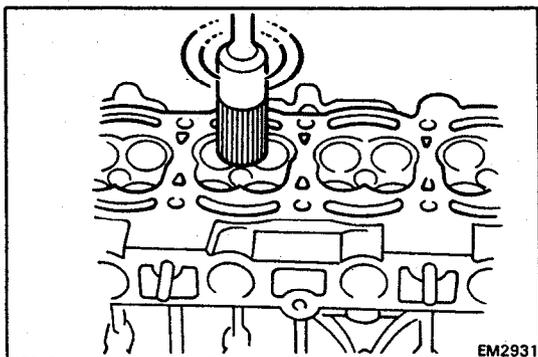
WARNING: Protect your eyes when using high pressure air.

2. REMOVE GASKET MATERIAL

Using a gasket scraper, remove all gasket material from the head and manifold surfaces.

CAUTION: Be careful not to scratch the surfaces.

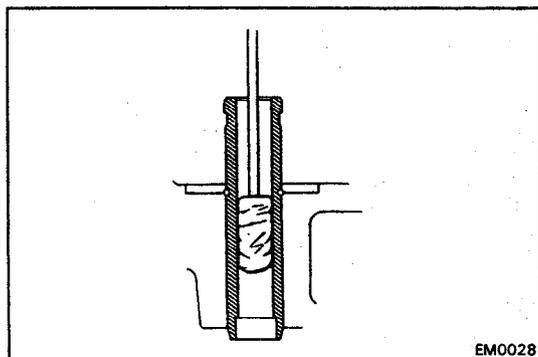




3. CLEAN COMBUSTION CHAMBER

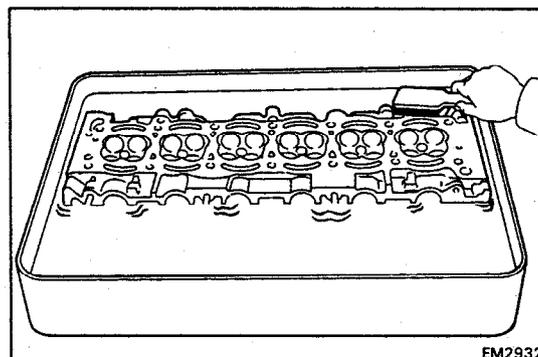
Using a wire brush, remove all the carbon from the combustion chambers.

CAUTION: Be careful not to scratch the head gasket contact surface.



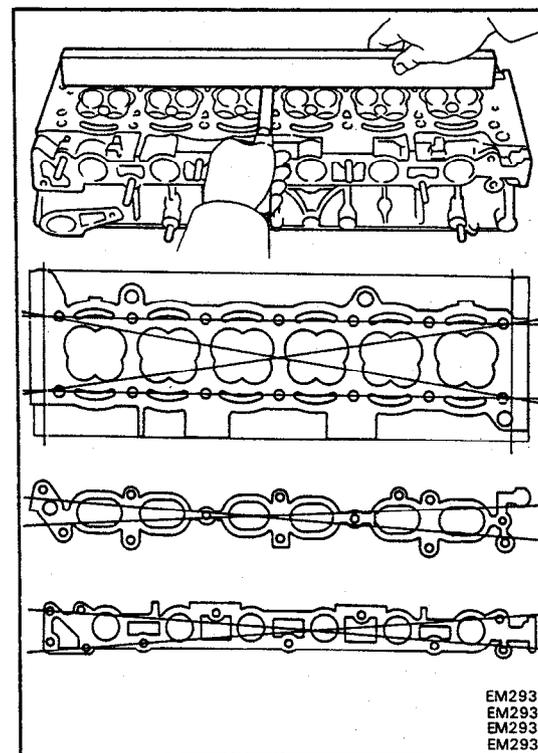
4. CLEAN VALVE GUIDE BUSHINGS

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



5. CLEAN CYLINDER HEAD

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

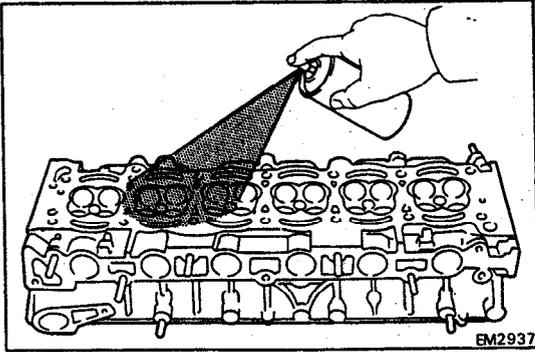


6. INSPECT CYLINDER HEAD FOR FLATNESS

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

Maximum warpage: 0.10 mm (0.0039 in.)

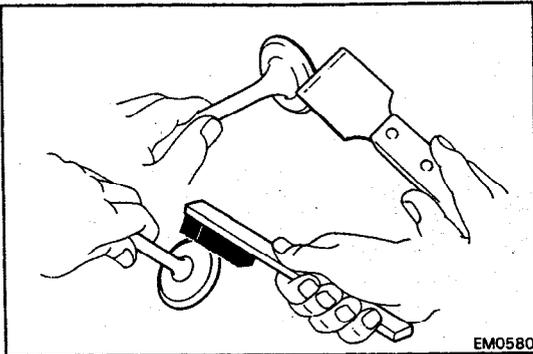
If warpage is greater than maximum, replace the cylinder head.



7. INSPECT CYLINDER HEAD FOR CRACKS

Using a dye penetrant, check the combustion chamber, intake and exhaust ports, head surface and the top of the head for cracks.

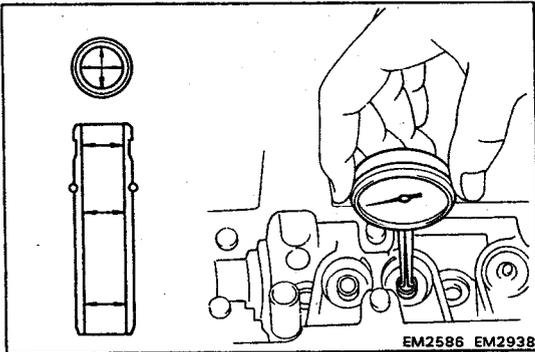
If cracked, replace the head.



8. CLEAN VALVES

(a) Use a gasket scraper to chip 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 valve guide.

Guide inside diameter: 6.010 – 6.030 mm
(0.2366 – 0.2374 in.)

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

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 valve guide bushing inside diameter measurement.

Standard stem oil clearance:

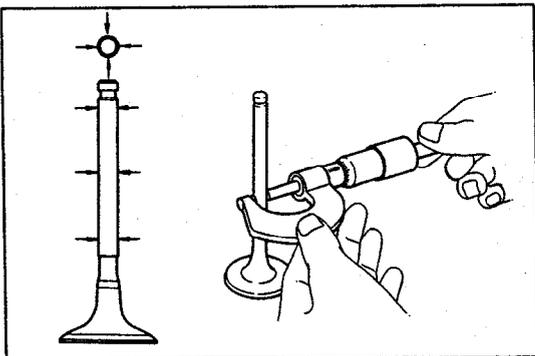
Intake 0.025 – 0.060 mm
(0.0010 – 0.0024 in.)

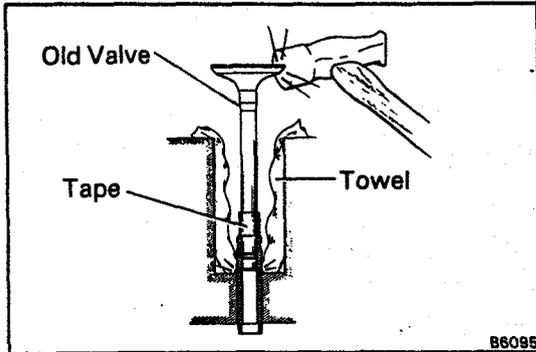
Exhaust 0.030 – 0.065 mm
(0.0012 – 0.0026 in.)

Maximum stem 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.

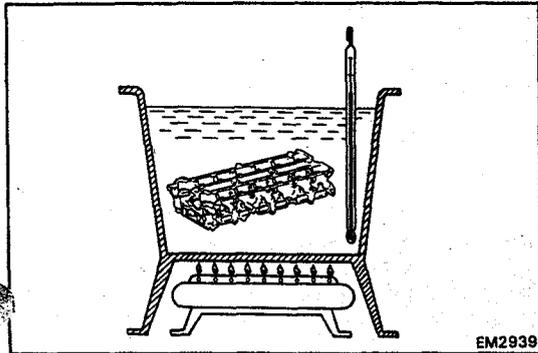




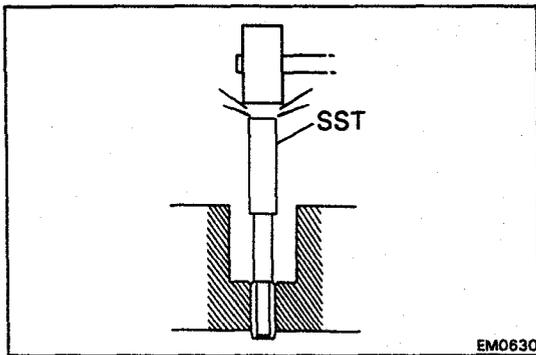
10. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

- (a) 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.

CAUTION: Be careful not to damage the lifter hole.

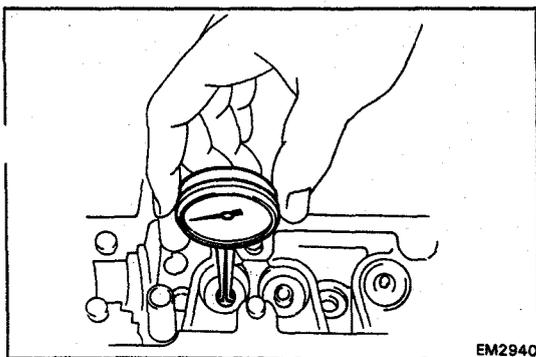


- (b) Gradually heat the cylinder head to approx. 90°C (194°F).



- (c) Using SST and hammer, drive out valve guide bushing.

SST 09201-70010



- (d) Using a caliper gauge, measure the valve guide bore of the cylinder head.

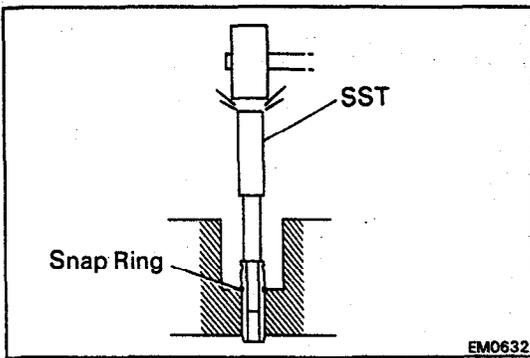
- (e) Select a new valve guide bushing.

If the valve guide bushing bore of the cylinder head is more than 11.027 mm (0.4341 in.), machine the bore to the following dimensions.

Rebored valve guide bushing bore dimension:
11.050 – 11.077 mm (0.4350 – 0.4361 in.)

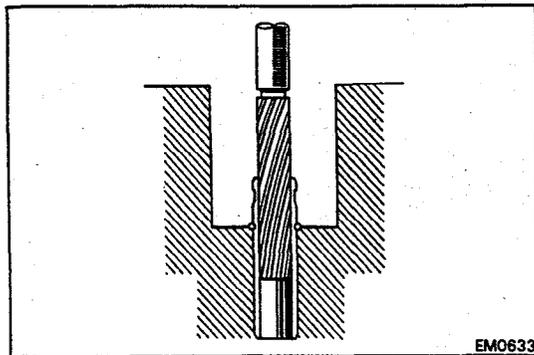
Both intake and exhaust

Bushing bore mm (in.)	Bushing size
11.000 – 11.027 (0.4331 – 0.4341)	Use STD
Over 11.027 (0.4341)	Use O/S 0.05

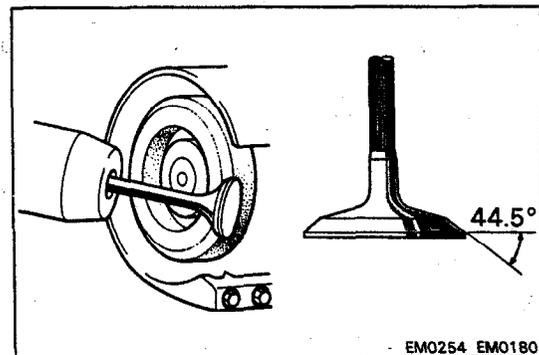


- (f) Gradually heat the cylinder head to approx. 90°C (194°F).
- (g) Using SST and hammer, drive in a new valve guide bushing until the snap ring makes contact with the cylinder head.

SST 09201-70010



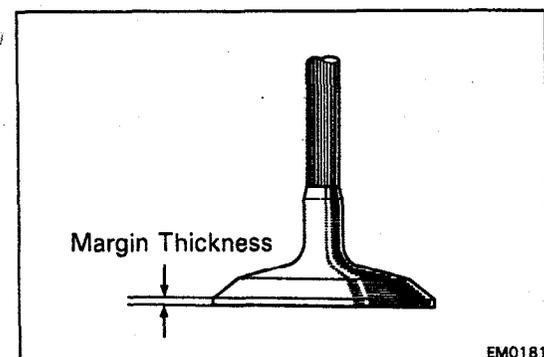
- (h) Using a sharp 6 mm (0.23 in.) reamer, ream the valve guide bushing to obtain standard specified clearance (See page EM-47) between the valve guide bushing and new valve.



11. INSPECT AND GRIND VALVES

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

Valve face angle: 44.5°

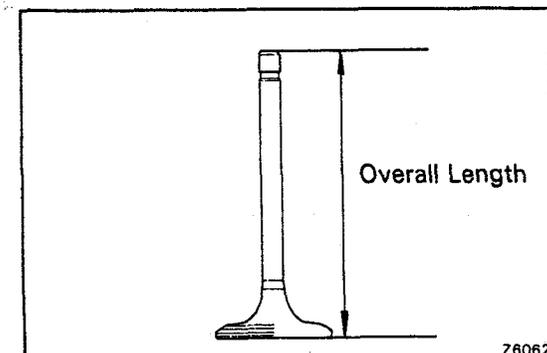


- (c) Check the valve head margin thickness.

Standard margin thickness: 1.3 mm (0.051 in.)

Minimum margin thickness: 0.5 mm (0.020 in.)

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

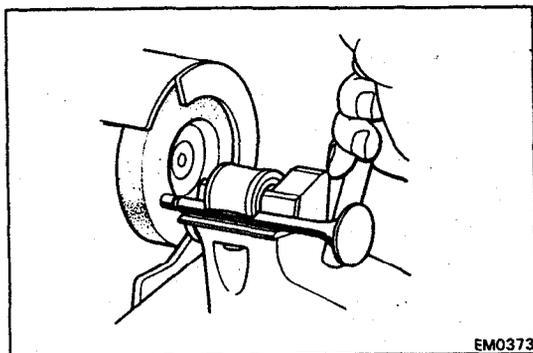


- (d) Check the valve overall length.

Standard overall length: 98.15 mm (3.8642 in.)

Minimum overall length: 97.75 mm (3.8484 in.)

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

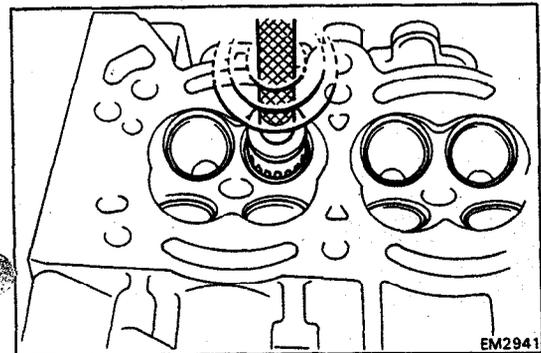


- (e) Check the surface of the valve stem tip for wear. If the valve stem tip is worn, grind it with grinder or replace the valve if necessary.

CAUTION: Do not grind off more than minimum overall length (See page EM-49).

12. 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 thin coat of prussian blue (or white lead) to the valve face. Install the valve. 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 seat are concentric. If not, resurface the seat.

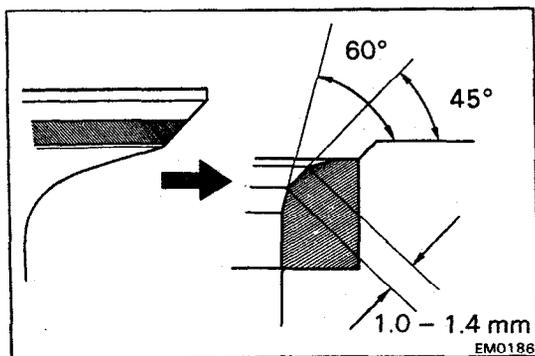
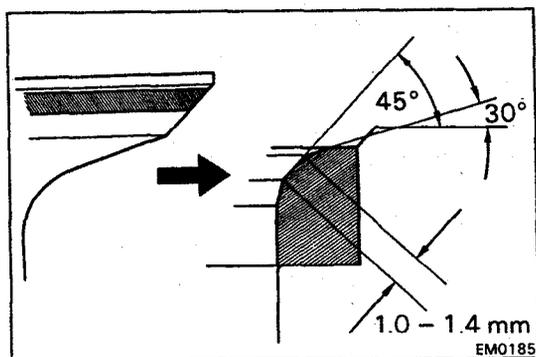
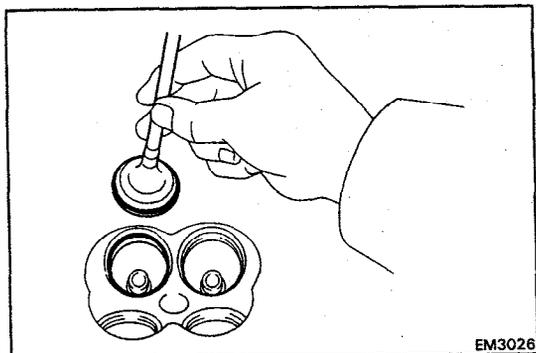
- Check that the seat contact is on the middle of the valve face with the following width.

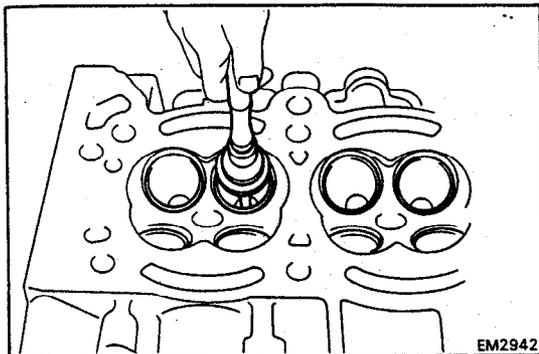
1.0 – 1.4 mm (0.039 – 0.055 in.)

If not, correct the valve seat as follows:

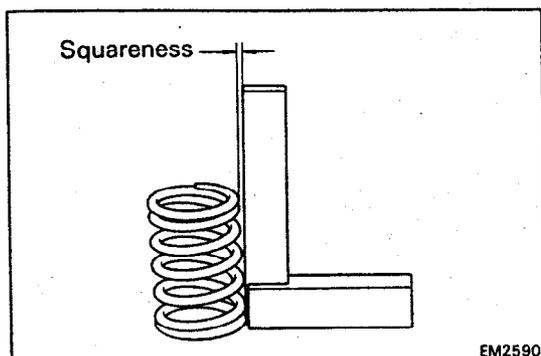
- If seating is too high on the valve face use 30° and 45° cutters to correct the seat.

- If 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.

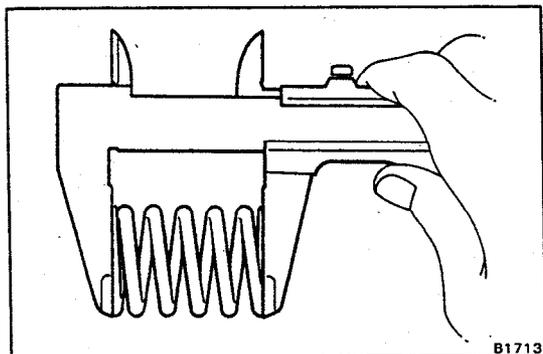


13. INSPECT VALVE SPRINGS

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

Maximum squareness: 1.5 mm (0.059 in.)

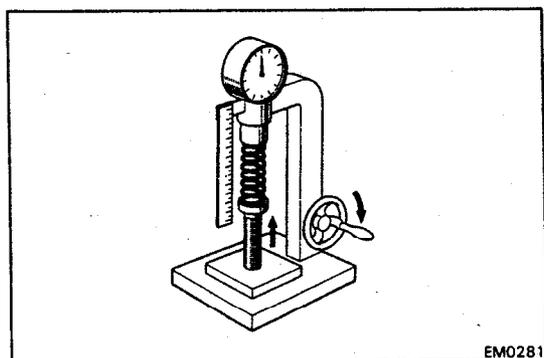
If squareness is greater than maximum, replace the valve spring.



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

Free length: 41.64 mm (1.6394 in.)

If the free length is not within specification, replace the valve spring.



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

Installed tension:

16.0 kg (35 lb, 157 N) at 35.0 mm (1.378 in.)

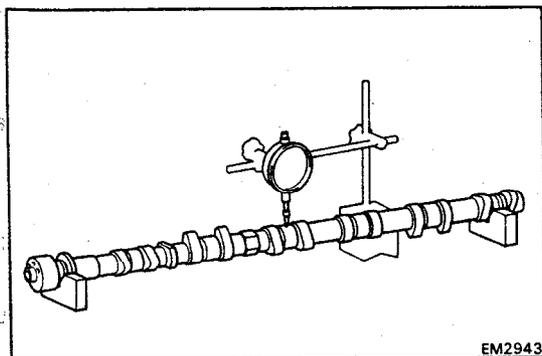
If the installed tension is not as specified, replace the valve spring.

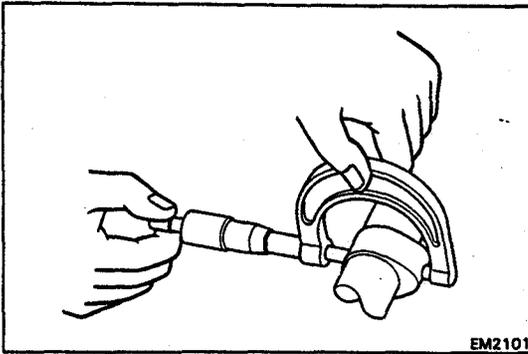
14. INSPECT CAMSHAFT AND BEARING CAPS

- (a) Place the camshaft on V-blocks and, using a dial gauge, measure the circle runout at the center journal.

Maximum circle runout: 0.03 mm (0.0012 in.)

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





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

Standard cam lobe height:

Intake

7M-GE MA 38.36 mm (1.5102 in.)

MS 38.16 mm (1.5024 in.)

7M-GTE 38.35 mm (1.5098 in.)

Exhaust

7M-GE MA 38.36 mm (1.5102 in.)

MS 38.35 mm (1.5098 in.)

7M-GTE 38.35 mm (1.5098 in.)

Minimum cam lobe height:

Intake

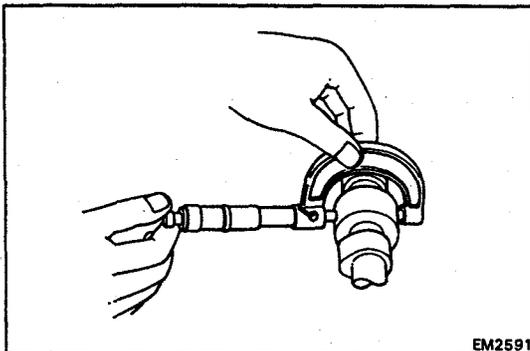
7M-GE MS 37.85 mm (1.4905 in.)

Others 38.00 mm (1.4961 in.)

Exhaust

38.00 mm (1.4961 in.)

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



(c) Using a micrometer, measure the journal diameter.

Standard diameter:

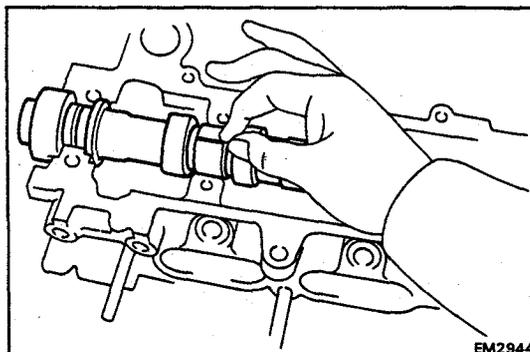
No.1

26.949 – 26.965 mm (1.0610 – 1.0616 in.)

No.2 – No.7

26.888 – 26.975 mm (1.0586 – 1.0620 in.)

If the journal diameter is less than specified, replace the camshaft.

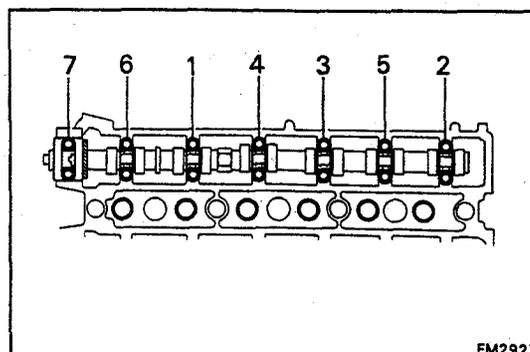


15. INSPECT CAMSHAFT OIL CLEARANCE

(a) Clean the bearing caps and camshaft journal.

(b) Place the camshaft in the cylinder head.

(c) Lay a strip of plastigage across each journal.



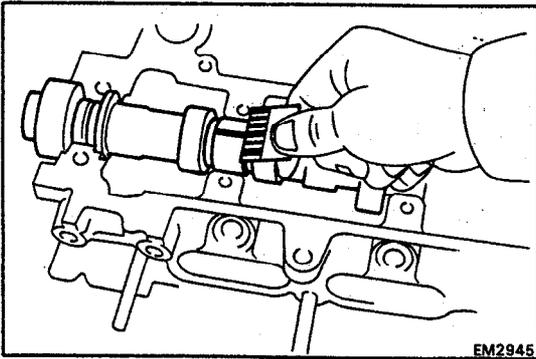
(d) Place the bearing caps with the top of the number on the cap pointing toward the front and in numerical order from the front side.

(e) Install and torque the cap bolts gradually in the sequence shown in the figure.

Torque: 200 kg-cm (14 ft-lb, 20 N·m)

NOTE: Do not turn the camshaft while the plastigage is in place.

(f) Remove the caps and measure the plastigage at its widest point.

**Standard oil clearance:**

No.1

0.035 – 0.072 mm (0.0014 – 0.0028 in.)

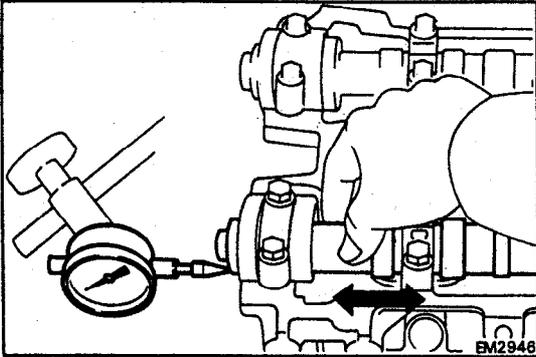
No.2 – No.7

0.025 – 0.093 mm (0.0010 – 0.0037 in.)

Maximum oil clearance: 0.13 mm (0.0051 in.)

If clearance is greater than maximum, replace the cylinder head and/or camshaft.

- (g) Clean out the pieces of plastigage from the bearing caps and journals.

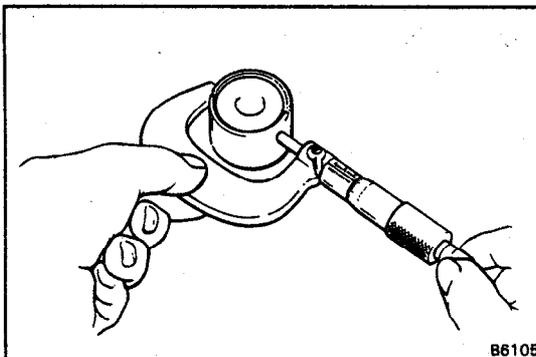
**16. INSPECT CAMSHAFT THRUST CLEARANCE**

- (a) Clean and install the camshaft and bearing caps.
 (b) Using a dial gauge, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance: 0.08 – 0.19 mm
 (0.0031 – 0.0075 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

If clearance is greater than maximum, replace the camshaft and/or cylinder head.

**17. INSPECT VALVE LIFTER OIL CLEARANCE**

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

Valve lifter diameter: 27.975 – 27.985 mm
 (1.1014 – 1.1018 in.)

- (b) Using a dial indicator, measure the inside diameter of the cylinder head bore.

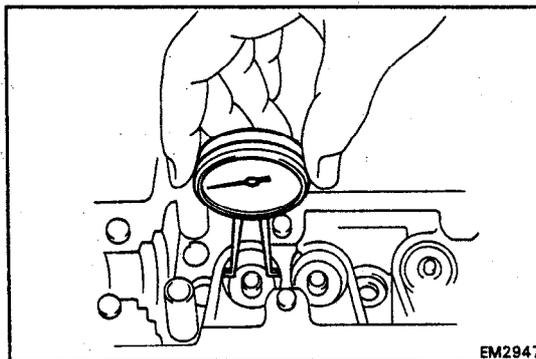
Lifter bore diameter: 28.000 – 28.021 mm
 (1.1024 – 1.1032 in.)

- (c) Subtract the valve lifter measurement from the cylinder head bore.

Standard oil clearance: 0.015 – 0.046 mm
 (0.0006 – 0.0018 in.)

Maximum oil clearance: 0.1 mm (0.004 in.)

If clearance is greater than maximum, replace the cylinder head and/or valve lifter.

**18. INSPECT INTAKE, EXHAUST MANIFOLD AND INTAKE CHAMBER**

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

Maximum warpage:

Intake manifold

0.10 mm (0.0039 in.)

Exhaust manifold

7M-GE

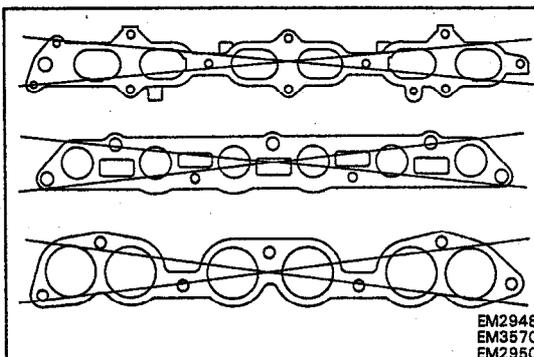
0.75 mm (0.0295 in.)

7M-GTE

0.50 mm (0.0197 in.)

Intake chamber

0.10 mm (0.0039 in.)

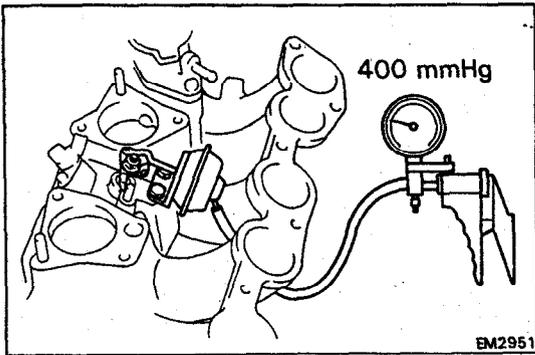


INSPECTION OF INTAKE AIR CONTROL SYSTEM (7M-GE only)

1. CHECK AIR CONTROL VALVE OPERATION

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

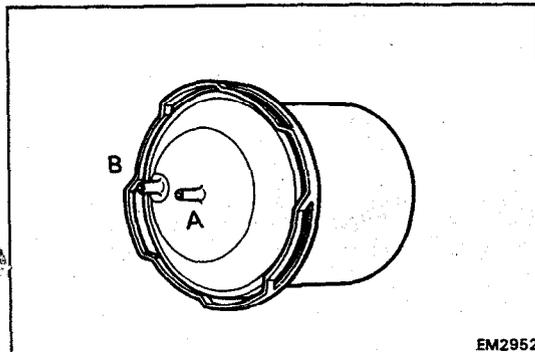
If not adjust with the adjusting screw.



2. CHECK VACUUM TANK BY BLOWING AIR INTO EACH PIPE

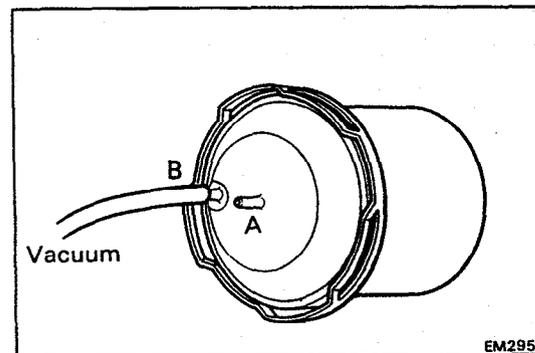
(a) Check that air flows from pipe B to A.

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



(c) Apply 500 mmHg (19.69 in.Hg, 66.7 kPa) of vacuum to pipe B and check that there is no change in vacuum after one minute.

If there is a change, replace the vacuum tank.



3. CHECK VACUUM CIRCUIT CONTINUITY IN THE VSV BY BLOWING AIR INTO PIPE

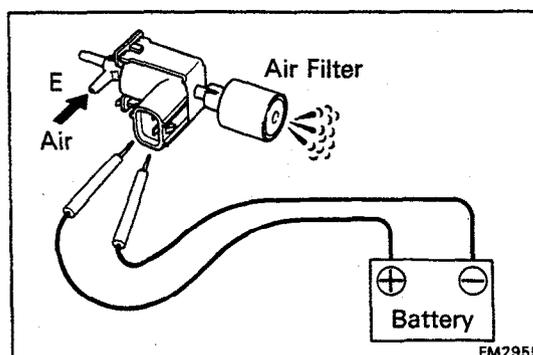
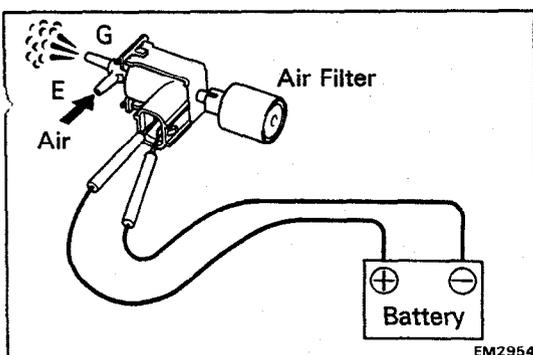
(a) Connect the VSV terminals to the battery terminals as illustrated.

(b) Blow into pipe E and check that air comes out of the pipe G.

(c) Disconnect the battery.

(d) Blow into pipe E and check that air comes out of the air filter.

If a problem is found, replace the VSV.

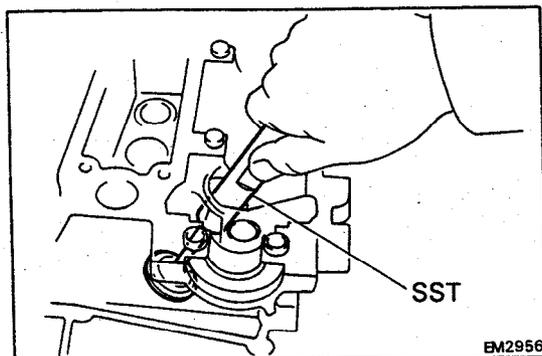


ASSEMBLY OF CYLINDER HEAD

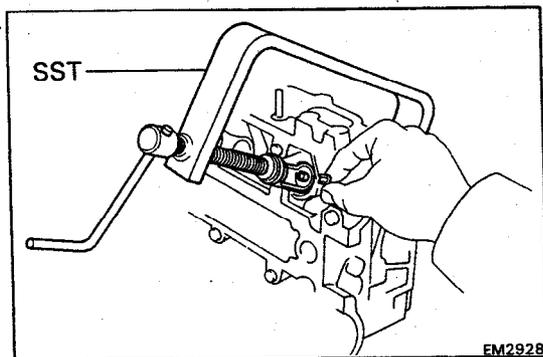
(See pages EM-37, 38)

NOTE:

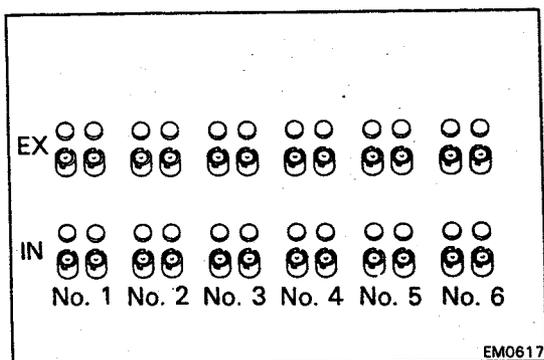
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.

**1. INSTALL VALVES**

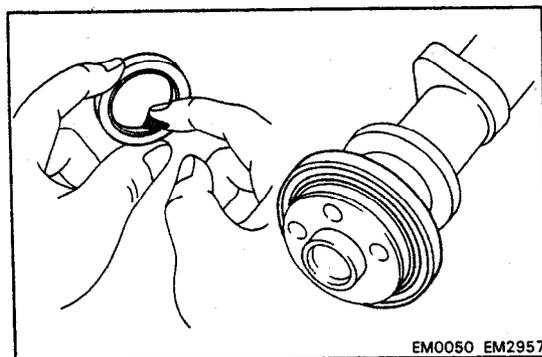
- (a) Insert the valves in the cylinder head valve guide bushing. Make sure the valves are installed in the correct order.
- (b) Using SST, install new oil seals on the valve guide bushings.
SST 09201-41020
- (c) Install spring seats, springs and spring retainers.



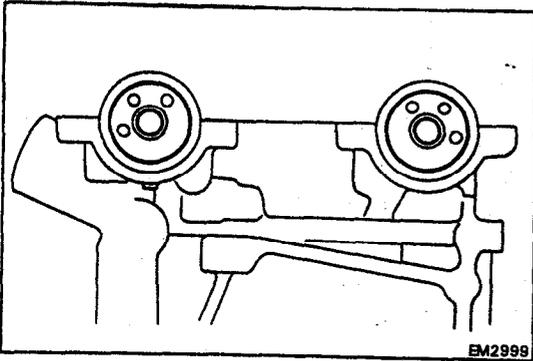
- (d) Using SST, compress the valve retainers and place two keepers around the valve stem.
SST 09202-70010
- (e) Tap the stem lightly to assure proper fit.

**2. INSTALL VALVE LIFTERS WITH SHIMS**

Make sure the valve lifters with their shims are installed in the correct order.

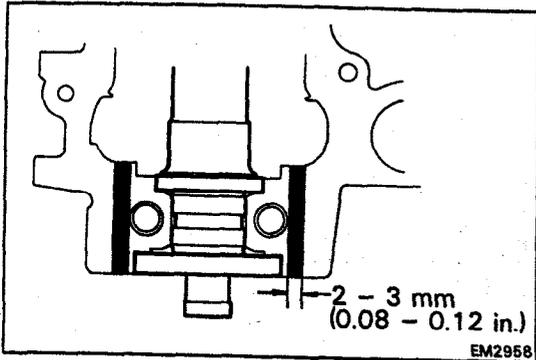
**3. INSTALL CAMSHAFTS AND OIL SEALS**

- (a) Apply engine oil to the lip of a new oil seal.
- (b) Install the oil seal to the camshaft.



- (c) Coat all bearing journals with engine oil.
- (d) Place the camshafts on the cylinder head as shown in the figure.

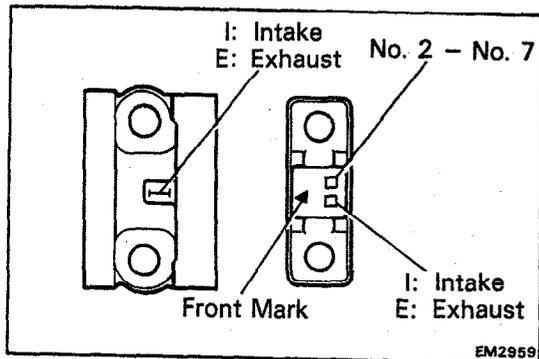
NOTE: The exhaust camshaft has a distributor (7M-GE) or cam position sensor (7M-GTE) drive gear.



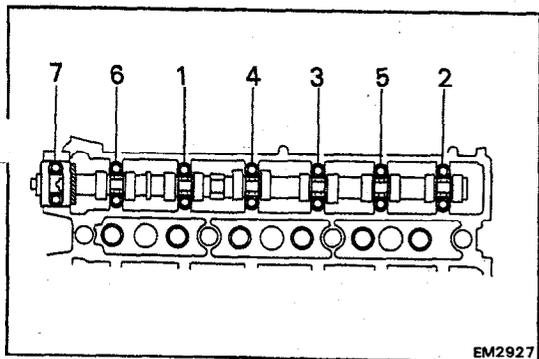
- (e) Apply seal packing to the areas indicated in the figure.

Seal packing: Part No.08826-00080 or equivalent

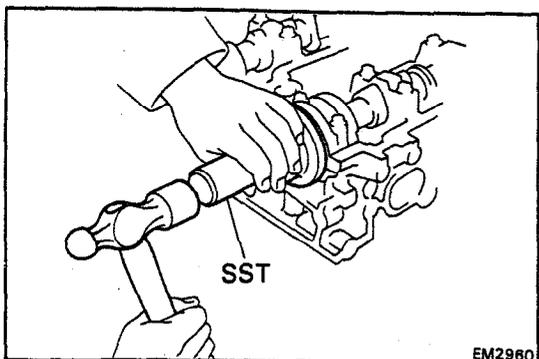
NOTE: Install the No.1 bearing cap immediately after applying the seal packing.



- (f) Place bearing caps on each journal with the front marks pointing toward the front.



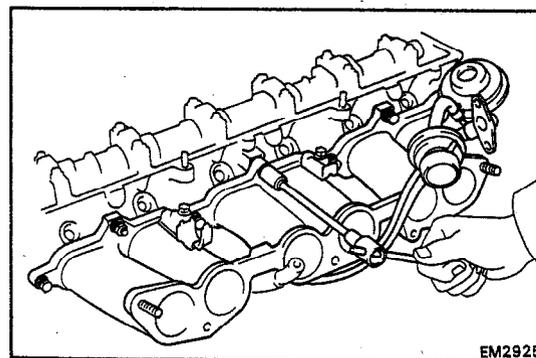
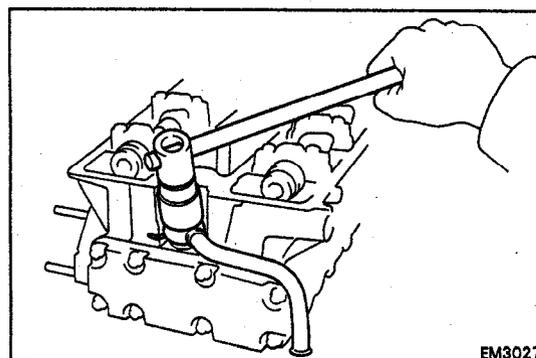
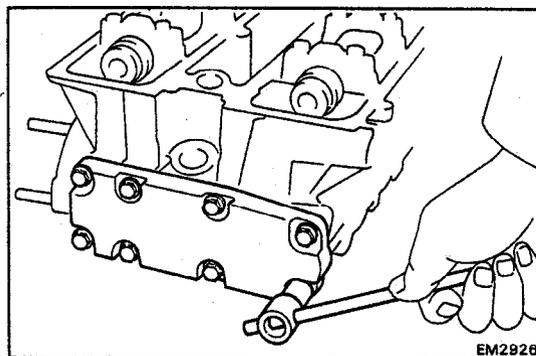
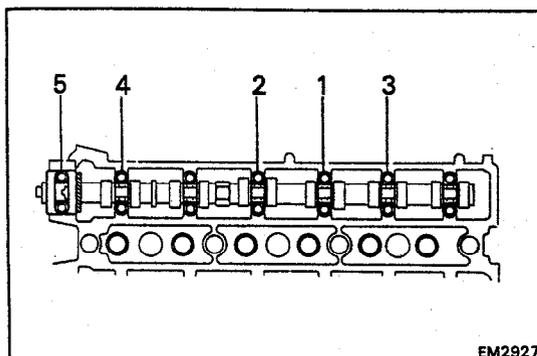
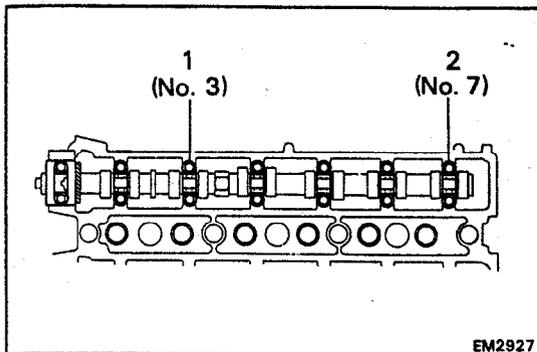
- (g) Tighten each bearing cap bolt a little at a time and in the sequence shown in the figure.



- (h) Using SST, drive in a new camshaft oil seal.

SST 09223-50010

NOTE: Be careful not to install the oil seal slantwise.



- (i) Tighten the No.3 and No.7 bearing cap bolts a little at a time and in the sequence shown in the figure.

Torque: 200 kg-cm (14 ft-lb, 20 N·m)

- (j) Torque each bearing cap bolt a little at a time and in the sequence shown in the figure.

Torque: 200 kg-cm (14 ft-lb, 20 N·m)

- (k) Check the camshaft thrust clearance.

4. (w/ EGR)

INSTALL EGR COOLER

Install a new gasket and EGR cooler with the eight bolts.

Torque: 140 kg-cm (10 ft-lb, 14 N·m)

(w/o EGR)

INSTALL EGR HOLE PLATE

Install a new gasket and EGR hole plate with the two bolts.

5. INSTALL HEATER UNION

- (a) Install a new gasket, union, another gasket and union bolt to the cylinder head.

- (b) Torque the union bolt.

Torque: 600 kg-cm (43 ft-lb, 59 N·m)

6. INSTALL NO.2 ENGINE HANGER AND GROUND STRAP

Torque: 400 kg-cm (29 ft-lb, 39 N·m)

7. INSTALL INTAKE MANIFOLD

- (a) Position a new gasket on the cylinder head.

- (b) (w/ EGR)

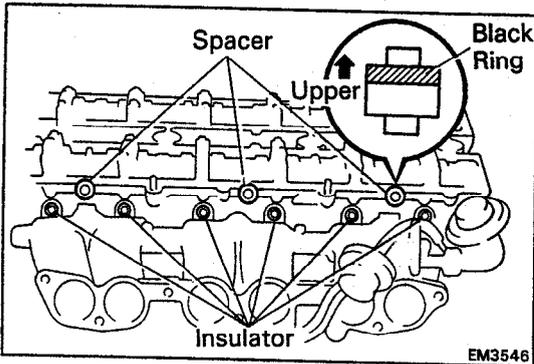
- Install the intake manifold and VSV with the two nuts and seven bolts.
- Install the EGR valve with the two nuts.
- Torque the bolts and nuts.

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

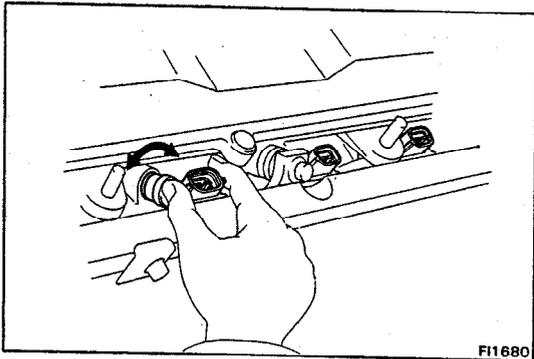
(w/o EGR)

- Install the intake manifold four nuts and seven bolts.
- Torque the bolts and nuts.

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

**8. INSTALL DELIVERY PIPE WITH INJECTORS**

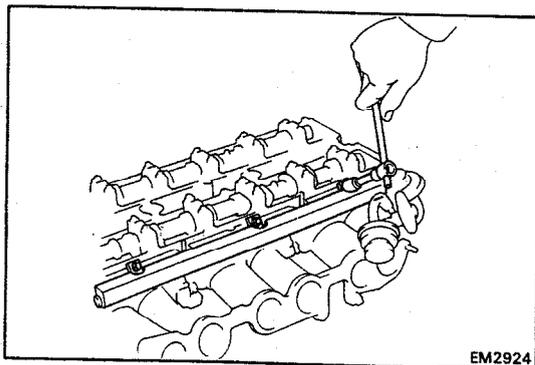
- Install the six insulators into the injector hole of the cylinder head.
- Install the black rings on the upper portion of each of the three spacers. Then install the spacers on the delivery pipe mounting holes of the cylinder head.



- Place the injectors together with delivery pipe on the cylinder head.
- Make sure that the injectors rotate smoothly.

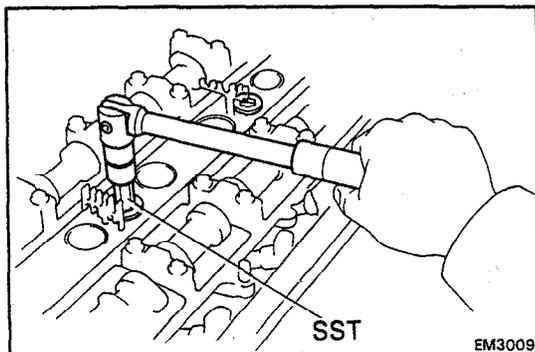
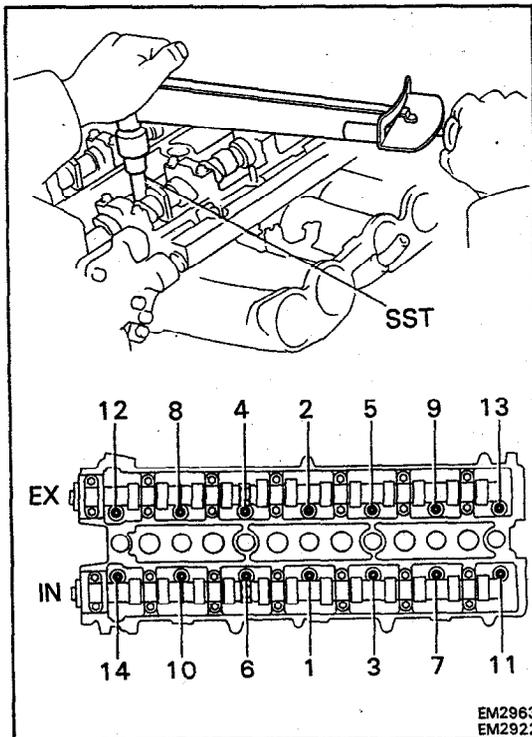
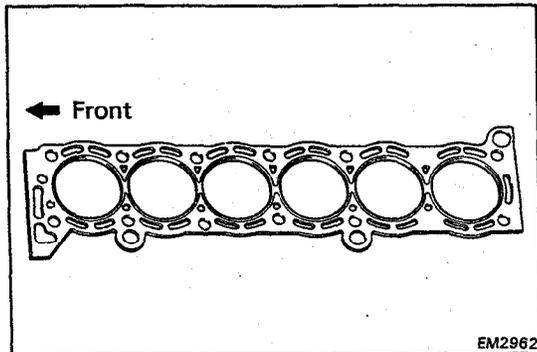
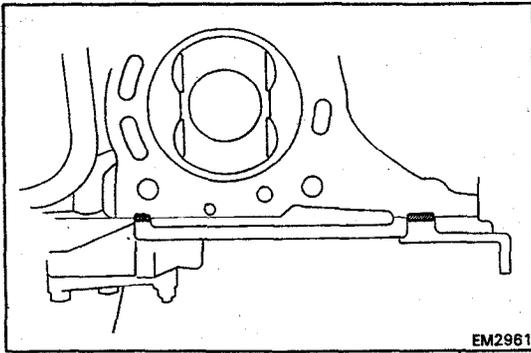
- Install the three thinner spacers and bolts. Torque the bolts.

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

**9. INSTALL ALTERNATOR BRACKET**

Torque: 400 kg-cm (29 ft-lb, 39 N·m)

10. INSTALL NO.2 TIMING BELT COVER



INSTALLATION OF CYLINDER HEAD

(See pages EM-37, 38)

1. INSTALL CYLINDER HEAD

- (a) Apply seal packing to the two locations shown.
Seal packing: Part No. 08826-00080 or equivalent

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

CAUTION: Be careful of the installation direction.

- (c) Place the cylinder head on the cylinder head gasket, and connect the No.5 water by-pass hose to the union.
- (d) Apply a light coat of the engine oil on the threads and under the cylinder head bolts.
- (e) Using SST, install and uniformly tighten the fourteen cylinder head bolts in several passes and in the sequence shown.

SST 09043-38100

Torque: 800 kg-cm (58 ft-lb, 78 N·m)

2. INSTALL CAMSHAFT TIMING PULLEYS AND TIMING BELT

(See steps 8 to 12 and 14 on pages EM-34 to 36)

3. INSTALL SPARK PLUGS

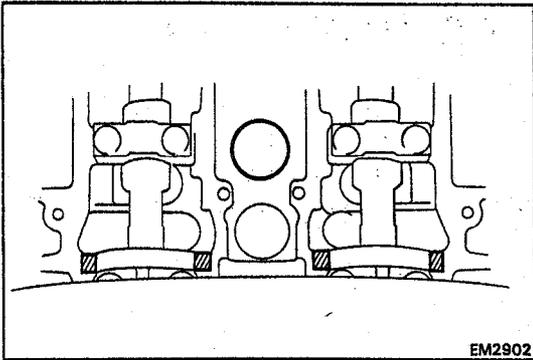
(See page IG-7)

4. INSTALL CYLINDER HEAD COVERS

- (a) Using SST, install the No.3 cylinder head cover and heater hose clamp.

SST 09923-00010

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

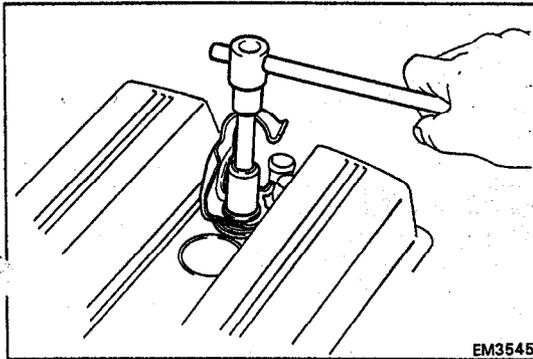


- (b) Apply seal packing to the cylinder head as shown in the figure.

Seal packing: Part No.08826-00080 or equivalent

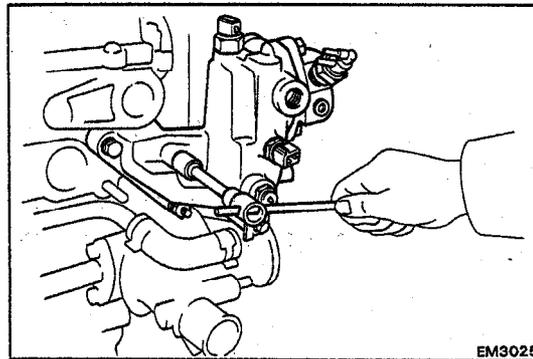
- (c) Install the No.1 and No.2 cylinder head covers.

Torque: 25 kg-cm (22 in.-lb, 2.5 N·m)



- (d) (MA)
Install the heater hose clamp.

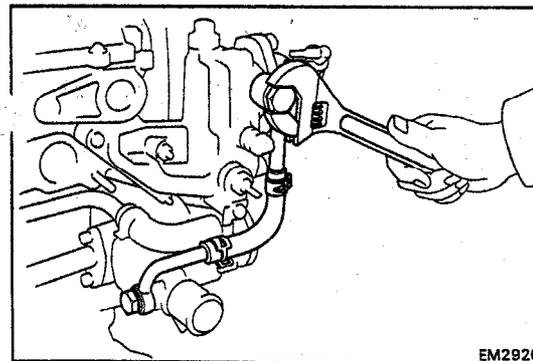
- (e) (7M-GTE)
Install the accelerator link.



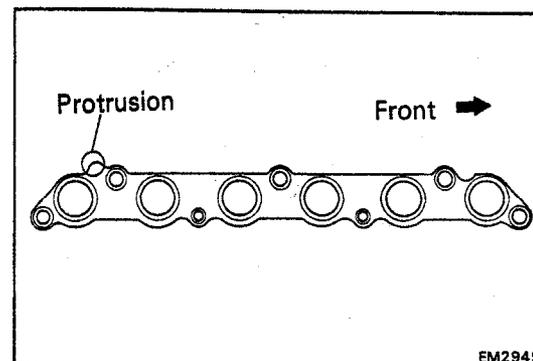
5. INSTALL WATER OUTLET HOUSING

- (a) Install a new gasket and water outlet housing with the bolt and two nuts.

- (b) Connect the No.6 water by-pass hose.

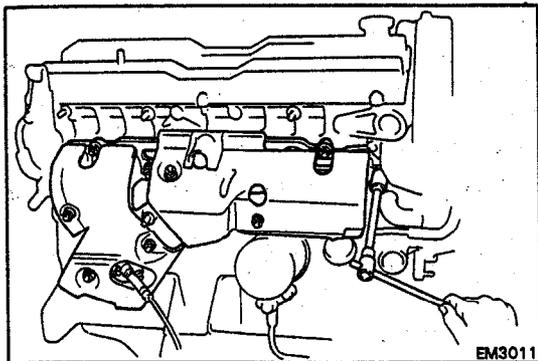


- (c) (7M-GE)
Install a new gasket, union, another gasket and union bolt to the water outlet housing.

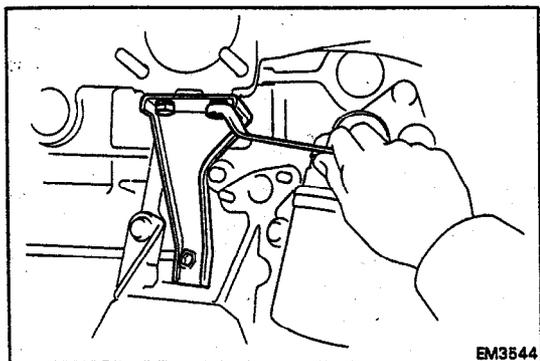


6. INSTALL EXHAUST MANIFOLD

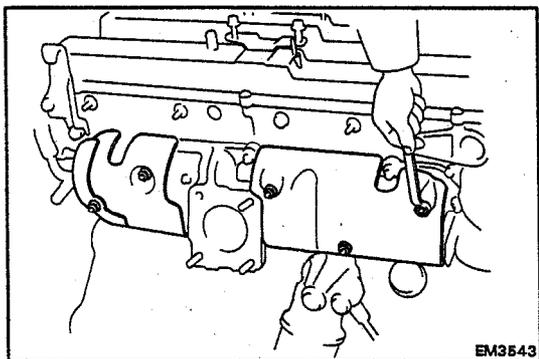
- (a) Face a new exhaust gasket so the protrusion is facing the rear and install on the cylinder head.



- (b) Install the exhaust manifold with the seven nuts.
Torque: 400.kg-cm (29 ft-lb, 39 N·m)

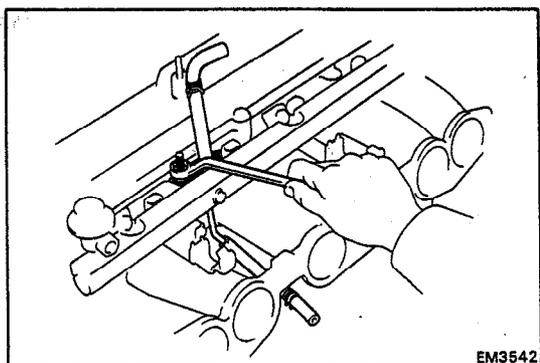


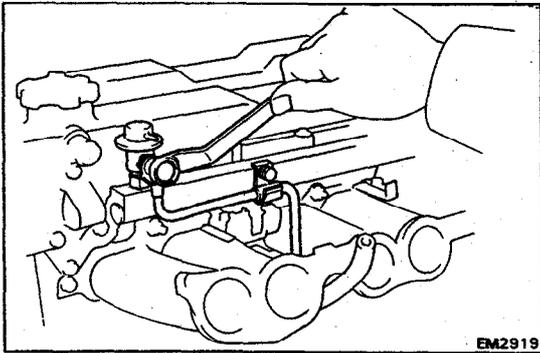
- (c) (7M-GTE)
Install the exhaust manifold stay with the three bolts.



- (d) (7M-GTE)
Install the heat insulators with the five bolts.

7. (7M-GTE)
INSTALL TURBOCHARGER
(See steps 4 to 8 and 10 to 12 on pages TC-15 to 17)
8. (7M-GE)
INSTALL OIL DIPSTICK
9. (7M-GE)
INSTALL DISTRIBUTOR AND HIGH-TENSION CORDS
(See page IG-22)
10. (7M-GTE)
INSTALL AUXILIARY AIR PIPE

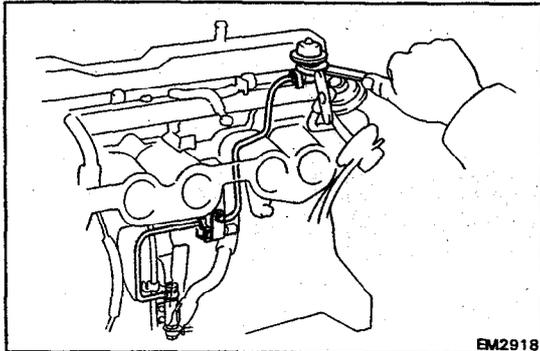


**11. INSTALL NO.2 FUEL PIPE**

- (a) Install a new gasket, No.2 fuel pipe, another gasket and union bolt to the pressure regulator.

Torque: 250 kg-cm (18 ft-lb, 25 N·m)

- (b) Install the No.2 fuel pipe to the delivery pipe with the bolt.

**12. INSTALL NO.1 FUEL PIPE AND PULSATION DAMPER**

- (a) Install a new gasket, No.1 fuel pipe, another gasket and pulsation damper to the delivery pipe.

Torque: 400 kg-cm (29 ft-lb, 39 N·m)

- (b) Install the No.1 fuel pipe and VSV to the intake manifold.

- (c) Connect the No.1 fuel pipe to the fuel support (MA) or fuel filter (MS).

13. INSTALL ENGINE WIRE

- (a) Install the engine wire to the each clamps.
- (b) Connect following wires:
- Three VSV connectors
 - Knock sensor connector
 - Ground strap to intake manifold
 - Injector connectors
 - Distributor connector
 - Cold start injector time switch connector
 - Water temp. sender gauge connector
 - Water temp. sensor connector
 - Oil pressure sender gauge connector
 - (w/ TWC)
Oxygen sensor connector

14. (7M-GTE)

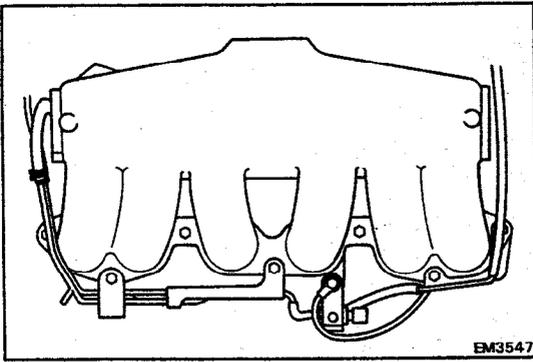
INSTALL IGNITION COIL WITH BRACKET
(See steps 11, 12 on page EM-13)

15. INSTALL AIR INTAKE CHAMBER WITH CONNECTOR

- (a) Position a new gasket on the intake manifold.

- (b) (7M-GTE)

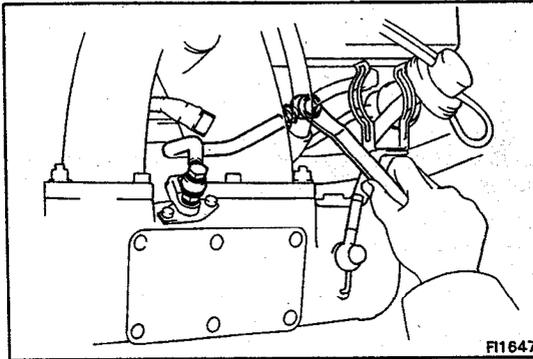
Connect the cold start injector connector



- (c) Install the intake chamber with connector and vacuum transmitting pipes with the two nuts and five bolts.

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

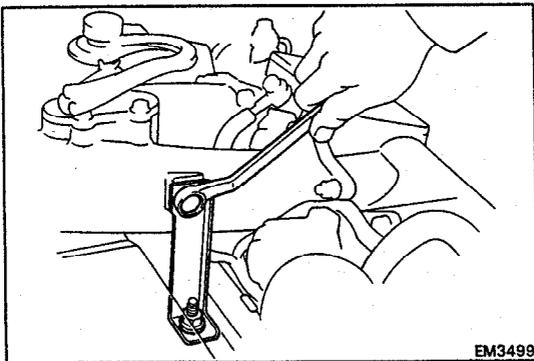
- (d) Connect the engine wire to the clamps of the intake chamber.



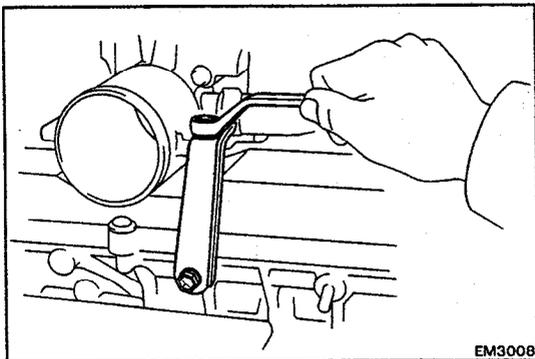
- (e) Install new gaskets and cold start injector tube.

**Torque: To delivery pipe
300 kg-cm (22 ft-lb, 29 N·m)
To cold start injector
180 kg-cm (13 ft-lb, 18 N·m)**

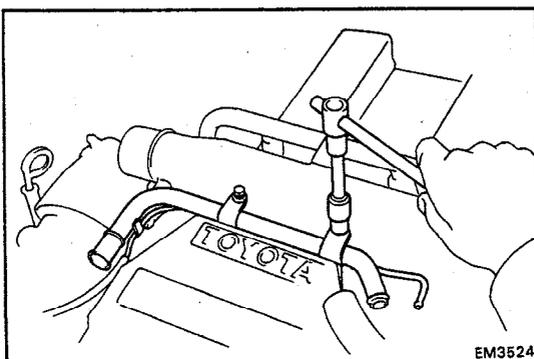
- (f) (w/ EGR)
Install the EGR vacuum modulator to the bracket.



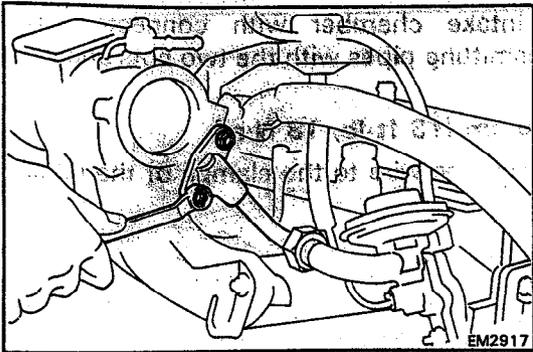
- (g) (7M-GE)
Install the air intake connector bracket mounting bolts.



- (h) (7M-GE)
Install the throttle body bracket(s).

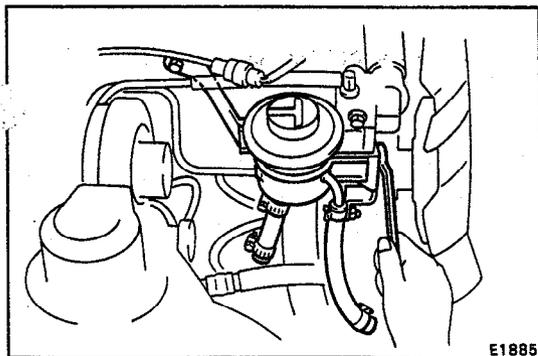


- (i) (7M-GTE)
Install the ISC pipe and connect the hoses.



- (j) Install the EGR pipe mounting bolts.
- (k) Install the manifold stay mounting bolt.
- (l) Connect following hoses:
 - (7M-GE)
No.3 water by-pass hose to throttle body (7M-GTE)
 - Auxiliary air pipe hose to vacuum transmitting pipe
 - No.1 water by-pass hose to ISC valve
- (m) Connect following hoses:
 - (7M-GE)
Diaphragm hose
 - VSV(for fuel pressure up)hoses
 - Pressure regulator hose
 - EGR hoses to throttle body and vacuum transmitting pipe.
 - Vacuum transmitting pipe hose to intake chamber
 - BSVV hose to throttle body
- (n) Connect following wires:
 - ISC valve connector
 - Throttle position sensor connector
 - (7M-GE)
Cold start injector connector
- (o) Install the PCV pipe.

**16. (7M-GTE)
INSTALL CAM POSITION SENSOR
(See steps 1, 2 on page IG-26)**

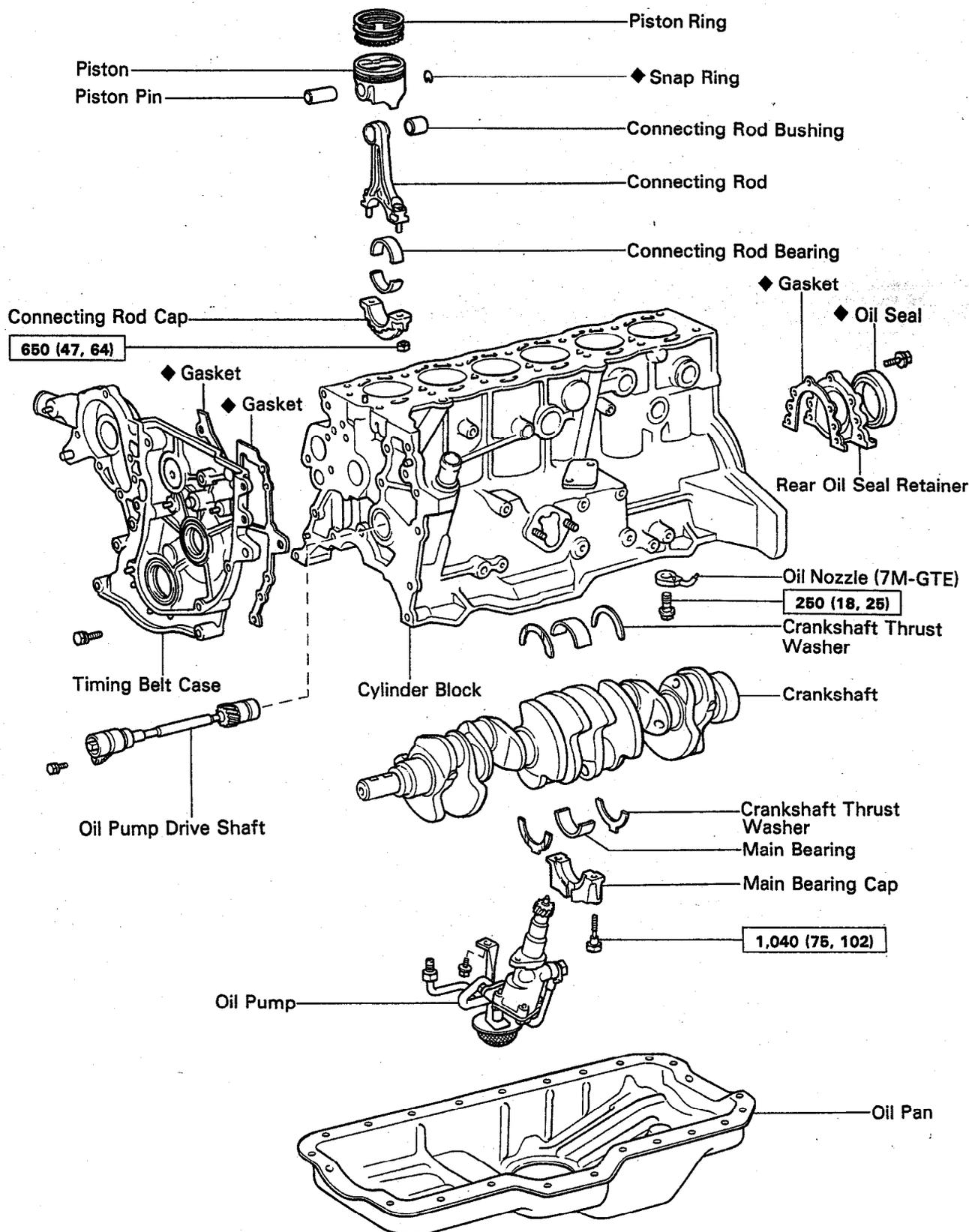


**17. (7M-GTE)
INSTALL PS RESERVOIR TANK**
Install the PS reservoir tank with bracket.

18. INSTALL ALTERNATOR AND ADJUSTING BAR

- (a) Install the alternator and adjusting bar.
- (b) Install the drive belt.
(See page EM-36)
- (c) Connect the No.3 PCV pipe.

CYLINDER BLOCK COMPONENTS



kg-cm (ft-lb, N·m) : Specified torque

◆ Non-reusable part

DISASSEMBLY OF CYLINDER BLOCK

(See page EM-65)

1. REMOVE FLYWHEEL OR DRIVE PLATE AND REAR END PLATE
2. INSTALL ENGINE STAND FOR DISASSEMBLY
3. REMOVE TIMING BELT
(See steps 2 to 8 and 10 to 18 on pages EM-28 to 31)
4. REMOVE CYLINDER HEAD
(See steps 1 to 15 and 18 on pages EM-39 to 43)

5. REMOVE WATER BY-PASS PIPE AND HOSES

- (a) Remove the two nuts from the timing belt case.
- (b) Remove the three bolts from the cylinder block and the water by-pass pipe and hose with gasket.

6. REMOVE GROUND STRAP FROM CYLINDER BLOCK

7. (7M-GE)
REMOVE VACUUM CONTROL VALVE SET

8. REMOVE FUEL RETURN PIPE SUPPORT
Remove the two nuts, fuel pipe support and insulator.

9. REMOVE ENGINE MOUNTING BRACKETS

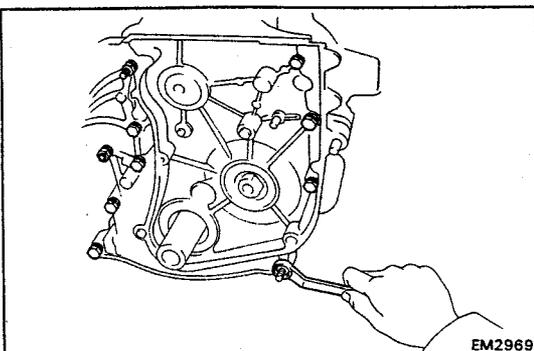
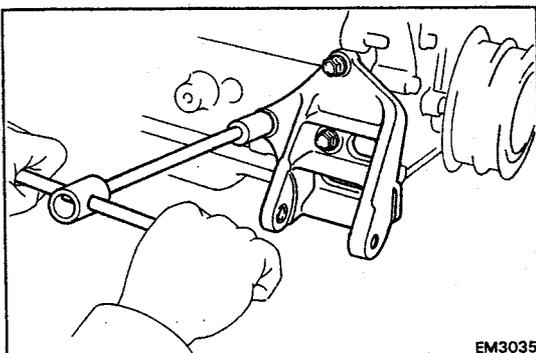
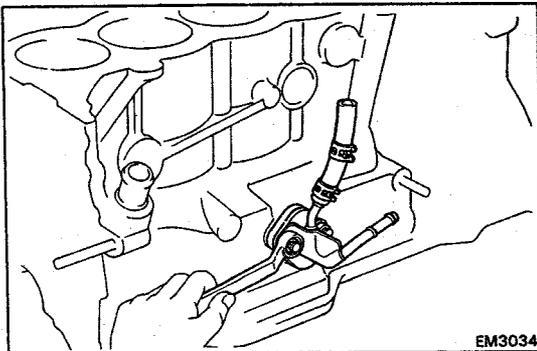
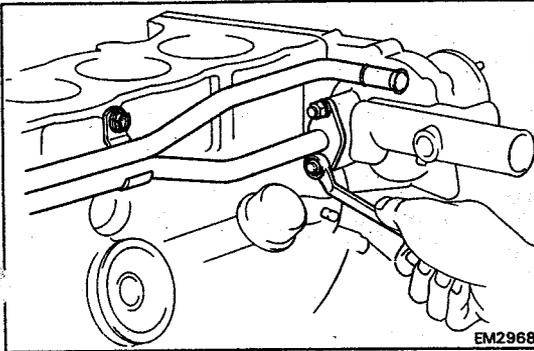
10. (7M-GE)
REMOVE OIL FILTER
(See page LU-6)
(7M-GTE)
REMOVE OIL FILTER BRACKET
(See step 1 on page LU-18)

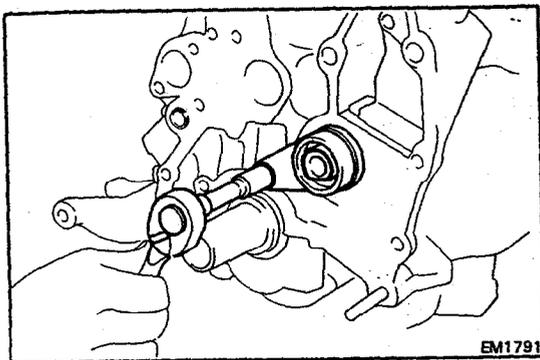
11. (7M-GE w/ Oil cooler)
REMOVE OIL HOLE COVER PLATE
(7M-GE w/o Oil cooler)
REMOVE OIL HOLE COVER PLATE

12. REMOVE PS PUMP BRACKET

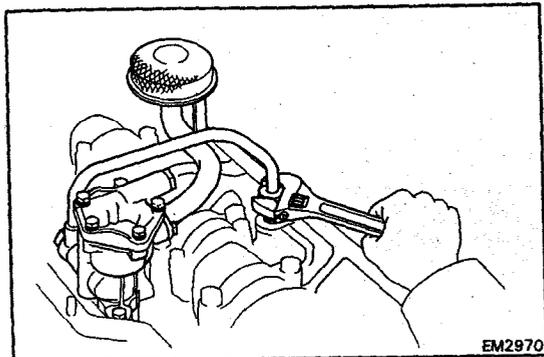
13. REMOVE OIL PAN
(See page LU-9)

14. REMOVE TIMING BELT CASE WITH WATER PUMP
Remove the seven bolts and three nuts, and remove the timing belt case and gaskets.

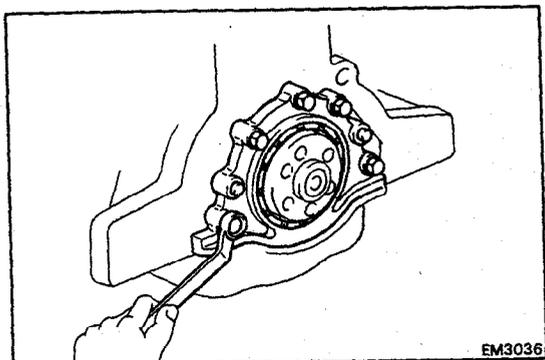


**15. REMOVE OIL PUMP DRIVE SHAFT**

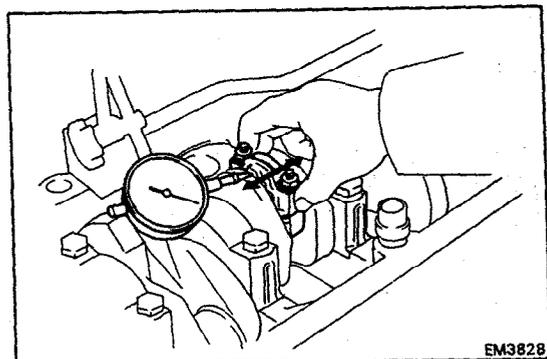
- (a) Remove the bolt and oil pump drive shaft.
- (b) While turning oil pump drive shaft, slowly pull out so as not to damage the bearing.

**16. REMOVE OIL PUMP**

- (a) Loosen the union nut.
- (b) Remove the two bolts and oil pump.

**17. REMOVE REAR OIL SEAL RETAINER**

Remove the five bolts, rear oil seal retainer and gasket.

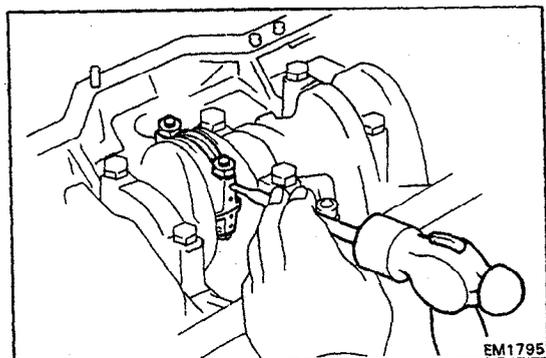
**18. CHECK CONNECTING ROD THRUST CLEARANCE**

Using a dial indicator, measure the thrust clearance while moving the rod back and forth.

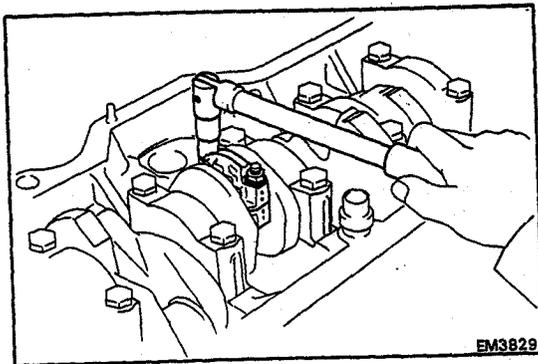
Standard thrust clearance: 0.160 – 0.296 mm
(0.0063 – 0.0117 in.)

Maximum thrust clearance: 0.3 mm (0.012 in.)

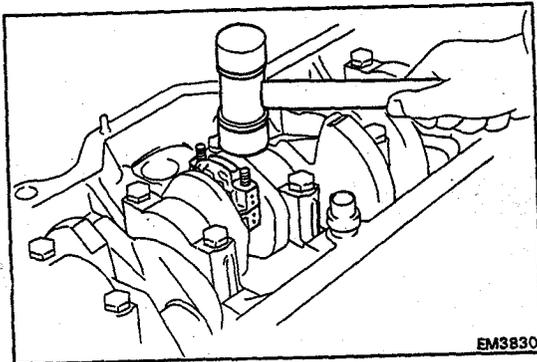
If clearance is greater than maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.

**19. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE**

- (a) Using a punch or numbering stamp, place the matchmarks on the rod and cap to ensure correct reassembly.

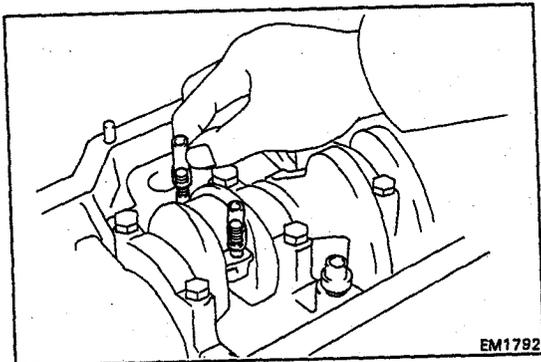


(b) Remove the connecting rod cap nuts.

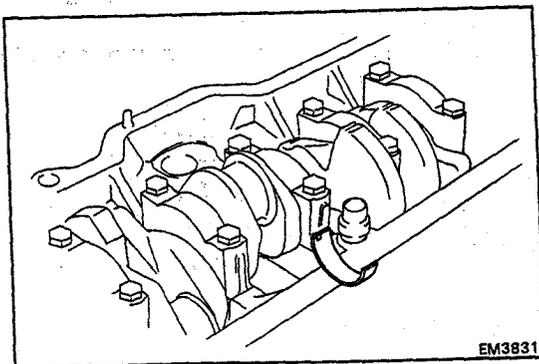


(c) Using a plastic-faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.

NOTE: Keep the lower bearing inserted with the connecting rod cap.



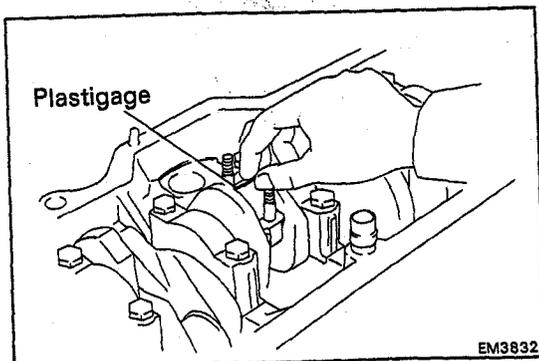
(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



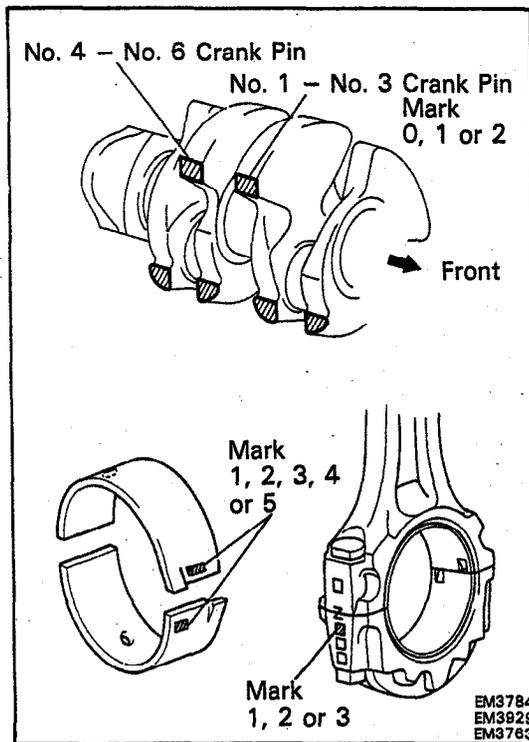
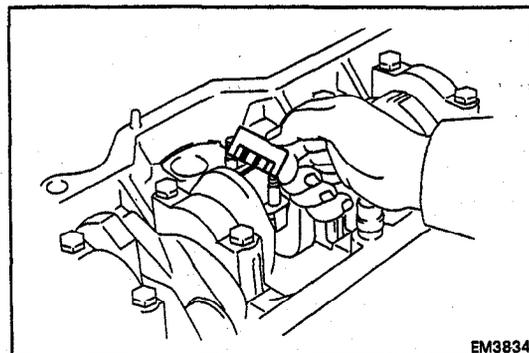
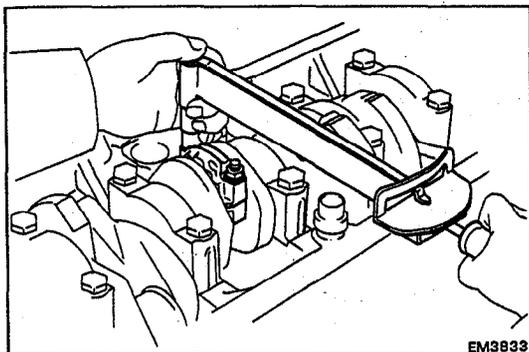
(e) Clean the crank pin and bearing.

(f) Check the crank pin and bearing for pitting and scratches.

If the crank pin or bearing are damaged, replace the bearings. If necessary, grind or replace the crankshaft.



(g) Lay a strip of Plastigage across the crank pin.



- (h) Install the connecting rod cap.
(See step 7 on page EM-90)

Torque: 650 kg-cm (47 ft-lb, 64 N·m)

NOTE: Do not turn the crankshaft.

- (i) Remove the connecting rod cap.
- (j) Measure the Plastigage at its widest point.

Standard oil clearance: 0.021 – 0.053 mm (0.0008 – 0.0021 in.)

Maximum oil clearance: 0.07 mm (0.0028 in.)

If the oil clearance is greater than maximum, replace the bearings. If necessary, grind or replace the crankshaft.

Undersized bearing: U/S 0.25

- (k) Completely remove the plastigage.

NOTE: If using a standard size bearing, replace with one having the same number. If the number of the bearing cannot be determined, select a bearing from the table below according to the numbers imprinted on the connecting rod cap and crankshaft. There are five sizes of standard bearings, marked "1", "2", "3", "4" and "5".

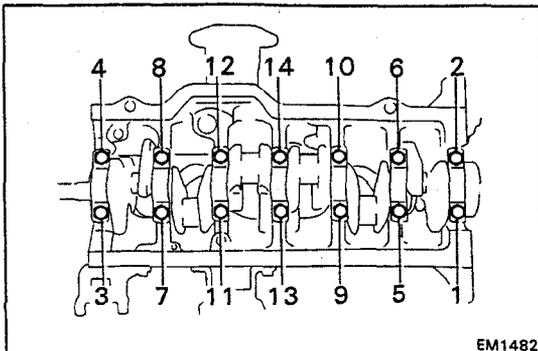
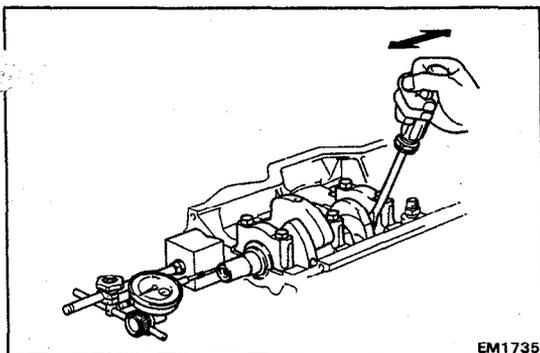
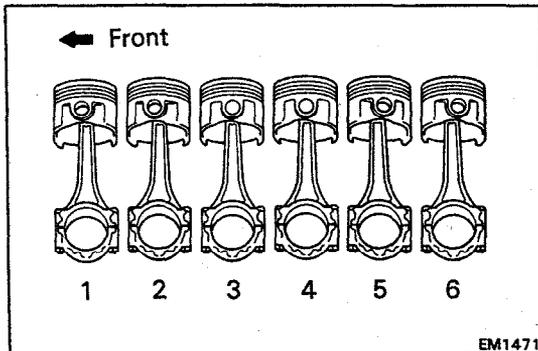
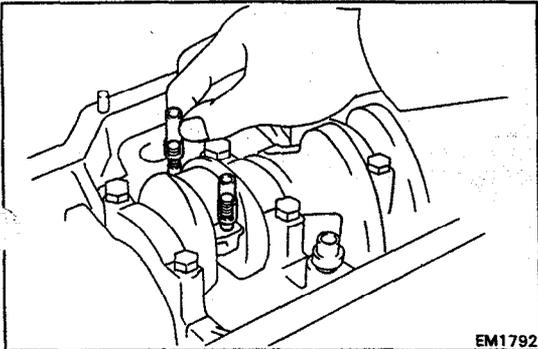
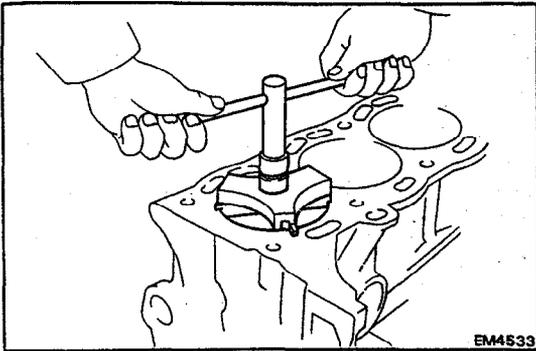
	Number marked								
Rod cap	1	1	2	1	2	3	2	3	3
Crankshaft	0	1	0	2	1	0	2	1	2
Bearing	1	2	2	3	3	3	4	4	5

Example: Rod cap "2", Crankshaft "1" = Bearing "3"

(Reference)

Mark	Big End Inner Diameter	Crank Pin Diameter	Bearing Center Wall Thickness
0	—	51.993 – 52.000 (2.0470 – 2/0472)	—
1	55.015 – 55.025 (2.1659 – 2.1663)	51.985 – 51.992 (2.0446 – 2.0469)	1.490 – 1.495 (0.0587 – 0.0589)
2	55.026 – 55.035 (2.1664 – 2.1667)	51.976 – 51.984 (2.0463 – 2.0466)	1.496 – 1.500 (0.0589 – 0.0591)
3	55.036 – 55.045 (2.1668 – 2.1671)	—	1.501 – 1.505 (0.0591 – 0.0593)
4	—	—	1.506 – 1.510 (0.0593 – 0.0594)
5	—	—	1.511 – 1.515 (0.0595 – 0.0596)
U/S 0.25	55.015 – 55.045 (2.1659 – 2.1671)	51.725 – 51.735 (2.0364 – 2.0368)	1.622 – 1.632 (0.0639 – 0.0643)

mm (in.)



20. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

- (a) Remove all the carbon from the top of the cylinder.
- (b) Cover the rod bolts with a short piece of hose to protect the crankshaft from damage.
- (c) Push the piston, connecting rod assembly and the upper bearing through the top of the cylinder block.

NOTE:

- Keep the bearing insert with the connecting rod and cap.
- Arrange the piston and connecting rod assemblies in order.

21. CHECK CRANKSHAFT THRUST CLEARANCE

Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard thrust clearance: 0.05 – 0.25 mm
(0.0020 – 0.0098 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

If the clearance is greater than maximum, replace the thrust washers as a set.

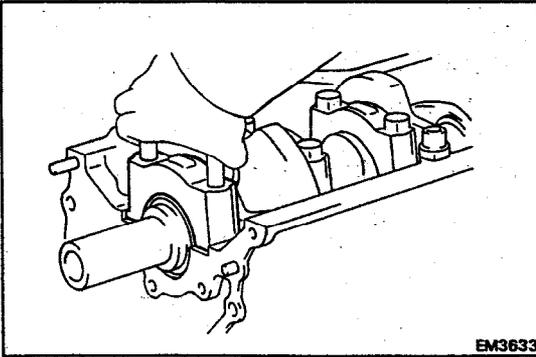
Thrust washer thickness:

STD size 2.925 – 2.975 mm
(0.1152 – 0.1171 in.)

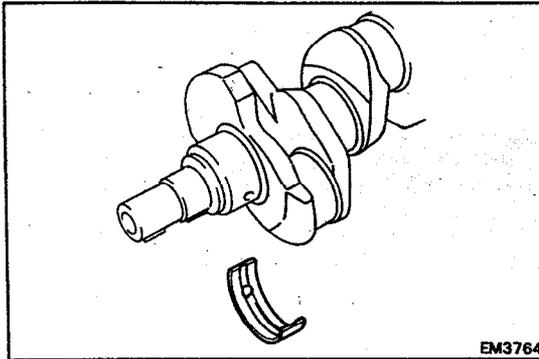
O/S 0.125 2.988 – 3.038 mm
(0.1176 – 0.1196 in.)

22. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

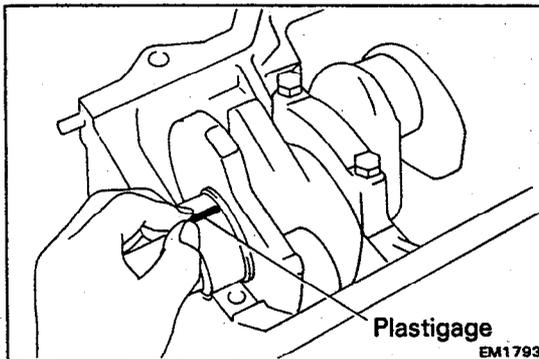
- (a) Uniformly loosen and remove the main bearing cap bolts in several passes, in the sequence shown.



EM3693

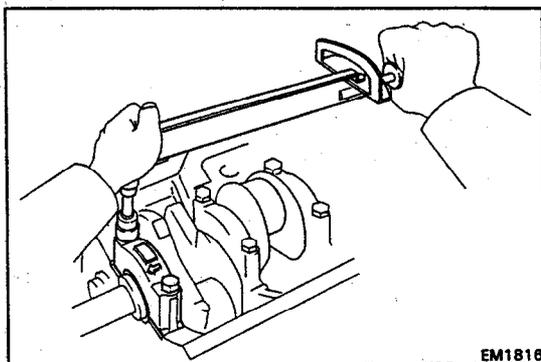


EM3764

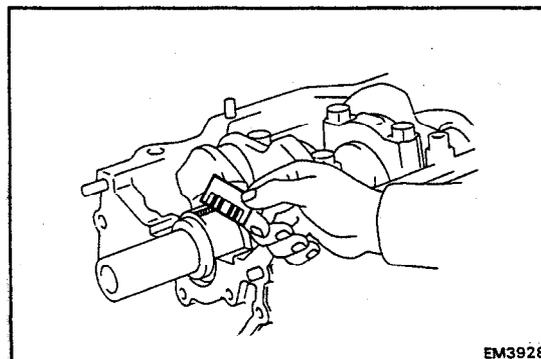


Plastigage

EM1793



EM1816



EM3928

- (b) Using the removed main bearing cap bolts, wiggle the cap back and forth, and remove the caps, lower bearings and lower thrust washers (No. 4 cap only).

NOTE:

- Keep the lower bearing inserted with the cap.
- Arrange the caps and lower thrust washers in correct order.

- (c) Lift out the crankshaft.

NOTE: Keep the upper bearings and upper thrust washers insert with the cylinder block.

- (d) Clean each journal and bearing.

- (e) Check each journal and bearing for pitting and scratches.

If the journal or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.

- (f) Place the crankshaft on the cylinder block.

- (g) Lay a strip of Plastigage across each journal.

- (h) Install the main bearing caps. (See step 5 on page EM-89)

Torque: 1,040 kg-cm (75 ft-lb, 102 N·m)

NOTE: Do not turn the crankshaft.

- (i) Remove the main bearing caps.

- (j) Measure the Plastigage at its widest point.

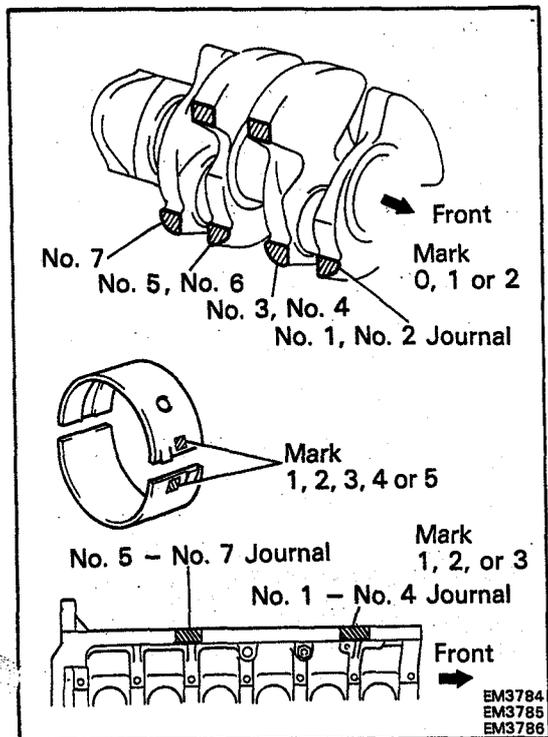
**Standard oil clearance: 0.030 – 0.048 mm
(0.0012 – 0.0019 in.)**

Maximum oil clearance: 0.07 mm (0.0028 in.)

If the oil clearance is greater than maximum, replace the bearings. If necessary, replace the crankshaft.

Under size bearing: U/S 0.25

- (k) Completely remove the Plastigage.



NOTE: If using a standard size bearing, replace with one having the same number. If the number of the bearing cannot be determined, select a bearing from the table below according to the numbers imprinted on the cylinder block and crankshaft.

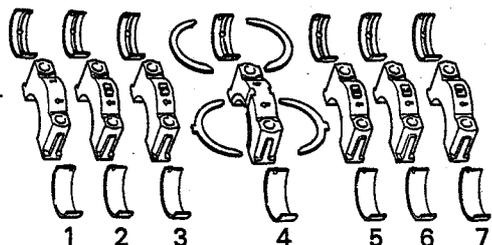
There are five sizes of standard bearings, marked "1", "2", "3", "4" and "5".

	Number marked								
Cylinder Block	1	1	2	1	2	3	2	3	3
Crankshaft	0	1	0	2	1	0	2	1	2
Bearing	1	2	2	3	3	3	4	4	5

Example: Cylinder Block "2", Crankshaft "1" = Bearing "3"
(Reference)

Mark	mm (in.)		
	Cylinder Block Main Journal Bore	Main Journal Diameter	Bearing Center Wall Thickness
0	-	60.007 - 60.012 (2.3625 - 2.3627)	-
1	64.024 - 64.030 (2.5206 - 2.5209)	60.001 - 60.006 (2.3622 - 2.3624)	1.988 - 1.991 (0.0783 - 0.0784)
2	64.031 - 64.036 (2.5209 - 2.5211)	59.994 - 60.000 (2.3620 - 2.3622)	1.992 - 1.994 (0.0784 - 0.0785)
3	64.037 - 64.042 (2.5211 - 2.5213)	-	1.995 - 1.997 (0.0785 - 0.0786)
4	-	-	1.998 - 2.000 (0.0787 - 0.0787)
5	-	-	2.001 - 2.003 (0.0788 - 0.0789)
U/S 0.25	64.022 - 64.046 (2.5205 - 2.5215)	59.730 - 59.740 (2.3516 - 2.3520)	2.123 - 2.133 (0.0086 - 0.0840)

Upper



Lower

EM3836

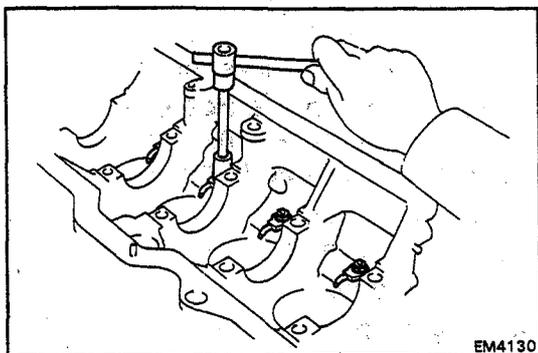
23. REMOVE CRANKSHAFT

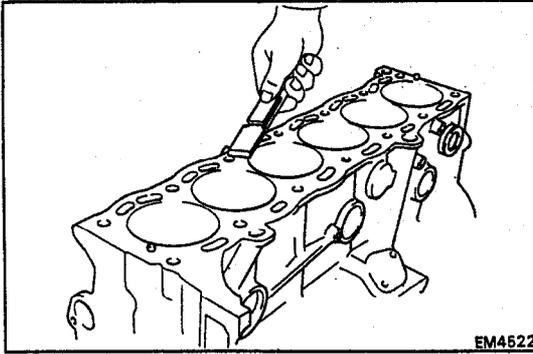
- Lift out the crankshaft.
- Remove the upper bearings and upper thrust washers.

NOTE:

- Arrange the caps, bearings and thrust washers in correct order.
- The pilot bearing in the crankshaft rear end is permanently lubricated and requires no cleaning or lubrication.

24. (7M-GTE) REMOVE OIL NOZZLES





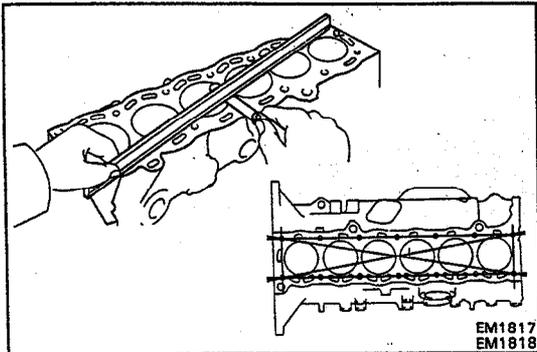
INSPECTION OF CYLINDER BLOCK

1. REMOVE GASKET MATERIAL

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

2. CLEAN CYLINDER BLOCK

Using a soft brush and solvent, clean the block.

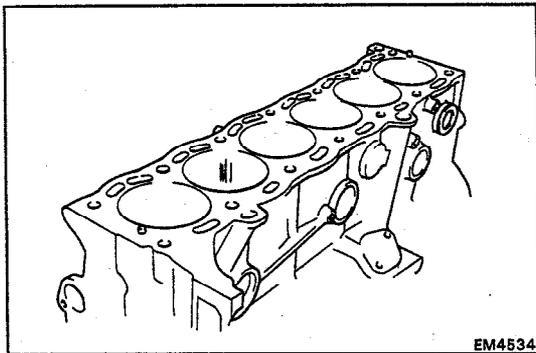


3. INSPECT TOP OF CYLINDER BLOCK FOR FLATNESS

Using a precision straight edge and thickness gauge, measure the surfaces contacting the cylinder head gasket for warpage.

Maximum warpage: 0.05 mm (0.0020 in.)

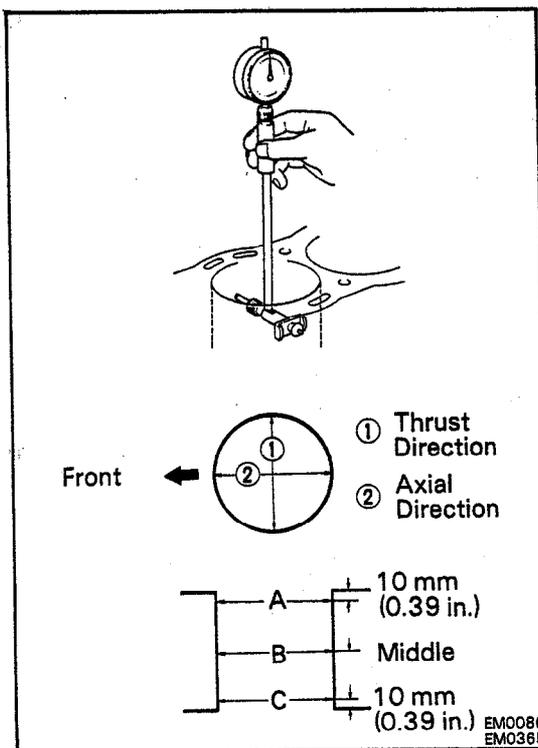
If warpage is greater than maximum, replace the cylinder block.



4. INSPECT CYLINDERS FOR VERTICAL SCRATCHES

Visually check the cylinder for vertical scratches.

If deep scratches are present, rebore all six cylinders. If necessary, replace the cylinder block.



5. INSPECT CYLINDER BORE DIAMETER

Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust and axial directions.

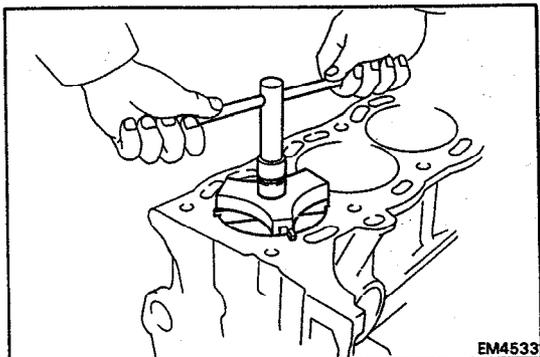
Standard diameter:

STD size 82.99 – 83.04 mm
(3.2673 – 3.2693 in.)

Maximum diameter:

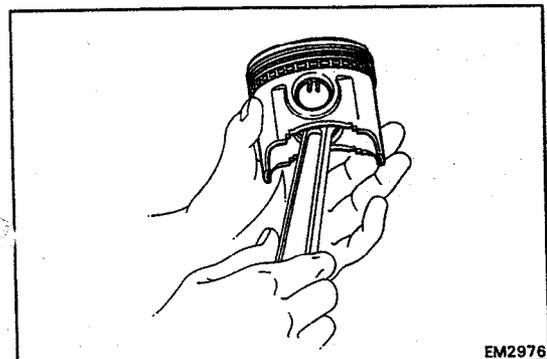
STD size 83.24 mm (3.2772 in.)
O/S 0.50 83.74 mm (3.2968 in.)

If the diameter is greater than maximum, rebore all six cylinders. If necessary, replace the cylinder block.



6. REMOVE CYLINDER RIDGES

If the wear is less than 0.2 mm (0.008 in.), use a ridge reamer to machine the top of the cylinder.

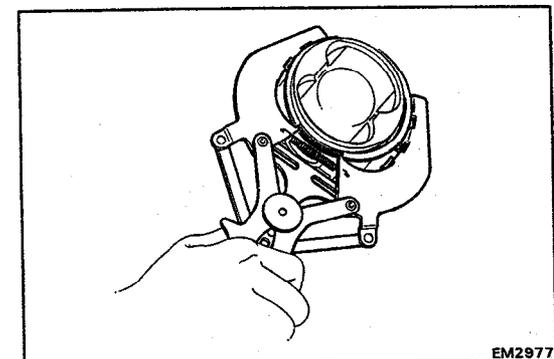


DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

(See page EM-65)

1. CHECK FIT BETWEEN PISTON AND PIN

Try to move the piston back and forth on the piston pin. If any movement is felt, replace the piston and pin as a set.

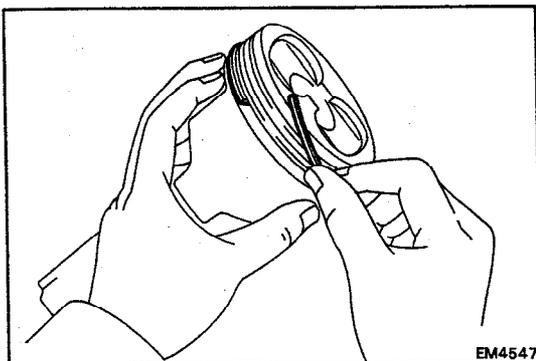


2. REMOVE PISTON RINGS

(a) Using a piston ring expander, remove the compression rings.

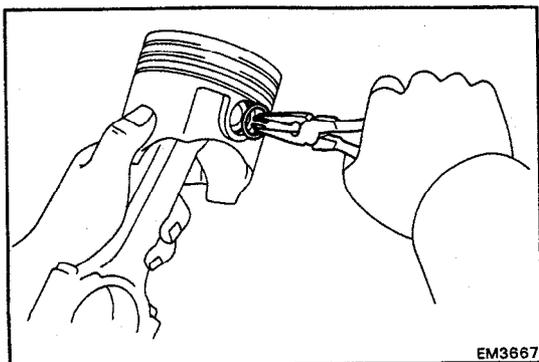
(b) Remove the two side rails and oil ring expander by hand.

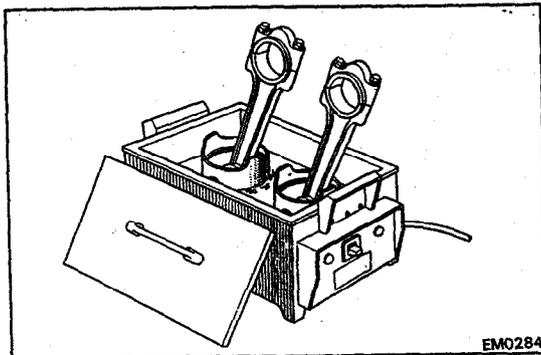
NOTE: Arrange the rings in correct order.



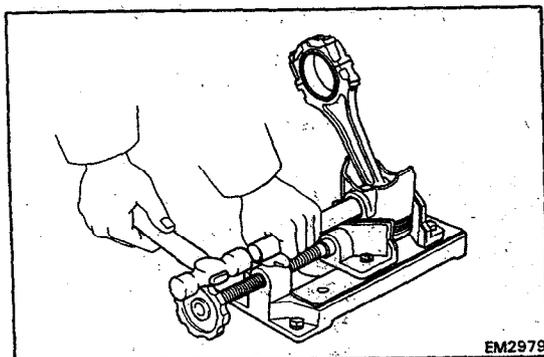
3. DISCONNECT CONNECTING ROD FROM PISTON

(a) Using needle-nose pliers, remove the snap rings from the piston.

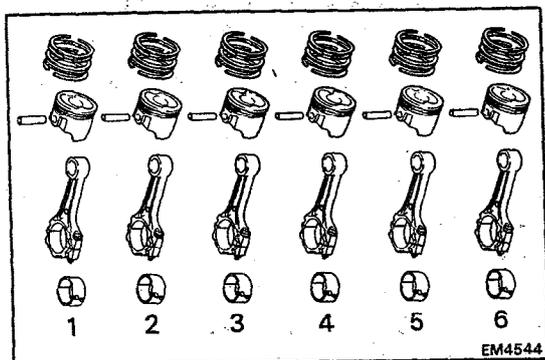




(b) Gradually heat the piston to approx. 60°C (140°F).



(c) Using a plastic-faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.

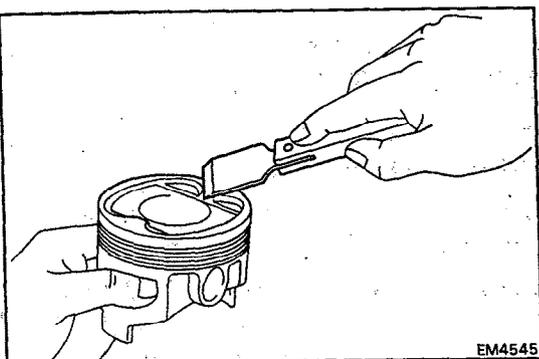


NOTE:

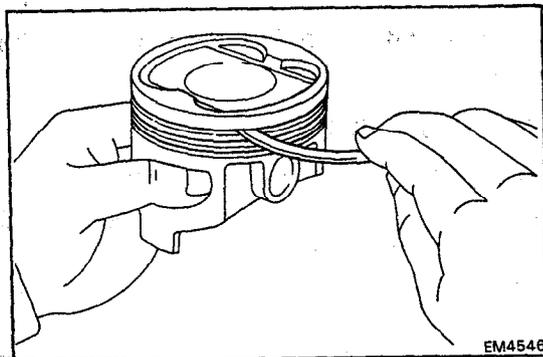
- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in correct order.

INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLIES

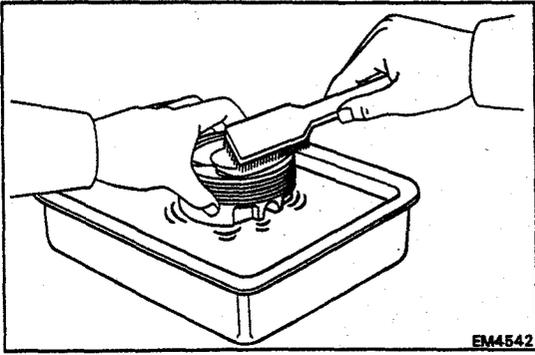
1. CLEAN PISTONS



(a) Using a gasket scraper, remove the carbon from the piston top.

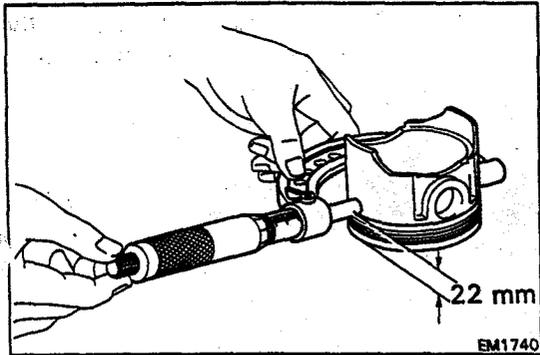


(b) Using a groove cleaning tool or broken ring, clean the ring grooves.



- (c) Using a soft brush and solvent, thoroughly clean the piston.

CAUTION: Do not damage the piston.



2. INSPECT PISTON DIAMETER AND OIL CLEARANCE

- (a) Using a micrometer, measure the piston diameter at a right angle to the piston pin hole center line, 22 mm (0.87 in.) from the piston head.

Standard diameter:

7M-GE	STD size	82.90 – 82.95 mm (3.2638 – 3.2658 in.)
	O/S 0.50	83.40 – 83.45 mm (3.2835 – 3.2854 in.)
7M-GTE	STD size	82.91 – 82.96 mm (3.2642 – 3.2661 in.)
	O/S 0.50	83.41 – 83.46 mm (3.2839 – 3.2858 in.)

- (b) Measure the cylinder bore diameter in thrust directions.

(See step 5 on page EM-73)

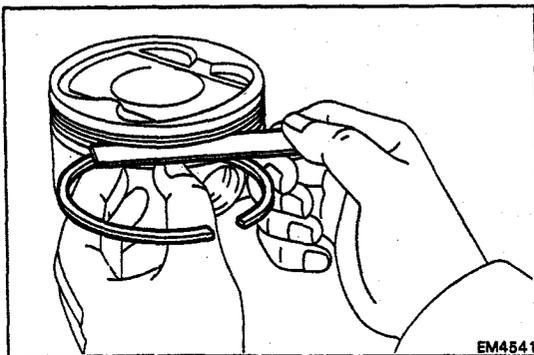
- (c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance:

7M-GE	0.08 – 0.10 mm (0.0031 – 0.0039 in.)
7M-GTE	0.07 – 0.09 mm (0.0028 – 0.0035 in.)

Maximum oil clearance: 0.13 mm (0.0051 in.)

If the oil clearance is greater than maximum, replace the piston. If necessary, rebore all six cylinders and replace all six pistons. If necessary, replace the cylinder block.



3. INSPECT CLEARANCE BETWEEN WALL OF RING GROOVE AND NEW PISTON RING

Using a thickness gauge, measure the clearance between new piston ring and the wall of the piston ring groove.

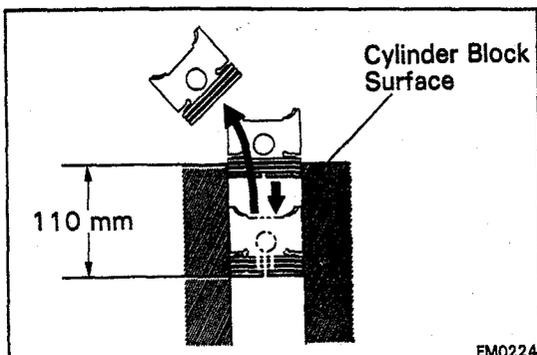
Ring groove clearance:	No. 1	0.03 – 0.07 mm (0.0012 – 0.0028 in.)
	No. 2	0.02 – 0.06 mm (0.0008 – 0.0024 in.)

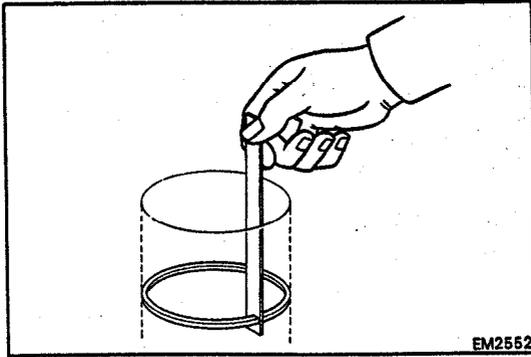
If the clearance is not within specification, replace the piston.

4. INSPECT PISTON RING END GAP

- (a) Insert the piston ring into the cylinder bore.

- (b) Using a piston, push the piston ring a little beyond the bottom of the ring travel.
(110 mm (4.33 in.) from top surface of cylinder block)





(c) Using a thickness gauge, measure the end gap.

Standard end gap:

No. 1

7M-GE (w/o TWC) and 7M-GTE
0.29 – 0.44 mm (0.0114 – 0.0173 in.)

7M-GE (w/ TWC)

0.23 – 0.38 mm (0.0091 – 0.0150 in.)

No. 2 0.25 – 0.53 mm (0.0098 – 0.0209 in.)

Oil (Side rail)

7M-GE (w/o TWC) and 7M-GTE

0.10 – 0.44 mm (0.0039 – 0.0173 in.)

7M-GE (w/ TWC)

0.10 – 0.40 mm (0.0039 – 0.0157 in.)

Maximum end gap:

No. 1

7M-GE (w/o TWC) and 7M-GTE

0.74 mm (0.0291 in.)

7M-GE (w/ TWC)

0.68 mm (0.0268 in.)

No. 2 1.13 mm (0.0445 in.)

Oil (Side rail)

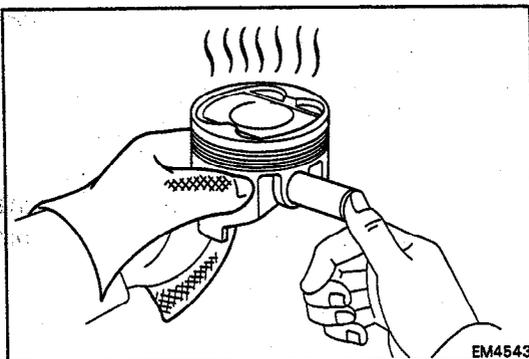
7M-GE (w/o TWC) and 7M-GTE

1.04 mm (0.0409 in.)

7M-GE (w/ TWC)

1.00 mm (0.0394 in.)

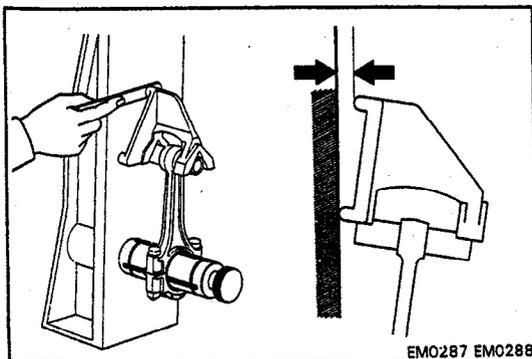
If the gap is greater than maximum, replace the piston ring. If the gap is greater than maximum, even with a new piston ring, rebore the cylinder and use an O/S piston ring.



5. CHECK PISTON PIN FIT

At 60°C (140°F) you should be able to push the pin into the piston with your thumb.

If the pin can be installed at a lower temperature, replace the piston.



6. INSPECT CONNECTING RODS

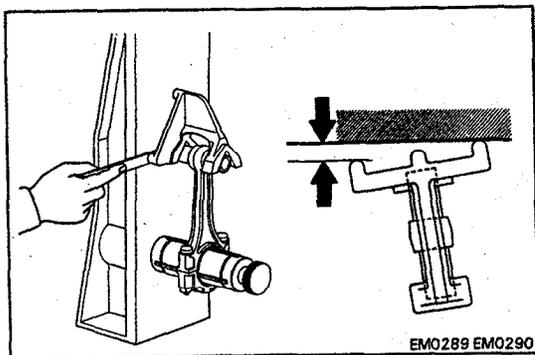
(a) Using a rod aligner and thickness gauge, check the connecting rod alignment.

- Check for bend.

Maximum bend:

0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

If bend is greater than maximum, replace the connecting rod assembly.

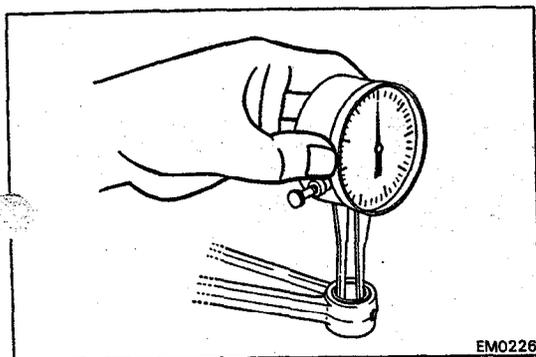


- Check for twist.

Maximum twist:

0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

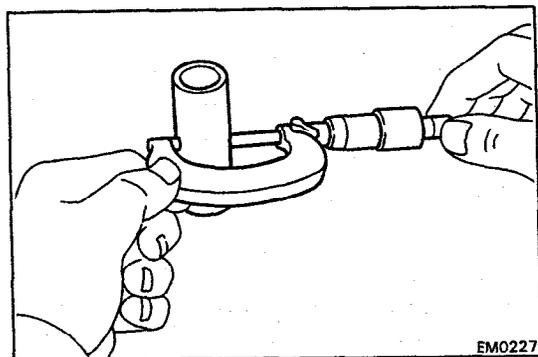
If twist is greater than maximum, replace the connecting rod assembly.



- (b) Inspect the oil clearance between the rod bushing and piston pin.

- Using a caliper gauge, measure the inside diameter of the connecting rod bushing.

**Bushing inside diameter: 22.005 – 22.017 mm
(0.8663 – 0.8668 in.)**



- Using a micrometer, measure the piston pin diameter.

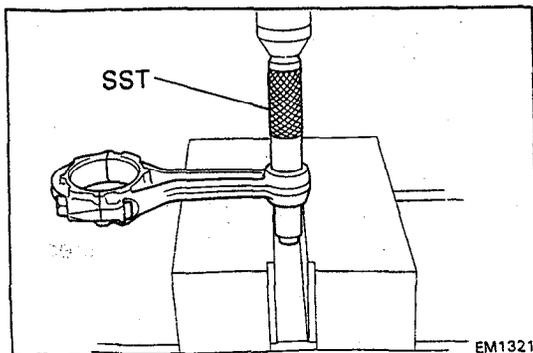
**Piston pin diameter: 21.996 – 22.009 mm
(0.8660 – 0.8665 in.)**

- Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

**Standard oil clearance: 0.005 – 0.011 mm
(0.0002 – 0.0004 in.)**

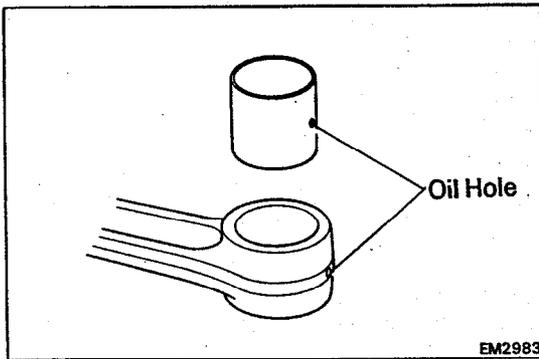
Maximum oil clearance: 0.02 mm (0.0008 in.)

If the oil clearance is greater than maximum, replace the bushing. If necessary, replace the piston and piston pin assembly.



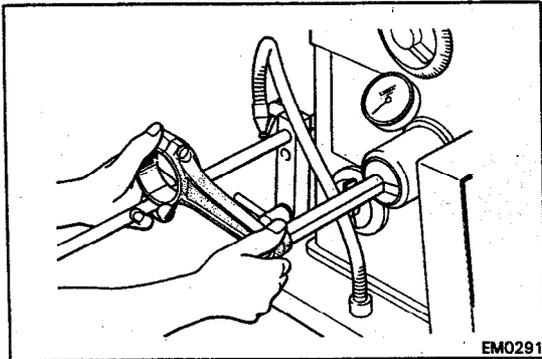
7. IF NECESSARY, REPLACE CONNECTING ROD BUSHINGS

- (a) Using SST and a press, press out the bushing.
SST 09222-30010

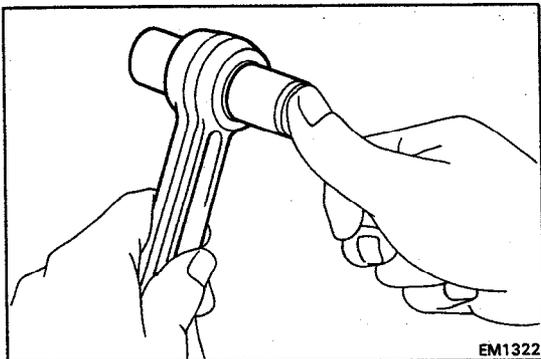


(b) Align the oil holes of a new bushing and connecting rod.

(c) Using SST and a press, press in the bushing.
SST 09222-30010



(d) Using a pin hole grinder, hone the bushing to obtain the specified clearance between the bushing and piston pin.



(e) Check the piston pin fit at normal room temperature. Coat the piston pin with engine oil and push it into the connecting rod with your thumb.

BORING OF CYLINDERS

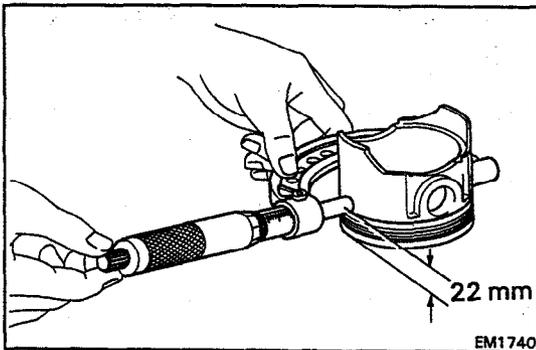
NOTE:

- Bore all six cylinders for the oversized piston outside diameter.
- Replace the piston rings with ones to match the oversized pistons.

1. SELECT OVERSIZED PISTON

Oversized piston diameter:

O/S 0.50	7M-GE	83.40 – 83.45 mm (3.2835 – 3.2854 in.)
	7M-GTE	83.41 – 83.46 mm (3.2839 – 3.2858 in.)



2. CALCULATE AMOUNT TO BORE CYLINDER

- Using a micrometer, measure the piston diameter at a right angle to the piston pin hole center line, 22 mm (0.87 in.) from the piston head.
- Calculate the amount each cylinder is to be rebored as follows:

$$\text{Size to be rebored} = P + C - H$$

P = Piston diameter

C = Piston clearance

$$\text{7M-GE } 0.08 - 0.10 \text{ mm} \\ (0.0020 - 0.0028 \text{ in.})$$

$$\text{7M-GTE } 0.07 - 0.09 \text{ mm} \\ (0.0028 - 0.0035 \text{ in.})$$

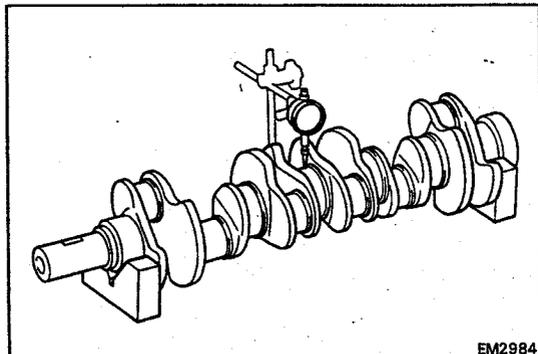
H = Allowance for honing

$$0.02 \text{ mm } (0.0008 \text{ in.}) \text{ or less}$$

3. BORE AND HONE CYLINDERS TO CALCULATED DIMENSIONS

Maximum honing: 0.02 mm (0.0008 in.)

CAUTION: Excess honing will destroy the finished roundness.



INSPECTION OF CRANKSHAFT

1. INSPECT CRANKSHAFT FOR RUNOUT

- (a) Place the crankshaft 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 crankshaft.

NOTE: Use a long spindle on the dial gauge.

2. INSPECT MAIN JOURNALS AND CRANK PINS

- (a) Using a micrometer, measure the diameter of each main journal and crank pin.

Journal diameter:

STD size 59.994 – 60.012 mm
(2.3620 – 2.3627 in.)

U/S 0.25 59.730 – 59.740 mm
(2.3516 – 2.3520 in.)

Crank pin diameter:

STD size 51.976 – 52.000 mm
(2.0463 – 2.0472 in.)

U/S 0.25 51.725 – 51.735 mm
(2.0364 – 2.0368 in.)

If the diameter is not within specification, check the oil clearance. If necessary, grind or replace the crankshaft.

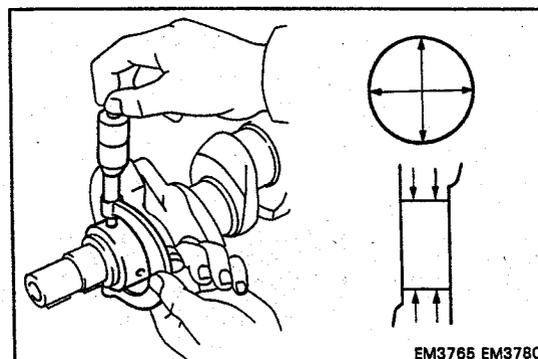
- (b) Check each main journal and crank pin for taper and out-of-round as shown.

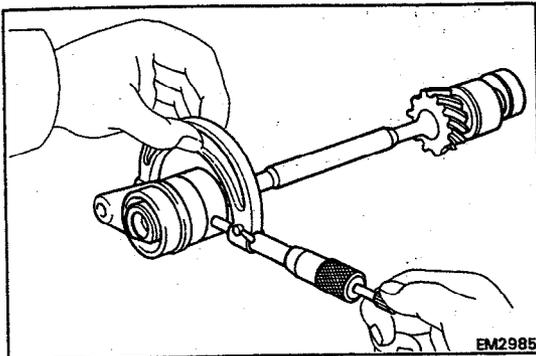
Maximum taper and out-of-round: 0.02 mm
(0.0008 in.)

If taper or out-of-round is greater than maximum, replace the crankshaft.

3. IF NECESSARY, GRIND AND HONE MAIN JOURNALS AND/OR CRANK PINS

Grind and hone the main journals and/or crank pins to the finished undersized diameter (See procedure step 2). Install new main journal and/or crank pin undersized bearings.





INSPECTION AND REPAIR OF OIL PUMP DRIVE SHAFT, BEARINGS AND BUSHING

1. INSPECT OIL PUMP DRIVE SHAFT

- (a) Using a micrometer, measure the journal diameter of pump drive shaft.

Standard journal diameter:

Front 40.959 – 40.975 mm
(1.6126 – 1.6132 in.)

Rear 32.959 – 32.975 mm
(1.2976 – 1.2982 in.)

- (b) Using a cylinder gauge, measure the inside diameter of the pump drive shaft bearing.

Bearing inside diameter:

Front 41.000 – 41.025 mm
(1.6142 – 1.6152 in.)

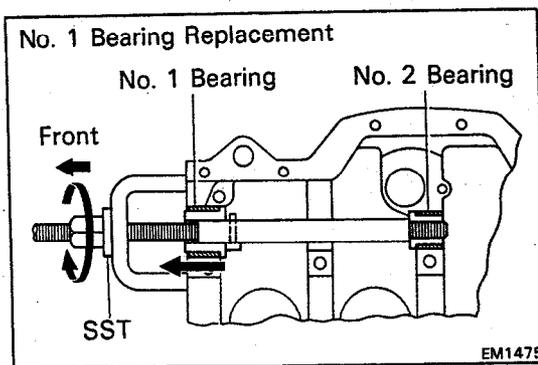
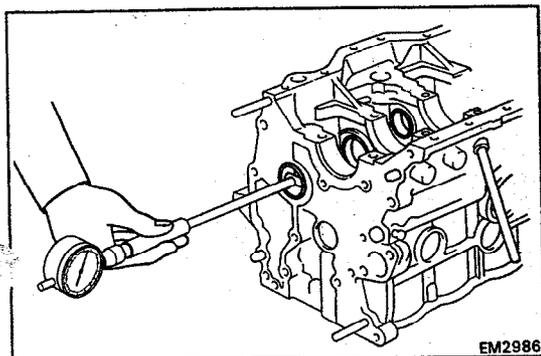
Rear 33.000 – 33.025 mm
(1.2992 – 1.3002 in.)

- (c) Subtract the journal diameter measurement from the bearing inside diameter measurement.

Standard oil clearance: 0.025 – 0.066 mm
(0.0010 – 0.0026 in.)

Maximum oil clearance: 0.08 mm (0.0031 in.)

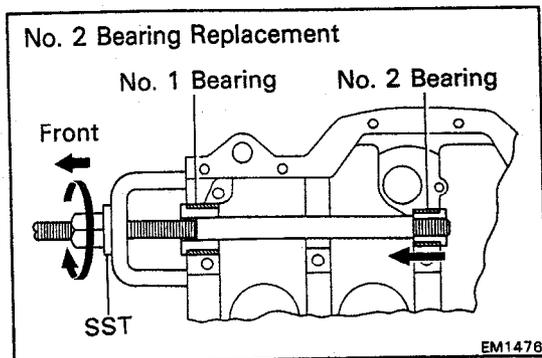
If the clearance is greater than maximum, replace the bearing. If necessary, replace the drive shaft.



2. IF NECESSARY, REPLACE OIL PUMP DRIVE SHAFT BEARING

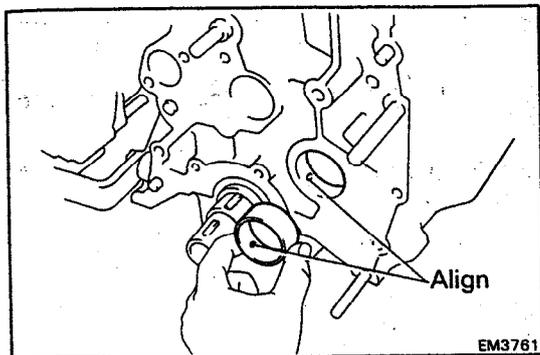
- (a) Using SST, replace the No. 1 bearing by using No. 2 bearing as a guide.

SST 09215-00100 (09215-00120, 09215-00130,
09215-00140, 09215-00160, 09215-00210,
09215-00220)

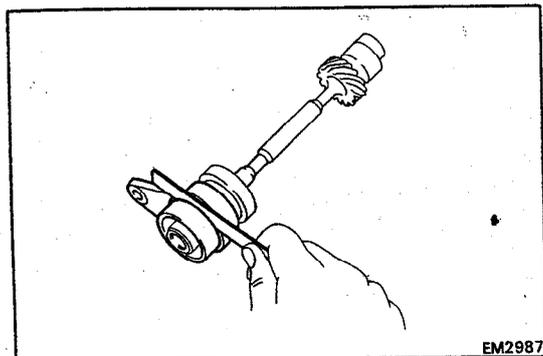


- (b) Using SST, replace the No. 2 bearing by using the No. 1 bearing as a guide.

SST 09215-00100 (09215-00120, 09215-00130,
09215-00140, 09215-00210, 09215-00220)



CAUTION: When inserting the bearings, align each oil hole.



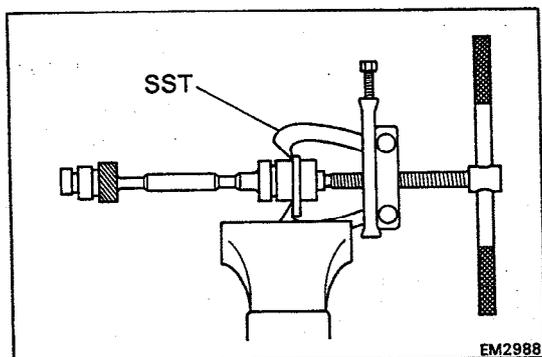
3. INSPECT OIL PUMP DRIVE SHAFT THRUST CLEARANCE

Using a thickness gauge, measure the drive shaft thrust clearance between the thrust plate and collar.

Standard thrust clearance: 0.06 – 0.13 mm
(0.0024 – 0.0051 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

If clearance is greater than maximum, replace the thrust plate and/or collar.

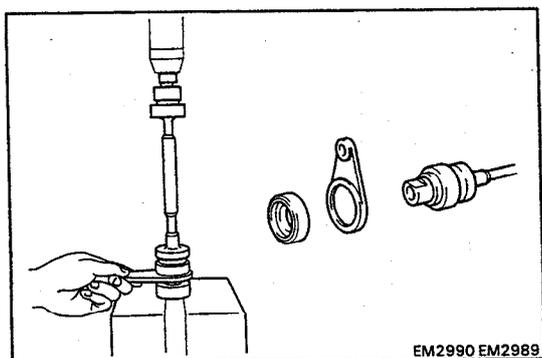


4. IF NECESSARY, REPLACE THRUST PLATE AND COLLAR

(a) Using SST, remove the thrust plate and collar.
SST 09950-20017

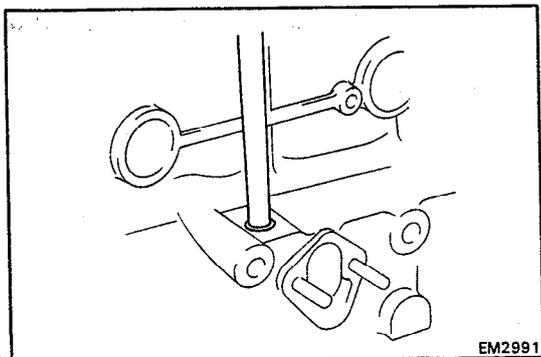
(b) Install the thrust plate and collar in the direction as shown.

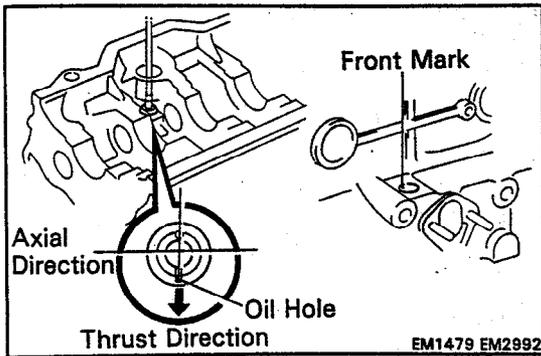
(c) Using a press, install the thrust plate and collar.



5. IF NECESSARY, REPLACE OIL PUMP GUIDE BUSHING

(a) Drive out the bushing from the outer side of the block.





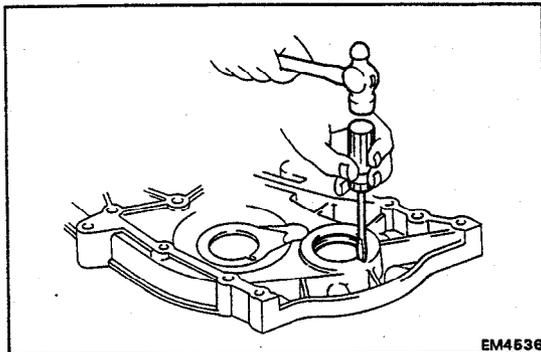
- (b) Drive in the bushing from the inside of the block with a suitable tool.

NOTE: The oil hole should be positioned toward the crankshaft side.

- (c) Make sure the front mark of bushing is positioned toward the front of block.

REPLACEMENT OF OIL SEALS

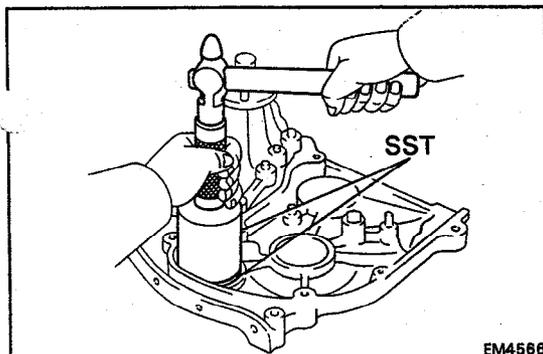
NOTE: There are two methods (A and B) of oil seal replacement.



1. REPLACE CRANKSHAFT FRONT OIL SEAL

- A. If the timing case is removed from the cylinder block:

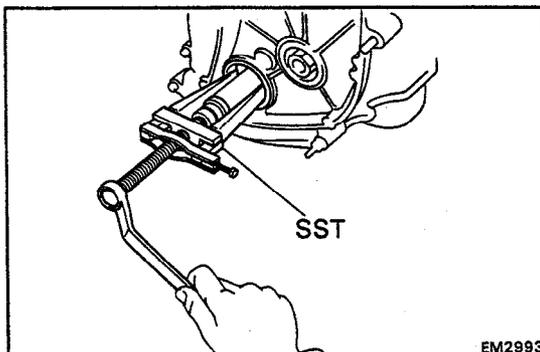
- (a) Using a screwdriver and hammer, tap out the oil seal.



- (b) Using SST and a hammer, tap in a new oil seal.

SST 09214-60010 and 09506-35010

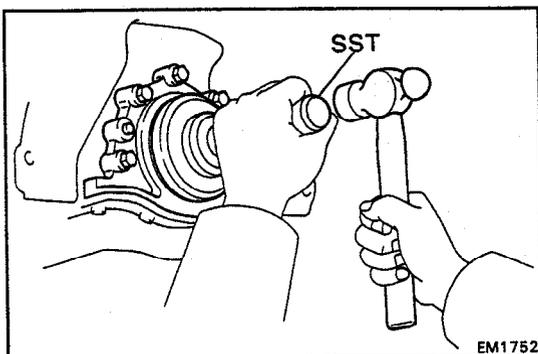
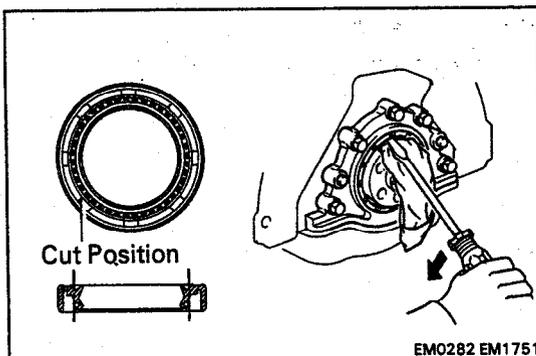
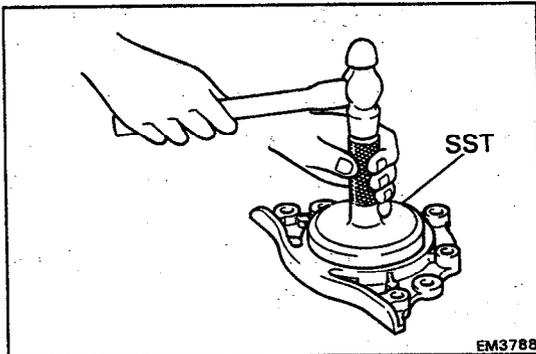
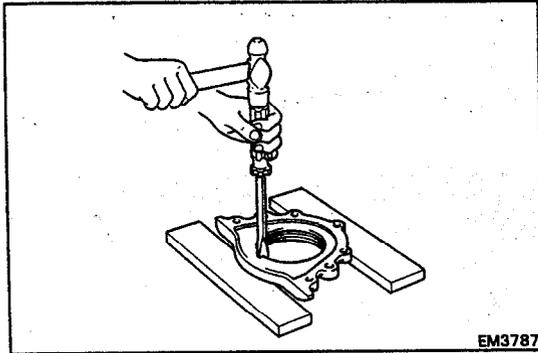
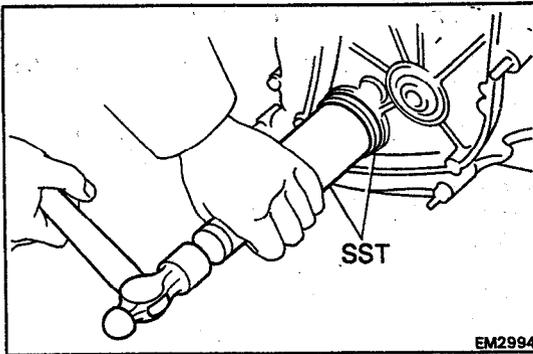
- (c) Apply MP grease to the oil seal lip.



- B. If the timing case is installed to the cylinder block:

- (a) Using SST, remove the oil seal.

SST 09308-55010



- (b) Apply MP grease to a new oil seal lip.
- (c) Using SST and a hammer, tap in the oil seal.
SST 09214-60010 and 09506-35010

2. REPLACE CRANKSHAFT REAR OIL SEAL

A. If the rear oil seal retainer is removed from the cylinder block:

- (a) Using a screwdriver and hammer, tap out the oil seal.

- (b) Using SST and a hammer, tap in a new oil seal.

SST 09223-41020

- (c) Apply MP grease to the oil seal lip.

B. If the rear oil seal retainer is installed to the cylinder block:

- (a) Using a knife, cut off the lip of the oil seal as shown.
- (b) Using a screwdriver, pry out the oil seal.

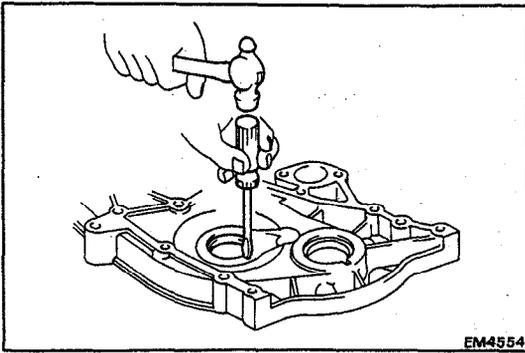
CAUTION: Be careful not to damage the crankshaft. Tape the screwdriver tip.

- (c) Check the oil seal lip contact surface of the crankshaft for cracks or damage.

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

- (e) Using SST and a hammer, tap in the oil seal.

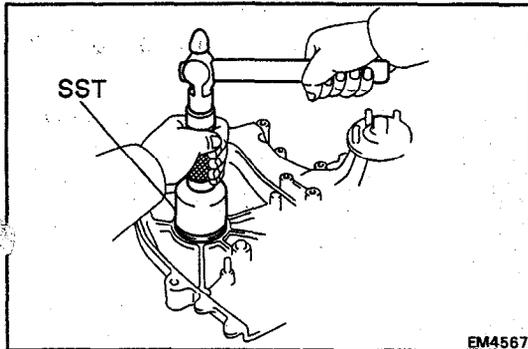
SST 09223-41020



3. REPLACE PUMP DRIVE SHAFT OIL SEAL

A. If the timing belt case is removed from the cylinder block:

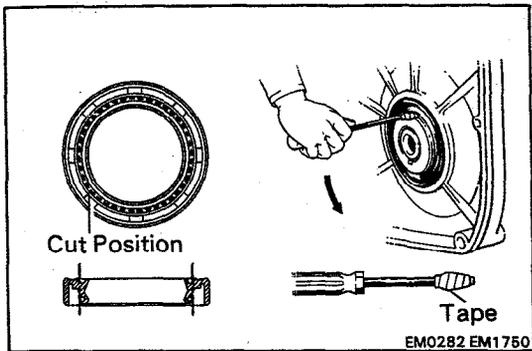
(a) Using a screwdriver and hammer, tap out the oil seal.



(b) Using SST and a hammer, tap in a new oil seal.

SST 09214-41010

(c) Apply MP grease to the oil seal lip.



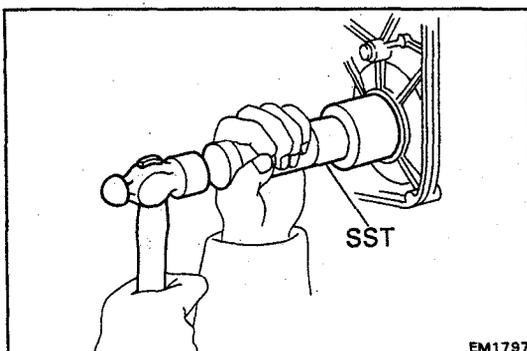
B. If the timing belt case is installed to the cylinder block:

(a) Using a knife, cut off the lip of the oil seal as shown.

(b) Using a screwdriver, pry out the oil seal.

CAUTION: Be careful not to damage the crankshaft. Tape the screwdriver tip.

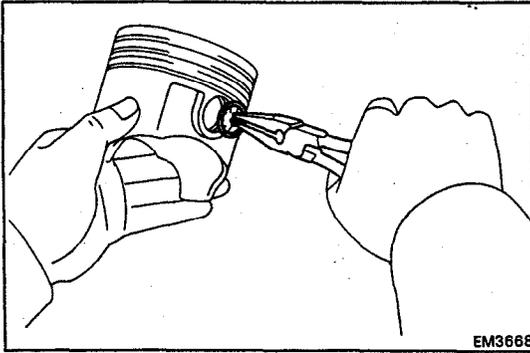
(c) Check the oil seal lip contact surface of the pump drive shaft for cracks or damage.



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

(e) Using SST and a hammer, tap in the oil seal.

SST 09214-41010

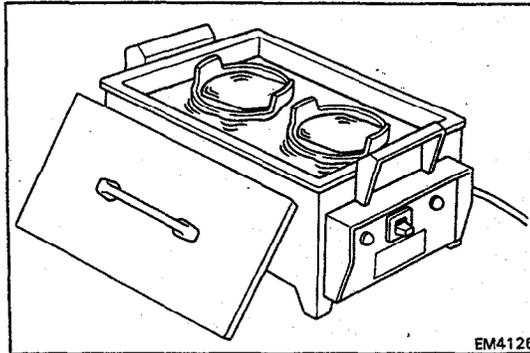


ASSEMBLY OF PISTON AND CONNECTING ROD

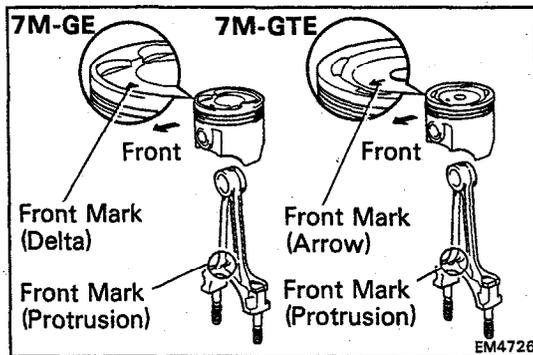
(See page EM-65)

1. ASSEMBLE PISTON AND CONNECTING ROD

- (a) Install a new snap ring on one side of the piston pin hole.



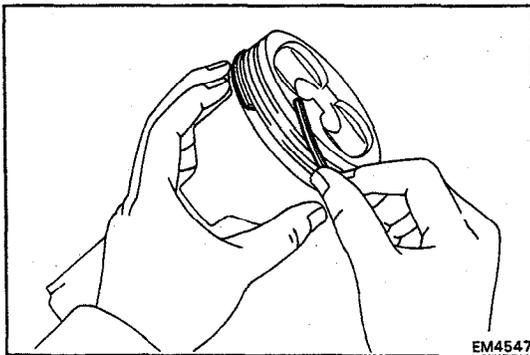
- (b) Gradually heat the piston to approx. 60°C (140°F).



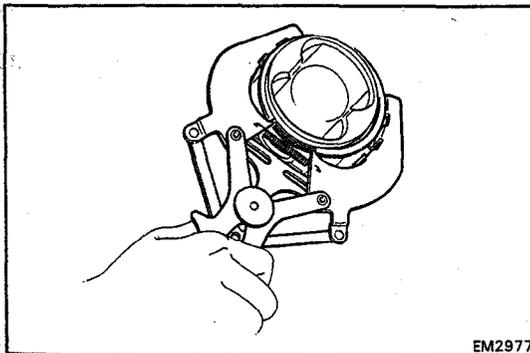
- (c) Coat the piston pin with engine oil.
- (d) Align the front marks of the piston and the connecting rod, and push in the piston pin with your thumb.
- (e) Install a new snap ring on the other side of the pin hole.

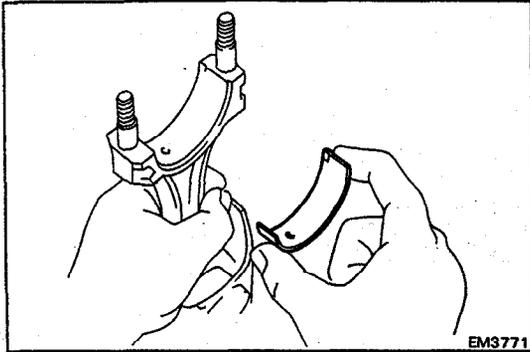
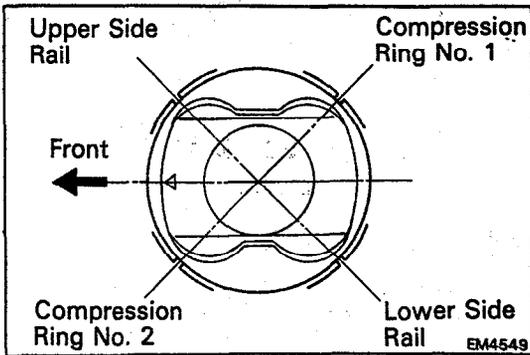
2. INSTALL PISTON RINGS

- (a) Install the oil ring expander and two side rails by hand.



- (b) Using a piston ring expander, install the two compression rings with the code mark facing upward.





(c) Position the piston rings so that the ring ends are as shown.

CAUTION: Do not align the ends.

3. INSTALL BEARINGS

(a) Align the bearing claw with the claw groove of the connecting rod or connecting rod cap.

(b) Install the bearing in the connecting rod and rod cap.

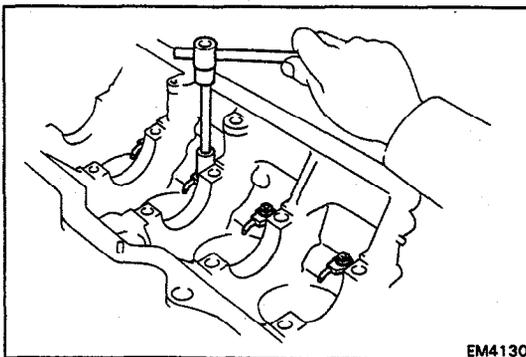
CAUTION: Install the bearings with the oil hole in the connecting rod.

ASSEMBLY OF CYLINDER BLOCK

(See page EM-65)

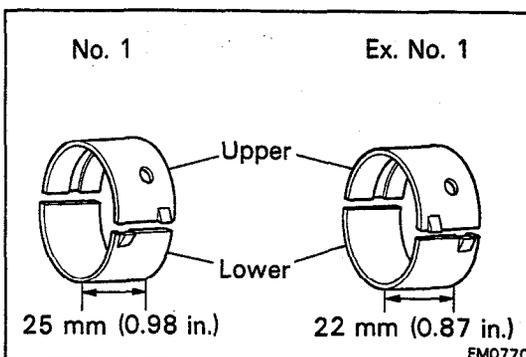
NOTE:

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



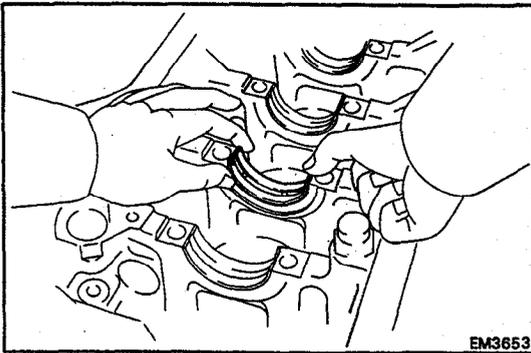
1. (7M-GTE) INSTALL OIL NOZZLES

Torque: 250 kg-cm (18 ft-lb, 25 N·m)



2. INSTALL MAIN BEARINGS

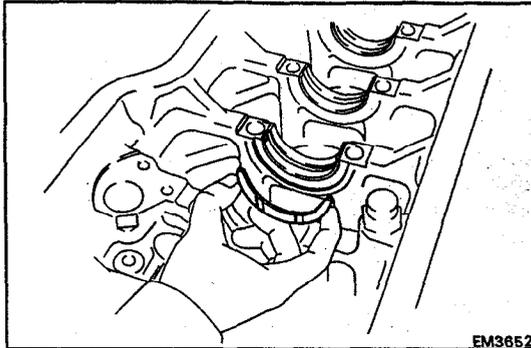
NOTE: Different the bearing are used for the No. 1 and ex. No. 1.



EM3653

- (a) Align the bearing claw with the the claw groove of the main bearing cap or cylinder block.
- (b) Install the bearing in the cylinder block and bearing caps.

CAUTION: Install the bearing with the oil hole in the block.

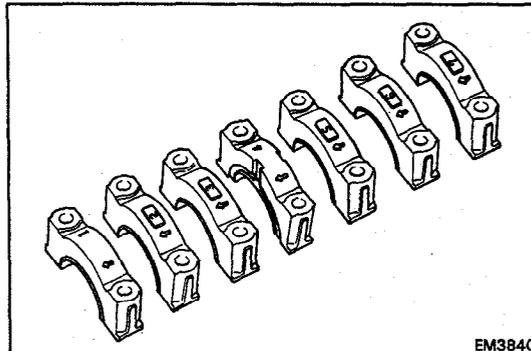


EM3652

3. INSTALL UPPER THRUST WASHERS

Install the thrust washers under the No. 4 main journal position of the block with the oil grooves facing outward.

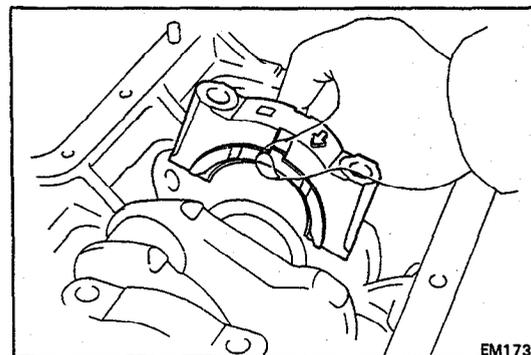
4. PLACE CRANKSHAFT ON CYLINDER BLOCK



EM3840

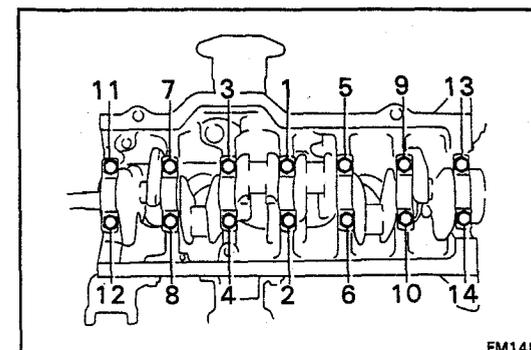
5. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

NOTE: Each bearing cap has a number and front mark.



EM1738

- (a) Install the thrust washers on the No. 4 bearing cap with the grooves facing outward.



EM1482

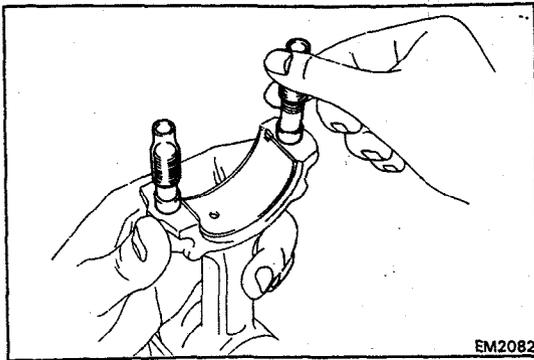
- (b) Install the bearing caps in numbered order with arrows facing forward.

- (c) Install and uniformly tighten the fourteen cap bolts in several passes, in the sequence shown.

Torque: 1,040 kg-cm (75 ft-lb, 102 N·m)

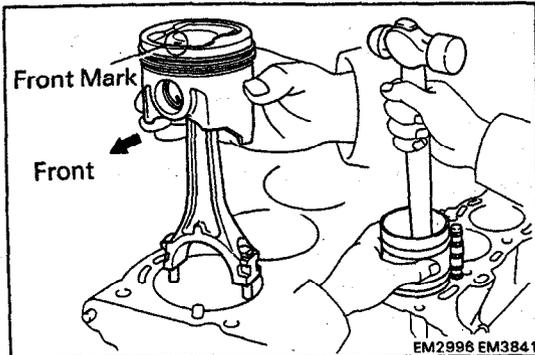
- (d) Check that the crankshaft turns smoothly.

- (e) Check the crankshaft thrust clearance.
(See step 21 on page EM-70)

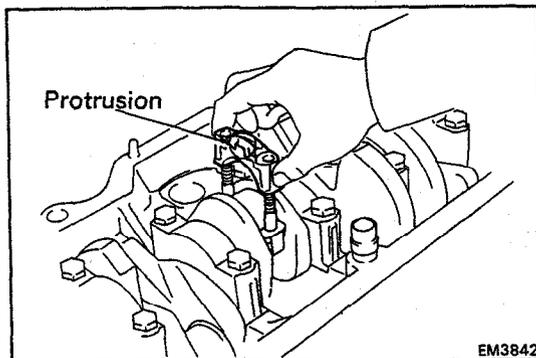


6. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

- (a) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.

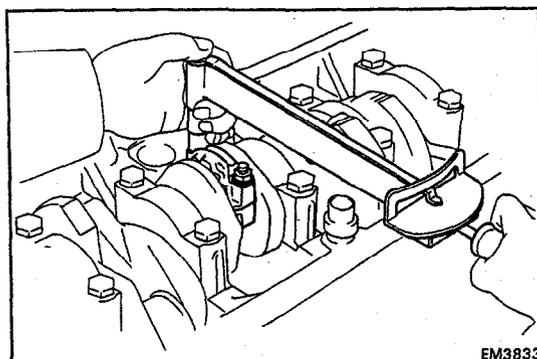


- (b) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark (delta for 7M-GE and arrow for 7M-GTE) of the piston facing forward.



7. INSTALL CONNECTING ROD CAPS

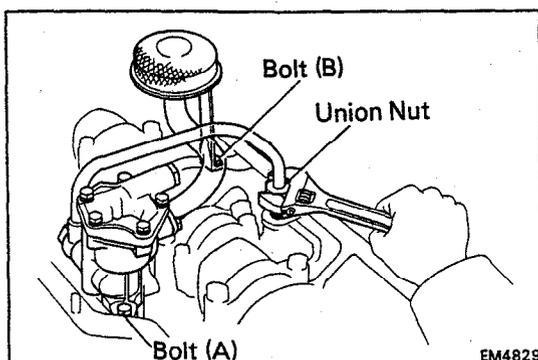
- (a) Match the numbered cap with the numbered connecting rod.
 (b) Install the cap with the protrusion facing forward.



- (c) Install and alternately tighten the cap nuts in several passes.

Torque: 650 kg-cm (47 ft-lb, 64 N·m)

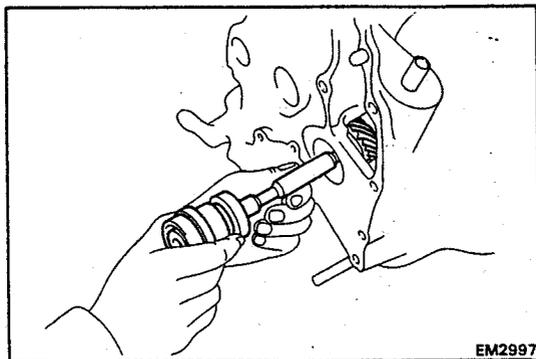
- (d) Check that the crankshaft turns smoothly.
 (e) Check the connecting rod thrust clearance.
 (See step 18 on page EM-67)



8. INSTALL OIL PUMP ASSEMBLY

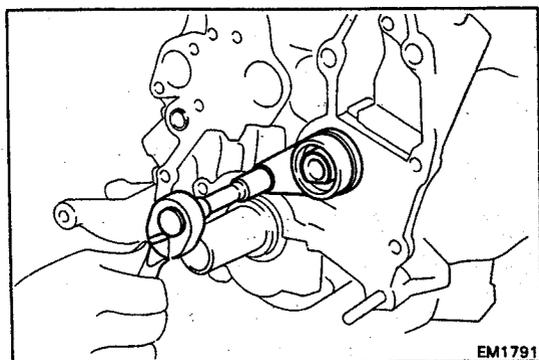
- (a) Clean the oil pump.
 (b) Install the oil pump with the two bolts and union nut.
 Torque the bolt and union nut.

Torque: Bolt (A) 220 kg-cm (16 ft-lb, 22 N·m)
Bolt (B) 60 kg-cm (52 in.-lb, 5.9 N·m)
Union nut 350 kg-cm (25 ft-lb, 34 N·m)



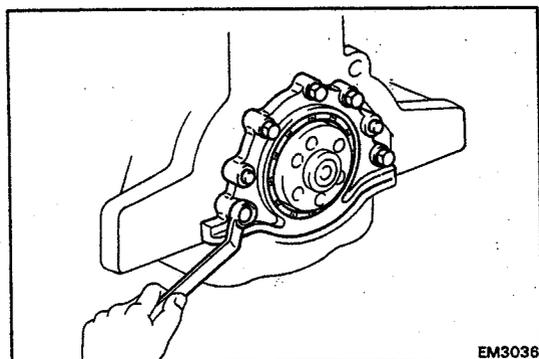
9. INSTALL OIL PUMP DRIVE SHAFT

- (a) While turning the drive shaft, insert slowly to avoid damaging the drive shaft bearing.



- (b) Install the bolt.

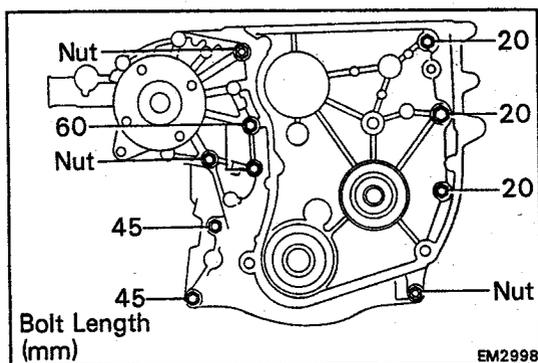
Torque: 145 kg-cm (10 ft-lb, 14 N·m)



10. INSTALL REAR OIL SEAL RETAINER

Install a new gasket and rear oil seal retainer with the five bolts.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)



11. INSTALL TIMING BELT CASE WITH WATER PUMP

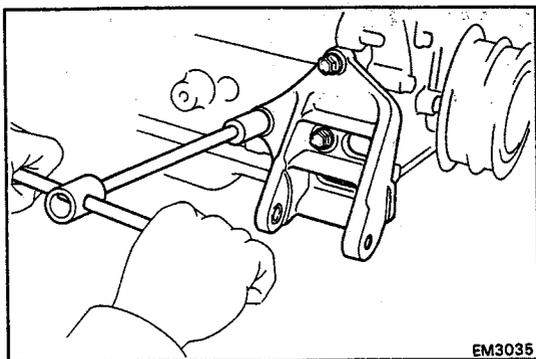
- (a) Position new gaskets on the cylinder block.
- (b) Apply sealant to two or three threads of the 10 mm bolt end.

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

- (c) Install the timing belt case with the seven bolts and three nuts.

12. INSTALL OIL PAN (See page LU-14)

13. INSTALL PS PUMP BRACKET



**14. (7M-GE w/ Oil Cooler)
INSTALL OIL REGULATOR**

Install a new gasket and oil regulator with the two bolts.

**(7M-GE w/o Oil Cooler and 7M-GTE)
INSTALL OIL HOLE COVER PLATE**

Install a new gasket and oil hole cover plate with the two bolts.

**15. (7M-GE)
INSTALL NEW OIL FILTER
(See page LU-6)**

16. INSTALL ENGINE MOUNTING BRACKETS

17. INSTALL FUEL RETURN PIPE SUPPORT

Install a new insulator and fuel pipe support with the two nuts.

Torque: 130 kg-cm (89 ft-lb, 13 N·m)

**18. (7M-GE)
INSTALL VACUUM CONTROL VALVE SET**

19. INSTALL GROUND STRAP TO CYLINDER BLOCK

20. INSTALL WATER BY-PASS PIPE

(a) Install a new gasket and water by-pass pipe to the timing belt case with the two nuts.

Torque: 140 kg-cm (10 ft-lb, 14 N·m)

(b) Install the water by-pass pipe to the cylinder block with the three bolts.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)

**21. INSTALL CYLINDER HEAD
(See steps 1 and 4 to 18 on pages EM-59 to 64)**

**22. INSTALL TIMING BELT
(See step 1 to 8 and 10 to 15 on pages EM-33 to 36)**

23. REMOVE ENGINE STAND

24. INSTALL REAR END PLATE

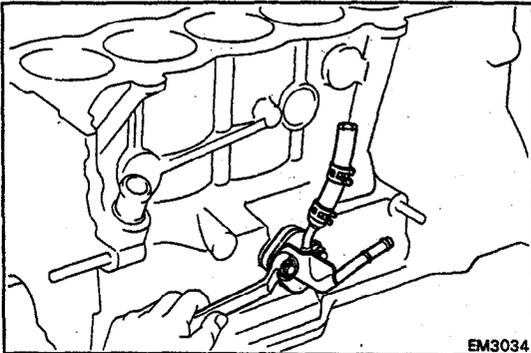
Torque: 130 kg-cm (9 ft-lb, 13 N·m)

**25. INSTALL FLYWHEEL OR DRIVE PLATE ON
CRANKSHAFT**

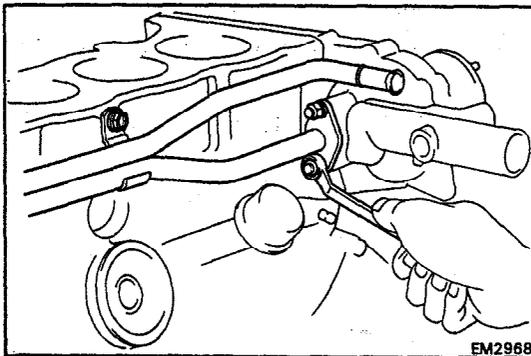
(a) Install the flywheel or drive plate on crankshaft.

(b) Install and uniformly tighten the bolts in several passes, in the sequence shown.

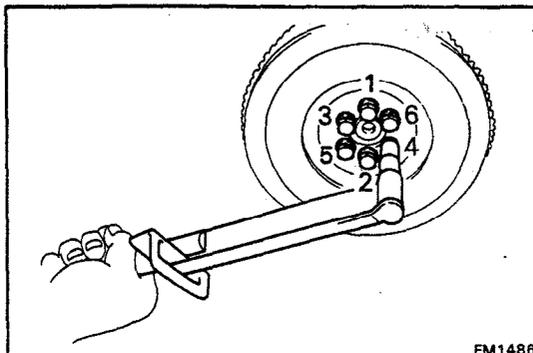
Torque: 750 kg-cm (54 ft-lb, 74 N·m)



EM3034



EM2968



EM1486